BC Aerospace Workforce Development Plan

Created under the sponsorship of:

Aerospace Industry Association of British Columbia (AIABC)

International Association of Machinists & Aerospace Workers (IAMAW)

Pacific Aircraft Maintenance Engineers Association (PAMEA)

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Human Resource Development Canada

BC Ministry of Skills Development & Labour

British Columbia Institute of Technology

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prepared by I.A.S. Chairperson Sylvia Holland

Table of Contents

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EXECUTIVE SUMMARY

Why is action necessary? Employment growth in both the manufacturing and the maintenance sectors within the aerospace industry in British Columbia is on a continuing upward trend: 5% per annum average growth for the manufacturing sector and 3% per annum growth for the (larger) maintenance sector, even despite events of September 11, 2001 that affected the global aerospace industry. Quantitative analysis of business growth and employment growth confirms that aerospace employers in this province face a potential skills shortage in at least six occupational groups. Many aerospace companies in British Columbia are still recovering from business slowdowns in the aftermath of September 11, 2001 events, and there are not acute hiring difficulties across the board right now. The skills shortage will become critical by 2005-08 however, if action is not taken now.

There are several reasons. Canada's population is aging and its birth rate falling, so employers face a smaller proportion in the 15-45 age segment of the labour pool. Many people already in the work force are retiring early, i.e., between 50-60, rather than working until 65 or older.[1] And because the aerospace workforce in BC has an older age structure than is true nationally, retirement rates will climb faster – and will keep climbing between now and 2008.

Job opportunities for young workers will be increasingly abundant in *all* sectors of the provincial economy – and aerospace employers face stiff competition for recruits from employers in other industries. The aerospace industry in British Columbia currently has a very low profile with youth, teachers and parents, career counsellors, adults who are considering a career change, and government workers who are involved in technical training and apprenticeship initiatives, so it is disadvantaged in this competition for skilled workers. As well, the labour pool that employers in the civilian aerospace industry could draw from during the 1990s, i.e., skilled workers leaving the military, no longer exists. Downsizing of national defense forces in Canada has not only stopped: the military are now competing with civilian aerospace employers in recruitment campaigns and offering signing bonuses.

The long training pipeline for aircraft maintenance workers – with waiting lists for training programs, lengthy technical training in classrooms, then long requirements for "time on trade" (on-the-job training requirements before being certified or licensed) – is one reason why training investments should be increased now, rather than waiting until new entry rates cannot begin to compensate for retirement-related exits. The complexity and cost of technical training requirements in aerospace is another reason for beginning increased training now: i.e., so that rising investment in aerospace training can be sufficiently moderate in annual increases as to be manageable for all stakeholders.

What skill shortages are most critical?

Research indicates that the occupation groups with the greatest anticipated demand are: (highest to lowest)

1. AME – M Aircraft Maintenance Engineers and unlicensed technicians on the same training path
2. AME – S Aircraft Structures Engineers and unlicensed structural repair technicians
3. AME – E Avionics Maintenance Engineers and unlicensed avionics technicians
4. Gas Turbine Engine Repair Technicians
5. Structures Manufacturing Technicians

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[1] Currently in BC, slightly more than one-third of workers in the MRO segment of the aerospace industry (which is the dominant sector of the industry in British Columbia) are 45 years or older. Maintenance employment has a sharper drop off after the age of 55 than does manufacturing employment: in other words, more MRO employees retire early than do manufacturing employees. And 42% of maintenance workers in aerospace are in the 35-44 age group. They will not retire in the next 10-15 years but will (in that period) enter the age group "where reduced physical ability will become a factor in on-the-job performance." (CAMC findings: *A Human Resource Study of the Canadian Aviation Manufacturing and Maintenance Industry*, September 2002)

6. Aviation Machinists
7. Helicopter Dynamic Component Technicians

Relative to anticipated supply of graduates from post-secondary educational institutions who are delivering aerospace technical training, the two areas in which supply is most likely to be inadequate are:

(1) AME-S and Aircraft Structures Technician group and

(2) AME-E and Avionics Technician group.

The top three categories on the "high demand" list are especially critical because it is only AMEs who can sign out aircraft on which many other workers in unlicensed occupational groups perform manufacturing or repair tasks. Without an adequate supply of AMEs to perform supervisory and coaching tasks, aerospace companies will find that productivity and profitability suffer – and industry growth is not possible.

Research has also identified significant *new* skills and knowledge that workers must acquire to effectively fulfill manufacturing and maintenance responsibilities: e.g., lean manufacturing principles and procedures, expertise in other process technologies, computer-based design, trend monitoring and predictive maintenance techniques that are computer-based, virtual modeling and other 3-D visualization and simulation technologies to determine airworthiness, more advanced knowledge about avionics systems and electronic control, business skills training that focuses on life cycle affordability analysis, toxicity reduction in manufacturing and maintenance processes, and enhanced team work and customer service skills to address the supply chain consolidation and increased precision requirements in virtually all business and technical processes.

What RECRUITMENT initiatives are planned?

One recruitment initiative is collaborative work with other aerospace associations across Canada to create an **enhanced on-line service for candidate screening and job posting**.

With the on-line service to facilitate recruitment of skilled workers, the strategy is to share development and maintenance costs with aerospace associations in other jurisdictions in Canada; to make the resume posting service international in scope for job candidates but limit job posting eligibility to Canadian employers; and to work with the Canadian Aviation Maintenance Council to explore the feasibility of enhancing the existing CAMC service (similar in nature but without some desired features) and offering it on a fee-for-service basis to non-members as well as members of CAMC, rather than building a parallel (competing) service at additional infrastructure cost.

Besides the national on-line service for job postings and screening of job candidates, recruitment initiatives include **targeted publicity campaigns** coordinated by the industry association (Aerospace Industry Association of BC). Key contacts and recommended tactics were identified during roundtable sessions.

Target audiences are: (a) parents, secondary school teachers and career counsellors, and youth; (b) women; (c) First Nations employment services and workers; (d) tradespeople (e.g., machinists) seeking re-employment in new industries; (e) recent immigrants employed in aerospace and those immigrants' professional networks in their countries of origin. In all cases, key objectives of the communication campaigns are to raise awareness of aerospace training, employment and career options and to heighten interest in the industry.

As discussed further below, **ongoing liaison with government contacts** is also essential.

What is the TRAINING strategy?

The primary feature of the HRD strategy of the industry in British Columbia is adoption of a "grow our own" approach to acquiring the skilled labour that is needed. The focus is:

- **Faster introduction to the workplace for learners** in aerospace trades training programs

- Creation of more on-the-job training (OJT) opportunities to enable technicians to meet certification standards (and for some, licensure requirements) – through **"chunking down" of OJT modules into smaller intervals of time (e.g., three-month blocks) and interspersing them with classroom training**
- **Increased transparency for learners about how specific training programs ladder into occupational and license requirements –** including better integration of standards and apprenticeship programs used by provincial trainers with *national* certification standards, licensure requirements and tracking system
- **Better coordination of work experience placements through establishment of an Aerospace Training Council** serving multiple employers and training providers
- **Heightened employer involvement in screening criteria and procedures for aerospace training** programs delivered by colleges – coordinated through an industry training council
- **Ongoing tracking of labour market information and setting of training priorities through this industry training council including business and labour representatives.**

In particular, addressing the skill shortage in aerospace means that **companies need to provide more supervised on-the-job training for graduates of basic training** delivered by regional colleges and training institutes. Increasing employer willingness and capacity for greater uptake of basic-training graduates is a more pivotal issue than increasing seat capacity at colleges. Once learners graduate from basic training, they still need 36 to 48 months of on-the-job training to qualify for licensed occupations and also the certified occupations on the high-demand list noted on page i.

Data supplied by companies participating in the HRD roundtables (on the number of OJT placements for these apprentices) indicates a considerable gap between current OJT opportunities for basic training grads and the number needed to develop a fully-qualified workforce of adequate size to meet employers' demands.

College capacity for aerospace technical training is an issue – but more work experience placements for learners to acquire their OJT credits are needed even *more.* The greatest skill shortage is in AME categories. Colleges do not graduate AMEs. Only aerospace companies can provide the necessary on-the-job supervised training that enables graduates of basic training to become AMEs.

Priority has been given to establishing a co-op delivery option for AME training by 2003 in one or more Approved Training Organizations (Lower Mainland, Northern BC, Central Interior). Implementation will begin with AME-M training, then expand within a year to include AME-S training, followed by a co-op program for AME-E training by 2005. By breaking OJT requirements into 3-month modules that can be interspersed with classroom studies, employers anticipate being able to accommodate more novice workers. The first co-op program can begin as early as May 2003 at BCIT, provided industry reps commit to work experience placements for a minimum of 17 students over a three-year period, and also take an active role in the curriculum review and other preparatory steps.

Priority has also been given to establishment of an **Aerospace Industry Training Council** to ensure ongoing monitoring of labour demands, stewardship of new training programs, and facilitation of work experience placements. Training providers in the secondary and post-secondary education network have demonstrated considerable openness to new delivery options, but implementation of proposed programs is contingent on industry being able to set (and meet) annual and multi-year targets regarding the number of work experience placements they can accommodate.

With the national findings on new technologies and on process improvements, the establishment of an Industry Training Council becomes all the more important. The knowledge and skills that are needed to complete aerospace manufacturing and aircraft maintenance are changing – and in some ways, quite dramatically so. Industry and educators need to work well and closely to ensure not just sufficient seat capacity in technical training programs but *appropriate curriculum and skill development experience.*

Ongoing liaison with government is also needed because of emergent policy in BC that favours competency-based assessments over time-on-trade requirements for apprentices, and also because of provincial proposals to considerably shorten the duration of much technical training. Regular and factual communication with key contacts in

the BC Ministries of Education, Advanced Education, Skills Development & Labour, and Competition, Science & Technology is needed because the aerospace industry is distinctive in the **high degree of regulation over training** of licensed workers, and allowance needs to be made for that when determining nature of provincial technical training programs to fund. Canadian Aviation Regulations currently include time-on-trade requirements. To eliminate these and rely solely on competency-based performance assessments would require a *national* initiative through the CARAC process (Canadian Aviation Regulation Advisory Committee), then *international* negotiations because of the bilateral agreement between Canada and the United States on aerospace-related training.

