

Sept 27

Working Group Report
Supply Chain Development

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This report reflects the views of one of the six industry-led working groups created to provide

advice to the Aerospace Review Head and the members of the Advisory Council. The recommendations therein may not reflect the findings of the Aerospace Review.

For more information on the Review process visit www.aerospacereview.ca

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Report Summary

This great nation has been built by leaders with vision for the future. From the creation of a national railway uniting the country in 1881, to more recent efforts to build large scale infrastructure projects, we have been successful in building industries when we plan for the future rather than get bogged down by the risks of the present. That forward thinking investment has contributed to the vitality of the Canadian standard of living we enjoy today.

In 2012, we have a similar vision: to connect our country from coast to coast with a cohesive and globally competitive aerospace supply chain which will attract business to this country and capture significant global market share. To make this happen, we must aggressively move our many successful small and medium sized aerospace enterprises (SMEs) up the value chain; moving from Tier 3 and 4 suppliers up to the Tier 1 systems integrator and Tier 2 equipment provider level. It is important as this occurs to ensure that these businesses are competitive at the global level as aerospace is very much a global industry. The days of it being good enough to be competitive at a domestic level only are long gone.

To compete globally, a competitive advantage that cannot easily be replicated is necessary. For many of our most successful aerospace firms such advantages have been created with technology development and engineering prowess. Other firms today are looking to higher levels of automation, intelligent manufacturing, and revolutionary production techniques such as additive manufacturing to make that leap up the value chain.

As leaders in the Canadian aerospace sector, we will continue to develop our supply chains, thereby contributing to our country's wealth. With the leadership and support of the Government of Canada, however, we can raise this contribution to new levels of success. By 2030, we can increase our contribution to GDP where it sits second only to the automotive sector by raising our global market share from \$22 billion today to \$35 billion; and we can increase employment from its current level of 80,000 to 124,000 world-class employees.¹ We took justified pride in being the fourth largest aerospace industry in the world; however since 2009, we slipped to fifth position and have been fighting to climb back. Not only are other nations aggressively pursuing our market share but we risk falling even further behind, as competitors move up the value chain and seek to capture more share of future aircraft platforms.

To have a leading position in this global supply chain race, Canada must assertively maintain its reputation of having an enviable, first-class aerospace supply chain. The strength of our existing supply chain is the long history we have in participating on major aircraft platforms, both in the commercial and defense industry segments. Our proximity to the world's largest aerospace market in the US and our historical ties to the UK and France have also contributed to this supply chain development. This strength can easily become a weakness as the supply chain globalizes if we do not quickly adjust to the new global paradigm. Our small and medium sized businesses need to adjust to this global reality as they face the competing pressures from low cost regions and a reduction in direct relationships with OEMs and Tier 1 systems integrators.

The Opportunity: Canada can and should capitalize on the rapidly growing worldwide demand for aerospace products & services.

The Problem: Limited Tier 1 integrators and limited support for aerospace supply chain development in Canada is hampering our ability to respond.

The Risk: Canada will lose market share and jobs to competing nations if we do not move our lower tier companies up the value chain.

The Solution: Leverage existing regional supply chain development programs and increase collaboration to allow faster development of SME's.

Government of Canada Action: Build upon existing provincial programs to create a National Aerospace Framework for Supply Chain Development to facilitate collaboration between SMEs and OEM's and Tier 1 integrators and allow profitable growth for these SMEs.

The nature of complex aerospace programs and the growing number of OEMs competing on a global scale creates not only complex technologies, but very complex supply networks. It also creates the urgent need for increased competitiveness from our domestic supply base. To realize our full potential we need to actively develop globally competitive supply chain expertise in aerospace in Canada and rapidly advance small and medium sized enterprises (SMEs) from Tier 3 and 4 level suppliers to Tier 1 system integrators and Tier 2 equipment providers. Other nations are working actively on Supply Chain Development programs and have a head start on Canada. Recent efforts have been made in several regions (Quebec, Ontario and Winnipeg) to create programs that will encourage these SMEs to “move up the feed chain” and collaborate with larger firms to ease the transition. These SMEs face the inherent challenge of having limited resources and investing in Supply Chain Development is unlikely to occur without support from industry and government. The models deployed in Quebec and Manitoba are designed to assist SMEs in moving up the value chain profitably with assistance from other established aerospace companies. Although these programs are in their early days, the initial feedback from SME's involved in the programs is very encouraging and in certain cases has already resulted in increased business opportunities for these SME's.

To enable the creation of a world class supply chain in aerospace in Canada we need to build upon the work started at the provincial level to create a National Framework for Supply Chain Development. A National Aerospace Framework for Supply Chain Development would contain the following elements:

- 1) Create a path for small and medium sized firms to differentiate and grow through Supplier Development Programs geared to the global aerospace industry;
- 2) Create a stable funding mechanism for Supplier Development Programs in Aerospace across Canada;
- 3) Maximize collaboration between the small and medium sized firms and the OEMs, Tier 1 Systems Integrators and Tier 2 Equipment Providers.
- 4) Develop a National certification framework that recognizes efforts made by SMEs that participate in Supplier Development Programs

Once we have created this National Aerospace Framework for Supply Chain Development, we can dramatically increase the number of competitive Canadian Tier 1 systems integrators and Tier 2 equipment providers actively winning new business in the global aerospace market.

1. Background

The Government of Canada has mandated a national Aerospace Review to be completed by the end of 2012:

"To explore how best to address key issues facing the aerospace and space sectors, such as innovation, market access and development, skills development, procurement, and supplier development, the Government is proceeding with a review of federal aerospace and space programs and policies. The Honourable David L. Emerson will head the review and will report his findings to the Minister of Industry in late 2012." (Budget 2012:80)

As part of the Review, expert groups have been established according to six themes in consultation with the Aerospace Industries Association of Canada: Technology Development, Demonstration and Commercialization; Space; Market Access and Market Development; Aerospace-Related Public Procurement; Small Business and Supply Chain Development; and People and Skills. This report is the product of deliberations by the first Supply Chain Development Working Group, the members of which are listed in Annex 1.

Some Numbers

Global aerospace revenues are currently estimated at US\$380 billion. Aircraft production is expected to experience growth of 45% between 2011 and 2020 driven primarily by increasing demand in emerging markets, most notably Asia-Pacific, and the need to replace aging fleets. Aircraft production between 2011 and 2020 is forecast to be 51% higher (by value) than in the previous decade.

Teal Group, December 2011

2. Mandate

According to the Terms of Reference, the Small Business and Supply Chain Working Group is responsible to examine the issues influencing the competitiveness of small and medium-sized businesses and effective positioning of Canadian SME's in global supply chains.

The working group was asked to consider the following questions:

- 1) What unique opportunities or challenges are small aerospace firms facing?
- 2) Are there obstacles or disincentives to growth for small firms?
- 3) Why have Canadian suppliers been unsuccessful in bidding for recent major contracts?
- 4) How do Canada's policies/practices compare to our major competitors?
- 5) What changes are recommended to address shortcomings/gaps in current federal policies and programs?

Based on these discussions, the Group was asked to offer advice to the Head of the Aerospace Review for consideration in preparing his final report to the Government of Canada.

3. Approach

Under the Terms of Reference, the Group was asked to consider the challenges faced by small and medium sized aerospace businesses in Canada as they seek to compete in the global aerospace industry that is seemingly dominated by large multinational aerospace firms. The decision was made early on to break into two Sub-Groups so that we could analyze this challenge from two very different perspectives:

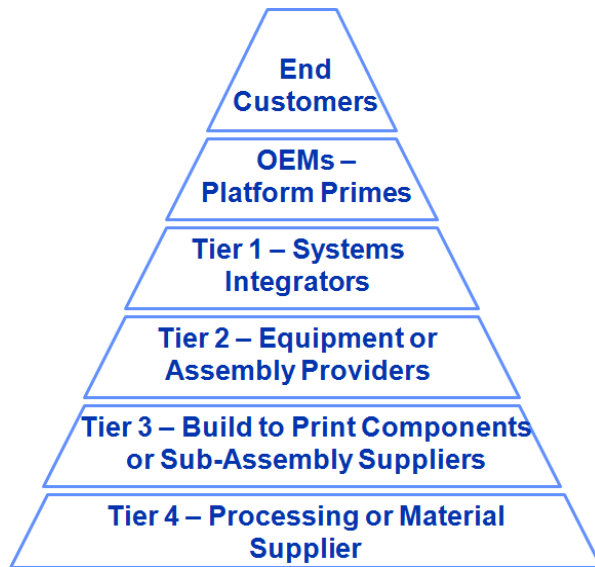
- 1) Small business perspective – this sub-group analyzed the challenges facing small businesses from the point of view of said companies as they seek to bid and land contracts with the larger firms in the industry (inside out view)
- 2) Supply Chain perspective – this sub-group analyzed the challenges facing the aerospace industry's small and mid-sized enterprises (SMEs) from the perspective of the larger firms that work with these smaller companies on a day to day basis (outside in view)

This report focuses on the discussions of the Supply Chain Development Working Group (hereafter referred to as the Group), however the discoveries of this Group were very closely tied to the findings of the Small Business Working Group.

