Aerospace Manufacturing Skills

Supply, Demand and Outcomes for Washington's Aerospace Training Programs

Annual Report - 2013

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This report and other aerospace-related information can be viewed at: www.wtb.wa.gov/aerospace.asp.

BACKGROUND

The Aerospace and Advanced Materials Manufacturing Pipeline Advisory Committee monitors the workforce needs of Washington's aerospace industry. The 15-member committee pays close attention to emerging trends in manufacturing and production, pinpoints training required of today's aerospace workers, and looks ahead to retirement and other factors that will impact the talent pipeline. In particular, the committee works to better align the state's community and technical college system and apprenticeship training with industry demand.

The committee was formed in 2012[1] and issued a preliminary report in September of that year. The committee's inaugural report was distributed in December 2012. Both reports were jointly written by the state's Workforce Training and Education Coordinating Board (Workforce Board) and the State Board for Community and Technical Colleges (SBCTC).

The first report defined Washington's aerospace industry[2] and created measurement baselines for two areas. Broadly, the first of these areas focused on evaluating the community and technical college programs most involved in educating and training workers employed in the aerospace and related industries in Washington. Specifically, the report provided:

- The number of workers trained in these programs.
- The employment and earning outcomes of those workers.

The second measure assessed the hiring needs of the industry, as identified by Washington's aerospace employers.

This initial report provided comparison data, employment, and earnings outcomes for community and technical college participants against the baseline year. It also outlined the hiring needs of the aerospace industry.

This year's report builds on the previous edition and includes a couple of new features:

- Employment and earnings of students trained by apprenticeship programs.
- Employer perspectives on their satisfaction with the skills of aerospace program graduates.

[1] The committee was formed to implement Chapter 50, following the passage of 2SSB 2156 (2012).
[2] Aerospace firms are defined using the North American Industry Classification System (NAICS). For further detail, see Appendix B.

EXECUTIVE SUMMARY

Key Themes

Industry Level

- Demand concerns are focused on several key occupations, although overall demand for workers is relatively flat. Caveat: Future demand, both overall and for specific occupations, depends on specific business and product cycles.
- The competitive factors of a shared labor pool stress the system when product and business cycles are on the upswing.

Worker Level

- The experience gap is pervasive. Aerospace employers report they face industry-specific and process-specific skills gaps.
- General workplace qualities and soft skills such as attendance, problem solving, communication, and work ethic continue to be frequent employer concerns.

Summary of Findings

Washington is an aerospace industry hub

- With over 94,200 workers in its core aerospace firms alone,[3] Washington is home to one out of five of the nation's aerospace jobs, the highest aerospace employment for any single state.
- Washington also outranks all other states in specialization in aerospace employment. With a location quotient of 8.9, aerospace is nearly nine times more concentrated in Washington than across the rest of the nation.
- Washington's aerospace manufacturing and supporting industries are comprised of 1,248 firms, with 175 of these firms located in the core industry.[4]

Core of industry centered on manufacturing

- The core of Washington's aerospace industry is Aerospace Manufacturing and Parts (NAICS 3364)[5] employing 96,800 as of July 2013.[6]
- Surrounding that core are an array of aerospace-related industries comprised of materials and parts suppliers, air transportation and related infrastructure employing 131,000 Washingtonians as of July 2013.
- Fully 80 percent of industry employment is concentrated in production, engineering, business/finance, and computer and mathematical occupations.

Training is accelerating in apprenticeships, and at community & technical colleges

[3] 2012 annual average.
[4] Retrieved from The Washington Aerospace Industry Strategy located at: http://www.governor.wa.gov/issues/economy/aerospace/Industry_Strategy.pdf
[5] Washington Employment Security Department (July 2013).
[6] NAICS 927000 - Space Research and Technology was also identified in the core of Washington's aerospace industry, yet employment data are sparse for this industry; therefore the when the report refers to the "core" it's generally referring to NAICS 3364 – Aerospace Manufacturing and Parts. Data for Space Research and Technology are included wherever possible.

- As of December 2013, 267 apprentices were enrolled in the Aerospace Joint Apprenticeship Center's four-year track. According to the Washington Department of Labor and Industries, AJAC is one of the state's fastest growing programs, both in terms of registered apprentices and new employer partners (training agents).
- The number of students served in the five aerospace programs selected for review at community and technical colleges increased 82 percent between 2008 and 2013.
- All community and technical college training programs, aside from Drafting and Design Technician, experienced increases. Plastics Engineering Technician (also known as Composites Manufacturing Technician or Composites Fabricator) has seen the most significant increase as composites become increasingly important in manufacturing.
- A little less than a third (31 percent) of students taking one of five selected programs went to work in the aerospace industry. The greatest number became aircraft/frame/power plant mechanics, followed by machine tool tech and engineering technicians.

Current hiring trends robust, but flat five-year forecast (with exceptions)

- Of the aerospace and aerospace-related firms surveyed, 81 percent indicated they hired new employees in the last 12 months.
- Among those hiring new employees, the majority (55 percent) hired between one and 10 workers.[7]
- Survey participants' outlook for the next five years is flat: Overall, participating firms expect a 1 percent growth in employment between 2013 and 2018.[8] This is consistent with macroeconomic forecasts for the state's aerospace industry from 2011-2021.[9]
- That being said, those who participated in the survey said demand for the following specific occupations is expected to grow robustly: CNC Programmers, Tool Makers, Planners – Manufacturing Planners/Engineers, Composites/Manufacturing, Assembly Mechanic, Computer Technician, driven largely by growth except for Assembly Mechanic and Tool Makers, for which demand is expected to be equally driven by retirements.

Some jobs hard to fill, some skills hard to find

- Firms had the hardest time filling vacancies for Machinist, Manufacturing/Production, CNC Programmer/Operator, Quality Assurance/Inspector, Assemblers, and Engineers.
- Shortcomings in aerospace-specific skills were more frequently identified in prospective employees than shortcomings in any particular general education or workplace skills, according to survey respondents.

[7] Of the Washington-based operations responding to the survey, approximately 40 percent of firms have 20 or fewer employees, 39 percent between 21 and 100 employees, and 19 percent have 100 or more employees.
[8] The response rate for this survey is too low to provide reliable figures upon which to base employment estimates and projections. The authors strongly suggest survey findings be used to supplement other information sources.
[9] Source: Washington Employment Security Department, Long-term Industry Employment Projections

Directions for Next Year's Report

Future reports should continue to focus on education and training programs (completions and outcomes) and employer hiring expectations and difficulties. The Aerospace Pipeline Committee's priorities and goals, set in August 2013, should also guide additional work.

- **Priority 1:** Capacity of aerospace programs.
- **Priority 2:** Experience of aerospace graduates and employees.
- **Goal 1:** Long-term strategy for aerospace workforce.
- **Goal 2:** Prioritize work to support efforts around the 777x.

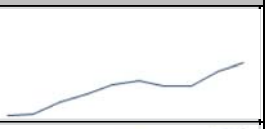
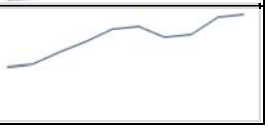
OVERVIEW OF WASHINGTON'S AEROSPACE INDUSTRY

Firms and Employment

The aerospace industry has a long history in Washington, dating back nearly 100 years. The first aerospace company began in 1916 with a single red barn in Seattle and has expanded to include 1,248 firms, with 175 of these firms in the core industry.[10]

The core of Washington's aerospace industry is Aerospace Manufacturing and Parts (NAICS 3364),[11] employing 96,800 workers as of July 2013.[12] Surrounding that core are an array of aerospace-related industries, comprised of materials and parts suppliers, air transportation and related infrastructure, employing an additional 34,100 for a total of 131,000 Washingtonians as of July 2013. Appendix B shows detailed employment trends for core and broader aerospace-related industries.

Figure 1. Aerospace Employment Trends, Washington, 2003-12

Industry Description	Dec-03	Dec-12	Trendline
Total "Core Aerospace" Employment (NAICS 3364)	61,995	96,450	
Total "Aerospace-related" Employment*	94,183	129,620	

*See Appendix B for a complete list of industries included in the aerospace-related group.
Source: Employment Security Department

Relative Concentration

By many measures, Washington is the leader in the nation's aerospace industry. One useful measure is the state's relative concentration, or specialization, in the aerospace industry. The relative concentration is measured using the location quotient (LQ), a ratio of the statewide

[10] Retrieved from The Washington Aerospace Industry Strategy located at: http://www.governor.wa.gov/issues/economy/aerospace/Industry_Strategy.pdf

[11] NAICS 927000 - Space Research and Technology was also identified in the core of Washington's aerospace industry, yet employment data are sparse for this industry. Therefore, when the report refers to the "core" it is generally referring to NAICS 3364 – Aerospace Manufacturing and Parts. Data for Space Research and Technology are included wherever possible.

[12] Washington Employment Security Department (July 2013).

share of employment in a certain industry compared to national share of employment in the same industry.

Washington outranks other leading states in specialization and overall employment, along with the relative concentration of core aerospace industry employment (see Figure 2).

With a location quotient of 8.9, aerospace is nearly nine times more concentrated in Washington than across the rest of the nation. With over 94,200 workers in the state's core aerospace segment alone (2012 annual average), Washington holds 20 percent of the nation's aerospace jobs, the largest number for any state.

Figure 2: Aerospace Core Industry Employment and Location Quotients, 2012, Washington and Other States

	2012 Employment	
	NAICS 3364 Aerospace product & parts manufacturing	Location Quotient (state: US)
U.S. TOTAL	494,975	-
Washington	94,224	8.9
Kansas	32,409	6.7
Arizona	26,652	2.9
Alabama	12,514	1.9
Georgia	22,002	1.5
Missouri	14,235	1.5
Utah	5,926	1.3
California	70,465	1.2
Texas	47,940	1.2
Oklahoma	6,218	1.1
South Carolina	5,867	0.9
Ohio	16,124	0.8
Pennsylvania	11,805	0.5
North Carolina	4,601	0.3

Source: U.S. Bureau of Labor Statistics, 2012 QWES

Occupational Composition

Production and engineering occupations are at the core of aerospace employment in Washington. As shown in Figure 3, over 54 percent of industry employment is in those two categories, and fully 80 percent of industry employment is concentrated in production, engineering, business/finance, and computer and mathematical occupations. Appendix D details Washington's aerospace industry top 50 occupations and the extent to which they're concentrated in aerospace, compared to all other industries.

Employment Forecasts

The general outlook for aerospace manufacturing is essentially flat according to Washington state projections for 2011-21. Manufacturing overall is expected to make slightly better gains over the decade.[13] There are, however, limitations to this forecast, including uncertainties resulting from the cyclical nature of aerospace employment and the dominant role in employment trends of the state's largest aerospace employer (The Boeing Company).

Figure 3: Aerospace Core Industry Occupational Composition, NAICS 3364, 2012, Washington

Major Occupation Group	% of Total Aerospace Employment	2012-2nd Quarter Employment
Production	**30.2%**	**28,158**
Architecture and Engineering	**24.4%**	**22,758**
Business and Financial Operations	**14.6%**	**13,602**
Computer and Mathematical	**11.0%**	**10,253**
Subtotal	**80.3%**	**74,771**
Installation, Maintenance, and Repair	4.9%	4,577
Management	4.8%	4,515
Transportation and Material Moving	3.5%	3,243
Office and Administrative Support	3.4%	3,204
All other major occupation groups	3.0%	2,805
Total	100.0%	93,115

Source: Washington Employment Security Department, 2013 Occupational Employment Projections.

[13] Washington Employment Security Department, Long-Term Industry Employment Projections, May 2013.

