



Department of Commerce  
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# ***WASHINGTON COUNCIL ON AEROSPACE***

*REPORT TO THE GOVERNOR AND LEGISLATURE*

*February 7, 2011*

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This report was prepared in response to **Executive Order 09-04**, establishing the Washington Council on Aerospace. The council was tasked with finding ways to:

- Improve coordination, responsiveness, and integration of the state's aerospace training, education, research, and development programs to meet industry needs;
- Enhance the state's economic climate for the industry;
- Provide a forum for industry, labor and government to collaborate to ensure the needs of this vital industry are met in a timely and effective manner; and
- Ensure that Washington remains the best place in the world to design and manufacture aircraft and grow jobs in the aerospace industry.

The Washington Council on Aerospace is an ongoing effort for private and public partners to collectively identify and take actions that make Washington state government more responsive to the needs of the aerospace industry in Washington.

## **COUNCIL MEMBERS**

- Rogers Weed, Director, Department of Commerce, Council Chair
- Larry Brown, Legislative and Political Director, IAM #751
- Don Bennett, Executive Director, Higher Education Coordinating Board
- Charlie Earl, Executive Director, Washington State Board for Community and Technical Colleges
- Phyllis Wise, Interim President, University of Washington
- Elson Floyd, President, Washington State University
- Sen. Mike Hewitt, R-Walla Walla
- Sen. Steve Hobbs, D-Lake Stevens
- Randall Julin, General Manager, Absolute Aviation Services
- Rep. Phyllis Kenney, D-Seattle
- Stan Sorscher, Legislative Director, Society of Professional Engineering Employees in Aerospace (SPEEA)
- Rep. Judy Warnick, R-Moses Lake
- Benjamin Hempstead, Mechanical Engineering Lead, Electro Impact
- Laura Peterson, Vice President for NW State & Local Government Operations, The Boeing Company

## **FORMER MEMBERS**

- Michael Zubovic, Vice President, Aviation Technical Services, Inc.
- David Schumacher, Director of Government Affairs, The Boeing Company
- Ann Daley, Executive Director, Higher Education Coordinating Board
- Mark Emmert, President, University of Washington

## **RECOMMENDATIONS FOR NEW MEMBERSHIP**

- Eleni Papadakis, Executive Director, Workforce Training & Education Coordinating Board
- Additional industry representation

## **EXECUTIVE SUMMARY**

2010 was the first full year of operation for the Washington Aerospace Council. Its mission is to ensure the continued health of the state's aerospace industry as measured by industry employment numbers. It is tasked to focus in three initial areas: Economic Development, Workforce Training and Research. This past year, the group shifted from idea generation to work plan implementation, meeting six times over the course of the year to explore and develop the action items identified in its work plan.

In the report that follows you will find an overview of the industry's employment trends over time, both in Washington and in other aerospace states. That is followed by specific policy recommendations that surfaced over the course of the past year. After that, you will find the Council's work plan with a recap of 2010 actions and a view of where the group is headed in 2011 on each item. Finally, there are a series of Appendices that provide more detail on several of the policy proposals that are surfacing through the Council.

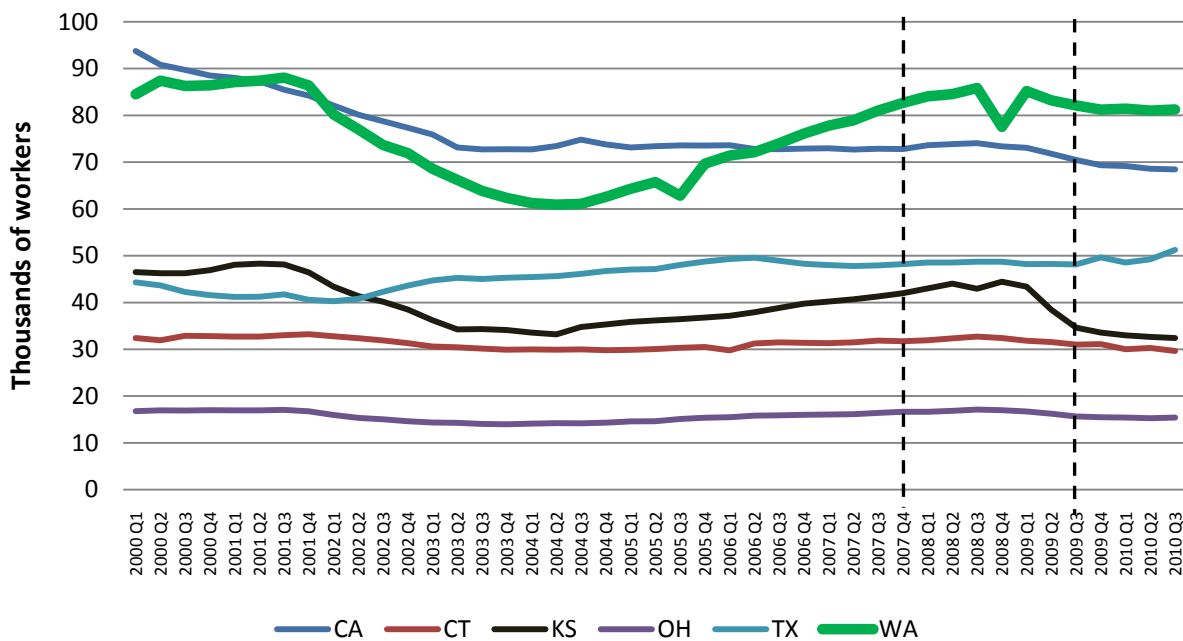
While the Council is very aware of the difficult budget environment that our state's policy makers face, we believe it is our responsibility to ensure that the State Government knows where some of the biggest opportunities lie to improve the health of the industry in the state through policy or budget choices. We look forward to interacting with the Governor and legislators on these ideas and to continuing our work on behalf of one of our state's most important industries.

# AEROSPACE INDUSTRY TRENDS

## Employment and Jobs

Aerospace jobs continue to show a slight quarterly decline through the first three quarters of 2010. After a 4.8% year-over-year increase in employment in Q4 2009 (artificially buttressed by the effects of the Q4 2008 Boeing machinists strike), year-over-year aerospace employment growth in Washington has been negative for the remaining quarters, with declines of 4.4%, 2.6%, and 1.1%. Of the six states compared below (**Figure 1**), Texas is the only one to have positive year-over-year growth in Q3 2010 (6.5%). In fact, Texas is *the only state* to have exhibited overall positive growth between Q4 2009 and Q3 2010, while Kansas saw a sizable year-over-year decline in its aerospace industry employment over this period, with declines of 24.5%, 24.0%, 15.2%, and 6.5% (Q4 2009 – Q3 2010). While growth seems to have tapered off in Washington, aerospace employment levels remained substantially above levels in 2004. This data also does not capture employment in suppliers not classified by the North American Industry Classification System (NAICS) as “aerospace,” such as many tooling, electronics, and composites companies that do significant aerospace-related work.

**Figure 1. Aerospace Workforce by State**



Source: U.S. Bureau of Labor Statistics, Current Employment Statistics (CES) database, various years

Even though the U.S. Bureau of Labor Statistics does not publish occupation by state and industry, we have identified occupations that are relevant to the aerospace sector. Among these, from 2008 to 2009 (the most recently available data), the largest net declines (in absolute number of jobs) were:

- computer software engineers, applications (1,740 jobs lost);
- shipping, receiving, and traffic clerks (1,040 jobs lost);
- first-line supervisors/managers of production and operating workers (830 jobs lost);  
and
- aircraft structure, surface, rigging, and systems assemblers (830 jobs lost).

(**Table 1**).

It is important to note that a large segment of Washington's aerospace employment base includes a higher percentage of non-shop floor occupations. In 2009, for instance, there were more than 19,000 engineers employed in the aerospace sector (NAICS 3364), equal to roughly 23% of total aerospace employment.<sup>1</sup>

Washington remains the state with the largest aerospace workforce. In aerospace engineering, the state ranks third behind California and Texas, though our concentration (as measured by the labor location quotient) is now second behind Kansas (**Figure 2**). It is difficult to identify the exact reasons for these changes in employment. The impact of the global recession may have been partially mitigated by the aerospace business cycle, which responds to long-term production and delivery schedules.

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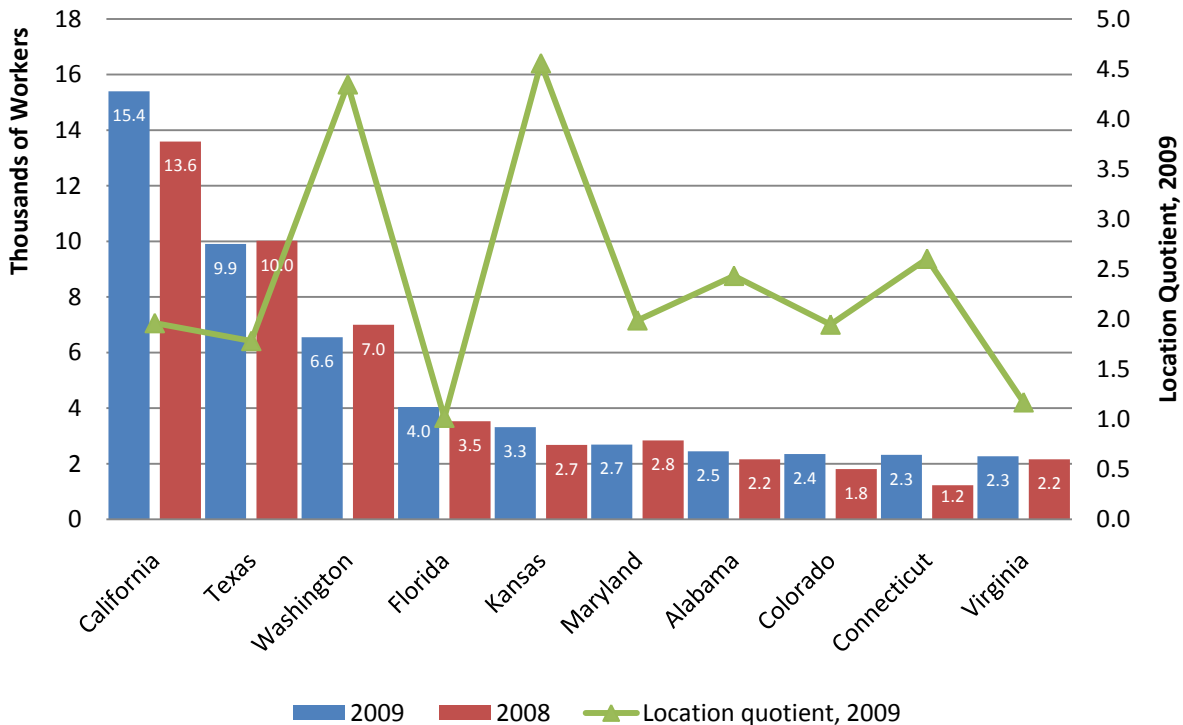
<sup>1</sup> Washington State Employment Security Department, Occupations-Industry Matrices, 2009 Q2

