

## THE WASHINGTON Aerospace Industry STRATEGY

Governor's Office of Aerospace May 2013









# Introduction

For nearly 100 years, Washington has been at the forefront of the global aerospace industry. It began in 1916 with a single red barn in Seattle and has grown to the largest and most robust aerospace cluster in the world, employing more than 131,000 people working in more than 1,250 companies located across nearly every county of the state.<sup>1</sup> In addition, dozens of entities, programs and efforts form a "support chain" for the industry. There are enormous opportunities

"You cannot overstate the importance of Boeing and the Boeing supply chain in the economy of the state of Washington." — GOVERNOR JAY INSLEE



for growth in aerospace in the coming decades. This Washington Aerospace Industry Strategy is our game plan for the next five years to sustain and grow the state's global leadership in this industry through the next century.

By 2017, hundreds of the world's first composite commercial airliner, the Boeing 787 Dreamliner, will be crisscrossing the sky on a daily basis delivering passengers from point to point around the globe. The 737 MAX will be delivered to its first customers and the U.S. Air Force will have received its first KC-46A aerial refueling tankers. The next iteration of the 777 will be well into its development. Beyond these Boeing programs, advances in new technologies will have brought significant opportunities to further diversify the industry in unmanned systems, space exploration and other emergent subsectors. Technological advances and market forces will enable a commercially viable aviation biofuels industry that will reduce the environmental impact of air travel.

These opportunities and Washington's place in the industry have not gone unnoticed by the competition. Other nations and U.S. states have made significant investments to emerge as formidable challengers to Washington. Nation-backed companies around the world are developing aircraft to eat into The Boeing Company's market share. States around the U.S. have demonstrated the ability to perform the complex work necessary to assemble a commercial airliner. This intense competition will force Washington to work even harder and with greater strategic focus if it is to maintain its world-leading position. The Washington Aerospace Industry Strategy is organized in four sections, establishing a flight plan to success:

- Growing and Diversifying Washington's Aerospace Cluster strategies to build upon our strengths, allowing our existing companies to thrive, attracting new investments, and diversifying the aerospace industry in Washington.
- Cultivating a Deep and Talented Aerospace Workforce developing a robust pipeline of aerospace workers, from inspiring our youngest children to pursue educational pathways that enable aerospace careers, to producing skilled laborers to work on the factory floors, to educating high quality engineers, designers, and researchers.
- Fostering a Culture of Aerospace Innovation building upon our wealth of existing resources, augmenting where necessary, to facilitate the discovery of new technologies and bring them to market, so that we are not only building the best airplanes in the world today, but the air and space vehicles that may come next.
- Linking Washington's Aerospace "Support Chain" how we organize ourselves and work together across the state to support the Washington aerospace industry, while making sure we are providing the infrastructure, tax policies and regulatory framework necessary to allow the aerospace industry to prosper and maintaining a high quality of life for all of Washington's residents.

Washington has made progress in recent years. The hard-won decisions to build both Boeing's KC-46A aerial refueling tanker for the U.S. Air Force and the 737 MAX in Washington are resulting in thousands of new jobs. Boeing alone hired more than 13,000 employees in the state between February 2011 and February 2013.

Washington has prioritized its support for the aerospace industry; creating the Governor's Office of Aerospace as a central point of contact to coordinate efforts and position Washington for sustained success; establishing an oversight body to ensure that workforce training programs are in line with industry needs; and developing a public/private research collaboration between the University of Washington, Washington State University and private industry to help ensure that the next great advances in aerospace technology are discovered and commercialized here. These efforts augment significant new investments in STEM (science, technology, engineering and math) education, workforce training and new engineering slots at our research universities. Regional and industry-segment-specific initiatives are building upon these state-level investments to build business consortia, attract new companies and ensure the availability of a highly skilled workforce. All of this effort will help prepare us to compete and win as new opportunities arise.

The sheer size and scope of the opportunity, as well as the breadth and depth of the industry, require a clear, concise strategy to protect and grow Washington's world-leading position in aerospace.

Given the broad spectrum of partners, this is by necessity a common-ground strategy. There will be issues, priorities and approaches to the goals and tactics outlined in this document that will differ among some stakeholders. There will be roles for all to play in the implementation and advocacy of these efforts, as well as other individual priorities not discussed here.

This Washington Aerospace Industry Strategy will be a continuously improving document with annual updates reporting progress. Near-term action items are prioritized on the following page.

Washington is in the enviable position of leading the world in a highly valuable and sought after growth industry. We must act in a strategic, orchestrated and sustained way to hold off competition from around the United States and the entire world. By working together to implement these goals and strategies, we will protect and grow the aerospace industry in Washington, ensuring our place as the global aerospace leader today and for the next century.

## The Next Big Prize: The 777X



The next generation of Boeing's twin-engine, twin-aisle workhorse is the next big prize in commercial aviation. Ensuring the plane and as many of its component parts as possible are built in Washington is one of the state's highest economic development priorities. While the timing of the program's launch is uncertain, the State will identify strategies and investments that can be made in advance — setting the stage for victory.

These include:

- Expand capacity and quality of workforce training programs in high-demand fields.
- Expand capacity and quality of engineering degree production.
- Prioritize funding for key transportation and port improvements.
- Work with local governments to ensure streamlined and predictable land-use permitting processes.
- Foster relationships in which organized labor and management can work together to create mutually beneficial environments.
- Conduct a comprehensive assessment of the economic impact of the Washington aerospace industry to illustrate the importance of the sector and justify investments.

## **2013–14 Action Items**

The following efforts are considered high priority for action over the next two years.