Figure 4: Washington Employment Projections, Aerospace and Selected Manufacturing Industries, 2011-21

Industry	Estimated employment 2011	Estimated employment 2016	Estimated employment 2021	Average annual growth rate 2011-2016	Average annual growth rate 2011-2016	Average annual growth rate 2016-2021	Average annual growth rate 2016-2021
TOTAL NONFARM	**2,821,200**	**3,083,800**	**3,264,800**	**1.8%**		**1.1%**	
MANUFACTURING	**268,300**	**292,800**	**300,300**	**1.8%**		**0.5%**	
Durable goods	193,200	215,100	219,500	2.2%		0.4%	
Fabricated metal product manufacturing	17,500	22,900	25,400	5.5%		2.1%	
Machinery manufacturing	12,900	16,800	19,400	5.4%		2.9%	
Computer and electronic product manufacturing	19,600	21,200	24,100	1.6%		2.6%	
Electrical equipment and appliance mfg	4,400	5,600	6,600	4.9%		3.3%	
Aerospace product and parts manufacturing	**86,600**	**91,800**	**87,600**	**1.2%**		**-0.9%**	
Other transportation equipment	9,200	9,400	8,700	0.4%		-1.5%	
Other durable manufacturing	16,400	16,900	17,400	0.6%		0.6%	

Source: Washington Employment Security Department, Long-term Industry Employment Projections

EDUCATION AND TRAINING

The aerospace industry is a powerful force within the national economy, but even more so for Washington's economy, where it is considered a key industry. In November 2013, the Legislature held a special session to extend nearly $9 billion in tax breaks for Boeing through 2040, in a bid to keep the production of the company's newest jet, the 777X, in the Evergreen state. In January, Boeing machinists narrowly approved an eight-year contract to build the 777x in Washington.

Aerospace-related jobs are predominantly skilled and well compensated. An analysis of the Boeing contract by the Associated Press sheds light on aerospace workers' earnings. For example, entry-level machinists who work on planes at Boeing currently start at $25,000 a year. Their pay steadily increases from there, reaching about $66,000 per year if they have six years of experience, the AP reported.

Earnings in other top aerospace occupations can also be substantial. For example, the median hourly wage for Aircraft Structure/Surface/Rigging/System Assemblers was $23.40 in 2013; and $35.41 for Engineering Technicians.[14]

Undoubtedly, meeting the workforce needs of the aerospace industry is important to the economic vitality of the state, as well as the economic wellbeing of individuals and families.

The graying workforce means that substantial numbers of aerospace workers are reaching retirement age, putting pressure on the education system to train sufficient replacements. At the same time, technology is changing. Aerospace workers require additional tech skills to fill new jobs.

[14] Washington Employment Security Department, 2013 Occupational Employment and Wage Estimates.

Washington has responded to this challenge by investing heavily in a variety of aerospace-related training. In this report, the focus is on:

- Apprenticeships.
- Community and technical college programs.

A third major training provider, the Washington Aerospace Training & Research (WATR) Center will be included in future reports.[15]

Aerospace Apprenticeship Programs

Aerospace apprenticeship combines supervised on-the-job training experience with college-level classroom instruction. This enables:

- Employees to earn a living wage while they learn on the job from a mentor and attend class one night a week at a local community or technical college.
- Employers to increase their workforce skills without disrupting production.

The following section analyzes aerospace apprenticeship dynamics, enrollments and a snapshot of completers since the creation of the Aerospace Joint Apprenticeship Committee (AJAC) in 2008.[16]

AJAC offers:

- Washington employers a proven method to tap into the knowledge and skills of their most experienced tradespeople, and pass it on to the next generation of employees.

- Apprentices the chance to gain the tools necessary to learn and master these skills, advance in their career and become master tradespeople.

- Apprentices the opportunity to advance their education. In addition to obtaining journey-level certification as a master tradesperson, an apprentice earns income and college credit. This sets apprentices on a path towards an associate's degree that can build into a four-year degree.

AJAC is considered to be one of the state's fastest growing programs, both in terms of registered apprentices and new employer partners (training agents).[17] As of December 2013, 267 apprentices were enrolled in AJAC's four-year track. In 2012, after four years of operation, AJAC received the U.S. Department of Labor's "21st Century Registered Apprenticeship Trailblazer and Innovator Award."

[15] Outcomes data for the WATR Center were not available at the time of publication. Located at Paine Field in Everett and managed by Edmonds Community College, the WATR Center trains students for high-wage, high-demand aerospace jobs in 12 weeks. Students start with a four-week core program and move on to specialized certificates such as assembly mechanic, electrical assembler, tooling, and quality assurance.

[16] Note: The Seattle Machinists Apprenticeship Program is not part of AJAC's program but included in the analysis of completion outcomes in this section.

[17] Washington Department of Labor and Industries.

Snapshot of Apprenticeship Completions and Outcomes

As of June 2012, 19 participants had completed the aerospace apprenticeship program.[18] The median number of months to completion was 51, or slightly more than four years.[19]

Among the 19 apprenticeship completers, six were trained via AJAC. The Seattle Machinists Apprenticeship program and the IAM/Boeing program trained five individuals each (for a total of 10); and three individuals were trained at Electroimpact Incorporated. With the exception of one person, participants completed apprenticeships in machinist programs. The one remaining participant was a composite manufacturing technician apprentice (SOC code 51-9199).

On average for the snapshot group, the median quarterly earnings of apprenticeship completers were $18,503 three quarters (or seven to nine months) after completion.[20]

Figure 5: Snapshot of Aerospace Apprenticeship Program Completions Washington, June 2012

Program completions (as of June 2012)	19
Aerospace JAC	6
IAM/Boeing JAC	5
Seattle Machinists Apprenticeship	5
Electroimpact, Inc. Plant Program	3
Median Quarterly Wage, 2013 Q1	$18,503
Completers working overtime hours, 2013 Q1	9
Median months to completion	51 months

Source: Workforce Board, 2013, Analysis of unemployment wage file records for apprenticeship completers as identified from Labor and Industries records.

Community and Technical College Programs

The Legislation that created the Aerospace Pipeline Committee calls for the program evaluation to be conducted by the Workforce Board, working with the State Board for Community and Technical Colleges. The Aerospace and Advanced Materials Manufacturing Pipeline Advisory Committee recommends which programs to evaluate. For this report, the committee identified five programs for review including:

- Engineering Technician
- Plastics Engineering Technician
- Drafting and Design Technician
- Aircraft/Frame/Powerplant Mechanic
- Machine Tool Technician

[18] This analysis follows standard outcomes analysis practices wherein a point-in-time snapshot is taken of a particular group, and their earnings are analyzed three quarters after training completion. As of June 2013, AJAC completers number 17. Future reports will track apprenticeship completers for the most recent quarter possible.

[19] AJAC's program is exactly 48 months.

[20] Quarterly earnings for apprenticeship completers three quarters after completion ranged from $10,343 to $40,889. The data do not tell the whole story: While a normal full-time quarter totals about 522 hours, apprenticeship completers analyzed here worked a range of 450 to 785 hours. Thus, earnings data are complicated by the fact that nine of the 19 completers clocked in overtime hours and earnings in the reference quarter.

As shown in Figure 6, the number of students served in the selected programs increased an average of 82 percent between 2008 and 2013. This growth occurred during a time of reduced state funding to the community and technical college system. During this same time, the system experienced a surge in enrollment as record numbers of unemployed Washington residents headed back to school to retrain during the recession. Enrollments increased, in particular, in the engineering technician program (883 percent), starting in 2010. The plastics engineering technician program also grew (1,275 percent), with enrollments rising significantly starting in 2011.

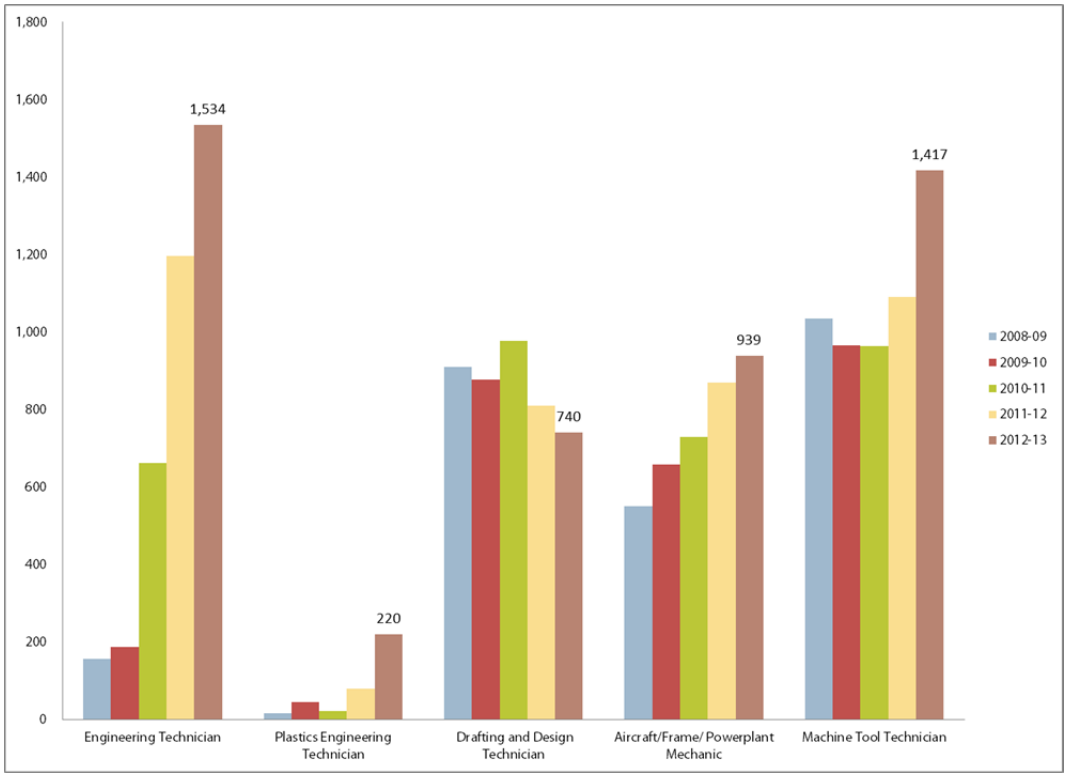
This concentrated growth occurred during a period of targeted financial investments made through federal, state and local resources. As part of the a Trade Adjustment Assistance Community College and Career Training grant the U.S. Department of Labor provided $20 million to 11 of the state's community and technical colleges, as part of a consortium called Air Washington. Also helping expand capacity was a $1.5 million Investment in Aerospace from then-Governor Christine Gregoire, who carved out discretionary funds from the federal Workforce Investment Act funds the state receives, and directed them to aerospace. The one area that saw a decline was the drafting and design technician program (-19 percent), which held largely steady during the earlier years in this study, before dropping in 2011-12 and again in 2012-13.

Figure 6: Select Aerospace Education and Training Program Enrollment, 2008-13, Washington

Year	Engineering Technician	Plastics Engineering Technician	Drafting and Design Technician	Aircraft/Frame /Powerplant Mechanic	Machine Tool Technician	Total Students Selected Programs
2008-09	156	16	910	551	1,034	2,667
2009-10	186	45	877	658	965	2,731
2010-11	662	22	976	729	964	3,353
2011-12	1,196	79	809	869	1,090	4,043
2012-13	1,534	220	740	939	1,417	4,850
5 Year Change	883%	1275%	-19%	70%	37%	82%

Source: The State Board for Community and Technical Colleges' (SBCTC) Data Warehouse, December 2013

Figure 7: Select Aerospace Programs, Five Year Headcount, 2008-13



Source: The State Board for Community and Technical Colleges' (SBCTC) Data Warehouse, December 2013

Full-time equivalent students (FTEs) in the five selected aerospace programs have risen 108 percent, following a similar pattern of student enrollment.