Employers recognize the high cost of aerospace trades training due to aircraft, equipment and related facility requirements. They also recognize that public investment to enable BCIT and Northern Lights College to acquire Approved Training Organization status with Transport Canada for aerospace training has already been substantial: over half a million dollars for BC Institute of Technology alone. **Industry (AIABC, IAMAW and PAMEA) therefore supports a "hub-and-spoke" model (or rather, "two-hubs-and-spokes") delivery strategy for training** that emphasizes the re-usability or multiple applications of the ATO status that has been earned by BCIT and Northern Lights by strengthening partnership arrangements between these ATOs and other regional colleges, and by also ensuring Transport Canada approval of credit transfer arrangements for all occupational training that is being delivered by publicly-funded colleges in BC and that potentially ladders into AME training.

Later phases of the training plan emphasize:

- Establishing a "common core" curriculum for Secondary School / Post-Secondary Integrated Studies
- Then expansion of the SS/PS Integrated Studies program to more school districts
- Fostering of multi-college partnerships for delivery of approved aerospace training in more regions of BC – without replicating large investment of public dollars into acquisition of ATO status by all providers.

What RETENTION action is also needed?

Retention initiatives are as critical as training initiatives because workers will be attracted to those employers offering the best compensation, best working conditions, and best chances of ongoing employment instead of project contracts. Given the reality that all sectors of the BC and Canadian economy are facing skill shortages (expected to become critical for every sector by about 2008), aerospace companies cannot simply compare themselves against other companies in their own industry. The aerospace industry is a relatively high-wage employer.[2] Nonetheless, **increased attention on workplace culture, working conditions, and compensation** for those already in the aerospace workforce in BC, as well as for new hires, is needed to prevent loss of highly skilled workers to other jurisdictions and other industries.

IMPLEMENTATION CONSIDERATIONS

The industry association (AIABC) has made HRD one of its three strategic priorities. In this HRD plan, it has the support of the International Association of Machinists and Aerospace Workers (IAMAW), and also of the Pacific Aircraft Maintenance Engineers Association (PAMEA). Significant progress on eight of the ten HRD strategy planks depends on HR effort alone: see items 1 (initial stages), 2, 4, 6-10 on page 20. However, the constraint of a tiny staff (one half-time position) means that the very active volunteer involvement of HR directors and training managers in the largest of AIABC's member companies remains the key to implementation success.

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[2] Average wages for aircraft production are 25% higher than for manufacturing as a whole. However, aircraft structural technicians and machinists (two of the occupational groups in relatively high demand in the BC aerospace industry) tend to have the lowest averages among all technicians in the industry

HIGHEST-PRIORITY INITIATIVES

During the industry roundtable sessions, business, employee, and educator representatives worked together to assign relative weights to the criteria against which action proposals were to be evaluated.[3]

In applying the first set of evaluation criteria, different results emerged from the different stakeholder groups.

Business reps ranked as most important:

1. National on-line service for candidate screening and job posting
2. Public relations campaign by AIABC
3. Establishment of Aerospace Training Council for ongoing priority setting with aerospace training, facilitation of work experience placements, and stewardship of training programs.

Employee reps[4] ranked as most important:

1. Best practices information push through AIABC newsletter, web site, and *Leading Edge* forums
2. National on-line service for candidate screening and job posting
3. Securing and sustaining Transport Canada involvement in the design stage of training programs for aerospace and in college reviews of credit transfer arrangements (i.e., between colleges)

Education and training provider reps ranked as most important:

1. National on-line service for candidate screening and job posting
2. Public relations campaign by AIABC
3. Best practices information push through AIABC newsletter, web site, and *Leading Edge* forums

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[3] Evaluation criteria in relative order of importance:

Will help an employer match company workload to skilled workers faster (either by helping employers find skilled workers faster AND/OR helping employers incorporate novice workers more easily AND/OR helping employers "grow their own" certified and/or licensed staff)

If *not* done, will intensify the skill shortage problem within the industry and/or will lead aerospace into an unfavourable position (rather than equivalent) position against other industries competing for similar skills

Will raise the profile of the aerospace industry with target audiences for employment and for training programs, as well as with the government

Will help skilled aerospace workers / learners to market themselves

Is more efficiently and effectively done on a collective basis than by each employer working independently to achieve the same result.

[4] Included representatives of the Pacific Aircraft Maintenance Engineers Association, International Association of Machinists and Aerospace Workers, and T.R.A.D.E.S. employment placement service

Government reps ranked as most important:

1. More use of the Secondary School / Post-Secondary Integrated Studies program[5]
2. Facilitation of partnerships between ATO and non-ATO colleges[6]
3. Establishment of Aerospace Training Council for ongoing priority setting with aerospace training, facilitation of work experience placements, and stewardship of training pilots.

However, as these stakeholder groups then also sorted action proposals according to relative payback for the effort required, as well as relative degree of difficulty to implement, consensus emerged regarding the most important initiatives on which to focus efforts during 2002-03.

The top-priority initiatives, from the perspective of *all* stakeholders, are:

- **Targeted public relations campaigns** by AIABC
- Enhancement (or creation) of **national on-line service for candidate screening and job posting**
- **Pushing of best HR practices information to aerospace employers** through AIABC newsletters, web site, and *Leading Edge* forums
- Establishment of an **Aerospace Training Council** for ongoing co-ordination and leadership (at an industry level) of training and work experience initiatives
- **Introduction of co-op delivery option** for students on training paths for the occupations that are most in demand – with agreement to begin with AME-path training
- **Piloting adoption of enhanced screening procedures / criteria**, including competitive entry, with co-op training programs in aerospace.

To facilitate implementation, it was agreed that three working groups would continue as the champions of these initiatives:

Working Group 1 – PUBLIC RELATIONS + ON-LINE SERVICE

- **Human Resource Directors from 4 major aerospace employers** (all AIABC member companies) – *Janice Antaya-Finlayson* (MTU Maintenance), *Ruth Buhagar* (Air Canada), *Leigh Anne Stitt* (ACRO), and *Harold Kamikawaji* (Kelowna Flightcraft)
- **supported by AIABC's Executive Director** *Andrew Huige*

Working Group 2 – AEROSPACE TRAINING COUNCIL

- **AIABC Board rep –** *Michael Coughlin* (Past President of AIABC; Executive Vice-President, Cascade)
- **HR Directors reps –** *Harold Kamikawaji* (HR Director for Kelowna Flightcraft) and *Janice Antaya-Finlayson* (HR Director for MTU) – both members of AIABC's HR Committee
- **Technical Trainer rep –** *Spence Mikituk* (Technical Training Manager for Air Canada)
- **HR Consultant (independent) –** *Sue Gardner* (AME and President of Aerosphere Technologies, previously Director of Quality for ACRO Aerospace)
- **Labour representative –** *Gary Mondoux* (IAMAW Vice-President, Joint Training and Licensing Committee) and PAMEA rep *(designate from PAMEA still to be determined)*

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[5] SS/PS Integrated Studies program allows students to begin entry-level trades training earlier (i.e., before high school graduation) and simultaneously earn their Dogwood Certificate for high school matriculation *and* a post-secondary diploma in technical training.

[6] ATO college = one that has Approved Training Organization status with Transport Canada for delivery of aerospace-related technical training

Working Group 3 – CO-OP DELIVERY OPTION

- **Workplace-based Technical Trainers –** *Spence Mikituk* (Technical Training Manager at Air Canada) and *Dave Hutchinson* (Training Manager at Avcorp)
- **HR Manager –** *Tamara Lord* (HR Manager, Cascade)
- **College / ATO representatives –** *Dave Mitchell*[7] (BCIT Associate Dean, Aviation Dept.), *Tony Sellar* (Vernon Airport Training Council)[8] and *Bob Earp* (University College of Fraser Valley)

This leaves four outstanding proposals not to be forsaken but rather, to be worked on in successive years of the 5-year implementation phase with this HRD strategy, under the leadership of the Aerospace Training Council:

- Establishment of a "common core" curriculum for the Secondary School / Post-Secondary Integrated Studies program
- Expansion of the SS/PS Integrated Studies program to more school districts
- Multi-college partnerships for delivery of approved aerospace training in more regions of the province – without replicating large investment of public dollars into acquisition of ATO status by all providers
- Program reviews with providers and Transport Canada to establish credit transfer arrangements – to create maximum "laddering" opportunities for learners in aerospace technical training programs.

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7 Jack Baryluk acting for BCIT Associate Dean (November 2002)

8 Has ATO application in process (and also has co-op training program in development)

BACKGROUND TO THIS STRATEGY REPORT

The Aerospace Industry Association of BC (AIABC) secured funding support from Human Resource Development Canada (HRDC), the BC Ministry of Skills Development & Labour (MSDL), and the British Columbia Institute of Technology (BCIT) to clarify labour demands in the industry, quantify labour supply from training providers, and develop a 5-year plan that encompassed recruitment, training, and retention initiatives. This document summarizes the outcome.

In late June 2001, a project Steering Committee was established with members of AIABC's Training and Apprenticeship Committee, additional employer reps, plus representatives of PAMEA (Pacific Aircraft Maintenance Engineers Association) and IAMAW (International Association of Machinists and Aerospace Workers). Resource persons from HRDC, MSDL, BCIT, BC Trade and Investment (Strategic Industries Branch) and the BC Ministry of Advanced Education also participated in Steering Committee meetings and industry roundtable sessions.