**Table 1. Washington Employment in Selected Occupations Critical to the Aerospace Industry, 2008-2009...**

Occupation Title	2009	2008	Change from 2008 to 2009 (#jobs)
Logisticians	4,040	4,000	40
Aircraft Mechanics and Service Technicians	4,140	4,180	-40
Industrial Engineers	4,970	5,270	-300
Machinists	5,090	5,530	-440
Mechanical Engineers	5,920	6,170	-250
Aerospace Engineers	6,550	7,000	-450
Engineers, All Other	7,310	6,910	400
Inspectors, Testers, Sorters, Samplers, and Weighers	7,680	8,190	-510
Computer Specialists, All Other	7,800	7,530	270
Purchasing Agents, Except Wholesale, Retail, and Farm Products	8,120	8,060	60
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	10,550	11,380	-830
First-Line Supervisors/Managers of Production and Operating Workers	10,550	11,380	-830
Management Analysts	11,750	11,240	510
Shipping, Receiving, and Traffic Clerks	16,640	17,680	-1,040
Computer Software Engineers, Applications	24,010	25,750	-1,740
Engineering Technicians, Except Drafters, All Other	3,250	3,140	110
Computer-Controlled Machine Tool Operators, Metal and Plastic	3,050	3,270	-220
Mechanical Drafters	1,990	2,130	-140
Materials Engineers	1,400	1,380	20

Data source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

**Figure 2. Aerospace Engineers by State**

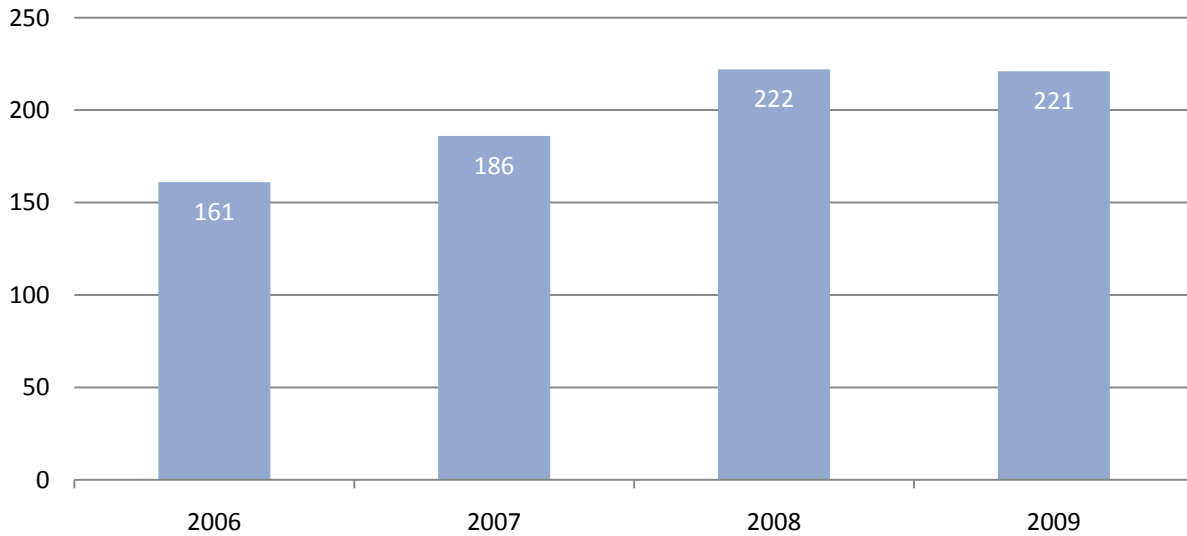


Data source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

### **B&O Tax Incentive**

In 2009 (most recently available year), 221 Washington state companies took advantage of the aerospace B&O tax incentive (**Figure 3**). However, this is far less than the estimated 650 companies that are either aerospace companies by definition (NAICS) or do significant aerospace-related work. This number is based on accountability reports submitted to the Washington State Department of Revenue (DOR) by firms that claimed to have participated in aerospace tax incentives during 2009 calendar year. Participants in this tax incentive program reported over 77,000 employees in total, with 76% coming from Boeing.

**Figure 3. Washington State Firms Taking Advantage of B&O Tax Incentive**



*Data source: Washington State Department of Revenue*

## **Aerospace in Washington – The Industry Perspective**

Washington is a world leader in aerospace. But Washington companies face an evolving competitive landscape and must be vigilant in working to continuously improve its long-term competitive position in a sustainable way.

**A dynamic and growing industry.** Between now and 2030, commercial aviation will continue to be a robust and growing industry of significant proportions. During that 20-year time frame, the market for commercial airplanes will total \$3.6 trillion.

**A changing competitive landscape.** New entrants in a number of markets are changing the competitive landscape for Washington aerospace companies. To compete, aerospace companies in Washington must solve a dual challenge. First, they must continually develop industry-leading technology, which requires a robust pipeline of well-educated people to develop and apply these technologies. At the same time, they must build current and future products on a cost-effective basis.

**Washington's competitiveness imperative.** Because of this simultaneous need to gain maximum efficiency while investing in the future, the needs of aerospace are twofold.

1. Washington must help to drive costs out of the system in any way possible. This includes finding ways to reform state-run systems such as workers compensation to keep employer and administrative costs down while protecting injured workers.
2. Washington must invest in its own future, by giving current and future students the skills they need to compete in this dynamic, hyper-competitive industry. Engineers & technical workers will drive the success of this industry – and the states in which it operates – for many years to come. Washington must invest heavily in these fields of education in order to retain its traditional status as the leading state for commercial aerospace.

## POLICY RECOMMENDATIONS

In the course of its work this past year, the Council has reviewed the following specific policy and/or budget recommendations which we pass on for consideration by policy makers:

- 1. Expand Engineering Education Capacity:** In July 2010, the Higher Education Coordinating Board in collaboration with the University of Washington and Washington State University presented information to the Aerospace Council on the importance of engineering education to the aerospace sector. The presentation laid out the business case for expanding engineering education to meet the current and future talent needs of Washington's aerospace companies.

The HECB report said that that fixing the problem was straightforward and cost effective. A \$5.0 million annual investment to increase engineering education capacity at UW and WSU would create 260 additional engineering FTE and 98 new degrees annually. The investment would cost the state about \$51,000 per engineering degree produced. Because engineers earn more than other degree holders, the investment would return to the state over \$61,000 in additional tax revenue (present value over 40 years) and a positive return on investment—without considering the additional value to the state of lowering industry recruitment costs and maintaining aerospace employment. See Appendix [A] for more details.

- 2. Create a Center for Aerospace Technology Innovation:** The mission of the proposed new Center for Aerospace Technology Innovation would be to advance new technologies addressing innovative products in aviation, aerospace, and defense. It would fund projects at the state's research institutions (primarily UW and WSU) building on existing strengths in aerospace research and would encourage strong industry-academic partnerships. Projects would be selected based on expert review, both scientific and industrial, considering critical criteria such as technological innovation, potential for impact on product development, and financial leverage by means of corporate support and/or grants from government or non-profit agencies. The Center would have minimal staff, just sufficient to facilitate rigorous decision making and timely management of awards, and would be overseen by an executive board with membership from state research institutions, the aerospace industry, and state government. State support at the level of \$3 million per year, \$6 million per biennium, is required to provide the breadth of programs needed to stimulate technology innovation in Washington's aerospace industry. The Center would report biennially to those committees of the Legislature concerned with economic development, summarizing its work, providing indicators of its impact, and outlining ideas for enhancing benefits to the State. See Appendix [B] for more details.

- 3. Tax Credit for Aerospace Apprenticeships:** In 2008, the Washington State Legislature provided funding to develop training programs, in the form of apprenticeships, to ensure that the knowledge and skills of Washington's aerospace master trades people are passed on to the next generation of employees. Apprenticeships combine on-the-job training with classroom instruction, allowing a student worker to earn a living wage while achieving continued growth in their occupation as well as a college degree. The Aerospace Joint

Apprenticeship Committee (AJAC) and its apprenticeship programs are a vital connection between education, workforce and economic development in Washington.

