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# Policy Solutions for a Stronger Technical Workforce

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## **Executive Summary**

### **Context**

The aviation maintenance industry, like many other industries, requires advanced technical skills for their workforce. Nationally, the Bureau of the Labor Statistics predicts employment growth of 2.4 percent by 2022. Moreover, employers and trade associations are feeling evidence of a labor shortage “on the ground.” The Government Accountability Office (GAO) conducted a national study of the issue and found inconclusive evidence. This report uses the same data sources to conduct a quantitative regional analysis.

### **Analysis**

Our research examines regional trends and variation in employment, wages, FAA certification, public funding, and postsecondary degrees and certificates for aviation maintenance programs. Both defining and concluding whether a labor shortage exists proves challenging. Based on state-level data that was publicly available, we considered total employment and median hourly wage (adjusted for inflation) to be indicators of employer demand. Likewise, we assessed trends in student degree and certificate completion for aviation maintenance programs as evidence of labor supply.

### **Findings**

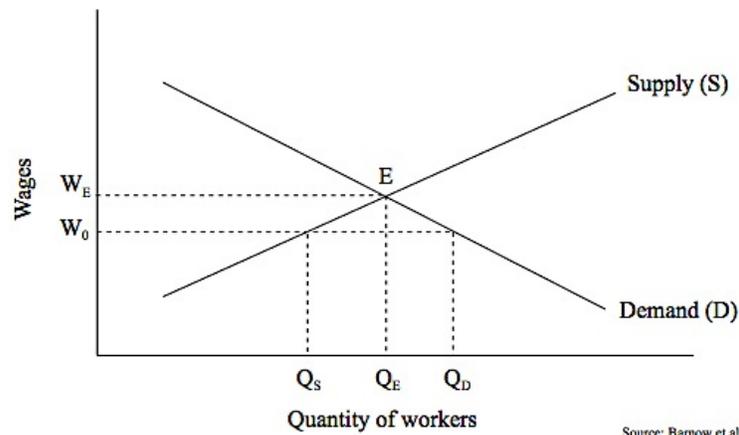
Mainly due to the same data limitations GAO mentions in their report, we were unable to conclusively say whether a labor shortage exists for any particular region. Overall, we found inconsistent employment trends among many of the regions, with only the Southern and Western-Pacific regions showing periods of steady growth over the last decade. Wages have remained relatively flat since the Great Recession (2008-2013). Education completion rates have been on the rise for most regions. Based on these results we present three hypotheses to explain the variation, for which future research is required. First, for regions with employment growth but little to no increase in postsecondary completion or vice-versa, employment migration from neighboring states may be occurring. Second, the growing technical workforce demand, coupled with the transferability of maintenance and electronic skills sets, has led to heightened competition among industries for the growing number of student graduates. Third, despite a rise in student completion rates, a larger share of the existing workforce is retiring, thus the replacement rate is insufficient to meet employment demand.

# Introduction

## Defining Labor Shortage

There is no consensus on the definition of the term “labor shortage.” Barnow, Trutko, and Piatak define labor shortage as “a sustained market disequilibrium between supply and demand in which the quantity of workers demanded exceeds the supply available and willing to work at a particular wage and working conditions at a particular place and point in time.”<sup>1</sup>

**Figure 1. Illustration of a Labor Shortage**



As shown in Figure 1, the supply curve for labor slopes upward because more workers are willing to enter the labor market when wages increase. The demand curve for labor slopes downward because as wages increase, employers are less likely to hire. Figure 1 shows if wages are at  $W_E$ , then the labor market is in equilibrium, where the labor supplied is equal to the labor demanded ( $Q_E$ ). However, if wages are at  $W_0$ , then the quantity of workers willing to enter the market is  $Q_S$  is less than the quantity of workers demanded by employers. Theoretically, the difference between the quantity of labor demanded and the quantity of workers supplied ( $Q_D - Q_S$ ) is the size of the labor shortage.

Barnow et al. provide three main reasons to explain the labor market moving away from equilibrium. First, there could be an increase in the demand of labor, which would shift the demand curve to the right. If the supply of labor and wages stay same, then market cannot supply

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<sup>1</sup> Barnow, Trutko, & Piatak. 2013. Occupational labor shortages: Concepts, causes, consequences, and cures. .2-4, Kalamazoo, Mich: W.E. Upjohn Institute for Employment Research.

the quantity of workers demanded, which results in a labor shortage. Second, a labor shortage can occur if there is a decrease in the supply of labor. If demand and wages do not change, one sees the same result. Third, direct restrictions on wage that do not allow the equilibrium wage can also cause a shortage.<sup>2</sup>

Besides the definition used by Barnow et al., there are several other possible definitions of labor shortage. The Blank-Stigler model, Arrow-Capron dynamic shortage model, the rate of return model, and the monopolistic labor model also are used by economists to define the problem. Most of these models imply that a labor market behaves like a commodity market, where a shortage occurs when the market is not in equilibrium.

However, it is debated that the labor market behaves this way at all. Some analysts believe “labor should not be viewed as a commodity being bought and sold in a market.”<sup>3</sup> If this is the case, can these models apply? It is argued that wages do not adjust instantaneously as prices in the commodity market do.<sup>4 5</sup> It is assumed that the wages should go higher once there is a labor shortage in the market because employers have to compete with each other to attract workers. Haskel and Martin state that this concept might not be completely accurate because “there is little evidence that firms adjust wages to reduce skill shortages.” They would rather try to augment recruitment through other means: by increasing search effort, outsourcing or contracting out jobs, reducing minimum qualifications for jobs, or replacing skilled workers with unskilled labor. One of the reasons firms don't raise wages to hire qualified individuals during times of prosperity is that they feel unable to part ways with the worker in the event of an economic downturn.<sup>6</sup>

## **Relevant Indicators to Measure a Labor Shortage**

Even when we assume the labor market behaves exactly like a commodity market, it is difficult to measure a shortage. In theory, the existence of a labor shortage in an occupation can

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<sup>2</sup> Barnow, 14-18.

<sup>3</sup> MS Cohen, 1995, Labor shortages as America approaches the twenty-first century, 7-8, Ann Arbor: Michigan UP

<sup>4</sup> Trendle, 2008, Queensland Department of Education, Training and the Arts, Labour Market Research Unit, “Skill and labour shortages: definition, cause and implications,” 6-26, Brisbane, Queensland, Australia.

<sup>5</sup> UK Commission for Employment and Skills, 2010, A Theoretical Review of Skill Shortages and Skill Needs, 21-45.

<sup>6</sup> Haskel & Martin, 1993, “Skill shortages, productivity growth, and wage inflation in UK manufacturing,” *CEPR Discussion Papers*, Center for Economic and Policy Research, London.

be determined if the demand exceeds supply. In practice, accurately measuring supply and demand of labor is challenging. Cohen notes that demand of labor is not directly observed, and the employment only indicates labor demand when the market is in equilibrium. Otherwise, the “demand could exceed or fall short of observed employment.” Determining the number of graduates from relevant degree programs may not correspond to an actual level of supply, as people who graduate from that degree program may join the corresponding industry.<sup>7</sup> Data shows this may be a problem within the aviation maintenance industry.

Another solution is using an alternative indicator. Cohen suggests combining multiple indicators to determine the conclusion:<sup>8</sup>

1. Unemployment rate
2. Rate of employment growth
3. Change in weekly wages
4. Projections of long-run employment growth
5. The rate at which workers leave an occupation, called replacement demand
6. The number of aliens granted permanent labor certifications
7. A measure of the amount of training required to perform the duties of a job, called specific vocational preparation

Levine notes that three of the measures: unemployment rate, current and projected employment growth, and rate of wage growth are demand focused, and do not capture the market’s supply component. This, while necessary, may not be sufficient to prove a shortage.<sup>9</sup>

## **National Perspective**

As requested by the Honorable John Thune, the Honorable Bill Shuster, the Honorable Frank A. LoBiondo, the Honorable John L. Mica, and the Honorable Thomas Petri on behalf of the Committee on Commerce, Science, and Transportation and the Committee of Transportation and Infrastructure, the Government Accountability Office (GAO) conducted a study to examine what available data says about the demand and availability for aviation maintenance laborers, and what federal actors are doing to retain workers in the industry.

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<sup>7</sup> Cohen, 25-26.

<sup>8</sup> Cohen 25-26.

<sup>9</sup> Phillip B. (1996) "Labor Shortages as America Approaches the Twenty-First Century by Malcolm S. Cohen."

The report analyzes data from the Bureau of Labor and Statistics' (BLS) Current Population Survey (CPS) on national unemployment rates (not industry specific), employment numbers, and median weekly earnings in order to analyze the labor market. To understand available workforce, the report analyzes data from the Department of Education (DOE) on completion rates for academic degree or certificate programs that would qualify someone to work in the field. The report also analyzes data from the Department of Defense (DOD) on servicemen working in the industry and data from the Federal Aviation Administration (FAA) on mechanic certificates issued.

To determine whether a shortage exists, GAO looked for three of the classic indicators of a shortage that economic literature defines:<sup>10</sup>

1. Low unemployment rates
2. Increase in wages
3. Projected growth in the industry

There was mixed evidence of a shortage using this technique, but GAO could make no strong conclusions. GAO calculated a 3 percent unemployment rate in the industry based on years when unemployment rate was accurately reported and a time sensitive regression to predict the missing data. This is lower than the national unemployment rate, and is the first and only positive indicator of a shortage. Next, GAO found no increase in national employment in the industry, either amongst aviation mechanics or avionics technicians as defined by BLS. There was also no significant increase in median earnings as documented in the report. Lastly, BLS projections showed less than average or no growth in the industry at 0.3 percent. Competing interests actually predict significant growth in the industry. Boeing predicts a 5.8 percent growth rate for all of North America. However, Boeing refuses to share their methodology of the projections for this report. GAO also attempted to vet Boeing's predictions and methodology because of some data reliability issues with BLS, but met the same result.

The report was also limited by data reliability issues. Part of every GAO engagement is a data reliability assessment. First, the titles that BLS uses to classify the occupation(s) (SOC) do not take into consideration the requirements for each position. For example, there are two different positions that fall under the BLS classification of aircraft mechanic. One type are those

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<sup>10</sup> Government Accountability Office, 2014, Aviation Workforce: Current and Future Availability of Aviation Engineering and Maintenance Professionals (14-237), 10, Washington, DC

who are educated in a postsecondary institution and then take the FAA exam to gain their certification. The other type, known in the industry as a repairman, are those who work at a repair station under a certified repairman, and get their certification when they are recommended for it. The repair station signs off on the work this type does. Obviously there are different requirements that would attract different individuals to each of these positions. Classifying them the same way means that one cannot track each position separately. Second, the BLS data is also collected by survey. As with any survey, there will be sampling and response errors. Third, annual employment data only includes occupations with 50,000 people. This leaves out some data for avionics technicians. Fourth, unemployment data comes from a person's last job, not the longest job or where someone's trying to work. Classic economic literature includes unemployment rates because it is assumed that someone will look for a job in the same field as their last job, and stay within the same career. Fifth, there is no data for starting wages. As already discussed, an increasing median wage is not by itself a good positive indicator. An aging workforce might simply increase the median wage by itself. The last data reliability issue is that data is missing on job vacancies at the occupational level. Economic literature explains that information on job vacancies is useful in conjunction with the other information collected to describe a shortage.<sup>11</sup>

## **Federal Policy Initiatives**

### *The Workforce Innovation and Opportunity Act*

The Workforce Innovation and Opportunity Act is legislation designed to improve technical workforce development across the country. Renewed in 2014, the amendments demonstrate an increased focus on state systems for growing a skilled workforce. Title I Subtitle B is the first, focusing on statewide investment systems. This new addition requires the creation of a state board to assist the governor in developing a statewide workforce development system. The state has jurisdiction as to how to fill the board, with some combination of appointees and elected seats. The amendment also grants those state boards the power to designate specific local investment areas. This power used to be held solely by the governor, but the power to determine eligibility for training providers still remains. WIOA states that local boards should submit

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<sup>11</sup> Swearingen, Melissa and Andrew Von Ah, Interviewed by Menuka Ban, Cale Jones, and Emily Uselton, 2014, "Interview with GAO 14-237 Analyst Team," September 25.

specific areas to the state board for approval. The amendment also, by the end of 2014, requires a plan that outlines a three-year strategy for statewide workforce development. That plan must describe:

1. Strategies and services to more fully engage employers and meet their needs. This includes ways to assist at-risk and out-of-school youth in acquiring education, skills, credentials and employment experience.
2. How the state board will convene industry or sector partnerships. These partnerships should be designed to lead to collaborative planning, resource alignment, and training efforts across multiple firms for a range of workers currently or potentially employed by a targeted industry cluster.
3. How the state will use technology to facilitate access to services in remote areas.
4. State actions to foster communication, coordination, and partnerships with non-profit organizations. These organizations should be ones that provide employment-related training and complementary services.
5. The process and methodology for determining one-stop partner program contributions for the cost of infrastructure for one-stop centers. This includes the formula for allocating investment for such infrastructure.

Subtitle D requires the Secretary of Education to investigate the national programs once every 5 years. It also requires the Secretary to create a system so that states could share information and best practices.

Subtitle F calls for a state “unified plan” that will describe a workforce investment system and its relationship with adult education in the state. These plans should be submitted for approval to the Secretary of Education to approve. This subtitle also allows the state to consolidate all funding for this purpose with the exception of funding from Perkins grants.

Title II of WIOA defines "adult education and family literacy education programs" as a sequence of academic instruction and educational services below the postsecondary level that increase an individual's ability to read, write, and speak English and perform mathematical computations leading to a level of proficiency equivalent to at least a secondary school

completion. Thus, it does not match the definition of career and technical education relevant to the industry and should be disregarded.<sup>12</sup>

### *Perkins Act*

The Perkins Act gives grants to states for career and technical education programs. States are required to submit their budget for the programs, and several indicators of their performance career and technical education (CTE). These indicators include:

1. Student attainment of academic standards as defined by each state
2. Student attainment of technical proficiencies as defined by industry recognized standards
3. Graduation rates
4. Job or postsecondary education placement rates
5. Success in alternative fields

There are two types of grants that states are eligible to receive. Title I grants are general block grants that are awarded for states to use on all of CTE. This is the larger of the funding sources. Title II grants are smaller grants that are used specifically for programs that are preparatory for further postsecondary study.<sup>13</sup>

## **Regional Analysis**

### **Overview**

#### *Data Sources*

To disentangle the mixed evidence of potential labor shortage concerns at the national level this study assesses similar data sources at the regional level. The paper extracts state level data from the following government sources: BLS, Department of Education – Integrated Postsecondary Education Data System (IPEDS), and the FAA. In general, all data sources cover the time period of 2003 to 2013. BLS data includes occupational employment statistics for two occupational codes of interest in the aviation maintenance sector, Aircraft Maintenance Repairmen (49-3011) and Avionics Technicians (49-2091). In addition, BLS is used to determine median hourly wage for both occupational codes from 2003 to 2013. It is worth noting the BLS occupational distinctions do not consider whether an employee holds a relevant FAA

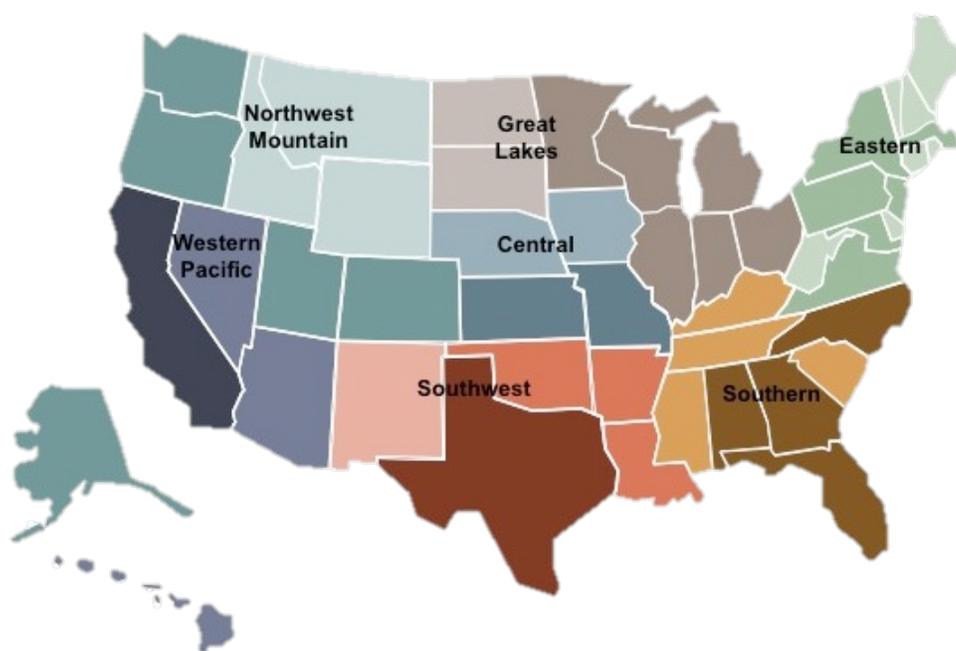
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<sup>12</sup> Workforce Innovation and Opportunity Act, 2014, 113<sup>th</sup> Congress, 1-199.

<sup>13</sup> US Department of Education, 2014, Reauthorization of Carl D. Perkins Act, <http://www2.ed.gov/policy/sectech/leg/perkins/index.html>.

certification for their field. IPEDS data provides information about the number of institutions offering programs in aviation maintenance and the total number of degrees and certificates issued by year.<sup>14</sup> Specifically, degrees and certificates for Airframe Mechanics and Aircraft Maintenance Technicians, Aircraft Power Plant Technicians and Avionics Maintenance Technicians are reviewed. FAA data supplies total annual number of aviation mechanic certificates and repairman certificates. Aviation Mechanic certificate data combines the airframe and power plant maintenance certificates. The FAA is also used to review the number of secondary schools offering an aviation vocation focus, though not necessarily exclusively.

**Figure 2. FAA Regions**



The paper divides the country into industry-known FAA regions. Guided by employment concentrations, it merges the New England region with the Eastern region to analyze collectively as the Eastern Region. Furthermore, it places Alaska as part of the Northwest Mountain region and Hawaii as part of the Western-Pacific region. The map above shows each FAA region (for purposes of the analysis) by color differentiation. The gradient of color within each region is indicative of the state's total employment concentration.<sup>15</sup>

<sup>14</sup> IPEDS only reports education statistics for institutions accepting federal student financial aid under the Higher Education Act

<sup>15</sup> Total employment refers to both BLS Occupation Codes 49-3011 and 49-2091 for 2013. Light = 0-99 employees; Medium = 100-2,499; Dark = 2,500-14,610.

This report is intended to be a resource guide for stakeholders in the aviation maintenance industry. Our intent was to provide information about the broad policy landscape across the country by summarizing regional employment, earnings, education, and legislative data. Subsequent sections will focus on individual regions, assessing the multiple dimensions of employment, earnings, education, industry certification and federal funding. The order of regional analysis is illustrative of the region’s total employment rank (highest to lowest). Looking across the regions certain trends and information are useful for framing the context of the individual regional analysis.

*National Trends*

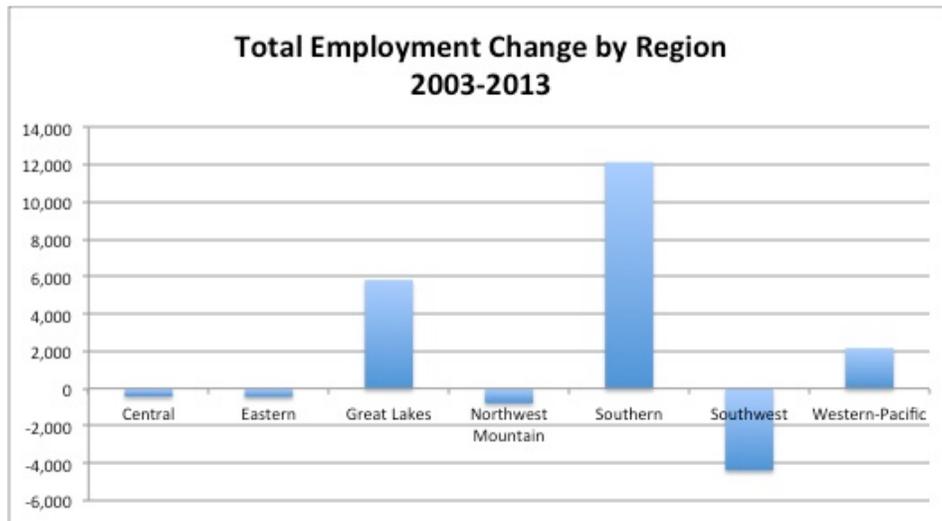
**Table 1. Regional Summary (2013)**

	Members	Employment	High Schools*	Post Secondary Institutions**	Post Secondary Certificates/Degree Completion	Total FAA Certificates Held	Perkins Title I	Earnings Change 2003-2013
Central	5%	5%	3%	6%	3%	5%	5%	11%
Eastern	13%	13%	25%	13%	9%	15%	21%	3%
Great Lakes	11%	11%	8%	17%	8%	14%	18%	-1%
Northwest Mountain	9%	9%	2%	7%	22%	11%	8%	3%
Southern	27%	28%	43%	20%	28%	23%	21%	2%
Southwest	17%	17%	8%	20%	16%	17%	14%	3%
Western-Pacific	18%	16%	11%	17%	13%	16%	15%	3%
United States [Total Count]	349	127,910	63	125	8,494	352,010	\$1.03 Billion	-

Table 1 above highlights 2013 data for each of the key labor indicators, providing context of magnitude and ranking to other regions and the nation at large. The “members” column indicates the total number of ARSA members in a particular region. While this is not illustrative of the total number of aviation maintenance employers, we feel it does provide a general sense of where employers are located. The Southern region is the largest employment region followed by four regions with over 10 percent of total employment: Southwest, Western-Pacific, Eastern and Great Lakes. Collectively the Eastern and Southern region account for 68 percent of high schools offering an aviation focus. There is a large disconnect in the Northwest Mountain region between supply of students and employment demand. This region issued 22 percent of total certificates and degrees in 2013 while only employing less than 10 percent in the industry. Perkins title I funding is representative of the larger technical workforce needs by state and region. Although aviation maintenance is only a subset of this, we see the Eastern and Southern region each receive a substantive portion of funding, over 20 percent respectively. Nationally, the wage growth between 2003 and 2013 was minor, only the Central region had growth in excess of 3 percent.

Change in regional employment from 2003 to 2013 varied significantly. Although one cannot speculate what portion of the change is organic and what is a result of migration, the pattern nonetheless is useful. National employment grew by 14,100 over this period, yet only three regions show net employment gain. The remaining four saw net declines in employment. The largest shifts are the Southwest region and the Southern regions losing over 30 percent, and increasing 86 percent of their employment, respectively.

**Figure 3. Total Employment Change by Region**



Not surprisingly, the hourly wage within Aviation Maintenance varies by region, likely a result of differences in cost of living. Collectively, however, earnings across the regions conveyed a common, flat, trend post-recession (2009) through 2013. Education statistics prove powerful when assessing current employment trends with future employment needs. Generally, the number of students earning degrees and certificates within the industry has increased in the past three years (2011-2013). The growth is not consistent across regions but it may be a sign of labor market forces working appropriately to correct for perceived workforce shortages. The interesting paradigm, however, is the declining rate of FAA certification. Numerous factors may contribute to this such as an aging workforce and transferable skills desired by other industries also in need of technical workforce supply. Unfortunately, data limitations preclude substantive conclusions around the anecdotal evidence found; namely, FAA certification requirements and the inability to trace student placement across industries.

The paper analyzes Perkins Title I funding by state from 2003 to 2013. Amounts funded for 2004 and 2005 are markedly lower than other years. This is a result of Congress failing to

pass a federal budget in FY 2004, resulting in the Perkins Act to not be reauthorized until 2006. Additionally, Perkins Title II funding is not included in our analysis because many states don't have qualifying programs, or simply use Title I moneys to fund them.

