

North Texas Aerospace and
Aviation Talent Pipeline Study
2017

+Acknowledgments

Dallas Fort-Worth Regional Aerospace Consortium

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North Texas Aerospace and Aviation Talent Pipeline Study

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North Texas Aerospace and Aviation Talent Pipeline Study

+Executive Summary

Aerospace and air transportation are critical industries in North Texas. Together, the industries comprise 489 companies in the region and employ more than 75,000 individuals. The industries generate \$10.5 billion of in-region purchases between them.

Nearly 7 in 10 aerospace jobs and nearly 6 in 10 air transportation jobs in the state are located in North Texas. In response, North Texas education and workforce systems have developed strong programs and offerings that generally meet the labor needs of these industries. While there are spot shortages in certain occupations, employers are not struggling to fill most of their open positions.

However, both aerospace and air transportation industries are changing, and skills are evolving. Manufacturing processes are increasingly automated, the use of composites and other advanced materials is growing, and technology has become more integrated and advanced at every step from production to operation. Neither employers nor education and workforce providers can afford to grow complacent based on the success of current programs, especially because workers will require new and increasingly more advanced skills as industries adapt to evolving technological innovations. In order to continue to support and grow both aerospace manufacturing and air transportation in North Texas, all stakeholders need to recognize current and future workforce gaps and work together to build pathways and programs that meet changing employer demands. These pathways and programs are necessary and must be sufficiently robust to include current and future technologies to prepare and train the future workforce, as well as to upskill the current workforce to keep up with the pace of advances in the industry.

Background on the Dallas-Fort Worth Regional Aerospace Consortium

Given the strength and importance of aerospace and air transportation in the region, many of the sectors' major employers and workforce leaders established the [Dallas-Fort Worth \(DFW\) Regional Aerospace Consortium](#) in 2003 in order to identify and address the industries' education and workforce needs.

Since its founding, the [DFW Regional Aerospace Consortium](#) has been led by companies including Bell Helicopter, Lockheed Martin and Triumph, and has been supported by the Arlington and Fort Worth Chambers of Commerce, Workforce Solutions for Tarrant County, the Texas Manufacturing Assistance Center and Hillwood Properties/Alliance Airport. The Consortium has been recognized for award-winning collaborative partnerships at federal, state and local levels. Along with educational partners, the Consortium has also produced or developed many effective workforce education and training programs on behalf of the aerospace advanced manufacturing and air transportation industries;

conducted outreach to local students; and developed industry intelligence that helps to inform the region's workforce planning. The DFW Regional Aerospace Consortium is one of the seven sectors included in the Regional Workforce Leadership Councils in North Texas convened by the region's workforce boards.¹



Report Overview

In the fall of 2016, the Consortium commissioned a talent pipeline study of the aerospace and air transportation industries in North Texas with the following goals:

- **Help improve** the Consortium's understanding of the aerospace and aviation sectors and the sectors' talent needs and opportunities;
- **Share information** about these talent needs and opportunities with employers, educators, students, community residents, and policy makers;
- **Spur interest** from students, parents and job seekers in aerospace and aviation careers; and
- **Lay the groundwork** for more communication amongst stakeholders and improved or expanded partnerships between employers and education and training organizations that address talent needs in these sectors.

This report provides an overview of the employment and skill needs in the aerospace and air transportation sectors over the next 3-5 years and trends that impact hiring in these sectors. In addition, the report examines labor market supply for these industries in the region, including data on

¹ The region's workforce boards are Workforce Solutions for Tarrant County, Workforce Solutions Greater Dallas and Workforce Solutions for North Central Texas.

relevant education and training programs from high schools, post-secondary institutions and community-based programs in the region; and data on job seekers with relevant skills and employment experience. Using these data, the report matches supply and demand and identifies potential current and future workforce gaps. The report ends with a set of recommendations to continue to strengthen and support the workforce pipeline for the aerospace and air transportation industries in North Texas.

While both industries have experienced significant fluctuations in employment over the last decade, the outlook for both is stable to growing over the 5 years from 2017-2022.

The aerospace industry employed 29,941 in North Texas in 2016. Aerospace companies posted a total of 12,932 jobs in North Texas from March 2016-March 2017. The air transportation industry employed 45,712 in North Texas in 2016. Air transportation companies posted 10,510 jobs from March 2016 to March 2017.²

Employers in aerospace and aviation spoke about trends like automation and additive manufacturing as well as the growth of unmanned aerial systems and fly-by-wire systems increasing demand for workers with computer, software and electrical engineering skills. They found that these workers and skills were generally harder to find in the labor market.

Program data and interviews show that North Texas educational and training institutions, including public and private universities, nonprofit community organizations, and career and technical education programs in high schools, have built expertise and offerings to meet aerospace and aviation industry needs. These institutions are interested in continuing to develop expertise and meet industry need in emerging areas, such as non-destructive testing and inspection, logistics and supply chain management, and systems engineering. Some institutions are ramping up programs, such as pilot training, that have graduated a small number of students to date but that employers are looking for. The Consortium is also working to re-launch the Aerospace Manufacturing Training Program (AMTP) in early 2018 in order to meet growing industry demand. In partnership with TCC's Opportunity Center, the Texas Workforce Commission and local employers, this new program will train new machinists to meet 5th generation aircraft requirements.

The data show that the aerospace and air transportation industries in the region are doing well in terms of having a skilled workforce available to meet currently projected needs. Only a few types of positions have workforce gaps and/or tight labor supply. These include machinists, pilots, software/application developers, adhesive bonding machine operators and tenders, and industrial engineers.

Overall, the talent pipeline for the aerospace and aviation industries is currently working well in terms of connecting talent to available jobs. However, given the aging workforce in the aerospace and air transportation sectors, as well as some of the demographic disparities in the sector, companies cannot be complacent about labor supply. Companies will need to plan for coming waves of retirements and

² Emsi 2017.2

build a longer-term talent pipeline that can bring more women and under-represented populations into the sectors.

Other ways that the sectors might strengthen their talent pipeline include building the long-term workforce for these industries, such as increasing enrollment and retention of middle and high school students in relevant technical fields; providing on-the-job training and work-based learning opportunities; and developing more education and training programs that focus on addressing industry needs and trends such as increased technology, advanced manufacturing and systems engineering.

By building on the foundation of work that has already been done, the Consortium, its partners and other stakeholders can help build an even stronger career pathway system for the air transportation and aerospace sectors that is responsive to the changing needs of employers and that aligns employers, agencies, funders and education and training providers.

1 - Introduction

The DFW Regional Aerospace Consortium convenes employers and workforce development leaders in order to identify and meet the education and workforce needs of the aerospace advanced manufacturing and air transportation industries. Founded in 2003, the DFW Aerospace Consortium is led by companies including Bell Helicopter, Lockheed Martin and Triumph, and supported by the Arlington and Fort Worth Chambers of Commerce, Workforce Solutions for Tarrant County, the Texas Manufacturing Assistance Center and Hillwood Properties/Alliance Airport. The DFW Aerospace Consortium is one of the seven Regional Workforce Leadership Councils in North Texas convened by the region's workforce boards.³

In the last several years, the Consortium has made a number of important contributions to the aerospace and aviation sectors in the North Texas region⁴. The Consortium has been instrumental in the creation of the "Gotta Jet?" career awareness programs, the Aerospace Manufacturing Training Program, and most recently, the FlyBy app that aims to increase student interest in aviation and aerospace careers. In all things, the Consortium focuses on developing a pipeline of skilled talent for years to come.

The Consortium commissioned this actionable report in order to:

- **Help improve** the Consortium's understanding of the aerospace and aviation sectors and the sectors' talent needs and opportunities;

³ WFS Tarrant County, WFS Dallas; WFS North Central Texas

⁴ For the purposes of this report and for the work of the Regional Workforce Leadership Councils, the North Texas region is defined as the following 16 counties: Collin, Denton, Dallas, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwall, Somervell, Tarrant, and Wise.

- **Share information** about these talent needs and opportunities with employers, students, community residents, and policy makers;
- **Spur interest** from students, parents and job seekers in aerospace and aviation careers; and
- **Lay the groundwork** for more communication amongst stakeholders and improved or expanded partnerships between employers and education and training organizations that address talent needs in these sectors.

1.1 – What’s in the report

This report covers three main themes:

- An overview of labor demand in the North Texas aerospace and aviation industries, which covers current and projected jobs and what they look like, what is most needed, projected job growth, and trends driving the industry.
- An overview of talent supply and how education and training institutions are preparing residents to meet industry needs.
- Recommendations to the DFW Regional Aerospace Consortium for improving talent pipelines into and within the aerospace and aviation sectors.

Unless otherwise noted, this report covers a 16 county North Texas Region, which consists of Collin, Denton, Dallas, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwall, Somervell, Tarrant, and Wise counties.

This report covers the aerospace and air transportation industries in North Texas and includes companies in the following [NAICS](#) codes:

- 3364 (Aerospace Parts and Products Manufacturing)
- 4811 (Air Transportation – Scheduled)
- 4812 (Air Transportation – Nonscheduled)
- 4811 (Support activities for Air Transportation)

Data about industry characteristics, workforce characteristics, workforce projections, educational program completions, jobs and growth primarily come from [Emsi](#), using data from 2017.Q2⁵ as well as from the [National Center for Educational Statistics](#) (NCES). These data are supplemented with 18 interviews with North Texas aerospace and air transportation companies and 11 interviews with regional education and training organizations. Appendix A provides more detail on methodology and data sources. Appendix B provides a list of interviewees.

⁵ Emsi’s 2017.2 data are based in part on 2014 projections from the state of Texas.

2 - Aerospace Industry: Current Workforce and Demand for Jobs and Skills

The aerospace and aviation sectors are major economic engines in the region. The aerospace sector employed 29,941 in 2016.⁶ The aerospace industry generates over \$6 billion of in-region purchases, of which \$4.2 billion are purchases from companies outside the aerospace industry.

	Total Jobs	Jobs Multiplier	Earnings Multiplier	Sales Multiplier
Aerospace Industry	29,941	4.49 ⁷	2.52	1.99

Figure 2.1 Overview of Aerospace Industry's Economic Impact in North Texas (Source: Emsi 2017.2)

2.1 - Current Aerospace Industry Workforce

The aerospace industry employed 29,941 in North Texas in 2016. Nearly 7 in 10 jobs (29,941 out of 44,490) in the aerospace sector statewide are here North Texas. Most of the North Texas aerospace industry employment is further concentrated in Tarrant County.

County Name	2015 Jobs	2016 Jobs	2016 Location Quotient	2016 Establishments
Tarrant County	19,695	19,476	6.60	56
Dallas County	6,278	6,191	1.09	27
Hunt County	2,990	3,027	30.42	1
Denton County	731	796	1.03	9
Johnson County	183	179	1.15	3

Figure 2.2 Nearly 70% of Statewide Aerospace Employment is in North Texas

Lockheed Martin employs more than 14,000⁸ of the 29,000 individuals in aerospace jobs in the region. Other large regional employers in the sector include: [Bell Helicopter \(Textron\)](#), [Raytheon](#), [Pratt & Whitney](#), [Airbus](#), and [Turbomeca](#).

Regional employment in the aerospace industry has fluctuated since 2001. The aerospace industry employment grew by 27% from 2001-2006. Since 2006, the industry has shed workers each year, experiencing its steepest decline between 2011-14, when the industry lost 11% of its employment, or an average of -3.7% per year. By contrast, from 2014-16, total employment in the industry was relatively stable.

⁶ This includes all employees but does not include self-employed individuals or contractors. A related industry that employs a small number of similar occupations is NAICS 3345-11 (manufacture of search, detection and navigation instruments). A total of 3,912 individuals were employed in this industry in 2016.

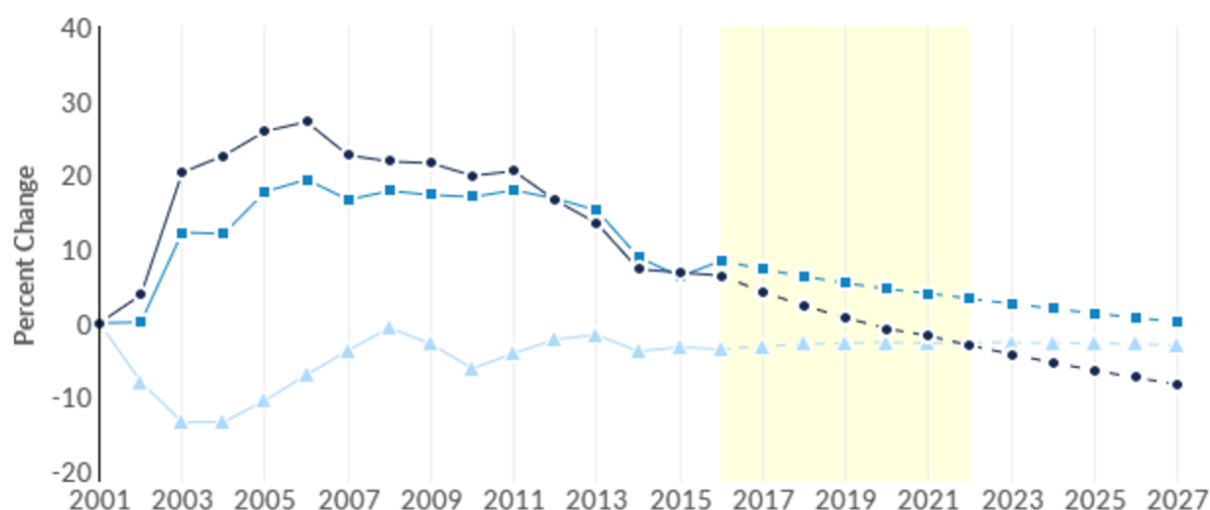
⁷ Emsi 2017.2; Each aerospace job generates in 0.69 direct jobs; 0.43 indirect jobs; and 2.37 induced jobs.

⁸ "Largest Employers in Dallas-Fort Worth," DestinationDFW. Accessed September 29, 2017 at <http://www.destinationdfw.com/Largest-Employers-in-Dallas-Fort-Worth-Texas/>

While job losses from 2011-2014 reflected fluctuations in contracts and projects in North Texas, local employers also stated that the industry adopted more automation and improved its efficiency as well over this time period. Overall, they emphasized that employment losses do not necessarily reflect the industry's overall health in the region, which they feel continues to be strong and will continue to grow based on current projects and those in the pipeline.

Regional Trends

[Jump to Regional Comparison by Industry](#)



Region	2016 Jobs	2022 Jobs	Change	% Change	
● Region	29,941	27,286	-2,655	-8.9%	
■ Texas	44,490	42,385	-2,105	-4.7%	✗
▲ United States	488,031	492,585	4,554	0.9%	✗

Figure 2.3 North Texas Aerospace Employment Trends, 2001-2027 (Source: Emsi 2017.2)

2.2 - Trends in the Aerospace industry

The aerospace industry is changing, and the skills that employers are looking for are changing as well. Original Equipment Manufacturers (OEMs) like Lockheed Martin and Bell Helicopter (Textron) are increasingly investing in R&D and advanced development. The development and greater utilization of fly-by-wire aircraft, unmanned aircraft, drones and other technologies are heightening the need for software engineers, developers, programmers and electrical engineers as well as electromechanical technicians (e.g. drone operators).

The industry has already shifted toward using more [composites](#) in aircraft, which has increased the need for technicians trained in adhesive and bonding materials, repairing and maintaining composites, and techniques for testing these materials. Aerospace companies are now using 3D printing technology for prototyping and for some parts in aircraft manufacturing. It is likely that [utilization of 3D printing will increase](#) in the future, which the supply chain and the mix of manufacturing skills required.

Automation will continue to impact the aerospace industry in terms of both jobs and skills, especially as the price of automated solutions decreases and performance increases.⁹ In the long term, robots will likely be able to perform repetitive assembly tasks and free up operators for higher value tasks.

Another important trend is the move toward more turnkey solutions, which integrates design engineering, process development, supply chain management, manufacturing, installation, training and support. This integrated approach demands more advanced skills from employees at OEMs and suppliers.

Companies including but not limited to Lockheed are growing their repair or “sustainment” operations in the region, which require different skills than assembly. This generates a continued need for craft-based occupations that more closely resemble high-end custom design and manufacturing than “drill and fill” assembly. Bell Helicopter, Airbus, Sikorsky, C&S Propeller and other companies often repair and finish products by hand.

Local employers anticipate needing more individuals with advanced manufacturing and additive manufacturing techniques, as well as familiarity with robotics.

Finally, many employers are concerned about the aging aerospace workforce. As experienced workers retire, employers will need to make sure that existing and new workers are trained and ready to step in.

⁹ “Assembly Automation takes off in Aerospace Industry,” AssemblyMag.com, April 2, 2015. Accessed September 29, 2017 at <http://www.assemblymag.com/articles/92790-assembly-automation-takes-off-in-aerospace-industry>.

2.3 - Projected Aerospace Industry Workforce Demand in North Texas

Aerospace companies interviewed for this report believe that in the short to medium term, the industry is entering a period of stability or even growth, and that overall headcount in the region looks relatively stable over the next 3-5 years. This stems from their current hiring projections as well as projects approved and in the pipeline.

The F-35 and its Impact on Lockheed's Workforce

The F-35 Lightning II is a 5th Generation fighter, combining advanced stealth with fighter speed and agility, fully fused sensor information, network-enabled operations and advanced sustainment. Powered by eight million lines of software code, it's equipped to enable the warfighter and defend any mission. The three variants of the F-35 will replace legacy fighters for the U.S. Air Force, U.S. Navy, U.S. Marine Corps and nine partner nations around the world.

The F-35 is assembled at Lockheed Martin's mile-long production facility in Fort Worth, where more than 8,800 people work on the jet and deliver four to five aircraft per month. As the global demand increases, F-35 production is expected to ramp up, delivering 17 jets a month by 2020. In an effort to meet the customers mission Lockheed Martin recently announced the addition of 1,800 jobs at its Fort Worth location.

The F-35 has significantly impacted the workforce needs of Lockheed Martin, its suppliers and competitors by casting an even brighter light on in-demand high tech programs, advanced development projects and science, technology, engineering and math (STEM) disciplines.

According to Lockheed Martin interviewees, the mix of talent will change over time as headcount remains stable or grows. Lockheed Martin anticipates the need for more STEM-oriented professionals, specifically who specialize in computing, and software or application development. Data scientists who understand the architecture of data will be needed in all areas, from production to supply chain to human resources, in order to analyze trends, use predictive analytics and develop models. Additionally, as automation continues to improve the corporation anticipates needing employees who not only can operate machines but who can also compute and program them. The corporation will still need technical school and apprenticeship graduates, such as welders, pipe benders and craftsmen but emphasizes that successful individuals will need to be aware of new changes and technologies in the craft.

Employer projections contrast with the regional labor market projections from Emsi, which are drawn from Texas state industry projections for 2014-2024. State projections are affected by steep declines

in the industry from 2011-2014, which were the largest in the industry since 2000. As a result, the Emsi model projects employment losses in the industry of about 6.7% from 2016-2020.¹⁰

The differences between employer expectations and labor market projections in the short-term underscore the difficulty of projecting long-term expectations in this industry. The short to medium term expansion that employers are projecting may or may not carry through to 2027 because of uncertainty built into the sector. Longer-term employment projections can be unreliable because of the cyclical nature of the industry, its reliance on government contracts, and its use of contract employees. Additionally, technological advances, including additive technology and greater automation will impact the industry and its labor market needs. On the other hand, companies in the region may win major new contracts and may ramp up production and headcount significantly. A large percentage of the workforce is nearing retirement age, and replacement workers may be needed. These factors further complicate projections beyond five years.

2.3.1 - Aerospace Employers Project Growth in the Short to Medium Term:

Lockheed Martin's expansion of F-35 production in the region is leading to significant growth in the industry. The company plans to add 1,800 workers for the F-35 by 2020.¹¹ By itself, this planned growth would add 6% to regional employment in the sector.

Lockheed is not the only company that is growing. Other companies that anticipate adding significantly to their workforce over the next few years include other OEMs, suppliers, and sustainment and maintenance companies.

Employers that did not anticipate significant new growth at this time discussed remaining relatively stable in terms of headcount for the short to medium term, pending the addition of new projects. Several referenced having "right-sized" during the 2011-2015 period and were now hiring for attrition and turnover.

2.3.2 - Real-Time Labor Market Information from March 2016-March 2017 Shows That Aerospace Companies are Hiring

Aerospace companies posted a total of 12,932 jobs in North Texas from March 2016-March 2017. These postings do not necessarily reflect the total number of job *openings*; they are a reflection of companies' desire to attract candidates. Therefore, certain jobs are overrepresented by job postings, and some are underrepresented. Conversations with hiring managers reveal that positions in

¹⁰ Emsi 2016.4 data, which is based on 2010 statewide data and does not include the 2011-14 period, projects a much smaller decline of less than 400 jobs in the region through 2020, and the addition of 570 jobs in the region over the next ten years, from 29,847 jobs in 2016 to 30,417 jobs in 2026.

¹¹ "2,000 Jobs coming to Lockheed Martin for F-35 Production," NBCDFW.com, March 24, 2017. Accessed on September 29, 2017 at <http://www.nbcdfw.com/news/local/Lockheed-Martin-Planning-Expansion-of-F-35-Production-in-Fort-Worth-416980823.html>

operations, maintenance, and assembly, companies hire more through word of mouth and referral rather than through by posting open positions, and the number of postings for these positions may be understated.

Of the nearly 13,000 unique positions posted over the last year, 8,661 were for positions at Lockheed Martin. Triumph Group and Triumph Aerostructures posted a total of almost 1,600 positions, and Bell Helicopter (Textron) posted an additional 1,296. Eight companies posted 96% of the job openings over the last year, which shows a significant concentration of hiring and employment in the industry.

Company	Unique Job Postings (Mar 2016 - Mar 2017)
Lockheed Martin Corporation	8,661
Bell Helicopter (Textron Inc.)	1,296
Triumph Group, Inc.	797
Triumph Aerostructures, LLC	796
BAE SYSTEMS PLC	329
The Boeing Company	274
Teledyne Technologies Incorporated	158
Kratos Defense & Security Solutions, Inc.	111
Chipton-Ross, Inc.	86
Orbital ATK, Inc.	71

Figure 2.4 Job Postings by Company, Mar. 2016-Mar. 2017 (Source: Emsi 2017.2)

Top postings require at least a Bachelor's degree. These include industrial, aerospace and electrical engineering; computer systems and programming/information security; and operations, logistics and manufacturing. Interviewed employers said they had a considerable need for engineers. Job posting data are in alignment, with 61.5% of postings requiring or requesting engineering skills.

Occupation (SOC)	Unique Job Postings (Mar 2016 - Mar 2017)
Industrial Engineers	1,524
Aerospace Engineers	1,070
Electrical Engineers	307
Mechanical Engineers	285
Electronics Engineers, except computer	124

Figure 2.5 Top Engineering Jobs and Postings, Mar. 2016-Mar. 2017 (Source: Emsi 2017.2)

Occupation (SOC)	Unique Job Postings (Mar 2016 - Mar 2017)
Software Developers, Systems Software	869
Computer Occupations, All Other	510
Software Developers, Applications	498
Information Security Analysts	419
Network and Computer Systems Administrators	261
Computer Systems Analysts	220
Computer User Support Specialists	189

Figure 2.6 Top IT Job Postings, Mar. 2016-Mar. 2017 (Source: Emsi 2017.2)

Occupation(SOC)	Unique Job Postings (Mar 2016 - Mar 2017)
Purchasing Agents, Except Wholesale, Retail, and Farm Products	470
Business Operations Specialists, All Other	335
Operations Research Analysts	295
Logisticians	286
First-Line Supervisors of Production and Operating Workers	264
Machinists	77
Aircraft Mechanics and Service Technicians	71

Figure 2.7 Top Operations, Logistics and Manufacturing Job Postings, Mar. 2016-Mar. 2017 (Source: Emsi 2017.2)

Job posting data may *underestimate* the number of open manufacturing, operations and maintenance/repair positions in the aerospace industry, as employers reported hiring many of these candidates through referral and word of mouth. In fact, even though there were 71 unique postings

for aircraft mechanics and service technicians over the last year, more than 300 were hired per month.¹²

2.4 - The Aerospace Industry Employs People in a Diverse Set of Occupations

The top 10 occupations in the aerospace industry employ 40.5% of the individuals in the sector, comprising nearly 12,000 jobs out of 29,941. In 2016, 65 occupations employed at least 100 individuals.¹³

People working in aerospace occupations can find work in many industries. Total employment in the top ten aerospace occupations across all industries in the North Texas region was 72,438 in 2016 and is projected to grow by 8.8% to 78,832 by 2026.¹⁴ From January 2016-May 2017, employers posted more than 44,000 jobs for these ten occupations, with a monthly average of more than 2,600 postings and more than 3,000 hires.¹⁵

Electro-mechanical technician, where drone and other unmanned aircraft system operators are classified, is a growing occupation that is not yet in the list of top jobs. There were 471 electromechanical technician jobs in North Texas in 2016 in all industries and 320 unique job postings in the year from March 2016-March 2017.¹⁶

Appendix E provides job descriptions and skill requirements for a few growing aerospace and air transportation occupations, including logisticians, software engineers and developers, repair and maintenance technicians, and electro-mechanical technicians.

¹² Emsi 2017.2

¹³ See Appendix C-Aerospace Staffing Patterns for a list of these 65 occupations.

¹⁴ Emsi 2017.2

¹⁵ Emsi 2017.2. Other industries that employ a significant number of individuals employed in the top ten aerospace occupations include: Computer Systems Design and Related Services (NAICS 5415); Employment Services/Temporary Services (5613); Semiconductor and Other Component Manufacturing (3344); the Federal Government (9011). See Appendix C-Aerospace Inverse Staffing Patterns for a list of primary industries employing the top 25 aerospace occupations.

¹⁶ Emsi 2017.2

SOC	Description	Employed in Aerospace Industry 2016	Employed in NTX Region 2016 ¹⁷
17-2011	Aerospace Engineers	1,756	2,836
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	1,609	12,839
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	1,467	1,610
51-4041	Machinists	1,377	7,860
49-3011	Aircraft Mechanics and Service Technicians	1,276	7,664
17-2112	Industrial Engineers	1,044	5,365
15-1133	Software Developers, Systems Software	947	15,206
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	890	3,097
17-2141	Mechanical Engineers	873	5,320
43-5061	Production, Planning, and Expediting Clerks	750	10,642
13-1081	Logisticians	675	4,233
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	669	7,648
51-1011	First-Line Supervisors of Production and Operating Workers	639	12,954
15-1132	Software Developers, Applications	582	21,032
51-2092	Team Assemblers	539	21,318
13-1199	Business Operations Specialists, All Other	502	20,457
15-1121	Computer Systems Analysts	487	23,751
17-2072	Electronics Engineers, Except Computer	350	6,244
17-2199	Engineers, All Other	339	2,589
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	336	2,874
17-2071	Electrical Engineers	327	4,168
43-5071	Shipping, Receiving, and Traffic Clerks	313	21,590
11-9041	Architectural and Engineering Managers	305	3,272
49-2091	Avionics Technicians	286	895
11-3051	Industrial Production Managers	267	3,433
Total		18,605	228,895

Figure 2.8 Total NTX Employment in Top 25 Aerospace Occupations by Total Employed in Industry (Source: Emsi 2017.2)

¹⁷ Total employment in the occupation across all industries in the region.