Currently, 15 US states, are offering tax incentives to businesses with apprenticeship programs as a means to create new jobs and stimulate the economy. Most of the states provide a variation of a five thousand dollar tax incentive to employers for each new apprentice hired. According to a survey that AJAC conducted in October 2010 of Washington manufacturing employers, 71.4% of respondents said they would consider hiring one or more apprentices for the program, who they would not have otherwise hired, if they received a \$5,000 tax credit for each new apprentice. To stimulate re-hiring and create jobs for Washington residents, AJAC proposes a \$5,000 tax incentive for employers who hire an Unemployment Insurance (UI) participant as a registered apprentice with the AJAC. See Appendix [C] for more details.

- 4. Industry Association Recommendations:** The industry associations in the state (AFA, PNAA, INWAC and PNDC) have a number of priorities for the upcoming legislative session including business climate reform (worker's comp and UI), enabling more students to attend the recently established Aerospace Training and Research Center, tax policy recommendations and research and marketing recommendations. See Appendix [D] for more details.

## **2010 AEROSPACE COUNCIL WORK PLAN OVERVIEW AND PROGRESS**

Early in 2010, the council created a work plan to guide our meetings organized in each of its three focus areas. Below is a review of that work plan, progress in 2010 and action items for 2011, if any.

### **ECONOMIC DEVELOPMENT (OPPORTUNITIES LISTED IN ORDER OF COUNCIL PRIORITY):**

#### **1. U.S. Air Force Tanker**

**Overview:** The Governor created a coalition of industry leaders (Washington Aerospace Partnership) to help generate support for Boeing's bid to manufacture and assemble a replacement for the KC-135 Air Force Tanker, which would be based on the 767. The goal is to get the political roots as strong as possible not just here in Washington but in the 14 other states that are relevant to the tanker. We have a number of companies throughout the state who are involved in constructing and maintaining the 767. A 2010 Boeing-funded study by the American Enterprise Institute estimates that a Boeing win would create between 62,605 and 70,706 U.S. job-years over the life of the contract, of which many would be in Washington.

#### ***Actions Taken in 2010:***

- The Washington Aerospace Partnership, a non-profit grassroots organization committed to advocating for the tanker in Washington, updated the Council on their work.

#### ***Action Items for 2011:***

- Continue monitoring developments and reacting as appropriate until a final decision is made.

#### **2. Aerospace Company Recruitment**

**Overview:** The goal is to strengthen our existing aerospace supply chain by recruiting companies into Washington State that fill gaps in our local supply chain. In 2008-2009, the Snohomish County EDC developed a detailed aerospace supply chain gap analysis which is comprehensive and could provide a foundation for a broader state recruitment strategy.

#### ***Actions Taken in 2010:***

- At the May 11, 2010 meeting, Commerce, Snohomish EDC, AFA Board members and Aerospace Council members discussed how to make the Snohomish County study available to the Council and to ensure Snohomish EDC participation going forward. The discussions were positive and a dialogue continues among these stakeholders. The Departure of the Snohomish EDC Director this Fall has delayed a final agreement here.
- Commerce Director Weed attended the AeroMart supplier conference in Toulouse, France and met with six European aerospace companies to discuss potential investment in Washington.

***Action Items for 2011:***

- Develop an action plan that allows the Governor/Department of Commerce to identify potential recruitment targets to round out the supply chain within the state, using EDC expertise and relationships.
- A recruitment strategy will be used to target potential meetings for the Governor and Commerce at the Paris Air Show in 2011.
- Washington will host five foreign delegations in February for the Pacific Northwest Aerospace Alliance Annual Conference and have the opportunity to present the business case for investing in Washington.

**3. International Trade**

***Overview:*** Connecting Washington's supply chain to other original equipment manufacturers (OEMs) and tier I suppliers is critical to the industry's vitality. In 2010, Commerce has considerably expanded its international trade program. With 2 FTEs in Seattle and several foreign consultants that focus on aerospace, Commerce's goal is to help companies gain access to global supply chains through research, contracts and marketing. Programs include local seminars, international business development missions and foreign trade shows.

***Actions Taken in 2010:***

- The Governor led a trade mission to China in September and promoted Washington State aerospace supply chain companies.
- 14 companies participated in Commerce-led international trade missions to three target aerospace markets: Montreal (April), China (November), and France (December).
- Commerce delivered 208 trade assistance cases for more than 100 individual aerospace companies.

***Actions Items for 2011:***

- Organize two local supplier fairs and trade shows that bring OEMs and Tier 1 suppliers to Washington State.
- Coordinate with local industry organizations, including AFA, PNAA and INWAC, to develop a domestic marketing strategy for Washington State aerospace. Commerce's focus has been on international marketing and business development, but there is a need for better coordinated marketing within the US.
- Commerce will lead a delegation of aerospace companies and suppliers to the Paris Air Show in June 2011.

**4. Unmanned aerial vehicles (UAVs)**

***Overview:*** The unmanned systems industry is expected to experience impressive growth over the next few decades and could be a major driver of job growth in the aerospace sector. Washington's UAV activity is primarily related to Boeing, which acquired Insitu in 2009,

and is heavily concentrated in the Columbia River gorge, Vancouver and Puget Sound areas. The complex technology and software that support UAVs are a potential high value sub-sector for the state. Market barriers for the unmanned sector include the high cost of civil applications of UAVs and current FAA restrictions on the use of national airspace.

***Actions Taken in 2010:***

- The council convened a special meeting in July to discuss the UAV industry, including presentations by Commerce and the University of Washington.
- State officials have been actively engaged with Boeing/InSitu on a location decision for their planned new headquarters facility.

***Actions Items for 2011:***

- The Council will continue to investigate whether Oregon offers a more competitive business environment than Washington for UAV production and related activities.
- ***Policy Recommendation:*** Extend the current commercial aerospace tax incentives to cover the design and manufacture of all aircraft, both commercial and military, to help grow burgeoning UAV-related operations in the state.

## 5. **Aerospace Software**

***Overview:*** This will be an agenda item for the first meeting of 2011. There has already been some overlap between information and communication technology (ICT) and aerospace, such as the Performance-Based Navigation (PNB) solutions developed by Kent-based Naverus, now part of GE Aviation. Aerospace is becoming increasingly software-intensive. For example, there are more than eight million lines of code in Boeing 787, compared with two million in the 777. Software will continue to play a larger role in the enabling infrastructure for aerospace companies – for management, technical and supply chain operations. As a state, we have a significant software skill base that may represent an opportunity to develop in this area.

***Actions Taken in 2010:***

- *None*

***Actions Items for 2011:***

- Research and provide a report on potential opportunities for Washington in aerospace software and cross-industry collaboration between the aerospace and ICT sectors.

## 6. **Green Aviation**

***Overview:*** Aviation has taken on carbon as one of their big issues. Carbon emissions are highly scrutinized, growing proportionally and are measurable. Sea-Tac Airport could be the first airport in the world to provide scalable aviation biofuels, which could happen as soon as 2013. Even though carbon is still not taxed in the U.S., carriers operating in Europe will soon need to comply with cap-and-trade carbon pricing. This will also be a theme of the 2011 Air Show in Paris, France.

***Actions Taken in 2010:***

- John Gardner of WSU updated the Council on the aviation biofuels initiative and key challenges and opportunities moving forward.

***Action Items for 2011:***

- Identify ways to support the research and development, manufacture, distribution and use of aviation bio-fuels in the Pacific Northwest.
- A recommendation is for the Council to work directly with the congressional delegation and let them know the importance of this opportunity.
- Make aviation biofuels a focus of the Paris Air Show and the Governor’s Mission to Europe.

**WORKFORCE TRAINING**

**1. Education and Training Coordination**

**Overview:** The goal is to coordinate the state’s mid-level aerospace education and training programs through the State Board for Community and Technical Colleges (SBCTC). Key organizations in this initiative with the community and technical colleges include the Center of Excellence in Aerospace and Advanced Manufacturing at Everett Community College, the Washington Aerospace Training and Research Center at Edmonds Community College, the emerging Inland Center for Aerospace Training at Spokane Community College, and AJAC, the Aerospace Joint Apprenticeship Committee. A great deal of progress has been made this year in establishing systems for coordination and collaboration.

***Actions Taken in 2010:***

- Community and technical colleges offering aerospace programs, with technical assistance from the Center of Excellence, have formed a collaborative workgroup, the Aerospace Curricular Alignment Team (ACAT), to evaluate the state-wide platform of technical training, identify training gaps, and develop common curriculum that assists students in more seamless pathways to skill building, education and employment. This team includes twenty-two community and technical colleges, AJAC, and training managers from Boeing. Additional aerospace companies have been invited to participate on this team.
- Many colleges have inadequate equipment to provide state-of-the-art training. Fortunately, four aerospace colleges responded to a request for proposals from SBCTC and were awarded a total of \$500,000 of the Governor’s 10% WIA fund to purchase aerospace-related equipment.

<b>College</b>	<b>Equipment</b>
Bates Technical College	Machining equipment
Clover Park Technical College	Aviation training simulators
Renton Technical College	Five Axis Vertical Machining Center
South Seattle Community College	Aviation training simulators

The equipment has been installed and students and faculty are excited and appreciative of these new learning opportunities.

- Dr. Richard Strand, Dean at Olympia College, developed an inventory and measured production level of aerospace programs in the community and technical college system over the past ten years. He grouped aerospace workers into five key industry clusters: Composite Manufacturing, Electronics, Industrial Manufacturing Technology, Machine Tool Technology, and Aircraft/Airframe Mechanic. Dr. Strand's research showed that production of aerospace workers has softened over the past decade, but it is now on the increase and could be expanded rapidly with funding for additional capacity. This work is being used as a platform for further discussion among colleges to coordinate curriculum and course outcomes.
- Composite Manufacturing training was identified as a major gap in Dr. Strand's research. Current programs in composites are relatively small, and much of this production targets the marine industry. Colleges and Boeing are now discussing expansion of this program and adoption of Clover Park Technical College's model curriculum. Colleges have convened several times to discuss sharing curriculum in composites and identifying equipment requirements. They also have been meeting with AJAC, who is adding composite manufacture equipment to their mobile training unit.
- The Aerospace Joint Apprenticeship Committee has so far created collaboration between 4 community and technical colleges to offer uniform apprenticeship programs across the state with common courses and course numbering to provide transferability and standardization.