**Figure 4. Growth Estimates by Region**

	Growth Estimates [2003-2013]		
	Employment	Degree Completion	FAA Certification
Central	11	22	11
Eastern	210	35	156
Great Lakes	197	34	84
Northwest-Mountain	49	160	415
Southern	847	27	1212
Southwest	-420	38	598
Western-Pacific	140	19	-183

The figure above summarizes regional growth estimates for employment, education, and FAA certifications over the last decade. The Southern region has the largest increase in employment and FAA certifications, but does not show the same growth in degrees completed. Inversely, the Southwest region has seen a loss of jobs, but an increase in degrees given and certifications. The Western-Pacific region has witnessed a loss of certifications despite increases in employment and degrees completed. The contradictions in this table are worth exploring while analyzing individual regions

*FAA Certification Process*

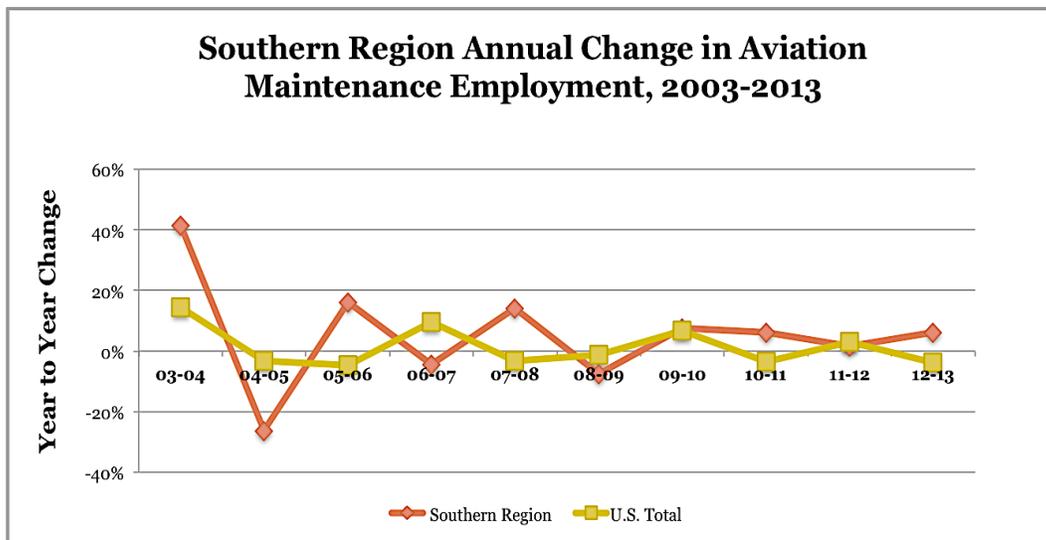
Given the volatile and at times contradictory data shown in FAA certification trends it is important to explain the certification process; in particular, the various ways in which certifications can expire and the timing of when such change is measured. Prudent caution should be used when analyzing certification trends due to the lag effect of certification turnover, which can lead to misleading conclusions. The FAA certifies two separate categories of maintenance technicians: mechanics and repairmen. According to the Aviation Maintenance Technician Handbook, both of the certificates are “issued to the technician based upon his or her training and knowledge,” but have a few differences. The repairman certificate is “specifically issued to that technician while he or she is employed at a distinct location of a specific company.” The certificate is valid as long as the technician stays at the location. Should they change locations, they must return the certificate to the Flight Standards District Office (FSDO) that issued it. On the other hand, the mechanic certificate is independent of where the technician is working and is transportable when the technician changes locations. There is no set duration of mechanic certificates. According to the handbook, the certificates are valid “until they are

surrendered, suspended, or revoked.” The certificate is “surrendered” when the certificate holder voluntarily gives up the certificate. It is “suspended” when the FAA temporarily removes the certificate from the holder. Lastly, the certificate is “revoked” when the FAA permanently removes it from the holder.<sup>16</sup> If a technician does not fall under these three cases, there is a possibility that they still hold the certificates even after the retirement or change of occupation. Thus, the total number of FAA certificates reported annually may not reflect the actual number of technicians in the job market.

### Southern Region Analysis

The Southern Region is the largest employment region and is comprised of seven states: Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee. Considering the key indicators of a labor shortage, this region perhaps holds the strongest argument that a shortage may exist due to steady employment increase. However, flat wage growth and data limitations such as starting wage preclude us from affirmatively concluding this. Furthermore, the supply of students has not kept pace with the overall growth in employment. An in depth analysis regarding each of these key indicators and other relevant information follows.

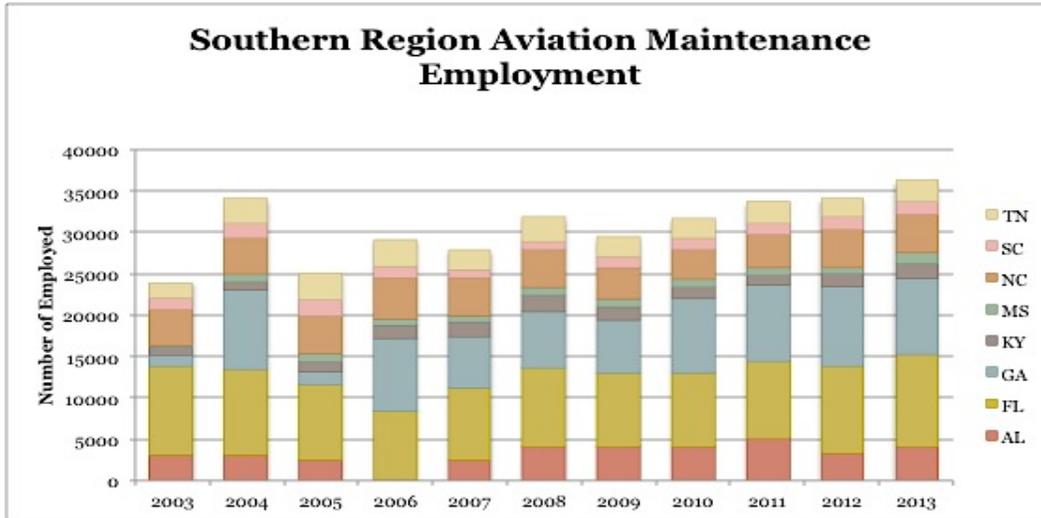
#### *Employment*



<sup>16</sup> Federal Aviation Administration, 2014, Aviation Maintenance Technician Handbook.

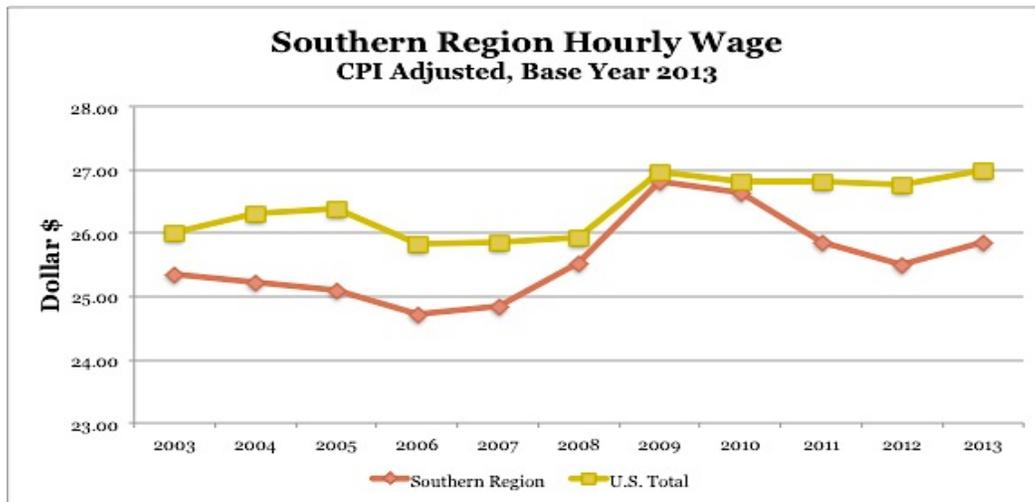
Since the recession, employment in the region follows the national picture. However, prior to 2008, the region's change in employment fluctuated greatly and didn't correspond to the national average. Most recently, employment has increased by over 6 percent from 2012 to 2013 in the region, whereas it has declined by over 4 percent nationally.

*State Employment Distribution*



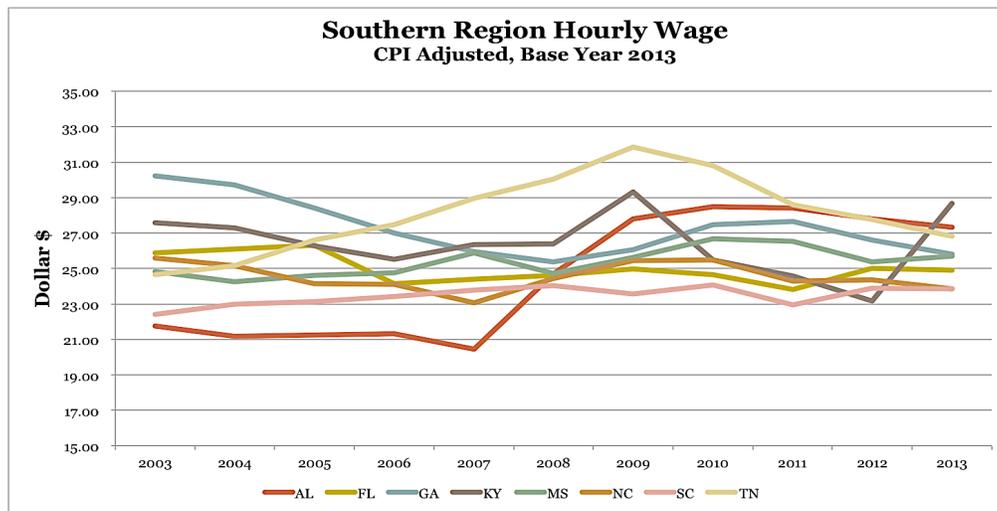
The Southern region contains four of the six largest states in the country in terms of employment (Florida, Georgia, Alabama, and North Carolina). Over the past decade, the region has shown some growth in the industry. The growth in employment numbers in Georgia is driving the overall growth in the region. From 2003-2004, the number of employed increased significantly in Georgia, but it took a noticeable decline in 2005. Since 2005, there is a positive trend in the state. A measurement error was noted in 2003 and 2005, as BLS did not report Aircraft Mechanics and Service Technicians data, explaining the steep decline for those years.

## Wage Analysis



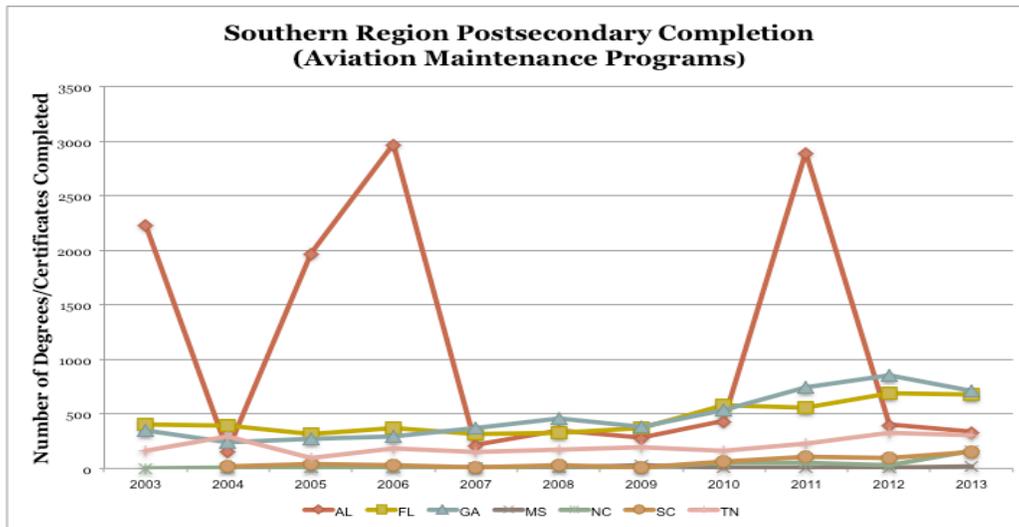
Despite employing more than any other region, average median hourly wage for aviation maintenance employees in the Southern Region has stayed below the national average. The average wages jumped roughly \$2 per hour during 2007-2009 to meet the national average, but declined in the following years.

## State Wage Distribution



With exception of a couple states, the average median hourly wage in the region shows little change over the last decade. In Tennessee, the real wage increased through 2009, followed by a period of decline. Alabama saw a spike in wages beginning in 2007 through 2010 but has since flattened.

## Education Analysis

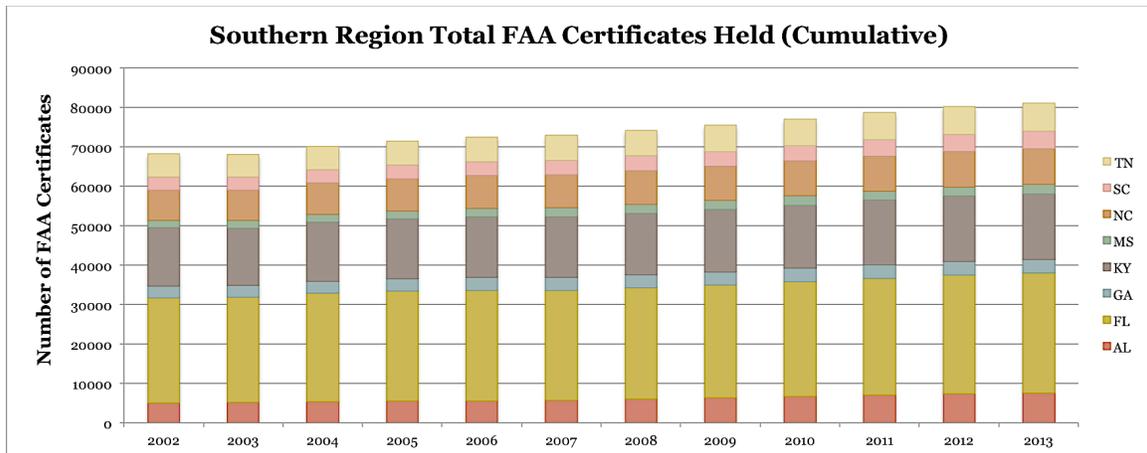


Except for Alabama, the region has shown slow but steady growth for the total number of students with completed degrees or certificates. Alabama has seen very steep increases in some years and steep decline in the following years. Generally, the total number of completions in Alabama stayed below 500, with 2003, 2005, 2006, and 2011 being the exception. One institution, Community College of the Air Force, drives the volatility in Alabama's postsecondary completion numbers. For years where data was available for this institution it was the largest contributor in the state; however, no data was reported during 2004, 2007, and 2010-13. Another noticeable issue is that North Carolina, one of the largest states in the region, has a miniscule number of students completing aviation-related programs each year, while there are none in Kentucky.

Florida, one of the bigger states in the region, has 11 high schools with a full or partial focus on aviation. The state also has 11 total postsecondary institutions with relevant industry programs. Alabama, another large state in the region, has only one high school and one postsecondary institution. This may explain the odd trend that observed in total number of degrees or certificate completions. North Carolina has four postsecondary institutions, but it has only one high school. Georgia has nine postsecondary institutions, but no high schools. It is also important to note that Kentucky has over a dozen high schools with a partial or full focus on aviation program, but the state has no postsecondary institutions for students to continue their education after high school.

It looks like current employment in North Carolina and Kentucky does not align well with education availability. However, one must remember that the primary source of postsecondary institutions is IPEDS, which publishes data only from those institutions that receive Title IV funding under the Higher Education Act (HEA). Please refer to the appendix, which provides a table of known secondary and postsecondary institutions by region. This includes ATEC members not listed in IPEDS.<sup>17</sup>

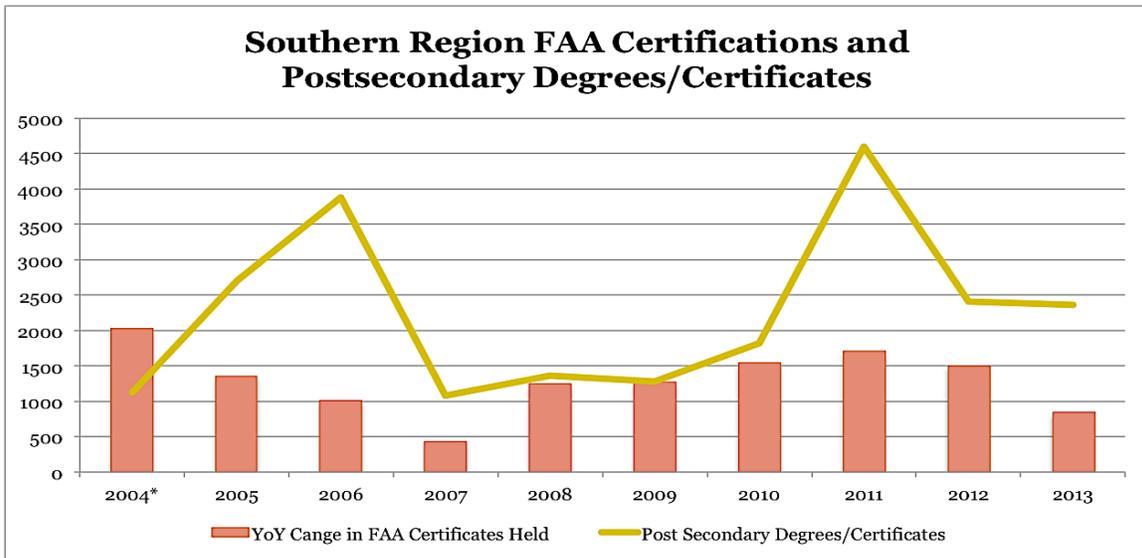
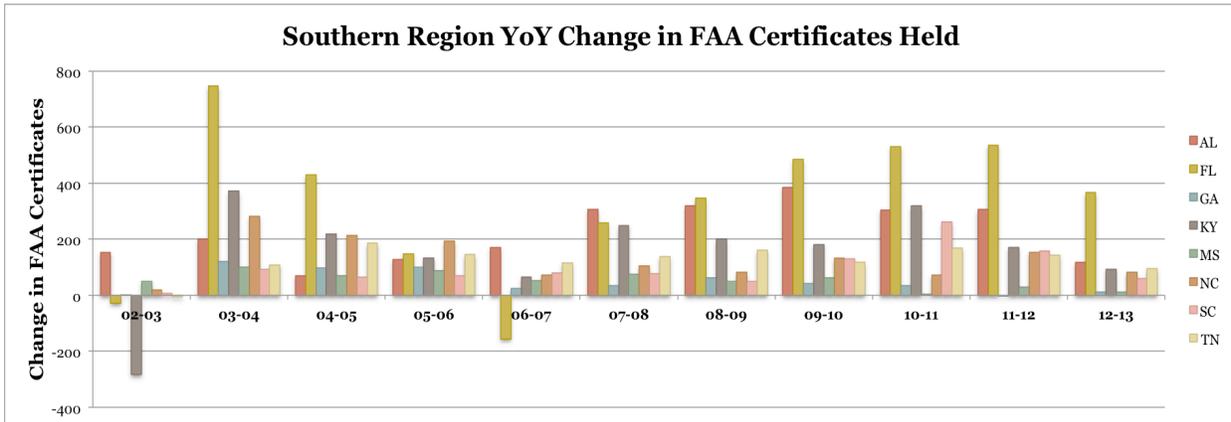
*FAA Certification*



Even though the total number of certificates held over the decade has increased in the Southern region, it does not correspond with the employment numbers, as one would expect. While Florida has the highest number of total certificates held in the region, Georgia has a very small fraction of total certificates held. Neither Alabama nor North Carolina has a significant portion of FAA certificates. Tennessee and Kentucky, which do not have a large portion of the region’s employment, have a large fraction of total FAA certificates held. Each state has shown slow but steady growth over the decade. Since the FAA provides cumulative certifications, it is necessary to look at the year-to-year change in order to accurately analyze the overall trend.

<sup>17</sup> Despite our best effort, the institutional list may still be incomplete. ATEC members retrieved from: <http://www.atec-ant.org/members.html>

*FAA certificates year-to-year change*



\*2003-2004 change in FAA certificates held

*Comparing postsecondary completions and FAA certifications*

Although it is somewhat volatile, the Southern region shows an increasing trend for the total number of students completing certification and degree programs within the industry. The year-over-year change is cumulative FAA certificates for the Southern region. While it was increasing at an increasing rate from 2007-2011, its growth has been slowing down since.



program, students begin “their course of study in high school and continue in college or an apprenticeship program.” The program “combine(s) the academic courses that students will need for success in college and technical courses that they will need to prepare them for a career.”<sup>18</sup>

Alabama has established ten Regional Workforce Development Councils (WDCA) have been to “provide a direct link to the workforce needs of business and industry at the local level.” These councils work with their member counties to “develop a regional strategic plan and comprehensive workforce development system that supports local economic and job development activities.”<sup>19</sup>

The Alabama Aviation Center, a division of Enterprise State Community College, “is the only postsecondary aviation training facility authorized by the Alabama State Board of Education.” However, the state has one of the highest fractions of employment in the region and the country. The center has different locations in Enterprise, Ozark, Mobile, Andalusia, Decatur, and Albertville.

Alabama is planning to develop the “state’s first program to teach maintenance on unmanned aircraft systems,” which is one of the fastest growing aviation segments. Courses and academic preparation have already started. The Alabama Aviation Center started the program in January 2014 with a \$360,000 initial grant from the Governor’s Office of Workforce Development. “Program graduates will be certified technicians qualified in both manned and unmanned aircraft maintenance.”<sup>20</sup>

### *Georgia*

Georgia has likely been able to expand its Aerospace workforce program due to Quick Start, which is claiming to be the “nation’s top workforce development program.”<sup>21</sup> Quick Start is one of the programs that provides workforce training in Georgia. This program is valuable and highly favorable to companies because the program is free and is customizable to the specific company. Due to this program’s long history of success, “Quick Start has updated the skill sets of more than 1 million employees in 6,500 projects.” The Quick Start program is also highly

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<sup>18</sup> Alabama Department of Education, 2014, About Tech Prep, <http://altechprep.org/abouttp.html>

<sup>19</sup> Alabama Community College System, 2014, Grant Resources, <https://www.accs.cc/index.cfm/workforce-development/grant-resources/>

<sup>20</sup> Alabama Department of Commerce, 2014, Made in Alabama, <http://www.madeinalabama.com/2013/03/alabama-aviation-center-provides-training-for-aeropsace-careers/>

<sup>21</sup> Georgia Department of Economic Development, 2014, “Aerospace”, Accessed Nov 9, 2014, <http://www.georgia.org/industries/Aerospace/>

adaptable to the training needs of a company because the training can be conducted in classrooms, mobile labs, or onsite at the company.<sup>22</sup>

Also, due to concerns from the private sector that Georgia was in need of a “consistent, trained and reliable workforce,” Governor Deal created the High Demand Career Initiative (HDCI) to improve the necessary training, certificates, and courses that the technical workforce in Georgia needs to move forward.<sup>23</sup> Aerospace was one of ten industries indicated in the meetings as needing to close the technical workforce gap. A first-year initiative report will be released in December 2014.

For the Integrated Workforce Plan presented for the years 2012-2017, Georgia identified a few key areas of improvement to alleviate the technical workforce issues. The state intends to better prepare youth for entry into the workforce. This will entail improving the high school graduation rate and providing adults without high school diplomas the chance to acquire adequate training. Georgia will also seek to continue developing the current supply of skilled labor, which means upgrading the skills of the current skilled labor force and expanding efforts to recruit and replace retiring workers<sup>24</sup>

### *Florida*

Similar to Georgia, Florida also implemented a workforce development program primarily driven and funded by the Workforce Investment Act, which encourages states to continue, “building and sustaining the skilled talent pipeline businesses need to compete and thrive in the marketplace.”<sup>25</sup> Career Source Florida has résumé and job preparedness training and has established a track record for delivering strong outcomes and more skilled and hireable workers. The Aviation and Aerospace industry is just one of the industries that has benefited from the WIA program.

The Florida Chamber of Commerce has also been open in its support of innovation within the aviation and aerospace industries. The Chamber focuses on making sure Florida does not lose its stake in space exploration and ensuring that the aerospace workforce remains highly skilled

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<sup>22</sup> Georgia Department of Economic Development, 2014, “Georgia Quick Start,” Accessed Nov 9, 2014, <http://www.georgia.org/competitive-advantages/training-hiring/quick-start/>

<sup>23</sup> Georgia Department of Economic Development, 2014, “High Demand Career Initiative,” <http://www.georgia.org/competitive-advantages/workforce-division/programs-initiatives/high-demand-career-initiative-hdci/>

<sup>24</sup> Georgia Workforce Investment Board, 2013, Georgia Integrated State Plan, <http://www.georgia.org/wp-content/uploads/2014/06/Georgia-Integrated-State-Plan-Revision9-20131.pdf>

<sup>25</sup> CareerSource Florida, 2014, “Florida’s Workforce Investment Works,” Accessed Nov 9, 2014 <http://careersourceflorida.com/floridas-workforce-investment-works/>.

and educated. The Chamber intends to monitor the success in order to fund aviation improvements.<sup>26</sup>

In 2006, Workforce Florida launched the Aerospace Resource Center with a \$1.2 million grant. The Center was launched specifically to make sure Florida's workforce was, "trained to meet the current and future needs of industries vital to the state's economy."<sup>27</sup>

### *North Carolina*

The Division of Policy, Research, and Strategic Planning of the North Carolina Department of Commerce conducted a regional Aerospace and Aviation Workforce study. The workforce analysis projected a 14 percent increase in aerospace and aviation related jobs for the twenty-five mile region surrounding Northeast North Carolina.<sup>28</sup> Strategic partnerships between state policymakers and private enterprise have played a tremendous role in attracting aerospace and aviation companies to the state. Additionally, the presence of several military bases within Northeast North Carolina has lead to numerous veterans being able to transition their skill set to aviation careers. Advocacy efforts begin early on. For example, STEM East is an exemplary initiative that promotes STEM programs in middle schools to encourage and prepare students for future opportunities in this field.<sup>29</sup>

The Piedmont Triad is located in the central part of North Carolina and consists of the area within and surrounding the three major cities: Greensboro, Winston-Salem, and High Point. The region is considered "a hub for commerce" with excellent transportation and educational facilities.<sup>30</sup> Due to its central location and the presence of Piedmont Triad International Airport, it has attracted a growing number of aerospace and aviation-related companies to the region. The aviation growth has lead to increased demand for skilled workers in the region. In order to meet this increasing demand, the Aviation Triad partnership between educational institutions and employers was developed.<sup>31</sup> The major objective of the Aviation Triad is to highlight the "opportunities that technical aviation careers provide and connects job seekers with education

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<sup>26</sup> Florida Chamber of Commerce, 2014, "Aviation and Aerospace: Strengthening Florida's Role in Space Exploration," *Innovation and Economic Development*, Accessed November 9, 2014, [http://www.flchamber.com/wp-content/uploads/1Pager\\_AviationandAerospace\\_2014.pdf](http://www.flchamber.com/wp-content/uploads/1Pager_AviationandAerospace_2014.pdf).