4. State of the Aerospace Supply Chain In Canada

Structure of the Aerospace Industry in Canada

The aerospace industry globally is very clearly segmented into OEMs that build the actual aircraft platform and sell it end customers and various tiers of suppliers as described in the diagram below:



End customers (entities buying the aircraft such as airlines and other organizations) sit atop the structure and they drive the need for competitiveness, improved technology and reduced operating costs. OEMs are the companies that assemble, then market and sell the final aircraft platform to such end customers. Canadian examples of end Customers include, but are not limited to: WestJet, Air Canada, the Canadian Department of National Defense and the Canadian Forces. Canadian examples of OEMs include Bombardier and Bell Helicopter.

The Tier 1 systems integrators are companies that are engaged in the integrated design, development, manufacture and marketing of major aircraft systems such as landing gear systems, environmental control systems, navigation systems, communications systems, avionics systems and propulsion systems; and companies that design and manufacture complete large, complex structures such as fuselage systems, empennage (tail) assemblies or wings. Canadian examples include, but are not limited to: Pratt & Whitney Canada, Messier-Dowty, Goodrich Canada, Heroux-Devtek, GE Canada, Rolls Royce Canada, CMC Esterline, Honeywell Canada, Arnprior Aerospace and Magellan.

The Tier 2 equipment providers are companies that are engaged in the design, development, manufacture and marketing of engineered and proprietary equipment and sub-systems such as sensors, instruments, actuators, displays, communications equipment, aerostructures, etc. Tier 2 suppliers typically have their own company name on the drawings for the products they design, produce and sell. Tier 2 suppliers may also be subcontractors who deliver complex products with many components, which are obtained from their own manufacturing operations and from a variety of outside suppliers. The customers of Tier 2 equipment providers are typically Tier 1 or OEM firms. Canadian examples include,

but are not limited to: Sonaca Montreal, Mecachrome, Aerolia, Northstar Aerospace, Centra, Cycleon, Composites Atlantic Limited, and Avcorp.

Tier 3 firms are parts or assembly suppliers who act as subcontractors that manufacture or supply components and sub-assemblies such as machined components, minor assemblies. Their customers are typically Tier 1 and 2 firms, and often other Tier 3 firms. It is becoming much less common for these firms to supply directly to the OEMs. Canadian examples include, but are not limited to: RTI Claro, Noranco, Celestica, CFN Precision, Koss, and Dishon.

Tier 4 firms are those that provide processing services for components (such as shot peening, heat treatment, plating, coating, etc) and companies that provide raw materials such as aluminum, steel, titanium, composites, etc. This level also includes companies that supply standard components such as hardware and wiring or harnesses. Their customers are typically tier 2 and 3 firms. Canadian examples include, but are not limited to: Interfast, Vac Aero, and Aero Tek.

The Fundamental Crisis for Aerospace SME's

At the outset, it was evident to the Group that the Tier 3 and 4 firms (which are typically SMEs) are facing an unprecedented challenge. To remain competitive and be able to launch new programs amid growing global competition, OEM airframe manufacturers are forced to move from a business model with many direct supplier relationships to one where they partner with fewer Tier 1 systems integrators. Airbus, Boeing, Bombardier and most other large aerospace firms all have stated goals of reducing the number of suppliers they deal with, which is causing them to award more business in greater scope to larger integrators. The Tier 1 systems integrators in turn are following the same approach in order to reduce their investment risk and supply chain complexity and are choosing fewer Tier 2 firms with which to do business. This is ultimately leading to the concentration of aerospace work globally with fewer large Tier 1 and 2 firms.

OEMs and integrators have no choice but to adopt this model for four primary reasons:

- 1) To face competition that is emerging from non-traditional nations as Brazil, China and Russia where the cost of labour is significantly lower.
- 2) To meet their end Customers needs for lower operating costs and more efficient aircraft.
- 3) To maintain a viable competitive offering to end Customers.
- 4) To reduce risk and complexity.

The result of these competitive pressures at the OEM level greatly affects the fortunes of SME aerospace firms in Canada as the trend is towards far fewer direct relationships with the OEMs. SMEs now have to compete globally to win business with the Tier 1 systems integrators and Tier 2 equipment providers. As business is concentrated with these integrators, competition is fierce for available contracts.

This fundamental crisis has been previously published identified in the AIAC Future Major Platforms Report:

“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

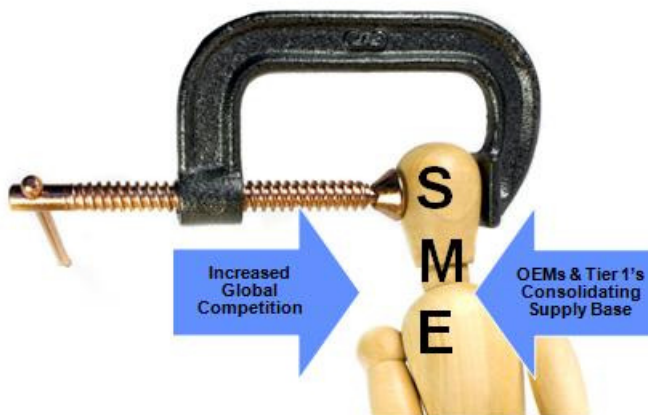
programs and the lack of an integrator capacity is also a concern for their participation on the CSeries as well.

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.”

Canada has relatively few Tier 1 systems integrators and very few home-grown firms at this level. This has been a definite factor in the loss of market share globally. Quebec has 4 OEMs and 15 Tier 1 systems integrators. Ontario has 1 OEM (Bombardier, which is also in the Quebec number) and 16 Tier 1 systems integrators. The remainder of Canada including the West and Atlantic Canada have approximately 3 OEMs and 5 Tier 1 companies outside of the MRO sector. So Canada in total has approximately 8 OEM's and 36 Tier 1 system integrators and many of the latter are subsidiaries of US and European firms.

This all leads to the fundamental crisis currently being experienced by aerospace SMEs in Canada as shown in the illustration below.

The Fundamental Crisis for Aerospace SMEs



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This “squeeze” on small and mid-size aerospace businesses is forcing only a few viable scenarios for the survival of these Canadian SMEs:

- 1) The SMEs grow and win more business as competitive and viable Tier 1 or 2 alternatives for the larger firms on a global scale, or
- 2) The SMEs develop a niche offering that offers a truly unique competitive advantage through differentiation or specialization, or
- 3) The SMEs see their aerospace revenues gradually decline over time, leading eventually to these firms ceasing to exist in any meaningful way.

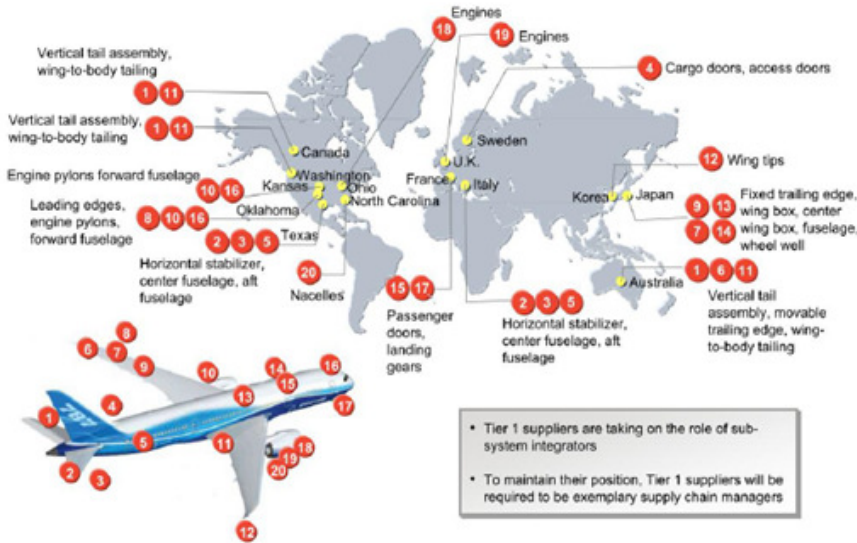
The first two scenarios require significant investment and time either through modernization of production methods or creation of design capability where none previously existed. This is not to say it cannot be

done as several small businesses in Canada have moved up the value chain by using automation and intelligent manufacturing methods to achieve low cost and high quality that makes them competitive on a global basis.