***Action Items for 2011:***

- Continue identifying specific ways to help increase the coordination, articulation, and growth of aerospace training programs state-wide.
- Continue to support collaborative groups such as ACAT; invite additional industry representatives.
- Seek funding to provide capacity to train needed aerospace workers.
- AJAC is organizing the effort to showcase Washington's aerospace and education training programs in a unified manner at the Paris Air Show.
- Spokane Community College and AJAC are coordinating the aerospace training and education programs to secure additional funding through the Trade Adjustment Assistance Community College and Career Training Grant.

## **2. Develop Industry Driven Training**

***Overview:*** It is critical to build program capacity at the Washington Aerospace Training and Research Center in Snohomish County, the Spokane Aerospace Technology Center in Spokane and the Aerospace Joint Apprenticeship program to develop and provide industry-driven, mid-level training to new students and current workers. Building degree and certificate programs at the community and technical colleges is also an important aspect of this activity.

***Actions Taken in 2010:***

- The ACAT team is working to insure that colleges' degree and certificate programs in aerospace meet industry standards. Together with Boeing training managers, AJAC, and both aerospace training centers, the team has scheduled five aerospace cluster workshops to review and revise core competencies critical to meeting industry needs. These workshops will include faculty and trainers who can integrate industry needs into current and future curriculum for college degree and certificate programs, short-term incumbent worker training and apprenticeship opportunities.
- Aerospace training centers at Edmonds and Spokane community colleges were established in 2010 and are offering classes. The Washington Aerospace Technology and Resource Center (WATR Center) has moved into their facility at Paine Field and is offering classes. The WATR Center is sharing curriculum with the Inland Northwest Aerospace Technology Center in Spokane. The Spokane center is offering classes at their current facility and is working with the Spokane Airport, Triumph Industries, and AJAC to develop plans for a new facility near the airport.
- The Aerospace Joint Apprenticeship Committee (AJAC) has worked with industry subject matter experts to develop innovative apprenticeships incorporating latest technology, safety and best practices. AJAC is partnering with approximately 60 participating employers and growing.

***Action Items for 2011:***

- Continue collaboration between WATR Center and Spokane Community College to offer training state-wide.
- Continue to pursue development of Spokane Aerospace Technology Center facilities. Encourage and seek industry participation in curriculum and program development efforts.
- Support continued activities of ACAT to revise short and long-term curricula to meet new industry requirements.
- AJAC will offer training to employers across the State by bringing the Advanced Inspection and Manufacturing Mobile Training Unit (AIM-MTU) to their door. The AIM-MTU is utilizing industry subject matter experts to create modularized curriculum and to bring the most advanced technology and short term training directly to employers.

**3. Create clear educational pathways, increase transfer agreements between educational institutions, and award credit for student's prior learning.**

***Overview:*** Post-secondary pathways and career advancement opportunities for future and current aerospace employees must be clear and accessible. Pathways should lead from two-year to four-year aerospace degree programs to shorten the time to degree completion. Curriculum must be flexible to meet the changing demands of industry and to meet the time constraints of working adults.

***Actions Taken in 2010:***

- Five colleges offering FAA certified Airframe and Power Plant Mechanic programs have collaborated with AJAC to develop a high quality common curriculum that is

currently under review for FAA certification. This curriculum has been developed with common course numbers so that students can transfer credits earned in technical courses easily from one institution to the other and employers can clearly understand the competencies included in each course. Common course numbering is a convention now common in academic transfer courses in Washington State, but is more difficult to apply to technical courses because of their specificity and the much larger number of technical courses offered related to technical occupations. The Airframe and Power Plant common courses are the first technical common courses in our state system.

- Washington's 2-year colleges are working toward aligning and standardizing aerospace curriculum which will allow course content to be updated and deployed regularly and system-wide as industry needs change.
- Creation of aerospace apprenticeship programs with full college credit allowing apprentices to acquire a two year degree and transfer to a four-year degree program.
- Progress is being made in common curriculum, technology transfer, and articulation among training programs.

***Action Items for 2011:***

- Complete recommendations for credit for prior learning in aerospace occupations.
- Establish common course numbering and curriculum for all Aviation Maintenance Technology programs (A & P) in the community and technical college system. AJAC will continue to lead the coordination of the five A & P schools in developing common curriculum, which provides greater transferability and accessibility for these programs.
- AJAC, King County WDC, and South Seattle Community College have created and are implementing an industry driven 10 week pre-apprenticeship training. The program includes a post training internship creating a pool of qualified candidates with entry level skills and certification for aerospace employers.
- Identify next steps and begin pursuing a crosswalk of certifications and skills for veterans transitioning into civilian aerospace jobs.

**4. Engage business and labor to identify training requirements leading to new credentials requiring less than two years to complete.**

***Overview:*** Community and Technical Colleges are currently expanding program production to meet Boeing's demand. Production of aerospace workers had fallen off during the post 9/11 recession and aerospace downturn, but production of skilled workers is increasing now. Increased program capacity among the colleges is available (if funded). However, knowledge gaps remain between business and labor requirements and training offered.

***Actions Taken in 2010:***

- The Aerospace Joint Apprenticeship Committee (AJAC) has played a key role in developing opportunities for potential workers and training for incumbent workers. Collaboration efforts between Boeing, community and technical colleges, and AJAC have identified two training programs: Advanced Composites and European Aviation Safety Agency (EASA) Aviation Maintenance Technician Certification where there are gaps between training and employment needs.

- Dr. Dirk Weiss of the Washington Technology Center has joined the team and is developing protocols for transferring research on composite materials into aerospace training curriculum. He meets regularly with college faculty and other researchers.
- Working closely with the aerospace industry, ACAT has identified Composite Manufacturing as one of five industry clusters for collaborative curriculum transfer. The Aerospace Curriculum Alignment Team will bring faculty together to work on developing common curriculum, integrating the principles of Dr. Weiss's research transfer protocol, and developing appropriate career pathways for students and workers involved in this program.
- Employees with European Aviation Safety Agency Aviation Maintenance Technician (EASA) Certification are needed by European companies that fly Boeing airplanes. This training is not currently available in the United States. It will take some time to develop the certification program here, but the colleges are working with AJAC to determine how best to implement this training in Washington.

***Action Items for 2011:***

- Create training that is responsive to dynamic employer and industry needs;
- Work with Washington Technology Center and aerospace community and technical colleges to transfer composite research into curriculum;
- Begin identifying resources and next steps for European Aviation Safety Agency (EASA) Aviation Maintenance Technician certification training.

**5. Aging Workforce**

***Overview:*** There is a need to address the challenges of employee attrition due to the aging aerospace workforce through development of: 1.) mentorship and training opportunities between new and experienced employees; and 2.) targeted marketing strategies to recruit individuals leaving the military, women, skilled dislocated workers from other industries, and other under-represented groups.

***Actions Taken in 2010:***

- The Aviation High School, Museum of Flight, school district skills centers, the Center of Excellence in Aerospace and Workforce Development Councils are all working on strategies to attract youth to aerospace careers.
- AJAC offers programs to transfer knowledge between generations. They recruit for employers and connect them with the next generation of diverse workers.
- The Museum of Flight partnered with Employment Security and Workforce Development Councils to offer the Washington Aerospace Scholars opportunity to Workforce Investment Act eligible youth. A total of 157 students completed an online and resident program in Seattle during summer 2010.
- Spokane Community College, the Museum of Flight, the Spokane Area Skills Center, and the Workforce Development Council worked together to sponsor a summer aerospace academy in Spokane.

***Action Items for 2011:***

- Increase aerospace career exploration opportunities for middle and high school students.
- AJAC is looking to bring more women and minorities into to the industry and to expand their Veterans in Aerospace program considerably in the future.
- AJAC is continuing to build their Train the Trainer program to teach the aging workforce how to pass on their skills and knowledge to the next generation of employees.

**6. Develop Mentorship and Training Strategies**

***Overview:*** There are a number of incumbent workforce issues. More “train-the-trainer” and “teach-the-teacher” programs are critical. There needs to be an ongoing partnership between legislators, business, education and the aerospace council to accomplish this.

***Actions Taken in 2010:***

- Aerospace instructor programs and train-the-trainer are available. An applied baccalaureate is in the planning for the future.
- Airframe and Powerplant Program Alignment—The five community and technical colleges in WA that do this training have worked with AJAC to develop a common FAA-approved Airframe and Powerplant curriculum. The curriculum has been developed and FAA approval is in process.
- After research, AJAC discovered that 15 other states have implemented employer incentives for apprenticeship programs. Most have started with a \$2,500 incentive (each employer they bring on they will receive approximately \$2,500). Those programs have been so successful that the majority of the states have upped them to \$5,000. From the October 2010 AJAC Survey Results regarding apprenticeship incentives in Washington, the overwhelming response received was “yes,” employers would bring on employees if they were offered a tax incentive similar to this.

***Action Items for 2011:***

- AJAC Inspection and Manufacturing Mobile Training Unit Program will be online in January 2011.
- Dr. Dirk Weiss of the Washington Technology Center and the Aerospace Curriculum Alignment team have scheduled a train-the-trainer event for faculty to learn about recent research transfers in March 2011. College faculty and instructional deans statewide will be attending this train-the-trainer event.
- The council has a policy proposal to adopt the apprenticeship tax incentive described above.
- An applied Baccalaureate (Teach Tech) is in the planning for the future.