2.5 - Aerospace Occupations Require a Diverse Set of Skills and Qualifications

The skills and qualifications that aerospace employers look for are as diverse as the occupations the industry employs. While many aerospace jobs do require post-secondary education and training, not all aerospace jobs require advanced degrees. Eleven out of the top 25 occupations in the sector require an Associate's degree or less.

The other 14 require a Bachelor's degree. These include all of the engineering occupations and IT positions, as well as some of the business operations positions. Section 4 includes a fuller discussion of education and skill requirements for aerospace and aviation jobs. See Appendix E for a list of selected jobs and their education requirements.

On-the-job training/hands on training and experience are especially important for those jobs that do not require a Bachelor's degree. All but three of the 11 jobs that do not require Bachelor's degree do require on-the-job training and/or relevant experience. Even jobs that require a Bachelor's degree also ask for or require work experience. For example, many companies do not hire inexperienced engineers, preferring instead to bring in experienced engineers and/or those who have some work experience. This can create challenges for new graduates seeking to enter the field.

Some hard-to-fill jobs require special certifications and training that are hard to find and that few organizations, if any, in the region provide training for. Some aerospace companies mentioned the need for individuals with FAA-[Organization Designation Authorization \(ODA\)](#). Others mentioned the difficulty in finding individuals with experience or certification in [non-destructive testing \(NDT\)](#) or inspection (NDI).

Depending on the contract or project, aerospace companies often need employees who are U.S. citizens and who have or can obtain the appropriate security clearances. Unfortunately, the process of getting clearance can take months, and employers are not willing to hire individuals and then wait for them to obtain the necessary clearance.

Finally, similar to other sectors, aerospace employers discussed the need for candidates to demonstrate strong soft skills.

Veterans are a particularly attractive labor pool for aerospace employers. Veterans often have the behavioral skills that employers are looking for coupled with experience working on aircraft or engines. Although most employers do not have formal veteran hiring programs or partnerships, they do seek out and recruit these candidates.

Airframe and Powerplant (A&P) Certificate

The Airframe and Powerplant (A&P) certificate* is issued by the FAA to qualified aircraft mechanics. A&P mechanics specialize in preventive maintenance that ensures various types of aircraft—such as commercial/non-commercial airplanes, helicopters and jets—are well maintained and working properly. They are responsible for inspecting the entire aircraft, including engines, instruments, gauges, landing gear, pressurized areas, brakes, air-conditioning, pumps, valves, and many other things.

To qualify for the A&P certificate, individuals must obtain 18 months of practical experience with either power plants or airframes, or 30 months of practical experience working on both at the same time. As an alternative to the experience requirement, individuals can graduate from an FAA-Approved Aviation Maintenance Technician School. Locally, these schools include Tarrant County College and Texas State Technical College. Individuals must also pass a written examination, an oral test, and a practical test.

For more information, see <https://www.faa.gov/mechanics/become/basic/>

*Employers also refer to an A&P certificate as an A&P license.

3 - Air Transportation: Current Workforce and Demand for Jobs and Skills

The aviation sector in North Texas, which includes scheduled air transportation; non-scheduled air transportation and support operations for air transportation employed 45,712 in 2016.¹⁸ The air transportation industry generates nearly \$4.5 billion of in-region purchase, of which \$4 billion are purchases from companies outside the air transportation industry.

	Total Jobs	Jobs Multiplier	Earnings Multiplier	Sales Multiplier
Aviation Industry	45,712	4.06 ¹⁹	2.28	1.97

Figure 3.1 Overview of Aviation Industry's Economic Impact in North Texas (Source: Emsi 2017.2)

¹⁸Flight training (6115-12) is a small, related industry with about 2,000 employees, including about 500 post-secondary instructors (many of whom are probably flight instructors); and about 20 maintenance/repair technicians. The Courier/Delivery industry sector, which includes employers like DHL, FedEx employs about 20 additional aircraft mechanics and service technicians (Emsi 2017.2).

¹⁹Emsi 2017.2 Each air transportation job generates in 0.64 direct jobs; 0.31 indirect jobs; and 2.12 induced jobs.

3.1 - Current Air Transportation Industry Workforce

The air transportation sector includes companies that provide scheduled and non-scheduled air passenger and freight transportation. It also includes support activities for air transportation such as airports, air fields, air traffic control, and refueling/ramp services. Companies in the sector include large commercial airlines as well as charter airline companies, airports, repair and maintenance companies, fixed base operators and air advertising companies.

The air transportation industry employed 45,712 in North Texas in 2016. Nearly 6 in 10 jobs in the air transportation sector statewide are in the region, with 66.6% of that employment concentrated in Tarrant County and 30% in Dallas County.²⁰

County Name	2016 Establishments	2016 Jobs	2022 Jobs	2016 - 2022 % Change
Tarrant County	135	30,467	31,217	2%
Dallas County	168	13,576	14,633	8%
Denton County	30	987	1,593	61%
Collin County	22	327	435	33%
Hunt County	4	206	195	(5%)

Figure 3.2 Air Transportation employment across 5 counties (Source: Emsi 2017.2)

Together, American Airlines and Southwest Airlines combined employ more than 36,000 people in the region²¹ (80% of regional employment in the sector).

²⁰Emsi 2017.2

²¹"Southwest Airlines Dallas City Fact Sheet," Southwest Airlines, Accessed May 25, 2017 at <https://www.swamedia.com/pages/city-fact-sheets>.

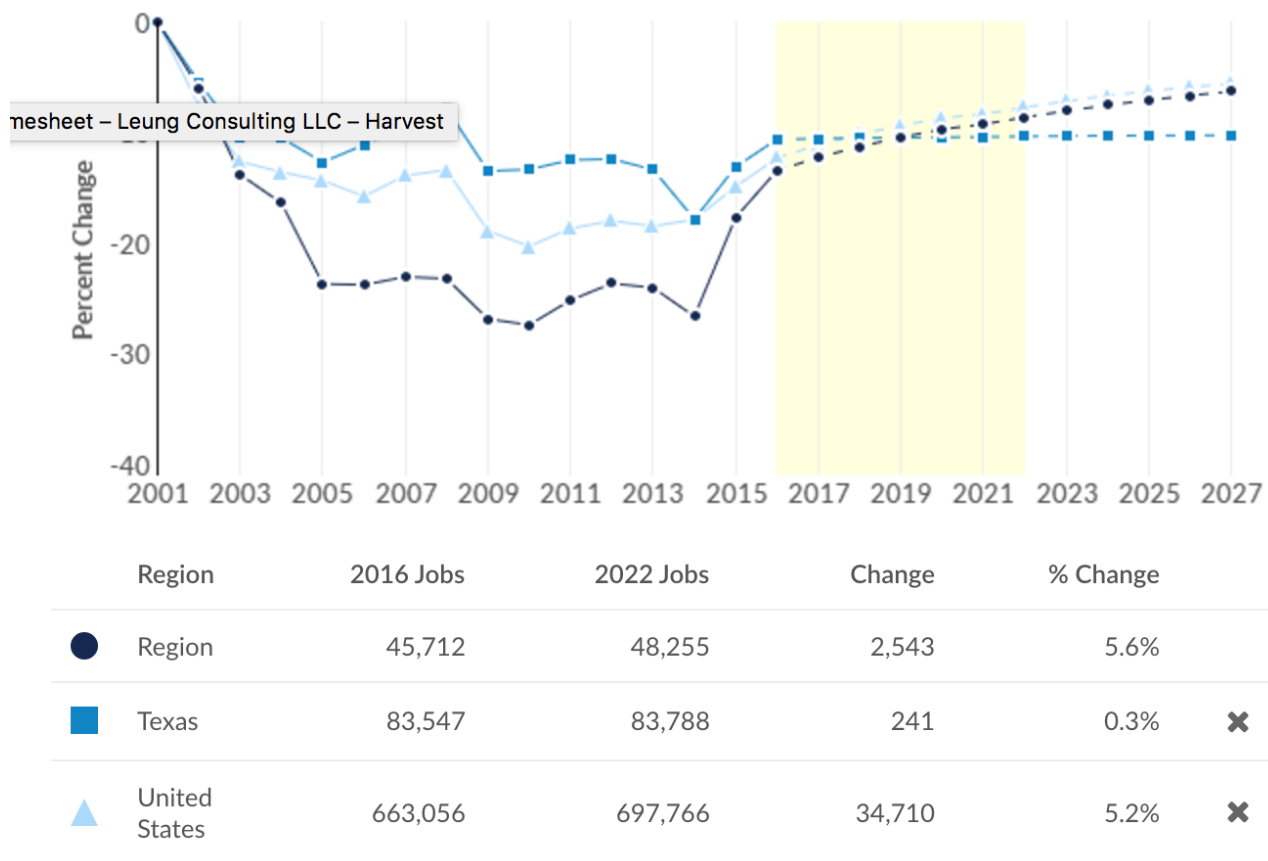


Figure 3.3 Air Transportation employment trends over time (Source Emsi 2017.2)

Employment in the air transportation industry in the region contracted significantly between 2001 and 2014, losing almost 29% of employment during that time period. However, from 2014-2016, the regional industry bounced back, growing almost 19% over the last two years, or 9.3% annually.²²

3.2 - Trends in the Air Transportation Industry

A number of trends have influenced and will continue to influence the growth and development of the air transportation sector in North Texas. One continuing trend is the growth of corporate aviation in the region, reflected in the non-scheduled air transportation sector growth above. Another important trend is the improvements in and increased use of technology in aviation. Technology is changing and will continue to change not only the aircraft but also airports and worker skill requirements in all parts of the sector. Two examples of the impact of technology in the sector include increased utilization of unmanned aircraft or drones as well as the planned development of electric vertical takeoff and landing aircraft for on-demand transportation.

²² Emsi 2017.2

A fuller discussion of these trends and others affecting the aviation industry can be found in the North Central Texas Council of Government's comprehensive 2009 report.²³

3.3 - Projected Air Transportation Industry Workforce Demand in North Texas

Air transportation companies interviewed for this report, which included airlines, airport service companies, and logistics/air freight companies, believe that their workforce will grow over the next 3-5 years. These employers have been adding employees over the last two years, as reflected in the labor market data, and they anticipate continuing to do so, albeit at a slower pace, going forward.

Vertical Take-off and Landing Aircraft (VTOL) and On Demand Air Transportation

In April 2017, Uber announced plans to launch the "Uber Elevate Network" in Dallas and Fort Worth. The new service will offer on-demand air transportation within an urban area through a network of flying vehicles, or vertical take-off and landing aircraft (VTOLs). Uber hopes to launch the Dallas demonstration network by 2020, its first such network in the U.S.

As part of this effort, Uber has collaborated with Hillwood Properties, the developer of AllianceTexas, to plan vertiports, sites where the aircraft would pick up and drop off passengers. Up to five ports may be developed within the next year, starting with DFW Airport and Frisco.

Bell Helicopter is one of the companies working to help develop the VTOLs. Bell is working on the propulsion technology that would be used in these electric vehicles. Initially, pilots would fly these vehicles, but the idea is that eventually they would operate with fly-by-wire systems and would be self-piloted.

While Uber is the first to announce the launch of this type of on-demand urban air transportation in the region, it certainly will not be the only company in this nascent market. The technology behind VTOL vehicles and the demand for more accessible, affordable air transportation will impact the air transportation industry in North Texas and beyond.

Sources:

"Uber Picks Dallas, Fort Worth as test cities for flying vehicle network," The Texas Tribune, April 25, 2017. Accessed September 29, 2017 at <https://www.texastribune.org/2017/04/25/uber-picks-dallas-fort-worth-test-cities-flying-vehicle-network/>.

"Bell Helicopter hints at new electric aircraft," Star-Telegram, April 25, 2017. Accessed September 29, 2017 at <http://www.star-telegram.com/news/business/article146771039.html>

Employer projections are generally in line with Emsi's regional labor market projections of 5.6% growth over the next 5 years (through 2022) or about 1.1% growth per year. At this rate, the industry should add about 2,500 jobs through 2022. This trend is projected to continue through 2026, with a growth

²³ "New Technologies and Industry Trends: A look at General Aviation History and Future in North Central Texas," NCTCOG, August 2009. Accessed August 29, 2017 at http://www.nctcog.org/trans/aviation/plan/Complete_Report_8.10.09.pdf

rate of 7.8% from 2016-2026.²⁴ This outpaces the national growth rate (7.3%) slightly.²⁵ Projected employment growth is mostly coming from companies in the Support Activities for Air Transportation and from Non-scheduled Air Transportation parts of the sector.²⁶

NAICS	Description	2016 Establishments	2016 Jobs	2022 Jobs
4811	Scheduled Air Transportation	49	32,542	32,246
4812	Nonscheduled Air Transportation	84	2,051	2,240
4881	Support Activities for Air Transportation	252	11,119	13,769
	Total	385	45,712	48,255

Figure 3.4 Air Transportation employment is projected to increase

Interviewed employers identified the following challenges and opportunities that could affect their growth rate: overall economic health in the U.S.; events and opportunities in emerging markets; fuel prices; and technological developments. American Airlines also pointed out that the transition to different/newer aircraft might trigger the hiring of more pilots and flight attendants. Recent industry reports show that airlines have been buoyed by rising passenger demand and low fuel costs. Passenger traffic grew by 6.3 percent in 2016, continuing a five-year streak of above 5% growth.²⁷

Currently, large and small airlines report a growing need for pilots, engineers, and information technology workers, and these positions are harder to hire. Airlines and air support activities employers will continue to hire mechanics and technicians, though employers did not report that these individuals were difficult to find in the labor market.

Employers reported that local supply of pilots is low. Many airline pilots are at or near the mandatory retirement age of 65, and the timeline for training and obtaining the necessary qualifications to fly commercial aircraft is long. In addition, airlines laid-off so many pilots after 9/11 that until 2012-13, hiring had primarily been from callbacks from the furlough list. Airlines have only begun hiring new pilots in the last few years, so there has not been significant demand for new trainees for some time. Airlines are now interested in developing a more robust pipeline for pilots, and some are thinking about how to help current employees pay for costly pilot training.

²⁴ Emsi projections, which draw from Texas state industry projections for 2014-2024, do not include the surge in employment in the air transportation sector from 2014-16.

²⁵ Emsi 2017.2

²⁶ One caveat: there was a big spike in support activities for air transportation (NAICS 4881) from 2013-14, so that would be reflected in the 2017 projections since they are based on 2014 data. The converse is true for scheduled air transportation, which showed an 11% decline in employment from 2013-14 followed by a spike of 19% growth from 2014-16. The 2013-14 data would have been included in the projections, but not the increase from 2014-16. Therefore growth in scheduled air transportation is probably underestimated.

²⁷ "Aerospace Manufacturing Attractiveness Rankings," PWC, August 2017.

Air transportation companies face a similar challenge to aerospace companies in finding qualified engineers and IT specialists/software developers, which are growing occupations within the sector. Workers in these occupations may not know or think about opportunities to use their skills within the air transportation sector. Companies in this sector report that they have to be aggressive and creative in terms of doing targeted recruitment for these positions.

As in aerospace, engineers are in constant demand. One challenge that air transportation sector companies identified is diversifying their engineering workforce in terms of both gender and race/ethnicity. Finally, air transportation employers reported difficulty finding enough mechanics and technicians with A&P certificates; they also compete with aerospace companies for these employees. Fixed base operators reported difficulty finding certified line service technicians.

There is significant growth expected in many occupations within the air transportation sector, and a lot of the growth is happening in occupations that are not just specific to air transportation. This implies both that air transportation companies must compete with other sectors for these employees and that individuals coming into the air transportation sector will have other options for employment and career advancement outside of this sector.

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2027)	Change (2016 - 2027)	% Change (2016 - 2027)
49-9043	Maintenance Workers, Machinery	183	245	62	34%
51-9122	Painters, Transportation Equipment	189	246	57	30%
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	194	249	55	28%
49-2091	Avionics Technicians	472	585	113	24%
49-9098	Helpers--Installation, Maintenance, and Repair Workers	139	170	31	22%
11-1021	General and Operations Managers	453	542	89	20%
53-2022	Airfield Operations Specialists	227	267	40	18%
49-9071	Maintenance and Repair Workers, General	297	339	42	14%
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	600	684	84	14%
49-3011	Aircraft Mechanics and Service Technicians	5,699	6,464	765	13%
53-2012	Commercial Pilots	976	1,103	127	13%
53-2011	Airline Pilots, Copilots, and Flight Engineers	4,592	4,691	99	2%

Figure 3.5 Technical/Operations Growth Occupations in Air Transportation Ranked by % Growth (Source: Emsi 2017.2)

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2027)	Change (2016 - 2027)	% Change (2016 - 2027)
39-6011	Baggage Porters and Bellhops	401	569	168	42%
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	201	275	74	37%
49-9043	Maintenance Workers, Machinery	183	245	62	34%
51-9122	Painters, Transportation Equipment	189	246	57	30%
53-6099	Transportation Workers, All Other	521	676	155	30%
53-7061	Cleaners of Vehicles and Equipment	369	462	93	25%
53-6061	Transportation Attendants, Except Flight Attendants	346	405	59	17%
43-5061	Production, Planning, and Expediting Clerks	322	358	36	11%
43-9061	Office Clerks, General	386	426	40	10%
43-5081	Stock Clerks and Order Fillers	398	435	37	9%
43-4051	Customer Service Representatives	1,090	1,177	87	8%
41-3099	Sales Representatives, Services, All Other	417	447	30	7%
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	3,386	3,613	227	7%
43-5011	Cargo and Freight Agents	2,056	2,147	91	4%
43-1011	First-Line Supervisors of Office and Administrative Support Workers	1,024	1,060	36	4%
53-2031	Flight Attendants	6,072	6,219	147	2%
43-4181	Reservation and Transportation Ticket Agents and Travel Clerks	7,404	7,435	31	0%

Figure 3.6 Non-Technical Growth Occupations in Air Transportation Ranked by % Growth (Source: Emsi 2017.2)

3.3.1 - Real-Time Labor Market Information from March 2016-March 2017 Shows that Air Transportation Companies are Hiring:

Air transportation companies posted 10,510 jobs from March 2016 to March 2017.

Two companies posted 86% of the positions—American Airlines (4,951 positions) and Southwest Airlines (3,239 positions). Seven other companies posted at least 100 positions over the last year. Top

posted occupations are on the business side, including management analysts, computer systems analysts, computer occupations, market research. Overall, there are fewer in-demand technical occupations in the air transportation than in the aerospace sector. The top skills requested over the March 2016-March 2017 period are management, FAA, revenue management, analysis, innovation and communication.

Company	Unique Job Postings
American Airlines Group Inc.	4,951
Southwest Airlines	3,239
DFW International Airport	357
Mesa Airlines, Inc.	223
Prospect Airport Services, Inc.	220
Air Serv Corporation	191
Airport Terminal Services Inc	135
Ameriflight, LLC	134
Worldwide Flight Services, Inc.	102
Envoy Air Inc.	96

Figure 3.7 Job Postings in Air Transportation by Company, Mar. 2016-Mar. 2017 (Emsi 2017.2)

Many of the top postings are for positions requiring a Bachelor's degree, although three of the top ten (customer service representatives, supervisors of office and administrative workers, and supervisors of mechanics, installers and repairers) do not. Of the top ten positions posted, three are IT related and three are management or operations analysts. Only one of the top ten postings is in operations.

Occupation (SOC)	Unique Postings (Mar 2016 - Mar 2017)
Management Analysts	745
Computer Systems Analysts	613
Computer Occupations, All Other	575
Market Research Analysts and Marketing Specialists	558
Operations Research Analysts	445
First-Line Supervisors of Office and Administrative Support Workers	349
Software Developers, Applications	332
Customer Service Representatives	308
Managers, All Other	289
First-Line Supervisors of Mechanics, Installers, and Repairers	243

Figure 3.8 Top 10 job postings in air transportation by occupation, Mar. 2016-Mar. 2017 (Emsi 2017.2)

Confirming employer feedback, the posting intensity (ratio of total job postings to unique job postings) is greatest for software developers (7:1), computer systems analysts (7:1), and other computer occupations (8:1), meaning that employers are posting in seven or eight locations for each of these types of job openings. The average posting intensity for the sector is about five postings for each job opening.

These postings may point to significant growth in these occupations within the air transportation sector. For example, as of 2016, the sector only employed a total of 101 computer system analysts, 59 computer user support specialists, and 85 software developers for systems or applications, yet there were more than 613 unique job postings in the sector for the year ending March 2017 for computer systems analysts in the sector; 332 postings for software developers; and 575 postings for all other computer occupations.

Interviewees talked about the need for more pilots; this is reflected in the data. Although there was a relatively low average of 13 unique postings for airline pilots per month from March 2016-March 2017, employers hired an average of 162 pilots per month over this same time period. Over the same time period, employers posted an average of 24 jobs per month for commercial pilots and hired an average of 66 commercial pilots per month.

Similarly, although air transportation employers advertised an average of 89 openings for aircraft mechanics and service technicians per month, they filled an average of 315 of these positions per month from March 2016-2017.

3.4 - The Air Transportation Industry Employs People in a Diverse Set of Occupations

The top ten occupations in the air transportation sector employ 71% of the individuals in the sector and comprise more than 32,000 jobs. These occupations represent a mix of technical and non-technical occupations. In 2016, there were 47 occupations that employed at least 100 individuals in the region.²⁸

SOC	Description	Employed in Industry Group (2016)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)
49-3011	Aircraft Mechanics and Service Technicians	5,699	9%	12.5%
53-2011	Airline Pilots, Copilots, and Flight Engineers	4,592	1%	10.0%
53-2012	Commercial Pilots	976	9%	2.1%
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	600	10%	1.3%
Total		11,867		

Figure 3.9. Top Air Transportation Occupations – Technical

²⁸ See Appendix C: Air Transportation Staffing Patterns for greater detail.

SOC	Description	Employed in Industry Group (2016)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)
43-4181	Reservation and Transportation Ticket Agents and Travel Clerks	7,404	0%	16.2%
53-2031	Flight Attendants	6,072	1%	13.3%
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	3,386	5%	7.4%
43-5011	Cargo and Freight Agents	2,056	3%	4.5%
43-4051	Customer Service Representatives	1,090	5%	2.4%
43-1011	First-Line Supervisors of Office and Administrative Support Workers	1,024	2%	2.2%
		21,032		

Figure 3.10 Top Air Transportation Occupations – Non-technical

People trained for air transportation occupations can find work in many industries. Total employment in the top 25 air transportation occupations across all industries in the North Texas region was 545,057 in 2016.²⁹ A list of these industries can be found in Appendix C.

3.5- Air Transportation Occupations Require a Diverse Set of Skills and Qualifications

Air transportation occupations offer many inroads for those without advanced degrees. Out of the top 25 occupations in the sector, just four require a Bachelor's degree, while 19 require a minimum of a high school diploma, and two positions (Avionics Technician and Aircraft mechanics) require either an Associate's degree or a post-secondary non-degree award. See Section 4 for a detailed discussion of education and skill requirements for selected air transportation and aerospace occupations.

Although work experience does not seem to be a minimum entry requirement for many positions, most employers still prefer to hire individuals with some experience, even if the experience is from outside the sector. Employers also discussed the need for and importance of soft skills, including customer service skills, to be successful in the industry.

4 - Overview of Current Workforce and Labor Supply for Aerospace and Aviation Industries

This section provides a picture of the current workforce in the aerospace and air transportation sectors as well as an overview of available local workforce supply. The analysis of supply is composed mainly of two elements: new graduates from post-secondary and workforce training programs and the

²⁹ See Appendix C: Air Transportation Staffing Patterns for greater detail.

existing talent pool of qualified unemployed workers actively seeking employment. Data on enrollments in relevant CTE programs in the K-12 system provide a partial picture of a longer-term talent pipeline for the aerospace and aviation industries. Labor supply for the two industry sectors is considered together.

4.1 - Labor Supply – Current Workforce

4.1.1 - Current Aerospace Industry Workforce:

Aerospace industry employers have some concerns about the age and diversity of their workforce, and employers are increasingly working to address these issues by focusing on the workforce pipeline.

Overall, 65% of the current aerospace workforce is 45 or over. This includes over 60% of the workforce in three major aerospace occupations—aerospace engineers, aircraft mechanics and service technicians; and machinists. 65% of aerospace engineers are age 45 or older; 61% of aircraft mechanics and service technicians are 45 or older; 61% of machinists are 45 or older. By contrast, 61% of software developers/programs are between 19-44.

Overall, 77% of employees in the industry are male, and 68% are white. Assemblers, tool setters and clerks are the most diverse occupational groups in the sector by race and ethnicity. These occupations employ a larger percentage of Hispanic and Black or African-American workers than other occupations in the industry.

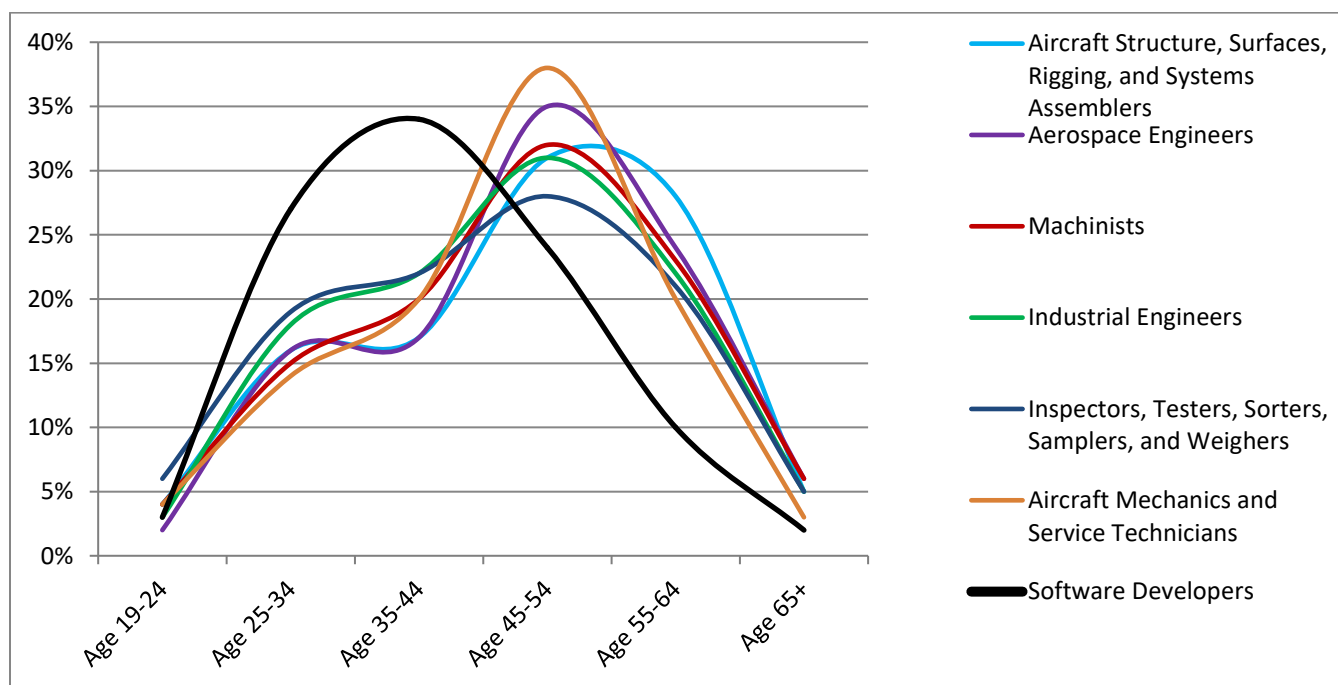


Figure 4.1 Age distribution within major aerospace occupations (Emsi 2017.2)

Race/Ethnicity	% of Aerospace Employees	% of NTX Population
White	68%	47%
Hispanic or Latino	16%	28%
Asian or Pacific Islander	8%	7%
Black or African American	7%	15%
Two or More Races	1%	2%
American Indian or Alaska Native	<1%	<1%

Figure 4.2 –Aerospace Industry Workforce by Race/Ethnicity (Emsi 2017.2)

4.1.2 - Aerospace Companies are Interested in Building a Talent Pipeline that Brings in Younger and More Diverse Employees:

Employers expressed concern about the wave of retirements they will face in the near future. They acknowledge the need to train and educate new and existing workers to replace retiring employees. They also want to expand the number of women and under-represented populations in their workforces.