	Strategy	Lead(s)
Growing and Diversifying Washington's Aerospace Cluster	Work with The Boeing Company to anticipate what may be necessary and implement strategies to ensure that the 777X and as many of its components as possible are built in Wash- ington State.	Governor's Office of Aerospace
	Create an online database of Washington suppliers to assist original equipment manufacturers (OEMs) in identifying and partnering with capable supply chain partners.	Department of Commerce
	Expand Washington's presence at the 2013 Paris Internation- al Air Show.	Washington Aerospace Partnership, Department of Commerce
	Identify, assist and attract Boeing suppliers, particularly in new programs such as the 737 MAX, KC-46A tanker, and 777X, in expansion and/or establishment of facilities in Washington.	Department of Commerce, associate development organizations
	Develop economic, educational, and cultural initiatives with the United Arab Emirates.	<i>Office of Aerospace, Trade Development Alliance of Greater Seattle</i>
	Ensure initial KC-46A aerial refueling tankers are stationed at Fairchild Air Force Base.	Forward Fairchild, Washing- ton Aerospace Partnership
	Support amendments to Washington State tax policy to remove barriers to the maintenance, repair, and overhaul (MRO), completion and storage of non-resident-owned private aircraft.	Aerospace Futures Alliance
<i>Cultivating a Deep and Talented Aerospace Workforce</i>	Build capacity for STEM education in preschool through 12th grade.	Office of the Superinten- dent of Public Instruction, Washington STEM
	Establish National Career Readiness Certification testing for high school graduates with an interest in pursuing careers in aerospace.	Office of the Superinten- dent of Public Instruction
	Support the strategic and targeted expansion of workforce training provided by community and technical colleges, as well as apprenticeship and short-term industry programs, in high demand fields.	Pipeline Committee, State Board of Community & Technical Colleges
	Establish and promote a clear point of entry for students and jobseekers to navigate their way through training programs to careers in aerospace.	Center of Excellence for Aerospace & Advanced Manufacturing
	Develop a multi-institutional, multi-level aerospace training center located in the central Puget Sound region.	City of Renton, Renton Technical College

	Strategy	Lead(s)
Fostering a Culture of Aerospace Innovation	Support the Joint Center for Aerospace Technology Innova- tion in its efforts to connect industry problems with techno- logical advances developed by research university brain power and facilities.	Joint Center for Aerospace Technology Innovation
	Secure Federal Aviation Administration designation as a national test site for unmanned aerial systems/vehicles at the Pacific NW Unmanned Aerial System Flight Center.	Innovate Washington, Pacific Northwest Nation- al Laboratory, University of Washington, Washington State University
	Pursue establishment of an FAA Center of Excellence for Alterna- tive Jet Fuels and Environment at Washington State University.	Washington State University
Ensuring a Healthy Business Climate	Prioritize funding for key transportation improvements that enable the efficient movement of employees, parts, and fin- ished products to and from aerospace manufacturing sites.	Governor's Office of Aerospace, Department of Transportation, Washington Aerospace Partnership
	Work with Washington's federal delegation to encourage re- forms at the Federal Aviation Administration to ease burdens and allow Washington companies to be more competitive.	Governor's Office of Aerospace
Linking Washington's Aerospace "Support Chain"	Develop a set of outcomes-based metrics to measure the ef- fectiveness and impact of investments in aerospace-related economic development and the programs they support.	Governor's Office of Aerospace
	Analyze the economic impact of the aerospace industry in Washington State.	Governor's Office of Aerospace, Washington Aerospace Partnership





The Washington Aerospace Industry Strategy

## THE WASHINGTON Aerospace Industry OVERVIEW

Washington is home to 175 firms working directly in aerospace manufacturing employing 92,040 people. The aerospace cluster as a whole numbers 1,250 firms employing more than 131,000 people in the state.<sup>2</sup> As of March 2013, The Boeing Company alone employed nearly 86,000 in Washington. In 2011, the company paid \$4.3 billion to its more than 2,100 unique suppliers in Washington.<sup>3</sup>

This cluster consists not just of aerospace manufacturing firms, but also comprises a wide range of supplier and related industries. These include machine shops, industrial machinery and equipment manufacturers, and companies engaged in the production of instrumentation and measurement equipment. This industry has a huge impact on the state's



Aerospace Employment in Washington

economy, paying out more than \$10 billion each year in wages (7.5% of the state's total).<sup>4</sup> According to the Trade Development Alliance and Washington Council on International Trade's International Competitiveness Strategy Report, the aerospace industry is the largest exporting sector by dollar value in Washington accounting for \$27 billion of the state's total \$64.6 billion in exports in 2011.<sup>5</sup>

While there are companies working directly and supporting aerospace in virtually every county in Washington, the industry is clustered in four regions across the state, each with different characteristics and strengths.

#### **Puget Sound**

- Global headquarters of three of The Boeing Company's five major business units (Boeing Commercial Airplanes, Shared Services Group, and Boeing Capital Corporation).
- Final assembly locations for all of Boeing's current commercial jet families (737 NG, 747-8, 767, 777, and 787).
- 585 other aerospace-related companies.<sup>6</sup>
- Sea-Tac International Airport is the 16th busiest airport in the U.S., providing service to nearly 33 million passengers and more than 300,000 aircraft operations in 2011.<sup>7</sup>
- The combined ability and capacity of the ports of Everett, Seattle and Tacoma provide unique advantages in terms of logistics capability for aerospace freight.

- The University of Washington is one of the leading public research universities in the U.S.
- Washington State University provides engineering degrees at Olympic College in Bremerton and at University Center of North Puget Sound in Everett.
- Headquarters for the Federal Aviation Administration's Northwest Mountain Region, one of nine regions nationally, is located in Renton.
- Joint Base Lewis-McChord employs 55,600 U.S. Army and Air Force personnel.<sup>8</sup>
- Home to significant U.S. Navy installations at Bremerton, Bangor, Everett, Marysville, and Oak Harbor and a number of supportive defense contractors.

#### Northwest Washington

- Composite and advanced materials manufacturing cluster.
- A global leader in the design and engineering of advanced composites, exotic materials and aircraft interiors.
- Composite and manufacturing programs at universities, and community and technical colleges.
- International gateway to markets with direct access to Canadian customers and suppliers.