<sup>27</sup> Austin, Curtis, 2006, "Workforce Florida Launches First Employ Florida Banner Center," Jacksonville, August 23.

<sup>28</sup> Department of Commerce, North Carolina-  
[http://www.nccommerce.com/Portals/47/Publications/Industry%20Reports/NCNE%20Aero%20Workforce%20Project%20Summary\\_FINAL%20PDF.pdf](http://www.nccommerce.com/Portals/47/Publications/Industry%20Reports/NCNE%20Aero%20Workforce%20Project%20Summary_FINAL%20PDF.pdf)

<sup>29</sup> Business Climate, <http://www.businessclimate.com/eastern-nc-economic-development/aerospace-aviation-boost-eastern-nc-workforce-development>

<sup>30</sup> Piedmont Triad Regional Council, <http://www.ptrc.org/index.aspx?page=3>

<sup>31</sup> Aviation Triad, <http://www.aviationtriad.com/>

and workforce development initiatives.” A major focus of the partnership has been education initiatives using a well-defined strategic plan.<sup>32</sup>

**Figure 5. North Carolina Piedmont Triad Region**



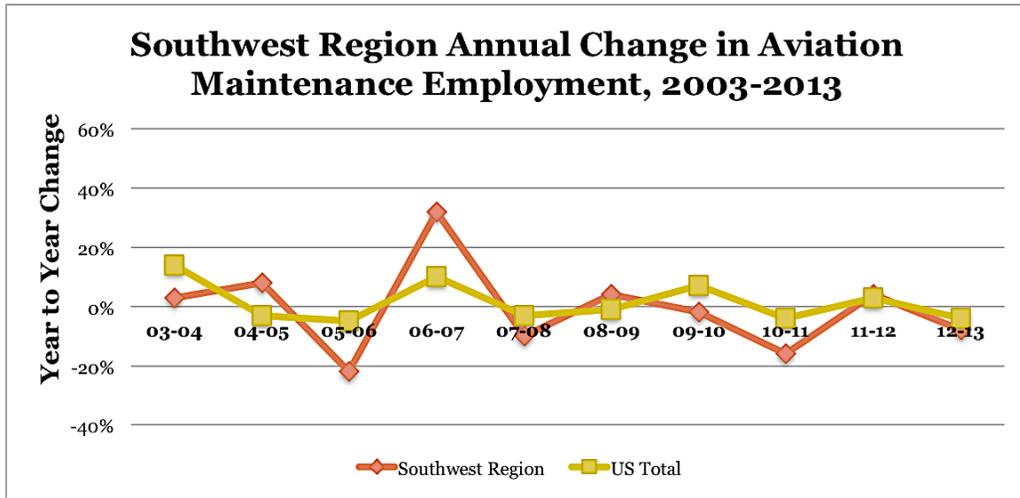
### **Southwest Region Analysis**

The Southwest region is comprised of five states: Arkansas, Louisiana, New Mexico, Oklahoma and Texas. Texas clearly dominates the region’s aviation maintenance employment with over 14,000 Aircraft Mechanics and Avionics Technicians (13,070 and 1,540, respectively). A review of the key indicators certainly points to inconclusive evidence of a labor shortage. This is driven primarily by a large disconnect in supply and demand. While student degrees and certificates are on the rise (supply), employment has declined and earnings have remained flat (demand). A more thorough analysis of these indicators, including state-level considerations, follows.

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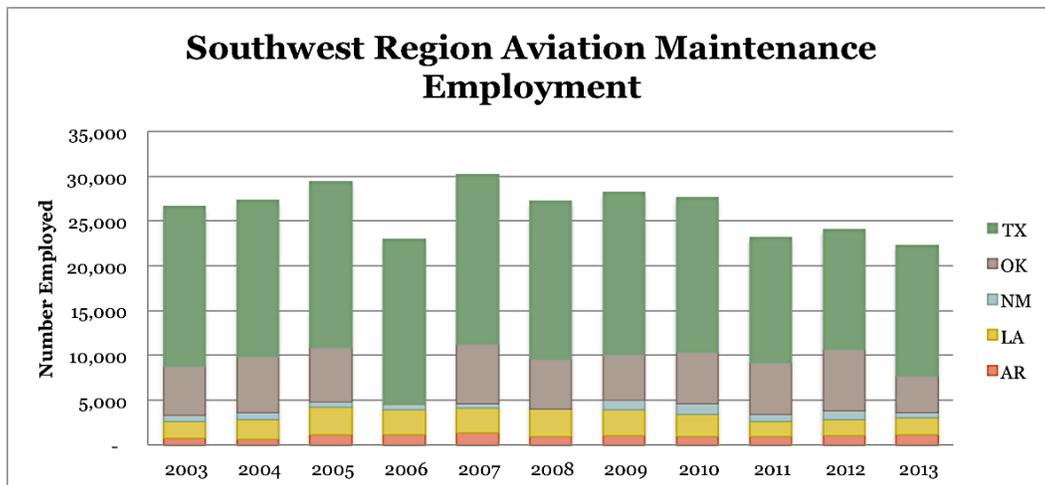
<sup>32</sup> Greensboro Partnership, Department of Commerce, <http://www.greensboro.org/?q=chamber-commerce/advocacy/aviation-triad>

*Employment*



Since the Great Recession employment nationally has shown minimal to no growth, with some periods of decline. The Southwest region certainly poses industry concern with declining or no employment growth beginning in 2009 through 2013. This trend falls below the national trend. Prior to the Great Recession there was a significant spike in employment (2006-2007). Putting that anomaly aside, employment over the past decade appears to be on the decline for the region. For this reason an in depth review by state may signal whether this trend is region-wide or mostly driven by the state of Texas.

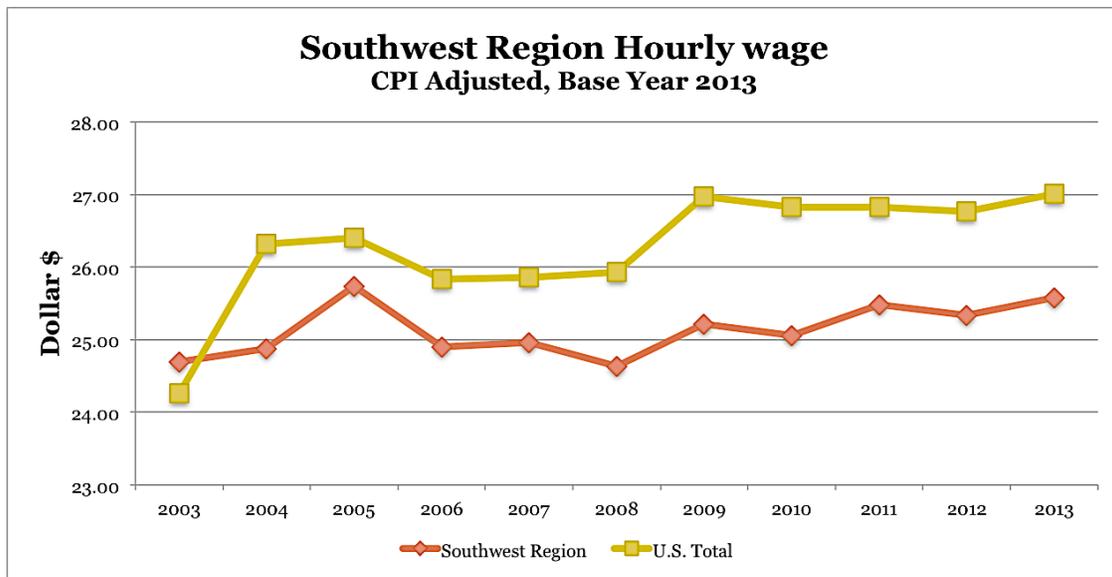
*State Employment Distribution*



Looking at employment trends by state from 2003 to 2013 it is clear that Texas is driving the overall decline in Aviation Maintenance employment. In 2005 they peaked with 18,060

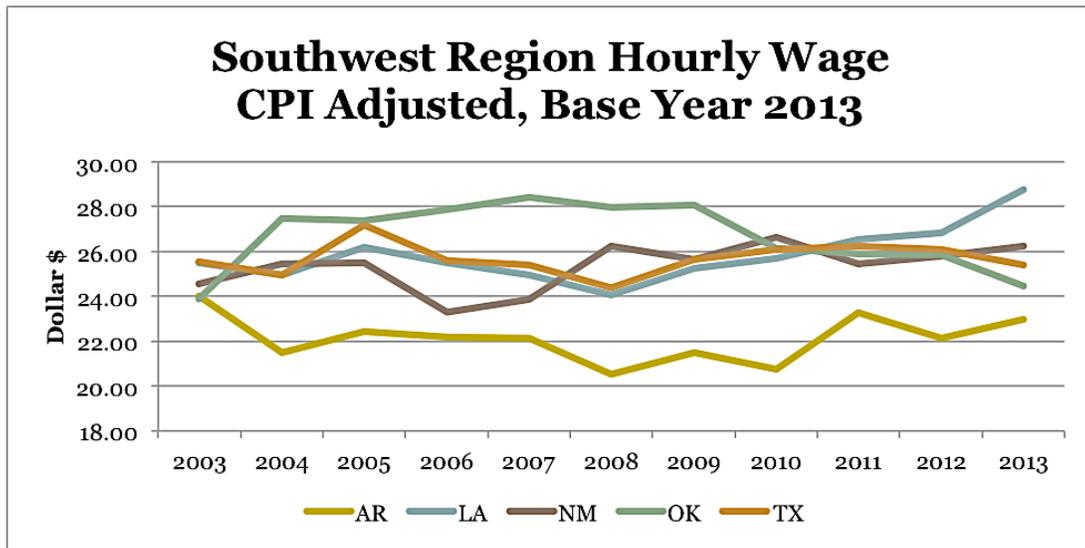
employed. Beginning in 2011, employment dropped significantly by approximately 4,500 employees. Interestingly, Texas did not see a major employment shock as a result of the Great Recession; conversely, Oklahoma, the state employing the second highest number in the region, saw a dramatic dip in employment during 2006. Oklahoma was able to maintain steady employment before 2006 until they recently experienced another decline of approximately 2,000 employees between 2012 and 2013. The remaining three states have held steady at lower employment levels. Arkansas actually saw a net gain of 490 employees between 2003 and 2013.

*Wage Analysis*



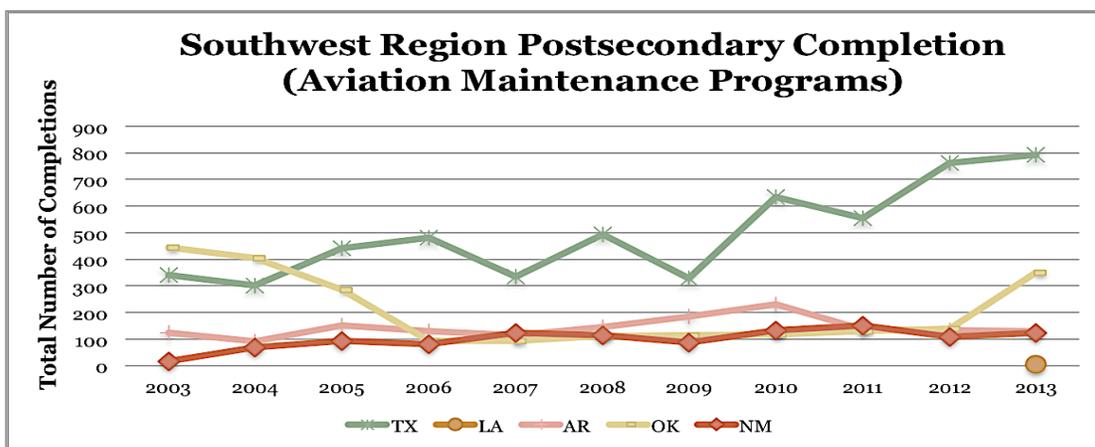
Aside from 2003, median hourly wage in the Southwest region has remained below the national average. The wage trend is consistent with the national average. After a short increase in 2005, earnings declined through 2008, followed by minimal growth from 2008 to 2013. The change in hourly wage was less than \$1 per hour between 2003 and 2013.

*State Wage Distribution*



Peeling back the regional wage trend to assess each of the five states individually provides evidence of meaningful variation. For a period of four years (2006 – 2009) Oklahoma employees earned nearly \$2 per hour more than their regional counterparts. That trend has since been replaced by Louisiana, where wages grew by over \$4 per hour between 2008 and 2013. Arkansas has consistently maintained the lowest wage rate in the region over the past ten years. Texas, the largest employment state, had a period of wage growth comparable to Louisiana but has since begun to flatten and decline slightly beginning in 2011. Finally, New Mexico exhibits a pattern akin to Arkansas but at a slightly higher hourly rate – generally between \$24 and \$26 per hour.

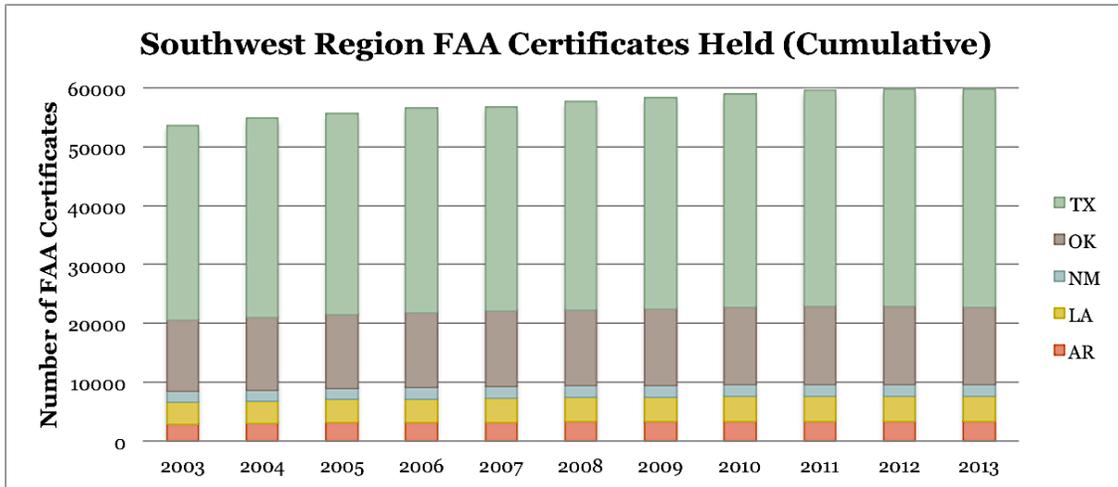
*Education Analysis*



By looking at total postsecondary degrees and certificates issued (airframe, avionics, and power plant) from 2003 to 2013 we see some interesting variation, particularly among Texas and Oklahoma, the two states with the highest employment. Perhaps the most encouraging assessment is total completion for the region was at its peak in 2013 at 1400 degrees or certifications. This represents a 51 percent increase between 2003 and 2013. Texas and New Mexico really led this charge with increases of 452 and 106, respectively. Their gains, however, were offset by a decline of aviation maintenance program completion in Oklahoma. While Arkansas only saw a net gain of six degrees or certificates issued over the entire period, they did show significant growth from 2008 to 2011. Despite Oklahoma's decline overall, they were able to recover a substantial portion during 2013, improving by 1.5 times the number of degree or certificates issued in 2012. Ideally the noteworthy increase in program completion will help, in the near future, offset the decline in employment the region has been experiencing.

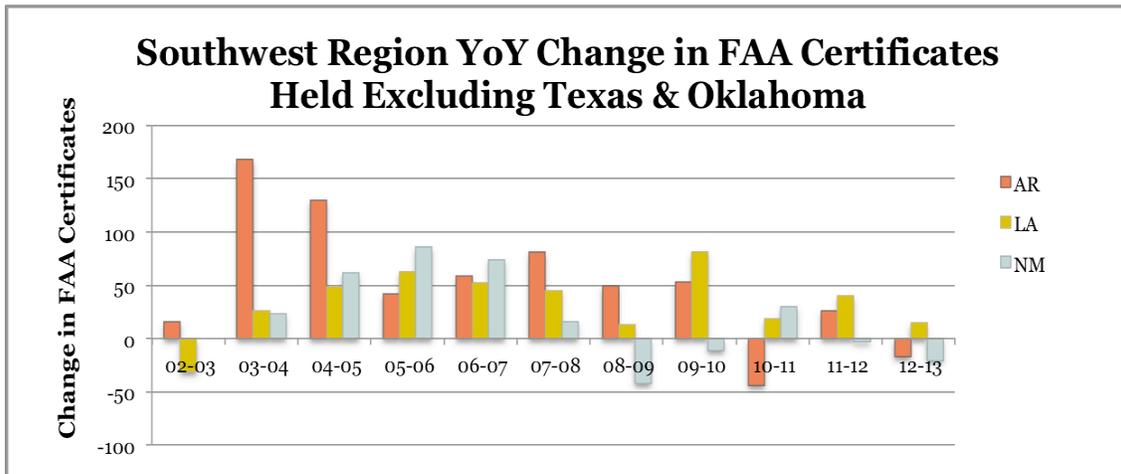
Current employment within the Southwest region aligns well with education availability. That is, Texas and Oklahoma have markedly more institutions offering aviation maintenance programs than the lower employment states in the region. Texas alone has 15 institutions, though this is necessary for the size of the state. Given most postsecondary institutions are community colleges they need to maintain the local presence for accessibility. Compared with other regions there are significantly fewer high schools in the Southwest region that offer an aviation specialty so that students can begin their technical career track early. Louisiana and New Mexico do not have high schools with an aviation focus while Arkansas and Oklahoma have only one high school each.

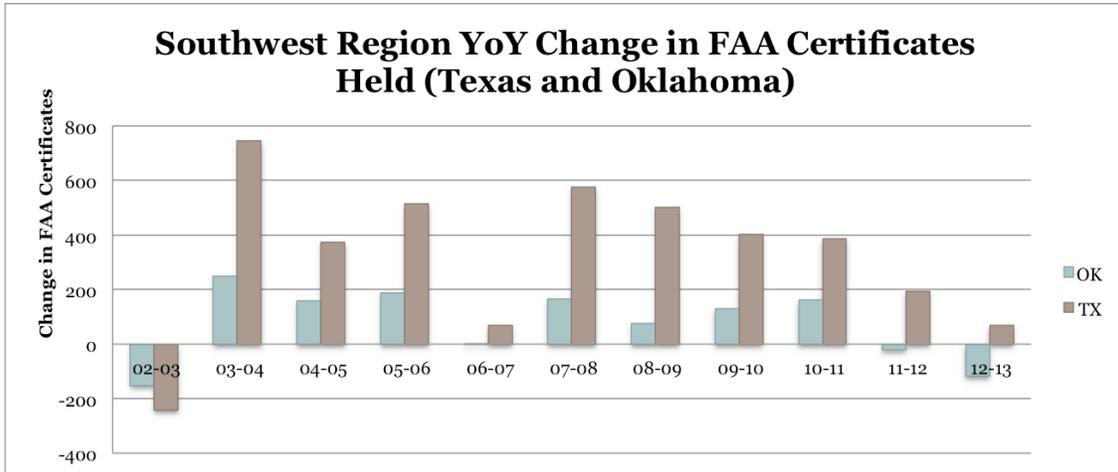
*FAA Certification*



FAA certificates in the Southwest region have increased by 6,000 certificates from 2003 to 2013 (53,640 to 59,640). The breakdown of certificates by state aligns with employment and education trends previously discussed. Texas and Oklahoma represent 84 percent of total certificates held in the region. Given the large disparity between these two states and the remaining three states in the Southwest region, year-to-year changes in FAA certification were reviewed separately below.

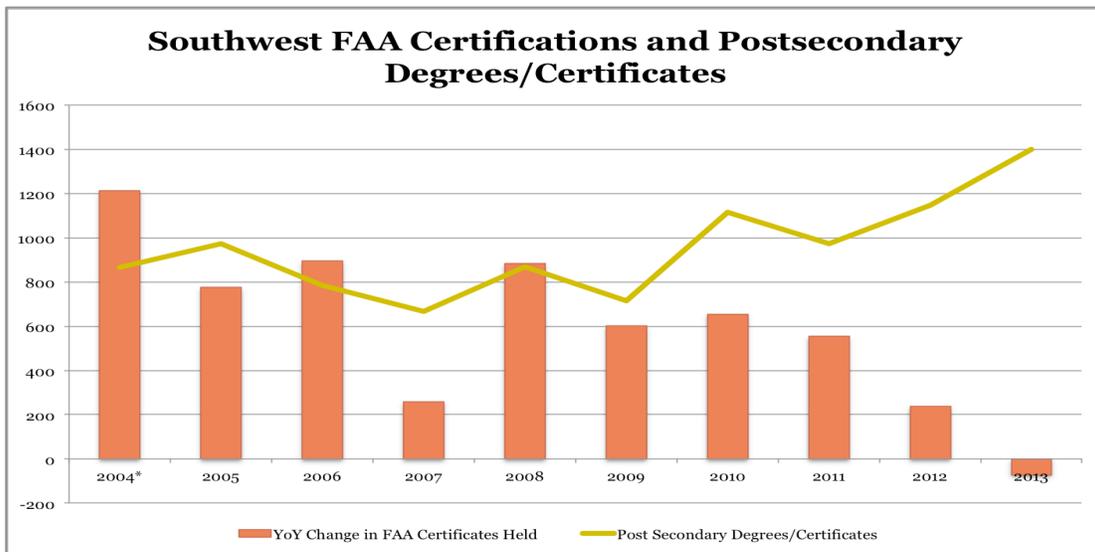
*FAA certificates year-to year change*





For the smaller states it is clear the rate of certification has been declining, though most years there is a net gain in number of certificates held. For New Mexico and Arkansas there is a net decline in certificates held between 2008-2009 and 2010-2011, respectively. Transitioning to Texas and Oklahoma specifically, change in the number of certificates held from year-to-year also appears to be declining. Texas was a bit volatile through 2008, after which, the net increase in certificates from year-to-year has been declining. This is particularly pronounced from 2011 to 2013. For that same time period, Oklahoma also saw a declining rate of additional FAA certificates held, so much so that change in certificates held from 2012 to 2013 was negative.

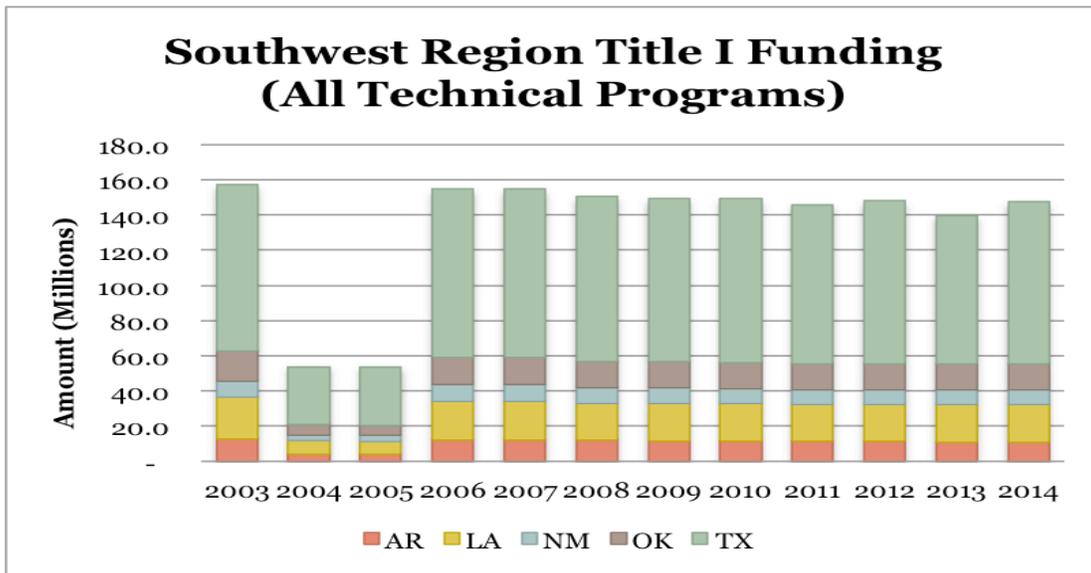
*Comparing postsecondary completions and FAA certifications*



\*2003-2004 change in FAA certificates held

The Southwest region shows a promising trend for students with aviation maintenance degrees and certificates entering the workforce. There has been strong growth in degree and certificate completion since 2010. As these graduates enter the workforce and complete the FAA certification process they will slowly replace the large number of aviation maintenance employees retiring or exiting the workforce. This trend has likely maintained the positive change in FAA certifications from year-to-year between 2004 and 2012, though at a declining rate. Perhaps most concerning is the net loss in FAA certificate holders during 2013, despite the highest program completion over the past ten years. This is indicative of more certificate holders leaving the industry, either due to retirement or transferable skills in other industries. Therefore, the intersection of current FAA certificate holders and future employees is at a critical juncture. If the student population begins to decline in the next few years then employers will likely see a labor constraint. The Southwest region needs to maintain a strong education pipeline to replace the increasing number of employees leaving the aviation maintenance industry.