SMEs are reluctant to invest in such scenarios when they are feeling the “squeeze” described above and are often struggling to make payroll and continue to invest in new sales opportunities. Unfortunately, without support from industry and government and a push to develop these capabilities, the third scenario will invariably lead to Canada’s share of the aerospace market continuing to shrink relative to other nations over the next 20 years.

To compound this challenge, the industry is also being pressured to reduce production costs in light of the economics of a low growth macro-economic environment, the emergence of low-cost aerospace manufacturers worldwide, and the high Canadian dollar. Recent major aircraft platforms such as the C-Series from Bombardier and the Boeing 787 Dreamliner have illustrated all too well that the supply chain is now truly global and it is no longer a certainty that Canadian firms will earn a spot on these platforms. As evidenced by the diagram below, the aerospace supply chain for the Boeing 787 Dreamliner is more globalized than any previously developed commercial air transport platform.

Tier 1 integrators are key in the development of all new platforms: the Boeing 787 business case



Canadian Advantages in Supply Chain

This is not to say that the supply chain in Canada does not have advantages. The Group’s experience is that as supply chains become more global and thus more complex, Canada is well positioned to take advantage of our relative maturity with respect to supply chain expertise, lean supply chain experience, and overall skills of our supply chain personnel. Our educational system continues to develop skilled professionals that are envied the world over, and that provides an inherent advantage. On top of our educational system advantages, we have decades of experience in the aerospace industry and we have specific expertises in certain areas of the supply chain. For example, our supply base in the area of

machining and metal processing is one of the most advanced in the world. Our proximity to the United States and its world leading aerospace industry also provides obvious advantages.

The other side of the coin of these advantages is that experience can often be a disadvantage as the industry undergoes paradigm shifts. For example, our strength in materials and metal processing in traditional aircraft materials such as aluminum can be seen as a disadvantage if we fail to adjust to the new paradigm and invest in new lightweight materials such as composites, titanium and plastics. Canada has a relative dearth of light weight material suppliers and is trailing the rest of the world in development and support of these advancements.

The long experience of the Canadian aerospace industry also results in our supply chain consisting of many aged facilities, many of which are in dire need of upgrades to meet the new world standard for manufacturing excellence. Greenfield operations in the developing world have the advantage of newer facilities, newer technologies and newer supply chain related infrastructure. Canadian firms must continually invest in process improvements through efforts such as Six Sigma or Lean and must also continue to upgrade their infrastructure, systems, software and quality management systems just to complete on a level playing field with firms in emerging regions. The dilemma is that these emerging regions are often viewed by OEMs and Tier 1 systems integrators as having both a cost advantage and an infrastructure advantage. To the casual observer of the industry, this may be surprising, but our experience and history can be viewed as a disadvantage as the supply chain evolves rapidly and processing technologies change swiftly.

This cost advantage and infrastructure advantage partially explains the rapid ascent of emerging regions such as the BRIC nations in the aerospace supply chain. This increased pressure on competitiveness at all levels has driven a partial shift from local supply chains to global supply chains which has slowly but steadily drawn jobs and investments away from Canada. There are still many examples of Canadian firms winning contracts with OEMs and Tier 1 systems integrators and Tier 2 equipment providers; however these wins are now largely based on offering a competitive advantage and value proposition at a global level. This global supply chain shift, and the relative dearth of Tier 1 and 2 firms in Canada could partially explain why Canada has been losing global market share. For many years Canada had enjoyed the status of 4th largest aerospace industry in the world but we have been steadily losing market share over the past decade and have slipped to 5th globally with Germany moving to 4th.

The table below shows the relative size of the aerospace industries globally and demonstrates that not only has Canada slipped to 5th, but we now less than 70% of the size of the 4th place industry in Germany. The Group believes that in order to reverse this troubling trend, more collaboration is needed between the federal government and industry to invest in Supply Chain Development with the express purpose of growing aerospace SMEs into globally competitive Tier 1 and 2 firms. Germany's success and growth can be at least partially attributed to collaboration between industry and government and the growth of their OEMs and Tier 1 and 2 firms.

Rank	Country	Revenue (US\$ Bil)
1	USA	\$204.0
2	France	\$50.4
3	UK	\$32.7
4	Germany	\$32.1
5	Canada	\$22.3
6	Japan	\$14.1
7	China	\$12.0
8	Russia	\$10.0
9	Italy	\$9.9
10	Brazil	\$7.6
11	Spain	\$6.1
12	Singapore	\$4.3
13	India	\$4.0
14	Netherlands	\$3.4
15	Mexico	\$3.0

5. Assessment of Government of Canada Policies and Programs

The Group examined several different federal government policies and programs including SADI, IRBs, and support from regional development agencies. In the context of supply chain development, the most crucial programs are those that were developed in various regions/provinces with support from the provincial governments and regional development agencies.

This section will examine three different efforts to achieve the same goal of developing SMEs, some of which were supported in part by the regional development agencies. The three provincial programs we will examine are the MACH Initiative in Quebec, Competitive Edge in Manitoba and Esprit (formerly MAP) in Ontario.

Industry Canada and IRBs

The Group spent some time examining the impact of IRB policy on supply chain development and SMEs. There was a real mixed feeling from the group as to the effectiveness of current IRB policies. Although IRBs do create some opportunity with proactive SMEs, in general it was felt IRBs were an ineffective way to develop the supply chain and grow SMEs from Tier 3 or 4 to Tier 1 or 2 firms. The primary cause of this was simply that unless an SME has a truly unique competitive advantage, it is very difficult to convince a Prime/OEM to partner with a small firm. The OEMs/Primes currently have obligations greater than \$20B so there is little motivation for these primes to work with many small companies, when they can more efficiently work with larger Tier 1 or 2 firms. This ties in to the fundamental crisis that is central to this report, which is that the larger OEMs and Tier 1's want to deal with fewer large firms amidst an environment of increased global competition.

While current IRB policies acknowledge the importance of directing funding to research and development activities, and to small business in particular, the policies themselves have not achieved significant results since most IRBs are still allocated to the purchase of off-the-shelf items from existing supply chains of prime contractors who have incurred the IRB obligations.

It was recognized by the Group that as an SME moved up the value chain, IRB opportunities became more viable as large OEMs are naturally incented to work with players that have a competitive advantage.

Industry Canada and Strategic Aerospace and Defence Initiative (SADI)²

SADI is undersubscribed because the terms and conditions are too restrictive, notably with respect to the use of intellectual property and the location of manufacturing activities. Repayable contributions are equivalent to a loan at a 3% interest rate, and some large firms can obtain similar rates through other financing mechanisms with less conditionality than SADI. For small firms, SADI has not been a viable R&D funding tool since the five eligibility qualifications virtually exclude them. Also, the application and negotiation process is overwhelming for a small business, even for companies with over 50 employees. Finally, the repayment terms are onerous for SMEs and would likely stymie attempts by them to commercialize any R&D performed under the program. It is believed a review of the SADI database would reveal that very few projects have been approved for small businesses.

Industry Canada's Strategic Aerospace and Defence Initiative (SADI) should be simplified and a portion of funding should be non-repayable. The development part of SADI (for firms at technology readiness

levels (TRL)³ 7 to 9) is refundable and hence in compliance with WTO rules. However, for research initiatives in TRL 1 to 6, funding should be non-refundable due to the high risks involved and their generic nature, as is the case in all European and United States programs: the current European scheme is 50% for large firms, 75% for small business, and 100% for universities.

MACH Initiative

In a context of globalized world markets, prime contractors are reducing the number of their suppliers, preferring to work with a few intermediary companies that offer integrated solutions and manage numerous subcontractors. Consequently, the global supply chain is changing, favouring the emergence of integrators who are entrusted with the responsibility for design, fabrication and assembly of complete systems.

To maintain its leadership position, our industry now has to constantly adapt and innovate to provide an integrated supply chain that is more flexible and aligned with the expectations of prime contractors and end Customers. Suppliers need to improve their operating practices, increase their innovation capacity and promote partnerships, in short, work together to be stronger and more competitive.

The OEMs have changed their supply methods to meet international competition. Now SMEs need to follow suit and adapt themselves or pool their efforts to have more clout.

In the midst of these transformations, Aéro Montréal created the Supply chain Development Working group. Composed of individuals representing stakeholders from the aerospace supply chain, the group's mandate is to oversee the planning, coordination and implementation of a concerted action plan to respond to the major issues of subcontracting and, ultimately, to increase the competitiveness of Québec aerospace suppliers. It also aims to strengthen the Québec aerospace supply chain vis-à-vis international competition. To date, the group's work has generated valuable courses of action and a structuring program, the MACH Initiative, which will benefit the entire industry.