#### Southwest Washington

- Provides support to Boeing in metal finishing, plastics and electronics.
- Home of Insitu (a wholly owned subsidiary of Boeing) and an emergent unmanned aerial vehicle/systems (UAV/UAS) cluster, including manufacturing, software development, engineering and design.
- Proximity to the Portland, Oregon metropolitan area, deep water ports, an international airport, and Boeing operations located in Gresham, Oregon.

#### Central/Eastern Washington

- Established and growing aerospace cluster.
- Grant County and Spokane International airports both offer large available development opportunities for aerospace manufacturing, expanded aviation services operations (maintenance, repair and overhaul) and carbon fiber production.
- Fairchild Air Force Base in Spokane is responsible for 5,000 jobs and an annual economic impact of nearly \$450 million, supporting 17,000 military pensioners.<sup>9</sup>



- Washington State University, the state's land grant institution that is performing world-leading research in areas such as aviation biofuels, is located in Pullman.
- Pacific Northwest National Laboratory (PNNL) presents significant research and development capabilities in its facilities in the Tri-Cities.

#### A Soaring Industry

The industry outlook in the state continues to be strong. In 2012, Boeing booked 1,203 commercial airplane orders, the second largest year in company history. These orders contributed to the largest backlog ever to be held by the company, currently at 4,373 commercial planes.<sup>10</sup> Production across each of its assembly lines continues to ramp up at extraordinary rates, most dramatically at the Boeing Renton plant, where the company recently celebrated reaching a production rate milestone of 35 jets every 20 work days, up from 14 per month in 2003. Scheduled rate increases are expected to bring production up to 38 jets per month by 2013 and to 42 by 2014.<sup>11</sup> There is also speculation about additional rate increases beyond those already announced, particularly for the 737<sup>12</sup> and 787<sup>13</sup> production lines.

#### **New Programs Ahead**

Boeing is currently developing a new derivative of the 737, the 737 MAX. Scheduled for first flight in 2016 and delivery the following year, the more fuel-efficient, single-aisle jet will be built in Renton as well. The company is also soon expected to announce an extendedlength version of the 787 Dreamliner, the 787-10, and a new iteration of its venerable twin-engine, twin-aisle workhorse, the 777, known as the 777X. The addition of these planes to the Boeing portfolio, combined with increased production rates of its existing models, presents significant opportunities for additional aerospace employment in Washington, directly at Boeing and across the supply chain.



While Boeing has committed to build the 737 MAX in Washington, it is not clear whether the 787-10 will be built in Everett, at its new production facility in North Charleston, South Carolina, or across both locations. In addition, the company is expected to consider all options before deciding where to assemble the 777X. Competition from South Carolina and many other states, including Texas and Kansas, will be strong.

#### International Competition

Additionally, other nations are building their own aerospace programs. Boeing already faces stiff competition in the commercial airframe business from Airbus. In 2012, the commercial division of the European aerospace consortium EADS announced plans to open a new production line for its successful single-aisle challenger to the 737, the A320, in Alabama. Canada, Japan, Brazil, Russia, China and even South Korea have all launched

#### **Missed Opportunities**

Washington has missed out on several large opportunities to capture additional aerospace work in recent years. Several companies announced major expansion plans and Washington did not appear to be in consideration. For example:

- In 2011, Brazil's Embraer opened an 80,000 square foot assembly hangar and paint shop in Florida where it will build its Phenom 100 entry-level business jet.<sup>14</sup>
- Belgium–based ASCO Industries announced plans in August 2012 to build a \$100 million plant and employ 500 to 600 workers in Oklahoma. The company supplies parts to Boeing and other original equipment manufacturers (OEMs).<sup>15</sup>
- The same month, Woodward Inc. announced it will open a 300,000 square foot campus in Illinois for its aircraft turbine systems unit, a supplier of engine parts on both the 737 MAX and Airbus A320neo.<sup>16</sup>

commercial aerospace programs and will eventually produce aircraft that compete directly with The Boeing Company and its Washington-assembled products.

#### A Critical Moment

The next five years represent an important period in the history of Washington's aerospace industry. By 2017, just a year after Boeing marks its centennial, the 737 MAX should be being delivered to its customers around the world and the U.S. Air Force should be taking delivery of its first KC-46A aerial refueling tankers. The 777X program will be well under development and scheduled for its first flight at the end of the decade. The company may well have announced plans to develop an all new airplane program. As these new Boeing Commercial programs emerge, other companies in the supply chain will have necessarily expanded their operations. New technologies will allow emergent subsectors, such as

unmanned systems, aviation biofuels, and space exploration to hit their stride.

If Washington is to capitalize on these opportunities and grow its market share in the aerospace industry, it will need to act aggressively and strategically. By working together across the state in pursuit of the potential before it and striving to implement the initiatives outlined in this Washington Aerospace Industry Strategy, Washington will be able to maintain and strengthen its position as the recognized worldwide leader in aerospace innovation, design and manufacturing.

## GROWING AND DIVERSIFYING Washington's Aerospace CLUSTER

Throughout the century of Washington's history in aerospace, employment in the sector has been dominated by Boeing commercial airplane manufacturing. Washington has one of the largest concentrations of aerospace manufacturing in the world, producing an average of nearly 450 commercial airliners annually over the past five years.<sup>17</sup> State-by-state, Washington is also the largest U.S. exporter of aerospace products, producing more than 25% of the national total in 2010.<sup>18</sup> This is more than three times the export level of California, which ranked #2.