Some companies interviewed had implemented one or two elements of long-term succession planning, such as partnerships with K-12 education to interest more students in aerospace careers; internships for college or graduate students; or mentoring and leadership programs for promising employees. However, most did not have robust succession planning efforts in place.

Aerospace companies could do more to develop internal career pathways and train existing workers to take on leadership and/or higher skill roles. This could be especially effective if companies develop pathways from positions that have more women and under-represented populations, such as team assemblers and quality control to positions such as machinists and technicians that are currently not as diverse.

Elbit Systems Engages Younger Workers

[Elbit Systems](#) of America, located in Fort Worth, is addressing succession planning challenges head on. It builds a pipeline into the company through participating in the Fort Worth Chamber's JobLinks events and hosting interns in multiple high need, high growth areas, such as software and engineering. It creates career pathways and leadership through its Internal Leadership Training (ILT) program that prepares employees from across the company for leadership positions. In addition, it has established a Millennial Think Tank to increase engagement and leadership of younger workers.

Over the long term, employers could deepen K-12 and post-secondary partnerships so that they are more strategic about creating the experiences and connections that will help students access career pathways in the sector.

Succession planning is working at Lockheed Martin

Lockheed Martin has developed succession plans for all of its directors and vice presidents. The company has integrated succession planning with talent assessment, performance management, and development and regularly revises its talent pipelines. The evidence of the success of this process is in the number of people the company hires through these plans into leadership positions. The national best practice benchmark is 28%. In 2016, the company placed 73% of leaders through the succession planning process. The company shared a little about how they do it.

In the first quarter of each year, Lockheed assesses about 37% of its aeronautics team members. Leaders are asked to complete an online, electronic assessment that focuses on their team members' career goals, leadership potential, critical skills, strengths and opportunities.

In the second quarter, the company meets with 150 leaders to validate these assessments and update the succession plans as well as address critical developmental and knowledge continuity needs.

In the third and fourth quarters, the company reviews talent on the succession plans and in the talent pools, utilizing an integrated development approach to accelerate readiness and enable movement.

The objective is to make the succession plans and pools operational—enabling prepared talent when needed.

SOC	Description	Employed in Aerospace Industry	% Male	% White	% Hispanic or Latino	% Black or African American	%Asian
17-2011	Aerospace Engineers	1756	89%	72%	11%	4%	12%
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	1609	62%	54%	24%	12%	8%
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	1467	71%	49%	33%	9%	7%
51-4041	Machinists	1377	96%	68%	19%	7%	5%
49-3011	Aircraft Mechanics and Service Technicians	1276	95%	63%	21%	9%	5%
17-2112	Industrial Engineers	1044	83%	72%	10%	5%	11%
15-1133	Software Developers, Systems Software	947	81%	54%	6%	4%	34%
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	890	93%	70%	17%	6%	6%
17-2141	Mechanical Engineers	873	93%	74%	10%	4%	11%
43-5061	Production, Planning, and Expediting Clerks	750	47%	67%	16%	11%	4%
13-1081	Logisticians	675	68%	58%	19%	16%	6%
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	669	50%	71%	14%	9%	4%
51-1011	First-Line Supervisors of Production and Operating Workers	639	82%	63%	24%	9%	3%
15-1132	Software Developers, Applications	582	80%	54%	6%	4%	34%
51-2092	Team Assemblers	539	64%	45%	29%	17%	7%
13-1199	Business Operations Specialists, All Other	502	43%	59%	19%	13%	7%
15-1121	Computer Systems Analysts	487	67%	61%	10%	9%	18%

SOC	Description	Employed in Aerospace Industry	% Male	% White	% Hispanic or Latino	% Black or African American	%Asian
17-2072	Electronics Engineers, Except Computer	350	92%	61%	11%	6%	21%
17-2199	Engineers, All Other	339	88%	66%	13%	5%	15%
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	336	80%	45%	35%	13%	7%
17-2071	Electrical Engineers	327	93%	65%	10%	5%	19%
43-5071	Shipping, Receiving, and Traffic Clerks	313	71%	48%	33%	14%	4%
11-9041	Architectural and Engineering Managers	305	92%	76%	8%	3%	11%
49-2091	Avionics Technicians	286	89%	63%	21%	10%	4%
11-3051	Industrial Production Managers	267	85%	76%	14%	4%	5%

Figure 4.3 Distribution of Gender & Race/Ethnicity within Aerospace Occupations by Total Employment in Sector (Emsi 2017.2)

4.1.3 - Workforce Composition of the Air Transportation Sector

While the air transportation sector is more diverse than the aerospace industry, employers in this industry are increasingly focused on bringing in and retaining women and under-represented minorities and building a more diverse long-term talent as well.

	Male	Female
Scheduled Air Transportation	62%	38%
Nonscheduled Air Transportation	71%	29%
Support Activities for Air Transportation	72%	28%
Total	65%	35%

Figure 4.4 Gender Distribution within the Air Transportation sector (Emsi 2017.2)

	White % of Industry	Hispanic or Latino % of Industry	Black or African American % of Industry	Asian or Pacific Islander % of Industry	Two or More Races % of Industry
Scheduled Air Transportation	63%	15%	13%	8%	2%
Nonscheduled Air Transportation	72%	13%	8%	5%	1%
Support Activities for Air Transportation	48%	29%	17%	4%	1%
Total	59%	18%	14%	6%	2%

Figure 4.5 Race/Ethnicity Distribution within the Air Transportation sector (Emsi 2017.2)

Air transportation sector employees are still largely white and male. Nearly 65% of employees in the industry are male, and 59% are white. While there are a significant number of people of color employed in the air transportation sector, many people of color are concentrated in the part of the sector that is least well-paid—Support Activities for Air Transportation. These companies include fixed-base operators, airport operations, and maintenance and comprise the fastest growing part of the air transportation industry.

Latino workers make up nearly 30% of the workforce in laborer, cargo, clerk and maintenance and repair positions. Black or African American workers make up a large percentage of transportation and laborer positions as well (20%+ each) and also make up a large percentage of customer service representatives and ticket agents and travel clerks.

The oldest segment of the industry is scheduled air transportation, where 26% of employees are age 55 or older. This may be related to the significant time and education requirements to be a commercial airline pilot as well as pilot tenure once employed with an airline. For example, 26% of airline pilots and 24% of commercial pilots are within 10 years of retirement,

including 3% that are at retirement age already. In addition, 65% of flight attendants are 45 or older, including 29% that are 55 and older.

	Age 18- 24 % of Industry	Age 25- 34 % of Industry	Age 35- 44 % of Industry	Age 45- 54 % of Industry	Age 55- 64 % of Industry	Age 65+ % of Industry
Scheduled Air Transportation	5%	15%	21%	33%	22%	4%
Nonscheduled Air Transportation	5%	17%	22%	31%	20%	4%
Support Activities for Air Transportation	11%	24%	22%	21%	17%	4%
Total	6%	17%	21%	30%	21%	4%

Figure 4.6 Age of Workers in the Air Transportation Industry (Emsi 2017.2)

Like aerospace companies, air transportation companies are working to bring in younger and more diverse employees. Large airlines like American and Southwest partner with K-12 schools, sponsoring STEM programs and connect with affinity groups like Women in Finance to build long-term pipelines and meet short-term needs. For example, Southwest Airlines recently formed a partnership with North Dallas High School to provide mentoring, host site visits, offer internships and job interviews for students in North Dallas High School's collegiate academy.

Some larger companies are also examining corporate culture and policies and their impact on recruiting and retaining a diverse workforce.

Companies in the sector expressed a need for more assistance to connect with a more diverse labor pool and building a long-term talent pipeline.

American Airlines' Adept IT Program

The American Airlines Development Program for Technology (ADEPT) is a recruiting program created to develop a technical talent pipeline for Information Technology(IT). The program was developed to promote leadership skills and to expose college recruits to the diverse opportunities American Airlines has to offer. The ADEPT program hires recruits out of college as full time employees. During the first year of the program, ADEPT members participate in training while assigned to a Technology team. After the completion of their first year, the ADEPT members rotate into new teams. After the second year, ADEPT members have officially completed the program and are encouraged to seek opportunities within American Airlines.

4.2 - Labor supply – New Graduates

4.2.1 - Educational Requirements and Programs for Aerospace and Aviation Occupations:

A total of 107 occupations in the aerospace and air transportation industries employ at least 100 individuals, and 59 of these have at least a 5% concentration within the aerospace and air transportation sectors. A partial list of these is presented in Figure 4.7. These 107 occupations have varying educational requirements:

- 46 occupations require an Associates, Bachelors or advanced degree
- 5 occupations require some college or post-secondary non-degree awards
- 50 occupations require a high school diploma or equivalent, and the vast majority of these require some on-the-job training as well. The three largest air transportation occupations in this category are reservation and transportation ticket agents; flight attendants; and cargo and freight agents. The three largest aerospace occupations in this category are inspectors, testers and weighers; aircraft structure assemblers; and machinists.
- 6 occupations require no formal education but do require short-to-moderate term on-the-job training. The largest occupation by far in this category is laborers, with over 3,600 jobs, followed by stock clerks, equipment cleaners, and janitors.

The analysis of labor availability is primarily focused on the occupations that have at least a 5% concentration within aerospace and/or aviation and employ at least 100 individuals in the sector. Selected occupations are included below. A full list is included in Appendix D.

Of the 51 occupations that require post-secondary education and credentials, 26 have at least a 5% concentration within the aerospace and air transportation sectors, and 10 of these occupations have more annual openings than program completions. The largest mismatches between supply and demand in terms of program completions are for: purchasing agents, airline pilots, industrial engineers, electrical and electronics repairers, purchasing managers, and aircraft mechanics and service technicians.

Not all individuals who complete programs related to aerospace or aviation careers end up seeking jobs in or employed in those industries. They simply meet the minimum educational requirements for these occupations. Companies may have additional requirements for experience or education beyond the minimum entrance standard, and companies will also have to compete with others outside the aerospace and air transportation sectors to hire qualified individuals. For example, even though there are many more completions than openings for systems software developers, the aerospace and aviation industries are competing with firms in many other industries to hire these individuals, and feedback from employers about the difficulty recruiting for and filling these positions confirms that competition can be fierce.

Description	Employed in Industry Group (2016)	% of Jobs in Region that are in Aerospace/ Aviation	Typical Entry Level Education	Work Experience Required	Typical On-The- Job Training
Flight Attendants	6,072	100%	High school diploma or equivalent	Less than 5 years	Moderate-term on-the-job training
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	1,553	96%	High school diploma or equivalent	None	Moderate-term on-the-job training
Reservation and Transportation Ticket Agents and Travel Clerks	7,404	87%	High school diploma or equivalent	None	Short-term on-the-job training
Transportation Workers, All Other	524	81%	High school diploma or equivalent	None	Short-term on-the-job training
Airfield Operations Specialists	239	76%	High school diploma or equivalent	None	Long-term on-the-job training
Commercial Pilots	1,025	76%	High school diploma or equivalent	None	Moderate-term on-the-job training
Aircraft Cargo Handling Supervisors	240	72%	High school diploma or equivalent	Less than 5 years	None
Transportation Attendants, Except Flight Attendants	346	57%	High school diploma or equivalent	None	Short-term on-the-job training
Baggage Porters and Bellhops	401	50%	High school diploma or equivalent	None	Short-term on-the-job training
Cargo and Freight Agents	2,056	38%	High school diploma or equivalent	None	Short-term on-the-job training
Transportation Inspectors	446	35%	High school diploma or equivalent	None	Moderate-term on-the-job training
Computer-Controlled Machine Tool Operators, Metal and Plastic	896	29%	High school diploma or equivalent	None	Moderate-term on-the-job training
Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	142	24%	High school diploma or equivalent	None	Moderate-term on-the-job training
Painters, Transportation Equipment	355	23%	High school diploma or equivalent	None	Moderate-term on-the-job training

Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	125	22%	High school diploma or equivalent	None	Long-term on-the-job training
Tool and Die Makers	148	21%	High school diploma or equivalent	None	Long-term on-the-job training
Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	113	19%	High school diploma or equivalent	None	Moderate-term on-the-job training
Machinists	1,446	18%	High school diploma or equivalent	None	Long-term on-the-job training
Aircraft Mechanics and Service Technicians	6,975	91%	Postsecondary nondegree award	None	None
Avionics Technicians	758	85%	Associate's degree	None	None
Aerospace Engineering and Operations Technicians	256	64%	Associate's degree	None	None
Air Traffic Controllers	95	23%	Associate's degree	None	Long-term on-the-job training
Airline Pilots, Copilots, and Flight Engineers	4,596	95%	Bachelor's degree	Less than 5 years	Moderate-term on-the-job training
Aerospace Engineers	1,899	67%	Bachelor's degree	None	None
Materials Engineers	224	27%	Bachelor's degree	None	None
Industrial Engineers	1,071	20%	Bachelor's degree	None	None
Logisticians	757	18%	Bachelor's degree	None	None

Figure 4.7 Selected Aerospace and Air Transportation Occupations with Education and Workforce requirements (Emsi 2017.2)

4.2.2 - Post-Secondary Educational Program Completions for Core Aerospace and Aviation Occupations:

Of the occupations that have at least a 5% concentration within aerospace and/or aviation and employ at least 100 individuals in the sector, 26 require entry-level candidates to have a post-secondary credential.

These occupations are cross-walked with [CIP codes](#) for education programs and used this information to generate program completion data, which are available through academic year 2015. This resulted in a list of 39 education programs, which were further narrowed to just technical programs in Figure 4.9. Regional completion data is included by educational program and by institution.

There are limits to program completion data. Our analysis included institutions and completions for North Texas institutions only; graduates from institutions outside the region are not included. In addition, national institutions that are headquartered outside the region, such as Embry Riddle, are not included in the analysis unless they report separate completion numbers for their North Texas locations. Nontraditional education and training programs are also not included.

CIP Code	Description	2013 Completions	2014 Completions	2015 Completions
52.0201	Business Administration and Management, General	5,778	6,108	5,954
52.0301	Accounting	2,214	2,313	2,361
52.0801	Finance, General	1,243	1,241	1,428
11.0101	Computer and Information Sciences, General	936	1,098	1,276
52.0101	Business/Commerce, General	916	892	952
14.1001	Electrical and Electronics Engineering	561	634	716
14.1901	Mechanical Engineering	323	417	507
48.0508	Welding Technology/Welder	238	304	440
27.0101	Mathematics, General	389	385	406
11.0901	Computer Systems Networking and Telecommunications	453	347	378
15.1301	Drafting and Design Technology/Technician, General	79	132	190
14.0901	Computer Engineering, General	146	153	176
52.0203	Logistics, Materials, and Supply Chain Management	275	340	164
11.0103	Information Technology	30	39	160
14.0801	Civil Engineering, General	155	157	157
47.0603	Autobody/Collision and Repair Technology/Technician	193	191	146
11.0701	Computer Science	89	96	130
11.0201	Computer Programming/Programmer, General	91	65	129
14.0501	Bioengineering and Biomedical Engineering	75	73	125
14.3501	Industrial Engineering	81	95	121

52.1001	Human Resources Management/Personnel Administration, General	106	138	102
04.0201	Architecture	116	92	98
47.0607	Airframe Mechanics and Aircraft Maintenance Technology/Technician	144 ³⁰	127 ³¹	150 ³²
14.0201	Aerospace, Aeronautical and Astronautical/Space Engineering	66	70	66
14.1801	Materials Engineering	53	71	65
11.1001	Network and System Administration/Administrator	5	12	30
04.0301	City/Urban, Community and Regional Planning	35	19	15
15.0613	Manufacturing Engineering Technology/Technician	16	13	10
49.0102	Airline/Commercial/Professional Pilot and Flight Crew	4	17	14
11.0804	Modeling, Virtual Environments and Simulation	0	0	0
14.0701	Chemical Engineering	0	0	0
15.1302	CAD/CADD Drafting and/or Design Technology/Technician	68	2	0
27.0301	Applied Mathematics, General	9	2	0
47.0000	Mechanics and Repairers, General	0	0	0
47.0101	Electrical/Electronics Equipment Installation and Repair, General	0	0	0
47.0303	Industrial Mechanics and Maintenance Technology	0	0	0
47.0609	Avionics Maintenance Technology/Technician ³³	4	17	14
48.0501	Machine Tool Technology/Machinist	0	0	0
52.0202	Purchasing, Procurement/Acquisitions and Contracts Management	0	0	0
TOTAL		14,891	15,660	16,480

Figure 4.8. Total Completions by CIP Codes matching one or more Aerospace and Aviation Occupations, North Texas 2013-2015 (Emsi 2017.2)

In North Texas, a total of 16,480 educational program completions were in fields that match to one or more aerospace or aviation occupations in 2015, an increase of more than 1,500 completions from 2013. The top ten programs accounted for 88% of these completions in 2015.

³⁰ 2013 data includes 112 certificate completions from Aviation Institute of Maintenance-Dallas ; 7 associates degrees and 10 short-term certificates from TCC; and 12 associates degrees and 3 short-term certificates from TSTC.

³¹ 2014 data includes 82 certificate completions from Aviation Institute of Maintenance-Dallas ; 9 associates degrees and 9 short-term certificates from TCC; and 21 associates degrees and 6 short-term certificates from TSTC. TCC reports that 48 students actually earned short-term certificates in 2014.

³² 2015 data includes 72 certificate completions from Aviation Institute of Maintenance-Dallas ; 7 associates degrees and 7 short-term certificates from TCC; and 47 associates degrees and 17 short-term certificates from TSTC. TCC reports that 48 students actually earned short-term certificates in 2014.

³³ These data are from TCC and TSTC; no TCC completion data was reported in this CIP code in 2015.

The top three CIP codes are business-related: Business Administration and Management, General; Accounting; and Finance, General. These three CIP codes alone account for 59% of all completions in programs related to aerospace and aviation occupations. Appendix D provides more detailed program completion data by degree and institution.

Institution	All Certificates	All Degrees	All Completions
The University of Texas at Dallas	320	3,016	3,336
The University of Texas at Arlington	23	2,284	2,307
Tarrant County College District	950	326	1,276
University of North Texas	12	1,129	1,141
Southern Methodist University	0	1,126	1,126
Texas A & M University-Commerce	0	912	912
Texas Woman's University	22	638	660
University of Dallas	169	349	518
Richland College	389	129	518
Texas Christian University	0	505	505
All other Institutions	1,552	2,538	4,090
TOTAL	3,437	12,952	16,389

Figure 4.9 Total Completions in 39 Aerospace + Aviation Related Programs by Institution (Emsi 2017.2)

The top 5 institutions generated 56% of all program graduates in 2015. Tarrant County College District generated most of certificate completions, while UTD and UTA accounted for most of the degree completions.

Because business administration and business-related programs dominate all other types of completions, they have been removed in Figure 4.10 to provide a clearer picture of the institutions that are preparing graduates for technical occupations within the aerospace and aviation industries.

Institution	All Certificates	All Degrees	All Completions
The University of Texas at Dallas	0	1,253	1,253
The University of Texas at Arlington	0	1,018	1,018
Tarrant County College District	355	137	492
University of North Texas	0	457	457
Southern Methodist University	0	300	300
Lincoln College of Technology-Grand Prairie	234	0	234
Eastfield College	119	25	144
Mountain View College	118	22	140
North Lake College	107	18	125
Richland College	91	15	106
El Centro College	85	10	95
Collin County Community College District	44	48	92
Texas Christian University	0	74	74
Aviation Institute of Maintenance-Dallas	72	0	72
Texas A & M University-Commerce	0	69	69
DeVry University-Texas	0	51	51

Brookhaven College	38	13	51
Tarleton State University	0	46	46
Navarro College	39	5	44
M T Training Center	40	0	40
ITT Technical Institute-Richardson	0	28	28
ITT Technical Institute-Arlington	0	25	25
Vista College-Online	3	16	19
Peloton College	13	0	13
Remington College-Dallas Campus	0	11	11
Texas Woman's University	0	11	11
ITT Technical Institute-DeSoto	0	10	10
Dallas Baptist University	0	9	9
University of North Texas at Dallas	0	9	9
Remington College-Fort Worth Campus	0	8	8
Cedar Valley College	2	4	6
Brightwood College-Arlington	0	6	6
Texas Wesleyan University	0	5	5
University of Dallas	0	3	3
Brown Mackie College-Dallas	0	3	3
Southwestern Adventist University	0	2	2
Weatherford College	1	0	1
University of Texas Southwestern Medical Center	0	1	1
Total	1,361	3,712	5,073

Figure 4.10 Total Completions in 31 Selected Technical (non-business) Aerospace + Aviation Related Programs by Institution³⁴ (Emsi 2017.2)

In 2016, more than 5,000 non-business degrees were awarded in the 31 programs related to aerospace and aviation technical occupations. The top five institutions generated 69% of the completions, and smaller institutions, including many for-profit training institutions, made a larger contribution to this list.

4.2.3 - On-the-Job Training and Non-Postsecondary Aerospace and Aviation Program Completions:

Not all occupations require a post-secondary certificate or degree, and a few community-based organizations and others offer training programs relevant to the aerospace and aviation industries.

The [Community Learning Center \(CLC\)](#) in Fort Worth, a community-based organization and technical school certified by the State of Texas, is an important source of aerospace and aviation training for prospective candidates for employment. CLC currently operates the **Manufacturing and Aircraft Assembly Training Program (MAAT)**, which is supported by a three year Wagner-Peyser grant. The program just completed its first year. Over the course of the grant, CLC will enroll between 100-120 students per year in cohorts of about 20. The six-week, 240-hour course trains students in working with composites, advanced bonding, and aircraft

³⁴ Excludes general business and commerce, business administration, human resources, architecture, city planning, general mathematics. Includes computer science and programming.

assembly. The curriculum was designed and approved in concert with local employers. Students receive a certificate of completion that is recognized by local employers but is not a formal credential. Upon course completion, sample occupations that students are qualified for include composite bonders, aircraft assemblers, aircraft mechanics, and composite technicians. The course is free for those who meet federal eligibility criteria, and there is currently a waitlist of about 100 individuals.

CLC offers a few other trainings that are relevant to the aerospace and aviation sectors: CNC Machining, which trained about 35 individuals in 2015 and offers prepares participants for the NIMS certification exam; welding, which trained about 115 individuals in 2015 and prepares individuals to enter the Ironworkers Union; and Logistics, which offers MSSC Certified Logistics Associate/Certified Logistics Technician curriculum.

The DFW Aerospace Consortium is also working to re-launch the Aerospace Manufacturing Training Program (AMTP) in early 2018 in order to meet growing industry demand. In partnership with TCC's Opportunity Center, the Texas Workforce Commission and local employers, this new program will train new machinists to meet 5th generation aircraft requirements. The new AMTP will kick-off its first cohort in the first quarter of 2018. The goal is to replicate the program with other community college partners and learning centers to increase the candidate pool. The initiative has strong union support from the International Association of Machinists (IAM), and the revised AMTP training program has the potential to produce up to 24 program graduates from Tarrant County College every 8 weeks, increasing to 48 graduates if the program is replicated at other sites.

Training programs are now coming online for emerging occupations like electro-mechanical technicians, or Unmanned Aerial Systems (UAS) operators. [RMS Aerospace Training and Support Services](#) is one such program with a location in North Texas. RMS provides UAS operator training programs and curriculum development for in-classroom and on-field instruction and simulation and is currently awaiting DOL approval for its UAS operator apprenticeship program. UAS operators must obtain at minimum an FAA remote license, currently available to individuals over 16 who can pass the licensing exam. The FAA remote license does not have any required flight training or pre-requisites.

Of the occupations requiring high school and on the job training, 15 occupations have qualified candidates completing local programs.

SOC	Description	Employed in Industry Group (2016)	Annual Openings	Regional Completions (2015)
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	125	26	478
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	1,553	35	209

51-9122	Painters, Transportation Equipment	355	65	146
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	896	143	103
43-4181	Reservation and Transportation Ticket Agents and Travel Clerks	7,404	145	18
51-1011	First-Line Supervisors of Production and Operating Workers	691	312	45
53-1011	Aircraft Cargo Handling Supervisors	240	15	45
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	686	1487	37
53-6099	Transportation Workers, All Other	524	58	15
53-6051	Transportation Inspectors	446	45	15
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	1,803	418	4
43-5011	Cargo and Freight Agents	2,056	269	2
43-4199	Information and Record Clerks, All Other	249	175	2
51-2023	Electromechanical Equipment Assemblers	130	31	2
51-2031	Engine and Other Machine Assemblers	127	30	2
Total		17,285	3,254	1,123

Figure 4.11 Aerospace and Aviation Occupations Requiring On-the-Job Training, Annual Openings and Regional Completions in North Texas (Emsi 2017.2)

4.2.4 - Local education institutions have built programs that meet needs in the aerospace and aviation industries:

Program data and interviews show that North Texas educational and training institutions have built expertise and offerings to meet aerospace and aviation industry needs. These institutions are interested in continuing to develop expertise and meet industry need in emerging areas, including needs that employers discussed such as non-destructive testing and inspection, logistics and supply chain management, and systems engineering. Some institutions are ramping up programs, such as pilot training, that have graduated a small number of students to date but that employers are looking for.