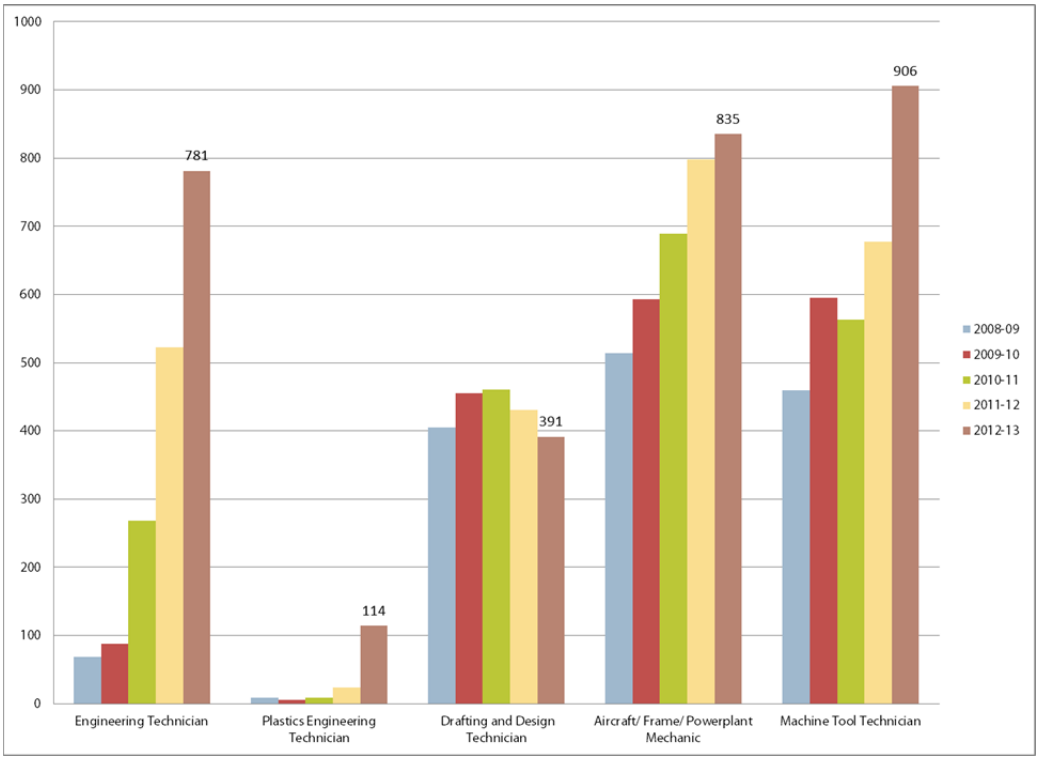
Annual program completions have risen 286 percent in the past five years. The growth in completions is across all five program areas.

Figure 8: Select Aerospace Programs, Five Year FTEs, 2008-13

Year	Engineering Technician	Plastics Engineering Technician	Drafting and Design Technician	Aircraft/ Frame/ Powerplant Mechanic	Machine Tool Technician	Total Students Selected Programs
2008-09	69	8	405	514	459	1,455
2009-10	87	6	455	593	595	1,736
2010-11	268	9	460	689	563	1,989
2011-12	522	24	430	798	678	2,452
2012-13	781	114	391	835	906	3,027
5 Year Change	1033%	1293%	-3%	62%	97%	108%

Source: The State Board for Community and Technical Colleges' (SBCTC) Data Warehouse, December 2013

Figure 9: Select Aerospace Programs, Five Year FTES, 2008-13



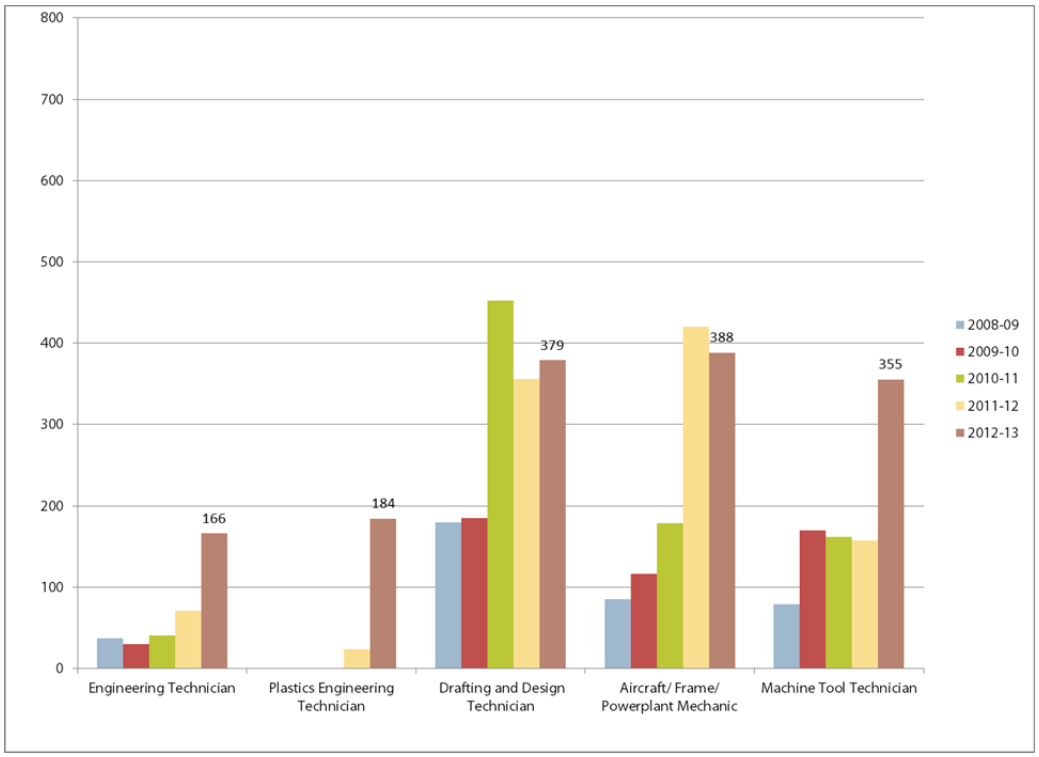
Source: The State Board for Community and Technical Colleges' (SBCTC) Data Warehouse, December 2013

Figure 10: Select Aerospace Program Completers, 2008-13

Year	Engineering Technician	Plastics Engineering Technician	Drafting and Design Technician	Aircraft/ Frame/ Powerplant Mechanic	Machine Tool Technician	Total Students Selected Programs
2008-09	37	*	180	85	79	381
2009-10	30	*	185	116	170	501
2010-11	41	*	452	179	162	834
2011-12	71	24	356	420	157	1028
2012-13	166	184	379	388	355	1472
5 Year Change	349%		111%	356%	349%	286%

Source: The State Board for Community and Technical Colleges' (SBCTC) Data Warehouse, December 2013
*Years with less than 10 completions have been redacted.

Figure 11: Select Aerospace Programs, Five Year Completers, 2008-13



Source: The State Board for Community and Technical Colleges' (SBCTC) Data Warehouse, December 2013

Figure 12: Select Aerospace Program Median Wages and Annual Earnings, 20011-12

Program Title	Inflation Adjusted Wage	Inflation Adjusted Earnings (annual est.)
Engineering Technician	$21.18	$50,565.83
Plastics Engineering Technician	$14.55	$26,782.43
Drafting and Design Technician	$17.98	$34,055.21
Aircraft/Frame/Powerplant Mechanic	$17.98	$36,452.34
Machine Tool Technician	$16.63	$34,167.11

Source: The State Board for Community and Technical Colleges' (SBCTC) Data Warehouse, December 2013

The accompanying charts describe employment results for participants who left college training in 2011 and went to work in 2012. Students who studied as engineering technicians had the highest earnings, followed by those who studied aircraft/frame/power plant mechanic and machine tool technician.

Figure 13: Select Aerospace Program Employment Outcomes, 2011-12

Year	Program	All Students Employed	Students Employed in Aerospace Industry	Percent Employed in Aerospace Industry
2011-12	Engineering Technician	64	35	55%
2011-12	Plastics Engineering Technician	35	*	*
2011-12	Drafting and Design Technician	159	23	14%
2011-12	Aircraft/Frame/Powerplant Mechanic	198	98	49%
2011-12	Machine Tool Technician	191	45	24%
Total		647	201	31%

Source: The State Board for Community and Technical Colleges' (SBCTC) Data Warehouse, December 2013
*Programs with fewer than 10 students have been redacted.

Nearly a third (31 percent) of students taking the five programs went to work in the aerospace industry. This number may appear smaller than expected. However, some of this discrepancy may be due to the way firms are coded.[21] Proportionately, Aerospace employers hired a larger share (55 percent) of Engineering Tech completers compared to the other programs, followed closely by Aircraft Mechanics (49 percent).

AEROSPACE EMPLOYER SURVEY

Employment and Hiring Expectations Survey

To gain a more nuanced understanding of the hiring needs of Washington's aerospace employers, and how the state can better prepare the labor force for expected increases in aerospace production over the coming years, the Workforce Board conducted a hiring expectations survey. The 2013 survey is the second such survey targeted at Washington's aerospace industry. It provides details on employers' perceptions of future workforce needs, helping inform policy on how to best prepare Washington's workforce to meet industry demand.[22]

[21] Under the North American Industry Classification System (NAICS), codes identify a company's primary business activity. To quantify the percent employed in the aerospace industry, the State Board for Community and Technical Colleges reviewed employment with firms coded as Aerospace Parts and Equipment manufacturers (NAICS 3364). When looking at the broad array of NAICS-based industries included in core and ancillary aerospace-related sectors in Washington, not all "aerospace" related employers are coded as such. Thus, firms producing products that supply a variety of transportation equipment manufacturers could be coded into broader manufacturing industries, such as transportation equipment (NAICS 336) rather than the more detailed Aircraft Parts and Equipment Manufacturing (NAISC 3364). Because of the variety of NAICS codes used among manufacturers, it's likely that a larger percentage of aerospace-related program completers are working on aerospace-related products, even if the companies they work for are not specifically classified as such.

[22] The ability to use survey results for year-over-year trend analysis is limited because the survey was significantly revised from 2012 to 2013.

Survey Results – Firm Participation & Characteristics

A survey was fielded to 694 Washington-based firms from August through November 2013. A total of 100 employers responded to the survey—16 through paper surveys and 89 via the web, for a response rate of 14.4 percent. While concentrated in the Puget Sound region and, to a lesser degree, west of the Cascades, respondents represent ZIP codes from across Washington.

Aerospace Employment and Hiring Expectations Survey

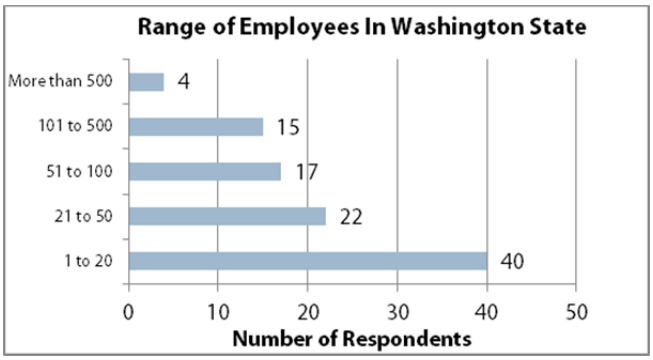
694	Firms surveyed (by email or post)	
100	Valid responses	
	89	online
	16	paper
	5	removed - outside industry scope
14.4%	Response rate	

Source: Workforce Board's 2013 Aerospace Employer Survey

The firms participating in the survey represent both small and large enterprises. Of the Washington-based operations responding to the survey, approximately 40 percent of firms have 20 or fewer employees, 39 percent between 21 and 100 employees, and 19 percent have 100 or more employees. Some 15 percent of respondents reported also employing workers in another state, and 10 percent reported employees outside of the U.S.

Survey participants represent both the core aerospace industry (NAICS 3364 – Aerospace Product and Parts Manufacturing) and related supplier-distributor networks of supporting industries, as depicted in Figure 15. Overall, participating firms reported that 75 percent of their business is part of, or directly supports, the aerospace industry. Figure 16 describes the spread of business with major aerospace firms among survey participants. Overall, 78 survey participants reported doing business directly with Boeing, with an average of 41 percent of their business direct to that enterprise.