A much larger HR study was undertaken nationally at the same time as this provincial HRD project. This parallel study was sponsored by the Canadian Aviation Maintenance Council (CAMC). The scope of research undertaken by the national consulting team covered (1) analysis of current workforce demographics; (2) labour demand analysis for the forthcoming periods of 5, 10, and 15 years under different growth scenarios; (3) analysis of regulatory, competitive, and other business changes affecting aerospace operations and HR demands nationally and internationally; (4) analysis of changes in the manufacturing and repair technology which also affect HR requirements; and (5) other best practices research.

Because of a desire to not duplicate research efforts and also because of very significant differences in budget allocations between the two HRD initiatives, the BC Steering Committee decided to rely on the national study for its labour demand analysis[9] and to concentrate its own project resources on labour supply and other research, and on action planning through a series of strategy sessions involving a wide range of industry stakeholders and training providers.

Five sequenced roundtables were held to craft the BC workforce development strategy. Originally scheduled to start in the Fall of 2001, these sessions were delayed because of the operational challenges that aerospace employers faced in the aftermath of the September 11th terrorist attacks in the United States.

Research on attrition patterns, current recruitment and retention practices amongst BC aerospace employers, as well as research on labour supply through BC training providers, got under way in September 2001 and was completed in the spring of 2002.

Roundtable sessions were held on January 23, March 27, May 29, June 26, and July 31. An additional roundtable session was held in Vancouver on February (hosted by CAMC) to present interim findings[10] of the national study.

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9 Research interests of the BC Steering Committee were closely scrutinized by the national team of researchers, and follow-up with CAMC led the BC Steering Committee to understand that once the national study was complete, data collected provincially could be analyzed separately to provide a reliable reading of the labour demand in BC.

10 National research findings were released in November 2002. Further analysis was then done by a BC-based labour economist under contract to the BC HRD Steering Committee to integrate national findings on anticipated labour demands, information on BC's aerospace companies and workforce base, information on immigration into the BC labour force, and BC findings on labour supply through provincial training providers, so as to update the skill shortage analysis that was completed by AIABC in October 2000.

INDUSTRY CONTEXT:
Key Considerations affecting HRD Planning

- **Aerospace work is highly regulated.** Though many manufacturing and repair tasks can be completed by unlicensed staff, aircraft cannot be signed out for operation without review and signature by a licensed Aircraft Maintenance Engineer. **AME training regulations are set by Transport Canada**. These Canadian Aviation Regulations (CAR standards) govern not only curriculum for both theoretical and practical components but also qualifications of instructors, supervision of learner assignments, detailed logbook requirements, attendance requirements, examination procedures, pass rates (minimum 70% with no blending of theoretical and practical marks allowed), equipment and facility requirements, and hours of on-the-job training required for licensure.

- For licensed occupations[11] in aerospace, **it is critical to understand the difference between "accepted training" vs. "*approved* training."** Under Transport Canada regulations, learners may acquire the requisite competencies through a wide range of training programs (including correspondence courses), but they cannot be assured of meeting licensure requirements *unless* they have completed their training through an Approved Training Organization (ATO).

  In British Columbia, there are currently only two colleges with Approved Training Organization status. Several aerospace companies in BC have ATO status as well, used mostly to deliver recurrent training that is specific to the type of aircraft they service or build.[12] While two other training providers in BC (University College of the Fraser Valley and the Vernon Airport Training Council) are seeking ATO status, the only colleges in this province that currently meet Transport Canada standards for delivery of training relevant to licensed occupations in aerospace are BCIT and Northern Lights College.

- **The greatest labour demand in the aerospace industry is in the licensed trades, i.e., for Aircraft Maintenance Engineers.** This is true nationally. In BC the highest demand projections are for **the three streams of AMEs (Mechanical, Electrical, and Structural) and the non-licensed technicians whose work forms the "first step" on AME career paths.**

- Besides this demand for AMEs (and related technicians), **there is also significant demand in BC for three other *non*-licensed occupational groups:**
  (1) Gas Turbine Engine Repair & Overhaul Technicians
  (2) Aviation Machinists
  (3) Aircraft Structures Manufacturing Technicians.

  While there is a need for new workers in other occupational groups in this industry (to replace retiring workers and/or to meet company growth targets), by and large the training institutions are producing enough graduates to meet that demand.[13]

- **Most non-licensed employment paths are governed by standards of competency that are set not provincially but nationally.** Competency standards are set by the Canadian Aviation Maintenance Council through an industry process that involves employers and practitioners across the country in the specification and validation of workplace performance requirements.

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11 There are three licensed occupations in aerospace: all Aircraft Maintenance Engineers. AME – M (Mechanical), AME – E (Electrical), and AME – S (Structural)

12 Also known as "endorsement training" or "type training"

13 For all other occupational groups, current evidence indicates that the labour market for aerospace workers in BC is close to being in equilibrium: the differential between anticipated supply and anticipated demand is less than fifty workers over a three-year period, so industry HRD strategy in BC has not focused on these other occupational classifications.

- **Most apprentices in aerospace trades are therefore registered nationally – and often are not noted in the apprenticeship tracking system administered by the provincial government in BC.**
- **"Time on trade" as well as demonstration of required competencies is a requirement both for CAMC certification and for licensure under Transport Canada.** There is a long training "pipeline" for workers in the maintenance sub-sector especially. Training requirements for licensed occupations include (a) verification of minimum attendance of 95% for all theoretical and practical training sessions, (b) minimum work experience component of 36 to 48 months, and (c) detailed logbooks maintained by Approved Training Organizations to document not only the nature of tasks completed by the learner but also the hours of work experience and who has supervised. This requirement makes e-learning, other forms of distance education, and much abbreviated training programs not practical as dominant training strategies in this industry under current regulatory schemes.
- **Changing the time-on-trade requirement would have to be a national initiative through the CARAC process (Canadian Aviation Regulation Advisory Committee).** Such a change – moving to a competency-based training system in which demonstration of requisite skills through a Prior Learning Assessment & Recognition mechanism or other examination process is all that is required for occupational certification or licensure – would have to be supported by all (or a majority) of provincial aerospace industry associations.
- **Changing training regulations in aerospace is made more complicated by the presence of a bilateral agreement between Canada and the United States** (i.e., between Transport Canada and the Federal Aviation Authority). **Removing the time-on-trade requirement** or substantially altering other training requirements for AMEs **would require international agreement.**
- **Aerospace trades training is very costly because of the aircraft and other equipment requirements, and because of related facility requirements.** Even for programs that provide a general introduction to aviation, the per-student costs are higher than for many other career preparation courses because of the toolbox requirements for learners.
- **Because of the human safety considerations in aviation, practical skills training remains essential.**
- **There are few economies of scale achievable through integrating training programs at the firm level** because most of this training investment is related to the particular aircraft type that the company manufactures or services.
- **Industry investment in training is substantial.** Data collected during a Fall 2002 survey of BC aerospace companies (commissioned by the Steering Committee for the BC Aerospace Workforce Strategy project) revealed that the investment is close to $7 million annually just for respondents (a group representing 41% of the BC aerospace workforce of 7,500). If training investments made by other aerospace businesses who collectively employ the other three-fifths of the aerospace workforce in BC were included, the total would be considerably higher.
- **Public investment to enable BC colleges to acquire Approved Training Organization status with Transport Canada for aerospace training has also been substantial.[14] Industry therefore supports a "hub-and-spoke" model (or rather, "two-hubs-and-spokes")** that emphasizes re-usability or multiple applications of the ATO status that has been earned by BCIT and Northern Lights, i.e., by strengthening partnership arrangements between these ATOs and other regional colleges, and also by ensuring Transport Canada approval of credit transfer arrangements for all occupational training that potentially ladders into AME training and is being delivered by publicly-funded colleges in BC. This is seen to be a more cost-effective strategy from the taxpayer's perspective than one that necessitates further investment of an equivalent magnitude to secure ATO status for more colleges to qualify them fully to deliver the training needed to develop sufficiently skilled aerospace workers to meet the anticipated labour demand.
- **The situation faced by BC aerospace employers is mirrored across the country, in the United States, and around the world.** Competition for skilled aerospace workers is intensifying. Because the language for basic training for aerospace

[14] For BC Institute of Technology alone, that investment was over half a million dollars.

in most jurisdictions is English, and because most basic training is already being done to Transport-Canada approved training standards, graduates of these programs are in demand in many countries. The size of the aerospace workforce in the US is more than twenty times greater than it is in Canada. The demographic challenges are the same: many skilled workers are approaching retirement, so competition for qualified employees is fierce.

- ***Retention* initiatives are as critical as training initiatives.** Workers will be attracted to those employers offering the best compensation[15], best working conditions, and best chances of ongoing employment rather than project contracts. This is especially so given the reality that all sectors of the BC and Canadian economy are facing skill shortages: shortages that will become critical by 2008-2010.
- **Investment in effective HRD planning and action has significant benefit potential to the provincial and federal economy.** The global aerospace industry generated revenues of US$ 200 billion in 2000 and employed over 1,000,000 people. Though Canada's portion of this industry is not huge (6%), this participation rate is roughly double our nation's contribution to the world GDP. In Canada, the aerospace industry has also shown strong growth over the last decade, based on robust markets for its principal exports (regional jets, civil helicopters, business jets, small gas turbine engines and systems such as landing gear).[16]

  Aerospace workers in BC generate annual revenues of Cdn.$ 800 million, of which about one-third ($264 million) comes from manufacturing sales and two-thirds from the maintenance sector.