The MACH Initiative is a unifying model whose design and implementation has mobilized more than 100 industry professionals over 3 years. Its aim is to optimize the performance of Québec's aerospace supply chain by strengthening companies and the structure of the supply chain.

It does so by leveraging collaboration between customers and suppliers as well as by ensuring the implementation of strategies and projects that help bridge gaps in integration capabilities in Québec.

The MACH initiative is a change program for accelerating the aerospace supply chain competitiveness and performance through three main strategic goals which are:

1. To create an improved business culture for more openness, collaboration and innovation;
2. To improve supply chain competitiveness, one company at a time;
3. To develop new local integration capabilities.

The initiative is centered on a supplier competitiveness development framework that includes a performance label which allows suppliers to position themselves, identify their improvement opportunities and work on them.

The initiative also aims to develop strategies and projects that will help fill the gaps in integration capabilities in Québec and to foster the development of a world-class supply chain. Mechanisms to develop or attract world class integrators are implemented in collaboration with the various cluster partners to strengthen weak links in the Québec aerospace supply chain.

With a budget of \$15 million over five years, this collaborative program targets 70 suppliers, which will join the program in five annual cohorts. Besides financial support, it provides a framework for excellence composed of methodologies, tools and a training program that enables participants to enhance their capabilities across key business processes and areas. Funding for this effort came primarily from the Province of Quebec. The Canada Economic Development for the Quebec Region assisted with start-up and marketing funding, however the funds to support the SMEs in implementing their improvement plans came primarily from the province.

Since supply chains are never static, continually transforming and evolving to take into account customer's requirements, the need for collaboration in the supply chain is mandatory. Consequently, key in the initiative's model, is providing SMEs with the environment for establishing tight collaborative relations between a customer and its supplier to foster innovation and allowing for a more proactive supply chain.



Source: Aéro Montréal

The MACH excellence framework: an indispensable tool

As discussed before, all SMEs participating in the initiative are supported in their activities by a prime contractor or equipment manufacturer that acts as sponsor or mentor for the SME. This mentoring relationship is at the heart of the initiative as well as the MACH excellence framework. This framework is a management system that encourage and helps suppliers assess their performance, identify gaps and determine the actions necessary to improve and better position themselves within the supply chain.

The MACH excellence framework prioritizes three fundamental pillars for improving suppliers' competitiveness:

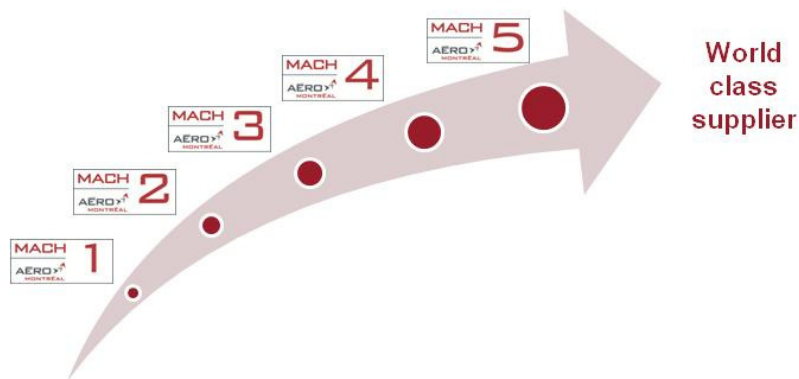
- excellence in leadership,
- excellence in operations,
- and excellence in planning and developing the workforce.

		5 maturity levels				
PROCESSES		MACH 1	MACH 2	MACH 3	MACH 4	MACH 5
LEVER 1 LEADERSHIP 21 THEMES	1.1 - Strategic Planning & Positioning	Red	Yellow	Yellow	Blue	Green
	1.2 - Performance & Management systems	Red	Yellow	Yellow	Blue	Green
	1.3 - Project & Risk Management systems	Red	Yellow	Yellow	Blue	Green
	1.4 - Innovation	Red	Yellow	Yellow	Blue	Green
	1.5 - Corporate Social Responsibility	Red	Yellow	Yellow	Blue	Green
LEVER 2 WORKFORCE PLANNING 15 THEMES	2.1 - Workforce Planning	Red	Yellow	Yellow	Blue	Green
	2.2 - Hiring, Workforce Mobilization & Retention	Red	Yellow	Yellow	Blue	Green
	2.3 - Workforce Training	Red	Yellow	Yellow	Blue	Green
	2.4 - Individual Performance Evaluation	Red	Yellow	Yellow	Blue	Green
LEVER 3 OPERATIONS 34 THEMES	3.1 - Supply Chain Management	Red	Yellow	Yellow	Blue	Green
	3.2 - Customer Relationship Management	Red	Yellow	Yellow	Blue	Green
	3.3 - Manufacturing Control & Management	Red	Yellow	Yellow	Blue	Green
	3.4 - Continual Improvement	Red	Yellow	Yellow	Blue	Green
	3.5 - Engineering, Methods & New product/program Introduction	Red	Yellow	Yellow	Blue	Green
	3.6 - Quality Management	Red	Yellow	Yellow	Blue	Green

Source: Aéro Montréal

The MACH excellence framework has a five level maturity scale, ranging from MACH 1 to MACH 5, as an evaluative basis for each of the framework’s 15 key business processes as well as for awarding the supplier a global performance label.

The performance label or certification provides suppliers with better visibility and more business opportunities as potential customers can, for a start, appreciate the value of this indicator in evaluating a supplier’s maturity and performance.



Source: Aéro Montréal

The first and the second cohorts

The Mach Initiative has started operations in July 2011 with a group of 20 suppliers supported in the process by 9 prime contractors. The first year of operations has allowed Aéro Montréal to optimize the operational processes as well as create all the tools necessary to support the program’s operations.

The MACH Initiative is now moving forward with its second cohort and as of July 10th 2012, supplier’s wishing to join the initiative will have to submit their application so we can proceed with the selection of 10 new suppliers that will start the initiative process by the end of September 2012.

Competitive Edge

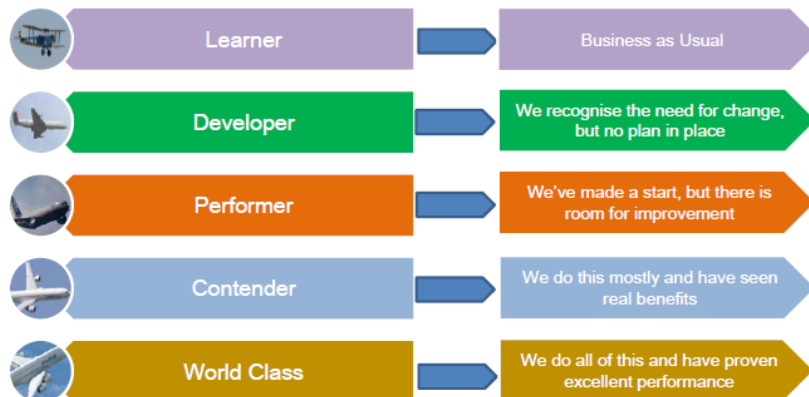
The Manitoba Aerospace Human Resources Council has recently collaborated with the United Kingdom’s North West Aerospace Alliance (NWAA) and their Aerospace Supply Chain Excellence (ASCE) team to deploy a similar program in Manitoba. This is an interesting case study, as you can see a domestic interpretation of a very successful foreign program. The goals of this program are quite simply to help enable aerospace SMEs in Manitoba become world class suppliers. The program uses assessors to walk an SME through an assessment and benchmarking process to show them just what it takes to become a world class supplier.

Funding for this effort came partially from the Province of Manitoba and partly from the Western Economic Diversification Canada agency.