The aerospace industry will see significant changes in the coming years, creating market opportunities for Washington companies. The Next Generation Air Transportation System ("NextGen") will transform the National Airspace System (NAS). The final flight of the Space Shuttle Atlantis in 2011 marked the end of NASA's dominance of manned spaceflight, forcing new interest and demand for privately funded commercial space missions. The use of new composite materials will continue to be adopted by the industry, as well the need to develop new methods of repair, maintenance, recycling and disposing of the materials. In addition, the industry will continue to pursue cost and environmental impact

#### Goals:

- Ensure the Boeing 777X and as many of its component parts as possible are built in Washington
- Help existing Washington aerospace businesses thrive
- Work to ensure that new work by existing companies is located in the state
- Attract new companies from around the world to locate here

reductions through advancements such as the use of aviation biofuels.

Washington is well positioned to capitalize on these opportunities. The strategies detailed below aim to build upon Washington's strengths in key subsectors.

## *Strategies:* Commercial Airplanes:

Employment and economic activity in Washington's aerospace industry is dominated by Boeing Commercial Airplanes and its significant supply chain. However, many of these companies provide parts and equipment to other original equipment manufacturers around the world, including Airbus, Bombardier, and Embraer.

- Work with The Boeing Company to anticipate what may be necessary and implement strategies to ensure that the 777X and as many of its components as possible are built in Washington.
- Strengthen the existing aerospace supply chain by attracting companies located around the U.S. and in other countries to locate facilities in Washington and helping existing Washington suppliers connect with Boeing, Airbus and other original equipment manufacturers (OEMs):
  - o Create an online database of Washington suppliers to assist OEMs in identifying and partnering with capable supply chain partners.
  - o Identify gaps in the Boeing supply chain, particularly in the 737 MAX, KC-46A tanker and 777X programs, where there may be opportunities to attract investment in facilities and employees in close proximity to final assembly sites.



- o Identify opportunities and aggressively pursue other aerospace business recruitment targets.
- o Continue to leverage the U.S. Small Business Administration's State Trade & Export Promotion (STEP) grant funding to assist Washington's suppliers market and export products abroad and encourage Congress to support its continued funding.
- o Improve the visibility of the Washington aerospace industry by hosting and/or supporting supplier fairs and trade shows, such as the Aerospace & Defense Supplier Summit which is returning to Seattle in March 2014, and attending international trade events, such as the Paris and Farnborough International Air Shows and Aeromart Toulouse on an annual basis.
- o Organize an annual familiarization ("FAM") tour for national aerospace site selectors to help make them aware of development opportunities.
- Support efforts by Sea-Tac International Airport to identify and recruit carriers to provide direct flights to strategic international destinations currently without service.
- Recognizing the important role the Middle East region is playing in the aerospace industry, build upon recent trade missions to the United Arab Emirates to develop economic, educational, and cultural initiatives to better connect the state with the country.

## **Emergent Subsectors:**

Technological and market developments will change the future of the aerospace industry. Demands for more efficiency are driving alternative sources of fuel and materials and system advances. In addition, new markets for space technology and unmanned flight will create opportunities for Washington companies.

#### **Advanced Materials:**

- Examine Utah, Michigan and other states' activities in support of advanced composites and capitalize on their examples.
- Support efforts by the Olympic Composites Corridor to establish an Advanced Composites Center to conduct research and development surrounding composite materials manufacturing.

#### Unmanned Aerial Vehicles and Systems (UAV/UAS):

- Secure Federal Aviation Administration (FAA) designation as a national test site for unmanned aerial systems/vehicles.
- Support efforts to establish an FAA center of excellence for unmanned aerial vehicles/systems research in conjunction with the University of Washington (UW) and Washington State University (WSU).
- Advocate for more civilian use of unmanned aerial vehicles, including roles in wildlife management, wildfire monitoring and tsunami debris monitoring.

### **Advanced Composites Center**

The Olympic Composites Corridor, stretching from Port Angeles to Frederickson, is working to fully develop the composites industry cluster in the region along with the associated well-paying jobs. The planned Advanced Composites Center fills an existing gap in the technology transfer process for the composites industry, while putting Clallam County in an international spotlight.

The Advanced Composites Center will be a not-for-profit collaborative facility that helps fast track innovative technologies to full-scale manufacturing and be a training resource closely aligned with regional composites training programs. The path to commercialization for a new technology can be long, expensive and complex. The center will be staffed with designers, manufacturing experts and product evaluators to provide fee-based resources, training and guidance. A steering committee is currently working with key stakeholders to develop funding for the center; an anticipated U.S. Department of Energy grant opportunity would significantly impact the scale of the initial facility.

Learn more at www.olympiccomposites.org.



• Support expansion of worker training programs in closer geographic proximity to the Southwest Washington unmanned systems cluster to meet the needs of the industry.



#### **Green Aviation:**

- Aviation Biofuels:
  - o Support efforts and recommendations of the Sustainable Aviation Biofuels Working Group.
  - o Leverage research underway at UW and WSU that includes two \$40 million U.S. Department of Agriculture grant-funded projects to develop a commercially viable biofuels industry anchored in Washington.
  - o Pursue establishment of the FAA Center of Excellence for Alternative Jet Fuels and Environment at WSU.
- Build upon the work of Sea-Tac International Airport, Alaska Airlines and The Boeing Company's Greener Skies Over Seattle initiative and American Airlines' and Boeing's ecoDemonstrator to advance technologies that reduce the environmental impact of air travel.

#### Space:

• Develop strategies that enable Washington to emerge as a national center for both private and academic efforts to develop private space exploration and propulsion initiatives.

#### Software & Systems:

• Build upon the state's assets in computer science research (including UW, WSU, Pacific Northwest National Laboratory, and Microsoft Research), the presence of The Boeing Company and regional headquarters of the Federal Aviation Administration, as well as the national leadership already underway by Sea-Tac International Airport and Alaska Airlines, to establish a leading role in the development of Next-Gen Air Traffic Control.

• Develop opportunities to further the expansion of companies working in avionics, and other aerospace-related software and systems development.

### Military:

Military employment is a significant factor in Washington's economy. Continued alignment between the state's aerospace industry and the military's needs will sustain significant economy activity.