  Nationally, over 100,000 people are employed in aircraft manufacturing, repair and overhaul, and annual sales are over Cdn.$ 20 billion. Since 1990, gross industry sales have increased by 160% and employment has risen by more than 35%.

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15 Aerospace employers in BC already know, for example, that the median wages offered entry-level technicians are lower than entry-level compensation for automotive mechanics.

16 Canadian aerospace companies currently control:
- 42% of the world market for regional aircraft
- 50% of the world commercial turbine helicopter market
- 35% of the world market for large business jets
- 60% of the world market for large aircraft landing gear systems
- 75% of the world commercial simulator market
- 1/3 of the world market for small turbine engines
- 2/3 of the world market for aircraft environmental systems.

LABOUR MARKET:
Current Situation & Anticipated Needs

- **The aerospace industry in British Columbia is growing** – both in terms of revenues generated and employment openings. **Employment in the *maintenance* sector is growing at an annual rate of 3%,** a pattern that is also reflected at the national level for the Canadian aerospace industry as a whole.
  On the manufacturing side, the national pattern shows a current decline in employment and a predicted employment growth rate of zero (to two percent at best) over the next four years. However, the BC aerospace industry appears to be bucking that trend. In British Columbia, **in the *manufacturing* sector, employment is growing at annual rate of 5%**. This rise in aerospace manufacturing employment has, in BC, persisted in 2002, despite the events of September 11, 2001.

- Though the annual rate of employment growth is higher for the manufacturing sector than it is for the maintenance sector of the industry in BC, the **actual number of new employment openings is greatest in the MRO sector** (maintenance, repair & overhaul) because that is the largest sector of the industry in BC.

- **Several indicators define the skilled labour market in the BC aerospace industry as tight and prone to selective shortages.** Work is typically full-time, full year. Unemployment rates are low – much lower than the all-occupation baseline. Earnings are higher than average for the full-time full-year worker. Work weeks and annual work patterns are also higher than average.

- **Compared to the age structure of the national aerospace workforce, the aerospace workforce in British Columbia is older.**

- **The core attrition rate (based on the age structure of the BC workforce) is projected to be 2 to 4% per year over the next three years. Retirements are expected to increase between 2005-08.**

- Though increased investment in recruitment and training initiatives may attract more young workers into aerospace and alter somewhat the age structure of the workforce here, it must be remembered that **competition for BC's skilled workforce in aerospace is international.** The US aerospace industry is many times larger than the aerospace industry in Canada, and highly skilled aerospace workers are also frequently offered employment abroad. **So actual replacement rates are higher because there is additional "leakage" from the aerospace workforce for reasons other than age-related retirement.**

- Critical skill shortages have been identified on the basis of:
  - multi-year industry growth projections collected from employers two years ago,
  - adjustment of those projections in light of 2001-02 employment findings,
  - national demand analysis, and
  - more rigorous analysis of attrition patterns.

  In quantitative terms, the most critical shortages appear to be in the following categories:
  1. AME – M Aircraft Maintenance Engineers
  2. AME – S Aircraft Structures Engineers
  3. AME – E Avionics Maintenance Engineers
  4. Gas Turbine Engine Repair Technicians

5. Aircraft Structures Fabricators
6. Aviation Machinists.

NOTE: The skill shortage in the first three categories includes unlicensed technicians on the same training pathway as the licensed engineers.

- **The quantitative breakdown of *incremental* demand for the four years between 2001-05 is:**
  (N.B. See next page notes re: limitations of the methodology used in 2000 to project labour demands.)

BC Aerospace Sector Employment Trends: Highlights of Research Findings

	2001/05 Employment Change	Annual Requirements
Skilled Workforce (less professional engineers)	**700**	**175**
Aircraft Manufacturing	360	90
Aircraft Maintenance	370	93
Key Occupations - Industry Occupational Classifications		
AME - M	158	40
Maintenance technician	50	13
AME - S	100	25
Structures technician	55	14
AME - E	73	18
Avionics technician	24	6
Gas Turbine Engine Repair technician	71	18
Aircraft Structures Fabrication	51	13
Aviation machinist	18	5
Helicopter Dynamic Component technician	28	7
Other skilled occupations	72	18

NOTES:

NET GROWTH for these specific occupations is based on **overall employment growth of 700**, shared to industry occupations on the basis of project-based demand as developed in the 2000 demand report.

ATTRITION from Skilled Workforce **332-700** **83-175**
This refers to potential attrition due to retirement. There may be further exits of skilled workers from the aerospace sector in BC but there is currently no empirical data to assess this accurately.

- **Addressing *qualitative* changes in the nature of competencies required by both new and current aerospace workers is as important as facing these quantitative demands.** *(See relevant section below.)*

- When attrition needs are considered as well as the likely *new* employment growth, along with anticipated supply of basic training graduates from post-secondary educational institutions, the two areas in which projected supply is most likely to be inadequate are (1) AME-S and Aircraft Structures Technician group and also (2) AME-E and Avionics Technician group. *See Appendix 2 for more detail.*

- The pivotal challenge in meeting the anticipated skills shortage (from a quantitative perspective) is that of aerospace companies individually and collectively ensuring sufficient "take-up" of these basic training graduates. Aerospace employers must also support these novice employees long and well enough to enable them to acquire the necessary on-the-job training (OJT) credits for licensure as AMEs.

  Post-secondary educational institutions can only provide basic training. License and certification requirements involve additional on-the-job training. Only aerospace employers can effectively produce AMEs from the supply of trained (uncertified) technicians.

  And historically, the preferred ratios of experienced : novice workers that employers hold, combined with market-driven fluctuations in project demands, have driven employers to keep their "take-up" of basic training grads to lower levels than is optimal for development of the size of skilled workforce that they foresee needing.

Adjustment Considerations in Employers' Demand Projections [17]

- **Analysis of Statistics Canada data upheld the AIABC baseline estimate of approximately 7,500 individuals in the BC aerospace industry as of 2000-2001.**

  NOTE: This is close to one-tenth of the national aerospace workforce, even though BC accounts for less than 2% of revenues from aerospace manufacturing in Canada.

  In BC, an estimated 60-65% of this workforce is highly skilled technical staff, supported by management and administration personnel, professional engineers (e.g., for R&D work in manufacturing, etc.), and other support staff whose functions are not directly related to aerospace functions (e.g., truck drivers).

  Three-quarters of BC's aerospace workforce is employed in the Maintenance, Repair & Overhaul (MRO) sector. British Columbia has a very high proportion (25%) of aircraft mechanics and inspectors and (30%) supervisors of mechanics trades, relative to its overall proportion (9%) of the Canadian aerospace workforce.

  Aircraft maintenance engineers (AMEs) are almost exclusively employed in maintenance. According to surveys by the Canadian Aviation Maintenance Council, AMEs account for almost 40% of the maintenance sector.

- In BC, employment not only in the maintenance sector but also in the manufacturing sector of the aerospace industry continues to be on an *upward* trend – mirroring the pattern predicted nationally for maintenance, and bucking the national indications of a slowdown[18] in the manufacturing sector.

  However, growth projections submitted by aerospace employers to the Aerospace Industry Association of British Columbia (compiled in October 2000) were particularly high for 2001 and 2002 – in retrospect, unreasonably so. Actual employment growth in BC for those two years does not confirm the high growth that was anticipated.

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17 Adjustments recommended by labour economist Ruth Emery (based on analysis done for the BC Aerospace HRD Steering Committee – October-November 2002)

18 The national HR study completed by CAMC in November 2002 found that an eight-year period of strong global economic growth ended early in the summer of 2001 – and concluded that planned aircraft production rates would not be sustainable over the next few years.

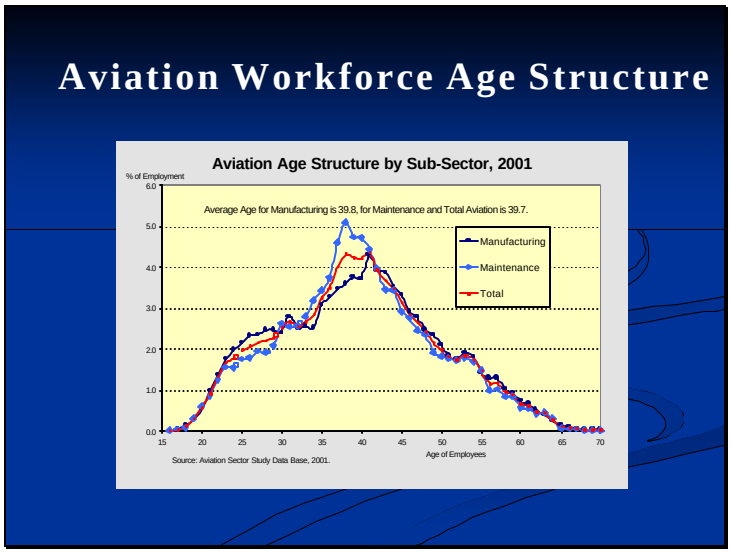
Employment increases projected by BC aerospace firms for 2003-04-05 were somewhat more modest than their 2001-02 predictions, but still, the cumulative 2001-05 projections made in 2000 were overly optimistic totals.

As noted above, **empirical evidence of actual employment for the first two years of the 5-year projection done by AIABC in the year 2000 suggests a much lower rate of growth.** Trend analysis of actual employment growth from 1991-2002 has been used to calculate likely increases in demand for the 2001-05 period.

- **The methodology used in AIABC's study in 2000 did not take into account movement between firms but rather, assumed that all attrition at the firm level – and even at the job-classification level – were exits from the industry.** The attrition rate has been adjusted to an annual average in the range of 2 to 4%, based on the age structure of BC's workforce[19] and probable retirements.