Figure 14: Survey Respondents by Size of Firm (Washington-based employees)



Source: Workforce Board's 2013 Aerospace Employer Survey

Survey Highlights Employment and Hiring Expectations

Of the aerospace and aerospace-related firms surveyed, 81 percent indicated they had hired new employees in the last 12 months, with the majority of those hiring one to 10 workers (55 percent). On average, respondents hired 11 new employees in the 12 months preceding the survey.[23]

Firms identified engineers, administrators/managers, and machinists as the three occupations in which they currently have the largest number of employees. Figure 18 (next page) details the expected employment trends for the most commonly employed occupations among the firms surveyed. Survey respondents' outlook for the next five years is nearly flat: on average, respondents expect a 1 percent growth in employment from 2013 to 2018.[24] This is consistent with macroeconomic forecasts for the state's aerospace industry for 2011-21.

Survey participant demand for selected occupations is expected to grow robustly, including:

- CNC Programmers (45 percent)
- Tool Makers (31 percent)
- Planners – Manufacturing Planners/Engineers (19 percent)
- Composites/Manufacturing (17 percent)
- Assembly Mechanic (17 percent)
- Computer Technician (15 percent)

Figure 15: Survey Participants by Industry

4-digit NAICS	Industry	Respondents
3261	Plastics Product Mfg	2
3323	Architectural and Structural Metals Mfg	1
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Mfg	5
3329	Other Fabricated Metal Product Mfg	1
3333	Commercial and Service Industry Machinery Mfg	1
3335	Metalworking Machinery Mfg	1
3339	Other General Purpose Machinery Mfg	1
3344	Semiconductor and Other Electronic Component Mfg	1
3345	Navigational, Measuring, Electromedical, and Control Instruments Mfg	1
3359	Other Electrical Equipment and Component Mfg	1
3364	**Aerospace Product and Parts Mfg**	**57**
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	1
4881	Support Activities for Air Transportation	2
5413	Architectural, Engineering, and Related Services	4
5415	Computer Systems Design and Related Services	1
5629	Remediation and Other Waste Management Services	1
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	1
	Blank	18
	Total	100

Source: Workforce Board's 2013 Aerospace Employer Survey

Figure 16: Approximately what percentage of your business is with the major aerospace firms or their subsidiaries?

Percentage range of respondents' business conducted with major aerospace firms. Number of respondents: 92					
Major Aerospace Firms	**None**	**Less than 25%**	**25% to 75%**	**76% to 99%**	**100%**
Boeing	15	17	37	15	8
Airbus/EAD	58	20	14		
Bombardier	65	27			
Embraer	78	14			
Gulfstream	73	19			
Lockheed Martin	72	19	1		
Mitsubishi Aircraft Co.	84	6	2		
Northrop Grumman	74	17	1		
Other	27	29	19	9	8

Source: Workforce Board's 2013 Aerospace Employer Survey

Figure 17: How many new employees have you hired in the last 12 months?

New employees hired last 12 months	Respondents	Percent
None	19	19%
1 to 10	54	55%
11 to 20	10	10%
21 to 40	10	10%
41 to 100	5	5%
100+	1	1%
Average Number of New Hires	11	

Source: Workforce Board's 2013 Aerospace Employer Survey

[23] To give a perspective on the size of the companies hiring, of the Washington-based operations responding to the survey, approximately 40 percent of firms have 20 or fewer employees, 39 percent between 21 and 100 employees, and 19 percent have 100 or more employees.

[24] The response rate for this survey is too low to provide reliable figures upon which to base employment estimates and projections. The authors strongly suggest survey findings be used to supplement other information sources.

Figure 18: Aerospace Employment and Retirement by Occupation: Current and Future Expectations, Washington, 2013-18

	Current Employment		2018 Employment Expectations			2018 Retirement Expectations		
Occupation	Number of firms identifying occupation	Current Employeees in Washington State	Number of firms identifying occupation	Employees in Washington State Expected to be Employed in 2018	Change Rate Based on Survey Expectations 2013-2018	Number of firms identifying occupation	Employees in Washington State Expected to Retire by 2018	Retirement Rate Based on Survey Expectations 2013-2018
Engineers	52	1,490	45	1,636	10%	33	41	3%
Administrator/ Management	94	1,039	83	1,062	2%	68	107	10%
Machinist	52	1,003	48	949	-5%	36	66	7%
Electrical Assembler	23	522	23	562	8%	14	8	2%
Composites/ Manufacturing	40	473	36	553	17%	29	29	6%
Assembly Mechanic	37	431	34	506	17%	22	81	19%
Quality Assurance/ Inspector	77	374	66	412	10%	52	38	10%
CNC Programmer/ Operator	56	278	50	403	45%	34	19	7%
Engineering Technician	35	186	28	199	7%	19	6	3%
Planner (Mfg Planner/ Mfg Engineer)	66	161	60	192	19%	39	19	12%
Airframe Mechanic	12	96	11	93	-3%	9	1	1%
Computer Technician	28	81	24	93	15%	20	7	9%
Tool Maker	45	53	42	69	31%	35	16	30%
Other (all others combined)	37	456	32	503	10%	29	36	8%
Total - All Occupations		6,642		7,232	9%		474	7%

Source: Workforce Board's 2013 Aerospace Employer Survey

In terms of overall job numbers, respondents expect the largest job growth for engineers and CNC programmers. In terms of potential retirement effects, toolmakers top the list with the greatest percentage of net openings expected over the next five years. Assembly mechanics garner a large number of net openings when retirement is taken into consideration.

Hiring Difficulties and Turnover

The following occupations were top-ranked by firms having the hardest time filling vacancies in the 12 months preceding the survey:

- Machinist
- Manufacturing/Production
- CNC Programmer/Operator
- Quality Assurance/Inspector
- Assembler
- Engineers

Figure 19: How have you responded over the last year to difficulty finding qualified applicants?

	n = 90	
Response to difficulty finding qualified applications	Firms Identifying Reason	Percent
Increased overtime hours for current workers	56	62%
Hired a less qualified applicant	45	50%
Increased recruiting efforts	39	43%
Did not fill the job opening	36	40%
Outsourced work or purchased services from another firm	32	36%
Engaged education providers to access skilled graduates exiting their programs	26	29%
Increased wages to attract more applicants	21	23%
Other	20	22%

Source: Workforce Board's 2013 Aerospace Employer Survey

Firms have responded to difficulty finding qualified applicants in several ways, including increasing overtime hours for their current workforce (62 percent), hiring a less qualified applicant (50 percent), increasing recruiting efforts (42 percent), and not filling the job opening (40 percent). Additional strategies to cope with difficulties finding qualified applicants volunteered by respondents include:

- Apprenticeship and pre-apprenticeship
- Using paid interns (high school and from abroad)
- Providing in-house training

Survey participants cited numerous reasons for employee turnover. While no trends or direct causes can be determined from the small number of survey participants, certain reasons for turnover were repeated often enough to divide into broad categories. Those included:

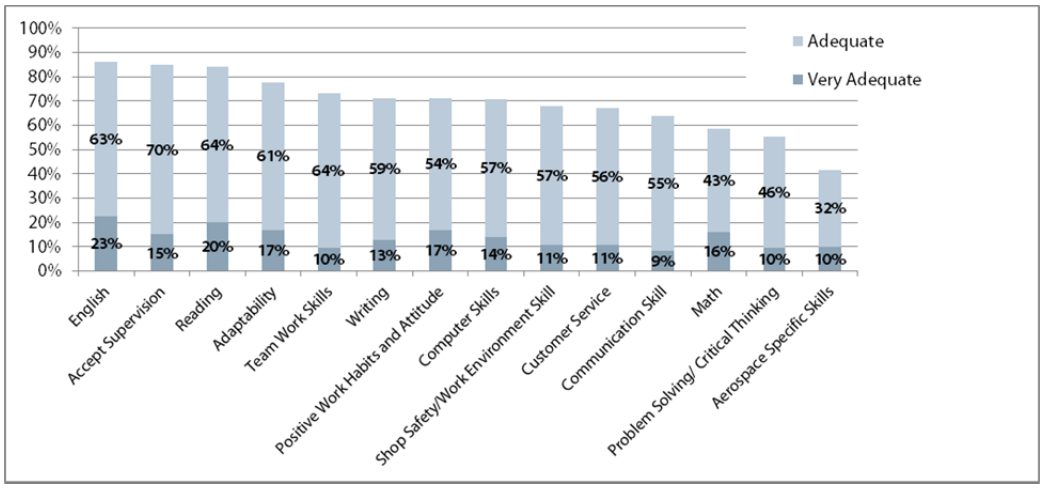
- Poor work habits and/or low quality work effort by workers.
- Skill level doesn't keep pace with expectations of the workplace.
- Pay and/or benefits offered by small firms cannot keep up with what larger firms offer.[25]

Skill Set Adequacies and Preparing for the Next Generation

Of 94 firms responding to a question about the adequacies of job interviewee skill sets, survey participants singled out aerospace-specific skills as those most frequently lacking. Figure 20 shows skill adequacy in descending order, based on survey respondents' experiences with job candidates in the prior year. Also frequently lacking were problem solving/critical thinking and math skills. Least often cited as inadequate were English, accepting supervision, and reading skills.

When asked what strategies their companies use to help prepare the next generation of workers for aerospace careers, respondents favored employing interns from colleges and universities, followed by using interns from high school vocational or technical programs. In the year preceding the survey, 42 percent of respondent firms had hired workers from an apprenticeship program, community or technical college, and/or the Washington Aerospace Training and Research Center (WATR). Of the workers hired from one or more of these training programs, respondents rated them more adequate, on the whole, than the general pool of prospective employees. The general pattern of skill adequacy, however, followed a consistent pattern, with aerospace-specific and problem-solving skills as hardest-to-find, and English language, reading and ability to accept supervision as the least scarce.

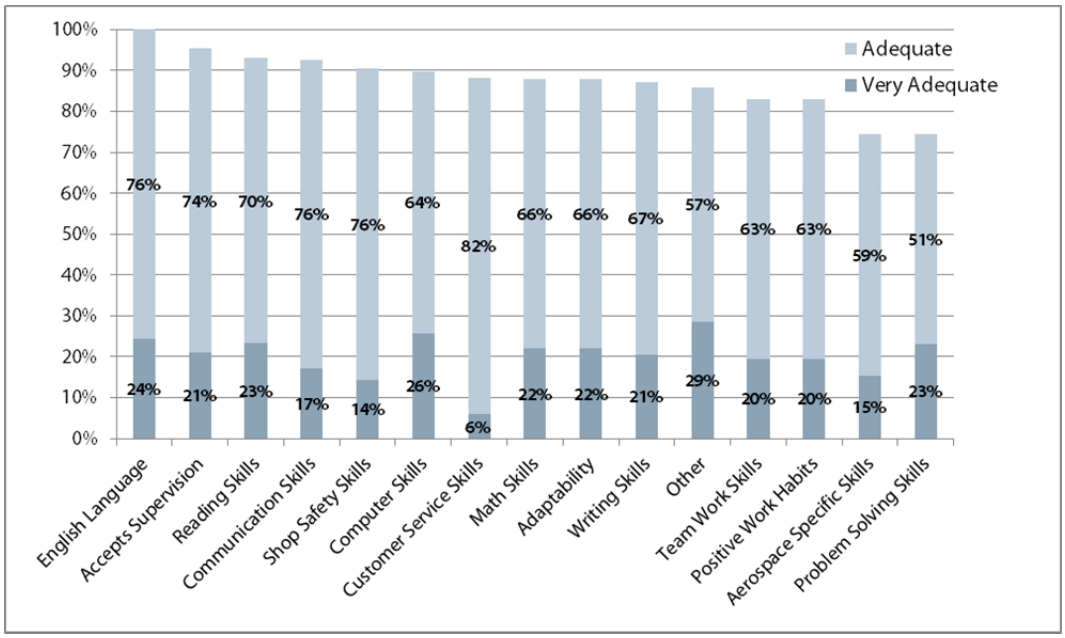
Figure 20: Considering only those people who have applied and been interviewed/tested for jobs at your establishment in the past year, please rate the following skill sets:



Source: Workforce Board's 2013 Aerospace Employer Survey

[25] Several respondents cited Boeing in particular for attracting their employees.