Institution	Specialized Offerings for Aerospace and Aviation
<u>Community Learning Center (CLC)</u>	Advanced Material Repair (AMR); aircraft assembly, composite bonding, MSSC Certified Logistics Associate and Technician, MSSC Certified Production Technician
<u>Dallas County Community College District (DCCCD)</u>	Logistics, materials and supply chain management, welding, Computer systems networking, autobody collision and repair
<u>Tarrant County College (TCC) – Erma C. Johnson Hadley Northwest Center of Excellence for Aviation, Transportation and Logistics</u>	Advanced Composites certificate; Airframe and Powerplant certificate and degree; Avionics certificate and degree; logistics and supply chain management; Professional Pilot certificate and degree, in conjunction with US Aviation Academy
<u>Texas State Technical College (TSTC) - Waco</u>	Aviation maintenance, pilot training, aircraft dispatch, avionics, industrial maintenance, logistics, welding, and electrical maintenance.
<u>University of North Texas (UNT)</u>	Aviation Logistics degree program in the College of Business is one of the top U.S. programs and has a strong focus on logistics and supply chain management
<u>University of Texas-Arlington (UTA)</u>	Aerospace Engineering ³⁵ , industrial engineering, mechanical engineering
<u>University of Texas-Dallas (UTD)</u>	Systems Engineering and Management, particularly at the graduate level; software engineering; computer science

Figure 4.12 Aerospace and Aviation Programs - Post-Secondary and Community Institutions in North Texas

In addition to the training listed above:

- TCC will launch a new non-credit NDI/NDT program in the fall of 2017 as well as a simulator maintenance technician that could work at Part 142 Flight Centers on simulators. TCC is also considering launching a flight dispatch program.
- DCCCD had a pilot training program that last graduated students in 2013-14. It is also currently exploring partnerships to start aerospace engineering technician and maintenance programs for the 2018-19 academic year.
- Collin County College District has a number of computer and information technology programs, though it does not currently have any other programs that are directly related to key aerospace and aviation occupations.
- TSTC will start an agricultural crop-dusting AS degree program based on high need from employers. This will be an add-on to their pilot training program.

Several private educational institutions and career training schools in the region offer programs geared toward the aerospace and aviation industries. TCU has a robust program in logistics and supply chain management, which graduated 63 individuals in 2015. The Aviation Institute of Maintenance, a for-profit institution with several locations, graduated 72 aircraft maintenance technicians or mechanics from its Irving campus in 2015.

Outside the region, LeTourneau University in Longview graduated 4 pilots in 2015.³⁶ Spartan College of Aeronautics and Technology in Tulsa, another for-profit institution, offers a number

³⁵ All regional completions in aerospace engineering in 2015 were from UTA.

³⁶ Emsi 2017.2

of programs in aviation maintenance, technology and electronics, non-destructive testing as well as pilot training. Embry Riddle Aeronautical University has a Fort Worth campus that offers a limited number of on-campus educational degree and certificate options, including aviation maintenance and aeronautics. More options are available online. Other private training companies offer non-degree pilot training; candidates interested in obtaining a job with a major airline after completing these programs will need to earn a Bachelor's degree elsewhere or have one already in hand.³⁷

Interest in and capacity for airline/professional pilot training is growing in the region. While TSTC was essentially the only educational institution in North Texas to provide degrees for this occupation in 2013-14, TCC, in partnership with US Aviation Academy, is building the capacity of its program. TCC graduated two pilots with AAS degrees in 2016 and five in 2017. Sixteen individuals also completed certificate programs in this area in 2016-17. The program, which is offered in partnership with US Aviation Academy and accessible to day or evening students, offers fixed-wing and rotor-wing training at the largest aviation education facility in Texas. The two-year program provides successful graduates with their license, ratings and associate of applied science degree, or AAS.

TCC has also increased the capacity of its airframe and powerplant certificate and degree programs. In 2016, 20 students completed associate's degrees and 57 received certificates of completion in this area. In 2017, 34 students completed associate's degrees and 89 received certificates of completion.

It is worth noting that employers interviewed do not consider all programs equal in terms of preparing students to be successful on the job. Private for-profit institutions in particular can be costly and do not always have good completion or placement outcomes. Individuals should seek out [program cost, completion, graduation data](#), as well as [gainful employment statistics](#) for any program that they are considering, especially in comparison to often lower-cost public options. The U.S. Department of Education's [College Scorecard](#) is a helpful tool in this regard.

4.2.5 - Education and Training Partnerships with Employers

Educational institutions interviewed for this report are used to consulting with employers to determine the feasibility of and need for new programs and to design curricula. However, maintaining these partnerships at the institutional level over the long-term can be challenging because of limited staff and organizational capacity within both the employer and the educational institution.

Examples of specific collaborations include:

- Lockheed Martin has leveraged TWC Skills Development Fund grants to partner with both TCC and TSTC on aeronautics pipeline programs.
- Bell Helicopter has also collaborated with TCC and TSTC as well as West Texas A&M and Amarillo College to develop and deliver training.

³⁷ A nonexhaustive list of these schools, most of which are located on or near regional airports, include Slipstream Aviation, Marcair Aviation, Delta Qualiflight, Rich Aviation Service, and Goldstar Aviation.

As part of the ramp up for the F-35, Lockheed is exploring a partnership with technical schools to develop a pre-employment pipeline for structural assembly positions, where students would be pre-screened and vetted for employment at Lockheed and receive additional training specific to Lockheed's needs while still in school. The idea is to build pipeline of local and regional talent, accelerate training and get candidates into production sooner. TCC is also working with Lockheed Martin on a grant that allows instructors to work at the company in order to shape curriculum for their aerospace programs.

Beyond these partnerships, there are a variety of ongoing individual communications and relationships between individual instructors and staff at post-secondary institutions and their contacts with aerospace and aviation companies. Many instructors leverage these relationships to help students identify or secure internships, work experience or job placements during or after their coursework.

Human resources professionals at aerospace and aviation companies described reaching out to faculty at post-secondary institutions to let them know about internship and summer job opportunities. These relationships also lead to other types of industry exposure for students such as guest speakers, mentoring or facility tours. However, these opportunities are highly person-dependent; they are not built into the systems and practices of either the educational institution or the companies. This makes them flexible and personal but also vulnerable to personnel changes.

Employers interviewed for this study expressed great interest in establishing more co-ops, where structured work opportunities are built into the curriculum, and students receive credit for this work toward their degree. Educational institutions, while generally supportive of work experience for their students, pointed out that in some programs, such as A&P certification, the significant time requirements that are already imposed for graduation and accreditation make adding co-op hours extremely challenging.

That being said, there may be an opportunity to find common ground and work toward shared interests of helping students gain more work experience while enrolled in education programs so they are work ready when they graduate. Some employers, like Lockheed Martin, Airbus, and Safran have structured, robust internship programs in partnership with universities and even local high schools. While not every employer has the capacity to manage a large internship program, most were interested in developing current programs further and expressed interest in learning about best practices and resources for hiring and managing interns as well as increased capacity to manage relationships with post-secondary and secondary institutions.

4.3 - Labor Supply – Existing Talent Pool

In order to provide a picture of the existing talent pool for the aerospace and aviation sectors, we examined Texas Industry Profiles (TIP) data about the individuals in the region who have filed for UI or completed jobseeker profiles on WorkInTexas.com.

4.3.1 - Data from Texas Industry Profiles (TIP) for Aerospace and Aviation Sectors:

The TIP profiles for aerospace and aviation provide aggregate data about recent Texas Workforce Commission (TWC) applications for unemployment insurance (UI) as well as for individuals from the region with jobseeker profiles in WorkinTexas.com. While these data have limitations, the industry profiles provide a sense of the size of the existing available talent pool.³⁸ Data about applicants are provided by occupation, not by sector. While individuals may be seeking employment in these occupations within aerospace or aviation, they may also be available for work outside these sectors. We have therefore adjusted the TWC figures based on the percentage of occupational concentration within the aerospace and aviation sectors to come to a more realistic picture of labor force availability.³⁹

Because the TIP data is from 2012, we also looked at unemployment data from January 2017, but because these are only available at the two-digit occupational level, we had to make assumptions about the number and concentration of aerospace and aviation employees. These data are included in Appendix D. Overall, the data are directionally similar to the TIP data (e.g. a large number of unemployed in transportation and material moving occupations within the sector; a very small number of unemployed information technology workers in the sector), but the numbers of unemployed in every occupation group are smaller in 2017 than in 2012.

SOC	Title	Employment 2012	TWC Applicant Transactions	Available for employment in sector
11-9041	Architectural and Engineering Managers	4,310	537	106
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	7,410	744	150
13-1081	Logisticians	4,120	814	291
13-1111	Management Analysts	13,050	1,124	45
13-1199	Business Operations Specialists, All Other	20,450	3,405	232
13-2031	Budget Analysts	1,220	734	135
13-2051	Financial Analyst	6,890	1,318	79
15-1121	Computer Systems Analysts	15,710	-	0
15-1132	Software Developers, Applications	16,380	-	0
15-1133	Software Developers, Systems Software	13,070	-	0
17-2011	Aerospace Engineers	3,570	300	300
17-2071	Electrical Engineers	4,240	666	107
17-2112	Industrial Engineers	4,890	203	81
17-2141	Mechanical Engineers	5,470	472	160
39-6011	Baggage Porters and Bellhops	720	234	222

³⁸ Using Texas Industry Profile data to approximate labor supply has limitations. These data are from 2010-2012, when the industry was beginning to shed jobs, and the data may not accurately reflect the current labor market in 2017. Individuals with profiles in TWC may not necessarily be currently unemployed or seeking work.

³⁹ We used the percentage of concentration for each occupation within the aerospace and aviation sectors in order to calculate an approximate number of individuals who would be available for employment in the sector. We doubled occupational concentration for occupations where the concentration is under 50%. We included 100% of TWC applicants if the occupational concentration is above 50%.

SOC	Title	Employment 2012	TWC Applicant Transactions	Available for employment in sector
43-1011	First-Line Supervisors of Office and Administrative Support Workers	36,440	6,202	360
43-4051	Customer Service Representatives	75,210	33,461	1,003
43-4181	Reservation and Transportation Ticket Agents and Travel Clerks	8,060	432	432
43-5061	Production, Planning, and Expediting Clerks	8,280	1,418	284
43-5071	Shipping, Receiving, and Traffic Clerks	17,630	6,020	265
49-2091	Avionics Technicians	630	421	421
49-2093	Electrical and Electronics Installers and Repairers, Transportation Equipment	670	266	41
49-3011	Aircraft Mechanics and Service Technicians	5,260	1,116	1,116
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	6,240	578	18
49-9098	Helpers--Installation, Maintenance, and Repair Workers	4,810	1,392	92
51-1011	First-Line Supervisors of Production and Operating Workers	12,570	3,516	186
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	2,970	1,007	1,007
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	2,570	540	313
51-4041	Machinists	7,880	802	294
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	12,560	2,176	609
51-9191	Adhesive Bonding Machine Operators and Tenders	1,270	59	20
53-2011	Airline Pilots, Copilots, and Flight Engineers	2,410	98	98
53-2012	Commercial Pilots	1,810	117	117
53-2021	Air Traffic Controllers	850	92	92
53-2031	Flight Attendants	4,340	0	4,340
53-6061	Transportation Attendants, Except Flight Attendants	500	0	0
53-7061	Cleaners of Vehicles and Equipment	9,490	890	68
53-7199	Material Moving Workers, All Other	710	3,014	807

Figure 4.13 TWC Applications for North Central Texas for Key Aerospace and Aviation Occupations by SOC (Source: Texas Industry Profiles, Labor Availability Estimator, Author's analysis)

The occupations with greater numbers of jobs and people employed generally have the highest number of TWC applicant transactions. These occupations tend to have lower educational requirements and to have significant numbers of individuals employed outside of the aerospace sector (e.g. shipping and receiving clerks, first-line supervisors of production workers, business operation specialists, inspectors, weighers, and testers, and production and planning clerks).

By contrast, engineering occupations, adhesive bonding machine operators, and machinists have much lower ratio of applications to employment. This may indicate that fewer engineers are unemployed or that fewer engineers use WorkinTexas.com to looking for new employment.

There are no TWC applicants at all for software developers and computer systems analysts. Again, this may speak to the generally low unemployment rate for these occupations as the tendency for people in these occupations to use other avenues to seek employment. The data also reflect what employers communicated about the competitive market and difficulty finding these types of individuals for the aerospace sector.

4.4 - Longer-term Labor Supply Pipeline

The region is building longer-term workforce pipelines for the aerospace and aviation industries by developing and offering CTE courses as well as more STEM education and enrichment opportunities. Schools and CTE programs are building specific relationships between aerospace and aviation companies and K-12 schools and districts.

These data provide a snapshot of the numbers of students enrolling in specific courses as well as categories of CTE courses in Academic Year 2015-16 in regions 10 and 11.⁴⁰ Each student may be counted more than once in the enrollment numbers if s/he enrolled in more than one CTE course or program during the school year. Enrollments in five CTE categories are summarized below: computer science, information technology, manufacturing, STEM and Transportation, Distribution and Logistics. These align with industry interests as well as specific courses related to aerospace and aviation careers.

CTE Category	Region 10 Enrollments	Region 11 Total Enrollments	Total Enrollments	Grade 6-8	Grade 9- 12
Computer Science	31,313	15,045	46,358	22,871	12,487
Information Technology	16,363	7,607	23,970	0	23,970
Manufacturing	2,994	2,079	5,073	0	5,073
Science, Technology, Engineering and Math (STEM)	22,800	14,718	37,518	0	37,518
Transportation, Distribution, Logistics (TDL)	3,901	2,701	6,602	0	6,602
Total	77,371	42,150	119,521	22,871	85,650

Figure 4.14 Enrollments in selected CTE Program Categories, Regions 10-11 (Source: Texas Education Authority)

⁴⁰ These data come from Texas Education Authority (TEA) reports on enrollments in K-12 CTE programs in Region 10 (east side of the Metroplex, including Dallas) and Region 11 (west side of the Metroplex, including Fort Worth), which roughly correspond to the 16-county North Texas region and comprise 147 ISDs plus 113 public charter schools.

The data show that computer science enrollments, with more than 46,000, are highest. Most of these enrollments are at the middle-school level, with nearly twice as many enrollments in grades 6-8 as in grades 9-12. The other CTE categories only report enrollments in grades 9-12. Enrollments in STEM courses are next, followed by information technology. Enrollments in manufacturing and TDL courses are much lower.

Enrollments in specific CTE courses relevant to careers in aviation and aerospace are listed below. These include general, survey courses, such as principles of engineering and principles of manufacturing, as well as higher level or specific courses such as aerospace engineering and aircraft technology.

Specific Course Enrollments	Region 10 Enrollments	Region 11 Enrollments	Total Enrollments
Principles of Engineering	1,927	1,336	3,263
Welding	843	1,089	1,932
Robotics and Automation	1,299	411	1,710
Principles of TDL	953	748	1,701
Principles of Manufacturing	1,034	546	1,580
Aerospace Engineering (PLTW) ⁴¹	443	325	768
Flexible Manufacturing	541	37	578
Aircraft Technology	95	107	202
Manufacturing Engineering	10	54	64
Robotics Programming and Design	0	59	59
Advanced Aircraft Technology	25	10	35
Logistics, Planning and Management	30	0	30
	7,200	4,722	11,922

Figure 4.15 Enrollments in Selected CTE Courses, AY 2014-2015, Regions 10-11 (Source: Texas Education Authority)

For context, Region 10 serves over 810,000 students, of which 227,558 are in grades 9-12.⁴²

Region 11 serves a total of 578,910 students, of which 174,943 are in grades 9-12.⁴³

Unsurprisingly, Region 10 has more students enrolled in CTE courses than Region 11. Still, it is clear from reviewing the data that only a fraction of all high school students in both regions is enrolled in these CTE courses.

Not surprisingly, many more students enrolled in introductory/general courses than in more specific or higher level courses. While 202 students enrolled in Aircraft Technology, just 35 students enrolled in advanced aircraft technology. Similarly, 3,263 students enrolled in principles of engineering, but 768 students enrolled in aerospace engineering through Project

⁴¹ Course offered as part of Project Lead the Way (PLTW). See note 44 for more on PLTW.

⁴² Texas Education Agency Enrollment Data for Region 10. Accessed September 29, 2017 at https://tea.texas.gov/Reports_and_Data/Student_Data/Standard_Reports/PEIMS_Standard_Reports/

⁴³ Texas Education Agency Enrollment Data for Region 11. Accessed September 29, 2017 at https://tea.texas.gov/Reports_and_Data/Student_Data/Standard_Reports/PEIMS_Standard_Reports/

Lead the Way.⁴⁴ Finally, 1,580 students enrolled in principles of manufacturing, but only 64 enrolled in manufacturing engineering.

A number of districts in the region have strong aviation or aerospace programs. Although the text boxes below feature programs from McKinney and Fort Worth ISDs, districts with the greatest enrollment in aviation programs are Dallas, Fort Worth, Irving, McKinney, Desoto, Grand Prairie and Northwest ISDs.

McKinney HS Aviation Academy

The **McKinney Aviation Academy** is a four-year preparatory program that enables high school students at all MISD campuses to study the history of aviation, careers in aviation, participate in hands-on projects, build and fly model aircraft, attend air shows, earn their student pilot license, work on actual aircraft, and discover the many options available in the aviation industry. Students may choose to complete either their Sport Pilot License or Private Pilot license, the latter of which will put them on the path for a career as a Professional Pilot.

The academy includes instruction with an FAA certified Advanced Ground Instructor; time in a Redbird LD flight simulator; preparation for the FAA written exam for pilots; and a practicum focused on either pilot training or aircraft maintenance.

For more information, see:

<http://www.schools.mckinneyisd.net/mhs/academics/departments/career-technology-education/aviation/>

Dunbar HS Aviation Technology Program

Dunbar High School in Fort Worth offers an Aviation Technology dual-credit program that is part of Fort Worth ISD's Gold Seal Program of Choice. Dunbar High School Aviation students have the opportunity to earn college credit at Tarrant County College through courses that include fundamentals of flight, weather, space travel, & flight planning through hands-on projects in Dunbar's state-of-the-art aviation lab.

At Aviation Summer Camp, which students have access to as part of the program, students can expect to participate in activities that feature STEM (Science, Technology, Engineering, and Math) components related to aerospace & aviation, which also involves actual flight

Students may also apply for internships at Bell Helicopter and Lockheed Martin, where they work on real world projects that relate to their classroom learning.

For more information, see: <https://www.fwisd.org/Page/4893>

⁴⁴ Project Lead the Way (www.pltw.org) is a nonprofit organization that works with K-12 students and teachers around the U.S. Its pathways in computer science, engineering, and biomedical science, teach students technical skills, problem-solving, critical-thinking, communication, creativity and collaboration.

4.4.1 - Total Supply for Aerospace and Aviation, North Texas:

Figure 4.10 summarizes workforce supply by source/educational attainment. In raw numbers, the region currently generates approximately 31,382 workers with qualifications for jobs in the aerospace and air transportation industries each year. However, just because an individual completes a relevant training program does not mean that s/he has the experience and background that employers are seeking or require for a specific job opening. In addition, the number of TWC applicants who are in the labor supply is probably overstated, as unemployment in the sector was much higher in 2012 than it was in 2016.

Source of Supply	# Qualified Workers per Year
On-the-Job/Technical Training ⁴⁵	1,097
Post-secondary Award (non-degree)	2,861
Associates Degree	1,330
Bachelor's Degree	5,177
Post-Baccalaureate or Masters Degree	6,744
Doctorate	247
TWC applicants (In-Sector) ⁴⁶	13,891
HS CTE Students in Aviation/Aerospace ⁴⁷	35
Total	31,382

Figure 4.16 Summary of Workforce Supply for Aerospace and Aviation Occupations by source/educational level (Sources: Emsi 2017.2; Texas Industry Profiles; Texas Education Agency; Author's analysis)

5 - Supply, Demand and Gap Analysis

Overall, the aerospace and air transportation industries in the region are doing well in terms of having a skilled workforce available to meet currently projected needs. Only a few occupations in both sectors are projected to have workforce gaps or tight labor supply.

⁴⁵ Emsi 2017.2 plus author estimate of completions from community programs.

⁴⁶ The total number of TWC applicants refers to individuals who might seek work in any sector but who are qualified for jobs in the aerospace and/or aviation sectors. The in-sector number of TWC applicants refers to an estimate of the number of individuals who are expected to seek work within the aerospace and aviation sectors, based on the concentration of each of the target occupations within the sector.

⁴⁷ This is a conservative estimate based on CTE enrollments in the advanced aircraft technology course only.

Occupation	Total Annual Openings	Total Graduate Supply	Approx. TWC Applicant Supply	Approx. (Gap) or Surplus
Inspectors, Weighers, Testers, Sorters, Samplers	418	4	609	+195
Reservation and Transportation Ticket Agents and Travel Clerks	145	18	432	+305
Computer-Controlled Machine Tool Operators, Metal and Plastic	143	103	313	+273
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers ⁴⁸	435	209	1,007	+781
Adhesive Bonding Machine Operators and Tenders	16	0	20	+4
Machinists	325	0	294	(31)

Figure 5.1 Industry Annual Supply and Demand, Key Aerospace and Aviation Occupations, North Texas, 2016-2022 – Occupations requiring Short-term or On-the-Job Training (Sources: Emsi 2017.2, Texas Industry Profiles, Author's Analysis)

Looking at the positions above, omitting TWC applicant supply for CNC machine tool operators and aircraft assemblers results in a labor gap for both of those positions rather than a surplus. Because both occupations require current skills and specific training for the aerospace industry, and because Lockheed Martin is hiring and will continue to hire a significant number of assemblers on the F-35 production line, the surplus is probably not as large as the data might imply. According to employers, increased additive and advanced manufacturing will likely increase the number of CNC operators that they need.

Occupation	Avg Annual Openings 2016-22	Avg Annual Graduate Supply	TWC Applicant Supply (2012)	Approx. (Gap) or Surplus	(Gap) or Surplus without TWC data
Aircraft Mechanics and Service Technicians	267	209	1,116	+1,058	(58)
Avionics Technician	27	90	421	+480	+63
Commercial Pilots	56	1	117	+62	(55)
Airline Pilots	153	1	98	(54)	(152)
Aerospace engineers	86	66	300	+280	(20)
Aerospace Engineering and Operations Technicians	12	31	ND	+19	+19
Industrial Engineers	212	131	81	0	(81)
Electrical Engineers	131	716	107	+692	+585

⁴⁸ This number includes approximately 400 individuals per year through 2021 for Lockheed Martin, which is not reflected in the Emsi data set.

Occupation	Avg Annual Openings 2016-22	Avg Annual Graduate Supply	TWC Applicant Supply (2012)	Approx. (Gap) or Surplus	(Gap) or Surplus without TWC data
Computer Systems Analysts*	1,070	1,927	0	+857	+857
Software Developers, Applications*	1,024	799	0	(225)	(225)
Software Developers, Systems Software*	566	1,477	0	+911	+911
Mechanical Engineers	226	507	160	+441	+281
Logisticians	105	209	291	+395	+104

Figure 5.2 Industry Annual Supply and Demand, Key Aerospace and Aviation Occupations, North Texas, 2016-2022 – Occupations requiring post-secondary degree or certificate (Sources: Emsi 2017.2, Texas Industry Profiles, Author's Analysis)

*** There is a large labor supply gap for these positions in the region across all industries. Even though graduate supply looks like it meets or exceeds demand, employers from many industries are competing to fill computer systems analyst and software developer positions in the North Texas region.**

Despite the data in the tables above, there are good reasons not to become complacent about labor supply.

Companies need to consider the aging workforce in the aerospace and air transportation sectors, as well as the gender and racial/ethnic demographics of the region with respect to the demographics of the industry sectors in building a longer-term talent pipeline. This pipeline strategy must be able to upskill existing workers, attract and retain students in relevant programs of study, and bring more women and under-represented populations into the aerospace and air transportation industries.

New graduate supply does not meet employer demand for occupations like avionics technicians, aircraft mechanics, airline pilots, commercial pilots, and aerospace engineers, CNC machinists, adhesive bonding machine operators and tenders, and computer application developers. In these cases, the majority of the available labor supply is coming from churn in existing workers or UI applicants. Given the caveats discussed before about these numbers, there is great uncertainty about what this labor force looks like and whether or not these individuals are actively seeking employment.

Software developers, application developers and computer analysts, which are growth positions in both sectors, are in short supply across the region. Aerospace and aviation employers are competing with many other industries to hire for these positions. Therefore, though the number of graduates may meet demand for the aerospace and aviation industries, it is insufficient to meet regional demand overall, which reflects what employers communicated about the difficulty filling these positions. Aerospace and aviation employers may need to

aggressively market their positions to IT graduates and collaborate with employers in other industries to increase the overall number of completions in these programs.

CIP Code	Program	Regional Completions (2016)	Regional Openings (2016)
11.0101	Computer and Information Sciences, General	1,795	3,359
14.0901	Computer Engineering, General	171	2,848
11.0201	Computer Programming/Programmer, General	109	4,350
11.0701	Computer Science	170	5,001
11.0901	Computer Systems Networking and Telecommunications	335	3,305

Figure 5.3 Competition for IT graduates across NTX is stiff (Source: Emsi 2017.2)

Employers may also need to partner more with educational and training institutions to help potential hires as well as incumbent workers gain the skills and experience they need to qualify for the more advanced/skilled positions that employers need to fill, especially with the aging workforce and coming wave of retirements.

Finally, technology is changing the aerospace and air transportation industries. Unmanned air systems (UAS), drones, on-demand air transportation using electric vertical takeoff and landing (e-VTOL) vehicles, such as the service Uber is planning to launch in DFW by 2020, are currently impacting and will continue to change these sectors and the types of employees and skills that are in-demand.⁴⁹ The FAA has forecasted that commercial UAS units used in commercial applications will grow from 32,800 to 542,500 by 2020 nationally, and Texas currently ranks third in the country in terms of drone licenses issued. These drone units will need pilots as well as maintenance and repair technicians, which could result in increased employment in these areas beyond what is currently forecasted. Timely and organized employer feedback and communication with training providers and educators will be crucial in helping them stay abreast of industry trends and better prepare students to meet industry needs.

Finally, as discussed in section 4.1, the aerospace and air transportation workforces are aging, with many workers nearing or at retirement age. Succession planning is a big concern for employers, who discussed the challenge of replacing experienced workers and skilling up existing or new workers. There will be a continued need to develop talent for these industries, especially talent with skills to meet new industry trends and skills, such as increased automation, additive manufacturing, technology, and turnkey operations.

⁴⁹ "Uber Plans 2020 VTOL Air Taxi Launch in Dallas and Dubai," Aviation Daily, April 25, 2017. Accessed on September 29, 2017 at <http://aviationweek.com/technology/uber-plans-2020-vtol-air-taxi-launch-dallas-and-dubai>.