Demographic Shifts Occurring In Labour Pool & Aerospace Workforce

- The excerpt below from the national HR study completed in 2002 by the Canadian Aviation Maintenance Council shows how significant in size the older (soon-to-retire) segment of the workforce is. *(NOTE: Study covered maintenance and manufacturing sub-sectors of the aerospace industry.)*



- A declining proportion of youth in the Canadian labour force (overall) makes recruitment from non-traditional labour sources – women, adult career-changers, First Nations people, etc. – a particularly important element of aerospace industry strategy. (NOTE: Under 25 years-of-age representation in aerospace employment is already 10% *below* that of the overall labour force.)

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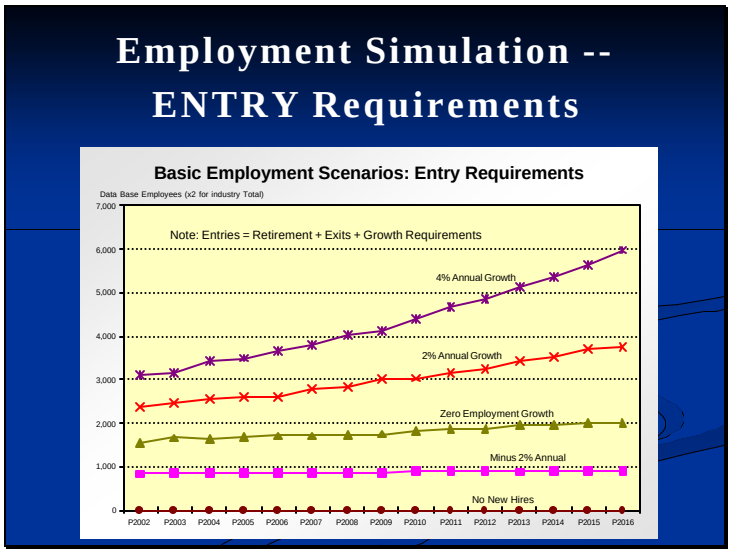
19 BC and Ontario have older workforces than other jurisdictions in Canada where companies are hiring manufacturing or maintenance workers for aerospace.

- Though the age profile of the national aerospace workforce (overall) is comparable to the rest of the Canadian economy, the CAMC study revealed that there are some key occupations in which the workforce is considerably older than the industry average. Rising retirement rates will have a significant impact within 5-6 years.
  - By 2016, only 40% of the current manufacturing workforce and less than 33% of current AMEs will be on the job.[20]
  - 60% of Aircraft Maintenance Inspectors ("super AMEs") can be expected to retire in the next 15 years.
  - For AMEs, the retirement rate will be most elevated for those in the AME-**S** group, of whom 43% are now above the age of 45.
- The demographic profile for Canada's aerospace workforce is not uniform across the regions. British Columbia (and Ontario) have a significantly older demographic. In BC, more than one-third of the workforce is over 45 now.
- Across the country, the occupations with the most serious age demographic problems are:
  - Machinists, Tool and Die Makers, Millwrights
  - AME Structures Technicians
  - Non-Destructive Inspection Technicians
  - Maintenance Inspectors and Quality Assurance/Control staff.

  In British Columbia, the following category of workers is also of concern because of the high ratio of workers over the age of 45:
  - Avionics Technicians and AME-Es
    ("Aircraft Instruments / Avionics" category in the National Occupational Classification system).
- **Even under the most conservative of scenarios (Zero Employment Growth conditions in the manufacturing sector, and 2% Employment Growth in the maintenance sector), attrition in the industry is high enough to generate a net need of 3,000 to 4,000 new aerospace workers (Canada-wide) *every* year from 2002 to 2016.**



20 Retirement probability simulations actually indicate a *declining* rate of retirement in the maintenance sector over the next five years, followed by an increasing rate of retirement in all scenarios beginning in 2008.

- **Nationally, the 2% annual employment growth rate for the maintenance sub-sector will require nearly 900 new AMEs in 2003**, then a steady increase to a peak of 1,100 per year in the 2009-12 period, followed by an average of about 975 per year until 2016. At 5% employment growth, the annual new AME requirement grows from just under 1,000 in Year 2003 to 1,700 in Year 2016.[21]
- **In BC, the incremental demand (maintenance and manufacturing combined) over the four years from 2001 to 2005 is estimated to be 1,032 to 1,400 workers – of whom more than one-third will be AMEs.**

- In British Columbia, the **percentage of women** in engineering or other technical occupations in aerospace is currently 7 to 8%, considerably below other high-technology sector rates of 17.7% (average).[22]

  Nationally, female representation in the licensed AME category is only 1% based on the Transport Canada AME database.[23] The 11% female representation among the estimated 247 AMES under age 25 may signal that the industry is attracting more women to these professions. The fairly steep drop off after the early years, however, indicates that retention of young women in these professions is more difficult. This suggests that more attention to workplace culture, HR management practices, employee benefits and working conditions is warranted.

Business Environment Changes Affecting Labour Demand for Aerospace [24]

- The global aerospace industry is historically and consistently among the most cyclical of all industry sectors because it is so strongly influenced by fuel prices, political events, and national and international economic performance.

  However, despite the current downturn, **growth in air passenger traffic is expected to average 4-5% annually for the next 20 years: a virtual doubling of passengers per mile flown**. **Cargo traffic is expected to increase** by more than 6% per year. To accommodate this growth in demand and to replace aging aircraft, **the world's aircraft fleet is expected to more than double**. Regional aircraft – an area of specialization for Canada – will capture a disproportionately higher share of the fleet coming on-line.

- Maintenance activity in the aerospace industry will grow significantly and steadily between now and 2020[25] to deal with an expanding and more complex fleet as well as aging aircraft and mounting regulations. **Increasing**

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21 CAMC report: *A Human Resource Study of the Canadian Aviation Manufacturing and Maintenance Industry* published in November 2002

NOTE: In early 2002, there were over 12,000 AMEs in the Transport Canada database. The workforce profile developed by CAMC in its HR study completed November 2002 indicated ~9,700 AMEs actively engaged as aircraft mechanics in the three major license categories: maintenance (M), structures (S), and avionics (E). However, additional AMEs may be engaged in other occupations, particularly as managers – in the manufacturing sub-sector as well as the MRO sub-sector. This highlights the fact that the AME is technically not an occupation, but a professional license.

22 *Competing in a Global Industry: Attracting and Retaining BC's Aerospace Industry Workforce* – report produced by John Appleton in Spring 2002

23 CAMC report published in November 2002

24 Abridged from the CAMC report: *A Human Resource Study of the Canadian Aviation Manufacturing and Maintenance Industry* published in November 2002

sophistication and effectiveness of repair technologies are putting a growing emphasis on repair over replacement of aircraft. Still, growth in the maintenance sector will not match fleet growth because many newer generation aircraft have fewer maintenance requirements. There are more systems to maintain on new aircraft but many are more reliable, requiring less maintenance per system.

- **Although historically most of the airlines did their own in-house maintenance, a trend now apparent among the world's airlines is to increase the volume of maintenance work outsourced to 3rd party service providers.** This stands to benefit British Columbia where the dominant sector of the aerospace industry is the Maintenance, Repair & Overhaul (MRO) sector. The wild card in maintenance forecasts is the extent to which Canadian firms can capture maintenance business from North American carriers.

- **Additional and more stringent regulations are creating demand.** Aerospace is one of the most highly regulated industries, with new regulations issued almost daily by national authorities around the world. Regulations are based on the International Civil Aviation Organisation (ICAO) standards, modified to meet the laws, policies and regulations of individual countries. The Federal Aviation Administration (FAA), the European Joint Aviation Authorities (JAA) and Transport Canada are the leaders in regulatory developments.

  Regulations have also shifted responsibility more to the individual maintenance worker, increasing the skill level and experience needed. Previously, many small maintenance firms hired and retained personnel who were mechanically minded but who lacked formal accreditation or a post-secondary education. Now some of these experienced personnel are leaving to find work in other industries that do not require the accreditation and training requirements mandated in the aerospace industry.

Business Environment Changes Affecting Labour Supply For Aerospace [26]

- **Recruitment through the late 1990s and into 2000 was heavily affected by the strong expansion of the auto industry** in Central Canada during that period. Wages and benefits in the automobile industry rose steadily throughout the late 1990s. Skilled tradespersons were drawn out of related industries and into the auto sector.

- As a result of slower growth of the auto industry (and other industries) from later 2000, it is likely that short term pressures on the skilled labour supply will be somewhat less in the first few years of this century. However, since some of the pressure is related to demographic issues (replacement of retiring workers), it is likely that pressures will remain in the medium to longer term.

- **Layoffs and reduced intake of electrical and electronics engineers and software personnel into the high technology sector** also appear to have eased shortages of such skilled workers in the aerospace industry. Because the education pipeline for such prospective employees in information technology was also increased

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25 BC labour market analysis suggests 3% annual employment growth rate between 2001-05. National labour market analysis (done for CAMC) suggests annual average growth rate between 2002 and 2020 of 3-5% business growth and 2-4% employment growth, possibly as high as 5% after 2005.

26 Abridged from the CAMC report: *A Human Resource Study of the Canadian Aviation Manufacturing and Maintenance Industry* published in November 2002

significantly in the late 1990s, the aerospace industry may as a result be able to draw from a larger pool of candidates for some work.

- **Aggressive government programs in the United States, Britain and Europe** to meet their own needs in the aerospace industry will likely reduce the supply of foreign workers for Canadian aerospace companies. Flows of immigrants from countries with recognized and admired skill-development systems are becoming much smaller.

- **Declining enrolments in aerospace science and engineering programs in United States universities** (as compared to other studies) is leading to a long-term decline in the size of the labour pool following aerospace careers.