Figure 21: Of the workers that you have hired from one or more of these training providers (apprenticeship programs, community colleges, technical colleges, and/or the Washington Aerospace Training and Research (WATR) Center), on average how would you rate them on the following:



Source: Workforce Board's 2013 Aerospace Employer Survey

A small number of respondents (n=40) had direct participation with those training providers, with 85 percent reporting that relationship as satisfactory. Participation with training providers included: serving on program advisory committees, procuring contract training, and posting job announcements. (It's worth noting that some aerospace firms have employees who are also instructors with training providers.)

Aerospace Outlook: Employer's Perspectives

It's no surprise that aerospace firms participating in the survey tied their industry outlook primarily to Washington's relationship with Boeing and, secondarily to labor force dynamics, including skills and costs. When asked about how industry expansion will impact their workforce practices, narrative responses give a glimpse into industry concerns.

Will aerospace industry expansion over the next 5-10 years result in any other anticipated impact on your workforce or employment practices, including outsourcing, which we have not asked you about?

- No, we do not outsource and do not foresee any change in our practices. We currently benefit from the WA state B&O tax credit for research and development. The savings from this credit pays for our summer intern, which we will no longer have if the credit is not renewed.
- Of course. We are continually looking to rely on our supply chain to support our continued growth. This includes local supply chain as well as low-cost domestic and international sources.
- Qualified work force will likely be a constraint to growth which may affect employment practices. Have reviewed the possibility of outsourcing to low cost areas.
- We are concerned that the cost of land acquisition required for expansion will increase.
- We will no doubt up our out of state recruiting efforts.
- We'd like to outsource less but in reality there'll probably be more carbon fibers or composites so we'll probably have to outsource more.
- Yes, we may be looking at different manufacturing sites out of the state.
- Yes, we will continue to outsource outside of the state and country.
- Yes, we are experiencing impacts on qualities and characteristics of our employees. For example, due to customer demand, we needed to add AS9100 certification to our business. AS Certification brings several levels of change to our staff. Another example is growth. Once we grew beyond 50 employees, there have been several changes impacting our workforce.
- Yes. We are focusing heavily on retention for the next 24 months.
- Yes. May require more capital investment rather than relying on the labor component.
- We have an IPC-620 CIT on staff and all of our employees are IPC-620 CIS. We have supplied a lot of basic skills development training to our staff to bring them up to acceptable levels for needed work processes. We anticipate a larger need for this as our customer base develops and grows. We will need to allocate additional resources to train many of our existing employees for the needs of the future.
- We subcontract most production tasks and some engineering specialty tasks. We will likely bring some of that work in house, but we will be conservative in how we hire, since we can be effective and profitable with our own specialized staff. We will only expand if there is enough work to reliably hire, and we will only hire if we find good candidates who can perform a wide variety of tasks.
- We will need to hire less experienced people and do better at internal training.

Source: Workforce Board's 2013 Aerospace Employer Survey

Employer Satisfaction Survey

Employer Satisfaction Survey

37	2013 Aerospace Employer Survey respondents willing to participate in satisfaction survey
10	removed - out of scope (did not hire in the last year)
1	removed - out of scope (educational institution)
26	revised S2 denominator
11	S2 respondents
42.3%	Response rate

To assess employer satisfaction with Washington aerospace training programs, interviews were conducted with those employers who responded to the Industry Employment and Hiring Expectations survey (above), **and** had made qualifying hires within the last year, **and** were willing to participate in phone interviews.

Appendix G provides detailed results from the Employer Satisfaction Survey.

Employer Satisfaction Survey questions pertained only to workers trained in one or more of the following Washington training programs:

- Apprenticeship programs.
- Community and technical college programs.
- The Washington Aerospace Training and Research Center (WATR).

The goal of the Employer Satisfaction Survey is to assess, in the aggregate, the satisfaction of employers with training provided in Washington, and to take cues from the findings to improve the education and training required by the aerospace industry.

The story from these respondents seems to be that overall the system is serving them adequately, but there are areas for improvement. When asked about the job-related skills their recent hires demonstrate, employers rated them "adequate" more frequently than "more than adequate." Problem-solving skills needed the most improvement. When asked about why they said certain skill sets needed improvement in new hires, employers explained the classroom can't fully prepare students for real-world challenges found in the workplace. They also cited shortcomings in terms of hands-on practice (e.g., with tools), time spent practicing with certain equipment, and a lack of focus on problem-solving or troubleshooting.

Appendix A — Aerospace Pipeline Advisory Committee

Industry Representatives

- Frank Nichols, CEO, Silicon Forest Electronics
- Eric Hahn, Vice President/organization Development, General Plastics
- Al Pennell, The Boeing Company
- Debbie Byrd, Human Resources Manager, GE Aviation Services LLC
- John Theisen, President and CEO, ORION
- Jackie Davis, Regional Sales Manager, AMI Metals Inc
- Bahman Hadi, Cascade Engineering Services
- Tom Doughty, VP Administration, Janicki Industries
- Ben Hempstead, Engineer-Mechanical Lead, Electroimpact
- Linda Lanham, Director, Aerospace Future Alliance
- Tim Morgan, CEO, TTF Aerospace, LLC

Education Representatives

- David Beyer, President, Everett Community College
- Larry Cluphf, Director, Washington Aerospace Training & Research Center
- Steve Hanson , President, Renton Technical College
- Laura Hopkins, Executive Director, Aerospace Joint Apprenticeship Program

Labor Representatives

- Chelsea Orvella, Legislative Director, SPEEA, IFPTE 2001
- Ron Harrell, Staff Assistant, IAM&AW District Lodge 160

Ex-Officio Members

- Alex Pietsch, Director, Governor's Office of Aerospace
- Mary Kaye Bredeson, Director, Center of Excellence for Aerospace & Advanced Materials Manufacturing
- Betty Klattenhoff, Career and Technical Education Director, Office of the Superintendent of Public Instruction
- Marty Brown, Executive Director, WA State Board for Community & Technical Colleges
- Marcia Garrett, Director of Regional Relations, Washington State University

Committee Staff

- Jim Crabbe, Director-Workforce Education, WA State Board for Community & Technical Colleges
- Kendra Hodgson, Policy Associate, WA State Board for Community & Technical Colleges
- Tina Bloomer, Policy Research Associate, WA State Board for Community & Technical Colleges
- Carolyn McKinnon, Research Investigator, Workforce Training and Education Coordinating Board

Appendix B — Aerospace Industry Employment by North American Industry Classification System (NAICS)

Employment counts per industry code were derived from quarterly unemployment insurance contribution reports filed with the Washington Employment Security Department by most every employer. These reports counted only filled jobs, whether full or part-time, temporary or permanent, by place of work. The quarterly reports included the establishment's monthly employment levels for the pay periods that included the 12th of the month. Because the QCEW (Quarterly Census of Employment and Wages) data was based on an establishment census which counts only filled jobs, it is likely that a multi-job holder will be counted two or more times in QCEW data. Major exclusions from UI coverage included self-employed workers, most agricultural workers on small farms, all members of the Armed Forces, elected officials in most states, most employees of railroads, some domestic workers, most student workers at schools, and employees of certain small nonprofit organizations.

The next page is the table of NAICS codes that constitute this report definition of aerospace and related firms. The rows of shaded NAICS codes represent the core aerospace industry.

NAICS Code	Industry Description	Dec-02	Dec-03	Dec-04	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12
325211	Plastics material and resin mfg	144	308	358	394	448	*	506	446	485	*	*
332710	Machine Shops	3,141	2,995	3,312	3,705	4,002	4,369	4,123	3,560	4,070	4,544	4,795
332813	Electroplating, anodizing, and coloring	853	852	832	906	905	1,024	935	767	803	920	969
332999	Miscellaneous fabricated metal product mfg	805	909	983	925	1,043	1,141	1,166	841	805	787	786
333512	Machine Tool Mfg	229	247	392	411	482	515	531	465	484	-	-
333514	Special Die and Tool Mfg	299	419	604	611	675	721	747	623	711	822	851
333517	Machine tool mfg	-	-	-	-	-	-	-	-	-	547	593
333611	Turbine and turbine generator set units	*	*	*	*	*	*	*	55	55	58	65
333612	Speed changer, drive, and gear mfg	*	120	138	148	180	256	*	*	153	*	*
333613	Mechanical power transmission equipment	*	*	*	*	*	39	38	57	67	71	84
333618	Other engine equipment mfg	*	96	89	71	*	27	27	23	*	*	*
334418	Printed Circuit Assembly (Electronic Assembly) Mfg	251	226	232	241	240	273	283	252	304	285	287
334417	Electronic Connector Mfg	735	797	744	721	1,016	659	826	703	759	827	944
334419	Other Electronic Component Mfg	1,855	1,718	1,907	2,068	2,072	2,594	2,553	2,110	2,105	2,189	2,368
334511	Search, Detection, Navigation, Guidance, and Nautical System Mfg	1,865	1,789	1,951	1,934	1,855	1,955	1,715	1,640	1,687	1,744	1,716
334513	Instruments and Related Products Mfg	669	612	610	641	688	722	743	702	789	846	892
334515	Instrument Mfg for Measuring and Testing Electricity and Electrical Signals	2,397	1,916	1,883	1,963	1,922	2,556	2,282	2,035	2,054	2,119	2,116
334519	Other Measuring and Controlling Device Mfg	866	805	779	791	762	743	766	700	771	769	777
335311	Power, Distribution, and Specialty Transformer Mfg	*	186	179	181	105	101	88	36	77	228	251
335314	Relay and Industrial Control Mfg	797	851	911	1063	1211	1319	1480	1532	1719	2101	*
335921	Fiber Optic Cable Mfg	*	*	*	-	-	-	-	-	-	-	-
335991	Carbon and Graphite Product Mfg	-	-	-	-	-	-	-	-	*	*	*
335999	All Other Miscellaneous Electrical Equipment and Component Mfg	1,136	1,055	1,275	1,323	1,352	1,170	1,332	1,091	1,109	1,169	1,055
336411	Aircraft Mfg	63,769	54,692	55,435	61,787	66,027	71,027	74,132	71,190	71,456	79,316	84,358
336412	Aircraft Engine and and Engine Parts Mfg	176	183	148	124	126	148	162	128	86	187	225
336413	Other Aircraft Parts and Auciliary Equipment Mfg	7,233	6,546	6,953	7,951	9,287	10,986	10,464	9,364	9,776	10,947	11,867
336414	Guided Missile and Space Vehicle Mfg	-	-	-	-	-	-	-	-	-	-	-
336415	Guided Missle and Space Vehicle Propulsion Mfg	*	*	*	*	*	*	*	*	*	*	*
336419	Other Guided Missile and Space Vehicle Parts Mfg	*	*	*	*	*	*	*	*	*	*	-
481111	Scheduled passenger air transportation	12,851	11,571	11,584	10,408	10,321	10,049	10,069	9,678	9,693	10,081	10,220
481112	Scheduled freight air transportation	159	154	131	185	222	168	136	99	105	100	101
481211	Nonscheduled air passenger chartering	307	297	255	299	315	291	330	281	292	280	290
481212	Nonscheduled air freight chartering	108	117	101	87	86	88	74	68	68	81	80
481219	Other nonscheduled air transportation	124	131	136	112	134	170	117	83	79	104	83
488111	Air traffic control	*	*	*	*	*	*	*	*	*	*	*
488119	Other airport operations	1,424	1,497	1,414	1,864	1,897	2,162	1,999	1,699	1,692	1,809	1,918
488190	Other support activities for air transport	1,041	1,237	1,450	1,684	1,810	1,838	1,778	2,033	2,108	2,054	1,929
611512	Flight Training	750	639	639	478	524	561	513	374	375	373	*
927000	Space Research and Technology	-	-	-	-	-	-	-	-	-	-	-
Total "Aerospace" Firms (shaded codes above)		178	**71,721**	**61,995**	**62,833**	**70,390**	**75,979**	**82,745**	**85,323**	**81,198**	**81,865**	**90,991**
Total "Aerospace-related" Firms (all NAICS codes listed above)		**1,353**	**105,293**	**94,183**	**96,340**	**104,224**	**110,848**	**119,494**	**121,055**	**113,643**	**115,848**	**126,953**

*Employment and wages not shown to avoid disclosure of data for individual employer.
Source: Labor Market and Economic Analysis Branch, Employment Security Department

Appendix C — Aerospace Industry Excluded NAICS

The following NAICS industries were excluded from the aerospace industry definition due to insufficient numbers of firms to include in the entire industry definition. However, we know that a small number of aerospace companies are found under these industry codes.