- Support Forward Fairchild, an organization committed to supporting Fairchild Air Force Base as an economic engine for the greater Spokane region, in its efforts to ensure initial USAF KC-46A Tankers are stationed in Washington.
- Work with the Washington Military Alliance to prepare efforts to sustain the state's military bases.
- Support Joint Base Lewis-McChord, Fairchild Air Force Base and Naval Air Station Whidbey Island's continued air and aircraft operations by encouraging local governments to consider protective land use approaches.
- Pursue and develop opportunities for U.S. Military and National Guard aviation-related facilities and operations, including maintenance and repair.

### Aviation Services:

Increases in private aircraft ownership and the maintenance and repair work that comes with it is an opportunity for the state.

- Support amendments to Washington State tax policy to remove barriers to the maintenance, repair, and overhaul (MRO), and completion and storage of nonresident-owned private aircraft.
- Pursue additional strategies to support the growth of existing and attract new MRO facilities.

- Support the emergence of Washington as a global center for aviation maintenance technician (AMT) training by:
  - o Pursuing the ability for Washington-trained AMTs to receive European Aviation Safety Agency certification.
  - o Securing FAA approval for flexible AMT training programs.

"We're building the Silicon Valley of Space." — Chris Lewicki, President & Chief Engineer, Planetary Resources

In April 2012, Bellevue–based Planetary Resources announced its audacious plan to mine asteroids for natural resources. This exciting venture, combined with those of other companies like Redmond's Aerojet, Amazon–founder Jeff Bezos' Blue Origin in Kent, and Andrews Space in Seattle, comprise a relatively small cluster making large advances in space exploration with significant opportunities for growth.



The Washington Aerospace Industry Strategy

## CULTIVATING A DEEP AND TALENTED Aerospace WORKFORCE



Washington's existing aerospace workforce is both highly skilled and highly concentrated. According to the U.S. Department of Labor's Bureau of Labor Statistics, the state's location quotient for aerospace engineers is the nation's highest at 4.61. This means that for every aerospace engineering job on average in the U.S., Washington has nearly five, accounting for more than 7,000 aerospace engineers employed locally.<sup>19</sup> There are significantly more engineers of all types employed in the aerospace sector in Washington, including mechanical, electrical, and others. According to the Washington Employment Security Department, in 2011, there were nearly 15,000 engineers employed in aerospace, accounting for almost 26% of all engineers employed in the state.<sup>20</sup> However, the workforce demands of the industry, immediately as well as those anticipated in the future, suggest the need not only for more engineers, but many additional workers possessing a broad array of aerospace-related skills.

The education and training of a qualified workforce is a challenge to the future health of the aerospace industry both nationwide and in Washington. The importance of this issue will be exacerbated dramatically in future years by the increasing demand for workers as this industry expands. The Boeing Company forecasts that global demand for new commercial jetliners will exceed 34,000 through both replacement and fleet expansion, with an estimated value of \$4.5 trillion over the next 20 years.<sup>21</sup> Tens of thousands of workers will be needed to build, fly, and maintain these planes. The 2012 Boeing market outlook also predicts a need for approximately 1 million additional commercial airline pilots and maintenance personnel worldwide by 2031.<sup>22</sup>



Because of this, the Washington aerospace-related employment level is expected to continue to be strong in the future. State employment has increased in recent years, with Boeing adding 13,000 new employees between February 2011 and November 2012, to a company high nearing 87,000.<sup>23</sup> Boeing's employment growth in Washington accounted for more than 90% of the company's total growth over that period. Employment levels dropped slightly in the spring of 2013 due to a normalizing of production rates on the 787 and 747-8 production lines.

#### Aging Workforce

But even with demand for new positions slowing, strong demand for workers is expected to continue due to the industry's aging workforce. Nearly two-thirds of the higher wage engineering and architecture workers in the region are more than 45 years old.<sup>24</sup> A 2010 Aviation Week survey of U.S. aerospace companies reported nearly 20% of their employment force is at retirement age, and is projected to rise to 40% by 2014.<sup>25</sup> Locally the problem is more severe. It is estimated that about 40% of Boeing's workforce is currently within five years of retirement age.<sup>26</sup> This translates to more than 30,000 employees – most of whom would likely need to be replaced to maintain Boeing's body of technical knowledge and expertise.

#### Responding to the Workforce Demand

In response to this imperative, Washington has invested heavily in its aerospace-related training programs. Since 2009, \$4.8 million in Workforce Investment Act funding has been deployed to expand aerospace training. In 2011, a consortium of 11 Washington community and technical colleges, working together as "Air Washington," was awarded a \$20 million, three-year U.S. Department of Labor grant to train more students in aerospace skills. In all, 24 community and technical colleges in Washington are providing aerospace-specific training programs.<sup>27</sup> The Center of Excellence for Aerospace & Advanced Materials Manufacturing is established by the State Board of Community & Technical Colleges to coordinate their activities.

Beyond these community and technical college-offered training programs, additional specialized training offerings have been developed by the Washington Aerospace Training & Research (WATR) Center in Everett and the Inland Northwest Aerospace Training Center in Spokane. The City of Renton is working with Renton Technical College and others to establish an additional facility to meet the growing workforce demand anticipated in the central Puget Sound region due to the development of the 737 MAX program. Additionally, the Washington Aerospace Joint Apprenticeship Committee (AJAC) provides a broad range of on-the-job training programs across the state.

The Washington Aerospace & Advanced Manufacturing Workforce Pipeline Advisory Committee ("Pipeline Committee") was established to coordinate these training programs and ensure that they are meeting the needs of the industry. The Washington Training and Education Coordinating Board was tasked with assisting the Committee in the evolution of these training programs and tracking the success of their graduates. However, given the sheer number and specificity of the programs and the types of jobs for which they are designed to prepare students, there is a need to develop and/or promote tools to help jobseekers navigate their way toward employment. students to pursue aerospace career pathways. Additionally, funding has been directed to establish skills centers and aerospace assembly programs to foster a high school-to-post-secondary education as well as high school-to-work pathways.