- In the Department of National Defense (DND), almost 40% of DND aerospace technicians are now eligible for pensions. In five years, this figure will rise to 60%. Downsizing of the Canadian military forces that occurred over the 1990s has ceased. For a decade, employers in the civilian aerospace industry could rely on recruiting many skilled workers from the pool of people leaving the military. Now, rather than continuing to downsize, **DND has introduced special incentive programs for new hires** (including $25,000 signing bonuses) – so the military side of the industry has become a competitor for skilled workers, rather than a labour source, for the civilian side of the industry.

- **Frequent layoff cycles within aerospace** have affected the image of the industry and are driving some experienced workers to other industries.

- **Long shifts and working conditions** such as gasoline fumes and other hazards affect retention of skilled workers in the industry, especially those with young families.

- If successful, **Air Canada's expanded training and maintenance operations through a subsidiary company** will likely reduce the labour pool and retention success of small firms in BC's aerospace industry.

Qualitative Changes In Skill Requirements For Aerospace Workers [27]

- As or perhaps even more important as the quantitative estimates of skill shortages are national findings regarding **new skill requirements** for aerospace workers. Not only are more personnel needed to meet an increased maintenance workload between 2002-20 (including more maintenance administration because of a more demanding regulatory environment): increased skills are now also required to perform maintenance.

- Consolidation within the industry – and constant pressure to reduce costs – mean ongoing need for instruction in **lean manufacturing principles and procedures**. This includes Statistical Process Control (SPC), process re-engineering, and other waste reduction techniques.

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[27] Abridged from CAMC report: *A Human Resource Study of the Canadian Aviation Manufacturing and Maintenance Industry* published in November 2002

- Technology advances are driving changes in specific knowledge and skill sets, altering the definition of requirements for some traditional trades and also creating some new trades. The current paradigm for aerospace manufacturing is *better, faster and cheaper* (vs. an earlier focus on *higher, faster, further)*, putting more emphasis on **"process" technologies** in design, development and manufacturing.
  - In the maintenance sector, emerging repair technologies will incorporate increased automation but will also require significant **operator training to ensure that close process tolerances are maintained**.

- Re: **computer skills**, an increasing proportion of the aerospace workforce will soon access and manage data and information using electronic devices 100% of the time. This will require a generic ability to interact with electronic devices[28], an understanding of operating systems, and more specifically, familiarity with software applications to accomplish specific manufacturing or maintenance tasks.
  - The manufacturing sub-sector will place a greater reliance on computer-based design, analysis and virtual modeling.
  - Maintenance suppliers are introducing trend monitoring and predictive maintenance techniques that require new competencies in data capture, storage and diagnostic analysis.
  - Aerospace workers need a systems-oriented approach to maintenance, and need to become adept at increasingly integrated software-based "health monitoring" systems. In the future, working with Artificial Intelligence (AI) in systems that allow real-time off-aircraft data transmission will become a requirement. Maintenance workers will require training in how to solve problems with the help of built-in-test equipment (BITE) and other databased devices.
  - Familiarity with Enterprise Resource Management (ERP) programs and databases is critical now.
  - Increased skill with 3-D visualization and simulation technologies to determine airworthiness is needed.

- **Other specific skills that require strengthening** in the aerospace workforce are:
  - Use of non-metallic materials, including repair of composite components (related to somewhat reduced emphasis on sheet metal components – but metallic, non-metallic and hybrid materials will co-exist for the foreseeable future)
  - High-speed machining
  - Laser and friction stir welding (assembly techniques that reduce the number of fasteners needed)
  - "Near net shape" processes – e.g., advanced casting and forging techniques; possibly superplastic forming and diffusion bonding
  - Process-specific skills that reflect greater diversity of materials being used to meet design and operational requirements – including but not restricted to new surface treatments (e.g., thin film, thermal spray and diffusion processes that are replacing current toxic plating processes to improve durability, corrosion resistance, and reparability of airframe and engine components)
  - Avionics systems and electronic control (Even people who specialize in "conventional " mechanical systems increasingly need to understand their electrical and electronic components and related functionality, which is usually software-based.)

- **Business skills training for all aerospace workers needs to focus on *life cycle affordability*.**
  I.e., how to increase utilization and productivity from high value assets; how to increase schedule reliability under all operational conditions for aircraft; how to reduce life cycle costs.
- With the new paradigm, there is **increased focus on safety training**. Specific initiatives driven by the US Safer Skies / Commercial Aviation Safety Team (CAST) and Transport Canada's Flight 2005 program will necessitate training in:
  - How to reduce flammability and ignition sources, particularly in aging aircraft
  - How to reduce rate of uncontained failures of gas turbine engines
  - Improvements in the cockpit man-machine interface
  - Electro-Magnetic Interference (EMI) characteristics of high band-width digital systems
  - Improved ice protection techniques.

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[28] Desktop personal computers, portable computers, and an array of Personal Electronic Devices (PEDs)

- As well, the new paradigm requires attention to the **environmental impact of the processes used in manufacturing, repair and overhaul**. Training needs to cover:
  - How to reduce toxicity of manufacturing and maintenance practices – e.g., use of benign dry media for paint stripping, cleaning and trimming; use of Chemical Vapour Deposition (CVD) and Ion Vapour Deposition (IVD) to reduce use of very toxic cadmium plating
  - How to reduce external noise levels in terminal operations
  - How to reduce toxicity of engine emissions in both cruise and terminal phases of flight
  - How to reduce fuel consumption
  - Cabin environment improvements
  - Challenges to supersonic flight.
- "Aerospace is a dynamic, technology-driven, knowledge-intensive industry, where innovation is key to business advantage."[29] That said, **technological change** is accommodated well within the industry, in part because of the slow rate of absorption required to safely prove new technology.
- After technical competency, the most important skill shortage will be for people with **"crossover" skills**. This includes engineers who understand business and information technology, business graduates who have engineering or computer knowledge, and technical and scientific employees who have training in strategic decision making in business, presentation skills, and business case development.
- Because of supply chain consolidation, closer integration and standardization of business and technical processes, and a need for more precision in all aspects of implementation, **managers need:**
  - increased expertise in quality control, risk mitigation, and systems integration at a human level
  - training in developing continuous improvement (CI) cultures and implementing CI initiatives
  - awareness-raising and skill development in creating environments which favour trust, information sharing and collaboration (and not just lip service to these concepts)
  - expertise in interacting physically and electronically with suppliers, partners and customers on a *global* basis – especially important development for small operators at 2nd and 3rd tier
  - focus on developing more transparent and more comprehensive horizontal and vertical sharing of technical data and information – including greater emphasis on standardization of systems and protocols, but also higher-level "translation" of specialized technical data.

  Collaboration skills, business analysis skills, organizational development skills, and financial analysis skills are needed as critical complements to technical maintenance or manufacturing skills.
- **More support** from educational institutions **for upgrading and retraining of current workers** is needed.
- Last but not least, there is an almost universal recognition amongst aerospace employers in Canada of the need for **stronger "employability skills"** in aerospace workers. I.e.,
  - Fundamental communication skills
  - Problem solving skills
  - Customer service skills
  - Team work skills
  - Leadership competencies.

  There is widespread agreement amongst aerospace employers that these skills are best acquired and demonstrated in the workplace – or else under conditions that closely simulate the workplace.
- **NOTE 1** Re: skill development, **company investment in training workers** (measured as a percentage of payroll) is significantly lower in British Columbia (2.6% median) than the Canadian average (6.2%).

[29] Aerospace Industry Association of Canada

- **NOTE 2** Incorporating more soft skills training into existing technical training will impact delivery costs, since the technical components in these programs (curriculum mandated by Transport Canada and/or CAMC) cannot be replaced by more generic business training or employability skills without risk of endangering accreditation.

SUMMARY OF STRATEGIC AIMS

More than anything else, the HRD strategy developed by the aerospace industry places increased emphasis in BC aerospace companies on a **slow-and-steady "grow our own" approach** to developing a skilled workforce of sufficient size to meet anticipated labour demands. This is rooted in the recognition that, because of the intensity of global competition for skilled workers combined with the shift in labour pool demographics, the industry cannot continue to rely on traditional recruitment approaches, HR plans that concentrate on "urgent ramp-ups," and being able to hire needed workers always "just in time."

The "grow our own" direction means commitment to:

- **Faster introduction to the workplace for learners** in aerospace trades training programs

- Creation of more on-the-job training (OJT) opportunities to enable technicians to meet certification standards (and for some, licensure requirements) – through **"chunking down" of OJT modules into smaller intervals of time (e.g., three-month blocks) and interspersing them with classroom training**

- **Increased transparency for learners about how specific training programs ladder into occupational and license requirements –** including better integration of standards and apprenticeship programs used by provincial trainers with *national* certification standards, licensure requirements and tracking system

- **Heightened employer involvement in screening criteria and procedures for aerospace training** programs delivered by colleges – coordinated through an industry training council

- **Better coordination of work experience placements through establishment of an industry training council** serving multiple employers and training providers

- **Ongoing tracking of labour market information and setting of training priorities through an industry training council that includes business and labour representatives**

- **Increased attention on workplace culture, working conditions and compensation to retain highly skilled workers** – those in the aerospace workforce in BC now, as well as new hires.

ACTION PLAN FOR 2002-2007

More specifically, the following actions are proposed in the industry's 5-year workforce development plan:

Recruitment

1) Enhance / create a **national on-line database** for employers of skilled workers who are available for employment, as well as an on-line bank of BC job openings.

2) Develop and implement **collaborative marketing campaigns** coordinated by the industry association and targeted to (a) parents, secondary school teachers and career counsellors, and youth; (b) women; (c) First Nations employment services and workers; (d) tradespeople seeking re-employment in new industries; (e) recent immigrants and selected countries – to raise awareness of aerospace training, employment and career options and to heighten interest in the industry.