The Competitive Edge program features six interwoven components:

1. Developmental Model: Learner to World Class – this model seeks to use a Plan-Do-Check-Act approach to develop SMEs from a Learner level where the SME acts in a business as usual manner to a world class enterprise

Developmental Model



2. 11 Foundational Processes – the Competitive Edge process seeks to understand the SMEs current maturity level on these 11 foundational processes, and then develop a project plan or A3 to improve maturity in selected areas, including:

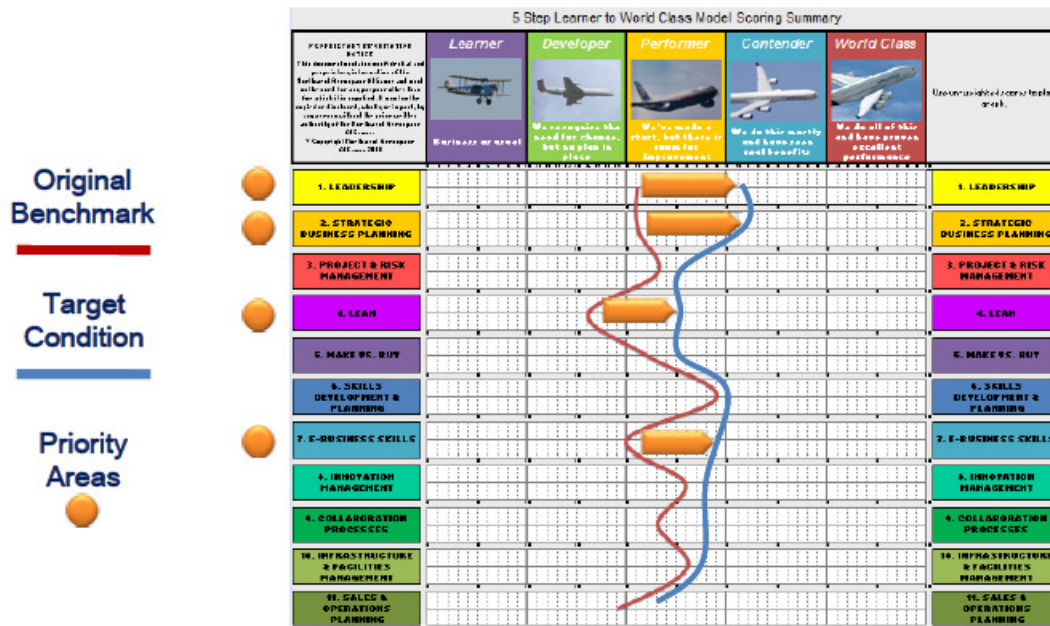
- Leadership
- Strategic Business Planning
- Project and Risk Management
- Lean
- Make versus Buy
- Skill Development and Planning
- e - Business
- Innovation
- Collaboration
- Infrastructure and Facilities Management
- Sales and Operations Management

- Benchmarking against the Model with confirmation tools to assist – five different measures are used to develop a benchmark for the SME going through the Competitive Edge program. They are;

- 1) Vision
- 2) Mindset, Culture and Journey Status
- 3) Advice, Training, Support and Sustaining
- 4) Pilot Sponsorship and Ownership
- 5) Performance Metrics

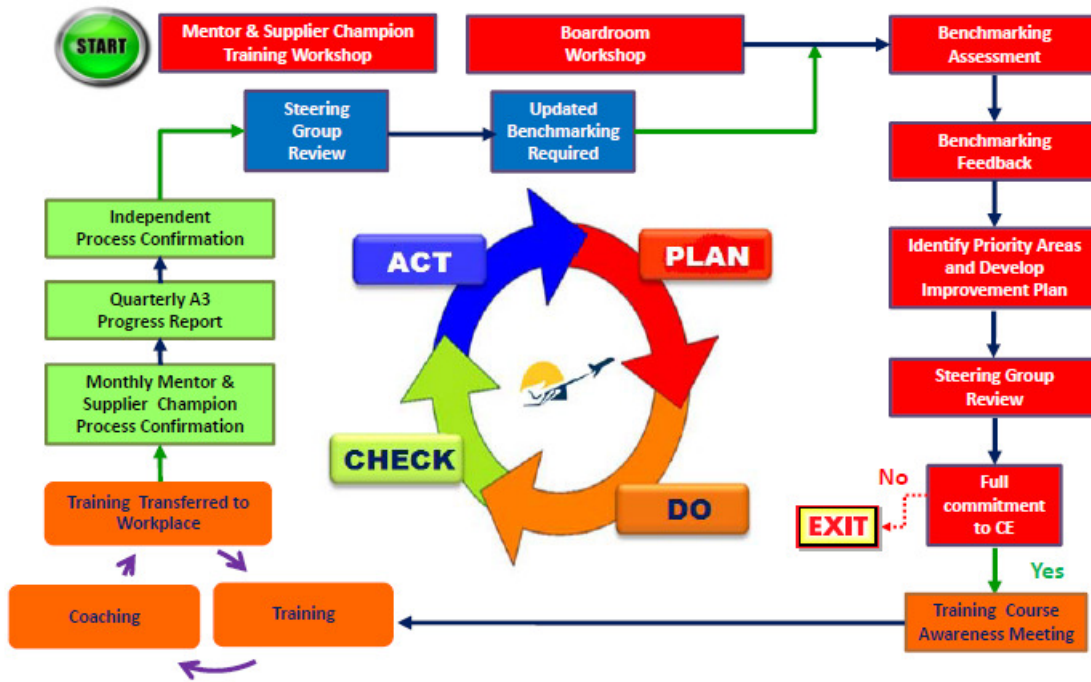
The scores in each different measure are used to create a benchmark scoring summary and a target condition based on the SME's improvement objectives.

Benchmarking



- Training and Coaching on the Foundational Processes – once the benchmarking assessment is complete, and the SME has fully committed to the Competitive Edge program, training and coaching begin in the chosen areas of improvement for the SME.

Process Map



- Mentoring utilizing senior operations expertise – Competitive Edge utilizes a check process that includes a quarterly progress report, mentoring and independent process confirmation from senior operations staff.
- Steering Committee for Oversight and Management – the final step in the process is an oversight process by a Steering Committee composed of senior operations staff and leaders of the Competitive Edge program.

The ultimate goals of the Competitive Edge program in Manitoba is to improve the SME's people, improve their practices, their performance and their overall business.

Esprit – Ontario Aerospace Council Global Clusters Accelerator

Source: Ontario Aerospace Council

ESPRIT is an initiative of the Ontario aerospace industry, working together through the Ontario Aerospace Council (OAC) that will drive business productivity improvements in several key Ontario Aerospace supply clusters through the adaptation and adoption of new technologies, processes and skills development by firms at all levels in the targeted clusters/supply chains. Esprit is currently in the conceptual phase as the OAC seeks funding partners from the provincial and federal governments and is designed to be an industry and government partnership. The OAC has approached the Federal Development Agency for Southern Ontario to support the program, but at the time of writing of this report no decision has been made.

Esprit's long-term objective is to achieve productivity levels comparable to those in other leading aerospace jurisdictions, such as the UK, France, Germany and Japan. This would require an improvement of approximately 31% from our current productivity levels. Closing half this gap plus increasing our market share by 10% will result in annual revenues growing from \$6,415 billion to \$8,709 billion and employment growing from 21,900 to 25,300 over the next 10 years in the Ontario aerospace industry alone, of which the targeted Key Clusters are the dominant part. Considering that serious skilled labour shortages are expected soon in Canada, these productivity improvements may, in fact, be seen as essential to growing the industry.

	Revenue (\$000)	Employment	Revenue per employee
Atlantic Canada	\$1,251	7,902	\$158,314
Quebec	\$11,511	36,054	\$319,271
Ontario	\$6,415	21,935	\$292,455
Western Canada	\$3,019	13,073	\$230,934
CANADA Total	\$22,196	78,964	\$281,090
GERMANY			\$430,000
FRANCE			\$390,000
UK			\$330,000
JAPAN			\$410,000

Esprit targets specific aerospace clusters of companies in an effort to encourage supply chain development through collaboration. A “Cluster” is a group of companies all involved in a specific product supply chain, with defined Tier-level positions within the supply chain, and located in a specific

geographic region. Ontario’s aerospace industry has several key Clusters. These are listed in the table below, which also shows the number of companies active at the various Tier levels and the total number of employees in these companies:

Cluster	Tier 1	Tier 2	Tier 3	Tier 4	Employees
Aerostructures	2	13	42	29	12,400
Landing Gear and Flight Control Actuation	4	13	19	18	9,000
Avionics & Flight Management	2	24	12	3	5,500
Turbine Engines	1	6	17	12	2,900
Environmental Conditioning & Electric Power	2	2	3	2	1,900
MRO	7	10	11	2	7,200

ESPRIT will leverage a substantial amount of work that has already been done by the Ontario aerospace industry to identify and define key strategic initiatives with the highest leverage to improve our business productivity and performance, including but not limited to:

- MAP – OAC’s SME Supplier Development Program
- MOSAIC – OAC’s Environmental Sustainability Initiative
- OAC’s Employee Training and Development System
- Dock-to-Dock – a concept for efficient management of processing requirements within a supply cluster
- AERO-Canada – the OAC’s powerful and efficient aerospace capabilities database
- Schedule Synchronicity – a simple means for ensuring that all suppliers throughout a Cluster supply chain work to the same schedule

ESPRIT will bring together all the companies in the targeted Key Clusters to forge a game changing vision of what constitutes excellence and global competitive advantage in individual company performance and supply cluster performance. ESPRIT’s work will deepen the connectedness of the Cluster members, and will reduce the time and increase the opportunities for a deep connectedness to occur. Each member will have an enhanced picture of its role and responsibilities and have an increased opportunity and responsibility to communicate with other Cluster members. This deeper connectedness with other Cluster members will result in firms sharing costs, increasing innovation within the cluster, improve scheduling and other interconnected operational tasks, all of which will improve their individual company productivity and cluster supply chain productivity. ESPRIT will work with SMEs in particular to illuminate and enhance their state of readiness for productivity improvement changes.