6 – Recommendations

Preparing residents for and connecting them to jobs in the region’s growing aerospace and air transportation sectors should be a priority for educators, workforce training organizations, and employers alike.

While the talent pipeline for the aerospace and aviation industries is currently working well in terms of connecting talent to available jobs, there is room for improvement in several areas. Recommendations below focus on what the DFW Regional Aerospace Consortium, employers, educators, workforce and community organizations and individuals can do to build the long-term workforce pipeline for aerospace and air transportation in North Texas.

The recommendations build on the strong foundation and work of the Consortium and address increasing enrollment and retention of middle and high school students in relevant technical fields; improving connections for under-represented but growing populations to aerospace and aviation careers; providing on-the-job training and work-based learning opportunities; and developing a workforce that has the skills that the industry needs in the future, especially with regard to increased technology, advanced manufacturing and systems engineering.

Recommendations are organized into four main sections:

- 6.1 – What can the DFW Regional Aerospace Consortium do?
- 6.2 – What can air transportation and aerospace companies do?
- 6.3 – What can educators, workforce and community organizations do?
- 6.4 – What can students, parents and job seekers do?

6.1 - What can the DFW Regional Aerospace Consortium do?

- 1 - Work to more clearly define the value proposition of participating in and engaging with the DFW Regional Aerospace Consortium in order to increase participation and engagement.
- 2 - Intentionally find ways to engage and meet the needs of smaller aerospace and aviation companies in the region, as well as those companies located outside of Tarrant County.
- 3 - Continue to work on expanding Consortium Membership beyond employers to a broader group of stakeholders; and open the Consortium's regular meetings to these stakeholders to increase coordination and communication about needs, trends and opportunities.
- 4 - Increase visibility of the Consortium's activities, starting by updating the website with member companies, recent news and accomplishments, a calendar of upcoming meetings and events, and an overview of the Consortium's work and key contacts.
- 5 - Develop a regular occupational or career pathway feature, starting with in-demand occupations, that includes labor market information, training and education programs and pathways, career advancement opportunities, and information about companies that employ these positions. Share via traditional and social media and on the Consortium website.
- 6 - Work with the North Central Texas Council of Governments (NCTCOG) to add aerospace career opportunities to the [NCT Aviation Careers website](#) and build out the speakers bureau of industry experts.

6.2 - What can Air Transportation and Aerospace companies do?

- 1 - Join the DFW Regional Aerospace Consortium to gain access to training, education and outreach opportunities that will help you meet your company's workforce and training needs.
- 2 - Continue to participate in and support industry outreach efforts that increase the visibility of opportunities and trends in aerospace and air transportation, such as the NCTCOG aviation and aerospace speakers bureau and other community events for students and jobseekers.
- 3 - Increase firm investments in incumbent worker training and succession planning with an eye to increasing workforce availability and preparation for key or in-demand occupations.
- 4 - Partner with workforce and education partners to invest in apprenticeships, leveraging opportunities such as [Apprenticeship Texas](#). Focus on growth occupations such as computer systems and software developers.

5 - Partner with educators to highlight and support high quality CTE programs in order to increase the number of K-12 students interested in and pursuing aerospace and aviation careers.

6 - Provide opportunities for K-12 and post-secondary educators to participate in workplace learning experiences to help them keep curricula current with industry equipment, trends and skill requirements.

7 - Acknowledge and specifically call out increasing diversity of the talent pipeline as a goal, and set some preliminary targets toward this end.

6.3 - What can Educators, Workforce and Community Organizations do?

1 - Utilize the North Central Texas Council of Government's (NCTCOG) Aviation Careers website (www.nctaviationcareers.com) to learn more about opportunities in aerospace and aviation and direct students and adult job seekers to relevant education and career pathways.

2 - Work with the DFW Regional Aerospace Consortium to highlight industry opportunities and career pathways in order to inform parents, students and job seekers about in-demand occupations and skills.

3 - Communicate the value of CTE programs to students and parents in terms of gaining industry skills, experience and exposure.

4 - Reach out to the NCTCOG Speakers Bureau to bring industry speakers and insight into the classroom and community.

5 - Highlight successful job seekers that have transitioned from training into aerospace and aviation careers.

6.4 - What can Students, Parents and Job Seekers do?

1 - Explore careers and educational opportunities in aviation and aerospace on the NCTCOG's Aviation Careers website (www.nctaviationcareers.com).

2 - Download the DFW Regional Aerospace Consortium's FLYBY app to learn more about aerospace and aviation careers.⁵⁰

3 - Explore and enroll in relevant STEM and CTE courses, such as aviation, aerospace engineering, computer science, engineering, manufacturing and robotics at the high school and post-secondary levels.

4 - Upload your resume and explore internship opportunities in aerospace and aviation at Texas Internship Challenge (<https://www.txinternshipchallenge.com>)

⁵⁰ The FLYBY app is available at no cost on iTunes and GooglePlay.

7 - Conclusion

The aerospace and aviation sectors in North Texas contribute greatly to the region's economic strength and vitality. The sectors will continue to grow over the next 3-5 years, employing nearly 80,000 people in a diverse set of occupations, and both expected growth and coming retirements will create opportunities for more of the region's residents to find employment in these industries. The region's education and training systems are, for the most part, also meeting the needs of the industries, graduating students prepared to work. Greater utilization of technology both in the manufacturing process and in the operation of aircraft is creating greater demand for workers with these skills. The move toward turnkey solutions as well as growing maintenance and sustainment operations will increase demand for workers with high-end manufacturing, repair and craft skills.

Moving forward, employers, education and training providers, the public sector, and other stakeholders can build on the work that has already been done to strengthen the talent pipeline and create opportunity for further industry growth as well as more economic opportunity for North Texans.

8 - Appendices

See separate file for appendices, available for download at www.workforcesolutions.net.

Appendix A – Data, Methodology, and Sources

Appendix B – Interviewees

Appendix C – Data tables – Workforce Demand for Aerospace and Air Transportation

Appendix D – Data tables – Workforce Supply for Aerospace and Air Transportation

Appendix E – Selected Occupation Descriptions for Aerospace and Air Transportation

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North Texas Aerospace and
Aviation Talent Pipeline Study
Appendices

North Texas Aerospace and Aviation Talent Pipeline Study Appendices

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Appendix A – Methodology, Geography and Data Sources

Research for this report was primarily completed over a 12-month period from August 2016-July 2017.

A.i – Geography

Unless otherwise noted, this report covers a 16 county North Texas Region, which consists of Collin, Denton, Dallas, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwall, Somervell, Tarrant, and Wise counties. These are the counties served by Workforce Solutions Greater Dallas, Workforce Solutions Tarrant County, and Workforce Solutions North Central Texas, which are the three workforce boards that collaborate to support the [Regional Workforce Leadership Councils](#). The DFW Aerospace Consortium is one such council. Some demographic data in the report are provided for the Dallas-Fort Worth-Arlington Metropolitan Statistical Area, which consists of a subset of 13 counties.¹ These instances are clearly identified.

A.ii - Data Sources

Industry Data

This report covers the aerospace and air transportation industries in North Texas and includes companies in the following [NAICS](#) codes (See Appendix A for more detail):

- **3364 (Aerospace Parts and Products Manufacturing)** – includes aircraft manufacturing; aircraft engines and other parts manufacturing; guided missile systems and space vehicles; and other auxiliary parts and equipment manufacturing.
- **4811 (Air Transportation – Scheduled)** – includes passenger transportation (commercial airlines) as well as scheduled freight transportation
- **4812 (Air Transportation – Nonscheduled)** – includes non-scheduled passenger transportation (such as charter flights) as well as freight transportation
- **4811 (Support activities for Air Transportation)** – includes airport employment such as airfield operations, aircraft maintenance and repair, air traffic control, and other support activities for air transportation.

Data about industry characteristics, workforce characteristics, workforce projections, jobs and growth primarily come from [Emsi](#), using data from 2017.Q2². The author supplemented this data by conducting 18 interviews with North Texas aerospace and air transportation companies identified with the help of the DFW Aerospace Consortium.

(See Appendix B for a full list of interviewees).

¹ The Dallas-Fort Worth-Arlington MSA consists of Collin, Dallas, Denton, Ellis, Hunt, Hood, Johnson, Kaufman, Parker, Rockwall, Somervell, Tarrant, and Wise Counties.

² Emsi's 2017.Q2 data are based in part on 2014 projections from the state of Texas.

The terms “air transportation” and “aviation” are used interchangeably in this report.

Occupation and Job Posting Data

This report includes information about the primary occupations in the aerospace and air transportation industries and their concentration within these industries as well as other industries in the North Texas region. Information about these occupations is drawn primarily from Emsi’s 2017.Q2 reports on employees (QCEW and non-QCEW).³

Real-time labor market data provides information about job postings from the 12-month period ending March 31, 2017. This information is supplemented by interviews and data gathered from local aviation and aerospace companies, as noted above.

In addition to Emsi data, the report also draws from publicly-available labor market information through the state’s [Texas Industry Profiles](#).

Labor Supply Data

The report includes data on recent graduates from relevant education and training programs as well as job seekers/unemployed residents of the region that previously worked in aerospace and aviation occupations. The report examines the longer-term talent pipeline for the industry by looking at enrollments in applicable career and technical education (CTE) courses in the K-12 educational system in Regions [10](#) and [11](#), which together roughly align with the 16 county North Texas region and comprise 197 ISDs.

Labor supply data are drawn from the following sources:

- Emsi, which draws from the [National Center for Education Statistics](#) database, is the report’s primary data source for new graduates from relevant programs that prepare individuals for aerospace and air transportation occupations. The report draws on completion data from 2012-2015 for post-secondary institutions in the North Texas region.
- We also obtained and reviewed enrollment and completion data from a few educational and training institutions in the region directly, including Tarrant County College, Dallas County Community College District, and the Community Learning Center, a community-based organization that is a key provider of aerospace training programs. Finally, we completed interviews with education and nonprofit leaders to include more in-depth information about their programs and collaboration with employers.
- [Texas State Industry Profiles](#) for the aerospace and aviation industries provide most of the information used in the report to determine the existing talent pool for aerospace and aviation jobs. These profiles provide data on the number of individuals who have applied for unemployment insurance and on the number of individuals who have searched for employment based on their last known occupation/job. The report aggregates information from the Dallas, Tarrant and North Central Texas regions to create a North Texas dataset.

³ We have excluded the self-employed, which constitute a very small number of individuals in these industries.

- Enrollment information for CTE programs comes from the state of Texas' [Texas Public Education Information Resource \(TPEIR\)](#). TPEIR provides course level enrollment data by TEA region. We aggregated information on aerospace and aviation-related CTE courses in regions 10 and 11, which roughly an area slightly larger than the 16 county North Texas region for this report. We also met with CTE directors from Region 11, including the directors from Arlington, Azle, Aledo, and Birdville Independent School Districts.
- Surveys and interviews with educational institutions and community-based organizations in the region, including six post-secondary institutions, CTE directors from Region 11, and representatives from three workforce boards.

A.iii - Aerospace and Air Transportation NAICS Codes used in the Study

[31-33 - Manufacturing](#)

- [3364 - Aerospace product and parts manufacturing](#)
 - [33641 - Aerospace product and parts manufacturing](#)
 - [336411 - Aircraft manufacturing](#)
 - [336412 - Aircraft engine and engine parts manufacturing](#)
 - [336413 - Other aircraft parts and auxiliary equipment manufacturing](#)
 - [336414 - Guided missile and space vehicle manufacturing](#)
 - [336415 - Guided missile and space vehicle propulsion unit and propulsion unit parts manufacturing](#)
 - [336419 - Other guided missile and space vehicle parts and auxiliary equipment manufacturing](#)

[48-49 - Transportation and warehousing](#)

- [481 - Air transportation](#)
 - [4811 - Scheduled air transportation](#)
 - [481111 - Scheduled passenger air transportation](#)
 - [481112 - Scheduled freight air transportation](#)
 - [4812 - Nonscheduled air transportation](#)
 - [481211 - Nonscheduled chartered passenger air transportation](#)
 - [481212 - Nonscheduled chartered freight air transportation](#)
 - [481219 - Other nonscheduled air transportation](#)

[48-49 - Transportation and warehousing](#)

- [488 - Support activities for transportation](#)
 - [4881 - Support activities for air transportation](#)
 - [48819 - Other support activities for air transportation](#)
 - [488190 - Other support activities for air transportation](#)
 - 488111- Air Traffic Control

A.iv - Education CIP Codes associated with aerospace and air transportation occupations

CIP Code	Description
04.0201	Architecture
04.0301	City/Urban, Community and Regional Planning
11.0101	Computer and Information Sciences, General
11.0103	Information Technology
11.0201	Computer Programming/Programmer, General
11.0701	Computer Science
11.0804	Modeling, Virtual Environments and Simulation
11.0901	Computer Systems Networking and Telecommunications
11.1001	Network and System Administration/Administrator
14.0201	Aerospace, Aeronautical and Astronautical/Space Engineering
14.0501	Bioengineering and Biomedical Engineering
14.0701	Chemical Engineering
14.0801	Civil Engineering, General
14.0901	Computer Engineering, General
14.1001	Electrical and Electronics Engineering
14.1801	Materials Engineering
14.1901	Mechanical Engineering
14.3501	Industrial Engineering
15.0613	Manufacturing Engineering Technology/Technician
15.1301	Drafting and Design Technology/Technician, General
15.1302	CAD/CADD Drafting and/or Design Technology/Technician
27.0101	Mathematics, General
27.0301	Applied Mathematics, General
47.0000	Mechanics and Repairers, General
47.0101	Electrical/Electronics Equipment Installation and Repair, General
47.0303	Industrial Mechanics and Maintenance Technology
47.0603	Autobody/Collision and Repair Technology/Technician
47.0607	Airframe Mechanics and Aircraft Maintenance Technology/Technician
47.0609	Avionics Maintenance Technology/Technician
48.0501	Machine Tool Technology/Machinist
48.0508	Welding Technology/Welder
49.0102	Airline/Commercial/Professional Pilot and Flight Crew
52.0101	Business/Commerce, General
52.0201	Business Administration and Management, General
52.0202	Purchasing, Procurement/Acquisitions and Contracts Management
52.0203	Logistics, Materials, and Supply Chain Management
52.0301	Accounting
52.0801	Finance, General
52.1001	Human Resources Management/Personnel Administration, General

Appendix B - Interviewees

Aerostar

Terrence Brown

Airbus

Susan Davis
Kathy Hassenpflug

American Airlines

Mike Waldron

Bell Helicopter

Tricia Hiros
Jill Morgan-Frost
Allison Mullis
Wilson Tan

**BTX Logistics / DFW Air
Cargo Association**

Ryann Malaby

C&S Propeller

Buddy Tobin

Cooperative Industries

Dottie Muldowney

Elbit Systems

Alicia Cooper
Teresa Pallas

**Garland Chamber of
Commerce**

Paul Mayer

Lockheed Martin

Devon Brown
Jon Gustafson
Cara Lundquist

**Micropac Industries / Dallas
County Manufacturers
Association**

Mark King

Orbital ATK

Michael Ogle

Pratt Whitney

Kathy Clark

Sagem Avionics

Tarese Jackson

Sikorsky

Kumi Wright

Southwest Airlines

Rodney Blake

Texas Jet

Reed Pigman

Triumph Air Systems

Bill McDonough
Norm Porter

Wesco Air

Steve Pontikis

Community Learning Center

Sam Dekich
Angela Traiforos

**Dallas County Community
College District**

Roy L. Bond
Ben Magill
Tim Samuels
Joyce Williams

**North Central Texas Council
of Governments**

Natalie Bettger
Ernest Huffman

**Tarrant County College
District**

Darrell Erby
Clint Grant
Keva Montrose

**Texas Manufacturing
Assistance Consortium**

Frank Groenteman

**Texas State Technical
College**

V. Carson Pearce
Marcus Balch
Steve Pape

University of North Texas

Steve Joiner

University of Texas – Dallas

Rajiv Shah
Steve Yurkovich

**Workforce Solutions Greater
Dallas**

Laurie Larrea
Richard Perez

**Workforce Solutions Tarrant
County**

Judy McDonald
Jann Miles
Renee Parker

Region 11 CTE Directors

Mary Smith, Aledo ISD
Susan Patterson,
Arlington ISD
Suzanne Murr, Azle ISD
Linda Anderson, Birdville ISD
Allison Vinson, Birdville ISD
Kady Donaghey, Crowley ISD
Annette Duvall, Crowley ISD

Appendix C – Workforce Demand Tables

C.i – Aerospace Staffing Patterns

SOC	Description	Employed in Industry (2016)	Employed in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
17-2011	Aerospace Engineers	1,756	1,546	(210)	(12%)	5.9%	\$51.22	Bachelor's degree	None	None
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	1,609	1,447	(162)	(10%)	5.4%	\$17.69	High school diploma or equivalent	None	Moderate-term on-the-job training
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	1,467	1,366	(101)	(7%)	4.9%	\$21.68	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4041	Machinists	1,377	1,301	(76)	(6%)	4.6%	\$17.68	High school diploma or equivalent	None	Long-term on-the-job training
49-3011	Aircraft Mechanics and Service Technicians	1,276	1,155	(121)	(9%)	4.3%	\$29.22	Postsecondary nondegree award	None	None
17-2112	Industrial Engineers	1,044	1,003	(41)	(4%)	3.5%	\$44.06	Bachelor's degree	None	None
15-1133	Software Developers, Systems Software	947	851	(96)	(10%)	3.2%	\$49.12	Bachelor's degree	None	None
51-4011	Computer-Controlled Machine Tool Operators,	890	874	(16)	(2%)	3.0%	\$18.08	High school diploma or equivalent	None	Moderate-term on-the-job training

SOC	Description	Employed in Industry (2016)	Employed in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	Metal and Plastic									
17-2141	Mechanical Engineers	873	868	(5)	(1%)	2.9%	\$44.67	Bachelor's degree	None	None
43-5061	Production, Planning, and Expediting Clerks	750	677	(73)	(10%)	2.5%	\$21.95	High school diploma or equivalent	None	Moderate- term on-the- job training
13-1081	Logisticians	675	611	(64)	(9%)	2.3%	\$34.89	Bachelor's degree	None	None
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	669	605	(64)	(10%)	2.2%	\$29.80	Bachelor's degree	None	Long-term on-the-job training
51-1011	First-Line Supervisors of Production and Operating Workers	639	578	(61)	(10%)	2.1%	\$28.00	High school diploma or equivalent	Less than 5 years	None
15-1132	Software Developers, Applications	582	529	(53)	(9%)	1.9%	\$49.19	Bachelor's degree	None	None
51-2092	Team Assemblers	539	494	(45)	(8%)	1.8%	\$13.06	High school diploma or equivalent	None	Moderate- term on-the- job training
13-1199	Business Operations Specialists, All Other	502	456	(46)	(9%)	1.7%	\$36.90	Bachelor's degree	None	None
15-1121	Computer Systems Analysts	487	453	(34)	(7%)	1.6%	\$42.71	Bachelor's degree	None	None
17-2072	Electronics Engineers, Except Computer	350	315	(35)	(10%)	1.2%	\$48.54	Bachelor's degree	None	None

SOC	Description	Employed in Industry (2016)	Employed in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
17-2199	Engineers, All Other	339	308	(31)	(9%)	1.1%	\$48.14	Bachelor's degree	None	None
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	336	301	(35)	(10%)	1.1%	\$14.48	High school diploma or equivalent	None	Moderate- term on-the- job training
17-2071	Electrical Engineers	327	298	(29)	(9%)	1.1%	\$44.66	Bachelor's degree	None	None
43-5071	Shipping, Receiving, and Traffic Clerks	313	276	(37)	(12%)	1.0%	\$13.37	High school diploma or equivalent	None	Short-term on-the-job training
11-9041	Architectural and Engineering Managers	305	281	(24)	(8%)	1.0%	\$66.57	Bachelor's degree	5 years or more	None
49-2091	Avionics Technicians	286	261	(25)	(9%)	1.0%	\$26.93	Associate's degree	None	None
11-3051	Industrial Production Managers	267	242	(25)	(9%)	0.9%	\$47.15	Bachelor's degree	5 years or more	None
51-2022	Electrical and Electronic Equipment Assemblers	262	235	(27)	(10%)	0.9%	\$12.56	High school diploma or equivalent	None	Moderate- term on-the- job training
13-2011	Accountants and Auditors	251	227	(24)	(10%)	0.8%	\$34.95	Bachelor's degree	None	None
49-9041	Industrial Machinery Mechanics	249	249	0	0%	0.8%	\$23.47	High school diploma or equivalent	None	Long-term on-the-job training
11-1021	General and Operations Managers	239	216	(23)	(10%)	0.8%	\$55.84	Bachelor's degree	5 years or more	None
51-4121	Welders, Cutters,	231	206	(25)	(11%)	0.8%	\$17.26	High school diploma or	None	Moderate- term on-the-

SOC	Description	Employed in Industry (2016)	Employed in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry (2016)	Median Hourly Earnings	Typical Entry Level Education equivalent	Work Experience Required	Typical On- The-Job Training job training
	Solderers, and Brazers									
17-3026	Industrial Engineering Technicians	225	207	(18)	(8%)	0.8%	\$33.06	Associate's degree	None	None
17-2131	Materials Engineers	224	214	(10)	(4%)	0.7%	\$46.24	Bachelor's degree	None	None
49-9071	Maintenance and Repair Workers, General	222	202	(20)	(9%)	0.7%	\$17.06	High school diploma or equivalent	None	Long-term on-the-job training
17-3021	Aerospace Engineering and Operations Technicians	217	198	(19)	(9%)	0.7%	\$27.93	Associate's degree	None	None
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	211	173	(38)	(18%)	0.7%	\$13.89	High school diploma or equivalent	None	Moderate- term on-the- job training
13-1111	Management Analysts	207	189	(18)	(9%)	0.7%	\$41.37	Bachelor's degree	Less than 5 years	None
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	204	186	(18)	(9%)	0.7%	\$11.53	No formal educational credential	None	Short-term on-the-job training
13-2051	Financial Analysts	201	180	(21)	(10%)	0.7%	\$38.55	Bachelor's degree	None	None
51-9198	Helpers-- Production Workers	200	176	(24)	(12%)	0.7%	\$10.39	No formal educational credential	None	Short-term on-the-job training
15-2031	Operations	197	197	0	0%	0.7%	\$39.36	Bachelor's	None	None

SOC	Description	Employed in Industry (2016)	Employed in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry (2016)	Median Hourly Earnings	Typical Entry Level Education degree	Work Experience Required	Typical On- The-Job Training
	Research Analysts									
43-9061	Office Clerks, General	175	153	(22)	(13%)	0.6%	\$15.39	High school diploma or equivalent	None	Short-term on-the-job training
51-9122	Painters, Transportation Equipment	166	150	(16)	(10%)	0.6%	\$21.08	High school diploma or equivalent	None	Moderate- term on-the- job training
13-1071	Human Resources Specialists	163	143	(20)	(12%)	0.5%	\$29.60	Bachelor's degree	None	None
43-6011	Executive Secretaries and Executive Administrative Assistants	158	135	(23)	(15%)	0.5%	\$27.07	High school diploma or equivalent	Less than 5 years	None
43-5081	Stock Clerks and Order Fillers	151	136	(15)	(10%)	0.5%	\$11.57	No formal educational credential	None	Short-term on-the-job training
17-3027	Mechanical Engineering Technicians	149	137	(12)	(8%)	0.5%	\$23.85	Associate's degree	None	None
51-4111	Tool and Die Makers	143	127	(16)	(11%)	0.5%	\$25.30	High school diploma or equivalent	None	Long-term on-the-job training
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	142	115	(27)	(19%)	0.5%	\$18.43	High school diploma or equivalent	None	Moderate- term on-the- job training
51-4031	Cutting, Punching, and Press Machine Setters,	139	111	(28)	(20%)	0.5%	\$14.07	High school diploma or equivalent	None	Moderate- term on-the- job training

SOC	Description	Employed in Industry (2016)	Employed in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	Operators, and Tenders, Metal and Plastic									
15-1143	Computer Network Architects	139	130	(9)	(6%)	0.5%	\$50.55	Bachelor's degree	5 years or more	None
17-3013	Mechanical Drafters	138	119	(19)	(14%)	0.5%	\$28.80	Associate's degree	None	None
17-3029	Engineering Technicians, Except Drafters, All Other	134	119	(15)	(11%)	0.4%	\$26.49	Associate's degree	None	None
13-2099	Financial Specialists, All Other	131	116	(15)	(11%)	0.4%	\$32.30	Bachelor's degree	None	Moderate- term on-the- job training
51-2023	Electromechanic al Equipment Assemblers	130	113	(17)	(13%)	0.4%	\$13.55	High school diploma or equivalent	None	Moderate- term on-the- job training
51-2031	Engine and Other Machine Assemblers	127	118	(9)	(7%)	0.4%	\$18.61	High school diploma or equivalent	None	Moderate- term on-the- job training
17-3023	Electrical and Electronics Engineering Technicians	127	113	(14)	(11%)	0.4%	\$28.01	Associate's degree	None	None
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	126	113	(13)	(10%)	0.4%	\$16.04	High school diploma or equivalent	None	Short-term on-the-job training
51-4012	Computer Numerically Controlled Machine Tool	125	124	(1)	(1%)	0.4%	\$25.03	High school diploma or equivalent	None	Long-term on-the-job training

SOC	Description	Employed in Industry (2016)	Employed in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	Programmers, Metal and Plastic									
43-4051	Customer Service Representatives	121	109	(12)	(10%)	0.4%	\$16.07	High school diploma or equivalent	None	Short-term on-the-job training
11-3021	Computer and Information Systems Managers	120	110	(10)	(8%)	0.4%	\$68.60	Bachelor's degree	5 years or more	None
51-2041	Structural Metal Fabricators and Fitters	120	108	(12)	(10%)	0.4%	\$15.57	High school diploma or equivalent	None	Moderate- term on-the- job training
13-1151	Training and Development Specialists	120	108	(12)	(10%)	0.4%	\$30.23	Bachelor's degree	Less than 5 years	None
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	113	89	(24)	(21%)	0.4%	\$20.63	High school diploma or equivalent	None	Moderate- term on-the- job training
11-9199	Managers, All Other	111	103	(8)	(7%)	0.4%	\$58.02	Bachelor's degree	Less than 5 years	None
43-1011	First-Line Supervisors of Office and Administrative Support Workers	104	94	(10)	(10%)	0.3%	\$27.88	High school diploma or equivalent	Less than 5 years	None