Training

3) Establish a **"common core" entry-level training program** that will prepare students for a variety of aerospace work options – enabling more students to start their trades training while still in secondary school, and also enabling adult learners to test their interest in the aerospace industry and develop related competencies before narrowing their career choice to a specific occupation.

4) Introduce modularized delivery, i.e., a **co-op program option**, for all streams of AME training.

5) Push down delivery of basic training to the high school level to support early entry into aerospace careers: expand **Secondary School–Post Secondary Integrated Studies Program** into more school districts.

6) Foster **multi-college partnerships between ATO and non-ATO colleges** – to include regional colleges and aerospace employers in those communities as fully as possible in the delivery of approved aerospace training, to provide "close to home" training opportunities and to strengthen regional economic development while focusing on approved training for aerospace trades.

7) **Involve Transport Canada early in the design stage of initiatives 3, 4, 5, and 6 – and establish credit transfers between training providers** (to ensure regulators' support, adherence to national standards, effective development of needed labour pool, and maximum labour mobility for learners).

8) Move from wait-list entry to a **competitive entry system for aerospace trades training** to ensure the best candidates and increase the ratio of new hires : training graduates. Also ensure incorporation of these **other enhancements to the screening process**: requirement for applicants to first complete career / industry investigation reports; character reference letters; fuller communication to prospective participants of working conditions and required aptitudes for aerospace work; career aptitude testing as a step in the selection process; background criminal record checks of applicants; and for selected programs, screening interviews by employer representatives.

9) Establish an **Aerospace Training Council** as a mechanism for ongoing industry leadership and stewardship of training initiatives, to:
   - monitor labour market intelligence
   - facilitate work experience placements for apprentices
   - secure commitment at an industry level to a minimum number of work experience placements to complement basic classroom training
   - establish training priorities from an employer perspective
   - co-ordinate multi-year plans with the provincial network of publicly funded training providers.
   - Include labour representatives on this council to develop a common understanding of labour demand and supply issues, and to reach agreement on most critical HRD initiatives.

Retention

10) Use existing **AIABC communication vehicles** – the association's newsletter, web site, *Leading Edge* forums – **to continue dissemination and discussion** between employers, and also between employer and employee associations, **of best practices** in workforce development.[30]

[30] Including best practices from other industries

REGIONALIZATION & RATIONALIZATION OF TRAINING

The aerospace industry (AIABC, IAMAW and PAMEA) supports the principle of closer-to-home training for aerospace workers and advocates for more opportunities for learners to begin their aerospace training in their home regions through technical training programs at secondary schools and/or post-secondary co-op programs.

The industry advocates for greater use of co-op programs for *all* basic training, to support the integration of skilled individuals into regional employment.

The industry recognizes the efficiency of centralized facilities for the majority of aerospace trades training, given the high cost of equipment needed, but promotes the expansion of regional training provided community commitment is strong, local employment opportunities for graduates are available, and AIABC member companies' interests are served.

The minimum rate of return (for investment by training providers in a regional program) should be local employment opportunities for 40-50% or more of all program graduates.

The industry recognizes that some areas of British Columbia will remain without strong regional centres of aerospace training – but may still be the chosen location of aerospace employers. The Aerospace Training Council is intended to help coordinate work experience placements on an inter-regional basis, to accommodate learners in secondary school apprenticeship programs, post-secondary co-op education programs, or other training initiatives.

STRATEGY IMPLEMENTATION

Resource Requirements & Action Priorities

- ***The 10-Point Plan for Aerospace HRD in BC: Action Priorities for Years 2002-07*** **sets out the proposed time line for implementation, the major steps involved in each of the ten initiatives, the individuals and organizations whose involvement is key to success, the HR effort required, and other costs.** More detailed terms of reference for each initiative – including guiding principles, specific expectations of employers and training providers, learning objectives, operating procedures, lessons from pilot programs or other history, etc. – are contained in roundtable meeting records and pre-session information packages. See Reference List in the *10-Point Plan* document.

- As noted in the opening pages of this report, **the initiatives that warrant the greatest initial investment of time and effort are proposals 1, 2, 4, 9 and 10** – i.e.,

  1. **National on-line service for candidate screening and job posting**

  2. **Public relations / marketing campaigns to** (a) parents, secondary school teachers and career counsellors, and youth; (b) First Nations workers and employment services; (c) women; (d) recent immigrants and selected countries; and (e) government officials who participate in trade missions and international recruitment of workers

  4. **Co-op program option** for all streams of AME training

  9. **Aerospace Industry Training Council** as a mechanism for ongoing industry leadership and stewardship of training initiatives

  10. **Dissemination of best HRD practices through existing AIABC communication vehicles** – the association's newsletter, web site, *Leading Edge* forums.

- **Several of the initiatives in the 5-year plan can be undertaken with staff and volunteer effort, and do not involve capital investments. These include initiatives 2, 6, 7, 8, 9, and 10 in section "Action Plan for 2002-2007".**
  (NOTE: Three of these are among the highest-priority items: #2, 9 and 10.)
  Initiative 2 will require a modest operating budget (in the range of $25,000) for updating of resource materials ($5,000) and event fees and expenses ($20,000 for 4-6 key events in a given year).

- **Initiatives 3 and 4 will require funding support for curriculum reviews, detailed program design, and facilitated industry review / validation sessions.**

  For Initiative 3 (creation of a common core program for delivery as Secondary School / Post-Secondary Integrated Studies program), the estimated development cost is $20,000 for Phase I (analysis of competency and curriculum requirements), $15,000 for Phase II (industry validation process and feasibility check), and $40-100,000 for Phase III (curriculum and program development) – for an estimated total of $75-135,000.

  For Initiative 4, which is a high-priority item, the estimated operating cost for a pilot is $150,000, with ongoing operation and expansion of the program possible within base funding for colleges. This assumes introduction of the co-op option for AME-M training first, then for AME-S training.

  (NOTE: The co-op option for AME-M training could begin even without incurring estimated costs of $150,000 for a pilot program. BCIT has already indicated receptivity to making one of their eleven sets of AME-M training offered now (as part of their base-funded program) a co-op program. Two other training providers – (1) the Vernon Airport Training Council which is working in co-operation with Okanagan University College and which also has an ATO application in process, and (2) the University College of Fraser Valley – have also indicated a keen interest in offering co-op programs as part of their base-funded training.)

A later phase of Initiative 4 – introduction of the co-op program for AME-E training, targeted now for 2005-06 – would require industry investment of $500,000 into facility, aircraft and other equipment costs if implementation is to begin earlier.

- **Initiative 5 will require the establishment of cost-sharing agreements between ATO colleges / councils and an employer (or cluster of employers) in a specific district, for both capital and operating costs.** This initiative also requires identification of, and relationship building with, program champions within specific school districts – in the school board administration and in secondary school instructional teams.

Roundtable Process & Consensus Building

A big first step in the implementation process is development of a collective will to proceed.

This solidarity has been slowly coalescing during the roundtable process that has been part of this HRD project. This was an Industrial Adjustment Services project that focused as much on dialogue and collective action planning by industry reps as it did on technical research of labour demand and supply and current HRD investments. As a result, there has been some significant forging of common ground regarding what action would be most constructive.

The chart on the following page maps the meeting-by-meeting progress.

Summary of Roundtable Outcomes

	Roundtable One	Roundtable Two	Roundtable Three	Roundtable Four	Roundtable Five
	January 23	**March 27**	**May 29**	**June 26**	**July 31**
FOCUS	**Employee Recruitment Strategies**	**Secondary School Apprenticeship Training Model**	**Training Strategies (cont'd)**	**Marketing Strategy, Prior Learning Assessments, Multi-Trade Core Training**	**Synthesis, Priority Setting, Partnering Agreements for Implementation**
Participants	• Large and small company reps • Union and AME assoc. reps • BC Min. of Advanced Ed., Min. of Skills Development & Labour, BC Trade & Investment, Industry Training & Apprenticeship Commission • Human Resource Dev. Canada	• Large and small company reps • Transport Canada • Training providers (post-secondary and high school) • Union and AME association reps • Various provincial and federal departments (see Jan. 23 list)	• Large and small company reps • Transport Canada • Post-secondary training providers • Union and AME association reps • Various provincial and federal departments (see Jan. 23 list)	• Large and small company reps • Training providers & funders incl. Women in Trades & Aboriginal Employment & Training reps • Union and AME association reps • Transport Canada • Various govt. depts. (see Jan. 23 list) and including EE Coordinator in HRDC	• Large and small employers (CEOs and HR / Training Mgrs.) • Union and AME assoc. reps • Training providers & funders • Various provincial and federal depts. (see Jan. 23 list) • AIABC Board members
	Key Agreements	**Key Agreements**	**Key Agreements**	**Key Agreements**	**Key Agreements**
	• **On-line database of skilled candidates for work –** enhancement of CAMC service or development of new service for employers • **On-line job bank** for aerospace workers – also (ideally) as enhancement of national CAMC database • **Cooperative promotional campaign** (stronger links between individual firm efforts and AIABC efforts) to promote employment opportunities in BC industry to skilled workers • **AIABC to lead a campaign to ensure government promotion** of the BC industry • Industry pursuing **blanket application approval for expedited process for foreign worker permits** to assist all employers who don't yet have it (especially SMEs) • Industry considering a position paper and **lobbying effort to create a tax incentive scheme** to promote industry investment in training (this initiative related to training but agreement emerging from Roundtable 1)	• **Framework developed for proposed expansion of Secondary / Post-Secondary Program of Integrated Studies & Apprenticeship** (SS/PS) to more regions in BC • **Terms of reference drafted and discussion to be continued re: Industry Training Council** to provide leadership and focus for training programs supporting aerospace • **Inter-regional employer agreements to coordinate work experience placements** to be developed under stewardship of Industry Training Council • Identification to begin of **core curriculum components** for delivery in SS/PS integrated studies program to develop workers for several trades, rather than single-trade program • **Interest in strengthening partnerships between colleges with ATO standing and those without** to support expansion of SS/PS program as a delivery vehicle for core training for multiple aerospace trades • **Recognition of the need to develop student credit transfer standards as supplement to career pathways map** – in part, to better link ITAC certifications and provincial SSA rqmts. to national occupational and certification requirements	• Agreement on **six focus areas (occupations) for expansion of basic and on-the-job training**: AMEs – E, M & S, Gas Turbine Engine Repair and Overhaul Technicians, Aviation Machinists, and Aircraft Structures Manufacturing Technicians • **Program objectives clarified for "common core" entry-level training** • **Improvements in screening criteria and process defined** for aerospace entry-level trades training • **Apprenticeship strategies to increase on-the-job training placements** to develop adequate pool of AMEs and other occupational groups in short supply • **Focus areas identified for employer and AIABC collaboration on soft skills training**: leadership skills, supervisory skills for crew managers, and human factors training in maintenance	• **Outreach tactics and key contacts for marketing strategy** aimed at parents, secondary school teachers, career counsellors, government, women, mid-career changers, First Nations workers, target recruits, and skilled workers in other countries • Agreement on **implementing a competitive entry system** for entry-level trades training in aerospace, and **other enhancements to screening criteria and procedures** • Adoption of all Working Group recommendations regarding design and delivery plan for **co-op delivery model for AME training** • **Draft policy statements developed on regionalization of training** and rationalizing of training investments across the province • **E-learning to be considered for limited use** as part of the core skills entry-level program • **Positive indications from Transport Canada reps on feasibility of implementing all training strategy proposals** • **Prior Learning Assessment** system to be reviewed at WAA Conference	• **SKILL SHORTAGE REVIEW –** update on national + BC research findings re: labour demand • **ACTION PRIORITIES –** PHASING of initiatives, given recommendations based on work done by Steering Committee, roundtable participants, and smaller task groups on: – Recruitment outreach campaign – Common core entry program – Secondary school programs – Screening process at colleges – Co-op delivery model – Credit transfers + TC support – Partnerships between publicly-funded training suppliers – Financing & resource allocation • **PARTNERSHIP AGREEMENTS FOR IMPLEMENTATION** – Individual champions of specific initiatives – Working team structure for implementation of highest-priority action items