ESPRIT will bring together the expertise (consultants, technical experts, skills development experts, etc.) necessary to deliver the intended programs and support cluster companies in implementing their productivity improvements.

ESPRIT is planned as an initiative within the OAC, with personnel and experts engaged to lead and manage ESPRIT programs and to provide technical and business expertise to Cluster companies that are participating in the programs offered by ESPRIT. ESPRIT will be an active Change Agent, serving as a catalyst & facilitator for desired changes to introduce productivity improvement in and among supplier firms. ESPRIT will be adaptable in its program delivery to suit specific cluster and individual company situations.

It is expected that Program Managers will be engaged on a part-time basis, supported by several technical and business experts also engaged on a part-time basis. ESPRIT will work with each cluster in a client relationship. ESPRIT will engage with the cluster and initially contact the lead firms in the supply chains to review the process in detail, outline commitments and expectations of players, time and resource commitments. A project charter which reflects the business approach that ESPRIT brings to the collaboration will be reviewed. Once the lead firms have signed, the same process would then be followed with the other members of the cluster.

The initial step in the program would be a ‘readiness for change’ instrument to be administered to each member. The results would be shared as part of the initial meeting of the cluster members. This meeting is critical to the definition of what the cluster could be for each of the members. It will be facilitated by ESPRIT. Outputs would be a clear definition of what the cluster with deepened connections could be – a

game-changing vision of what constitutes excellence and global competitive advantage; how it would operate; benefits expected by each member and measures of performance to use as the cluster proceeds through the process; expectations of the cluster members of ESPRIT and what ESPRIT expects of the members.

These outcomes would take more than one meeting to achieve. Once agreed by all cluster members, then the ESPRIT programs outlined below would be introduced in a logical pattern to meet the business environment and priorities facing the cluster.

The programs to be delivered by ESPRIT which will enable the desired productivity improvements to enable a global competitive advantage include:

- Design Engineering
- Enhanced Skills and Knowledge
- Environmental Sustainability
- Transformational Manufacturing
- Manufacturing System (i.e. Lean/Six Sigma)
- SME Supplier Development
- Supply Cluster Management

The ESPRIT program will focus on revenue per employee as the key measure of organizational productivity. ESPRIT will engage the leading Tier 1 Systems Integrator companies in each of the targeted clusters as principal participants in ESPRIT. Achievement of significantly higher productivity levels comparable to those in other leading aerospace jurisdictions, such as the UK, France, Germany and Japan, is the long-term objective of the Ontario aerospace industry.

Current productivity performance data for various relevant jurisdictions is shown in the table below:

As Canada possesses the 5th largest aerospace industry world-wide, in order to gain on any of the top 4 nations (Germany, France, UK and the US) we need to improve productivity. Current productivity performance in all regions of Canada significantly lags the top 4 nations globally and that of 6th place Japan.

6. Supply Chain Development Programs in the United Kingdom

The United Kingdom (UK) has long recognized aerospace as a vitally important sector and has the vision that “by 2022 the UK will offer a global aerospace industry, the world’s most innovative and productive location, leading to sustainable growth for all its stakeholders.”

To this end, the UK has developed a program called Supply Chain 21 in collaboration with their national aerospace and defense industry association (ADS). Supply Chain 21 is a national supply chain development initiative that certifies suppliers that go through its program to a Bronze, Silver and Gold level. SMEs that go through this program are then able to market themselves to other prospective customers as certified SC 21 aerospace suppliers. This effort has received significant funding in the amount of £100M from the Sector Skills Council for Science, Engineering and Manufacturing Technologies (Semta) plus it is augmented by regional development funding. In the UK, there is £2.4B in regional development funding available through the Regional Growth Fund. This was initially funded with £1B and was later augmented with another £1.4B. Aerospace is recognized as a key sector and SMEs in aerospace regularly access these funding sources.

The UK’s regional aerospace industry associations such as the North West Aerospace Alliance and the Midlands Aerospace Alliance have long encouraged their members to take advantage of this program and other regional funding available to aerospace firms. For example, the NWAA created the ASCE1 and ASCE2 programs through access to these funds and this was complemented by £6.4M in funding from the European Regional Development Fund and the Ministry of Business, Innovation and Skills.

The UK has recently announced a new Advanced Manufacturing Supply Chain Initiative available to multiple sectors including aerospace. This is a national initiative with a fund of up to £125m to create more competitive supply chains, sustain or create new employment opportunities, and create better synergies and sustained collaborative relationships throughout supply chains that participate in this initiative.

7. National Aerospace Supply Chain Development Framework

As the sector positions itself for the next phase of growth, which includes increasing its global market share from \$22 billion today to \$35 billion by 2030, and increasing the number of aerospace jobs for Canadians from 80,000 to 124,000 by that time,⁴ tremendous opportunities exist for industry, academia, and governments to work together to leverage existing policies, programs, and resources to assure that Canada develops the best supply chain capabilities in the world. To realize this growth, decisive action is needed.

To enable the creation of a world class supply chain in aerospace in Canada we need to create a National Framework for Supply Chain Development. Simply put, SMEs do not have the resources to invest in supply chain development and government can play a hugely influential role in this process with relatively modest funding.

A National Aerospace Framework for Supply Chain Development would contain the following elements:

- 1) Create a path for small and medium sized firms to differentiate and grow through Supplier Development Programs geared to the global aerospace industry;
- 2) Create a stable funding mechanism for Supplier Development Programs in Aerospace across Canada;
- 3) Maximize collaboration between the small and medium sized firms and the OEMs, Tier 1 Systems Integrators and Tier 2 Equipment Providers.
- 4) Develop a National certification framework that recognizes efforts made by SMEs that participate in Supplier Development Programs

Element 1: Create a path for small and medium sized firms to differentiate and grow through Supplier Development Programs geared to the global aerospace industry

Canada needs a national strategy to ease and quicken the maturation process that an SME must go through in order to become a viable supplier to global OEMs and Tier 1's. The MACH initiative in Quebec, the Competitive Edge program in Manitoba and the Esprit program in Ontario are all examples of programs that seek to assist aerospace SMEs become world-class aerospace firms.

Other regions of Canada such as the Atlantic Provinces and Western Canada have no such supplier development programs specific to aerospace's very stringent requirements. As such firms in these regions are at a competitive disadvantage if they seek assistance in becoming a world-class globally competitive and successful supplier for aerospace.

The Group felt there were two possible solutions to create this path:

- 1) The creation of a national program for aerospace supplier development patterned after these provincial/regional programs, or
- 2) The creation of a national framework that sought to integrate the provincial/regional programs and map their various ratings so that a national standard could emerge over time

The benefits of a national supply chain development initiative include:

- Harmonization of various provincial initiatives;
- International recognition and leverage for suppliers;
- Assistance for OEMs in identifying credible suppliers; and,
- Encouraging collaboration between OEMs and suppliers across the country.

The drawbacks of a national initiative include:

- Differing industry structure across regions (for example, in Ontario only 20% of SME output is consumed in the province and there is only 1 OEM, while in Quebec 50% of SME output is consumed in the province and there are 4 large OEMs);
- Differing objectives of current provincial initiatives; and,
- The inherent cost and time challenges in establishing a federal program

The Group felt that the first solution would be more desirable, but would require a significantly higher investment by both the federal government and industry to achieve. A more practical, short-term solution would be to create a national framework within which the existing regional programs could receive funding and collaborate on outcomes. The Group reached consensus that this national framework should:

- Be led by industry and focused on improving our productivity relative to other nations
- Be funded in an even split by the provinces, federal government (most likely regional development agencies) and the participating firms
- Seek to develop a “conversion table” over time that would equate the various levels of achievement in the differing programs
- Be focused on moving SMEs up the Tiered Value Chain with the intent of creating more Canadian based Tier 1 and 2 firms
- Be performance and outcomes focused with an emphasis on a sound business strategy for the SME that results in a powerful customer value proposition
- Recognize that to the SME owner/investor, there needs to be a return on investment
- Encourage the SME to differentiate themselves in a sustainable manner against their competitors
- Encourage the SME to improve their productivity continually to enhance their competitiveness
- Allow the SME to compete successfully in the global marketplace

Element 2: Create a stable funding mechanism for Supplier Development Programs in Aerospace across Canada

One common theme from all the existing provincial/regional supplier development programs is that they seek to mature aerospace SME's through a process of collaboration either with other firms or with industry associations. The cost of running these programs was fairly low considering the value provided to the firm. Across the programs, cost varied from \$50,000 to \$100,000 per firm in cash and in kind investments from the participating SME firms were expected. On a larger scale, it is very conceivable that an effective program could be delivered for \$50,000 per program.