#### Engineering and STEM at the University Level

At the university level, Washington is blessed by a geographically dispersed network of high caliber institutions, including two well-respected public research universities (University of Washington and Washington State University), their branch campuses, and regional institutions (Central Washington University, Eastern Washington University, Evergreen State College, and Western Washington University). The University of Washington ranks 16th in the 2012 Academic Ranking of World Universities.<sup>28</sup> U.S. News & World Report ranks UW 46th on its 2013 list of national universities and its College of Engineering is tied for 26th place on a list of "Best Engineering Schools" compiled by the same publication.<sup>29</sup> WSU ranks



#### **Elementary through High School Programs**

The state has also worked to enhance K-12 programs that build an interest in STEM (science, technology, engineering and math) fields and skills for aerospace crafts and professions among students. Highline School District's Aviation High School and other STEM-based magnet schools, including Delta High School in the Tri-Cities, the Technology Access Foundation Academy in Federal Way, and the new Riverpoint Academy in Spokane, as well as programs such as Washington Aerospace Scholars, have had success in preparing 125th overall by U.S. News and its College of Engineering and Architecture ranks 82nd.<sup>30</sup> The UW is the only one of the two with a specific aeronautics and astronautics department (which ties with four other universities for 13th place in the U.S. News rankings).<sup>31</sup> Eastern Washington University offers a range of B.S. degrees in engineering. The other regional universities offer a variety of engineering technician, supply chain management, financial and accounting, safety and health, pilot training, and other degree programs important to the industry.

The University of Washington's College of the Environment and its Department of Earth and Space Sciences plays an important role in STEM train-

ing and preparation of students for careers in the aerospace industry through the NASA Space Grant program. Through a consortium established in 1989, the UW partners with more than 20 organizations within the state, including universities, community colleges, private industry, educational organizations and museums in this effort. As one of the 52 members of the National Space Grant College and Fellowship Program, the consortium is committed to expanding opportunities for students to learn about STEM in all of its various applications and to participate in NASA's aeronautics and space programs. Since 2007, \$16 million has been invested to increase math and science enrollment at these schools, including \$7.6 million in 2012 to expand engineering enrollments at UW and WSU by 850 slots. On top of this, Microsoft and The Boeing Company each pledged \$25 million to fund the Opportunity Scholarship Fund which, in 2012 alone, awarded 3,000 scholarships of \$1,000 each to students seeking four-year degrees in STEM fields. Despite these significant investments, additional capacity is necessary to meet the current and anticipated needs of



the aerospace industry in Washington.

In addition to a lack of adequate capacity of training programs, state public schools are not adequately preparing students to meet the requirements of those programs. The National Center for Education Statistics' Condition of Education Indicators reports that only 40% of 8th graders in Washington are proficient in math, and less than 35% in science.<sup>32</sup> Remediation becomes more expensive the later it is addressed, which calls attention to the need to better prepare students at the beginning of their K-12 careers.

#### Inspiring Youth to Reach for the Skies

These figures mirror another issue that needs to be addressed: students simply lack interest in pursuing science and technical careers. A recent national survey of nearly 270,000 college students reported that only 9.6% had interest in majoring in engineering, with less than 1% expecting to major in aeronautical or astronautical engineering.<sup>33</sup> This may be due in part to the perception of manufacturing in the U.S. as a declining industry. Interest in engineering would be expected to increase as the outlook for manufacturing improves overall.

Interest in pursuing a career in aerospace can often be traced back to specific incidents in childhood; whether watching the moon landing or the launch of the Space Shuttle on television, a positive experience with a skilled teacher, or a visit to a science museum. Students who have access to these types of experiences, as well as quality math and science instruction in their K – 12 grades, are more likely to consider a career in aerospace and are more likely to be successful in their future endeavors.

#### Goals:

- Meet the industry's significant workforce demand across all levels of the workforce by:
  - Better coordinating, promoting, and measuring outcomes of workforce training and education programs;
  - o Improving the quality and expand the capacity of training and workforce development programs in high demand fields;
  - o Improving the quality and expand the capacity of engineering programs at Washington's public research and comprehensive universities; and
  - o Inspiring students to pursue aerospace careerenabling educational pathways.

#### Strategies:

### General:

- Expand the representation and role of the Pipeline Committee to include the full continuum of aerospace-career enabling education, from preschool through graduate school, and workforce development councils representing areas with significant aerospace presence.
- Establish and promote a clear central point of entry for students and jobseekers to navigate their way through training programs to careers in aerospace.
- Collect and publish data tracking the transition from education to employment as well as the outlook for

employment in private companies, to provide students and their families confidence that their social investments will pay off, help direct future program prioritization, and justify the expenditure of public resources to the legislature and other key funders.

- Establish a Washington Aerospace Internship Cooperative to develop and coordinate high school and collegeage internships at private companies across the state.
- Develop a marketing program targeting aerospacerelated students and graduates of top-ranked engineering universities and career and technical colleges around the country informing them of aerospace career opportunities in Washington.
- Consider incentives, such as tax credits, benefitting companies that donate time/resources for education programs and/or host interns.

## Preschool-12th Grade:

- Support the work of Washington STEM and other organizations to build capacity for and acceptance of STEM education at elementary, middle and high school levels.
- Utilizing the successful models established by Aviation High School, Delta High School, Riverpoint Academy, the Technology Access Foundation Academy, and other state STEM magnet schools, support the establishment of additional STEM-focused magnet high schools around the state.
- Develop a sustainable funding stream for the Washington Aerospace Scholars Program.
- Work with the Museum of Flight, Pacific Science Center, Future of Flight Aviation Center, Mobius and other science-themed education facilities and non-profit organizations around the state to expose children to the magic of flight and space travel and the science behind it.
- Develop Washington aerospace-themed STEM curricula for the elementary and middle school ages.
- Expand offerings of hands-on, applied STEM courses, such as those provided in the Project Lead the Way engineering series, FIRST Robotics, and machining technology courses in high schools and skills centers.