*Perkins Funding*

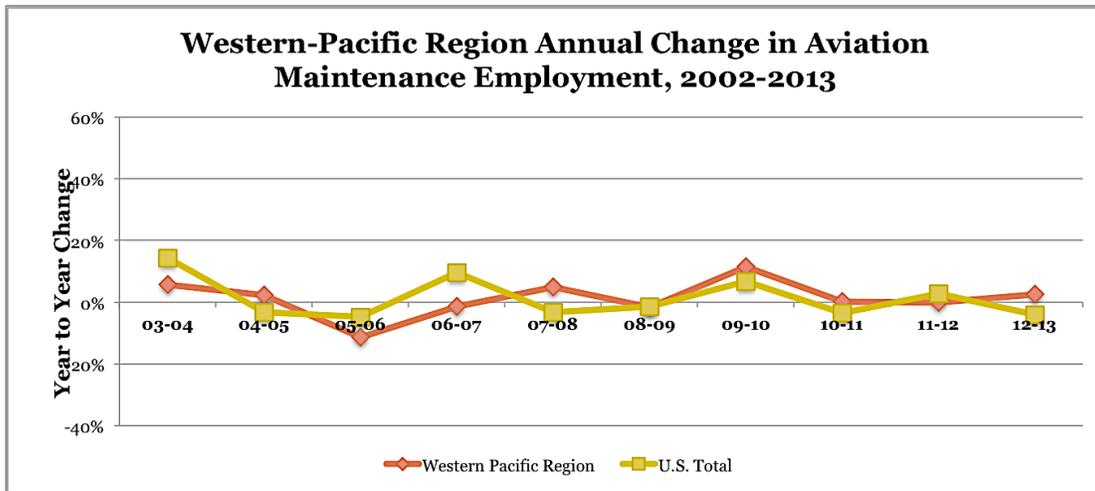


The region saw a slight decline in Perkins funding over the past 12 years (2003 to 2014). Since 2005 the average funding for this five-state region was just shy of \$150 million, with Texas receiving the largest share. Interestingly, Louisiana receives a significant share of total funding, even though their presence in the technical aviation industry is relatively small. This may be indicative of broader technical industries present in the state.

## Western-Pacific Region Analysis

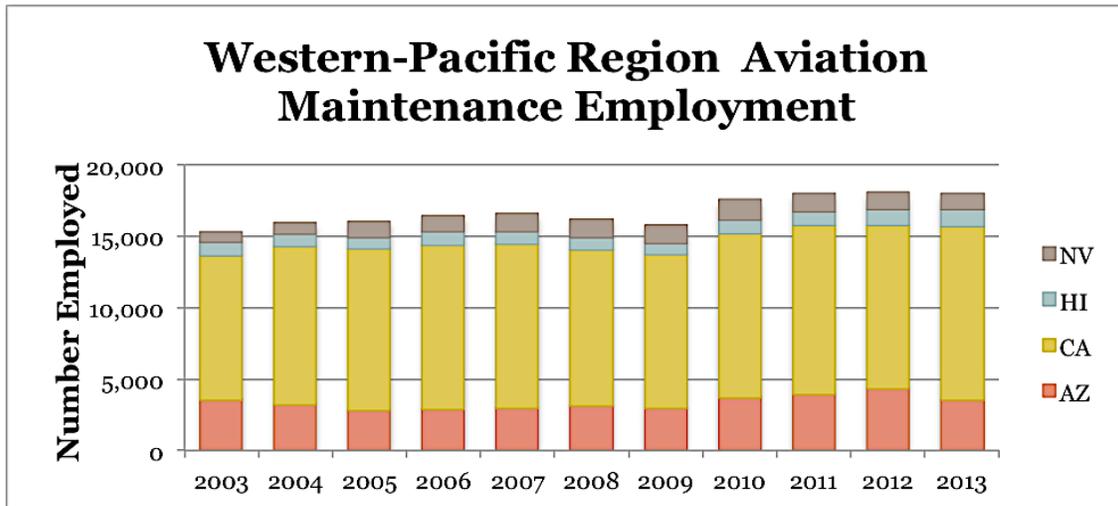
Comprised of Arizona, California, Hawaii, and Nevada, the Western-Pacific's numbers are driven by California, who only employs fewer people in the industry than Texas. Both employment and wage trends in the region follow the right growth trajectory, albeit on a small scale. For this reason, there lacks significant evidence of shortage. Moreover, certificate and degree attainment has also grown but again at a very slow pace. Detailed analysis regarding noteworthy trends within the region and among key states follows.

### *Employment*



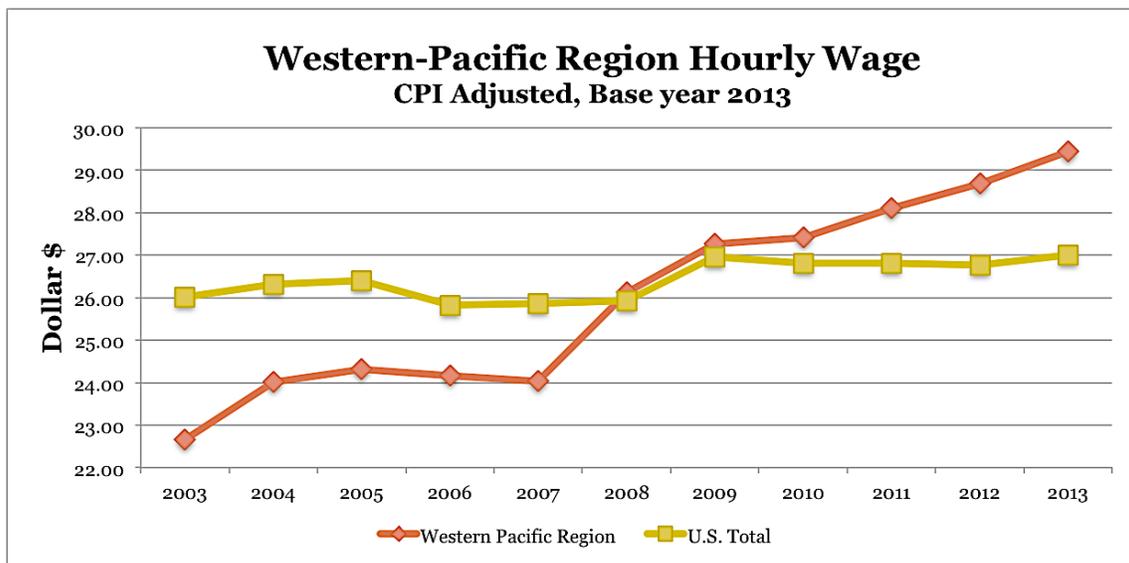
After the 2008-2009 recovery period, industry employment in the region has been growing slightly above the national average, and has not seen a decrease in any one year, where 2011 and 2013 saw national decreases in employment. Still, the trend is very similar to the national picture. Again, this is likely caused by California employing more people in the industry than almost any other state.

*State Employment Distribution*



The graph demonstrates California’s influence on the regional numbers. As regional employment numbers have grown over the decade, the other three states have remained mostly constant or even declined slightly. The steady employment growth in the state is one indicator of a labor shortage, but is not the most significant. In this area, one would also like to see how job vacancies in the state have changed.

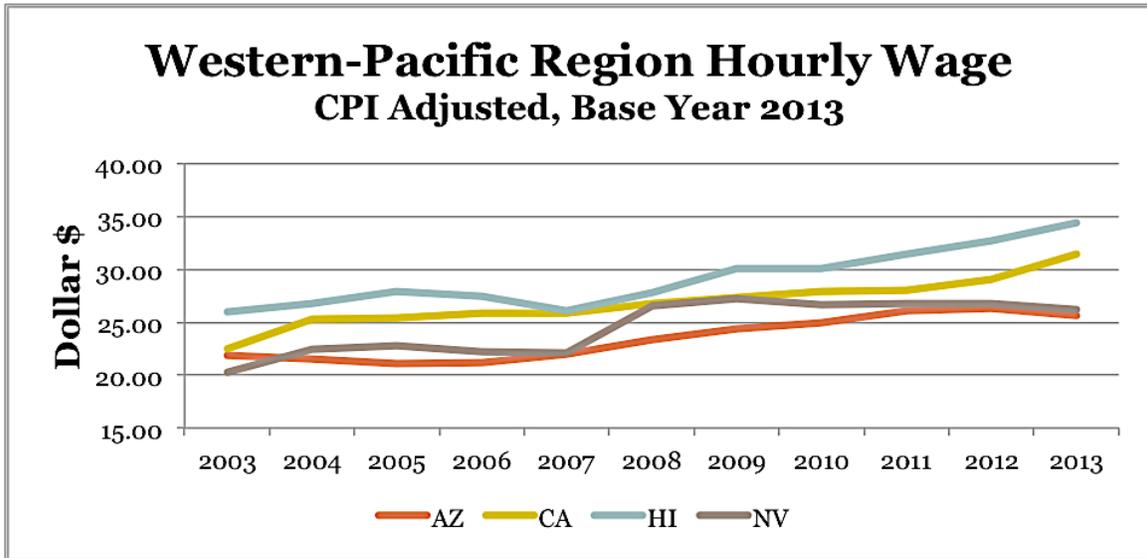
*Wage Analysis*



Since the end of the Great Recession, wages in the region rose slightly above the national average, now just over \$29 per hour. They are also growing slowly, while wages across the nation have remained constant at around \$27 per hour. There’s no large evidence of a shortage in

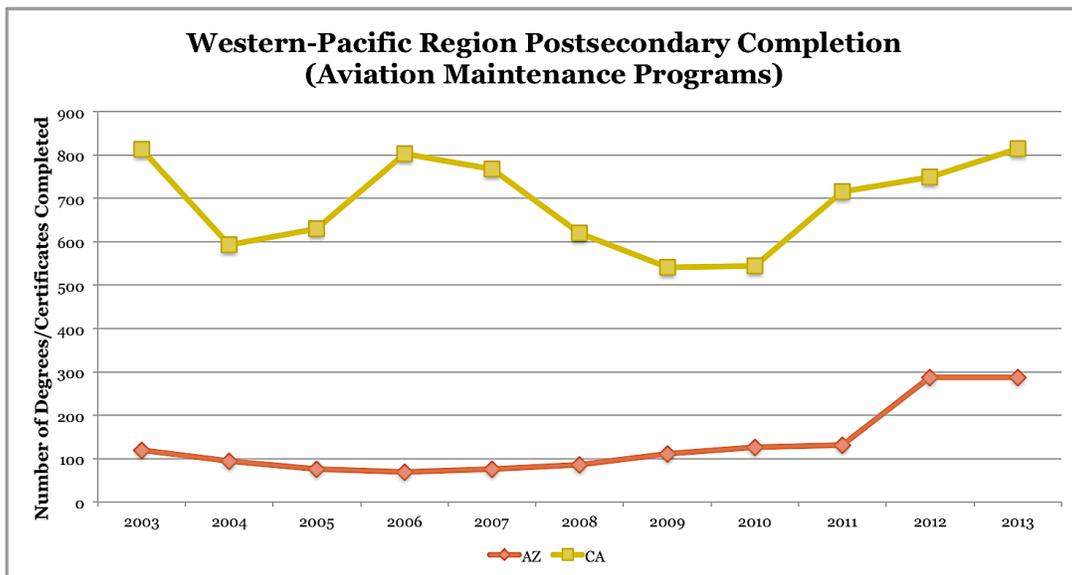
the region. So, a sharper growth in wages combined with other positive indicators would be necessary.

*State Wage Distribution*



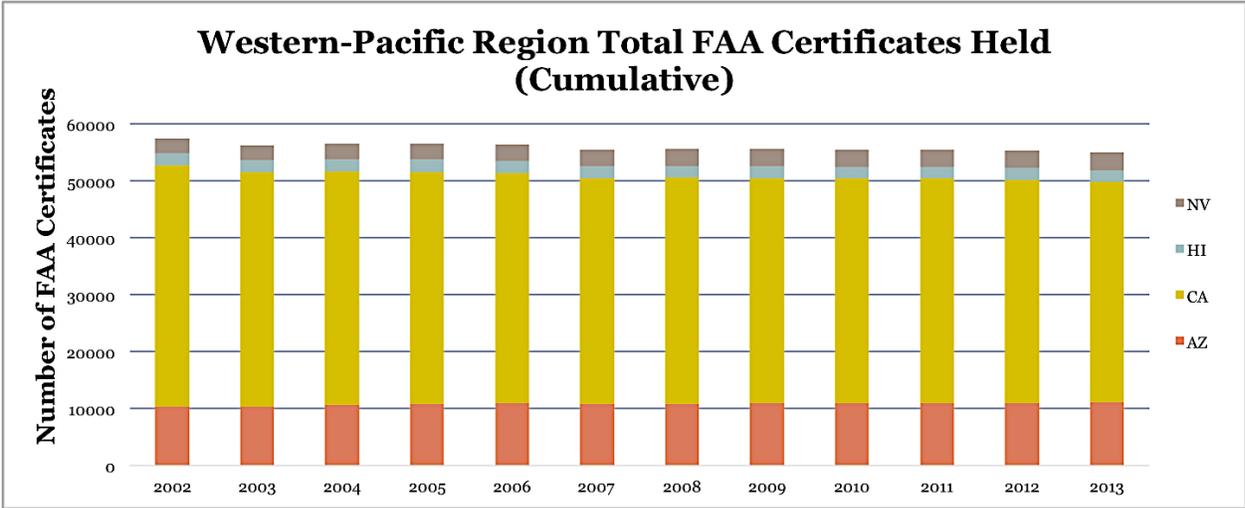
Hawaii has the highest wages in the region, but, with such small employment numbers, this is likely inconsequential when considering substantial elements. California is second in the region. But its high cost of living in most areas could be responsible for the higher wages. What is interesting is the change in wages in the last year. Arizona and Nevada have actually seen wages drop while California has the sharpest increase. This increase could be indicative of a shortage, but a one-year sample does not provide enough information.

*Education Analysis*



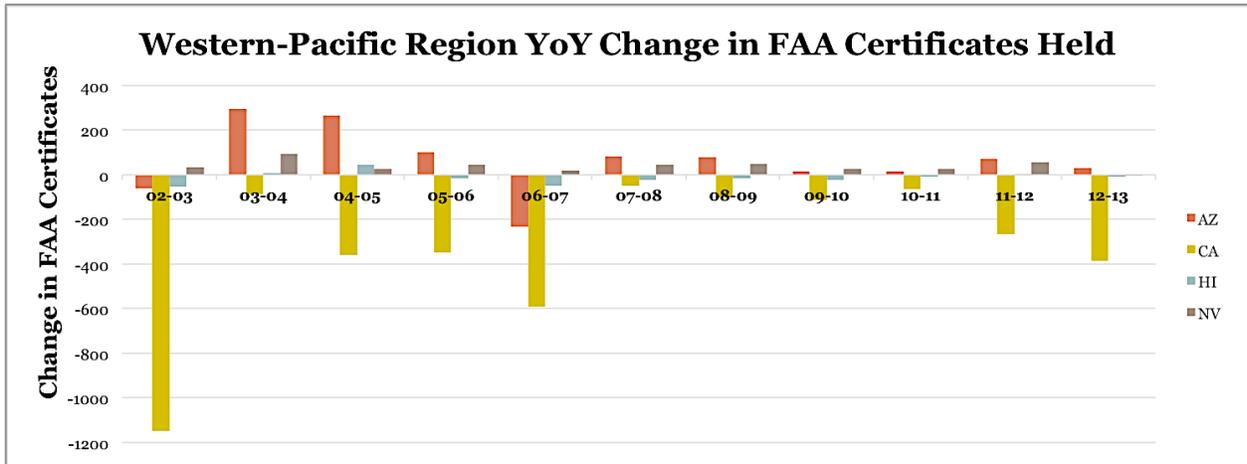
While California has seen changes in both directions throughout the decade, since the Great Recession there has been a rise in postsecondary degrees completed in the region. This is true in Arizona, as well as across the country. California has 17 of the region’s 21 postsecondary institutions, which explains its larger number of degrees given. Hawaii has no high schools or postsecondary institutions while Nevada has one that was founded in 2013. There seems to be some credence to the theory that the Great Recession opened some students’ eyes as to the value of a university or liberal arts education when compared to a specific technical skill set.

*FAA Certification*



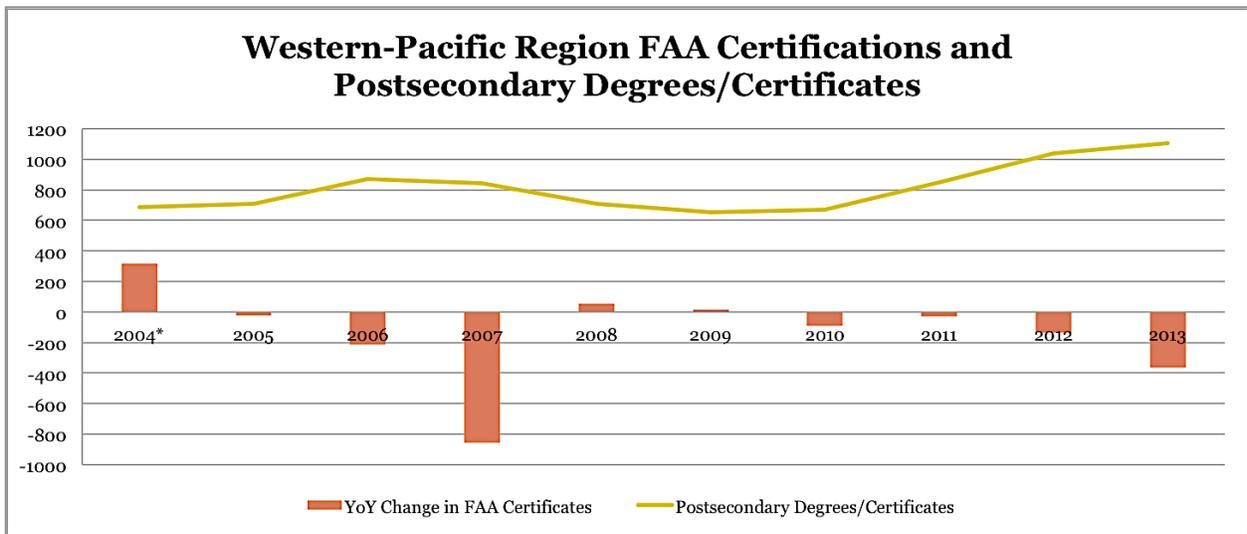
As a whole, certificates are declining slightly in the region. Nevada and Arizona have actually had slight increases, but California’s decrease brings up some interesting points when compared with the other indicators. A growth in employment and wages in the industry would suggest, more people are working and succeeding, so why would certificates be declining? There are two possible theories. One is that employers are not requiring their employees to remain certified. The other is one of migration of students. The Northwest-Mountain region is nearby, has low employment, and educates a lot of students. Some of these students may be finishing their certifications there, and then finding jobs in California

*FAA certificates year-over-year change*



This graph demonstrates California’s loss in certificates each year as compared to the rest of the region. If the migration theory is correct, however, this loss should begin to turn around as more degrees are given, unless more and more workers start to retire. The difficulty with this theory is the inherent difficulty tracking how many workers are moving, as well as the regions they are moving to and from.

*Comparing postsecondary completions and FAA certification trend*

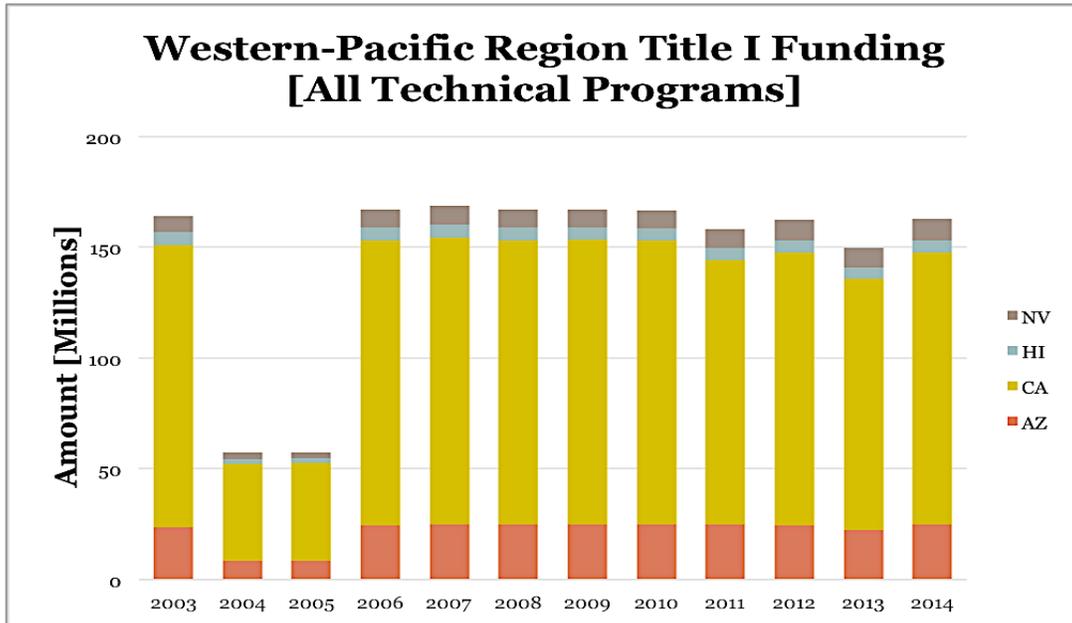


\*2003-2004 change in FAA certificates held

This graph shows the disparity between the change in certificates and degrees issued. As you can see, the number of degrees issued has been increasing in the region since 2010, while certificates have been declining over the same timeframe. Again, this should begin to correct

itself one way or another unless there are some other immeasurable factors or something in the market changes.

### *Perkins Funding*

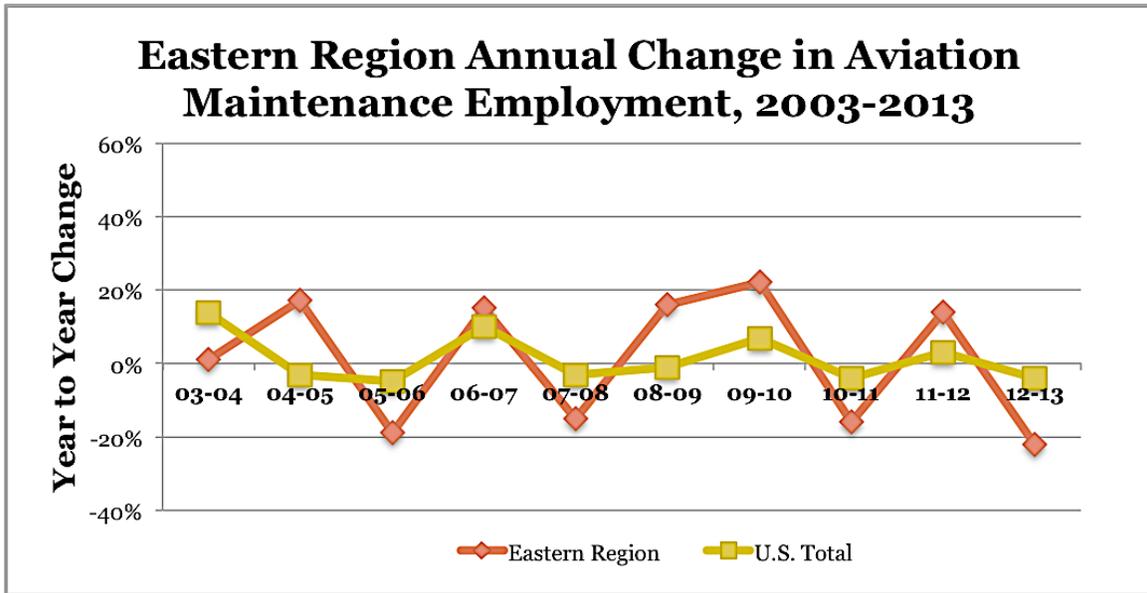


California receives the majority of the region’s Perkins grant funding for career and technical education. The Title I Grants are base grants that can be spread however school districts want to along their career and technical education facilities. Overall, the region’s numbers have remained constant over the past decade, with Arizona getting a slight increase throughout the measured twelve years.