NAICS Code	Industry Description
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing
334411	Electron Tube Manufacturing
334412	Bare Printed Circuit Board Manufacturing
334413	Semiconductor and Related Device Manufacturing
334414	Electronic Capacitor Manufacturing
334415	Electronic Resistor Manufacturing
334416	Electronic Coil, Transformer, and Other Inductor Manufacturing
334417	Electronic Connector Manufacturing
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use
334514	Totalizing Fluid Meter and Counting Device Manufacturing
334516	Analytical Laboratory Instrument Manufacturing
334517	Irradiation Apparatus Manufacturing
334518	Watch, Clock, and Part Manufacturing
335312	Motor and Generator Manufacturing
335313	Switchgear and Switchboard Apparatus Manufacturing
335911	Storage Battery Manufacturing
335912	Primary Battery Manufacturing
335929	Other Communication and Energy Wire Manufacturing
335931	Current-Carrying Wiring Device Manufacturing
335932	Noncurrent-Carrying Wiring Device Manufacturing
336900	Other Motor Vehicle Parts Manufacturing
423860	Other transportation goods merchant wholesalers
517410	Satellite Telecommunications
541330	Engineering services
541512	Computer Systems Design Services
541712	Research and development in the Physical, Engineering, and Life Sciences
928110	National security

Appendix D — Aerospace Top 50 Occupations, 2012 Q2, May 2013

Ranking	SOC	Occupation	Aerospace Employment	Share of Total Aerospace	Cumulative Percentage	Total Employment for this Occupation (all industries)	Aerospace Share of Total Employment for this Occupation	Education Level
1	51-2011	Aircraft Structure, Surfaces, Rigging, .Assemblers	13,225	14.2%	14.2%	13,360	99%	High School Education/training less than one month
2	17-2011	Aerospace Engineers	7,091	7.6%	21.8%	8,306	85%	Bachelor's degree
3	13-1081	Logisticians	4,142	4.4%	26.3%	6,839	61%	Bachelor's degree
4	51-9061	Inspectors, Testers, Sorters, Samplers, Weighers	3,958	4.3%	30.5%	10,235	39%	High School Education/training less than one month
5	17-2112	Industrial Engineers	3,591	3.9%	34.4%	5,894	61%	Bachelor's degree
6	13-1023	Purchasing Agents	2,583	2.8%	37.1%	9,363	28%	Bachelor's degree
7	53-7062	Laborers and Freight, Stock, and Material Movers	2,334	2.5%	39.7%	38,794	6%	High School Education/training less than one month
8	15-1121	Computer Systems Analysts	2,136	2.3%	41.9%	14,856	14%	Bachelor's degree
9	17-3026	Industrial Engineering Technicians	2,102	2.3%	44.2%	2,652	79%	Mid-level: High School education, plus >one month training to <4 years education
10	49-3011	Aircraft Mechanics and Service Technicians	2,098	2.3%	46.5%	5,881	36%	Mid-level: High School education, plus >one month training to <4 years education
11	17-3013	Mechanical Drafters	1,865	2.0%	48.5%	2,906	64%	Mid-level: High School education, plus >one month training to <4 years education
12	17-2071	Electrical Engineers	1,816	2.0%	50.4%	5,620	32%	Bachelor's degree
13	15-1133	Software Developers, Systems Software	1,798	1.9%	52.3%	15,016	12%	Bachelor's degree
14	15-1132	Software Developers, Applications	1,670	1.8%	54.1%	41,608	4%	Bachelor's degree
15	13-1199	Business Operations Specialists, All Other	1,538	1.7%	55.8%	26,474	6%	Mid-level: High School education, plus >one month training to <4 years education
16	51-1011	First-Line Supervisors of Production and Operating Workers	1,444	1.6%	57.3%	12,212	12%	High School Education/training less than one month
17	17-2141	Mechanical Engineers	1,389	1.5%	58.8%	5,962	23%	Bachelor's degree
18	11-9041	Architectural and Engineering Managers	1,323	1.4%	60.3%	5,999	22%	Master's, Ph.D., and professional degrees
19	13-1111	Management Analysts	1,304	1.4%	61.7%	16,512	8%	Bachelor's degree
20	51-4041	Machinists	1,297	1.4%	63.0%	6,011	22%	Mid-level: High School education, plus >one month training to <4 years education
21	15-1143	Computer Network Architects	1,230	1.3%	64.4%	5,344	23%	Bachelor's degree
22	13-2031	Budget Analysts	1,183	1.3%	65.6%	2,290	52%	Bachelor's degree
23	51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	1,114	1.2%	66.8%	3,089	36%	High School Education/training less than one month
24	43-5071	Shipping, Receiving, and Traffic Clerks	997	1.1%	67.9%	14,070	7%	High School Education/training less than one month
25	51-4111	Tool and Die Makers	914	1.0%	68.9%	1,522	60%	Mid-level: High School education, plus >one month training to <4 years education

Appendix D — Aerospace Top 50 Occupations, 2012 Q2, May 2013

Ranking	SOC	Occupation	Aerospace Employment	Share of Total Aerospace	Cumulative Percentage	Total Employment for this Occupation (all industries)	Aerospace Share of Total Employment for this Occupation	Education Level
26	15-2031	Operations Research Analysts	906	1.0%	69.9%	2,029	45%	Master's, Ph.D., and professional degrees
27	15-1131	Computer Programmers	900	1.0%	70.8%	13,643	7%	Bachelor's degree
28	17-2131	Materials Engineers	899	1.0%	71.8%	1,188	76%	Bachelor's degree
29	17-2199	Engineers, All Other	895	1.0%	72.8%	4,001	22%	Bachelor's degree
30	49-9041	Industrial Machinery Mechanics	853	0.9%	73.7%	6,843	12%	Mid-level: High School education, plus >one month training to <4 years education
31	17-2072	Electronics Engineers, Except Computer	790	0.8%	74.5%	3,648	22%	Bachelor's degree
32	49-2091	Avionics Technicians	688	0.7%	75.3%	1,300	53%	Mid-level: High School education, plus >one month training to <4 years education
33	17-3012	Electrical and Electronics Drafters	677	0.7%	76.0%	1,182	57%	Mid-level: High School education, plus >one month training to <4 years education
34	13-1151	Training and Development Specialists	651	0.7%	76.7%	4,114	16%	Bachelor's degree
35	15-1141	Database Administrators	621	0.7%	77.3%	2,775	22%	Bachelor's degree
36	51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	621	0.7%	78.0%	953	65%	Mid-level: High School education, plus >one month training to <4 years education
37	43-6011	Executive Secretaries and Executive Administrative Assistants	616	0.7%	78.7%	14,362	4%	Mid-level: High School education, plus >one month training to <4 years education
38	11-3021	Computer and Information Systems Managers	599	0.6%	79.3%	10,494	6%	Bachelor's degree
39	11-3051	Industrial Production Managers	594	0.6%	80.0%	3,128	19%	Bachelor's degree
40	51-9122	Painters, Transportation Equipment	589	0.6%	80.6%	1,804	33%	High School Education/training less than one month
41	17-3021	Aerospace Engineering and Operations Technicians	572	0.6%	81.2%	760	75%	Bachelor's degree
42	13-2011	Accountants and Auditors	545	0.6%	81.8%	27,167	2%	Bachelor's degree
43	13-1071	Human Resources Specialists	543	0.6%	82.4%	10,758	5%	Bachelor's degree
44	51-2022	Electrical and Electronic Equipment Assemblers	483	0.5%	82.9%	4,747	10%	High School Education/training less than one month
45	51-2092	Team Assemblers	468	0.5%	83.4%	5,828	8%	High School Education/training less than one month
46	51-9199	Production Workers, All Other	461	0.5%	83.9%	5,199	9%	High School Education/training less than one month
47	43-5061	Production, Planning, and Expediting Clerks	458	0.5%	84.4%	5,288	9%	High School Education/training less than one month
48	13-1051	Cost Estimators	410	0.4%	84.8%	5,255	8%	Bachelor's degree
49	51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	399	0.4%	85.2%	2,346	17%	High School Education/training less than one month
50	11-3031	Financial Managers	393	0.4%	85.7%	11,860	3%	Bachelor's degree
	Top 50 Occupations Totals		**79,773**	**85.7%**	**--**	**431,487**	**18%**	
	Grand Total		93,115	100.0%	--			

*Employment and wages not shown to avoid disclosure of data for individual employer.
Source: Labor Market and Economic Analysis Branch, Employment Security Department

Appendix E - Aerospace Employer Survey Results

Survey Distribution and Overall Response Rate

- **694 firms surveyed** (who received email or post version)
    - 751 firms were identified on our combined contact list of aerospace employers. We combined lists from the following sources: Governor's office, Association of Washington Businesses (AWB), and the Pacific Northwest Aerospace Alliance (PNAA).
        - 57 firms were removed due to returned emails, opt-outs, or undeliverable mail surveys indicating company was out of business or had moved.
- **100 valid responses (14.4 percent response rate)**
    - 105 completed responses received
    - 5 responses removed – outside industry scope

Survey Respondents by Industry

4-digit NAICS	Industry	Respondents
3261	Plastics Product Manufacturing	2
3323	Architectural and Structural Metals Manufacturing	1
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Mfg	5
3329	Other Fabricated Metal Product Manufacturing	1
3333	Commercial and Service Industry Machinery Manufacturing	1
3335	Metalworking Machinery Manufacturing	1
3339	Other General Purpose Machinery Manufacturing	1
3344	Semiconductor and Other Electronic Component Manufacturing	1
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufact	1
3359	Other Electrical Equipment and Component Manufacturing	1
3364	**Aerospace Product and Parts Manufacturing**	**57**
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	1
4881	Support Activities for Air Transportation	2
5413	Architectural, Engineering, and Related Services	4
5415	Computer Systems Design and Related Services	1
5629	Remediation and Other Waste Management Services	1
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	1
	Blank	18
	Total	100

Approximately what percentage of your business is with the major aerospace firms or their subsidiaries?

Percentage range of respondent business conducted with major aerospace firms	Respondents	Percent
None	18	18%
1-25 percent	18	18%
25-50 percent	9	9%
50-75 percent	9	9%
75-100 percent	46	46%
Total	100	

Major aerospace firms include: Boeing, Airbus/EADS. Bombardier, Embraer, Gulfstream, Lockheed Martin, Mitsubishi Aircraft, and Northup Grumman

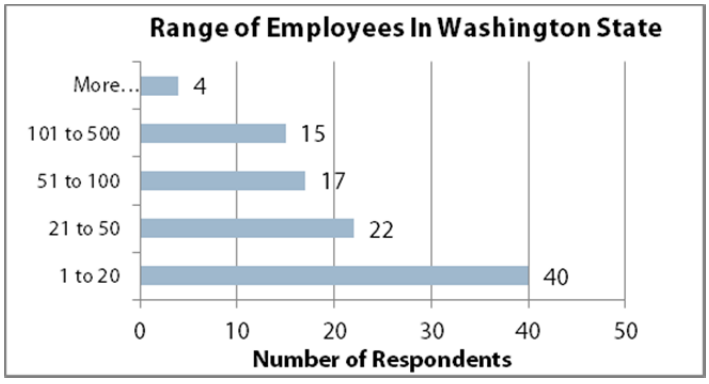
Approximately how many employees does your company have?