C.ii – Aerospace Inverse Staffing

NAICS	Industry	Occupation Group Jobs in Industry (2016)	Occupation Group Jobs in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Occupation Group in Industry (2016)	% of Total Jobs in Industry (2016)
5415	Computer Systems Design and Related Services	23,513	30,611	7,098	30%	10.1%	35.3%
3364	Aerospace Product and Parts Manufacturing	19,088	17,496	(1,592)	(8%)	8.2%	63.8%
5613	Employment Services	11,204	12,731	1,527	14%	4.8%	10.2%
3344	Semiconductor and Other Electronic Component Manufacturing	7,113	6,175	(938)	(13%)	3.1%	35.7%
9011	Federal Government, Civilian	6,941	6,743	(198)	(3%)	3.0%	15.5%
5511	Management of Companies and Enterprises	6,939	8,748	1,809	26%	3.0%	14.2%
5413	Architectural, Engineering, and Related Services	6,360	6,906	546	9%	2.7%	19.8%
5416	Management, Scientific, and Technical Consulting Services	6,049	7,377	1,328	22%	2.6%	13.0%
3361	Motor Vehicle Manufacturing	4,384	5,419	1,035	24%	1.9%	65.8%
3363	Motor Vehicle Parts Manufacturing	3,968	4,298	330	8%	1.7%	45.2%
4881	Support Activities for Air Transportation	3,921	4,820	899	23%	1.7%	35.3%
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers	3,623	3,828	205	6%	1.6%	14.3%
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	3,588	3,431	(157)	(4%)	1.5%	44.5%
3323	Architectural and Structural Metals Manufacturing	3,484	3,688	204	6%	1.5%	22.7%
5182	Data Processing, Hosting, and Related Services	3,304	3,461	157	5%	1.4%	22.9%
5171	Wired Telecommunications Carriers	3,288	3,151	(137)	(4%)	1.4%	13.0%
3261	Plastics Product Manufacturing	3,253	3,182	(71)	(2%)	1.4%	27.4%
4811	Scheduled Air Transportation	3,244	3,177	(67)	(2%)	1.4%	10.0%
5112	Software Publishers	3,240	3,696	456	14%	1.4%	35.3%
3342	Communications Equipment Manufacturing	3,158	2,774	(384)	(12%)	1.4%	39.7%
4931	Warehousing and Storage	3,090	3,563	473	15%	1.3%	10.3%
4236	Household Appliances and Electrical and Electronic Goods Merchant Wholesalers	2,561	2,653	92	4%	1.1%	14.6%
5241	Insurance Carriers	2,349	2,754	405	17%	1.0%	6.9%
9039	Local Government, Excluding Education and Hospitals	2,188	2,424	236	11%	0.9%	2.3%
5222	Nondepository Credit Intermediation	2,184	2,435	251	11%	0.9%	4.8%

NAICS	Industry	Occupation Group Jobs in Industry (2016)	Occupation Group Jobs in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Occupation Group in Industry (2016)	% of Total Jobs in Industry (2016)
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	2,123	2,176	53	2%	0.9%	52.7%
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	2,121	2,331	210	10%	0.9%	10.7%
9026	Education and Hospitals (State Government)	1,848	1,979	131	7%	0.8%	3.9%
3391	Medical Equipment and Supplies Manufacturing	1,763	1,907	144	8%	0.8%	32.4%
5221	Depository Credit Intermediation	1,743	1,987	244	14%	0.7%	4.0%
5611	Office Administrative Services	1,718	2,059	341	20%	0.7%	7.0%
4251	Wholesale Electronic Markets and Agents and Brokers	1,676	1,918	242	14%	0.7%	7.7%
2111	Oil and Gas Extraction	1,652	1,672	20	1%	0.7%	14.0%
3341	Computer and Peripheral Equipment Manufacturing	1,601	1,952	351	22%	0.7%	38.4%
3331	Agriculture, Construction, and Mining Machinery Manufacturing	1,583	1,553	(30)	(2%)	0.7%	36.2%
3399	Other Miscellaneous Manufacturing	1,563	1,582	19	1%	0.7%	27.1%
9036	Education and Hospitals (Local Government)	1,527	1,751	224	15%	0.7%	0.7%
3339	Other General Purpose Machinery Manufacturing	1,448	1,446	(2)	(0%)	0.6%	39.7%
3231	Printing and Related Support Activities	1,386	1,248	(138)	(10%)	0.6%	11.7%
6221	General Medical and Surgical Hospitals	1,185	1,342	157	13%	0.5%	1.5%
5417	Scientific Research and Development Services	1,180	1,326	146	12%	0.5%	22.7%
4244	Grocery and Related Product Merchant Wholesalers	1,156	1,268	112	10%	0.5%	5.9%
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	1,111	969	(142)	(13%)	0.5%	37.0%
2211	Electric Power Generation, Transmission and Distribution	1,085	1,232	147	14%	0.5%	15.0%
3219	Other Wood Product Manufacturing	1,083	1,149	66	6%	0.5%	21.0%
3329	Other Fabricated Metal Product Manufacturing	1,081	1,154	73	7%	0.5%	38.1%
5223	Activities Related to Credit Intermediation	1,037	1,278	241	23%	0.4%	6.7%
5172	Wireless Telecommunications Carriers (except Satellite)	1,035	695	(340)	(33%)	0.4%	16.9%

C.iii - Aerospace Top Posted Occupations

Occupation (SOC)	Total Postings (Mar 2016 - Mar 2017)	Unique Postings (Mar 2016 - Mar 2017)
Industrial Engineers	8,131	1,524
Aerospace Engineers	6,463	1,070
Software Developers, Systems Software	6,311	869
Computer Occupations, All Other	2,626	510
Software Developers, Applications	3,615	498
Purchasing Agents, Except Wholesale, Retail, and Farm Products	3,195	470
Information Security Analysts	2,673	419
Business Operations Specialists, All Other	2,021	335
Electrical Engineers	2,020	307
Operations Research Analysts	1,618	295
Management Analysts	1,637	291
Logisticians	1,314	286
Mechanical Engineers	1,492	285
First-Line Supervisors of Production and Operating Workers	1,627	264
Network and Computer Systems Administrators	1,845	261
Managers, All Other	1,168	239
Computer Systems Analysts	1,392	220
Accountants and Auditors	1,013	219
Purchasing Managers	1,066	203
Computer User Support Specialists	979	189
Financial Analysts	1,034	185
Architectural and Engineering Managers	747	165
Production, Planning, and Expediting Clerks	704	157
Electronics Engineers, Except Computer	756	124
Marketing Managers	563	123
Electrical and Electronics Engineering Technicians	729	122
Executive Secretaries and Executive Administrative Assistants	558	113
Unclassified Occupation	356	108
Construction Managers	490	97
Cost Estimators	593	95
Postsecondary Teachers	567	78
Machinists	439	77
Human Resources Managers	461	76
Computer Hardware Engineers	375	74
Industrial Production Managers	364	72
Sales Engineers	429	71
Aircraft Mechanics and Service Technicians	345	71
Inspectors, Testers, Sorters, Samplers, and Weighers	389	71
Training and Development Specialists	359	68
Market Research Analysts and Marketing Specialists	271	66
General and Operations Managers	279	64
Computer and Information Systems Managers	275	62
First-Line Supervisors of Mechanics, Installers, and Repairers	312	59
Human Resources Specialists	324	58
Industrial Engineering Technicians	237	56
Database Administrators	254	53

Occupation (SOC)	Total Postings (Mar 2016 - Mar 2017)	Unique Postings (Mar 2016 - Mar 2017)
Bookkeeping, Accounting, and Auditing Clerks	185	50
Commercial Pilots	279	50
Engineers, All Other	241	49
Transportation, Storage, and Distribution Managers	187	44

C.iv – Aerospace Hard Skills

Skill	Relevance Score	Postings with Skill
Engineering	7.98	7,958
Earned Value Management	5.36	548
Computer Aided Three-Dimensional Interactive Application (CATIA)	3.69	374
Aerospace Engineering	3.30	318
Avionics	2.34	389
Systems Engineering	2.04	1,192
Innovation	1.85	4,494
Microsoft Office	1.47	2,301
Material Requirements Planning	1.42	446
Systems Integration	1.36	877
Integration	1.33	1,994
Defense (Legal)	1.32	1,153
Manufacturing	1.29	2,639
Testing	1.23	3,609
Verification	1.20	1,031
Office Suite	1.15	1,394
Microsoft PowerPoint	1.14	1,718
Manufacturing Engineering	1.06	332
Procurement	0.94	925
Configuration Management	0.83	462
Information Security	0.82	3,296
Analysis	0.76	2,769
Proposal (Business)	0.74	609
Security Clearance	0.67	381
Simulations	0.66	307
Mechanical Engineering	0.66	513
Microsoft Excel	0.57	1,932
Systems Design	0.56	539
Machining	0.56	380
Materials	0.55	1,291
Electrical Engineering	0.54	583
Interface	0.54	687
Tooling	0.48	344
Subcontracting	0.45	414
Program Management	0.45	645
Fabrication	0.43	346
Operations	0.42	3,341

Skill	Relevance Score	Postings with Skill
Rapid Amplification Of CDNA Ends	0.37	473
Management	0.37	5,484
C++ (Programming Language)	0.36	490
Aviation	0.36	338
Software Design	0.35	295
Lean Manufacturing	0.34	478
Software Development	0.29	738
Corrective And Preventive Actions	0.29	471
Presentations	0.26	1,634
Engineering Design Process	0.24	263
Metrics	0.23	662
Software Engineering	0.22	402
Maintenance	0.22	1,874

C.v - Air Transport Staffing Patterns

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
43-4181	Reservation and Transportation Ticket Agents and Travel Clerks	7,404	7,404	7,408	4	0%	16.2%	\$18.49	High school diploma or equivalent	None	Short-term on-the-job training
53-2031	Flight Attendants	6,072	6,072	6,141	69	1%	13.3%	\$27.81	High school diploma or equivalent	Less than 5 years	Moderate-term on-the-job training
49-3011	Aircraft Mechanics and Service Technicians	5,699	5,699	6,228	529	9%	12.5%	\$29.22	Postsecondary nondegree award	None	None
53-2011	Airline Pilots, Copilots, and Flight Engineers	4,592	4,592	4,643	51	1%	10.0%	\$72.98	Bachelor's degree	Less than 5 years	Moderate-term on-the-job training
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	3,386	3,386	3,539	153	5%	7.4%	\$11.53	No formal educational credential	None	Short-term on-the-job training
43-5011	Cargo and Freight Agents	2,056	2,056	2,116	60	3%	4.5%	\$21.52	High school diploma or equivalent	None	Short-term on-the-job training
43-4051	Customer Service Representatives	1,090	1,090	1,149	59	5%	2.4%	\$16.07	High school diploma or equivalent	None	Short-term on-the-job training
43-1011	First-Line Supervisors of Office and Administrative Support Workers	1,024	1,024	1,046	22	2%	2.2%	\$27.88	High school diploma or equivalent	Less than 5 years	None
53-2012	Commercial Pilots	976	976	1,060	84	9%	2.1%	\$42.73	High school diploma or equivalent	None	Moderate-term on-the-job training
49-	First-Line Supervisors	600	600	658	58	10%	1.3%	\$31.30	High school	Less than 5	None

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
1011	of Mechanics, Installers, and Repairers								diploma or equivalent	years	
53- 6099	Transportation Workers, All Other	521	521	629	108	21%	1.1%	\$19.80	High school diploma or equivalent	None	Short-term on-the-job training
49- 2091	Avionics Technicians	472	472	551	79	17%	1.0%	\$26.93	Associate's degree	None	None
11- 1021	General and Operations Managers	453	453	514	61	13%	1.0%	\$55.84	Bachelor's degree	5 years or more	None
41- 3099	Sales Representatives, Services, All Other	417	417	437	20	5%	0.9%	\$25.36	High school diploma or equivalent	None	Moderate- term on-the- job training
39- 6011	Baggage Porters and Bellhops	401	401	518	117	29%	0.9%	\$9.27	High school diploma or equivalent	None	Short-term on-the-job training
43- 5081	Stock Clerks and Order Fillers	398	398	425	27	7%	0.9%	\$11.57	No formal educational credential	None	Short-term on-the-job training
43- 9061	Office Clerks, General	386	386	416	30	8%	0.8%	\$15.39	High school diploma or equivalent	None	Short-term on-the-job training
53- 7061	Cleaners of Vehicles and Equipment	369	369	434	65	18%	0.8%	\$9.90	No formal educational credential	None	Short-term on-the-job training
53- 6051	Transportation Inspectors	364	364	381	17	5%	0.8%	\$35.19	High school diploma or equivalent	None	Moderate- term on-the- job training
53- 6061	Transportation Attendants, Except Flight Attendants	346	346	389	43	12%	0.8%	\$10.43	High school diploma or equivalent	None	Short-term on-the-job training
43- 5061	Production, Planning, and Expediting Clerks	322	322	348	26	8%	0.7%	\$21.95	High school diploma or	None	Moderate- term on-the-

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
									equivalent		job training
49-9071	Maintenance and Repair Workers, General	297	297	326	29	10%	0.6%	\$17.06	High school diploma or equivalent	None	Long-term on-the-job training
11-3071	Transportation, Storage, and Distribution Managers	295	295	308	13	4%	0.6%	\$45.87	High school diploma or equivalent	5 years or more	None
43-4199	Information and Record Clerks, All Other	245	245	241	(4)	(2%)	0.5%	\$17.41	High school diploma or equivalent	None	Short-term on-the-job training
53-1011	Aircraft Cargo Handling Supervisors	240	240	247	7	3%	0.5%	\$23.29	High school diploma or equivalent	Less than 5 years	None
53-2022	Airfield Operations Specialists	227	227	255	28	12%	0.5%	\$34.46	High school diploma or equivalent	None	Long-term on-the-job training
13-1199	Business Operations Specialists, All Other	204	204	212	8	4%	0.4%	\$36.90	Bachelor's degree	None	None
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	201	201	251	50	25%	0.4%	\$9.41	No formal educational credential	None	Short-term on-the-job training
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	194	194	233	39	20%	0.4%	\$17.69	High school diploma or equivalent	None	Moderate-term on-the-job training
43-3031	Bookkeeping, Accounting, and Auditing Clerks	191	191	200	9	5%	0.4%	\$18.89	Some college, no degree	None	Moderate-term on-the-job training
51-9122	Painters, Transportation Equipment	189	189	230	41	22%	0.4%	\$21.08	High school diploma or equivalent	None	Moderate-term on-the-job training
13-1151	Training and Development	188	188	195	7	4%	0.4%	\$30.23	Bachelor's degree	Less than 5 years	None

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	Specialists										
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	183	183	203	20	11%	0.4%	\$16.04	High school diploma or equivalent	None	Short-term on-the-job training
49-9043	Maintenance Workers, Machinery	183	183	225	42	23%	0.4%	\$20.05	High school diploma or equivalent	None	Moderate-term on-the-job training
43-5071	Shipping, Receiving, and Traffic Clerks	176	176	196	20	11%	0.4%	\$13.37	High school diploma or equivalent	None	Short-term on-the-job training
13-2011	Accountants and Auditors	170	170	189	19	11%	0.4%	\$34.95	Bachelor's degree	None	None
43-5032	Dispatchers, Except Police, Fire, and Ambulance	150	150	160	10	7%	0.3%	\$17.61	High school diploma or equivalent	None	Moderate-term on-the-job training
17-2011	Aerospace Engineers	144	144	157	13	9%	0.3%	\$51.22	Bachelor's degree	None	None
53-1031	First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	140	140	157	17	12%	0.3%	\$26.17	High school diploma or equivalent	Less than 5 years	None
49-9098	Helpers--Installation, Maintenance, and Repair Workers	139	139	161	22	16%	0.3%	\$13.79	High school diploma or equivalent	None	Short-term on-the-job training
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	138	138	156	18	13%	0.3%	\$29.80	Bachelor's degree	None	Long-term on-the-job training
53-1021	First-Line Supervisors of Helpers, Laborers,	127	127	147	20	16%	0.3%	\$22.84	High school diploma or	Less than 5 years	None

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	and Material Movers, Hand								equivalent		
13-1071	Human Resources Specialists	116	116	122	6	5%	0.3%	\$29.60	Bachelor's degree	None	None
11-3011	Administrative Services Managers	116	116	125	9	8%	0.3%	\$47.93	Bachelor's degree	Less than 5 years	None
53-7051	Industrial Truck and Tractor Operators	116	116	121	5	4%	0.3%	\$13.51	No formal educational credential	None	Short-term on-the-job training
15-1121	Computer Systems Analysts	101	101	107	6	6%	0.2%	\$42.71	Bachelor's degree	None	None
53-2021	Air Traffic Controllers	99	99	116	17	17%	0.2%	\$60.13	Associate's degree	None	Long-term on-the-job training
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	98	98	102	4	4%	0.2%	\$21.82	High school diploma or equivalent	None	Long-term on-the-job training
15-1142	Network and Computer Systems Administrators	95	95	101	6	6%	0.2%	\$40.12	Bachelor's degree	None	None
33-9032	Security Guards	89	89	103	14	16%	0.2%	\$11.46	High school diploma or equivalent	None	Short-term on-the-job training
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	86	86	110	24	28%	0.2%	\$21.68	High school diploma or equivalent	None	Moderate-term on-the-job training
43-6011	Executive Secretaries and Executive Administrative Assistants	85	85	87	2	2%	0.2%	\$27.07	High school diploma or equivalent	Less than 5 years	None
13-1081	Logisticians	82	82	88	6	7%	0.2%	\$34.89	Bachelor's degree	None	None
49-	Installation,	73	73	88	15	21%	0.2%	\$17.16	High school	None	Moderate-

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
9099	Maintenance, and Repair Workers, All Other								diploma or equivalent		term on-the- job training
13- 1111	Management Analysts	71	71	73	2	3%	0.2%	\$41.37	Bachelor's degree	Less than 5 years	None
51- 4041	Machinists	68	68	73	5	7%	0.1%	\$17.68	High school diploma or equivalent	None	Long-term on-the-job training
53- 3032	Heavy and Tractor- Trailer Truck Drivers	65	65	76	11	17%	0.1%	\$18.41	Postsecondar y nondegree award	None	Short-term on-the-job training
11- 9199	Managers, All Other	65	65	71	6	9%	0.1%	\$58.02	Bachelor's degree	Less than 5 years	None
13- 2051	Financial Analysts	63	63	69	6	10%	0.1%	\$38.55	Bachelor's degree	None	None
13- 1161	Market Research Analysts and Marketing Specialists	61	61	64	3	5%	0.1%	\$33.71	Bachelor's degree	None	None
11- 2022	Sales Managers	60	60	64	4	7%	0.1%	\$63.06	Bachelor's degree	Less than 5 years	None
15- 1151	Computer User Support Specialists	59	59	65	6	10%	0.1%	\$23.48	Some college, no degree	None	None
39- 1021	First-Line Supervisors of Personal Service Workers	59	59	63	4	7%	0.1%	\$17.66	High school diploma or equivalent	Less than 5 years	None
13- 1041	Compliance Officers	58	58	62	4	7%	0.1%	\$34.06	Bachelor's degree	None	Moderate- term on-the- job training
11- 3031	Financial Managers	57	57	60	3	5%	0.1%	\$63.08	Bachelor's degree	5 years or more	None
43- 9199	Office and Administrative Support Workers, All	56	56	57	1	2%	0.1%	\$18.58	High school diploma or equivalent	None	Short-term on-the-job training

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	Other										
15-1131	Computer Programmers	53	53	53	0	0%	0.1%	\$39.49	Bachelor's degree	None	None
51-1011	First-Line Supervisors of Production and Operating Workers	52	52	62	10	19%	0.1%	\$28.00	High school diploma or equivalent	Less than 5 years	None
11-3021	Computer and Information Systems Managers	52	52	52	0	0%	0.1%	\$68.60	Bachelor's degree	5 years or more	None
43-4071	File Clerks	49	49	46	(3)	(6%)	0.1%	\$15.19	High school diploma or equivalent	None	Short-term on-the-job training
41-1012	First-Line Supervisors of Non-Retail Sales Workers	49	49	51	2	4%	0.1%	\$34.26	High school diploma or equivalent	Less than 5 years	None
15-1133	Software Developers, Systems Software	48	48	53	5	10%	0.1%	\$49.12	Bachelor's degree	None	None
17-2199	Engineers, All Other	48	48	50	2	4%	0.1%	\$48.14	Bachelor's degree	None	None
51-4121	Welders, Cutters, Solderers, and Brazers	47	47	54	7	15%	0.1%	\$17.26	High school diploma or equivalent	None	Moderate-term on-the-job training
53-3033	Light Truck or Delivery Services Drivers	44	44	51	7	16%	0.1%	\$14.75	High school diploma or equivalent	None	Short-term on-the-job training
43-3021	Billing and Posting Clerks	42	42	45	3	7%	0.1%	\$17.25	High school diploma or equivalent	None	Moderate-term on-the-job training
49-3023	Automotive Service Technicians and Mechanics	40	40	46	6	15%	0.1%	\$19.40	Postsecondary nondegree award	None	Short-term on-the-job training
17-3021	Aerospace Engineering and	40	40	40	0	0%	0.1%	\$27.93	Associate's degree	None	None

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	Operations Technicians										
43-4171	Receptionists and Information Clerks	39	39	45	6	15%	0.1%	\$12.64	High school diploma or equivalent	None	Short-term on-the-job training
43-3051	Payroll and Timekeeping Clerks	37	37	35	(2)	(5%)	0.1%	\$20.06	High school diploma or equivalent	None	Moderate-term on-the-job training
15-1132	Software Developers, Applications	37	37	39	2	5%	0.1%	\$49.19	Bachelor's degree	None	None
17-3023	Electrical and Electronics Engineering Technicians	34	34	43	9	26%	0.1%	\$28.01	Associate's degree	None	None
17-2072	Electronics Engineers, Except Computer	33	33	42	9	27%	0.1%	\$48.54	Bachelor's degree	None	None
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	33	33	38	5	15%	0.1%	\$28.72	High school diploma or equivalent	None	Moderate-term on-the-job training
53-3041	Taxi Drivers and Chauffeurs	32	32	35	3	9%	0.1%	\$11.63	No formal educational credential	None	Short-term on-the-job training
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	31	31	30	(1)	(3%)	0.1%	\$20.71	High school diploma or equivalent	None	Moderate-term on-the-job training
27-3042	Technical Writers	30	30	33	3	10%	0.1%	\$33.34	Bachelor's degree	Less than 5 years	Short-term on-the-job training
29-9011	Occupational Health and Safety Specialists	30	30	31	1	3%	0.1%	\$33.73	Bachelor's degree	None	None

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
43-4161	Human Resources Assistants, Except Payroll and Timekeeping	29	29	29	0	0%	0.1%	\$19.14	Associate's degree	None	None
15-1152	Computer Network Support Specialists	29	29	27	(2)	(7%)	0.1%	\$36.00	Associate's degree	None	None
43-4151	Order Clerks	29	29	32	3	10%	0.1%	\$16.79	High school diploma or equivalent	None	Short-term on-the-job training
43-3061	Procurement Clerks	29	29	31	2	7%	0.1%	\$19.72	High school diploma or equivalent	None	Moderate-term on-the-job training
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	27	27	30	3	11%	0.1%	\$25.74	Postsecondary nondegree award	None	Long-term on-the-job training
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	27	27	33	6	22%	0.1%	\$22.25	High school diploma or equivalent	None	Long-term on-the-job training
43-9021	Data Entry Keyers	27	27	30	3	11%	0.1%	\$14.04	High school diploma or equivalent	None	Moderate-term on-the-job training
17-2112	Industrial Engineers	27	27	31	4	15%	0.1%	\$44.06	Bachelor's degree	None	None
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	26	26	28	2	8%	0.1%	\$20.77	Postsecondary nondegree award	None	Long-term on-the-job training
33-9093	Transportation Security Screeners	25	25	31	6	24%	0.1%	\$18.57	High school diploma or equivalent	None	Short-term on-the-job training
11-	Marketing Managers	25	25	26	1	4%	0.1%	\$65.87	Bachelor's	5 years or	None

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
2021									degree	more	
47- 2211	Sheet Metal Workers	25	25	31	6	24%	0.1%	\$16.14	High school diploma or equivalent	None	Apprentices hip
43- 5021	Couriers and Messengers	24	24	26	2	8%	0.1%	\$13.27	High school diploma or equivalent	None	Short-term on-the-job training
27- 3031	Public Relations Specialists	24	24	26	2	8%	0.1%	\$28.98	Bachelor's degree	None	None
53- 6031	Automotive and Watercraft Service Attendants	23	23	30	7	30%	0.1%	\$11.55	No formal educational credential	None	Short-term on-the-job training
41- 3041	Travel Agents	23	23	23	0	0%	0.1%	\$20.02	High school diploma or equivalent	None	Moderate- term on-the- job training
53- 7199	Material Moving Workers, All Other	23	23	26	3	13%	0.1%	\$14.31	No formal educational credential	None	Short-term on-the-job training
15- 1143	Computer Network Architects	23	23	24	1	4%	0.0%	\$50.55	Bachelor's degree	5 years or more	None
11- 3061	Purchasing Managers	22	22	25	3	14%	0.0%	\$56.62	Bachelor's degree	5 years or more	None
17- 3029	Engineering Technicians, Except Drafters, All Other	22	22	24	2	9%	0.0%	\$26.49	Associate's degree	None	None
39- 9099	Personal Care and Service Workers, All Other	21	21	34	13	62%	0.0%	\$10.21	High school diploma or equivalent	None	Short-term on-the-job training
39- 9021	Personal Care Aides	21	21	25	4	19%	0.0%	\$8.81	No formal educational credential	None	Short-term on-the-job training
13- 2031	Budget Analysts	20	20	20	0	0%	0.0%	\$38.83	Bachelor's degree	None	None

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
11-9041	Architectural and Engineering Managers	19	19	26	7	37%	0.0%	\$66.57	Bachelor's degree	5 years or more	None
13-2099	Financial Specialists, All Other	19	19	19	0	0%	0.0%	\$32.30	Bachelor's degree	None	Moderate-term on-the-job training
29-2041	Emergency Medical Technicians and Paramedics	18	18	19	1	6%	0.0%	\$17.92	Postsecondary nondegree award	None	None
39-6012	Concierges	18	18	18	0	0%	0.0%	\$11.11	High school diploma or equivalent	None	Moderate-term on-the-job training
15-1199	Computer Occupations, All Other	18	18	26	8	44%	0.0%	\$47.53	Bachelor's degree	None	None
17-2141	Mechanical Engineers	18	18	20	2	11%	0.0%	\$44.67	Bachelor's degree	None	None
51-7011	Cabinetmakers and Bench Carpenters	18	18	19	1	6%	0.0%	\$12.67	High school diploma or equivalent	None	Moderate-term on-the-job training
15-2031	Operations Research Analysts	18	18	22	4	22%	0.0%	\$39.36	Bachelor's degree	None	None
41-2021	Counter and Rental Clerks	17	17	18	1	6%	0.0%	\$11.97	No formal educational credential	None	Short-term on-the-job training
41-2031	Retail Salespersons	17	17	24	7	41%	0.0%	\$10.61	No formal educational credential	None	Short-term on-the-job training
47-2111	Electricians	17	17	20	3	18%	0.0%	\$20.18	High school diploma or equivalent	None	Apprenticeship
11-3121	Human Resources Managers	17	17	18	1	6%	0.0%	\$57.40	Bachelor's degree	5 years or more	None
49-2093	Electrical and Electronics Installers	17	17	21	4	24%	0.0%	\$26.75	Postsecondary nondegree	None	Long-term on-the-job