### **Eastern Region Analysis**

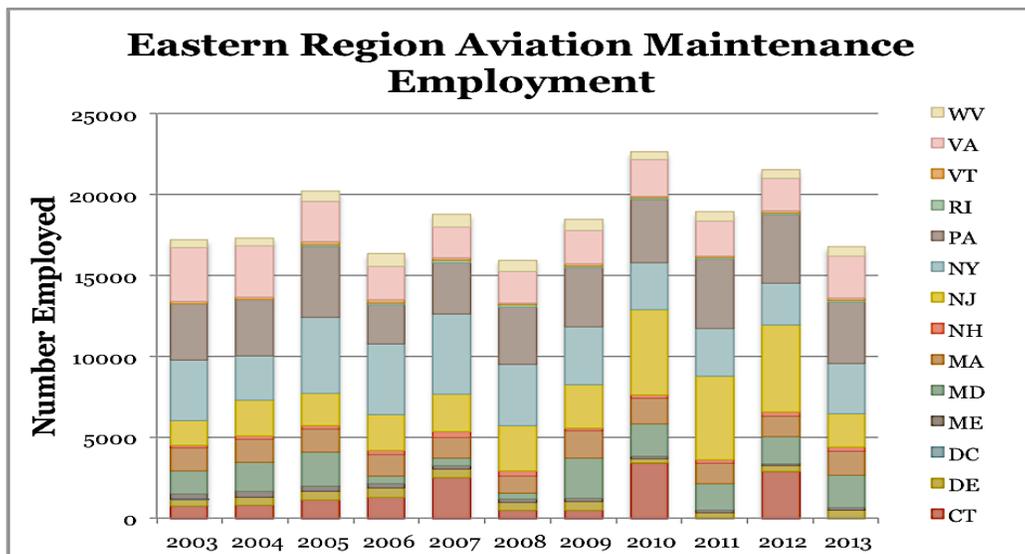
The Eastern region is comprised of 13 states from Maine to Virginia. While no one state dominates in the aviation maintenance industry, collectively, these states comprise a noteworthy share of the national picture. Strong evidence is not found for any of the key labor shortage indicators. There is significant variation in earnings by state; however, wage growth overall has been flat, following the national trend quite closely. Employment change has been volatile, no steady increase or decrease can be detected over the past decade. The education pipeline is growing but on a much smaller scale than some of the other regions. A more in depth analysis of employment, wages, education, and funding follows.

*Employment*



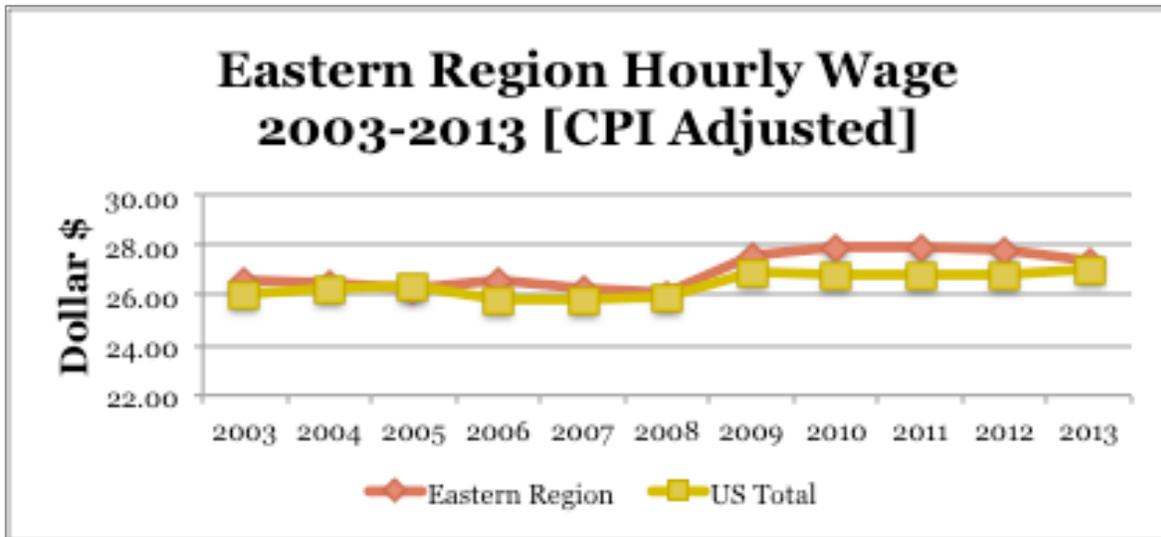
Aviation maintenance employment in the Eastern region over the past decade mirrors that of the national trend. Since the Great Recession employment nationally has been flat to minimal growth, with some periods of decline. The Eastern region saw more volatile swings in employment with a 20 percent increase immediately after the Great Recession, followed by a comparable decline during 2010 to 2011. Most recently employment has declined by over 20 percent from 2012 to 2013.

*State Employment Distribution*



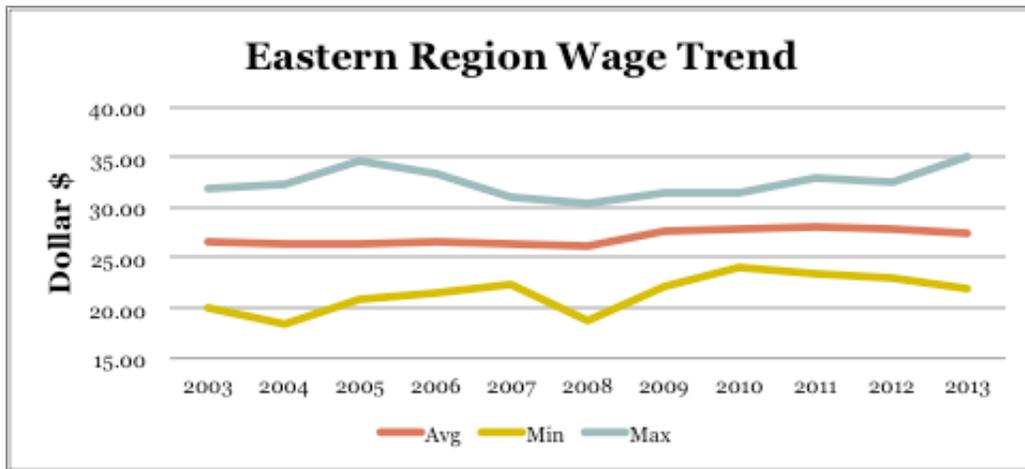
Three of the fourteen Eastern region states had aviation maintenance employment over 2,500 in 2013 - New York, Pennsylvania, and Virginia. In 2003, Virginia's employment was 3,300. As of 2013 it had dropped to 2,590, a loss of 710 employees over the past 10 years. New York also saw a comparable drop in employment between this same time period, losing 670 employees. Pennsylvania was able to gain 300 additional employees from 2003 to 2013. Individual years within this period were volatile, with no steady growth in employment from year to year. Maryland and New Jersey have shown positive employment growth overall, netting an additional 560 and 550 employees from 2003 to 2013, respectively.

*Wage Analysis*

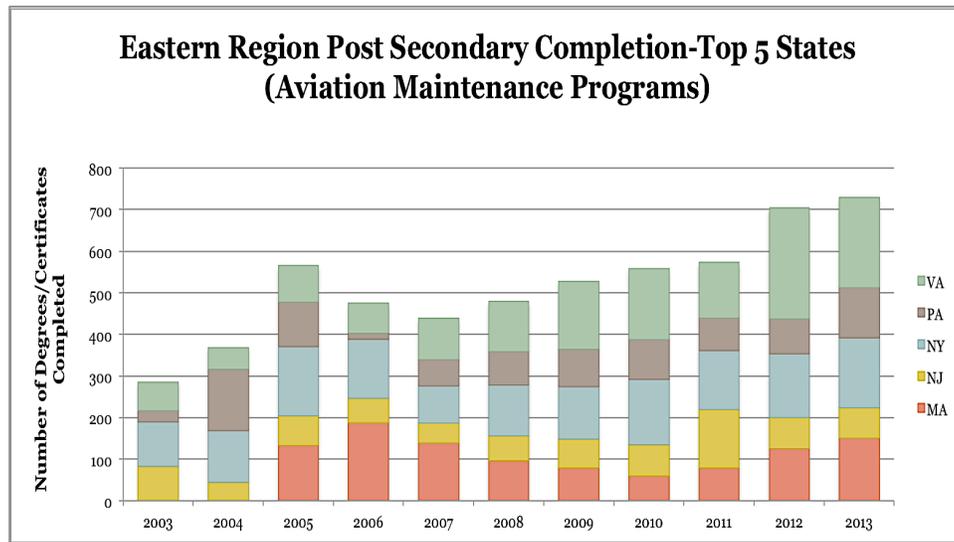


Average median hourly wage for aircraft maintenance employees in the Eastern region have been flat to declining the past five years (2009 to 2013). Wages jumped roughly \$2 per hour immediately after the Great Recession, slightly higher than the national average. Wages in the Eastern region remain at or above the national average. Although earnings were \$1 per hour higher from 2010 to 2012, they dipped equal to the national wage of \$27 per hour in 2013.

## State Wage Distribution



The fact that the Eastern region contains 13 states leaves room for significant variation in earnings over the past decade. The average median hourly wage was relatively steady at just over \$27 per hour through 2008, then jumping slightly less than \$1 per hour to just over \$28 per hour from 2009 to 2013. The minimum and maximum hourly wage over the same time period, however, experienced greater change. The average difference between the highest earners in this region and the lowest was \$11 per hour. The lowest hourly wage was typically found in Maine during this time period, but Rhode Island, West Virginia, Virginia and New Hampshire also had individual years with the lowest hourly wage. Contrast this with the region's highest wage, mostly found in New Jersey and Connecticut. New Jersey maintained the highest hourly wage leading up to 2008, when Connecticut, Massachusetts and Maryland then took over through 2012. The most recent data, however, shows New Jersey back on top in 2013. The maximum average hourly wage was over \$32 per hour for the decade of 2003 to 2013.

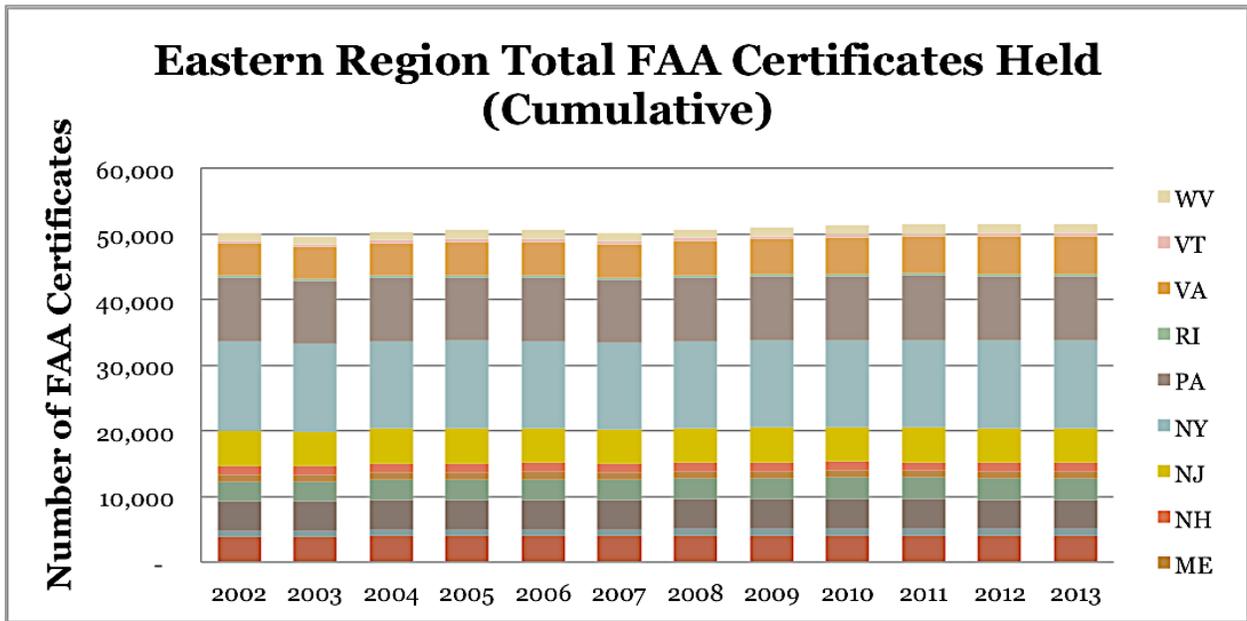


The majority of postsecondary degrees and certifications issued in the Eastern region come from five of the thirteen states, Massachusetts, New Jersey, New York, Pennsylvania, and Virginia. The remaining states have minimal student enrollment and completion, well below 50 certifications and degrees in the past decade (2003 to 2013). Within the five states, Virginia stands out with promising growth in student degrees and certifications. They began the first part of the decade with just under 70 degrees and certificates, growing consistently over the next nine years to a peak of 266 in 2012. New York took a noticeable hit during the Great Recession but has successfully rebuilt their education pipeline back to a level consistent with pre-recession completion rates. Massachusetts did not begin offering aviation maintenance degrees and certificates until 2005. Despite a quick rise the following year, they went into a period of steady decline through 2010. Since 2010 it seems they have been able to rebuild their completion rates, with 150 degrees and certificates issued in 2013. New Jersey completion rates have been somewhat volatile the past few years, while Pennsylvania looks to be on a positive trend toward increasing total degrees and certifications consistent with pre-recession levels.

Ten of the thirteen states in the Eastern region have at least one high school or postsecondary institution associated with aviation maintenance. The three states with the largest employment, New York, Pennsylvania, and Virginia, also have the largest number of institutions. The Department of Education reports sixteen postsecondary institutions offering airframe, power plant and avionics programs. An additional eight institutions are listed as member schools with ATEC. The FAA reports an equal number of high schools (16), offering

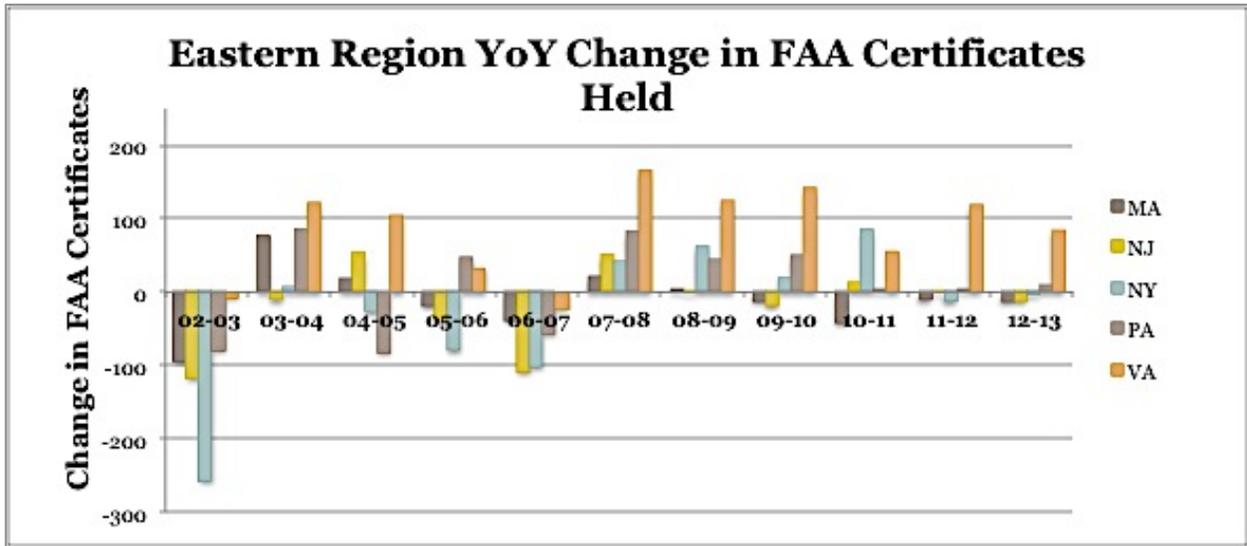
aviation specific vocational training programs. Collectively the region has a balanced number of secondary and postsecondary institutions. There are a few anomalies; Massachusetts, New Hampshire and New Jersey have no high schools with an aviation focus despite having one postsecondary institution in each state. Similarly, Connecticut has only one high school to four postsecondary institutions. Some of these disparities are compensated by the close proximity of the New England states whereby students can easily commute between states for education and job opportunities.

*FAA Certification*



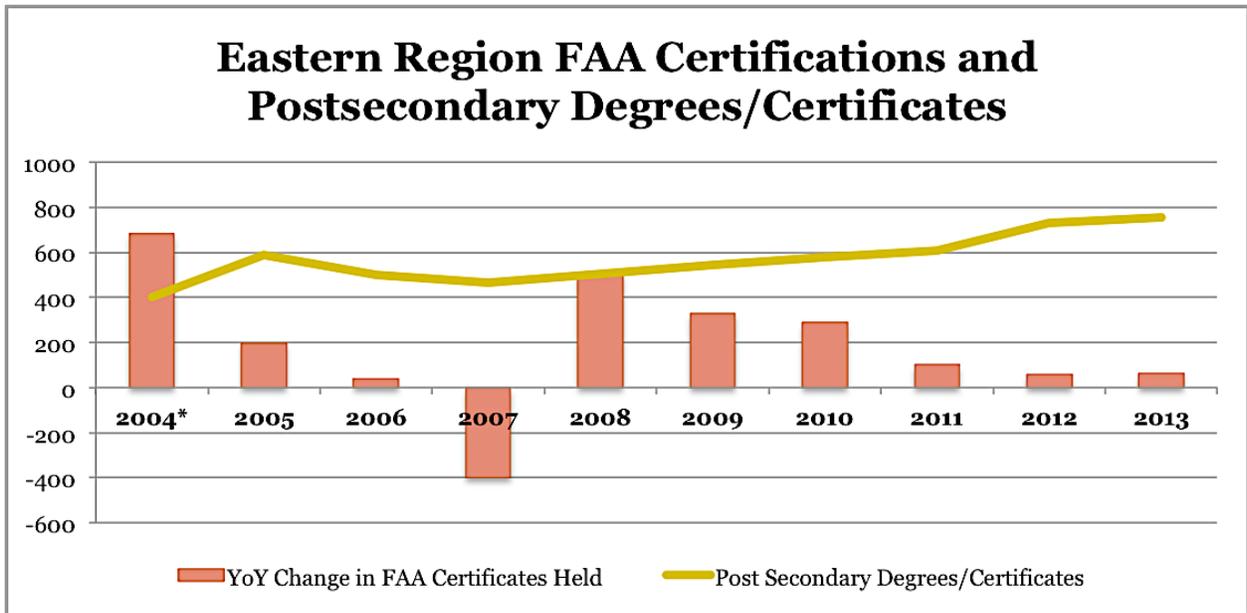
FAA certificates in the Eastern region have remained steady with only a slight increase of 1,400 certificates over the decade, 2003 to 2013 (50,099 to 51,513). The breakdown of certificates by state aligns with employment and education trends previously discussed. New York, Pennsylvania, and Virginia maintain the largest share of certification in the region at 56 percent. No one state shows pronounced growth over this time period. Since FAA keeps the cumulative count of the total certifications held it is more relevant to look at the year-to-year change in order to accurately analyze the overall trend. The line graph below displays such change for the largest certification states in the Eastern region.

*FAA certificates year-to year change*



Again, we see a steady state of certifications for this region. Though none of the large employment states are declining significantly, only Virginia has shown some growth since 2007.

*Comparing postsecondary completions and FAA certification trend*

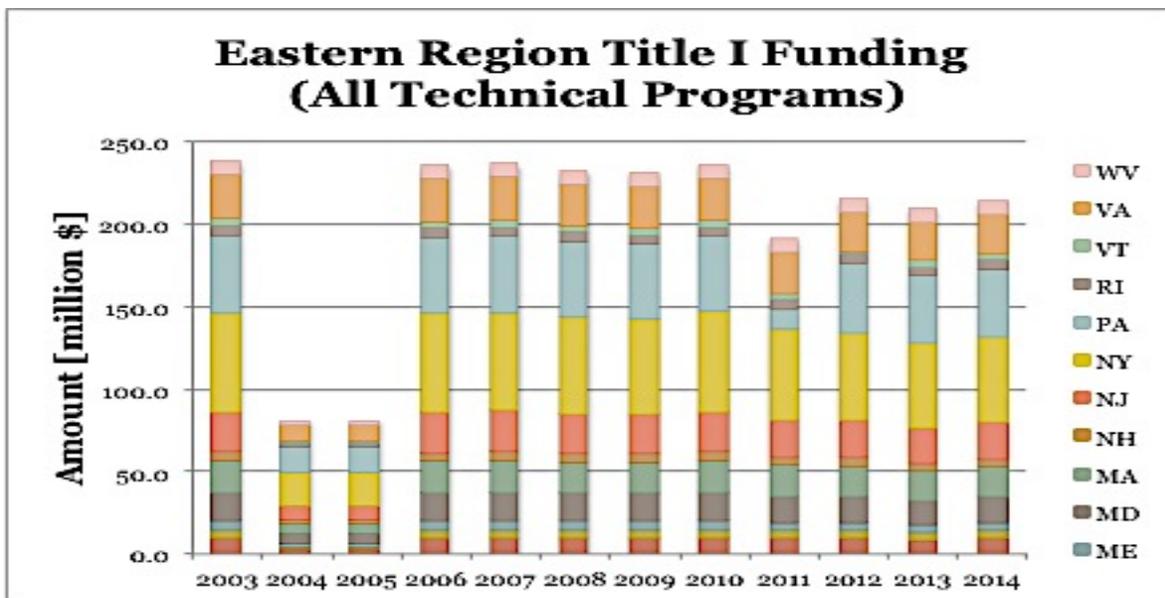


\*2003-2004 change in FAA certificates held

The Eastern Region shows a promising trend for students with aviation maintenance degrees and certificates entering the workforce. There has been strong growth in degree and certificate completion since 2009. As these graduates enter the workforce and complete the FAA

certification process they will slowly replace the large number of aviation maintenance employees retiring or exiting the workforce. There has been a positive change in FAA certifications from year-to-year since 2008, though at a declining rate. If the student growth continues, it seems the labor market will sufficiently adjust to meet the projected employment needs in 2022. Again, if student population begins to decline in the near future, employers will likely feel the effects. Furthermore, this trend only speaks to current employment needs. Should the aviation industry expand and grow faster than BLS projects, there will likely be a shortage of technical workers needed to accompany such a change.

*Perkins Funding*



The region has seen a decline in Perkins funding over the past few years (2011 to 2014) compared with prior years where funding was well in excess of \$200 million. The funding by state is closely associated with total employment by state. New York, Pennsylvania, Virginia, New Jersey and Massachusetts receive the largest share of funding for the region.

*Virginia – Newport News Aviation Academy*

Part of our research included an on-site tour and interview with Mr. Dhyronn Goggins, Lead Teacher at Newport News Aviation Academy, Virginia’s only aviation-specific high school. Newport News Aviation Academy is part of the public school system of Newport News and operates with 350 students who share time between their high school and the academy. The academy teaches courses in maintenance and avionics as well as trains pilots. Students do not

become certified while at the academy. The academy provides about a third of the training required to sit for the FAA certification exam. The remaining two-thirds of training and education is provided at a postsecondary institution, in this specific case, most likely Liberty University in Lynchburg, Virginia.

The school receives Perkins funding via the school district, which rotates it through all of its schools. Mr. Goggins alluded to limited funding overall and the fortunate opportunity they have to receive a portion of this funding. The school has a near 100% completion rate, and near 100% employment rate once becoming certified. To his knowledge, many employers are giving conditional jobs ahead of certification. Mr. Goggin's also mentioned how the aviation industry is not just competing with other obvious competitors like the automotive industry, but enterprises like theme parks as well. The desired transferable skill sets include general maintenance, hydraulics and electronics experience.<sup>33</sup>

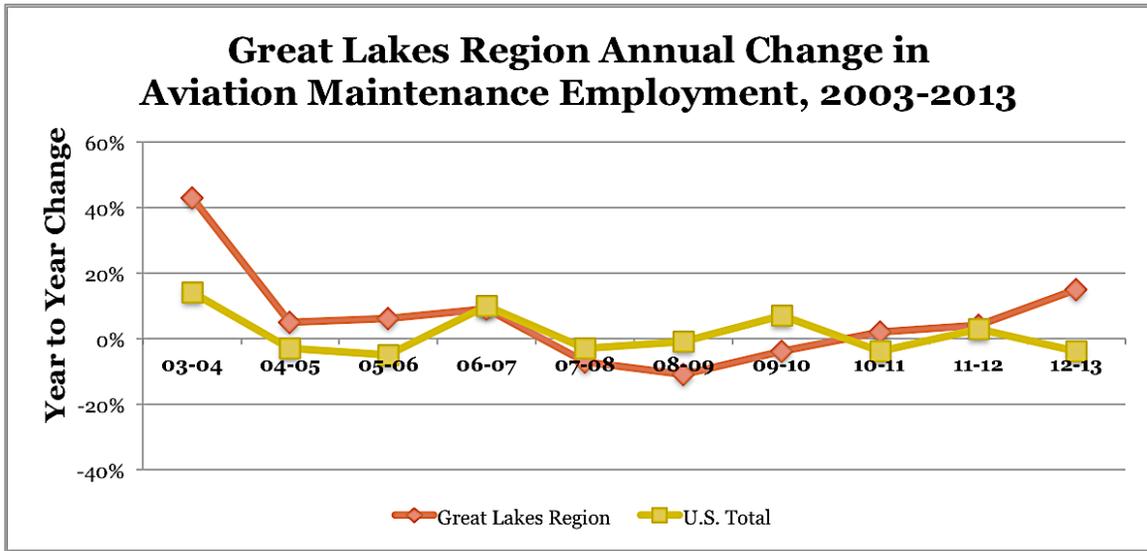
## **Great Lakes Region Analysis**

The Great Lakes region consists of eight states: Illinois, Indiana, Michigan, Minnesota, North Dakota, Ohio, South Dakota, and Wisconsin. The region employs just 11 percent of the industry and is the only region to have a negative earnings change over the last decade. Since 2010 employment has increased, yet current employment levels barely replace pre-recession numbers. The variable change in employment and wages yield inconclusive evidence for addressing labor shortage concerns. Education has remained fairly constant with the overall increase in the past few years driven entirely by the state of Michigan. A more in depth review of key indicators within the region follows.