- 7. Ensuring a strong, skilled aerospace workforce for the future.** Develop coherent technical educational pathways to support aerospace workers long term career needs. Launch an outreach campaign to recruit middle school, high school, and college-age students highlighting careers in the aerospace industry. Maintain a web-based clearinghouse

to provide information on post-secondary aerospace training programs offered throughout the state.

**Overview:** The Center of Excellence aims to build a competitive workforce for aerospace and aviation in Washington State. There have been several outreach programs and successes. There are ten “Centers of Excellence” in the State, although not all focus on aerospace.

***Actions Taken in 2010:***

- There are several outreach activities to engage students including *Mother Daughter TEA*, *Flight of Innovation*, and *Get AMPT*.
  - The *Mother Daughter TEA* event was founded to encourage young women to take an interest in pursuing a career in the engineering industry.
  - *Flight of Innovation* education program uses a scenario-based immersive learning model that encourages students to become innovators and collaborate as a team.
  - *Get AMPT* helps students learn about the wide range of excellent opportunities available in advanced manufacturing in Aerospace and Marine career opportunities.

***Action Items for 2011:***

- Continue to convene the Aerospace College consortium of 18+ community and technical colleges to share information, collaborate on curriculum, and pursue joint projects.
- Continue to promote aerospace careers with youth and secondary schools.
- Continue to serve as a repository of aerospace curriculum and information.

**8. Support third-party initiatives in the K-12 system directly focused on enhancing the foundational skills leading to higher education degree attainment in the science, technology, engineering, and math fields.**

**Overview:** Washington STEM Center seeks to improve student achievement and opportunity in areas critical to our state’s economic prosperity: Science, Technology, Engineering, and Mathematics (STEM). This builds upon existing programs, such as LASER and the Transitional Math Project. This initiative aims to catalyze innovation in the WA’s K-12 education system, increase teacher effectiveness and student learning. Boeing was involved in a 2-year planning process to create the STEM center along with Microsoft, Battelle, the Paul G. Allen Foundation, and the Bill & Melinda Gates Foundation.

***Actions Taken in 2010:***

- Council was briefed on efforts in this area.

***Action Items for 2011:***

- Beginning in January 2011, the Sno-Isle Technical Skills Center (one of 12 technical skill centers in WA), will be offering an Aircraft Assembly and Service Technician course. The course is designed to provide students with basic knowledge that would assist them in qualifying for entry level aircraft mechanic positions. It will also

provide an articulation path to aerospace certificate programs at the Washington Aerospace Training and Research Center.

- Boeing will be a major partner in the development and implementation of the Aircraft Assembly and Service Technician curriculum by providing subject matter experts, guidance for curriculum development, and donations of critical tools and equipment. Expansion of the Aircraft Assembly and Service Technician program into additional skill centers in WA is planned for 2011.

## **9. Build a business case for expanding degree capacity in aerospace-related high demand fields of study.**

**Overview:** Baccalaureate and advanced degree Engineers and scientists are a shortage in our state. We need to figure out how to close the gap between the supply and demand for engineers in the industry. WA's aerospace industry relies on engineering talent. That engineering talent is the catalyst for innovation and productivity in the aerospace industry. WA is turning away qualified engineers from programs because there is not enough capacity to enroll them. Expanding capacity to meet demand is necessary. See [Appendix A], "Aerospace engineers in short supply," report which looks at engineering and education capacity in WA and its importance to the aerospace industry. The report is a collaboration between the HECB, UW, WSU, SPEEA and Boeing.

Community and Technical college degree capacity in aerospace industries has declined since 2001 but is currently expanding to meet recent demand. If demand for technical aerospace workers increases (as Boeing is currently projecting), budgetary limitations will reduce the colleges' capacity to continue to expand these expensive technical programs.

### ***Actions Taken in 2010:***

- Community & technical colleges have a transfer function in engineering production and are working on improving student outcomes in mathematics in particular.
- Community & technical colleges capacity for education and training in composite technologies is very small, but could be expanded with funding.
- The HEC Board has developed a proposal to expand aerospace engineer capacity at our four year schools for consideration by the Governor and legislature [See Appendix A].

### ***Action Items for 2011:***

- Explain the benefits of the HEC Board proposal to the Governor and legislature.
- Develop next steps based on feedback from policy makers.

## **RESEARCH:**

### **1. Information Clearinghouse**

**Overview:** There is a need to help better connect the state's research activities with industry. By matching research faculty at higher education institutions with aerospace industry's needs, the private sector can take advantage of the cutting-edge aerospace-related research being done locally. Specific areas of interest are in composites and advanced materials,

robotics, aircraft design and manufacturing. A proposed “Information Clearinghouse” could be one solution -- and UW and WSU currently have 2 staff members exploring the idea.

***Actions Taken in 2010:***

- UW presented at the Governor’s Aerospace Summit in October on how companies can engage with aerospace researchers at the University.

***Actions Items for 2011:***

- Initiate a pilot project which would fund 2 post-doctoral fellow (one each at UW and WSU) to collaboratively:
  - Identify industry needs and university research strengths.
  - Assess and communicate database/web page needs.
- Commerce will help UW and WSU’s newly created “Industrial Liaisons” engage with private industry in order to facilitate more interaction between the research community and companies

## **2. Center for Aerospace Technology Innovation**

***Overview:*** Aerospace is a high tech industry driven by innovation, and therefore it can benefit from industry-academic partnerships which leverage federal funding for high-tech research. Our state’s higher education institutions have extensive research programs that could help drive aerospace innovation and make our industry more competitive in the world economy. The proposed Center for Aerospace Technology Innovation would be a public-private partnership driven by industry needs to help translate research into commercialized products.

***Actions Taken in 2010:***

- UW and WSU presented a 3-page white paper proposing a Center for Aerospace Technology Innovation (See attached)

***Actions Items for 2011:***

- **Policy Recommendation:** State support at the level of \$3 million per year, \$6 million per biennium, to be budgeted to create the Center for Aerospace Technology Innovation.

## [A.] AEROSPACE ENGINEERS IN SHORT SUPPLY

# Aerospace engineers in short supply

*Persistent funding gaps limit opportunity for students and increase firm costs*



As one of our State's most important economic resources and one of its largest employers, the aerospace industry needs talented young engineers to maintain and further develop its world leadership position.

And yet hundreds of *qualified students* are being denied admission to aerospace and related engineering degree programs in Washington because our research universities do not have the funding needed to educate them.

The rate of current aerospace-related engineering degree production is out of synch with employer demand, and the aerospace engineering workforce is aging, two factors likely to increase supply gaps in the future and impose additional employee recruitment costs on the industry.

However, the good news is that Washington can pursue a clear and proven strategy to address this challenge: fund more engineering enrollments at the University of Washington and Washington State University.

With an annual economic impact of \$36 billion and direct employment of 84,000 highly educated and skilled workers (263,000 if you include indirect and induced employment), Washington's aerospace industry is an economic powerhouse, one of four or five businesses and industries that continue to define the State's productive and creative capacity in the 21<sup>st</sup> century.

This vital economic engine creates thousands of additional jobs in related industries, many in high-paying fields requiring advanced education and training.

The industry's success is based on its sophisticated manufacturing design and development capability. The engineering and scientific talent that sustains the industry must be maintained and enhanced if the state hopes to preserve its world leadership position.

## **Aerospace workforce totals 84,000 workers**

Washington's core aerospace industry directly employs more than 84,000 workers. <sup>1</sup> About 72,000 of these workers (86 percent) are employed by the Boeing Company. <sup>2</sup> The remaining 156 aircraft, engine, and major component manufacturing firms are much smaller by comparison.

About 179,000 additional jobs exist in businesses and industries indirectly related to aerospace. Among these are manufacturers of small parts used in larger aircraft components and professional service providers serving other industries as well as aerospace.

Professional engineers, computer and software specialists, and others with high levels of education make up a large portion of all direct aerospace employment according to data provided by the Washington Employment Security Department.

<sup>1</sup> Data provided to the HECB by the Washington Employment Security Department, LMEA Division.

<sup>2</sup> Boeing Company website: [http://www.boeing.com/aboutus/employment/employment\\_table.html](http://www.boeing.com/aboutus/employment/employment_table.html)

# Top aerospace occupations

The table at right shows aerospace employment categories with 1,000 or more workers.

Professional engineers and individuals in engineering-related jobs with high levels of education account for a substantial share of the state's top aerospace occupations.

In 2008, professional engineers, engineering technicians, and mechanical drafters accounted for *eight* of 25 of these employment categories and 21,000 jobs (one quarter of all core aerospace jobs).

Based on BLS entry training levels, the data show that:

- 44 percent of the jobs in major aerospace occupations require a bachelor's degree or higher;
- 32 percent require a mid-level credential (post-secondary degree, certificate, or apprenticeship); and
- 24 percent require less than mid-level preparation (high school diploma, work experience, and/or on-the-job training).