Number of Employees	In Washington State	In the US, but outside Washington	Outside the US
1 to 20	40	11	7
21 to 50	22	2	1
51 to 100	17	--	--
101 to 500	15	2	1
More than 500	4	--	1
Blank	2	85	90
Total	100	100	100

Approximately what percentage of your business is with the following major aerospace firm?

Firm	Percent of Business	Respondents
Boeing	41%	78

Survey Respondents by Size of Firm (Washington-based employees)



Please provide an estimate of the number of employees for each of the following categories: (a) the current number of employees at your company; (b) the employees your company expects to have five years from now; and (c) the employees your company expects to retire in the next five years.

	Current Employment			2018 Employment Expectations			2018 Retirement Expectations		
Occupation	Number of firms identifying occupation	Total Number of Current Employeees in Washington	Average Number of Current Employeees in Washington	Number of firms identifying occupation	Total Number of Employees in Washington Expected to be Employed in 2018	Average Number of Employees in Washington Expected to be Employed in 2018	Number of firms identifying occupation	Total Number of Employees in Washington Expected to Retire by 2018	Average Number of Employees per Firm in Washington Expected to Retire by 2018
Administrator/ Management	94	1,039	11	83	1,062	13	68	107	2
Airframe Mechanic	12	96	8	11	93	8	9	1	0
Assembly Mechanic	37	431	12	34	506	15	22	81	4
Electrical Assembler	23	522	23	23	562	24	14	8	1
CNC Programmer/ Operator	56	278	5	50	403	8	34	19	1
Composites/ Manufacturing	40	473	12	36	553	15	29	29	1
Computer Technician	28	81	3	24	93	4	20	7	0
Engineering Technician	35	186	5	28	199	7	19	6	0
Engineers	52	1,490	29	45	1,636	36	33	41	1
Machinist	52	1,003	19	48	949	20	36	66	2
Planner (Manufacturing Planner/ Manufacturing Engineer)	66	161	2	60	192	3	39	19	0
Quality Assurance/ Inspector	77	374	5	66	412	6	52	38	1
Tool Maker	45	53	1	42	69	2	35	16	0
Other (all others combined)	37	192		32	503		29	12	
Total - All Occupations		6,378			7,232			438	

How many new employees have you hired in the last 12 months?

New employees hired last 12 months	Respondents	Percent
None	19	19%
1 to 10	54	55%
11 to 20	10	10%
21 to 40	10	10%
41 to 100	5	5%
100+	1	1%
Average Number of New Hires	11	

When hiring for positions requiring each level of education, approximately how many years of job experience do new hires have?

Education Level	None	1 to 2 Years	3 to 5 Years	6 to 10 Years	11 Years or More	Respondents
High School Diplomas/G.E.D	35%	30%	27%	5%	4%	83
Post-Secondary (Less than a Bachelors)	27%	38%	22%	10%	4%	79
Bachelors	25%	25%	28%	17%	6%	69
Graduate Degrees	39%	6%	24%	20%	11%	54
Other	52%	15%	30%	0%	4%	27

Considering only those people who have applied and been interviewed/tested for jobs at your establishment in the past year, please rate each of the following skill sets:

	Very Adequate	Adequate	Inadequate	Very Inadequate	Not Applicable (or Don't Know)	Respondents
Reading	20%	64%	7%	1%	7%	94
Writing	13%	59%	17%	2%	10%	94
Math	16%	43%	27%	3%	12%	94
English	23%	63%	6%	0%	8%	93
Aerospace Specific Skills	10%	32%	38%	5%	14%	91
Computer Skills	14%	57%	14%	2%	13%	93
Team Work Skills	10%	64%	15%	2%	10%	94
Shop Safety/Work Environment Skill	11%	57%	18%	2%	12%	93
Problem Solving or Critical Thinking Skill	10%	46%	34%	3%	7%	94
Communication Skill	9%	55%	29%	1%	6%	94
Positive Work Habits and Attitude	17%	54%	20%	2%	6%	94
Accept Supervision	15%	70%	8%	0%	8%	93
Adaptability	17%	61%	15%	0%	7%	94
Customer Service	11%	56%	18%	0%	15%	94

Using the list of occupations provided, please provide the specific job titles and approximate number of vacancies for at least three occupations for which you have had the hardest time filling vacancies for in the past 12 months.

Occupation	Aggregate Number of Vacancies	Number of Firms Identifying Occupation
Machinist	128	28
Other	84	39
Manufacturing/Production	57	16
CNC Programmer/Operator	49	20
Quality Assurance/Inspector	42	24
Assembler	31	6
Engineers	30	15
Planner (Manufacturing Planner/Manufacturing Engineer)	23	11
Airframe Mechanic	19	6
Designers	17	4
Administrators/Management	15	9
Engineering Technician	10	3
Tool Maker	9	6
Computer Technician	0	0

What are the primary drivers creating the largest turnover within your company's existing workforce?

Turnover cause (broad categories compiled from survey responses)	Number of respondents
Boeing	16
Competition	15
We don't have high turnover	15
Retirement/Age	7
Pay/Benefits	18
Work Habits/ Attitude	19
Skill level	15
Lack of Qualified candidates	7
Economic Drivers	6
Employee Personal Choices	8
Location	5
Other	24

"Other" responses:

- *Changes in contracts.*
- *Fluctuation schedule.*
- *Lack of sales due to product is niche and business comes in peak and valleys.*
- *Layoffs.*
- *New business/growth.*
- *Non-career positions are tough to keep filled.*
- *Personality conflicts.*
- *Projects in the shop - sometimes are busier than others. When it is busy we have to hire more people, when it is slow we have to lay people off.*
- *Salary and fast-paced work environment for qualified engineers.*
- *Unstable production work levels, lack of customer forecasting (feast or famine).*
- *Unwillingness to change.*
- *Work load.*
- *Advancement.*
- *Employees seeking consistent, stable schedule.*
- *Lack of work.*
- *Company growth creating need for personnel with higher qualifications.*
- *Failure to adhere to requirements.*
- *Found a better job.*
- *Lack of career growth.*
- *Lack of good management.*

How have you responded over the last year to difficulty finding qualified applicants?

	Respondents = 90	
Response to difficulty finding qualified applications	**Firms Identifying Reason**	**Percent**
Increased overtime hours for current workers	56	62%
Hired a less qualified applicant	45	50%
Increased recruiting efforts	39	43%
Did not fill the job opening	36	40%
Outsourced work or purchased services from another firm	32	36%
Engaged education providers to access skilled graduates exiting their programs	26	29%
Increased wages to attract more applicants	21	23%
Other	20	22%

"Other responses":

- *I have 4 employees in the AJAC program that I am paying the tuition. We need skilled CNC Machinist.*
- *Brought in a temp and if they could perform the job tasks for 90 days they would be hired.*
- *Wages.*
- *Have a need for a tool maker – started training apprentices.*
- *We have successfully hired candidates.*
- *Attended Job Fairs and other outreach.*
- *Due to my location never tried to hire any new employees.*
- *Wait for someone who wants to teach.*
- *Word of Mouth.*
- *Ran our own AJAC pre-apprenticeship program and became an AJAC apprenticeship site*
- *Cycling through temps.*
- *Hired – Paid High School Interns.*
- *Paid high costs to recruit candidates from outside the state and most have very little experience.*
- *The work load varies so much that I resist hiring even part time.*
- *We wait to fill positions until we find someone qualified.*
- *Increased our in-house training efforts and started with AJAC in the mold maker apprenticeship program.*
- *We trained, and then trained some more.*
- *Hired intern from Germany.*

Which of the following methods does your company use to help the next generation of workers prepare for careers?

How does your company prepare the next generation of workers	Respondents	Percent
Employ interns from high school vocational programs	29	39%
Employ interns from colleges and/or universities	48	65%
Allow employees to mentor high school or college students on company time	21	28%
Encourage employees to mentor high school or college students on their own time	11	15%
Other, specify	19	26%

"Other" responses:

- *Attend local high school and college job fairs and career days.*
- *Company participation in AFA, Gov.'s Aerosp Pipeline Comm. & advocacy of state vocational programs.*
- *Employees mentor trainees who have disabilities and barriers to employment.*
- *Encourage employees to participate in programs such as AJAC.*
- *Hire and train students exiting machining schools.*
- *Hired Interns from Aviation High School.*
- *I have begun an Instructor position with the local junior college teaching machine technology.*
- *I hired a "vet" who did not have a GED, had been home schooled and didn't know ANY math.*
- *I pay to educate my employees so they can move forward in a career.*
- *In-house training.*
- *Internal education and development programs.*
- *Let them see our business/tell them about opportunities in the machining world.*
- *OJT.*
- *Participate in outreach programs at UW School of Engineers, WISE events.*
- *Pay for AJAC training for employees who are interested in advancing their careers.*
- *Pay for outside training, education, English classes.*
- *Provide training to current staff to bring up to the standards required for their jobs.*
- *Started training apprentices.*
- *Support of and involvement with STEM projects locally.*
- *Try to educate local educators of the needs of our industry.*
- *We have hired employees still in high school but not in the last 12 months.*
- *We have three employees going through the AJAC program.*

Within the last year, have you hired any workers from any of the following: an apprenticeship program, community college, technical college, and/or the WATR (Washington Aerospace Training and Research) Center?

	Respondents	Percent
Yes	41	42%
No	57	58%

Approximately how many workers have you hired from the following providers?
Please also write in the name(s) of the provider.

Apprenticeship Program	Respondents	Approximate # of Employees
Aero Jack Community	1	6
Aerospace Assembler	1	1
AJAC	7	26
AJAC, Tool &b Die Maker	1	1
AJAX	1	4
Bates - We select employees for the program; do not hire "from" the program	1	12
Program Name Missing	7	5
Grand Total	19	55

Community College	Respondents	Approximate # of Employees
Edmonds, Everett, Shoreline, etc.	1	5
Everett Community College	1	2
Green River Community College	3	6
Renton and Shoreline	1	3
Shoreline Technical College	2	2
Skagit Valley College	1	5
Spokane Community College	2	4
South Seattle Community College	1	1
Tahoma HIGH SCHOOL	1	2
U.W. Aerospace Program	1	1
Wenatchee Valley College	1	2
Yakima Valley Community College	1	1
College Name Missing	4	7
Grand Total	20	41

Technical College	Respondents	Approximate # of Employees
Bates AJAC Program	1	8
Bates Machining	1	1
Bates, Renton, Clover Park	1	7
Bellingham Technical College	1	5
Clover Park Technical College	4	8
Clover Park, Bates	1	2
Everett Community College	2	8
Lake Washington Tech College	4	12
Perry Technical	3	7
Renton Technical	2	2
Technical College Conneticut	1	1
College Name Missing	5	6
Grand Total	26	67

WATR Center	Respondents	Approximate # of Employees
WATR Center	6	17

Of the workers that you have hired from one or more of these training providers (apprenticeship programs, community colleges, technical colleges, and/or the Washington Aerospace Training and Research (WATR) Center), on average how would you rate them on the following:

Skill Category	Very Adequate	Adequate	Respondents
Reading Skills	23%	70%	43
Writing Skills	21%	67%	39
Math Skills	22%	66%	41
English Language	24%	76%	41
Aerospace Specific Skills	15%	59%	39
Computer Skills	26%	64%	39
Team Work Skills	20%	63%	41
Shop Safety Skills	14%	76%	42
Problem Solving Skills	23%	51%	39
Communication Skills	17%	76%	41
Positive Work Habits	20%	63%	41
Accepts Supervision	21%	74%	43
Adaptability	22%	66%	41
Customer Service Skills	6%	82%	34
Other	29%	57%	7

Have you worked directly with any of the training providers (apprenticeship programs, community colleges, technical colleges, or the Washington Aerospace Training and Research (WATR) Center)?