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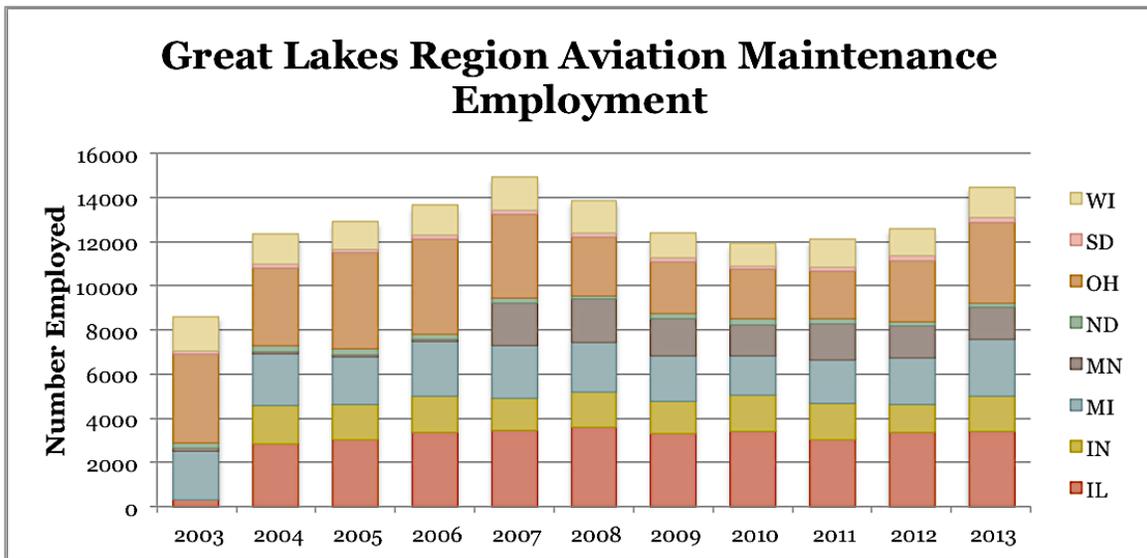
<sup>33</sup> Goggins, Dhyronn, Interviewed by Menuka Ban, Cale Jones, and Emily Uselton, 2014, Interview with Lead Teacher at Newport News Aviation Academy, October 31.

*Employment*



The Great Lakes region describes the national employment picture in a slightly more sensational fashion. The region experienced a sharper decline in the recovery and a sharper recovery since. The Great Lakes, however, did see a one year delivery in that recovery but has employed more in the industry in the last three years.

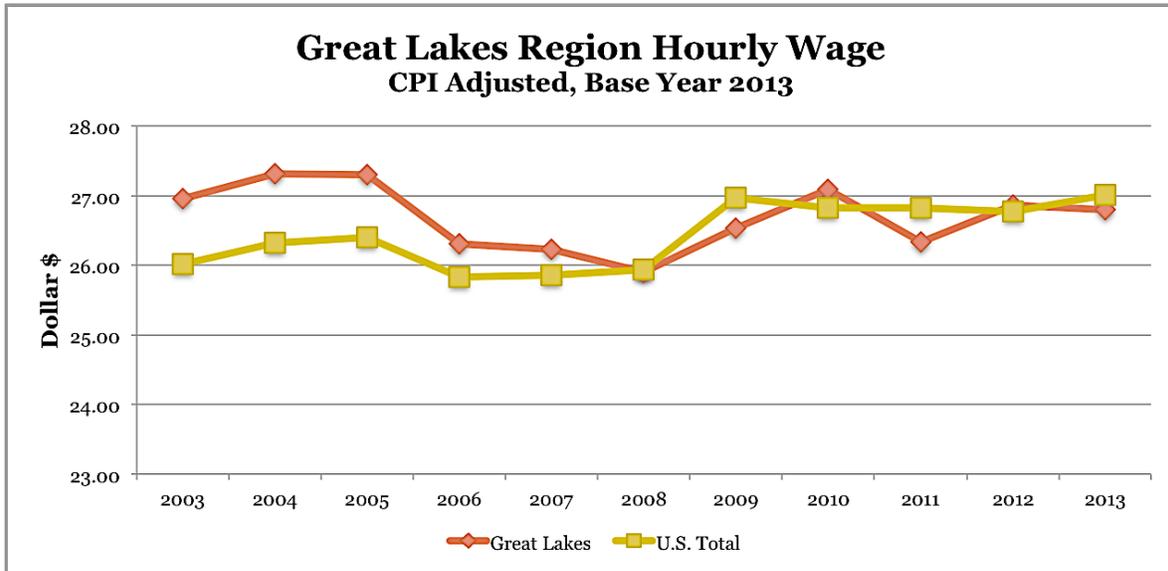
*State Employment Distribution*



This graph also helps illustrate the fluctuations in regional employment. The largest employers in the region are Illinois and Ohio, with Illinois seeing a huge increase between 2003 and 2004 to become the region’s second largest employer. It is likely that some type of reorganization or new training of some employees caused this. While employment has increased

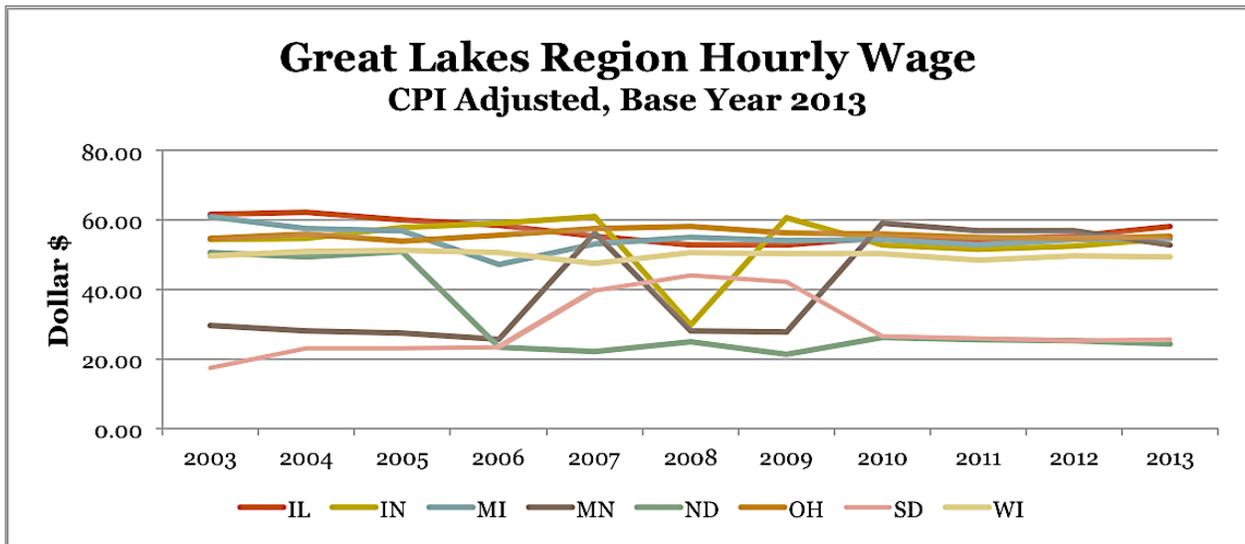
since 2003, it has been higher, and has fluctuated too much to give any indication about the presence of a shortage in the region.

*Wage Analysis*



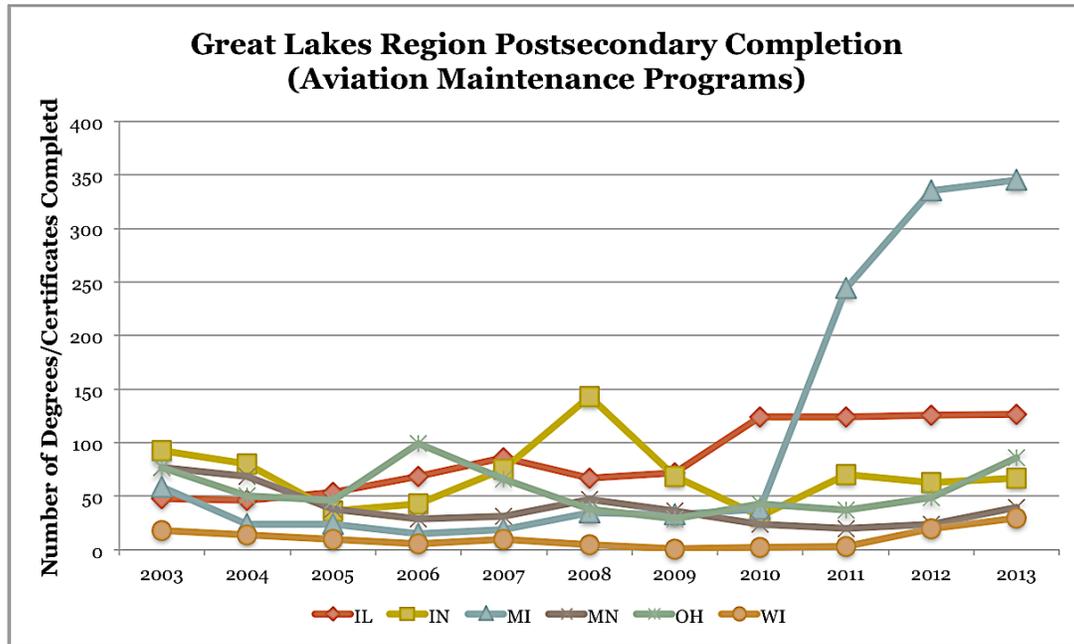
Prior to the recession, the region paid more than the national average. After the recession however, the region's wages have fluctuated while most of the country has remained constant. Over the last decade, wages have decreased slightly, but barely. This gives no evidence of a shortage.

*State Wage Distribution*



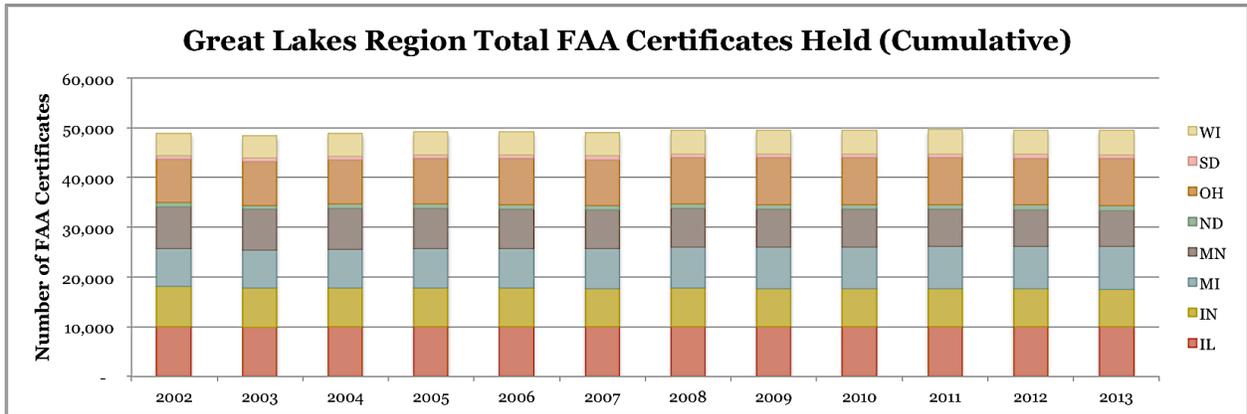
Looking within the region, wages have remained mostly constant for each state. Again, this shows no evidence of a labor shortage within the region. The biggest takeaway is the climb of South Dakota’s wages to get in a similar range of the rest of the region, and a convergence of wages in the region overall.

*Education Analysis*



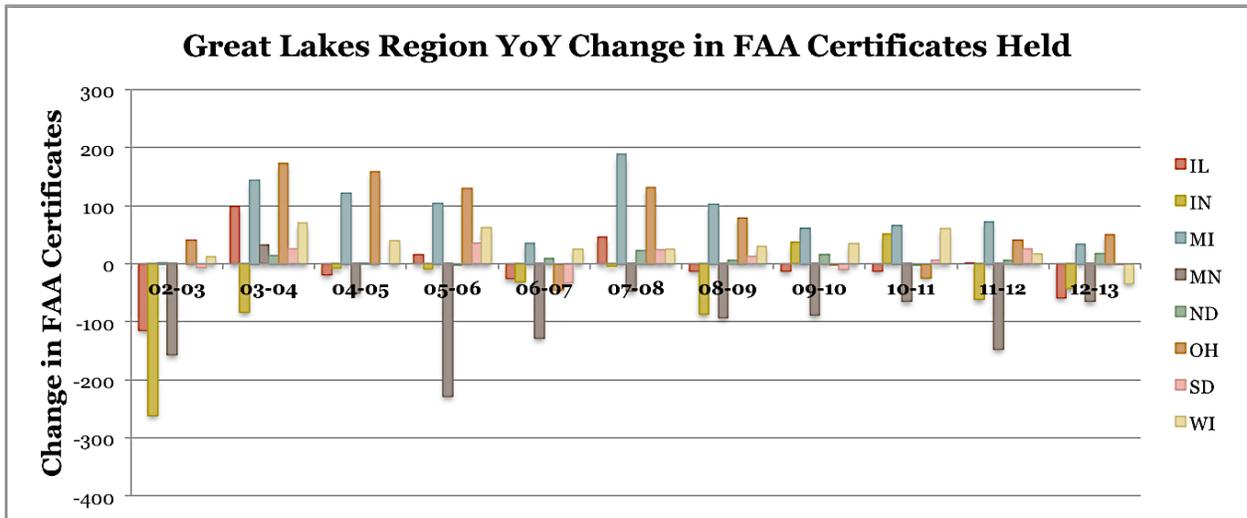
Each state, with the exception of Michigan and Illinois have seen rather constant numbers in degrees given throughout the decade. In 2010, Michigan’s MIAT College of Technology began reporting information to the Department of Education. Since then, they have issued roughly 200 degrees annually, driving the overall state growth. Illinois Ohio, and Wisconsin have also seen slight decreases over the decade.

*FAA Certification*



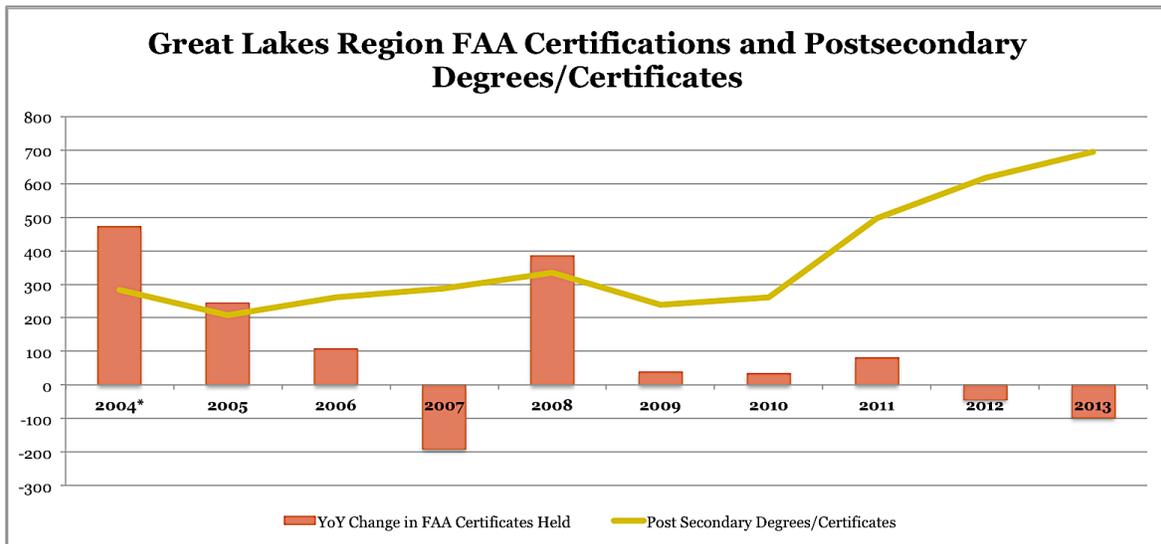
Certificates held in the region have remained incredibly constant, despite all of the fluctuation in employment. Any change from state to state has been offset and hasn't much affected the regional total. As expected, Illinois and Ohio hold the most certificates.

*FAA certificates year-to-year change*



This graph lets us take a closer look at the variation between states. Minnesota has seen a significant decrease in certificates every year but one, and Indiana has also seen decreases most years. Contrast this with Michigan and Ohio, and you'll see significant increases most years. Most other states have remained constant. Interestingly enough, these changes are not expected given the employment changes. For example, Minnesota had a new employer move into the state (or similar event) that caused an employment increase in 2006. One would expect a similar increase in FAA Certificates in the state.

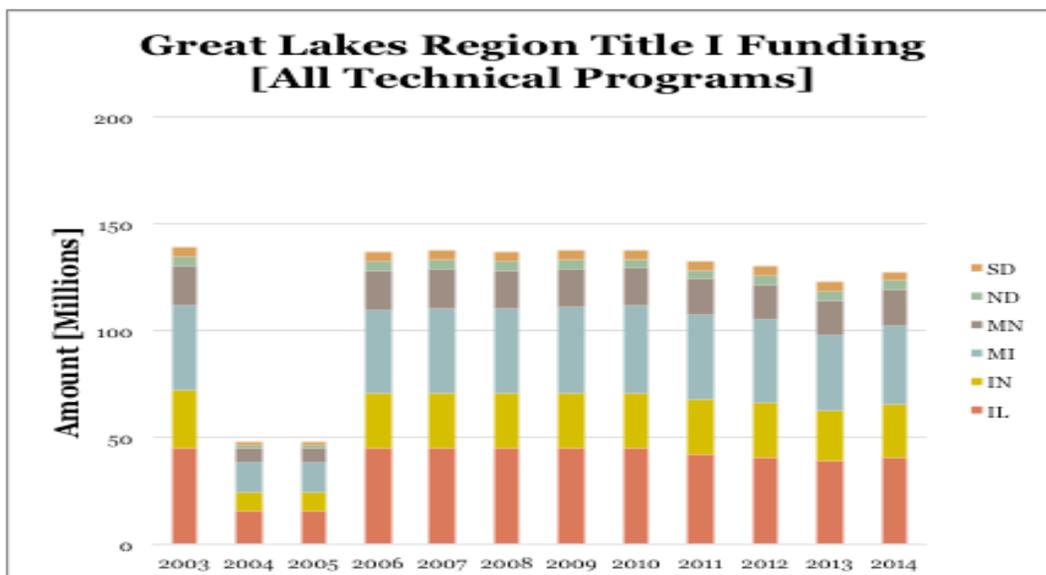
*Comparing postsecondary completions and FAA certifications*



\*2003-2004 change in FAA certificates held

When we compare the number of degrees given each year to FAA Certifications held, we see an unexpected trend that is occurring across the country. In this region, however, it is more discouraging than in the national picture. While more and more degrees are being given since the recession, as is occurring nationally as well, the change in certificates is not matching the trend. Especially in the Great Lakes, as certificates held has actually decreased in 2012 and 2013.

*Perkins Funding*

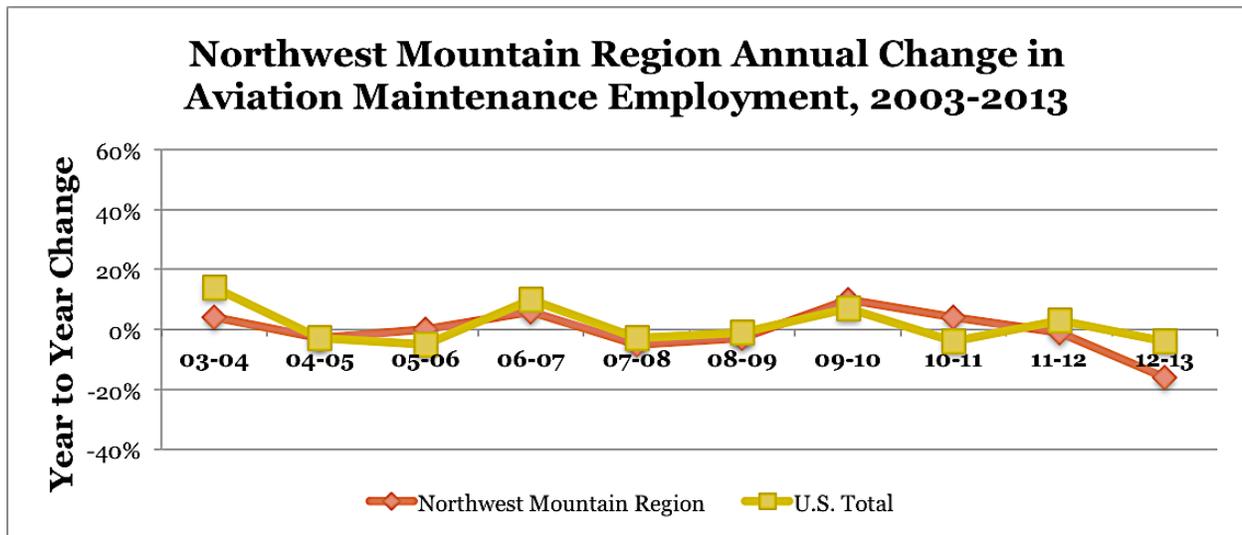


Perkins funding has remained mostly static throughout the decade, with Michigan and Illinois receiving the most in the region. While this may contribute to Michigan’s sharp rise in degrees given, there are many programs that Perkins grants go to, as they are for career and technical education in general.

### Northwest Mountain Region Analysis

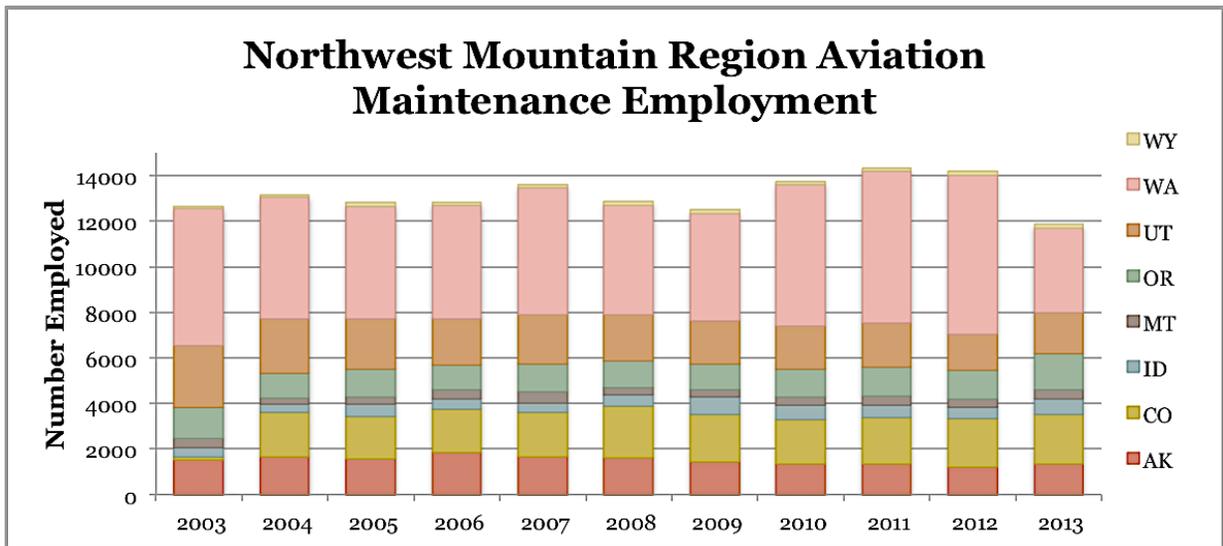
With Boeing making Seattle one of the country’s aviation hubs, the Northwest Mountain Region, still employs just 9 percent of the industry. Comprised of Alaska, Colorado, Idaho, Montana, Oregon, Utah, Washington, and Wyoming, the region gives more degrees than any region but the South. The sharp disconnect between education supply and employer demand signifies inconclusive evidence of a labor shortage. Employment change has been cyclical throughout the past decade, amid stagnant wage growth. 2010 initiated the sharp rise in certificate and degrees issued. The following analysis provides a more in-depth review of key indicators.