**Table 1—Occupational Employment for the Aerospace Industry  
Washington State, 2008, Q2**

*Occupations with more than 1,000 employees*

Occupational Title	Estimated Employment	Entry Training Level (BLS)
Aircraft structure, surfaces, rigging & systems assemblers	9,591	Long-term OJT
Aerospace engineers	5,669	Bachelor's degree
Engineers, all other	4,721	Bachelor's degree
Management analysts	3,329	Bachelor's degree plus work experience
Industrial engineers	2,895	Bachelor's degree
Business operations specialists, all other	2,892	Bachelor's degree
Inspectors, testers, sorters, samplers & weighers	2,749	Moderate-term OJT
Shipping, receiving, & traffic clerks	2,317	Short-term OJT
Logisticians	2,142	#N/A
Aircraft mechanics & service technicians	1,977	Postsecondary vocational
Purchasing agents, except wholesale, retail & farm products	1,952	Bachelor's degree
Computer-controlled machine tool operators	1,929	Long-term OJT
Metal and plastic mechanical engineers	1,840	Bachelor's degree
Computer software engineers, applications	1,678	Bachelor's degree
Machinists	1,532	Long-term OJT
Computer specialists, all other	1,438	Postsecondary vocational
Mechanical drafters	1,302	Postsecondary vocational
Engineering technicians, except drafters, all other	1,230	Associate degree
First-line supervisors/managers of production & operating workers	1,198	Related work experience
Materials engineers	1,188	Bachelor's degree
Budget analysts	1,167	Bachelor's degree

## *Demand for engineers outpacing supply in Washington*

Demand for engineers is outpacing supply in Washington, a trend expected to continue unless we begin to increase support for engineering education at the UW and WSU.

- Overall statewide engineering degree production increased at an average annual rate of only 1.3 percent between 2003 and 2009 (**See Table 2**).
- In 2007, Washington produced 982 aerospace-related engineering degrees to fill 2,312 aerospace-related engineering positions.
- The current 2010 estimate by EMSI is 2,014 new and replacement engineering jobs in Washington. This is down significantly from recent years but still well above the current production level of 1,375 baccalaureate and graduate engineering degrees (2009).
- There has been no growth in overall engineering degree production at the UW in the past 15 years. This has slowed average statewide degree production significantly. The UW produces more than 60 percent of all engineering degrees in the state each year.
- A 2009 joint agency analysis of supply and employer demand predicts that from 2011-2016 Washington's demand for all types of engineers will be nearly twice the current level of Washington-produced engineers receiving degrees and entering the labor force.<sup>3</sup>

<sup>3</sup> Higher Education Coordinating Board, State Board for Community and Technical Colleges, Workforce Training and Education Coordinating Board, "A Skilled and Educated Workforce." See <http://www.hecb.wa.gov/news/documents/Skilled-EducatedWorkforce2009.pdf>

**Table 2—Engineering Degrees Awarded in Washington, 2003-2009**

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
<b>Degrees Awarded</b>	1,264	1,255	1,262	1,293	1,347	1,343	1,375
<b>% Change year-to-year</b>		-0.7%	0.6%	2.4%	4.1%	-0.3%	2.4%

**Demand outpacing supply**

The UW and WSU produce the greatest number of aerospace-related engineering degrees in Washington.

The UW is the only institution producing degrees in industrial and aerospace engineering, the two disciplines currently in highest demand by the aerospace industry. WSU has several programs that target aerospace careers in other engineering disciplines.

The UW and WSU, through its branch campuses in Tri-Cities and Vancouver produced 850 of the 982 aerospace-related engineering degrees granted in 2007, about 87 percent of the total.

Washington State is ranked third in the employment of aerospace engineers behind California and Texas. <sup>4</sup> But our degree production has been declining in comparison to other states. In 2009, we ranked 22<sup>nd</sup> among states in the aerospace engineering degrees, down from 15<sup>th</sup> in 2003. <sup>5</sup>

**Table 3 (below)** provides more data on the production of aerospace-related engineering degrees and job openings statewide for 2007.

Some improvement in engineering degree production is beginning to take place. In the 2007-09 biennium, UW and WSU received funding to expand math and

science undergraduate enrollments in engineering and several other fields. Since then there has been about a seven percent increase in the number of students majoring in engineering in these institutions.

These data do not show how many engineering students actually enter the engineering workforce after earning their degrees in Washington. Some take jobs in other fields; some move to another state to work; and some remain in state to earn a graduate degree. All of these factors reduce the supply of available workers below the level of degree production.

**Table 3—Aerospace-related engineering degrees and job openings in Washington by discipline, 2007**

Institution	Level	Electrical, Electronics, Communication	Mechanical	Computer	Aerospace, Aeronautical, Astronautical	Industrial	Materials	Total
EWU	BS	2						2
	MS							
Gonzaga	BS	21	24					45
	MS							
PLU	BS			4				4
	MS							
St. Martins	BS		10					10
	MS							
SPU	BS	12		2				14
	MS							
Seattle U.	BS	18	21					39
	MS			18				18
UW Seattle	BS	176	89	62	44	32	29	432
	MS	39	40	64	36	14	3	196
Walla Walla	BS							
	MS							
WSU Pullman	BS	50	82	11			8	151
	MS	10	16				4	30
WSU Tri Cities	BS	6	7					13
	MS		1					1
WSU Vancouver	BS	New Program	25					
	MS		2					
Total	BS	285	258	79	44	32	37	735
	MS	49	59	83	36	14	7	247
Total Degrees		334	317	162	80	46	44	982

Note: Allocation of degree awards among WSU campuses is estimated based on course enrollments. Some engineering degrees may be transferrable across disciplines. \*Computer hardware engineers only. SOURCE: HECB from IPEDS data and OFM Higher Education Report 2006-07. Job openings data from EMSI, Inc.

<sup>4</sup> Bureau of Labor Statistics, May 2009, see <http://www.bls.gov/oes/current/oes172011.htm>

<sup>5</sup> HECB analysis of NCES IPEDS data.

## Boeing's aerospace workforce is aging

Boeing's engineering workforce is aging, another factor driving up demand for engineers in our state. Many Boeing engineers with more than 20 years of service will retire in the next decade and will need to be replaced with newly trained engineers.

The chart at right shows the changing age distribution of the Boeing engineering workforce based on data provided by the SPEEA union in Washington State.

More than 14,000 SPEEA engineers and scientists were represented in the Boeing Puget Sound bargaining unit in 2008.

Boeing employs about 20 percent of all engineers in Washington State. These engineers, who were in their 20s and 30s during the early 1990s, are advancing into middle age and are expected to begin retiring at increased rates in the next decade.

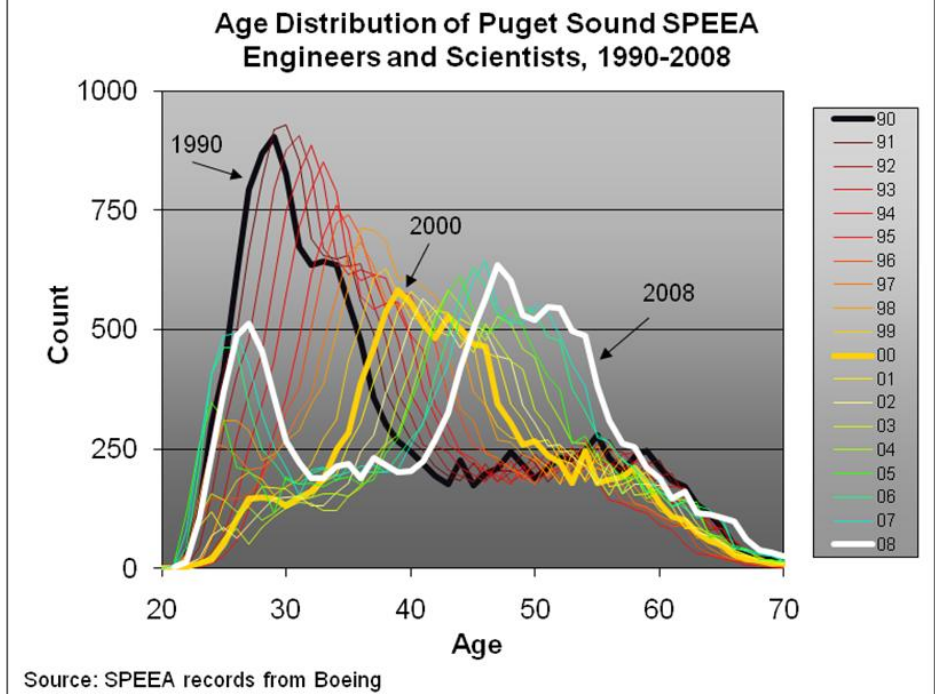
## Washington's reliance on importing talent may not be sustainable

Washington's aerospace industry has been forced to recruit engineers from other states and nations to meet its in-state supply gap. Much of this reliance on imported talent could be reduced if additional engineering enrollments were funded at the UW and WSU.

The alternative is to continue to fill high-paying aerospace engineering jobs with non-residents who have been educated elsewhere.

Analysis of H1B visa certifications shows that Washington employers

Table 4—Age Distribution of Puget Sound Engineers and Scientists



applied for and received visa applications for 550 foreign engineers in 2009. Half of these were electrical engineers hired predominantly by communications companies. The total also included 68 mechanical engineers, 49 aeronautical engineers, and 29 industrial engineers.<sup>6</sup>

The Boeing Company applied for and received 40 applications in 2009 in Washington, including 16 aeronautical engineers and 10 engineers from other disciplines. These numbers were thought to be high considering the poor state of the economy in 2009.

An analysis of Census ACS data shows that in 2005, Washington experienced net in-migration of 2,290 workers with baccalaureate degrees or higher who identified their occupation as engineer.<sup>7</sup>

Presumably, most of these new Washington residents found employ-

ment in their field. The data was based on a survey conducted in a single year. Despite a high potential margin of error, the data is startling since it was nearly twice the level of in-state engineering degree production in 2005.

Washington's reliance on importing talent is well established....but is it sustainable? In 2008, the HECB convened an economic needs assessment work group co-chaired by Lee Huntsman (Life Sciences Discovery Fund) and Steve Van Ausdle (Walla Walla Community College).