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	and Repairers, Transportation Equipment								award		training
43- 3071	Tellers	17	17	16	(1)	(6%)	0.0%	\$12.21	High school diploma or equivalent	None	Short-term on-the-job training
47- 4061	Rail-Track Laying and Maintenance Equipment Operators	16	16	17	1	6%	0.0%	\$17.39	High school diploma or equivalent	None	Moderate- term on-the- job training
11- 3131	Training and Development Managers	16	16	17	1	6%	0.0%	\$57.34	Bachelor's degree	5 years or more	None
13- 1141	Compensation, Benefits, and Job Analysis Specialists	15	15	16	1	7%	0.0%	\$31.40	Bachelor's degree	Less than 5 years	None
37- 3011	Landscaping and Groundskeeping Workers	15	15	19	4	27%	0.0%	\$11.64	No formal educational credential	None	Short-term on-the-job training
51- 6093	Upholsterers	15	15	18	3	20%	0.0%	\$13.70	High school diploma or equivalent	None	Moderate- term on-the- job training
11- 1011	Chief Executives	14	14	17	3	21%	0.0%	\$100.04	Bachelor's degree	5 years or more	None
51- 9198	Helpers--Production Workers	14	14	15	1	7%	0.0%	\$10.39	No formal educational credential	None	Short-term on-the-job training
41- 4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	14	14	17	3	21%	0.0%	\$35.19	Bachelor's degree	None	Moderate- term on-the- job training
23- 1011	Lawyers	14	14	14	0	0%	0.0%	\$61.32	Doctoral or professional	None	None

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
13- 2041	Credit Analysts	14	14	15	1	7%	0.0%	\$37.49	degree Bachelor's degree	None	None
15- 1141	Database Administrators	14	14	14	0	0%	0.0%	\$40.59	Bachelor's degree	Less than 5 years	None
33- 2011	Firefighters	13	13	16	3	23%	0.0%	\$26.02	Postsecondar y nondegree award	None	Long-term on-the-job training
43- 5111	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	13	13	17	4	31%	0.0%	\$13.68	High school diploma or equivalent	None	Short-term on-the-job training
11- 9021	Construction Managers	13	13	14	1	8%	0.0%	\$40.28	Bachelor's degree	None	Moderate- term on-the- job training
51- 2041	Structural Metal Fabricators and Fitters	13	13	15	2	15%	0.0%	\$15.57	High school diploma or equivalent	None	Moderate- term on-the- job training
49- 9096	Riggers	13	13	15	2	15%	0.0%	\$19.47	High school diploma or equivalent	None	Short-term on-the-job training
37- 1011	First-Line Supervisors of Housekeeping and Janitorial Workers	12	12	15	3	25%	0.0%	\$15.35	High school diploma or equivalent	Less than 5 years	None
15- 1122	Information Security Analysts	12	12	12	0	0%	0.0%	\$43.54	Bachelor's degree	Less than 5 years	None
13- 1051	Cost Estimators	12	12	13	1	8%	0.0%	\$29.76	Bachelor's degree	None	None
51- 2092	Team Assemblers	12	12	15	3	25%	0.0%	\$13.06	High school diploma or equivalent	None	Moderate- term on-the- job training
47- 4099	Construction and Related Workers, All	12	12	14	2	17%	0.0%	\$15.70	High school diploma or	None	Moderate- term on-the-

SOC	Description	Employed in Industry Group (2016)	Employed in Industry Group (2016)	Employed in Industry Group (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	Other								equivalent		job training
27-3091	Interpreters and Translators	12	12	12	0	0%	0.0%	\$18.38	Bachelor's degree	None	Short-term on-the-job training
43-4041	Credit Authorizers, Checkers, and Clerks	12	12	12	0	0%	0.0%	\$16.50	High school diploma or equivalent	None	Moderate-term on-the-job training
43-9011	Computer Operators	12	12	12	0	0%	0.0%	\$21.83	High school diploma or equivalent	None	Moderate-term on-the-job training
53-3099	Motor Vehicle Operators, All Other	11	11	14	3	27%	0.0%	\$17.71	No formal educational credential	None	Short-term on-the-job training
41-2011	Cashiers	11	11	12	1	9%	0.0%	\$9.07	No formal educational credential	None	Short-term on-the-job training

C.vi - Air Transport Inverse Patterns

NAICS	Industry	Occupation Group Jobs in Industry (2016)	Occupation Group Jobs in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Occupation Group in Industry (2016)	% of Total Jobs in Industry (2016)
481111	Scheduled Passenger Air Transportation	29,021	28,674	(347)	(1%)	5.3%	90.2%
561320	Temporary Help Services	24,857	27,365	2,508	10%	4.6%	28.9%
445110	Supermarkets and Other Grocery (except Convenience) Stores	13,469	14,632	1,163	9%	2.5%	29.9%
452910	Warehouse Clubs and Supercenters	13,068	16,228	3,160	24%	2.4%	27.9%

NAICS	Industry	Occupation Group Jobs in Industry (2016)	Occupation Group Jobs in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Occupation Group in Industry (2016)	% of Total Jobs in Industry (2016)
493110	General Warehousing and Storage	11,405	13,557	2,152	19%	2.1%	41.6%
903999	Local Government, Excluding Education and Hospitals	10,374	11,372	998	10%	1.9%	10.7%
492110	Couriers and Express Delivery Services	9,626	10,613	987	10%	1.8%	51.0%
551114	Corporate, Subsidiary, and Regional Managing Offices	9,082	11,376	2,294	25%	1.7%	19.3%
561110	Office Administrative Services	8,610	10,059	1,449	17%	1.6%	35.2%
561422	Telemarketing Bureaus and Other Contact Centers	8,340	9,636	1,296	16%	1.5%	53.7%
522110	Commercial Banking	7,906	8,757	851	11%	1.4%	21.4%
517110	Wired Telecommunications Carriers	7,007	6,678	(329)	(5%)	1.3%	27.8%
524210	Insurance Agencies and Brokerages	6,679	7,588	909	14%	1.2%	23.9%
903611	Elementary and Secondary Schools (Local Government)	6,308	6,894	586	9%	1.2%	3.4%
441110	New Car Dealers	6,103	6,915	812	13%	1.1%	22.0%
813110	Religious Organizations	5,576	6,182	606	11%	1.0%	10.9%
621111	Offices of Physicians (except Mental Health Specialists)	5,345	6,547	1,202	22%	1.0%	8.0%
541611	Administrative Management and General Management Consulting Services	5,310	6,817	1,507	28%	1.0%	23.6%
561311	Employment Placement Agencies	5,128	6,574	1,446	28%	0.9%	26.3%
531110	Lessors of Residential Buildings and Dwellings	5,116	5,195	79	2%	0.9%	40.5%
488190	Other Support Activities for Air Transportation	5,084	6,410	1,326	26%	0.9%	67.3%
425120	Wholesale Trade Agents and Brokers	4,658	5,439	781	17%	0.9%	22.5%
902612	Colleges, Universities, and Professional Schools (State Government)	4,483	4,810	327	7%	0.8%	12.5%
452112	Discount Department Stores	4,462	4,700	238	5%	0.8%	26.1%
531311	Residential Property Managers	4,121	5,251	1,130	27%	0.8%	37.8%
622110	General Medical and Surgical Hospitals	4,078	4,541	463	11%	0.7%	5.3%
452111	Department Stores (except Discount Department Stores)	4,049	3,592	(457)	(11%)	0.7%	26.4%
903612	Colleges, Universities, and Professional Schools (Local Government)	4,028	5,528	1,500	37%	0.7%	14.3%
541512	Computer Systems Design Services	4,020	4,985	965	24%	0.7%	12.3%
522220	Sales Financing	3,961	5,120	1,159	29%	0.7%	26.1%
721110	Hotels (except Casino Hotels) and Motels	3,944	4,202	258	7%	0.7%	12.6%
238220	Plumbing, Heating, and Air-Conditioning Contractors	3,888	4,515	627	16%	0.7%	14.4%
811192	Car Washes	3,845	4,570	725	19%	0.7%	59.6%

NAICS	Industry	Occupation Group Jobs in Industry (2016)	Occupation Group Jobs in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Occupation Group in Industry (2016)	% of Total Jobs in Industry (2016)
488510	Freight Transportation Arrangement	3,760	4,416	656	17%	0.7%	66.3%
541511	Custom Computer Programming Services	3,705	4,602	897	24%	0.7%	12.3%
444110	Home Centers	3,598	3,874	276	8%	0.7%	22.8%
522292	Real Estate Credit	3,586	3,063	(523)	(15%)	0.7%	20.6%
531120	Lessors of Nonresidential Buildings (except Miniwarehouses)	3,443	3,883	440	13%	0.6%	40.4%
901199	Federal Government, Civilian, Excluding Postal Service	3,300	3,253	(47)	(1%)	0.6%	10.3%
518210	Data Processing, Hosting, and Related Services	3,084	3,006	(78)	(3%)	0.6%	21.4%
443142	Electronics Stores	3,030	2,622	(408)	(13%)	0.6%	24.2%
524126	Direct Property and Casualty Insurance Carriers	2,995	3,495	500	17%	0.5%	15.8%
336411	Aircraft Manufacturing	2,862	2,696	(166)	(6%)	0.5%	12.5%
531312	Nonresidential Property Managers	2,717	3,269	552	20%	0.5%	37.7%
484121	General Freight Trucking, Long-Distance, Truckload	2,688	2,828	140	5%	0.5%	16.2%
621610	Home Health Care Services	2,654	3,601	947	36%	0.5%	5.1%
423690	Other Electronic Parts and Equipment Merchant Wholesalers	2,559	2,609	50	2%	0.5%	22.9%
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers	2,492	2,381	(111)	(4%)	0.5%	22.5%
488119	Other Airport Operations	2,398	2,908	510	21%	0.4%	67.2%
423830	Industrial Machinery and Equipment Merchant Wholesalers	2,391	2,545	154	6%	0.4%	24.9%
611310	Colleges, Universities, and Professional Schools	2,326	2,647	321	14%	0.4%	14.7%
238210	Electrical Contractors and Other Wiring Installation Contractors	2,284	2,593	309	14%	0.4%	9.4%
517210	Wireless Telecommunications Carriers (except Satellite)	2,240	1,568	(672)	(30%)	0.4%	36.6%
541110	Offices of Lawyers	2,197	2,271	74	3%	0.4%	8.9%
531210	Offices of Real Estate Agents and Brokers	2,189	2,274	85	4%	0.4%	29.8%
522390	Other Activities Related to Credit Intermediation	2,009	2,326	317	16%	0.4%	29.3%
541211	Offices of Certified Public Accountants	1,947	2,137	190	10%	0.4%	14.1%
424990	Other Miscellaneous Nondurable Goods Merchant Wholesalers	1,929	2,874	945	49%	0.4%	30.7%
424210	Drugs and Druggists' Sundries Merchant Wholesalers	1,899	1,884	(15)	(1%)	0.3%	23.0%
541330	Engineering Services	1,879	1,946	67	4%	0.3%	9.4%

NAICS	Industry	Occupation Group Jobs in Industry (2016)	Occupation Group Jobs in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Occupation Group in Industry (2016)	% of Total Jobs in Industry (2016)
452990	All Other General Merchandise Stores	1,780	2,154	374	21%	0.3%	27.9%
561720	Janitorial Services	1,777	1,982	205	12%	0.3%	7.3%
561621	Security Systems Services (except Locksmiths)	1,772	1,979	207	12%	0.3%	31.3%
561990	All Other Support Services	1,718	1,928	210	12%	0.3%	30.1%
561730	Landscaping Services	1,676	1,813	137	8%	0.3%	9.6%
811111	General Automotive Repair	1,663	1,941	278	17%	0.3%	22.3%
541613	Marketing Consulting Services	1,661	2,067	406	24%	0.3%	23.7%
524292	Third Party Administration of Insurance and Pension Funds	1,624	2,016	392	24%	0.3%	24.6%
323111	Commercial Printing (except Screen and Books)	1,618	1,379	(239)	(15%)	0.3%	17.2%
722511	Full-Service Restaurants	1,596	1,771	175	11%	0.3%	1.2%
541618	Other Management Consulting Services	1,591	1,341	(250)	(16%)	0.3%	23.6%
236220	Commercial and Institutional Building Construction	1,590	1,651	61	4%	0.3%	10.3%
522320	Financial Transactions Processing, Reserve, and Clearinghouse Activities	1,585	1,978	393	25%	0.3%	28.9%
621210	Offices of Dentists	1,567	1,904	337	22%	0.3%	6.9%
484122	General Freight Trucking, Long-Distance, Less Than Truckload	1,530	1,763	233	15%	0.3%	16.5%
561599	All Other Travel Arrangement and Reservation Services	1,476	1,664	188	13%	0.3%	47.5%
424490	Other Grocery and Related Products Merchant Wholesalers	1,467	1,742	275	19%	0.3%	25.1%
424410	General Line Grocery Merchant Wholesalers	1,449	1,417	(32)	(2%)	0.3%	25.1%
445120	Convenience Stores	1,417	1,761	344	24%	0.3%	29.6%
561440	Collection Agencies	1,396	1,617	221	16%	0.3%	29.1%
236115	New Single-Family Housing Construction (except For-Sale Builders)	1,367	1,446	79	6%	0.3%	15.8%
484110	General Freight Trucking, Local	1,361	1,787	426	31%	0.2%	16.3%
441120	Used Car Dealers	1,333	1,715	382	29%	0.2%	21.9%
523120	Securities Brokerage	1,309	1,508	199	15%	0.2%	14.8%
902999	State Government, Excluding Education and Hospitals	1,288	1,379	91	7%	0.2%	9.5%
423450	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers	1,278	1,502	224	18%	0.2%	22.2%
713940	Fitness and Recreational Sports Centers	1,272	1,328	56	4%	0.2%	11.2%

NAICS	Industry	Occupation Group Jobs in Industry (2016)	Occupation Group Jobs in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Occupation Group in Industry (2016)	% of Total Jobs in Industry (2016)
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	1,266	1,391	125	10%	0.2%	22.9%
722513	Limited-Service Restaurants	1,266	1,495	229	18%	0.2%	1.1%
441310	Automotive Parts and Accessories Stores	1,263	1,485	222	18%	0.2%	12.2%
211111	Crude Petroleum and Natural Gas Extraction	1,257	1,216	(41)	(3%)	0.2%	11.3%
444190	Other Building Material Dealers	1,252	1,373	121	10%	0.2%	22.8%
811121	Automotive Body, Paint, and Interior Repair and Maintenance	1,222	1,422	200	16%	0.2%	21.5%
334413	Semiconductor and Related Device Manufacturing	1,188	958	(230)	(19%)	0.2%	8.3%
442299	All Other Home Furnishings Stores	1,176	1,490	314	27%	0.2%	17.5%
442110	Furniture Stores	1,170	985	(185)	(16%)	0.2%	23.6%
423310	Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers	1,162	1,197	35	3%	0.2%	26.7%
484230	Specialized Freight (except Used Goods) Trucking, Long-Distance	1,152	1,381	229	20%	0.2%	22.0%
423120	Motor Vehicle Supplies and New Parts Merchant Wholesalers	1,151	1,198	47	4%	0.2%	24.4%
811191	Automotive Oil Change and Lubrication Shops	1,132	1,147	15	1%	0.2%	59.4%
611110	Elementary and Secondary Schools	1,127	1,329	202	18%	0.2%	5.1%
524114	Direct Health and Medical Insurance Carriers	1,119	1,361	242	22%	0.2%	23.5%
517911	Telecommunications Resellers	1,107	829	(278)	(25%)	0.2%	32.3%
481211	Nonscheduled Chartered Passenger Air Transportation	1,094	1,278	184	17%	0.2%	76.8%
522291	Consumer Lending	1,094	753	(341)	(31%)	0.2%	20.5%
453310	Used Merchandise Stores	1,080	1,307	227	21%	0.2%	24.2%
541219	Other Accounting Services	1,056	1,138	82	8%	0.2%	14.2%
221122	Electric Power Distribution	1,045	1,229	184	18%	0.2%	21.3%
623110	Nursing Care Facilities (Skilled Nursing Facilities)	1,041	1,181	140	13%	0.2%	4.0%
454111	Electronic Shopping	1,028	1,320	292	28%	0.2%	31.6%
561499	All Other Business Support Services	1,007	923	(84)	(8%)	0.2%	28.2%
903622	Hospitals (Local Government)	989	1,110	121	12%	0.2%	6.2%
511210	Software Publishers	988	1,115	127	13%	0.2%	10.8%
213112	Support Activities for Oil and Gas Operations	983	1,285	302	31%	0.2%	11.3%
448140	Family Clothing Stores	953	961	8	1%	0.2%	8.3%

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238990	All Other Specialty Trade Contractors	952	1,096	144	15%	0.2%	10.6%
541810	Advertising Agencies	942	907	(35)	(4%)	0.2%	18.3%
424690	Other Chemical and Allied Products Merchant Wholesalers	939	1,145	206	22%	0.2%	23.1%
522310	Mortgage and Nonmortgage Loan Brokers	924	1,150	226	24%	0.2%	28.8%
482110	Rail transportation	922	1,041	119	13%	0.2%	14.0%
423420	Office Equipment Merchant Wholesalers	913	1,011	98	11%	0.2%	22.3%
541690	Other Scientific and Technical Consulting Services	913	1,168	255	28%	0.2%	24.3%
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	902	914	12	1%	0.2%	23.0%
522130	Credit Unions	885	964	79	9%	0.2%	20.5%
524113	Direct Life Insurance Carriers	882	953	71	8%	0.2%	12.3%
531390	Other Activities Related to Real Estate	879	1,182	303	34%	0.2%	37.8%
541614	Process, Physical Distribution, and Logistics Consulting Services	876	971	95	11%	0.2%	23.8%
423990	Other Miscellaneous Durable Goods Merchant Wholesalers	873	1,062	189	22%	0.2%	32.0%
237130	Power and Communication Line and Related Structures Construction	870	1,175	305	35%	0.2%	12.1%
713910	Golf Courses and Country Clubs	854	1,015	161	19%	0.2%	10.6%
532111	Passenger Car Rental	852	868	16	2%	0.2%	28.1%
446110	Pharmacies and Drug Stores	845	936	91	11%	0.2%	6.6%
484210	Used Household and Office Goods Moving	841	852	11	1%	0.2%	22.3%
423510	Metal Service Centers and Other Metal Merchant Wholesalers	838	924	86	10%	0.2%	25.8%
484220	Specialized Freight (except Used Goods) Trucking, Local	828	962	134	16%	0.2%	21.5%
621340	Offices of Physical, Occupational and Speech Therapists, and Audiologists	825	1,181	356	43%	0.2%	6.9%
336413	Other Aircraft Parts and Auxiliary Equipment Manufacturing	822	656	(166)	(20%)	0.2%	13.2%
447110	Gasoline Stations with Convenience Stores	821	905	84	10%	0.2%	5.1%
901149	US Postal Service	812	707	(105)	(13%)	0.1%	6.4%

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813410	Civic and Social Organizations	805	802	(3)	(0%)	0.1%	12.3%
711310	Promoters of Performing Arts, Sports, and Similar Events with Facilities	803	921	118	15%	0.1%	21.2%
423110	Automobile and Other Motor Vehicle Merchant Wholesalers	791	806	15	2%	0.1%	24.5%
532299	All Other Consumer Goods Rental	779	972	193	25%	0.1%	29.7%
523930	Investment Advice	767	1,032	265	35%	0.1%	16.1%
451110	Sporting Goods Stores	766	994	228	30%	0.1%	11.1%
561710	Exterminating and Pest Control Services	762	820	58	8%	0.1%	26.3%
423710	Hardware Merchant Wholesalers	755	888	133	18%	0.1%	27.2%
624410	Child Day Care Services	749	804	55	7%	0.1%	3.5%
541940	Veterinary Services	745	816	71	10%	0.1%	9.0%
423860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers	743	819	76	10%	0.1%	24.9%
454113	Mail-Order Houses	732	734	2	0%	0.1%	31.6%
423220	Home Furnishing Merchant Wholesalers	719	770	51	7%	0.1%	31.9%
236118	Residential Remodelers	716	930	214	30%	0.1%	15.8%
531130	Lessors of Miniwarehouses and Self-Storage Units	714	818	104	15%	0.1%	40.5%
238160	Roofing Contractors	705	750	45	6%	0.1%	14.6%
238910	Site Preparation Contractors	705	794	89	13%	0.1%	10.6%
532120	Truck, Utility Trailer, and RV (Recreational Vehicle) Rental and Leasing	703	793	90	13%	0.1%	28.0%
423930	Recyclable Material Merchant Wholesalers	701	723	22	3%	0.1%	31.9%
444130	Hardware Stores	700	860	160	23%	0.1%	23.0%
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	670	723	53	8%	0.1%	27.3%
561330	Professional Employer Organizations	663	540	(123)	(19%)	0.1%	26.3%
423210	Furniture Merchant Wholesalers	648	751	103	16%	0.1%	31.9%
423840	Industrial Supplies Merchant Wholesalers	647	783	136	21%	0.1%	25.0%
237110	Water and Sewer Line and Related Structures Construction	645	716	71	11%	0.1%	8.2%
237310	Highway, Street, and Bridge Construction	642	784	142	22%	0.1%	6.8%
522298	All Other Nondepository Credit Intermediation	638	741	103	16%	0.1%	20.5%

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611710	Educational Support Services	636	736	100	16%	0.1%	21.0%
424480	Fresh Fruit and Vegetable Merchant Wholesalers	635	808	173	27%	0.1%	25.1%
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers	628	801	173	28%	0.1%	26.7%
238110	Poured Concrete Foundation and Structure Contractors	626	707	81	13%	0.1%	6.7%
424120	Stationery and Office Supplies Merchant Wholesalers	619	548	(71)	(11%)	0.1%	29.9%
722310	Food Service Contractors	619	704	85	14%	0.1%	5.2%
446120	Cosmetics, Beauty Supplies, and Perfume Stores	614	772	158	26%	0.1%	11.0%
424820	Wine and Distilled Alcoholic Beverage Merchant Wholesalers	613	724	111	18%	0.1%	20.2%
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	613	665	52	8%	0.1%	27.3%
424810	Beer and Ale Merchant Wholesalers	612	661	49	8%	0.1%	20.2%
523920	Portfolio Management	612	771	159	26%	0.1%	16.1%
532490	Other Commercial and Industrial Machinery and Equipment Rental and Leasing	599	732	133	22%	0.1%	28.4%
423940	Jewelry, Watch, Precious Stone, and Precious Metal Merchant Wholesalers	591	599	8	1%	0.1%	32.2%
621511	Medical Laboratories	583	790	207	36%	0.1%	12.2%
541214	Payroll Services	581	637	56	10%	0.1%	14.1%
522210	Credit Card Issuing	566	597	31	5%	0.1%	25.9%
332312	Fabricated Structural Metal Manufacturing	565	636	71	13%	0.1%	12.0%
493190	Other Warehousing and Storage	561	605	44	8%	0.1%	41.5%
541310	Architectural Services	559	607	48	9%	0.1%	9.3%
561312	Executive Search Services	551	718	167	30%	0.1%	26.4%
523110	Investment Banking and Securities Dealing	547	529	(18)	(3%)	0.1%	14.8%
441320	Tire Dealers	543	584	41	8%	0.1%	12.2%
424130	Industrial and Personal Service Paper Merchant Wholesalers	540	508	(32)	(6%)	0.1%	30.0%
332322	Sheet Metal Work Manufacturing	537	561	24	4%	0.1%	12.0%
453998	All Other Miscellaneous Store Retailers (except Tobacco Stores)	531	649	118	22%	0.1%	13.2%
532310	General Rental Centers	522	556	34	7%	0.1%	34.0%
713990	All Other Amusement and Recreation Industries	520	665	145	28%	0.1%	10.6%

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448120	Women's Clothing Stores	515	522	7	1%	0.1%	8.4%
532412	Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing	506	611	105	21%	0.1%	28.7%
611620	Sports and Recreation Instruction	499	626	127	25%	0.1%	13.4%
524298	All Other Insurance Related Activities	499	606	107	21%	0.1%	24.7%
237210	Land Subdivision	497	548	51	10%	0.1%	21.2%
561612	Security Guards and Patrol Services	493	558	65	13%	0.1%	2.5%
813910	Business Associations	489	477	(12)	(2%)	0.1%	29.1%
524291	Claims Adjusting	482	511	29	6%	0.1%	24.6%
423810	Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers	482	568	86	18%	0.1%	25.0%
424450	Confectionery Merchant Wholesalers	481	547	66	14%	0.1%	25.0%
238350	Finish Carpentry Contractors	481	515	34	7%	0.1%	17.5%
423440	Other Commercial Equipment Merchant Wholesalers	475	535	60	13%	0.1%	22.3%
561450	Credit Bureaus	474	473	(1)	(0%)	0.1%	29.4%
523910	Miscellaneous Intermediation	469	524	55	12%	0.1%	16.0%
492210	Local Messengers and Local Delivery	467	573	106	23%	0.1%	20.0%
621512	Diagnostic Imaging Centers	463	589	126	27%	0.1%	12.2%
623311	Continuing Care Retirement Communities	461	649	188	41%	0.1%	4.8%
812930	Parking Lots and Garages	457	523	66	14%	0.1%	9.4%
424720	Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)	457	544	87	19%	0.1%	22.2%
541410	Interior Design Services	456	500	44	10%	0.1%	20.3%
541990	All Other Professional, Scientific, and Technical Services	455	427	(28)	(6%)	0.1%	21.1%
325412	Pharmaceutical Preparation Manufacturing	454	472	18	4%	0.1%	11.6%
561920	Convention and Trade Show Organizers	453	518	65	14%	0.1%	30.3%
812320	Drycleaning and Laundry Services (except Coin- Operated)	452	395	(57)	(13%)	0.1%	9.5%
493120	Refrigerated Warehousing and Storage	451	514	63	14%	0.1%	41.6%
541910	Marketing Research and Public Opinion Polling	446	447	1	0%	0.1%	21.1%
238310	Drywall and Insulation Contractors	439	463	24	5%	0.1%	6.3%
561210	Facilities Support Services	430	525	95	22%	0.1%	18.1%