Yes	43
No	57
Respondents	100

How would you describe your participation with training providers? (e.g., Someone at my company is on an advisory committee, our company contracts with the provider for training, etc.)

- 40 people responded
- 17 mentioned an employee was on an advising committee or a Board
- 9 employers contract with
- 3 have posted jobs, or looked for prospective employees
- 3 have employees who are instructors
- 8 responded with "other"

Is your engagement with the training provider(s) satisfactory?

Yes	35	85%
No	6	15%
Missing	59	-
Respondents	100	100%

Why was your engagement with the training provider not satisfactory? (selected responses)

- *Experience with the college campus has been difficult as this was a new program just beginning, and I (having worked in a business environment so long) am not used to the slow moving bureaucracy. I find myself trying to teach skills without the proper tools, and sometimes without any tools. People I have met or hired from the technical school are not well equipped to be aerospace machinists as they seem to be lacking in a strong work ethic and/or the ability to maintain close tolerance work. One person I know who attended the local tech school is very capable, but learned his ethics from the military, and has been very disappointed with the school. When he gave recommendations about what would help him, he was ignored.*
- *Hires' expectations for wages was too high, attitude issues, some workmanship issues.*
- *I don't believe we've helped them. They wanted to bring people through and place one here for a couple days but we didn't do that.*
- *There was no consideration for skill level or ability in the apprenticeship program, you had to complete elementary work. The program should be able to train AS NEEDED.*
- *We are not fully engaged in this coordination as our program to do so has not been fully defined.*
- *We received no inquiries to our job postings (cnc machinist).*

Will aerospace industry expansion over the next 5-10 years result in any other anticipated impact on your workforce or employment practices, including outsourcing, which we have not asked you about? (selected responses)

- *Depends on if they stay local with manufacturing - if Boeing moves, then we will have an excess of qualified applicants.*
- *No, we do not outsource and do not foresee any change in our practices. We currently benefit from the WA state B&O tax credit for research and development. The savings from this credit pays for our summer intern, which we will no longer have if the credit is not renewed.*
- *Of course. We are continually looking to rely on our supply chain to support our continued growth. This includes local supply chain as well as low-cost domestic and international sources.*
- *Qualified work force will likely be a constraint to growth which may affect employment practices. Have reviewed the possibility of outsourcing to low cost areas.*
- *Unknown. Significant UAV manufacturing here in Washington could have a residual effect on our business and hiring.*
- *We are concerned that the cost of land acquisition required for expansion will increase.*
- *We'd like to outsource less but in reality there'll probably be more carbon fibers or composites so we'll probably have to outsource more.*
- *Yes, we will continue to outsource outside of the state and country.*

Appendix F

Employer Satisfaction Survey – Detailed Results

37	S1 respondents willing to participate in satisfaction survey
10	removed - out of scope (did not hire in the last year)
1	removed - out of scope (educational institution)
26	revised S2 denominator
11	S2 respondents
42.3%	Response rate

Question 1B. How many employees does your company have?

Respondent Distribution by Size of Firm

Number of Employees	Percent of Respondents
1 to 20	9%
21 to 50	18%
51 to 100	18%
101 to 500	46%
More than 500	9%

Question 2. From which ONE program have you hired the MOST employees? Would you say an apprenticeship program, a community college program, a technical college program or the Washington Aerospace Training and Research (WATR) Center?

Program Type	Number of Respondents	Percent of Respondents
An apprenticeship program	2	18.2
A community college	3	27.3
A technical college	4	36.4
The WATR Center	1	9.1
Total	10	90.9
Don't know	1	9.1

WATR Center: Washington Aerospace Training and Research Center

Question 2B. What is the name of the program? (Formal institutional names added in parenthesis)

1. Big Bend Community College
2. Renton Vo-Tech (Renton Technical College)
3. Shoreline Technical College (Shoreline Community College)
4. Everett Community College technical or transfer degrees
5. Lake Washington Vo-tech (Lake Washington Institute of Technology)
6. Perry Tech (Perry Technical Institute)
7. U of W, primarily cyber security is of late our concentration (University of Washington)
8. Lake Washington Vocational Tech (Lake Washington Institute of Technology)
9. Renton Tech (Renton Technical College)
10. Bates Technical College, Green River Community College
11. AJAC (Aerospace Joint Apprenticeship Committee)
12. Edmonds (Edmonds Community College)
13. South Seattle Community College
14. Shoreline Community College
15. Renton Technical College

Question 3. Approximately how many employees have you hired within the last 2 years?

Range of Employees Hired	Frequency	Percent
1 to 9	7	63.6
10 to 20	3	27.3
Total	10	90.9
Don't know	1	9.1

Position Hired	Number of Firms	Percent of Respondents
Airframe Mechanic	1	9.1
Aircraft Airframe or Powerplant Mechanic	1	9.1
Draft and Design Technician	1	9.1
CNC Programmer or Operator	5	45.5
Composites or Manufacturing Worker	3	27.3
Engineering Technician	3	27.3
Machinist or Machine Tool Technician	6	54.5
Other Occupations	6	54.5

Question 5. How do you rate your employees on the EDUCATIONAL PREPARATION for their particular job? Would you say: excellent, good, fair, or poor?

Educational Preparation	Number of Respondents	Percent of Respondents
Excellent	4	36.4
Good	4	36.4
Fair	3	27.3
Poor	0	0
Total	11	100

Question 6. How do you rate your employees on the PERFORMANCE LEVEL for their particular job? Would you say: excellent, good, fair, or poor?

Educational Preparation	Number of Respondents	Percent of Respondents
1 Excellent	4	36.4
2 Good	6	54.5
3 Fair	1	9.1
Poor	0	0
Total	11	100

Question 7A-H. Next I will read a list of key job related areas. For each area, I would like to know how you would rate the skills of your employees, whether they are more than adequate, adequate, need improvement, or it is not applicable?

	Total Number of Respondents = 11			
	Percent of Respondents			
Skill Set	**More than adequate**	**Adequate**	**Needs improvement**	**Not applicable/Don't know**
Technical job skills	27.3	63.6	9.1	0
Safety or environmental skills	27.3	54.5	9.1	9.1
Problem-solving skills	45.5	27.3	27.3	0
Communication skills	45.5	54.5	0	0
Ability to work with others	36.4	63.6	0	0
Work ethic	27.3	72.7	0	0
Adaptability or flexibility	27.3	63.6	0	9.1
Integrity	27.3	54.5	9.1	9.1

Question 8. Please explain why you answered 'Needs improvement'.

Number of Respondent = 4

1. A personality issue.
2. There are many things that come up, so many variables in the machining, that you can't possibly go through all of them in a classroom, especially the machine set-up for the different parts because each part is unique and requires different techniques for
3. When they're in the classes they're learning, let's say, A,B,C, D but when they get to the workplace it may go A,B, F, D. At college they try to get so much in in such a short period of time that a lot of times they don't focus on troubleshooting or problem solving.
4. They do a lot of online training but when it comes to hands-on, I've been told by the employees that there's a lack of tools, lack of equipment time, and lack of classroom time for this.

Question 9. What additional skills do you wish the students or graduates possessed before coming to your company?

1. Certification
2. More hands-on training

3. Problem solving in different areas than what trained in
4. More math skills, especially trig
5. Previous experience in our field
6. Experience in consulting
7. Students having some exposure to the jobs ahead of the time
8. Knowledge of motors and controls
9. Finding out what the differences between the different workplaces
10. Awareness that manufacturing is a good career choice
11. Blueprint reading
12. More shop safety training
13. Work their way up rather than want to be instant leader
14. Exposing students to the different ways of doing things at different companies
15. Use of measuring tools (gages, calipers, etc.)
16. Work ethic tools, especially attendance!

Question 10. Are there other majors that can be trained through an apprenticeship program, community college, technical college, or the WATR center from which your company seeks to hire that we have not mentioned?

	Percent of Respondents
Yes	36.4
No	63.6

Question 10. What other majors would you recommend that can be trained?

1. Engineering, instrumentation automation program
2. Industrial maintenance technician, aerospace inspection person
3. Specific job titles that relate to plastic injection molding, which is what our company does.
4. NDT, painting, heat treating, and chemical processing.

Question 11. Other comments?

1. Just a little more experience and challenge them a little more -- that's all I can think of as far as ways to improve their training.
2. Starting at the high school level, individuals should have the choice between a college type education or an apprenticeship program. That requires also more education of schools and students that those programs be made available.

3. CNC programmers. Regarding this position, the schools for this locally aren't pumping enough of them out. Boeing is getting all of them. When I advertised for this position, I got three applicants and they were all from far away states.

Appendix G - Report History

Second Substitute House Bill 2156 was passed in the 2012 Legislative session (Chapter 50 of the Laws of 2012). The bill relates to the "coordination and evaluation of workforce training for aerospace and materials manufacturing." The bill aims to improve the state aerospace training system by better aligning it with the industry's immediate and long term training needs. The legislation also seeks to "increase jobs available for Washington's citizens" by increasing their skill development and training.

The State Board for Community and Technical Colleges (SBCTC) is to "facilitate coordination and alignment of aerospace training programs to the maximum extent possible." This is to be done through coordination with other training and apprenticeship program providers. The alignment activities include:

- Providing current information about the state's programs.
- Providing information about grants and partnerships.
- Coordinating professional development of faculty and training providers.
- Evaluating programs identified by the Aerospace Pipeline Advisory Committee (as discussed in the body of this report).
- Making specific budget recommendations to the Governor and the Legislature for aerospace and advanced materials manufacturing programs.

SBCTC is empowered to "establish an aerospace and advanced materials manufacturing pipeline advisory committee" (Aerospace Pipeline Advisory Committee Appendix A) with the majority of the 11-15 members coming from the industry. Labor representation (2) from the industry is also included. The Aerospace Pipeline Advisory Committee's duties include:

- Providing direction for a skills gap analysis produced with the Workforce Training and Education Coordinating Board (Workforce Board) using data developed from the Education Research and Data Center (ERDC) that is consistent with *A Skilled and Educated Workforce—Joint Report*[26] by the Washington Student Achievement Council, SBCTC, and the Workforce Board providing the "number and type of higher education and training credentials required to match employer demand for a skilled and educated workforce."
- Establishing goals for students served, program completion rates, and employment rates.
- Coordinating and disseminating industry advice from aerospace and advanced materials programs.

[26] A Skilled and Educated Workforce, 2013 Update. A Joint report prepared by the Workforce Board, SBCTC & Washington Student Achievement Council, formerly HECB. http://www.wsac.wa.gov/sites/default/files/2013.11.16.Skills.Report.pdf

- Recommending training programs for review by the Workforce Board in coordination with SBCTC.

On September 1, 2012 and each September thereafter, a report is due that evaluates "the programs recommended for review" by the Aerospace Pipeline Advisory Committee. The evaluation, to be performed by the Workforce Board working with SBCTC, is to include "outcome results both for the persons receiving training and the employers."

The first meeting of the Aerospace Pipeline Advisory Committee was in July 2012 and meetings have taken place every other month since. Since the initial meeting, an Executive Order from the Governor's Office disbanded the Governor's Washington Council on Aerospace. The committee has overseen the definition of the aerospace industry, selection of specific training programs, and aerospace employer survey, all of which are presented in this report.

While Second Substitute House Bill 2156 indicated that the ERDC's employment data should be used for the report, due to the ERDC's pending launch and the long history of the Workforce Board and SBCTC sharing data, ERDC was consulted and all agreed that the most efficient path was to use SBCTC's data warehouse to produce the report, with data analyzed by Workforce Board and SBCTC research staff.