#### Employment



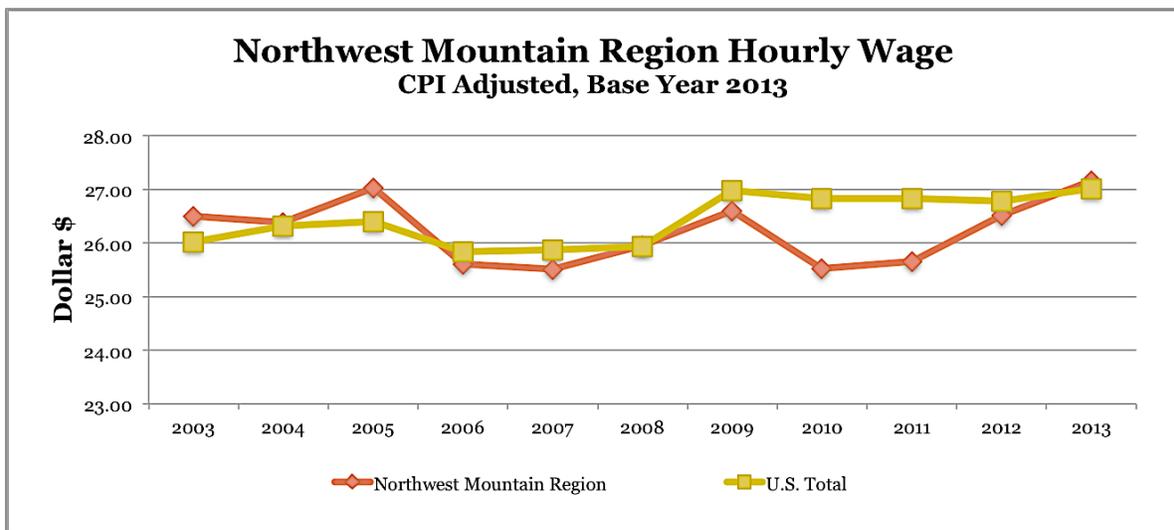
The industry change in employment in the Northwest Mountain Region largely mirrors that of the national average, with the sharp decrease from 2012 to 2013 being the exception. This is interesting given the picture of higher education in the region that will be discussed in following sections.

State Employment Distribution



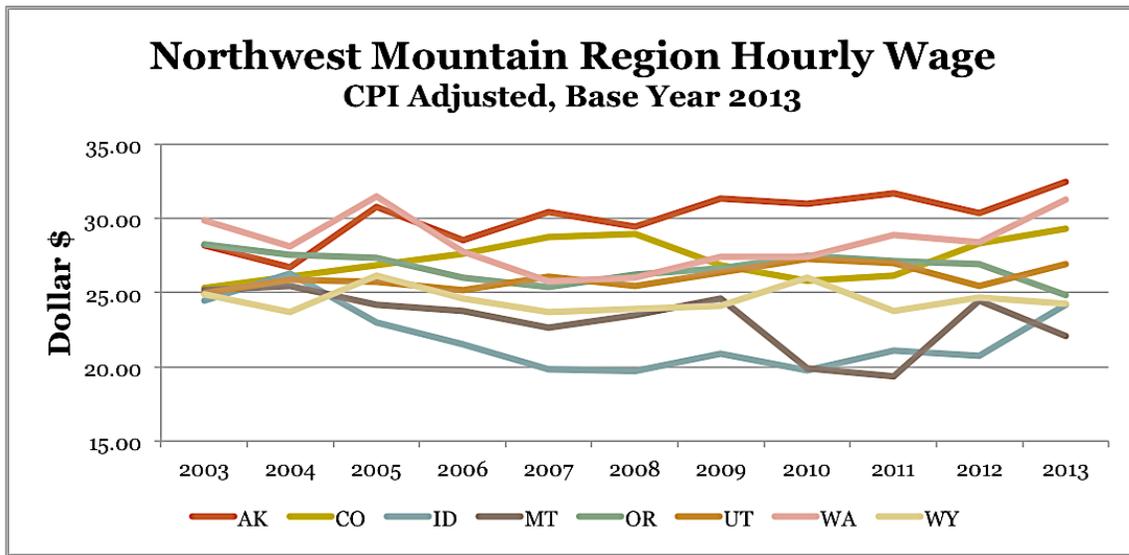
As expected, Washington employs more than any other state. Boeing’s presence in Seattle is the likely cause. Still, there is no state in the region with a majority of the workforce as is seen in some other regions throughout the country. As a whole, regional employment has remained mostly constant, and there is no sharp increase that would indicate a shortage.

Wage Analysis



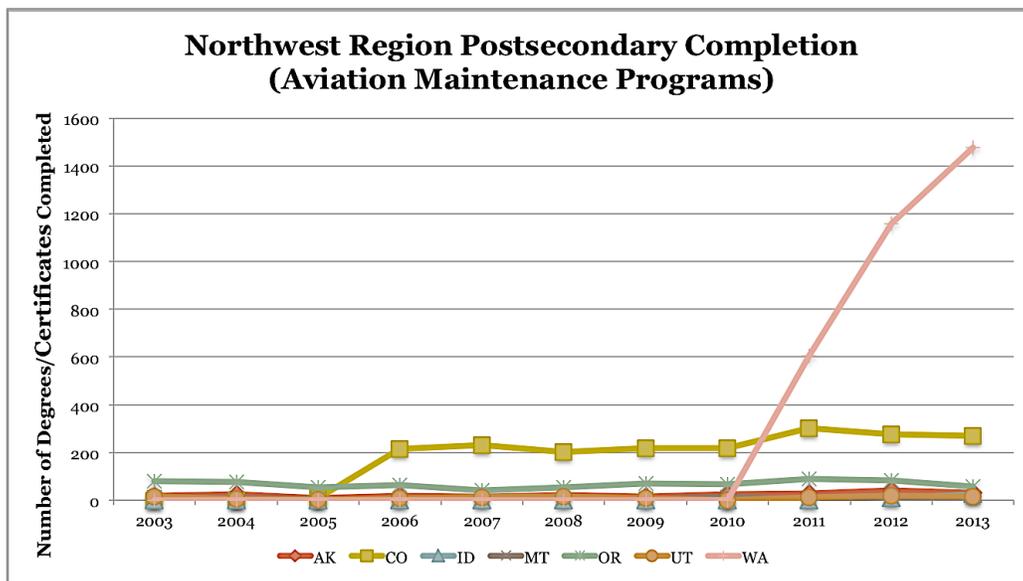
Wages in the region, for the most part, mirror the national average. But, similar to employment, this means there is no evidence of a regional shortage. The interesting piece is the decline from 2009 to 2010 while the rest of the nation remained constant, with a sharp increase since then to climb slightly above the national average in 2013.

*State Wage Distribution*



Looking within the region, wages have remained mostly constant for each state. Again, this shows no evidence of a labor shortage within the region. What might be the biggest takeaway is the slow, but steady climb of Washington’s wages since the Great Recession. This is likely indicative of Boeing’s performance and views on the industry.

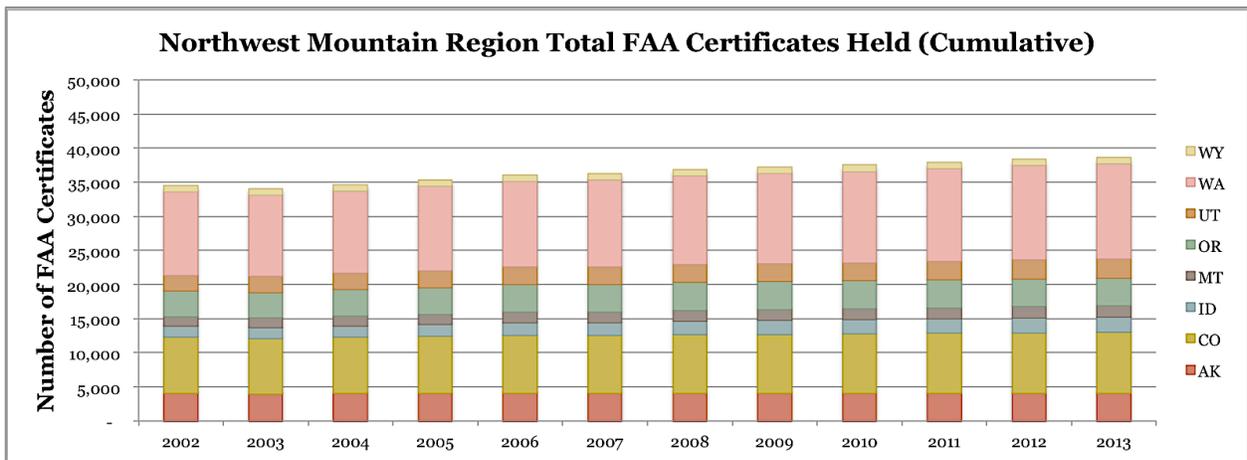
*Education Analysis*



Overall, degrees given throughout the decade have remained constant. Washington, however, has had a sharp increase of over 1,000 completed degrees per year since 2010. Similar to Michigan in the Great Lakes region, Edmonds Community College is the sole institution

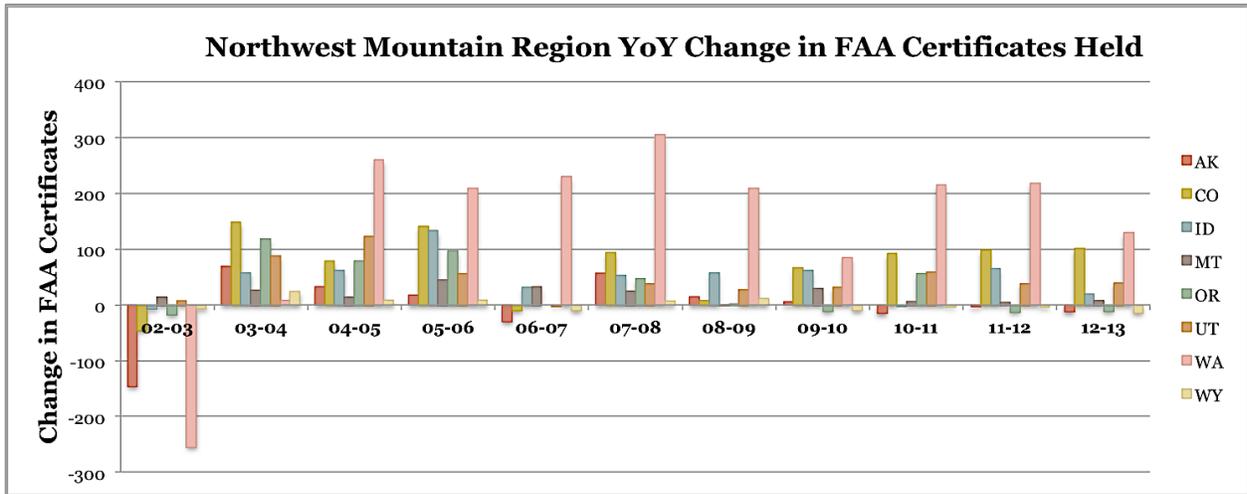
responsible for this spike in degree and certificates issued post 2010. IPEDS did not have institutional data for the state of Washington from 2003-2010. Thus, while it is interesting that this spike in education supply does not accompany a similar increase in employment, measurement error causes us to exercise caution when drawing inferences regarding this disconnect. Employment actually decreased in Washington in 2013. One possible theory comes when combining this analysis with that in the Western-Pacific Region. California has seen a growth in employment without degrees or certifications. One explanation could be that those being educated in Washington, and the Northwest-Mountain Region overall, are then moving to California for jobs with slightly higher wages.

*FAA Certification*



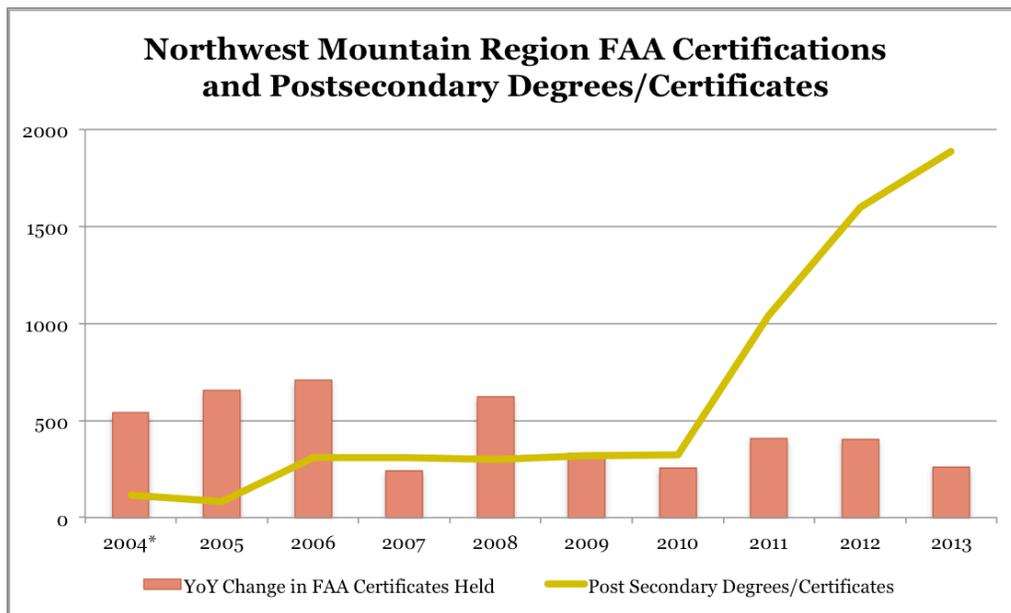
Certificates in the region have been on a slow steady increase, with no visual increase from the increase in degrees. Alaska and Oregon have remained constant while states like Colorado, Idaho and Washington seem to be responsible for the small increase.

*FAA certificates year-to-year change*



This graph also illustrates the steady increase throughout the region. Again, the largest changes happening in Washington, which leads one to wonder why there is a decrease in employment in the state. From 2003 on, any decreases in certificates held in the region are minimal, and are not trends for any state. For the region as a whole, the 2013 increase in certificates is disconcerting given the decrease in employment. One possibility is the theory of migration previously discussed in the context of California’s growth in employment.

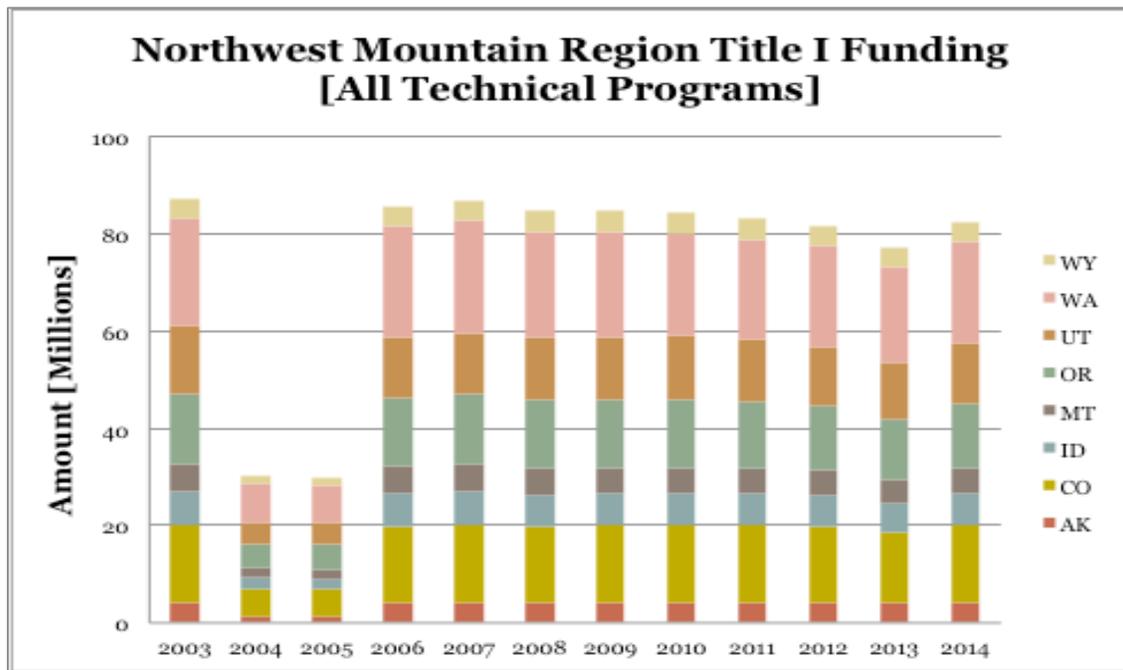
*Comparing postsecondary completions and FAA certification trend*



\*2003-2004 change in FAA certificates held

When we compare the number of degrees given each year to FAA Certificates held, we see an unexpected trend that is occurring across the country. In the Northwest Mountain region, however, it isn't as discouraging. While the number of certificates is increasing, it is increasing at a decreasing rate, which doesn't entirely match the sharp increase in degrees given in the industry. One possibility is the presence of employers from other industries recruiting out of aviation maintenance.

*Perkins Funding*



Perkins funding has remained mostly static throughout the decade, with Washington commanding the most funding in the region. This may translate to the number of degrees given, but the sharp increase in degrees given in the last three years obviously didn't result from an increase in Perkins grants.

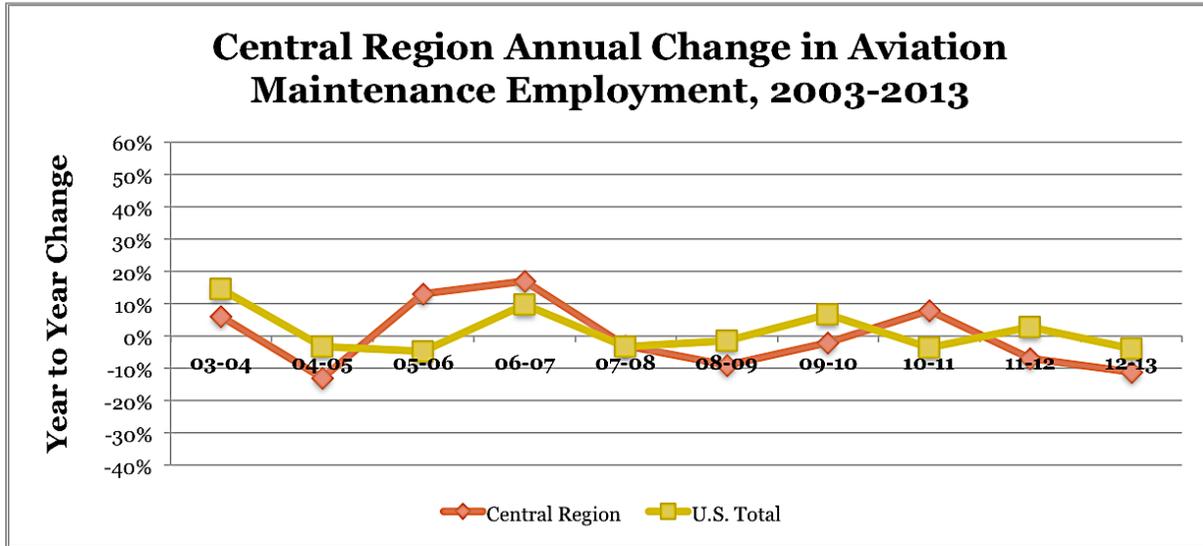
**Central Region Analysis**

The Central region is the smallest region and is comprised of four states: Iowa, Kansas, Missouri, and Nebraska. Prior to 2008 both earnings and employment showed signs of growth; however, post Great Recession employment has declined and earnings have remained flat. Degree and certificate completion rates have seen growth, but only minor and on a much smaller

scale than other regions. Given the small size of the region relative to total employment for the industry these key indicators do not provide significant evidence of a labor shortage.

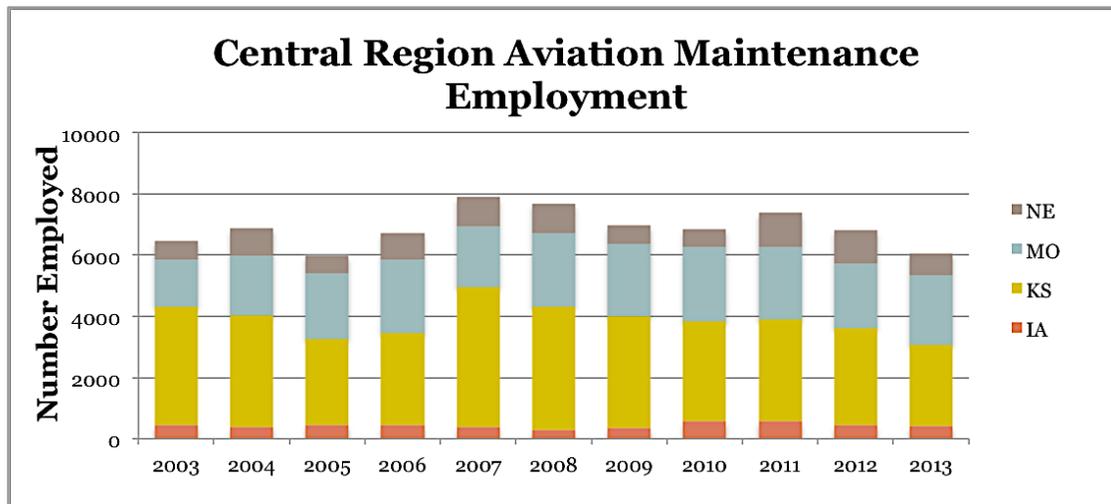
Nevertheless, additional information and trend analysis follows.

*Employment*



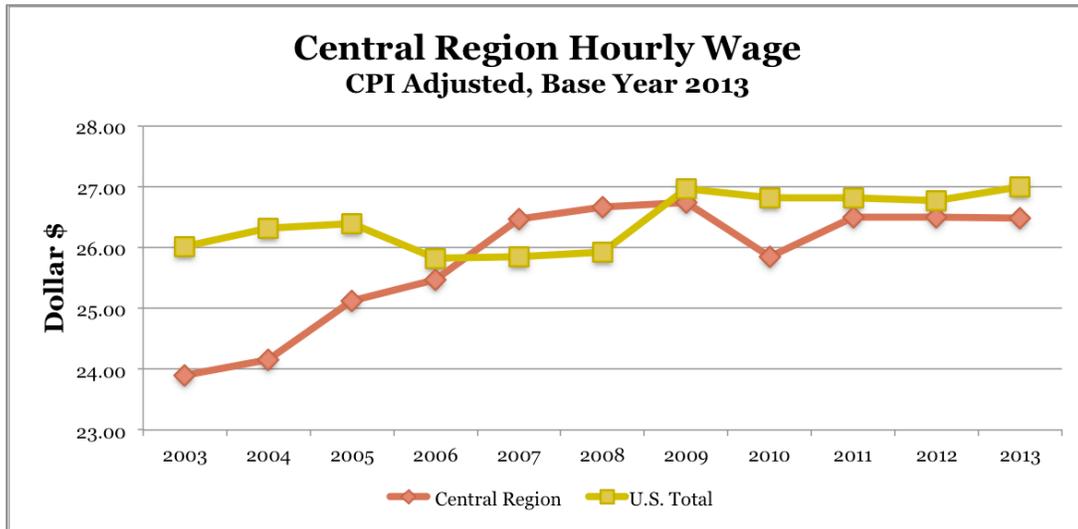
Employment in the region over the last decade mirrors the national average. Since the Great Recession, employment nationally has shown minimal growth, with some periods of decline. The Central region has fluctuated more than the national trend. Most recently, employment has declined by over 11 percent from 2012 to 2013.

*State Employment Distribution*



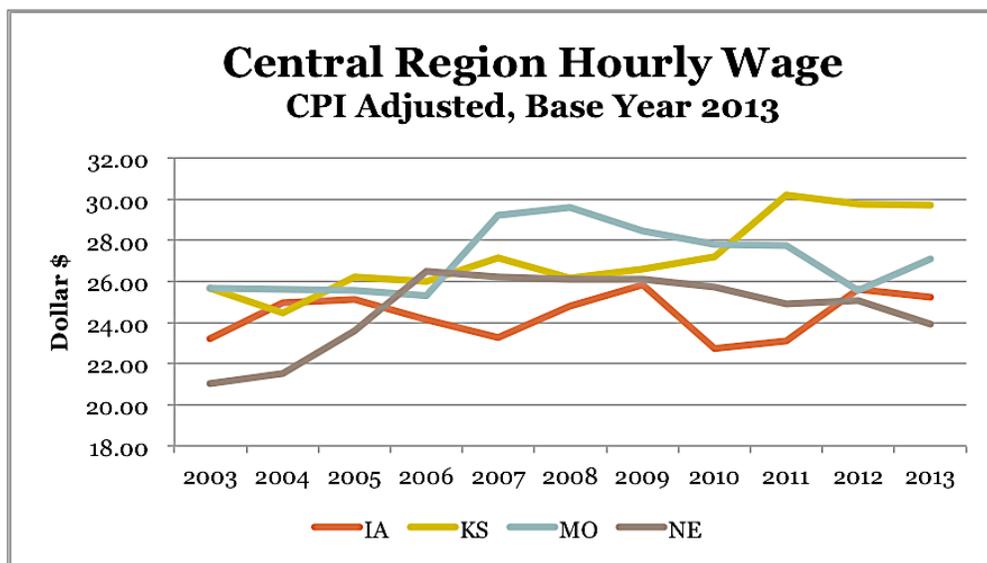
Over the past decade, the region has shown a slow decline in the aviation maintenance employment. Missouri and Kansas cover over 80 percent of employment in the region; with the employment change in Kansas is driving the overall change in the region. There was slight growth until 2007 in the region, but since the employment has declined overall.