### Air Washington

Air Washington is a consortium of 11 community and technical colleges and one apprenticeship training program in Washington state linked together to train the most skilled aerospace workforce in the world.

The U.S. Department of Labor awarded the Air Washington consortium a \$20 million grant to expand and improve our ability to deliver education and career training programs that can be completed in two years or less, are suited for workers who are eligible for training under the Trade Adjustment Assistance for Workers program and prepare program participants for employment in high-wage, high-skilled occupations in the aerospace industry.

Learn more about Air Washington at http://www. airwashington.org/.

## Skilled Labor:

Support the work of the Pipeline Committee and support its recommendations related to:

- Sustaining and expanding Air Washington programs identified as most beneficial.
- Supporting the strategic and targeted expansion of workforce training provided by community and technical colleges, as well as apprenticeship, short-term industry programs, and workforce development councils, in high demand fields, such as:
  - o Composites materials manufacturing and repair
  - o Machine maintenance and tooling
  - o Quality assurance
  - o Pre-engineering
  - o Specific needs of the unmanned aerial systems industry cluster
- Seeking National Career Readiness and National Association of Manufacturers certifications for high school and training program graduates.
- Developing an aerospace training center in the central Puget Sound region that incorporates training programs from various community and technical colleges, apprenticeship programs, and high school skills centers.

- Recognizing the cost differential between technical and general education training programs and redirecting funding in a way that supports additional technical training capacity.
- Supporting the development and expansion of pre-employment/pre-apprenticeship programs across the state.
- Develop programs to train aviation maintenance technicians to European Aviation Safety Administration specifications to establish an internationally literate aerospace workforce.

### Veterans and National Guardsmen/women:

• Work with the Department of Veterans Affairs, Center for Advanced Manufacturing Puget Sound, AJAC, U.S. Military, National Guard, and private employers to support programs that put veterans and guardsmen/women to work in aerospacerelated careers.

### Engineering:

- Increase the number of engineering graduates at universities across the state.
- Support the establishment of a WSU branch campus at Everett and prioritize the development of aerospace-related engineering programs there. In the near term, support the expansion of the University Center of North Puget Sound under the management of WSU.
- Invest in the colleges of engineering at UW and WSU in ways that improve their standing in the U.S. News and World Report engineering rankings. Specifically, target investments that support programs developing the future workforce in aerospace engineering.
- Support the expansion of pre-engineering programs at community and technical colleges across the state.

### Unemployed professionals from other industries:

• Work with workforce development councils across the state to develop programs to train unemployed workers from other industries with compatible skills, such as architects, for aerospace-related jobs.



## FOSTERING A CULTURE OF Aerospace Innovation

"Innovation is in our genes. We create. We invent. We build. So now we must go forward, with both high ambition and a recognition that the power of innovation will fuel the next wave of job growth in Washington." — Governor Jay Inslee

INAUGURAL ADDRESS, JANUARY 16, 2013



Washington is a global leader in aerospace research and development. Activities at the University of Washington, Washington State University, Pacific Northwest National Laboratory (PNNL), Boeing Research and Technology and Microsoft Research feed into the state's innovation ecosystem, driving new technologies and commercial activity to the industry. While aerospace companies are expected to continue to invest heavily in research and development activities, many are moving this work offshore to take advantage of tax incentives and low-cost engineering talent.

The Joint Center for Aerospace Technology Innovation was established in 2012 to better align university research to aerospace industry needs in technology, manufacturing and materials. The state also has a number of Aerospace Innovation Partnership Zones (IPZs) — an effort that has the potential to concentrate and incentivize research in specific geographic areas to promote collaboration that leads to new technologies.

Washington has had tremendous success over the years building entire industries through innovation. Hundreds of companies have spun out of Microsoft since it was established. While not as prolific, ideas and technologies that were first sparked and developed at The Boeing Company have resulted in stand-alone, successful and mature companies in their own right. By fostering a culture of aerospace innovation, Washington will not only be in a position to protect its position in the global aerospace industry of today, it will be at the forefront of developing the technologies and the industries of the future.

#### **Grant County International Airport**

One of the largest airports in the U.S., this facility in Moses Lake is already favored for military and commercial flight test with capacity for much more given its 13,500-foot runway and ample FAA-regulated airspace. Operated by the Port of Moses Lake, the former Larson Air Force Base has a long and storied aviation history and is poised for a new aerospace future with 240 acres of ramp space and 1 million square feet of additional industrial park.

A concept that should be explored for Grant County International Airport is the Research Airport Braunschweig. The facility, located in the German state of Niedersachsen, hosts more than 30 companies, two research institutes, as well as government agencies and federal offices in all employing 2,100 people working on safety, security and efficiency in aerospace. The facility covers the entire value chain of aircraft development — from aerodynamics to certification. With a technology transfer focus, its partners benefit from the identification of cross-industry interactions that occur naturally by working in close geographic proximity.

Learn more at www.forschungsflughafen.de/ cms/pages/en/home.php



#### Goals:

- Better connect activities at public research facilities with the aerospace industry.
- Aggressively pursue federal grant programs that will result in investment in research and development capacity in Washington.

#### Strategies:

- Support the Joint Center for Aerospace Technology Innovation in its efforts to connect industry problems with technological advances developed by research university brain power and facilities.
- Given the long lead-time necessary for researching and commercializing new technologies and the need for companies to be able to amortize their R&D investments over a long period, explore expansion of the existing aerospace research and development "preproduction" tax credit to all aerospace-related activity, not only work related, to "commercial aircraft."