Other HRD Achievements to Build On

- **Strengthening of relationships between aerospace employers** who have participated in the Steering Committee and/or roundtable sessions – fostering a climate of greater collaboration and an exchange of information on HRD practices proven effective
- **Relationship building also between the industry association, government, training providers and coordinators of employment placement services** – deepening understanding of the issues, options, and potential consequences with various options
- Active training **partnerships between secondary School Districts 22, 23, and 38 and post-secondary colleges (BCIT, Northern Lights, UCFV and Camosun College)** for delivery of aerospace programs
- **Hiring results with pilot SS/PS Integrated Studies programs –** very high take-up of program graduates into ongoing employment by employers participating in this program in the Central Interior of BC
- Development of **career pathways map** for employment opportunities in aerospace, and incorporation of **compensation ranges** into career path materials – completed in June 2002 by AIABC with funding from the BC Industry Training and Apprenticeship Commission (ITAC)
- Production of **aerospace careers booklets** by FutureWorks – available for numerous target audiences
- Establishment of an **industry training fund** to support employer-sponsored training – $500,000 fund established through ITAC contribution and administered now by AIABC
- **CAMC on-line service for employers and prospective workers** listing both available jobs and resumes of skilled workers – can potentially be enhanced to meet the needs of more aerospace employers
- **Involvement of Transport Canada representatives in development of this HRD action plan.**

Implementation Hurdles & Recommendations

- **Need for project champions** With or without additional staff capacity within AIABC, implementation of this HRD strategy will be successful only through the ongoing involvement of HR directors, training managers, and other champions in a number of aerospace companies –- and particularly within the larger firms operating in BC. There are only 9 aerospace manufacturing and MRO[31] companies in British Columbia who have more than 150 employees – i.e., are large enough to likely be able to dedicate a staff resource to workforce development. One or two representatives from each of these companies is still a small group of people. Yet such a group – a necessary condition, perhaps even the sufficient condition for progress – can be the critical nucleus that makes the difference between success and failure in implementing this HRD plan.
- **Support staff capacity** Providing HRD leadership is a new direction and a big step for the aerospace industry association in British Columbia (AIABC). Up until the last year, promotion of the business interests of its member

[31] Maintenance, Repair & Overhaul

companies and provision of networking support to individuals working in aerospace have consumed all of its staff and fiscal resources. The industry association currently has only one half-time staff person. Building additional capacity into AIABC for ongoing HRD leadership, project management and coordination of these initiatives on a day-to-day basis is seen by some employer reps as a vital step.

AIABC's Executive Director has recommended hiring an implementation coordinator with strong HR skills, to balance his own communications expertise. Such a move would be possible only if a core group of member companies in AIABC shared this HRD coordination cost (for one or more projects), the association raised its fees and/or expanded its membership base to fund the position, or a combination of these tactics are used.

In the interim, progress on all high-priority projects can be made through the volunteer efforts of the various working groups created in the last roundtable session, provided these groups are given some logistical support from AIABC's Executive Director.

- **Climate for volunteer work** "It isn't the plan that makes a difference. It's *people* who make the difference." No individual will stay involved for long in the arduous work of implementing new initiatives unless he or she is encouraged and supported in that leadership role.

  Primary responsibility for implementation of this strategy rests with the AIABC Board – and even more so, with the association's HR committee of volunteers from member companies. The biggest hurdle in implementation is mobilizing – and sustaining – volunteer support.

  The ability of the AIABC directors to support members of the HR Committee and also members of the proposed Aerospace Training Council, the ability of the association's Executive Director to encourage others, and the ability of the HRD champions to demonstrate solidarity with one another even when discouraged by the pace of progress will be a pivotal factor in the implementation phase now beginning. Every word, every gesture of support will count.

  For everybody involved, the potential payoff is the transformation of problematic patterns in aerospace into best practices – and the development of a workforce that enables growth of the aerospace industry in Canada and, more specifically, in British Columbia.

- **Beginning somewhere** Success breeds success. The important step now for stakeholders involved with the strategy development project is to tackle the five projects given high-priority status – and to simply commit some time, on a regular basis, throughout the next year, to achieving these goals.

  This document summarizes the direction in which employer, employee and trainer reps agree it is wise to go. It provides a road map for the start, and a useful checklist for stops along the way. It is a multi-year guide for action. Creators of this strategy recognize that all initiatives will not be undertaken at once nor come to fruition all at the same time – but that recruitment, training *and* retention initiatives are all needed, and that there is agreement on where to start.

KEY CONTACTS

See **APPENDIX 2 for a complete list of Steering Committee members**.

See section "Highest-Priority Initiatives" **for a list of the champions for particular initiatives**.

PROJECT SPONSOR = **Aerospace Industry Association of BC (AIABC)**
collaboratively with IAMAW and PAMEA (see employee associations below)

AEROSPACE COMPANIES who participated in this project include:

all but one of the largest aerospace employers in BC ("large" defined as more than 150 employees):

- ACRO Aerospace Inc.
- Air Canada
- Avcorp Industries Inc.
- Cascade Aerospace Inc.
- Helipro International
- Kelowna Flightcraft Ltd.
- MTU Maintenance Canada
- Viking Air Ltd.

and these smaller firms:

- Aerospace North America
- Ebco Aerospace
- Pacific Avionics & Instruments
- Pyrotek Heat Treating Ltd.
- Sealand Aviation Ltd.
- Stevested Machinery
- Tag Aerospace
- Van Isle Avionics

UNIONS and EMPLOYEE ASSOCIATIONS & AGENCIES who participated include:

- International Association of Machinists and Aerospace Workers
- Pacific Aircraft Maintenance Engineers Association
- Trade Referral and Assessment Directed Employment Strategy (T.R.A.D.E.S.)
- Trades & Transferable Skills

TRAINING PROVIDERS who participated in one or more of the roundtable sessions include:

- British Columbia Institute of Technology
- Camosun College
- Northern Lights College
- Okanagan University College
- University College of Fraser Valley
- Vernon Airport Training Council
- School District #22 (Clarence Fulton Secondary School)
- School District #23 (Rutland Secondary School and Central Okanagan Career Program)
- School District #38 (Charles E. London Secondary School)
- Abbotsford Secondary School
- West Vancouver Secondary School
- Aboriginal Employment and Training Programs (representative of First Nations Employment & Enterprise Centre, Aboriginal Career & Employment Services, and Stitsma Employment Center for the Squamish Nation)
- Career Technical Centres (Abbotsford CTC)
- Mission Skills Centre
- Trades Discovery for Women Program (BCIT-sponsored)

GOVERNMENT representatives from the following Ministries or agencies who participated in roundtables:

- Human Resource Development Canada
- Transport Canada
- BC Ministry of Skills Development & Labour
- BC Industry Training & Apprenticeship Commission
- BC Ministry of Advanced Ed – Industry Training Branch
- BC Ministry of Advanced Ed – Post-Secondary Educational Division (Public Institutional Branch)

- BC Trade & Investment – Strategic Industries Branch (Aerospace & Oceans Sector)
  (Ministry of Competition, Science & Technology)
- BC Immigration Branch, Provincial Nominee Program (Min. of Community, Aboriginal & Women's Services)

On occasion, independent HRD consultants also participated in the roundtable sessions.

I.A.S. Chairperson for this HRD strategy development project was Sylvia Holland.

Contractor for research assignments and roundtable support was John Appleton of dbappleton.com.
Labour market economist who undertook further analysis was Ruth Emery of CANBRITIC CONSULTANTS LTD.