The diverse panel of experts concluded that "our economy has increasingly relied on attracting specialized talent from outside the state [and] must instead produce a sufficient supply of its own skilled workers to meet its economic needs."<sup>8</sup>

<sup>6</sup> HECB analysis of U.S. Department of Labor data downloaded from <http://www.flcdatacenter.com/CASE>

<sup>7</sup> Spaulding, R. (2008), "Interstate Migration: Washington's Reliance on Imported Workers to Meet Employers' Human Resource Needs, Western Interstate Commission for Higher Education draft policy paper.

<sup>8</sup> See <http://www.hecb.wa.gov/boardmtgs/documents/TAB1A.ENAWrkGroupReportv11.pdf>

## What needs to be done?

The easiest and least expensive way to increase the number of engineering degrees being attained by Washington residents is to fund new engineering enrollments at UW and WSU, where most of the existing engineering education capacity and infrastructure exists.

Traditionally, to spur more engineering degree attainment, the state has increased funded FTE enrollments in engineering programs.

These FTE appropriations have been added to the institutions' base funding and then carried forward on a permanent basis. In the 2008 and 2009 academic years, for example, the UW and WSU received new FTE funding to support enrollments in Science, Technology, Engineering and Mathematics (STEM) fields.

It costs the UW about \$16,000 per year to educate one *undergraduate* FTE in engineering. The cost of educating one *graduate* FTE is \$25,000 per year.

It takes about three undergraduate FTE to produce one undergraduate engineering degree (BS) because students are enrolled in different years, and a few students fail to complete. It takes 2.5 graduate FTE to produce one graduate degree (MS/PhD).

If we fund additional enrollments in engineering, will there be enough students waiting to take seats in engineering classes? The answer would appear to be a resounding yes!



In summer 2009 the UW was forced to deny admission to 370 of 880 **qualified** applicants to the College of Engineering.

These applicants were primarily students already attending the University of Washington or a Washington community or technical college.

They were all qualified for admission, but were denied due to a lack of program capacity. They included 60 women and 26 under-represented minority students.

What is worse, 42 percent of those not admitted (217 students) had applied for slots in aerospace, electrical, and mechanical engineering.

It would cost the state about \$3.5 million per year to educate these students, an investment that would produce 72 additional aerospace-related engineers a year after the first class completed their degrees.

The UW has confirmed it has the capital infrastructure in place to accommodate the additional enrollment, but notes that further program expansion would require additional capital expenditure.

## What needs to be done?

Although WSU had significant growth in the number of undergraduates seeking engineering degrees between 2004 and 2009, it now reports it is 'at enrollment capacity' in the fields of mechanical, civil, and chemical engineering.

Enrollment in these fields at the main and branch campuses grew 58% (from 499 to 789) during this period. This growth was attributed, in part, to a combination of new, high demand funding, increased student interest in engineering, and increased efforts in student retention.

We should note this level of growth is not sustainable, however. Budget cuts

are not sustainable, however. Budget cuts necessitating capacity limits in the current biennium forced WSU to deny certification to nearly 50 qualified engineering students. And WSU expects more than 80 qualified students will be denied admission in academic year 2010-2011. These students will have to find major fields other than engineering.

Given that funding for higher education is likely to be cut again in the next biennium, it is imperative now to begin advocating for appropriations that can help us reduce the engineer supply gap in Washington State. As a first step, the Washington Aerospace Council should consider endorsing a plan to support additional funding for

the UW and WSU to expand enrollment in aerospace-related engineering disciplines.

An investment in the next biennium of \$3.5 million would permit the UW to increase its undergraduate enrollment in aerospace-related engineering fields by 120 FTE and its graduate enrollment by 60 FTE. For WSU, an investment of \$1.5 million would fund 55 undergraduate FTE and 25 graduate FTE.

This investment would produce about 70 additional degrees a year at the UW (46 bachelor's and 24 graduate) and 28 degrees at WSU (18 bachelor's and 10 graduate).

**Table 5—Engineering Education Capacity Investment Plan**

<b>Proposed State Investment</b>	<b>\$ 5.0 million</b>
University of Washington	\$3.5 million
Washington State University	\$1.5 million
<b>New Engineering Enrollments</b>	<b>260 Additional FTE</b>
Baccalaureate	175 FTE
Graduate	85 FTE
<b>New Additional Annual Engineering Degrees (beginning year 4)</b>	<b>98 New Degrees</b>
Baccalaureate	64 Degrees
Graduate	34 Degrees
<b>Annual State Cost Per Additional Degree (beginning year 4)</b>	<b>\$51,000</b>
<b>Fiscal Return on Investment to State and Local Government <sup>9</sup></b>	<b>\$61,400 per Degree</b>
Additional Annual Earnings (aerospace-related engineering median earnings minus Washington median baccalaureate earnings) <sup>10</sup>	\$32,600 per degree
Annual Additional State and Local Tax Revenues (based on 9.5% average annual effective tax rate) <sup>11</sup>	\$3,100 per degree
Present Value of Additional Taxes (over 40 years, 4.0% discount rate)	\$61,400 per degree

<sup>9</sup>Calculation does not consider the additional potential benefit to state and local government of successfully retaining and growing Washington aerospace firms and related employment.

<sup>10</sup>Engineering earnings data from EMSI, Inc., and baccalaureate earnings from U.S. Census American Communities Survey data.

<sup>11</sup>Institute on Taxation and Economic Policy (2009) estimated WA state and local annual tax rate for taxpayers with incomes between \$62,000 and \$99,000.

### For More Information

Contact John Lederer, Associate Director, Higher Education Coordinating Board  
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## **[B.] CENTER FOR AEROSPACE TECHNOLOGY INNOVATION**

### **Premises:**

1. The aviation/aerospace industry is vital to Washington, both economically and in terms of the excellent, contributing citizens it supports.
2. It is a high tech industry dependent on continuing innovation.
3. As with other highly competitive industries (eg: agriculture, life sciences) there is a critical role for modest levels of state support directed at innovation.
4. In particular, enabling the strengths of the state's research universities to be brought to bear on new technologies that will drive the future of the aerospace industry is a highly leveraged way to advance the industry and its economic benefit to Washington.

### **Experience supports this approach:**

1. There are numerous examples around the country showing that high tech industries benefit from industry-academic partnerships, leveraging federal research funding to provide fundamental research advances. However, additional funding and industry partnerships are needed for focused efforts to translate basic research into products.
2. University-company partnerships are highly effective because: a) academic labs can undertake technology innovation that is too risky or long-term for corporate entities; b) it is often possible to leverage additional financial resources from federal granting agencies and others; and c) universities provide highly trained individuals who can move, with the new technologies, to the companies.
3. The Boeing Company and other Washington firms have been active in supporting academic research in Washington and in translating that research into products. The Boeing Company has supported collaborative research efforts between UW and WSU, as well as individual investigator projects at these institutions separately. While this research has touched on several topics, projects are often incremental because of the short-term nature of funding. The proposed center will facilitate longer term funding, which will pave the way for a more comprehensive and forward-looking research agenda with a broader technology reach for the state's aerospace industry.
4. Several Washington companies have teamed with academic colleagues in successfully competing for funding from federal sources. One example is the FAA-sponsored AMTAS (Advanced Materials in Transport Aircraft Structures) consortium drawing together the expertise of five universities and a dozen private industry firms. In some cases, teaming has led to collaborations that bring in partners from other industries.

### **Research Strengths in Washington universities:**

The University of Washington and Washington State University have established leading-edge capabilities in several technological areas that can help drive innovation in the aerospace industry for both commercial and defense systems. Examples include:

- Biofuels for jet engines. Most roadmaps indicate scaling a biofuel for aviation first from existing vegetable oils, to next generation bio-oil feedstocks (such as algae), to lignocellulosic biomass over the next ten years.
- Structural foams. New foams promise dramatic savings in both raw materials and weight, leading to improved fuel economy. Immediate applications in the aerospace industry are in replacing the seat foams as well as the fuselage insulation, but there are benefits to other industries as well.

- Aircraft life-cycle management. Interdependencies of new developments (e.g. the effects of reducing weight using new composites and biofuels) on subsystem performance (fuel burn, noise, aircraft recycling) drive system-level sustainability and offer leverage points for improvements through life cycle assessment.
- Composite materials. Composite materials offer the potential to increase the strength of materials used in aircraft manufacture while increasing fuel economy. Research at the two universities covers development of new materials, fabrication, and inspection.
- Novel functional materials. New materials support new devices and offer the potential for energy harvesting, new fabrication methods, etc.
- Nanophotonic devices for computing and communication. Nanophotonics is a critical technology to reduce cost and weight of electronics, as well as increase speed and reliability. The Microfabrication Lab and Nanotech User Facility at UW together provide an extensive array of fabrication, process and characterization facilities that is one of 13 sites in the National Science Foundation's National Nanotech Infrastructure Network.
- Secure networking. Networking plays an important role in the design of hybrid aircraft power systems, which involve distributed energy resources, and wireless technology leads to savings on fuel and assembly costs, as well as new business models for in-flight services. However, security needs in aerospace applications are high.
- Unmanned vehicles. One of the fastest growing sectors in the aerospace industry is unmanned aerial vehicles (UAV). Research in dynamic and networked systems, founded on control theory, as well as bio-inspired flight is critical for UAV innovation.
- New materials for ice prevention. New coating materials prevent the formation of ice by altering the surface tension without adding significant weight to the aircraft, addressing one of the most serious safety hazards in the aerospace industry.

**Plan:**

Building on this experience that demonstrates state institutions can be a major support to innovation-dependent industries, the proposal is to establish the

**Center for Aerospace Technology Innovation:**

The mission of the Center will be to advance research on new technologies that offer the promise of innovative products in aviation, aerospace, and defense.