- Leverage federal support to develop resources to help translate research to commercialized products:
  - o Support the effort to establish an Olympic Composites Corridor in Kitsap and Clallam counties anchored by an Advanced Manufacturing Center at the Port of Port Angeles.
  - o Support the FAA UAV/UAS Test Site initiative and build upon it to establish a "research airport" at Grant County International Airport where private companies co-locate with research universities to conduct a variety of aerospace related R&D activities. Use Research Airport Braunschweig and The Boeing Company's Glasgow, Montana, test site as potential models.
  - o Secure Federal Aviation Administration designation of a Center of Excellence for Aviation Biofuels.
- Explore opportunities to expand flight test and certification operations.
- Support the Aerospace Innovation Partnership Zones (IPZ) by creating additional incentives and funding for implementation.



## LINKING WASHINGTON'S Aerospace "SUPPORT CHAIN"

Despite leading the world in the aerospace for nearly a century, it was not until relatively recently that there were organized efforts in Washington to support the industry. Decisions by The Boeing Company to move its corporate headquarters to Chicago in 2001 and establish a second assembly for the 787 in South Carolina in 2009 focused attention on the need

"Highly competitive states have specific government officials responsible for coordinating aerospace policy, promoting the state's role in aerospace, and allocating state incentives while permitting local economic development councils/ corporations to take the lead in recruiting companies, promoting their local markets, and providing local incentive packages."

— Accenture, Washington Aerospace Competitive Study (2011)

to develop strategies to protect and grow the industry. Dozens of entities, programs, and efforts have emerged in recent years all with the goal of supporting the aerospace industry. Just as a supply chain has developed around Boeing, Washington must link together a sustainable "support chain" of efforts to foster further aerospace growth in the state.

In March 2012, the Governor's Office of Aerospace was established to coordinate the various state agency efforts to support the state's aerospace industry, as well as guide the development and implementation of strategies to promote expansion of the sector.<sup>34</sup>

To "ensure Washington's continued leadership in the aerospace industry," Executive Order 12-05 further clarified the role and responsibility of the Office of Aerospace and directed specific activities with the following entities:<sup>35</sup>

- The Washington Aerospace and Advanced Materials Manufacturing Workforce Pipeline Committee, to ensure the state's workforce training programs meet the needs of the aerospace industry;
- The **Joint Center for Aerospace Technology Innovation**, to promote and foster research and development activity to ensure that Washington remains at the cutting edge of aerospace technology; and
- The Washington Aerospace Partnership and other organizations and agencies across the state, as necessary, to assist in the development, maintenance, and execution of a statewide aerospace industry strategy.

#### Goals:

- Ensure adequate funding to implement this strategy.
- Measure the effectiveness of efforts.
- Ensure that Washington is a competitive place for aerospace business activity by providing:
- o Freight infrastructure (ports, rail, and highway transportation corridors)
- o Commuter needs
- o Tax policies
- o Stable and competitive labor costs
- o Streamlined, predictable and reasonable regulatory framework
- Support for aerospace-related policies at the national level.



This directive has established a strong "support chain" through which partners around the state, along with Washington's federal delegation, can work together to maintain and execute this strategy.

Future success of the aerospace industry in Washington depends on a competitive tax environment. In recent years, Washington has made significant investments to keep its competitive edge in the aerospace industry. A preferential business and occupation (B&O) tax rate for aerospace companies has been adopted, in addition to credits for product development and technologies supporting manufacturing. Reforms to the state's unemployment and workers' compensation insurance programs adopted by the Governor and Legislature in 2011 have helped tax rates remain flat.<sup>36 37</sup> In addition, adequate infrastructure to effectively move goods and workers is crucial, as aerospace companies face increasing challenges moving parts and delivering finished products throughout the region.

### Strategies:

### Organize to Ensure Washington's Competitiveness:

- Conduct a comprehensive assessment of the economic impact of the Washington aerospace industry to illustrate the importance of the sector and justify future investments.
- Work with the State Legislature, federal delegation, and other entities to fully fund the implementation of this strategy.
- Work with public and private stakeholders to adequately fund the Washington Aerospace Partnership in its efforts to augment the state's ability to provide support for the aerospace industry.
- Develop and track a set of outcomes-based metrics to measure the effectiveness and impact of investments in aerospace-related economic development and the programs they support.
- Continue to monitor the efforts of others, including U.S. states and international regions, to ensure Washington remains competitive.

## Invest in Strategic Infrastructure:

- Prioritize funding for key transportation improvements that enable the efficient movement of employees, parts, and finished products to and from aerospace manufacturing sites.
- Work with Sound Transit and other transit agencies to ensure that the movement of employees to and from existing transit infrastructure and manufacturing employment centers is included in future transit funding packages.
- Support investments in maintenance and strategic expansion of airport facilities that enable aerospace manufacturing such King County International Airport/Boeing Field, Paine Field, and Renton Municipal Airport.
- Recognize the critical role commercial airports serve in stimulating the economies of their communities and the international aerospace supply chain; and support a sustainable system of local and federal funding to ensure these facilities are well maintained and able to support commercial passenger and freight service.
- Identify rail and port infrastructure necessary to support the expansion of aerospace activities around the state and pursue strategies for investment.

## Maintain a Competitive Business Climate:

- Ensure the state's ability to provide government services that support a high quality of life for all of Washington's residents through tax policies that also allow the aerospace industry to compete and prosper.
- Support reforms to the state's tax structure that encourage private aircraft purchases, ownership, and maintenance.
- Foster relationships in which organized labor and management can work together to create mutually beneficial environments.

## Provide a Balanced and Predictable Regulatory Environment:

- Protect our state's unique environment and preserve the health of the public while avoiding high-cost, low-impact regulatory requirements that negatively impact the aerospace industry.
- Work with local governments to ensure streamlined and predictable land-use permitting processes.

## Advocate on Behalf of the Industry:

- Work with Washington's federal delegation to encourage reforms at the FAA to ease burdens and allow Washington companies to be more competitive.
- Monitor and advocate for policies at the federal level that support the aerospace industry exports, including international trade, the Export/Import Bank, intellectual property (IP) protections, etc.



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