*Wage Analysis*



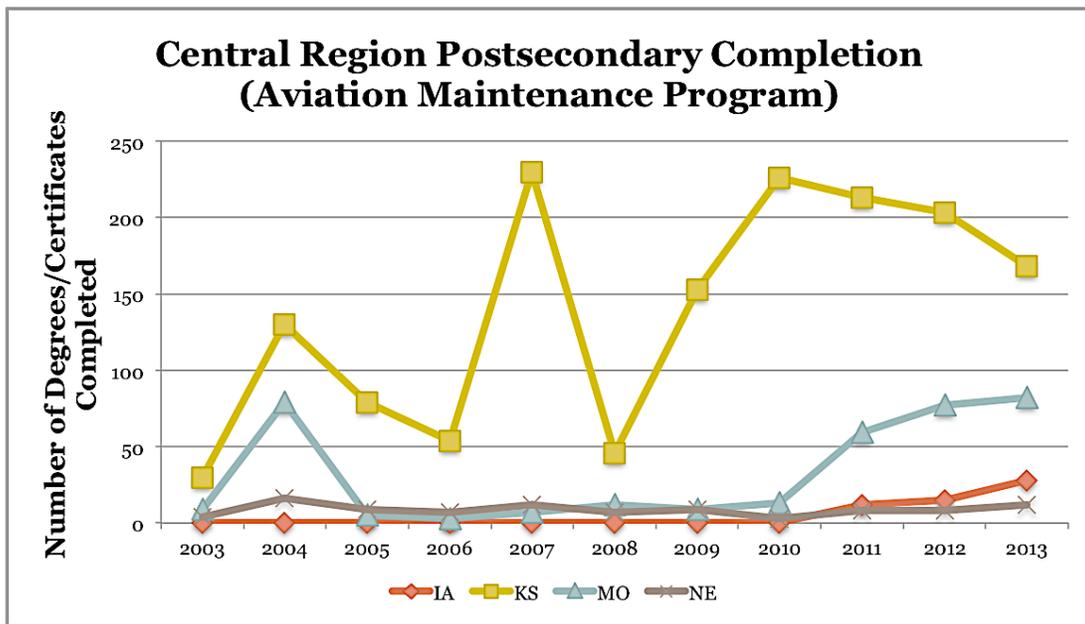
Overall, average median hourly wage for aviation maintenance employees in the central region have seen a positive trend over the past decade. Wages in the Central Region were below the national average, but were depicting a positive trend until 2007. Since 2007, the trend is flat, and wages in the region remain at the national average.

*State Wage Distribution*



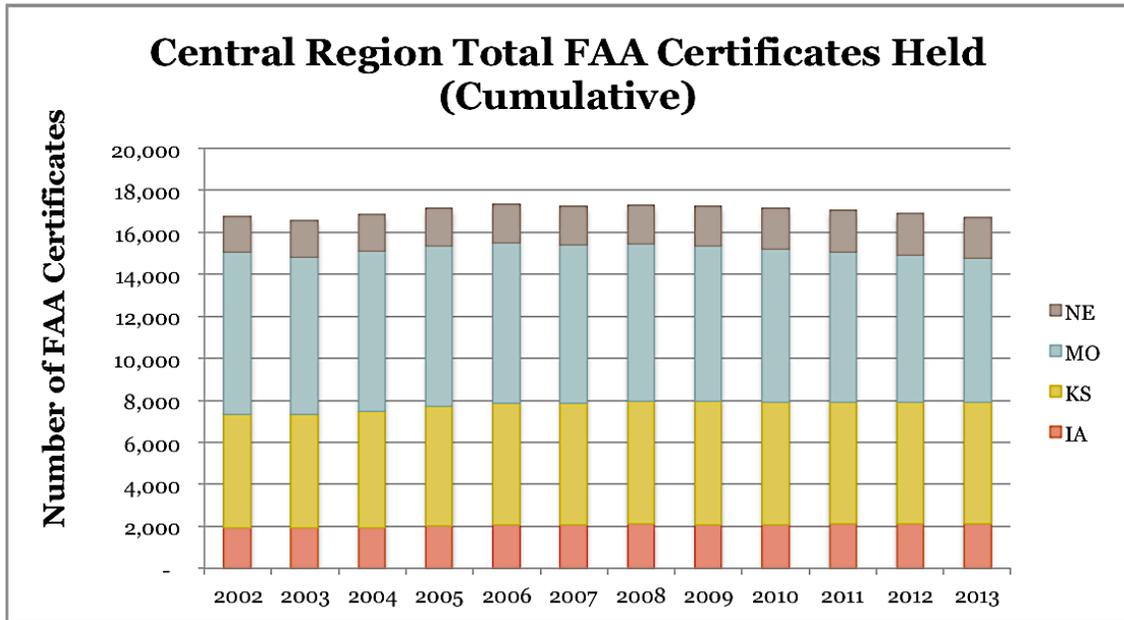
The average median hourly wage in the region has seen small growth over the past decade. Since Missouri and Kansas cover over 80 percent of employment in the region, it is important to focus on these two states. Missouri has seen steadier growth than any other state in the region. In Missouri, the average median hourly wage increased from \$26 per hour in 2003 to \$30 per hour in 2013. In Kansas, the wage jumped roughly \$5 per hour from 2006 to 2007, but it has been declining since 2007.

*Education Analysis*



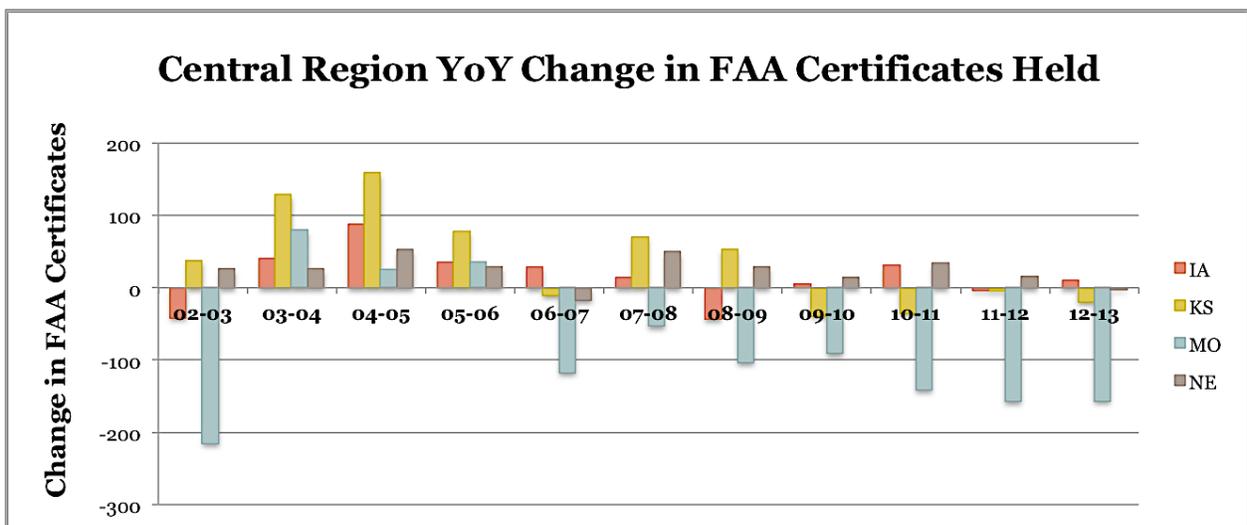
In the Central region, the majority of postsecondary degrees and certifications for airframe, avionics, and power plant mechanics are being issued in Kansas. Even though Kansas took a noticeable hit in 2006 and 2008, the number of degrees and certificates completions increased in the following years. Wichita Area Technical College in Kansas is the largest contributor of degrees and certificates. During 2006 and 2008 the number of students who completed programs from this institutions was markedly lower. After only issuing degrees in four separate years, Missouri has been on a steady increase since 2010. The remaining two states, Nebraska and Iowa, have issued none or next to no degrees over the decade. This makes sense because just below 20 percent of the total employment in the region is located in these two states.

FAA Certification



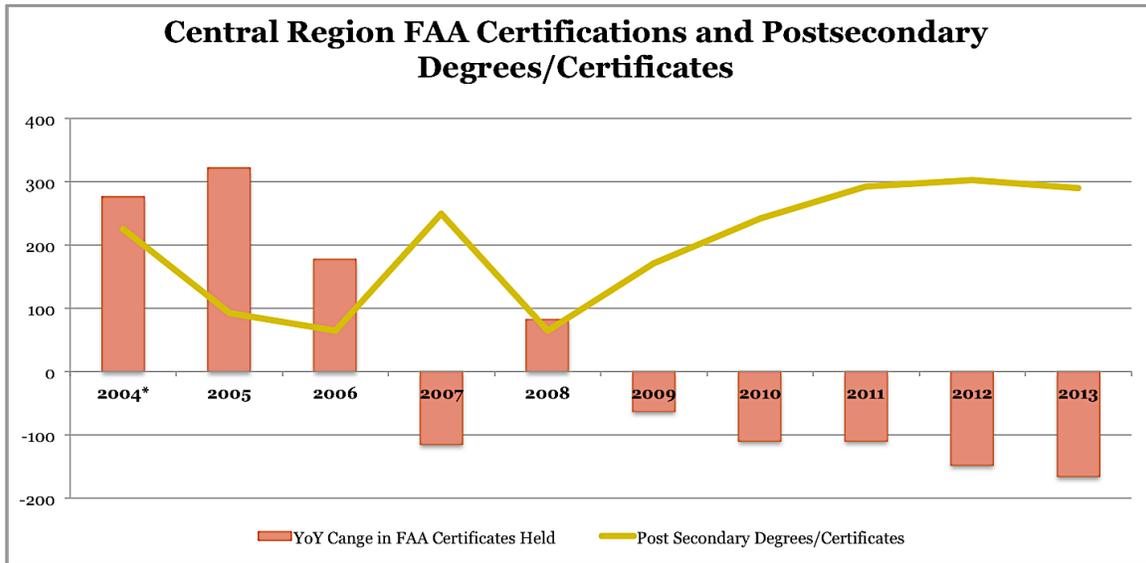
FAA certificates in the Central region have shown little to no growth over the last decade, and have declined since 2009. The breakdown of certificates by state aligns with previously discussed employment and education trends in the region. Kansas and Missouri represent over 80 percent of total certificates held in the region. However, despite employing and educating more than the other states, Kansas has a lower number of cumulative FAA certificates than Missouri each year.

FAA certificates year over year change



This graph demonstrates that certificates in Missouri declined in 2003 and in recent years since 2006. While Kansas has fewer total certificates than Missouri, if the current trend holds that may change due to the discrepancy between the losses in Missouri and Kansas.

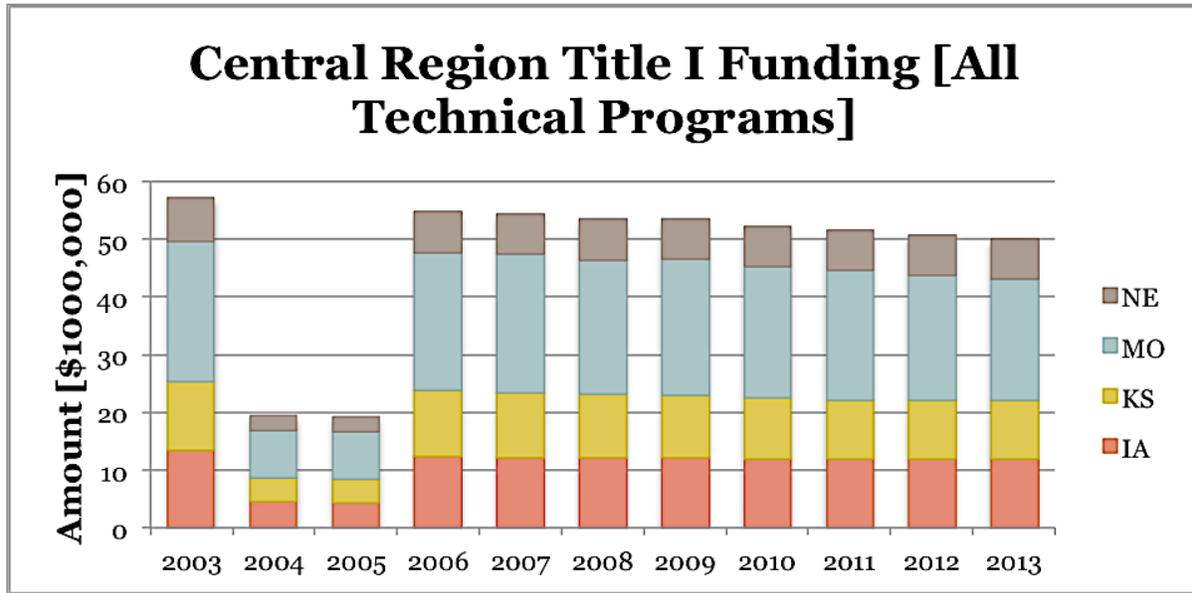
*Comparing postsecondary completions and FAA certification trend*



\*2003-2004 change in FAA certificates held

This graph shows the disparity between the year over year change in FAA certifications and the total number of degrees or certificates issued by the postsecondary institutions. The region has shown growth in degree and certificate completion since 2010, and one would hope means more people are entering the workforce. However, the number of FAA certificates has declined every year since 2009. This makes sense given the decline in regional employment. It is still concerning in the light of education. The ideas of migration and competition with other industries appear here again.

## Perkins Funding



The region has seen a decline in Perkins funding between 2011 and 2014. In prior years where funding was well in excess of \$200 million. The funding by state is not closely associated with total aviation employment by state. Missouri, with the second highest number of employees has received smaller proportion of funding than Iowa, which employs significantly fewer people.. However, one must remember that Perkins funding is provided to technical education programs, with aviation maintenance being one slice of that.

## Conclusion

### Results

Due to data limitations, we did not find substantive results to conclude whether a labor shortage does or does not exist in any particular region. This was primarily driven by insufficient starting wage data. There are, however, noteworthy trends in employment, education, and FAA certification. These indicators are useful for assessing the policy landscape in a region or state. While technical workforce development has gained national attention as being necessary to

maintain America’s global competitiveness, our research clearly supports the idea that the policy assessment and recommendation process is truly a state and local issue.<sup>34</sup>

The perceived “skills gap” and technical workforce need is supported by research noting the increased demand for postsecondary education. By 2018, 63 percent of jobs will require some form of education beyond a high school diploma. Moreover, the U.S. will require an additional 4.7 million new workers with postsecondary certificates.<sup>35</sup> Aviation Maintenance programs certainly fall within this broad category. We found positive evidence indicating greater completion of degrees and certificates for aviation maintenance postsecondary programs. This may be an early sign of the market appropriately adjusting to workforce demand. Students are realizing the cost-effectiveness and benefits of this postsecondary degree track.

There may be some concern that despite the growth in the education pipeline, employers may still find themselves with an insufficient hiring pool. Part of this concern can be supported by the declining rate of FAA certification from 2008 to 2013. Several factors may contribute to this, of which further empirical analysis can begin to substantively answer. Based on the anecdotal evidence we found, both quantitatively and qualitatively, two potential hypotheses can be formed. First, a large share of the existing FAA certified workforce, presumably baby boomers, are beginning to retire and exit the workforce. Although student completion is on the rise it is not sufficient to replace all of those retiring. Second, given the strong demand for technical skill sets, there is increasing competition among industries. Therefore, students are completing the aviation maintenance programs but electing to take jobs in other industries where wage or opportunity is greater. This is made possible by a desirable and transferable skill set.

## **Future Research**

Additional research can begin to disentangle several of the variations and trends we found at a regional level.

1. **International considerations:** On the subject of technical workforce development international considerations can be beneficial for providing best practices among other countries. Often Germany is referred to as the “best” for vocational and technical workforce

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<sup>34</sup> Zumeta, W, D Breneman, P Callan, & J Finney, 2012, *Financing American higher education in the era of globalization*. Cambridge, MA: Harvard EP.

<sup>35</sup> Carnevale, Anthony, Nicole Smith, & Jeff Strohl, 2010, *Help Wanted: Projections of Jobs and Education Requirements through 2018*, Center on Education and Workforce, Georgetown University, Washington DC, Georgetown UP.

development. While their model may not be directly transferable to the U.S. at a national level, certain objectives like lifetime learning and transferable skill-sets can be of value.<sup>36</sup>

The advantage of a diverse education system governed largely by the fifty states is the opportunity for states to integrate certain aspects of Germany's and other developed countries vocational systems into their workforce development plans.

2. **FAA regulatory impact:** the FAA regulatory environment certainly impacts workforce development initiatives. Conducting a thorough assessment of FAA regulations and how they coincide with employer and employee needs would provide valuable context to this policy issue.
3. **The Workforce Innovation and Opportunity Act:** the WIOA includes a requirement for states to develop statewide comprehensive plans addressing technical workforce needs. An in-depth analysis of these plans for states and regions with a large number of employees would provide valuable information regarding each state's appetite for technical workforce development initiatives.
4. **Competency-based education:** this is a growing higher education policy initiative, especially for veterans.<sup>37</sup> Many of the skill sets required for a career in aviation maintenance are developed while in the military. Advocating for accelerated completion in aviation maintenance programs based on previous and relevant work experience could help grow the pool of labor supply.
5. **Powerful Indicators to measure Labor Shortage:** The report analyzed publicly available data to disentangle the regional variations and trends, but a lack of powerful indicators that measure labor shortages, our results were ultimately inconclusive. For example, industry-specific placement data provides empirical support to accurately measuring labor supply. Similarly, vacancy data is considered integral to observing labor demand. In addition, access to entry-level wage data would supplement median hourly wage analysis.

Stakeholders are well aware of ongoing communication surrounding technical workforce development needs; ideally the quantitative information presented here supplements decision-making and advocacy efforts. Much analysis and comprehensive assessment remains to be done within each of these regions or key states.

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<sup>36</sup> Jacoby, Tamar, 2014, "Why Germany is so Much Better at Training its Workers," *The Atlantic*.

<sup>37</sup> Fain, Paul, 2014, "Big Ten and the Next Big Thing," *Inside Higher Ed*.

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## Appendix

**Table 1. Southern Region Educational Institutions**

States	High School Institutions	Postsecondary Institutions
Alabama	BTW Magnet High School	Enterprise State Community College
Florida	Choctawhatchee High School Crestview High School Ft. Walton Beach High School Hialeah High School Homestead Senior High School Peterson Aviation Academy Lake Worth Community High School Niceville High School North Miami High School Miramar High School Pahokee High School	Tom P Haney Technical Center National Aviation Academy of Tampa Bay Lorenzo Walker Institute of Technology Lively Technical Center George T Baker Aviation School Florida State College at Jacksonville Florida State College at Jacksonville Aviation Center of Excellence Embry Riddle Aeronautical University Central Florida Aerospace Academy/Traviss Career Center Broward College Aviation Institute of Maintenance-Orlando
North Carolina	Winston-Salem/Forsyth City Schools	College of the Albemarle Craven Community College Guilford Technical Community College Wayne Community College
Tennessee	Wooddale High School	Tennessee Technology Center of Nashville Tennessee Technology Center at Memphis North Central Institute Middle Tennessee State University
South Carolina	X	Greenville Technical College Pittsburgh Institute of Aeronautics (Myrtle Beach Campus) Trident Technical College
Georgia	X	Atlanta Technical College Augusta Technical College Aviation Institute of Maintenance-Atlanta Central Georgia Technical College Chattahoochee Technical College Georgia Northwestern Technical College Middle Georgia State College Savannah Technical College South Georgia Technical College
Mississippi	X	Hinds Community College Northwest Mississippi Community College
Kentucky	Shawnee Aviation High School Bryan Station High School Corbin High School Corbin Area Technology Center Danville High School Frankfort High School Glasgow High School Monroe Co High School Muhlenberg Co High School Rowan Co High School South Warren High School Taylor Co High School The Academy at Shawnee	X

**Table 2. Southwest Region Educational Institutions**

States	High School Institutions	Postsecondary Institutions
Arkansas	Langston Aerospace & Environmental Studies School	Black River Technical College Mid-South Community College Pulaski Technical College Southern Arkansas University Tech Arkansas Northeastern College
Louisiana	X	Baton Rouge Community College South Louisiana Community College Sowela Technical Community College
New Mexico	X	Central New Mexico Community College Eastern New Mexico University-Roswell Campus
Oklahoma	South East High School	Canadian Valley Technology Center Gordon Cooper Technology Center Oklahoma City Community College Southeastern Oklahoma State University Southwest Technology Center Tulsa Technology Center-Riverside Campus Metro Technology Center Spartan College of Aeronautics
Texas	Skyline High School Sterling Aviation Sciences High School James Madison H.S. for Meteorology & Space Science	Amarillo College Aviation Institute of Maintenance-Dallas Aviation Institute of Maintenance-Houston Coastal Bend College Del Mar College Hallmark College Midland College St Philip's College Tarrant County College District Texas State Technical College-Harlingen Texas State Technical College-Waco Texas State Technical College-West Texas Letourneau University Aviation Institute of Maintenance-Irving Texas State Technical College- Abilene

**Table 3. Western-Pacific Region Educational Institutions**

States	High School Institutions	Postsecondary Institutions
Arizona	South Mountain High School Coronado High School Catalina High Magnet School	Chandler-Gilbert Community College Cochise College Pima Community College West-Mec
California	Oakland Aviation High School Wathen Aviation Academy Westchester High School	Antelope Valley College Chaffey College City College of San Francisco College of Alameda College of the Sequoias Crimson Technical College Gavilan College Long Beach City College Mt San Antonio College Orange Coast College Reedley College Sacramento City College San Bernardino Valley College San Diego Miramar College San Joaquin Valley College-Fresno Aviation Solano Community College West Los Angeles College Aviation Institute of Maintenance-Oakland North Valley Occupational Center
Hawaii	X	X
Nevada	Rancho High School	Aviation Institute of Maintenance-Las Vegas

**Table 4. Eastern Region Educational Institutions**

States	High Schools Institutions	Postsecondary Institutions
Connecticut	Greater Hartford Academy of Math & Science	Gateway Community College Housatonic Community College Quinebaug Valley Community College Three Rivers Community College
Delaware	Delcastle Technical High School	Delaware Technical Community College-Owens Pittsburgh Institute of Aeronautics (Hagerstown Campus)
Maryland	Meade High School Williamsport High School	
Massachusetts	X	National Aviation Academy of New England Cape Cod Community College
New Hampshire	X	Nashua Community College
New Jersey	X	Teterboro School of Aeronautics
New York	Eastern Suffolk BOCES Questar III August Martin High School Aviation High School Ulster BOCES Vo-Tech Nassau BOCES	Mohawk Valley Community College Vaughn College of Aeronautics and Technology Western Suffolk BOCES BOCES West at Republic Airport Plattsburgh Aeronautical Institute Ulster BOCES Career and Technical Center
Pennsylvania	Philadelphia Academies George Washington High School	Aviation Institute of Maintenance-Philadelphia Pennsylvania College of Technology Pittsburgh Institute of Aeronautics (Pittsburgh Campus)
Virginia	Westfield High School Galileo Magnet High School Aviation Academy Denbigh High School	Aviation Institute of Maintenance-Chesapeake Aviation Institute of Maintenance-Manassas Blue Ridge Community College Liberty University
West Virginia	X	Pierpont Community and Technical College

**Table 5. Great Lakes Region Educational Institutions**

States	High School Institutions	Post Secondary Institutions
Illinois	Kishwaukee Area Career Center Wilco Area Career Center	Southern Illinois University Carbondale City Colleges of Chicago-Olive-Harvey College Lewis University Lincoln Land Community College Moody Bible Institute Rock Valley College Southwestern Illinois College
Indiana	X	Purdue University Vincennes University Aviation Technology Center Aviation Institute of Maintenance-Indianapolis
Michigan	Davis Aerospace Technical High School	Northern Michigan University Aviation Maintenance Technology Western Michigan University- College of Aviation Andrews University Lansing Community College MIAT College of Technology School of Missionary Aviation Technology Siena Heights University Wayne County Community College District
Minnesota	Washburn High School	Minneapolis Community and Technical College Northland Community and Technical College
North Dakota	South Central High School- Technical Center	X
Ohio	X	Aerospace Center Toledo Public Schools Cincinnati State Technical and Community College Mahoning County Career and Technical Center Pittsburgh Institute of Aeronautics (Vienna Campus) Columbus State Community College Great Oaks Institute of Technology and Career Development Miami Valley Career Technology Center Sinclair Community College
South Dakota	X	Lake Area Technical Institute
Wisconsin	X	Fox Valley Technical College Milwaukee Area Technical College

**Table 6. Northwest Mountain Region Educational Institutions**

States	High School Institutions	Postsecondary Institutions
Alaska	X	University of Alaska Anchorage University of Alaska Fairbanks
Colorado	X	Emily Griffith Opportunity School Redstone College
Idaho	X	Idaho State University
Montana	X	Helena College University of Montana
Oregon	X	Lane Community College Portland Community College
Utah	X	Salt Lake Community College
Washington	Aviation High School	Big Bend Community College
	X	Clover Park Technical College Everett Community College South Seattle Community College Spokane Community College

**Table 7. Central Region Educational Institutions**

State	High School Institutions	Postsecondary Institutions
Iowa	Des Moines Public School	Indian Hills Community College Iowa Western Community College
Kansas	Northeast Magnet High School	Cowley County Community College Kansas State University Wichita Area Technical College
Missouri	X	Aviation Institute of Maintenance-Kansas City Linn State Technical College
Nebraska	X	Western Nebraska Community College