**Approach:**

- The Center will act primarily as a funding source to support research at the University of Washington and Washington State University.
- It will use expert review, both scientific and industrial, to evaluate research proposals and make awards.
- Among the criteria considered will be technological innovation, potential for impact on product development, and financial leverage by means of corporate support and/or grants from government or non-profit agencies.
- The Center will seek to enhance its impact by soliciting corporate support and aiming to make awards to projects that have potential for follow-on funding from other sources.

**Structure:**

- The Center will be overseen by an executive board consisting of five members – a University of Washington representative, a Washington State University representative, a Boeing representative, a representative of aviation industry, and a person chosen by the Governor to represent the economic development interests of the State.
- The Center will have minimal staff, just sufficient to facilitate rigorous decision making and timely management of awards.
- The Center will solicit the interest of units within the two research universities – departments, institutes, etc. – and establish Center membership criteria whereby such units can be pre-qualified as potential recipients of Center awards, thus simplifying award management.

**Operations:**

- The Center will establish mechanisms for soliciting and evaluating proposals and for making awards and reporting on technological progress, financial leverage, and other measures of impact.
- Among those mechanisms will be a Selections Committee charged with choosing awardees; this committee will be made up of half academic researchers and half corporate representatives who have decision making authority for technology choices in their firms.
- The University of Washington will be asked to provide administrative infrastructure for the Center.

**Funding:**

- State support at the level of \$3 million per year, \$6 million per biennium, will be budgeted.
- Additional support will be solicited from companies, foundations and donors.
- Beyond possible donations, the Center will seek to leverage its financial impact through joint support arrangements on a project-by-project basis as appropriate.
- The two universities will limit indirect cost charges on awards to administrative costs, foregoing facilities costs, provided the research is done in facilities supported by state operations and maintenance funds.

**Reporting:**

- The Center will report biennially to those committees of the Legislature concerned with economic development, summarizing its work, providing indicators of its impact, and outlining ideas for enhancing benefits to the State.

## [C.] AJAC – BUSINESS TAX CREDIT FOR APPRENTICESHIP USE IN WORK FORCE

In 2008, the Washington State Legislature provided funding to develop training programs, in the form of apprenticeships, to ensure that the knowledge and skills of Washington's aerospace master tradespeople is passed on to the next generations of workers. Apprenticeships are unique in that they combine on the job training with classroom instruction, allowing a student worker to earn a living wage while achieving continued growth in their occupation while simultaneously working towards their college degree. The Aerospace Joint Apprenticeship Committee (AJAC) and its apprenticeship programs provide the vital connection between education, workforce and economic development in Washington.

**AJAC is unique.** AJAC is bipartisan. It works with both union and non-union businesses in the aerospace industry. AJAC is a statewide program, currently running in Pierce, Spokane, King, and Snohomish Counties with offices in both Seattle and Spokane. Plans to increase outreach operations in the coming months include the use of a mobile training unit designed to travel throughout the state to provide instruction and hands on training in rural areas. AJAC's main goal is to support and train the next generation of workers. Each apprentice works during the day and theoretically engages in class instruction at a community/technical college or designated training center in the evening. AJAC is a pathway. All course credit earned is transferrable to other colleges and can be applied to a 2 year and/or 4 year degree program. (Many other apprenticeship programs are dead degrees and don't provide this quality.) As well, apprentices are earning wages while they are working. They are NOT on Unemployment Insurance (UI), they DO have healthcare and do NOT utilize other government catch programs as a result. AJAC works to transition people from UI, putting them to work. AJAC is aware of the difficulty employers are having finding skilled workers. The apprenticeship program has the ability to help employers fill their needs. *(To be clear, AJAC does NOT hire. If asked, AJAC will share their pool of resumes for those who have passed qualifying requirements and completed instruction.)* Lastly, training in the aerospace manufacturing and mechanic trades includes the highest level precision work. With this high level of training the apprentice can transfer their work skills to other industry sectors (marine, biomedical, etc) but the same is not so when trained in other disciplines. Training students to the highest level possible provides flexibility in the work force. This is invaluable in the trades.

*Although the aerospace industry is the economic driver in WA, baby boomers are retiring and unless WA has a skilled, trained workforce to replace them, their secrets will retire with them.*

**Tax credits for businesses** hiring apprentices who have completed a certified apprenticeship program have been successful in 15+ other states and many countries around the world. It is helping to create new jobs and stimulate the economy. According to a survey conducted by AJAC in October, 2010 asking Washington manufacturing employers for their response; 71.4% of respondents said they would consider hiring one or more apprentices at their site (while they would not have otherwise hired them) – IF a \$5,000 tax credit incentive was available for each new apprentice hired. In most states offering the tax credit, the sum of money is divided into payments. The tax credit is a Single Business Tax Credit with money delivery in a bifurcating disbursement; first and foremost covering the costs of tuition and books. The remaining balance is to be used as

discretionary funds for wage-related costs including salary, fringe benefits and other payroll expenses. The tax credit is intended to offset the direct and indirect costs of establishing the registered apprenticeship program. If an employer earns an apprenticeship tax credit in a year that they report no business income, the unused tax credit can be carried over to the next taxable year.

Eligibility requirements require the apprentice to be in a Washington State Registered apprenticeship program. The program cannot be less than 2,000 hours and must provide an onsite mentor to the apprentice to ensure that they cross train and fulfill the requirements of the program. They learn skills from masters in their field. Apprenticeship terms are occupation specific. The average term is four years (for journeyman status), although apprentices may serve for a two-year time period and decide to exit the program. The apprentice must be employed full time. Pre-apprentices are not counted as apprenticeships and are not eligible. Successful completion of the registered Apprenticeship Program earns the apprentice nationally recognized state certification as a journeyman with transferable academic credits that provide a pathway to further higher education if desired.

The goal of the proposed tax credit is to provide assistance in the form of an incentive to employers that hire registered apprentices at their site. The tax credit is designed to help offset costs as businesses recover from the recent economic downturn. The credit works to stimulate re-hiring and create new jobs for Washington residents. Washington State legislators have shown interest in supporting apprenticeships in the manufacturing and industrial sector. They recognize the need to support the trades and help their constituents re-enter the job market. Despite the current budget constrictions, the need to help jumpstart the system so that it can return to its potential is now. Businesses make a powerful statement taking on apprentices and training the next generation of aerospace workforce in WA State. With nearly half of all workforce vacancies in the next decade likely to demand serious occupational skills acquired with a combination of postsecondary courses and learning on the job, apprenticeship programs are at a great advantage. ***AJAC and their apprenticeship program connects employers and work seekers in WA State to create jobs that lead to sustainable futures.*** Legislation is currently being drafted introduced, discussed and analyzed by policymakers in their Committees during the upcoming session.

Current Status: Pending

## ID.] INDUSTRY ASSOCIATION RECOMMENDATIONS



December 16, 2010

The Honorable Chris Gregoire  
Governor, State of Washington  
P.O. Box 40002  
Olympia, Washington 98504-0002

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Office of the Governor

Dear Governor Gregoire:

During last month's Governor's Aerospace Summit, our four aerospace organizations met with Randy Julin in his role as a member of the Washington State Aerospace Council. Collectively, our memberships represent over 500 aerospace suppliers, manufacturers, and professional service providers. Mr. Julin sought our input regarding the state of the industry and legislative priorities. We were grateful for his outreach and would encourage the Council to seek more industry participation in the future. As a first step, we recommend that two additional industry representatives be assigned to the Aerospace Council.

We are very optimistic about the growth and expansion of the aerospace industry in the State of Washington, particularly Boeing's continued production of the 737, 777, 747-800, and 787 and the potential air tanker and unmanned aerial vehicle's current military prowess and civilian expansion. Third-party maintenance such as parts remanufacturing and aircraft maintenance, repair and overhaul activities have a strong foundation and are focused segments, particularly for the training centers. Aerospace is very much a global industry and our memberships are poised to take advantage of the future opportunities presented by China, Canada, and our European clients. However, in an effort to retain and expand the industry's prominence, we urge you to join us in support of the following during the 2011 Legislative session:

- Workers Compensation and Unemployment Insurance Reform are significant competitive issues for aerospace as well as the other industry segments in the State of Washington. In order to reap the rewards of additional work, we have to play on a level playing field in comparison to other States.
- Continued support with of the Washington and Spokane Aerospace Technology Centers. Like many segments our core workforce is comprised of Vietnam era workers who are rapidly reaching retirement age. We are blessed with an effective community college system and four ear institutions. We believe the technology centers are responsive and progressive facilities to meet industry's demand for skilled labor.
- Protect existing aerospace tax rates.
- Oppose increased excise taxes on airplanes.
- More collaborative Aerospace-specific research and development between the University of Washington and Washington State University. At its very heart, Washington is an entrepreneurial State. The advancements of composite materials, aerospace software, aviation biofuels, and UAV's demonstrate to the world Washington's ability to literally change the
- Due to the high cost of Aerospace research, establish a mechanism to allow Washington State companies to purchase this research at reduced rates or to allow tax rebates/credits for the amount of research purchased.



Pacific Northwest Aerospace Alliance





The Honorable Chris Gregoire  
December 16, 2010  
Page 2


- Continued emphasis and funding invested in marketing Washington Aerospace companies to foreign countries and other states outside of Washington.
- Establish a top level department under the Department of Commerce to monitor and coordinate various statewide aerospace initiatives to include:
  - Aerospace education and training
  - Aerospace research and development
  - Aerospace labor and skills availability and pipeline
  - Aerospace labor relations
  - Aerospace infrastructure requirements and availability
  - Aerospace competitive issues and economic policies


Please be assured, we understand your commitment to the continued growth and expansion of the aerospace industry.

Sincerely,

  
Todd Woodard  
AFA

  
Michael Mooney  
INWAC

  
Kevin Steck  
PNA

  
Brice Barrett  
PNDC