The funding mechanism for these programs varied dramatically by region. In Quebec, the cost of the program was funded partially by the provincial government and the industry association Aero Montreal. In Manitoba, the federal regional development agency provided funding matched by the provincial government. In Ontario, the Esprit Program has yet to get off the ground due to a lack of funding and discussions with the federal regional development agency are ongoing.

Discussions with the Federal Regional Development Agencies (RDAs) were enlightening and showed that were differing approaches taken by each agency. Certain RDAs chose not to fund programs directly, but only specific supplier development projects if they met the required criteria. The Western Economic Diversification Canada agency did help provide funding for the Competitive Edge program, but it was not confirmed to be funded for more than the current fiscal year.

It is the recommendation of the Group that a consistent approach to funding Supplier Development Programs be established between these regional development agencies or another mechanism. This would not require new funding, but would simply seek to provide consistency among the agencies or partition a portion of the funding given to the SADI program for this purpose. A re-allocation of only \$2M annually of the existing budget from the various regional development agencies or the SADI program, targeted at aerospace supplier development across the country, could enable 200 aerospace SMEs nationwide take those first vital steps towards moving up the supply chain towards Tier 1 and 2 status over the next five years. And doing this in a collaborative way with industry would very likely lead to repeat business for these firms as they establish themselves as viable suppliers.

It should be noted that if the funding were allocated from existing Regional Development Agencies or the existing SADI budget, these program terms and conditions would need to be amended for this purpose.

Element 3: Maximize collaboration between the small and medium sized firms and the few OEM and Tier 1 Systems Integrators and Tier 2 Equipment Providers in Canada

One common theme from all the existing provincial/regional supplier development programs is that they seek to mature aerospace SME's through a process of collaboration either with other firms or with industry associations. These SME firms that participate in programs like the MACH Initiative and Competitive Edge achieve two distinct benefits from this collaborative approach:

- 1) They learn what is required to be a top supplier for an OEM or Tier 1 Aerospace company
- 2) They establish contacts and business channels with the OEM or Tier 1 that can lead to future business

This approach is one manner in which to accelerate the clustering that occurs over the long term in certain geographies. For example, Montreal has some of the largest concentrations of aerospace businesses in the world and collaboration between firms in these "clusters" could be further enhanced and accelerated by a national Supplier Development Program.

Although Canada has relatively few OEM's and Tier 1 systems integrators, those we have are actively engaged in program like MACH and are seeking to develop their supply bases locally where possible. The problem is that each large firm had different approaches to this effort and if an SME met all the requirements to be a supplier for one firm, it did not necessarily meet the needs of another large aerospace firm.

To streamline and increase the efficiency of this process, the four largest aerospace firms in Quebec (Bombardier, Bell Helicopter, Pratt & Whitney Canada and CAE) chose to collaborate in the creation of the MACH Initiative with the intent that once a supplier became MACH certified to a certain level (eg. MACH 2) it would be certified for all participating large aerospace firms. This would effectively lower the cost for supplier certification both for the large firms and for the SMEs involved.

This collaboration that occurred in the creation of the MACH initiative is a great example of what could be done nationally to Canada's great benefit. The challenge would be to replicate this success in other regions that have a lower density of aerospace companies. The group's recommendation would be to begin in areas where a higher density already exists such as the Toronto aerospace cluster or the Winnipeg cluster and grow outwards from those points. Both Toronto and Winnipeg have all the necessary elements and critical mass to make this successful and in both cases have already begun work on clustering efforts and Supply Chain Development programs. With further collaboration between industry, government and academia in these areas, great strides could be made to grow our SMEs in these centers of aerospace in a similar manner to what has already begun in Montreal.

Element 4: Develop a National certification framework that recognizes efforts made by SMEs that participate in Supplier Development Programs

With the various regional Supplier Development Programs in place, it is currently very difficult for any global OEM to understand the level of maturity of Canadian suppliers. Programs like the MACH Initiative in Quebec and Supply Chain 21 sought to recognize standard levels of achievement so that other potential customers could understand their level of maturity. In the latter case, the UK chose to go with Bronze, Silver and Gold certifications to the national program so that prospective customers would know how these SMEs had fared in the supply chain development program. In Quebec, as described earlier in the report, Aero Montreal chose to go with MACH 1 to 5 to describe the levels of maturity of the firms engaged in the program.

In collaboration with industry, a Canadian national standard should be established. This would allow participating firms to market themselves as a qualified supplier recognized by a national accreditation program. There are two possible approaches to develop such an accreditation:

- 1) Simply take an existing accreditation program such as the one used with the MACH Initiative and expand it nationally.
- 2) Combine elements of the accreditations used in the three existing initiatives (MACH, Competitive Edge, and Esprit) into a new national accreditation.

The recommendation of the Group is that Option 1 above would be preferable as the accreditation that is part of the MACH Initiative is the most advanced in Canada, would take less time to roll out nationally, and has already been adopted by a large number of firms.

8. Advice to Head of Review

Canada has many aerospace firms that are able to seek out and win new business competing against many of the best companies in the world. We have a proud tradition of success and the root of this success is the competitive advantages that have been developed over a long period of time. Some of our most successful aerospace firms are those that compete based on world-leading technology, engineering prowess, or other expertise that is world class. To develop such technology or expertise takes years of effort and investment. There are also very successful efforts underway today to gain market share through intelligent manufacturing, higher levels of automation, and revolutionary manufacturing techniques. Again these efforts take time and deep pockets.

To accelerate our market share gains in the global aerospace industry, it is evident that Canada needs to nurture its small and medium sized aerospace companies through a national framework of collaborative supply chain development programs. Other forward thinking nations such as the UK have already begun such program and they have a head-start on Canada. These programs seek to partner small and mid-sized aerospace businesses with larger Tier 1 or Prime firms in an effort to grow the business of the smaller firms and provide better linkages in the supply chain.

There are several examples of effective programs at the provincial level in Canada:

- The MACH Initiative in Quebec
- Esprit (formerly MAP) in Ontario
- Competitive Edge in Manitoba

While each of these programs is in the early stages, initial results are very heartening. The preference of the Working Group was that the MACH Initiative be expanded nationally in order to create a National Supply Chain Development Initiative. The MACH initiative is the most advanced in Canada, would take less time to roll out nationally, and has already been adopted by a large number of firms. It is our further recommendation that Aero Montreal work with the AIAC, OAC and Manitoba Aerospace to undertake a process of continuous improvement to enhance the MACH Initiative to ensure that it meets the needs of all regions of Canada without sacrificing or undoing any of the good work completed to date. Once this process is completed, and we estimate this would take no more than 8-12 months, the MACH Initiative would be poised to expand nationally to the benefit of all Canadian aerospace firms.

To date these Supply Chain Development programs have been funded provincially with matching industry funds and in some cases matching federal funding through Regional Development Agencies. To make a National Supply Chain Development Initiative successful, one key ingredient is needed: matching funding from the federal level, specifically to be allocated from the existing funding of the Regional Development Agencies or SADI in order to maintain the principal of fiscal neutrality. This will allow the Mach Initiative to be delivered to a larger cohort of companies on a national basis each year.

The cost of deploying such a National Supply Chain Development program is fairly minor compared to the benefit this could bring to Canada and the aerospace industry in Canada. Costs vary by program at the regional or provincial level, however an investment of around \$50,000 per small or mid-sized business will pay large dividends in securing future business with OEMs and Tier 1 and 2 firms. To deploy this type of Supply Chain Development program nationally to a group of 40 small and mid-sized businesses each year would cost approximately \$2,000,000 per year. If funded for a period of 5 years at a total cost of

\$10,000,000, 200 small and mid-sized businesses would benefit over that time period. The long-term competitive advantage that be developed is the linkages created through such programs between the larger companies and the smaller firms that will potentially lead to new business wins well after the initial program is completed. Essentially, a National Supply Chain Development program based upon the Mach Initiative would accelerate some of the clustering effect that already exists between the various levels of aerospace firms in Canada.

If only a portion of these firms grow into significant Tier 1 and 2 players that will double the size of the aerospace industry in Canada in the next 20 years, and this will have significant spin-off effects for Canada as a whole.

Annex 1: Small Business and Supply Chain Group Members

Supply Chain Development Working Group				
	Larry	Fitzgerald	Chair	Honeywell
	Adam	Moser	Secretary	Aerospace Review Secretariat
	Maryse	Harvey	AIAC	Aerospace Industries Association of Canada
Industry				
	Claire	Auroi	Bombardier	
	Suzanne	Benoit	Aéro Montréal	
	Jacques	Comtois	L-3 MAS	
	Pierre	Delestrade	EADS Canada	
	David	Gregory	Canrep	
	Konrad	Hahnelt	Magellan	
	Rod	Jones	OAC	
	Frédéric	Loiselle	Pratt & Whitney Canada	
	David	Stapley	CADSI (DRS Technologies Canada)	
	Linda	Wolstencroft	Aerospace Bizdev	
Academic				
	Claudia	Rebolledo	HEC Montreal	
Government Departments (Observers)				
	Atlantic Canada Opportunities Agency			
	Canada Economic Development for Quebec Regions			
	Foreign Affairs and International Trade Canada			
	Industry Canada			
	National Research Council			
	Western Economic Diversification Canada			

Annex 2: Surveys and Reports

- [AGM presentation Deloitte STC201010](#)
- [AIAC Deloitte Report ExecSummary - Final Oct 21](#)
- [AIAC FMP Report](#)
- [AIAC Phase 1 Report FINAL](#)
- [AIAC Phase 2 Report FINAL](#)
- [AIAC Phase 3 Report FINAL](#)
- [Airbus - Global Market Forecast 2011-2030](#)
- [Boeing - Current Market Outlook 2011-2030](#)
- [CAE - Jenkins Report and Economic Action Plan](#)
- [CAP Final Report](#)
- [FMP Overview presentation](#)
- [Global trends deck](#)
- [Invest in Canada 2011: Aerospace-Canada's Competitive Advantages](#)
- [Jenkins Report - Key aerospace recommendations not retained](#)
- [Jenkins Report - PandWC response](#)
- [Jenkins Report - Summary deck](#)
- [Jenkins Report - Summary of the RandD Review Panel](#)
- [Meeting of the Sub-Group on Defence Industrial Strategy and IRBs](#)
- [Public Funding Programs in other countries - Science-Metrix](#)
- [Summary of Budget 2012 for WGs](#)
- [Teal](#)
- [WTO Subsidy Disciplines and Program Design Considerations - FINAL](#)

Annex 3: Aerospace Activities by Province

Alberta: Alberta's aerospace industry contributes \$1.3 billion in annual revenue to the provincial economy and is responsible for over 5,000 jobs exclusive of airlines and airports. The industry exports 40 percent of its output. Alberta offers competitive strengths in robotics and unmanned vehicle systems, space science, geomatics and navigation systems, and maintenance, repair and overhaul. More than 50 aerospace companies are located in and around the city of Calgary, with strong clusters in maintenance, repair and overhaul, and information communications technology. Major Alberta companies involved in aerospace include ATCO Frontec, Field Aviation, ITRES, Iunctus Geomatics, Pratt & Whitney, NovAtel, and Raytheon.

British Columbia: Aerospace companies in the greater Vancouver region, such as Avcorp Industries benefit from their proximity to Boeing, located in neighbouring Washington State. British Columbia's aerospace strengths include helicopter services, aircraft engine overhaul, multi-role aircraft maintenance, repair and overhaul, space systems and advanced composite aircraft structures. The industry in B.C. is also supported by one of Canada's largest aerospace training centres, located at the British Columbia Institute of Technology. Leading B.C. aerospace firms include ASCO Aerospace, Avcorp Industries, Cascade Aerospace, CHC Helicopter, Kelowna Flightcraft, MDA (MacDonald, Dettwiler and Associates), MTU Maintenance, Vector Aerospace and Viking Air.

Manitoba: Winnipeg is the largest aerospace cluster in Western Canada and a major centre in North America for the manufacturing of composite aircraft components and aircraft maintenance, repair, and overhaul. Winnipeg is the location of Boeing's composite manufacturing plant, the largest such facility in North America, and home to one of Boeing's 10 major global sites for commercial aircraft. The aerospace cluster in Manitoba directly employs some 5,300 people and is led by four major global firms: Boeing Canada Technology, Magellan Aerospace, Aveos and StandardAero. The province is also home to 23 other established national and regional firms and several mid-sized aerospace suppliers. StandardAero, located in Winnipeg, is one of the largest independent maintenance, repair, and overhaul aerospace firms in the world.

New Brunswick: New Brunswick's aerospace technological environment includes companies in the fields of aerospace design, advanced composites research, secure communications research, electronics/avionics assembly, advanced learning and simulation systems, metal fabrication, and precision machining. Companies are located in cities such as Fredericton and Moncton.

Newfoundland and Labrador: Newfoundland and Labrador's aerospace capacity includes aircraft modification; systems integration; marine surveillance; manufacturing and assembly of aircraft components; aircraft maintenance repair and overhaul; navigation and communication systems; marine and flight training programs, including simulation; and research and development opportunities, including unmanned vehicle systems and marine acoustic applications. The province also plays a vital logistical role for civil aviation through the Gander airport and its North Atlantic air control capacity.

Nova Scotia: Halifax is home to a number of world-renowned aerospace firms specializing in composite fabrication, electronic assemblies, simulation and modeling technologies, and engine manufacturing. Companies operating in the province include Lockheed Martin, Pratt & Whitney Canada, IMP Group, EADS Composites Atlantic, C-Vision and CAE.

Ontario: Southwestern Ontario is the location of Canada's second-largest aerospace cluster, with over 200 firms employing more than 20,000 skilled employees. Toronto, the core of this cluster, has key strengths in aircraft parts manufacturing, aircraft systems development, and maintenance and overhaul. Toronto also hosts many world-leading aerospace firms, such as Bombardier, Pratt & Whitney Canada, Honeywell Canada, Magellan Aerospace, and Northstar Aerospace. The University of Toronto Institute for Aerospace Studies and the Ryerson Institute for Aerospace Design and Innovation collaborate with industry partners on numerous R & D projects.

Prince Edward Island: The Charlottetown aerospace cluster specializes in engine maintenance, repair and overhaul, and the manufacturing of precision components, engine coatings and airplane interiors. Nine aerospace firms, including Honeywell Canada and Vector Aerospace Engine Services - Atlantic, operate in the province and are located in Slemmon Park, near Summerside. Holland College's Aerospace Centre provides a range of training opportunities for the burgeoning aerospace industry.

Québec: Montréal is one of the three international aerospace capitals with Toulouse in France and Seattle in the USA. The city is the hub of Canada's aerospace industry and its largest aerospace cluster. Montreal is renowned for its expertise in aircraft assembly, engine manufacturing, maintenance, repair and overhaul, avionics, subsystems design and assembly as well as simulating and modeling technologies. Quebec accounts for 55% of Canadian aerospace turnover with \$11.7 billion in sales in 2011. Quebec also represents 50 % of the Canadian aerospace industry workforce with 42,040 jobs. The Montreal cluster encompasses more than 10 aerospace research centers including the Canadian Space Agency, the Aerospace Manufacturing Technology Centre (NRC Aerospace) and the CRIAQ, it also is home to four universities with dedicated aerospace programs, three dedicated professional schools and 234 companies (4 OEM, 15 Tier 1, and 215 tier 2 to tier 4 companies) which together put in for 70% of all Canadian funds invested in R&D. The main firms of the cluster are Bombardier Aerospace, Bell Helicopter Textron Canada, Pratt & Whitney Canada, CAE, Rolls-Royce, Heroux-Devtek, Messier-Dowty-Bugatti, Aerolia, Safran, Sonaca Montreal, L-3 Communications MAS, Thales, CMC Esterline, etc.

Saskatchewan: Saskatchewan's aerospace companies operate in satellite technology, wireless communication systems, atmospheric research and testing, synchrotron research and development, micro-electromechanical devices, building structures, cases and harnesses, mini unmanned aerial vehicles, and training programs. The province's industry employs approximately 2,500 people. Saskatchewan's aerospace companies, located near Saskatoon, include SED Systems, Vecima Networks, Scientific Instrumentation, Summit Structures, SBC Case, and Draganfly Innovations.

Source: [Invest in Canada 2011: Aerospace-Canada's Competitive Advantages](#) & Aéro Montréal.

Sources and Notes

¹ [The Strategic and Economic Impact of the Canadian Aerospace Industry](#)

² [Strategic Aerospace and Defence Initiative \(SADI\)](#)

³ Definitions for technology readiness levels (TRL) 1-9 are found in Annex 4.

⁴ [The Strategic and Economic Impact of the Canadian Aerospace Industry](#)