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326199	All Other Plastics Product Manufacturing	430	347	(83)	(19%)	0.1%	12.3%
515210	Cable and Other Subscription Programming	429	522	93	22%	0.1%	30.2%
334210	Telephone Apparatus Manufacturing	429	399	(30)	(7%)	0.1%	11.4%
524127	Direct Title Insurance Carriers	428	462	34	8%	0.1%	15.7%
624190	Other Individual and Family Services	426	482	56	13%	0.1%	9.4%
541612	Human Resources Consulting Services	421	474	53	13%	0.1%	23.7%
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	419	347	(72)	(17%)	0.1%	10.7%
541213	Tax Preparation Services	416	439	23	6%	0.1%	14.2%
337110	Wood Kitchen Cabinet and Countertop Manufacturing	413	419	6	1%	0.1%	10.4%
327320	Ready-Mix Concrete Manufacturing	410	449	39	10%	0.1%	11.6%
813920	Professional Organizations	407	461	54	13%	0.1%	28.5%
481212	Nonscheduled Chartered Freight Air Transportation	405	344	(61)	(15%)	0.1%	77.1%
488410	Motor Vehicle Towing	403	478	75	19%	0.1%	22.3%
812112	Beauty Salons	402	417	15	4%	0.1%	5.3%
423850	Service Establishment Equipment and Supplies Merchant Wholesalers	401	419	18	4%	0.1%	25.0%
423910	Sporting and Recreational Goods and Supplies Merchant Wholesalers	393	506	113	29%	0.1%	31.8%
453220	Gift, Novelty, and Souvenir Stores	389	379	(10)	(3%)	0.1%	9.6%
512110	Motion Picture and Video Production	384	426	42	11%	0.1%	20.0%
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations)	383	480	97	25%	0.1%	28.6%
562212	Solid Waste Landfill	382	368	(14)	(4%)	0.1%	17.2%
332710	Machine Shops	381	366	(15)	(4%)	0.1%	11.6%
621399	Offices of All Other Miscellaneous Health Practitioners	380	546	166	44%	0.1%	12.0%
238290	Other Building Equipment Contractors	379	450	71	19%	0.1%	11.9%
541380	Testing Laboratories	378	442	64	17%	0.1%	14.4%
541890	Other Services Related to Advertising	377	440	63	17%	0.1%	18.2%
561410	Document Preparation Services	374	455	81	22%	0.1%	27.4%
236210	Industrial Building Construction	371	447	76	20%	0.1%	10.4%
711211	Sports Teams and Clubs	371	402	31	8%	0.1%	13.2%
453910	Pet and Pet Supplies Stores	368	416	48	13%	0.1%	13.0%

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812210	Funeral Homes and Funeral Services	366	386	20	5%	0.1%	19.9%
322211	Corrugated and Solid Fiber Box Manufacturing	365	353	(12)	(3%)	0.1%	11.9%
238390	Other Building Finishing Contractors	365	338	(27)	(7%)	0.1%	17.5%
336111	Automobile Manufacturing	357	439	82	23%	0.1%	5.4%
562111	Solid Waste Collection	356	370	14	4%	0.1%	21.0%
561510	Travel Agencies	355	268	(87)	(25%)	0.1%	15.4%
333132	Oil and Gas Field Machinery and Equipment Manufacturing	354	314	(40)	(11%)	0.1%	11.6%
611512	Flight Training	354	431	77	22%	0.1%	22.0%
522120	Savings Institutions	353	371	18	5%	0.1%	20.7%
326111	Plastics Bag and Pouch Manufacturing	349	417	68	19%	0.1%	12.1%
424930	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers	347	369	22	6%	0.1%	30.6%
441228	Motorcycle, ATV, and All Other Motor Vehicle Dealers	347	407	60	17%	0.1%	19.6%
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	345	268	(77)	(22%)	0.1%	11.4%
481112	Scheduled Freight Air Transportation	343	438	95	28%	0.1%	94.0%
311612	Meat Processed from Carcasses	343	356	13	4%	0.1%	13.1%
451120	Hobby, Toy, and Game Stores	342	387	45	13%	0.1%	10.6%
522294	Secondary Market Financing	339	431	92	27%	0.1%	20.7%
623312	Assisted Living Facilities for the Elderly	336	453	117	35%	0.1%	4.9%
424940	Tobacco and Tobacco Product Merchant Wholesalers	329	375	46	14%	0.1%	30.5%
424950	Paint, Varnish, and Supplies Merchant Wholesalers	329	366	37	11%	0.1%	30.7%
423330	Roofing, Siding, and Insulation Material Merchant Wholesalers	327	387	60	18%	0.1%	26.9%
621320	Offices of Optometrists	324	399	75	23%	0.1%	9.5%
511110	Newspaper Publishers	323	176	(147)	(46%)	0.1%	14.9%
238120	Structural Steel and Precast Concrete Contractors	322	368	46	14%	0.1%	10.4%
444220	Nursery, Garden Center, and Farm Supply Stores	319	340	21	7%	0.1%	17.3%
323113	Commercial Screen Printing	316	380	64	20%	0.1%	17.2%
221210	Natural Gas Distribution	316	305	(11)	(3%)	0.1%	19.8%
332321	Metal Window and Door Manufacturing	314	267	(47)	(15%)	0.1%	12.1%
336320	Motor Vehicle Electrical and Electronic Equipment	313	333	20	6%	0.1%	10.3%

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	Manufacturing						
445310	Beer, Wine, and Liquor Stores	313	316	3	1%	0.1%	14.5%
424430	Dairy Product (except Dried or Canned) Merchant Wholesalers	309	285	(24)	(8%)	0.1%	25.1%
621310	Offices of Chiropractors	309	355	46	15%	0.1%	11.1%
339950	Sign Manufacturing	308	338	30	10%	0.1%	14.5%
327120	Clay Building Material and Refractories Manufacturing	308	310	2	1%	0.1%	14.3%
531320	Offices of Real Estate Appraisers	307	337	30	10%	0.1%	37.8%
532112	Passenger Car Leasing	306	340	34	11%	0.1%	28.2%
238330	Flooring Contractors	306	354	48	16%	0.1%	17.5%
519130	Internet Publishing and Broadcasting and Web Search Portals	304	362	58	19%	0.1%	19.5%
453210	Office Supplies and Stationery Stores	304	275	(29)	(10%)	0.1%	9.7%
238140	Masonry Contractors	302	362	60	20%	0.1%	6.8%
334111	Electronic Computer Manufacturing	302	375	73	24%	0.1%	8.1%
424330	Women's, Children's, and Infants' Clothing and Accessories Merchant Wholesalers	302	337	35	12%	0.1%	33.0%
561421	Telephone Answering Services	301	295	(6)	(2%)	0.1%	54.4%
551112	Offices of Other Holding Companies	301	299	(2)	(1%)	0.1%	19.4%
423460	Ophthalmic Goods Merchant Wholesalers	299	364	65	22%	0.1%	22.5%
533110	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	299	310	11	4%	0.1%	33.9%
611519	Other Technical and Trade Schools	299	193	(106)	(35%)	0.1%	21.5%
624310	Vocational Rehabilitation Services	296	242	(54)	(18%)	0.1%	10.6%
423820	Farm and Garden Machinery and Equipment Merchant Wholesalers	292	321	29	10%	0.1%	24.1%
488999	All Other Support Activities for Transportation	291	291	0	0%	0.1%	31.3%
336390	Other Motor Vehicle Parts Manufacturing	286	290	4	1%	0.1%	10.3%
611691	Exam Preparation and Tutoring	286	319	33	12%	0.1%	13.3%
424320	Men's and Boys' Clothing and Furnishings Merchant Wholesalers	284	314	30	11%	0.1%	33.1%
561439	Other Business Service Centers (including Copy Shops)	283	192	(91)	(32%)	0.1%	29.1%
448210	Shoe Stores	280	300	20	7%	0.1%	5.2%

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811198	All Other Automotive Repair and Maintenance	280	336	56	20%	0.1%	60.1%
562910	Remediation Services	279	306	27	10%	0.1%	19.8%
325620	Toilet Preparation Manufacturing	278	252	(26)	(9%)	0.1%	15.8%
442210	Floor Covering Stores	277	255	(22)	(8%)	0.1%	17.3%
238320	Painting and Wall Covering Contractors	276	292	16	6%	0.1%	7.7%
621492	Kidney Dialysis Centers	275	370	95	35%	0.1%	7.0%
811212	Computer and Office Machine Repair and Maintenance	274	210	(64)	(23%)	0.1%	19.2%
541620	Environmental Consulting Services	273	323	50	18%	0.1%	23.8%
339115	Ophthalmic Goods Manufacturing	270	278	8	3%	0.0%	12.9%
711320	Promoters of Performing Arts, Sports, and Similar Events without Facilities	269	381	112	42%	0.0%	21.1%
488210	Support Activities for Rail Transportation	266	256	(10)	(4%)	0.0%	22.8%
811211	Consumer Electronics Repair and Maintenance	263	375	112	43%	0.0%	19.1%
541519	Other Computer Related Services	262	289	27	10%	0.0%	12.3%
425110	Business to Business Electronic Markets	257	168	(89)	(35%)	0.0%	22.4%
712110	Museums	255	290	35	14%	0.0%	15.3%
424910	Farm Supplies Merchant Wholesalers	253	258	5	2%	0.0%	30.4%
238150	Glass and Glazing Contractors	252	291	39	15%	0.0%	10.6%
561520	Tour Operators	252	349	97	38%	0.0%	47.6%
325510	Paint and Coating Manufacturing	251	229	(22)	(9%)	0.0%	14.3%
238340	Tile and Terrazzo Contractors	250	260	10	4%	0.0%	17.5%
624110	Child and Youth Services	250	276	26	10%	0.0%	9.3%
424420	Packaged Frozen Food Merchant Wholesalers	249	292	43	17%	0.0%	25.2%
541921	Photography Studios, Portrait	248	238	(10)	(4%)	0.0%	23.0%
561910	Packaging and Labeling Services	247	308	61	25%	0.0%	29.6%
488490	Other Support Activities for Road Transportation	246	191	(55)	(22%)	0.0%	22.5%
811213	Communication Equipment Repair and Maintenance	246	221	(25)	(10%)	0.0%	19.2%
312111	Soft Drink Manufacturing	245	248	3	1%	0.0%	14.6%
812910	Pet Care (except Veterinary) Services	244	297	53	22%	0.0%	9.2%
424310	Piece Goods, Notions, and Other Dry Goods Merchant Wholesalers	243	223	(20)	(8%)	0.0%	33.0%
443141	Household Appliance Stores	241	240	(1)	(0%)	0.0%	24.1%
423390	Other Construction Material Merchant Wholesalers	238	265	27	11%	0.0%	26.7%

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423130	Tire and Tube Merchant Wholesalers	237	281	44	19%	0.0%	24.5%
541430	Graphic Design Services	235	237	2	1%	0.0%	20.8%
999999	Unclassified Industry	233	262	29	12%	0.0%	14.1%
511130	Book Publishers	232	181	(51)	(22%)	0.0%	19.2%
713110	Amusement and Theme Parks	231	267	36	16%	0.0%	8.3%
722410	Drinking Places (Alcoholic Beverages)	230	241	11	5%	0.0%	2.9%
311412	Frozen Specialty Food Manufacturing	230	228	(2)	(1%)	0.0%	13.8%
622310	Specialty (except Psychiatric and Substance Abuse) Hospitals	229	278	49	21%	0.0%	4.3%
541712	Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	228	257	29	13%	0.0%	8.6%
621493	Freestanding Ambulatory Surgical and Emergency Centers	227	334	107	47%	0.0%	7.0%
531190	Lessors of Other Real Estate Property	225	223	(2)	(1%)	0.0%	40.5%
611610	Fine Arts Schools	223	225	2	1%	0.0%	13.4%
621991	Blood and Organ Banks	222	254	32	14%	0.0%	13.2%
423920	Toy and Hobby Goods and Supplies Merchant Wholesalers	222	222	0	0%	0.0%	32.0%
902622	Hospitals (State Government)	222	278	56	25%	0.0%	4.6%
448190	Other Clothing Stores	219	225	6	3%	0.0%	8.3%
454390	Other Direct Selling Establishments	218	240	22	10%	0.0%	26.2%
512131	Motion Picture Theaters (except Drive-Ins)	217	250	33	15%	0.0%	4.3%
448310	Jewelry Stores	216	217	1	0%	0.0%	7.0%
321991	Manufactured Home (Mobile Home) Manufacturing	215	245	30	14%	0.0%	12.8%
511120	Periodical Publishers	212	150	(62)	(29%)	0.0%	19.2%
331420	Copper Rolling, Drawing, Extruding, and Alloying	211	268	57	27%	0.0%	12.4%
237120	Oil and Gas Pipeline and Related Structures Construction	209	259	50	24%	0.0%	8.4%
515112	Radio Stations	208	197	(11)	(5%)	0.0%	15.0%
331318	Other Aluminum Rolling, Drawing, and Extruding	207	213	6	3%	0.0%	13.1%
311919	Other Snack Food Manufacturing	204	157	(47)	(23%)	0.0%	14.0%
445299	All Other Specialty Food Stores	204	234	30	15%	0.0%	12.4%
517919	All Other Telecommunications	203	205	2	1%	0.0%	32.1%

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812199	Other Personal Care Services	203	253	50	25%	0.0%	5.2%
541513	Computer Facilities Management Services	202	197	(5)	(2%)	0.0%	12.2%
712130	Zoos and Botanical Gardens	201	246	45	22%	0.0%	15.4%
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	201	167	(34)	(17%)	0.0%	11.6%
441210	Recreational Vehicle Dealers	200	246	46	23%	0.0%	19.5%
424470	Meat and Meat Product Merchant Wholesalers	199	222	23	12%	0.0%	25.2%
624221	Temporary Shelters	197	222	25	13%	0.0%	14.7%
337215	Showcase, Partition, Shelving, and Locker Manufacturing	194	186	(8)	(4%)	0.0%	12.0%
321920	Wood Container and Pallet Manufacturing	193	218	25	13%	0.0%	14.1%
337910	Mattress Manufacturing	191	197	6	3%	0.0%	13.4%
711110	Theater Companies and Dinner Theaters	191	225	34	18%	0.0%	15.6%
237990	Other Heavy and Civil Engineering Construction	191	232	41	21%	0.0%	9.0%
541860	Direct Mail Advertising	189	99	(90)	(48%)	0.0%	18.2%
311812	Commercial Bakeries	189	190	1	1%	0.0%	8.5%
541191	Title Abstract and Settlement Offices	188	229	41	22%	0.0%	9.1%
532210	Consumer Electronics and Appliances Rental	186	138	(48)	(26%)	0.0%	28.7%
445210	Meat Markets	185	223	38	21%	0.0%	12.4%
448130	Children's and Infants' Clothing Stores	185	201	16	9%	0.0%	8.0%
327390	Other Concrete Product Manufacturing	185	196	11	6%	0.0%	11.2%
238190	Other Foundation, Structure, and Building Exterior Contractors	185	190	5	3%	0.0%	10.4%
423620	Household Appliances, Electric Housewares, and Consumer Electronics Merchant Wholesalers	183	168	(15)	(8%)	0.0%	23.0%
561790	Other Services to Buildings and Dwellings	183	201	18	10%	0.0%	7.3%
611430	Professional and Management Development Training	182	165	(17)	(9%)	0.0%	24.6%
713950	Bowling Centers	181	202	21	12%	0.0%	10.5%
561431	Private Mail Centers	181	164	(17)	(9%)	0.0%	28.7%
541720	Research and Development in the Social Sciences and Humanities	181	201	20	11%	0.0%	14.6%
332323	Ornamental and Architectural Metal Work Manufacturing	181	214	33	18%	0.0%	12.1%

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511140	Directory and Mailing List Publishers	176	142	(34)	(19%)	0.0%	19.2%
339113	Surgical Appliance and Supplies Manufacturing	174	184	10	6%	0.0%	12.3%
332313	Plate Work Manufacturing	173	165	(8)	(5%)	0.0%	11.8%
448110	Men's Clothing Stores	171	159	(12)	(7%)	0.0%	8.5%
236117	New Housing For-Sale Builders	170	175	5	3%	0.0%	15.7%
446130	Optical Goods Stores	168	204	36	21%	0.0%	10.9%
561622	Locksmiths	168	197	29	17%	0.0%	31.1%
326140	Polystyrene Foam Product Manufacturing	167	171	4	2%	0.0%	12.1%
334419	Other Electronic Component Manufacturing	166	143	(23)	(14%)	0.0%	7.9%
812990	All Other Personal Services	165	177	12	7%	0.0%	9.3%
446199	All Other Health and Personal Care Stores	164	169	5	3%	0.0%	10.9%
621498	All Other Outpatient Care Centers	164	222	58	35%	0.0%	7.1%
541820	Public Relations Agencies	164	182	18	11%	0.0%	18.3%
811219	Other Electronic and Precision Equipment Repair and Maintenance	164	157	(7)	(4%)	0.0%	19.2%
541870	Advertising Material Distribution Services	162	151	(11)	(7%)	0.0%	18.8%
454210	Vending Machine Operators	162	139	(23)	(14%)	0.0%	19.7%
611699	All Other Miscellaneous Schools and Instruction	161	181	20	12%	0.0%	13.1%
611210	Junior Colleges	161	174	13	8%	0.0%	23.4%
813930	Labor Unions and Similar Labor Organizations	159	164	5	3%	0.0%	12.8%
448150	Clothing Accessories Stores	159	175	16	10%	0.0%	8.5%
621910	Ambulance Services	157	235	78	50%	0.0%	5.1%
811118	Other Automotive Mechanical and Electrical Repair and Maintenance	155	143	(12)	(8%)	0.0%	22.4%
312112	Bottled Water Manufacturing	152	185	33	22%	0.0%	14.4%
213111	Drilling Oil and Gas Wells	151	114	(37)	(25%)	0.0%	11.4%
311511	Fluid Milk Manufacturing	151	133	(18)	(12%)	0.0%	14.6%
311352	Confectionery Manufacturing from Purchased Chocolate	151	158	7	5%	0.0%	12.0%
532291	Home Health Equipment Rental	150	151	1	1%	0.0%	28.4%
711510	Independent Artists, Writers, and Performers	150	160	10	7%	0.0%	19.3%
451211	Book Stores	147	115	(32)	(22%)	0.0%	8.7%
339910	Jewelry and Silverware Manufacturing	146	139	(7)	(5%)	0.0%	15.2%
444120	Paint and Wallpaper Stores	146	141	(5)	(3%)	0.0%	22.8%

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541850	Outdoor Advertising	145	123	(22)	(15%)	0.0%	18.5%
221112	Fossil Fuel Electric Power Generation	142	152	10	7%	0.0%	15.0%
541370	Surveying and Mapping (except Geophysical) Services	142	162	20	14%	0.0%	9.6%
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	142	156	14	10%	0.0%	12.3%
332812	Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	141	150	9	6%	0.0%	13.7%
562211	Hazardous Waste Treatment and Disposal	140	103	(37)	(26%)	0.0%	16.8%
813211	Grantmaking Foundations	140	168	28	20%	0.0%	17.0%
331221	Rolled Steel Shape Manufacturing	139	198	59	42%	0.0%	12.9%
236116	New Multifamily Housing Construction (except For-Sale Builders)	139	165	26	19%	0.0%	15.8%
311615	Poultry Processing	138	150	12	9%	0.0%	11.3%
485210	Interurban and Rural Bus Transportation	138	115	(23)	(17%)	0.0%	23.2%
488991	Packing and Crating	137	122	(15)	(11%)	0.0%	30.7%
454310	Fuel Dealers	136	132	(4)	(3%)	0.0%	26.0%
334290	Other Communications Equipment Manufacturing	135	124	(11)	(8%)	0.0%	11.3%
332912	Fluid Power Valve and Hose Fitting Manufacturing	135	143	8	6%	0.0%	11.8%
523999	Miscellaneous Financial Investment Activities	134	207	73	54%	0.0%	16.4%
813319	Other Social Advocacy Organizations	133	137	4	3%	0.0%	15.6%
339920	Sporting and Athletic Goods Manufacturing	132	124	(8)	(6%)	0.0%	14.6%
624120	Services for the Elderly and Persons with Disabilities	131	219	88	67%	0.0%	1.2%
212322	Industrial Sand Mining	131	160	29	22%	0.0%	14.6%
515120	Television Broadcasting	131	127	(4)	(3%)	0.0%	8.7%
812332	Industrial Launderers	130	161	31	24%	0.0%	9.5%
444210	Outdoor Power Equipment Stores	130	143	13	10%	0.0%	17.5%
332813	Electroplating, Plating, Polishing, Anodizing, and Coloring	130	114	(16)	(12%)	0.0%	13.9%
221310	Water Supply and Irrigation Systems	129	127	(2)	(2%)	0.0%	23.0%
312120	Breweries	126	131	5	4%	0.0%	13.3%
423490	Other Professional Equipment and Supplies Merchant Wholesalers	125	109	(16)	(13%)	0.0%	21.8%
337127	Institutional Furniture Manufacturing	124	131	7	6%	0.0%	12.7%

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811490	Other Personal and Household Goods Repair and Maintenance	123	127	4	3%	0.0%	18.9%
339999	All Other Miscellaneous Manufacturing	123	111	(12)	(10%)	0.0%	14.4%
336360	Motor Vehicle Seating and Interior Trim Manufacturing	122	123	1	1%	0.0%	10.3%
314120	Curtain and Linen Mills	122	102	(20)	(16%)	0.0%	12.0%
446191	Food (Health) Supplement Stores	120	126	6	5%	0.0%	10.9%
327332	Concrete Pipe Manufacturing	120	125	5	4%	0.0%	11.5%
339112	Surgical and Medical Instrument Manufacturing	120	137	17	14%	0.0%	12.2%
336412	Aircraft Engine and Engine Parts Manufacturing	119	92	(27)	(23%)	0.0%	13.2%
423740	Refrigeration Equipment and Supplies Merchant Wholesalers	119	90	(29)	(24%)	0.0%	27.4%
325520	Adhesive Manufacturing	119	136	17	14%	0.0%	14.4%
321918	Other Millwork (including Flooring)	118	105	(13)	(11%)	0.0%	14.8%
541840	Media Representatives	118	55	(63)	(53%)	0.0%	18.3%
327993	Mineral Wool Manufacturing	117	117	0	0%	0.0%	13.1%
711130	Musical Groups and Artists	117	119	2	2%	0.0%	14.9%
321911	Wood Window and Door Manufacturing	117	121	4	3%	0.0%	14.0%
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing	116	128	12	10%	0.0%	7.5%
521110	Monetary Authorities-Central Bank	116	102	(14)	(12%)	0.0%	11.8%
423140	Motor Vehicle Parts (Used) Merchant Wholesalers	115	133	18	16%	0.0%	24.4%
334412	Bare Printed Circuit Board Manufacturing	115	97	(18)	(16%)	0.0%	8.3%
523991	Trust, Fiduciary, and Custody Activities	115	129	14	12%	0.0%	16.1%
621999	All Other Miscellaneous Ambulatory Health Care Services	115	151	36	31%	0.0%	13.2%
811113	Automotive Transmission Repair	114	121	7	6%	0.0%	22.1%
311941	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	114	127	13	11%	0.0%	14.0%
238130	Framing Contractors	114	125	11	10%	0.0%	10.3%
333413	Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing	114	93	(21)	(18%)	0.0%	11.8%
541711	Research and Development in Biotechnology	113	121	8	7%	0.0%	8.6%
311830	Tortilla Manufacturing	113	114	1	1%	0.0%	8.5%

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337121	Upholstered Household Furniture Manufacturing	113	132	19	17%	0.0%	12.7%
722515	Snack and Nonalcoholic Beverage Bars	113	138	25	22%	0.0%	1.1%
332999	All Other Miscellaneous Fabricated Metal Product Manufacturing	113	118	5	4%	0.0%	11.9%
326113	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	110	80	(30)	(27%)	0.0%	12.2%
327991	Cut Stone and Stone Product Manufacturing	110	116	6	5%	0.0%	13.1%
814110	Private Households	109	108	(1)	(1%)	0.0%	1.7%
515111	Radio Networks	108	98	(10)	(9%)	0.0%	15.2%
311811	Retail Bakeries	108	134	26	24%	0.0%	8.5%
722320	Caterers	107	110	3	3%	0.0%	5.2%
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	106	113	7	7%	0.0%	10.6%
424920	Book, Periodical, and Newspaper Merchant Wholesalers	106	71	(35)	(33%)	0.0%	30.8%
334519	Other Measuring and Controlling Device Manufacturing	105	124	19	18%	0.0%	10.6%
333131	Mining Machinery and Equipment Manufacturing	104	128	24	23%	0.0%	11.6%
325920	Explosives Manufacturing	104	111	7	7%	0.0%	14.1%
336211	Motor Vehicle Body Manufacturing	103	117	14	14%	0.0%	10.9%
445230	Fruit and Vegetable Markets	102	106	4	4%	0.0%	12.4%
335921	Fiber Optic Cable Manufacturing	102	119	17	17%	0.0%	11.6%
611511	Cosmetology and Barber Schools	102	109	7	7%	0.0%	21.6%
334614	Software and Other Prerecorded Compact Disc, Tape, and Record Reproducing	102	95	(7)	(7%)	0.0%	18.1%
332216	Saw Blade and Handtool Manufacturing	101	109	8	8%	0.0%	12.7%
322230	Stationery Product Manufacturing	101	71	(30)	(30%)	0.0%	12.4%
491110	Postal Service	101	142	41	41%	0.0%	18.5%
624210	Community Food Services	100	121	21	21%	0.0%	14.9%
485320	Limousine Service	100	96	(4)	(4%)	0.0%	12.8%
485510	Charter Bus Industry	99	108	9	9%	0.0%	21.6%
332618	Other Fabricated Wire Product Manufacturing	99	82	(17)	(17%)	0.0%	12.7%
322219	Other Paperboard Container Manufacturing	98	78	(20)	(20%)	0.0%	12.4%
622210	Psychiatric and Substance Abuse Hospitals	98	133	35	36%	0.0%	3.9%
812331	Linen Supply	98	113	15	15%	0.0%	9.4%

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441222	Boat Dealers	98	103	5	5%	0.0%	19.7%
811122	Automotive Glass Replacement Shops	97	102	5	5%	0.0%	21.4%
115115	Farm Labor Contractors and Crew Leaders	97	119	22	23%	0.0%	5.3%
453110	Florists	97	94	(3)	(3%)	0.0%	8.7%
811412	Appliance Repair and Maintenance	97	105	8	8%	0.0%	18.9%
623220	Residential Mental Health and Substance Abuse Facilities	97	136	39	40%	0.0%	4.9%
333613	Mechanical Power Transmission Equipment Manufacturing	96	109	13	14%	0.0%	10.0%
621420	Outpatient Mental Health and Substance Abuse Centers	96	109	13	14%	0.0%	8.8%
812220	Cemeteries and Crematories	96	100	4	4%	0.0%	22.0%
424340	Footwear Merchant Wholesalers	95	104	9	9%	0.0%	32.9%
324122	Asphalt Shingle and Coating Materials Manufacturing	94	82	(12)	(13%)	0.0%	11.8%
447190	Other Gasoline Stations	93	107	14	15%	0.0%	5.2%
333922	Conveyor and Conveying Equipment Manufacturing	91	82	(9)	(10%)	0.0%	12.9%
621330	Offices of Mental Health Practitioners (except Physicians)	91	105	14	15%	0.0%	12.2%
813212	Voluntary Health Organizations	91	98	7	8%	0.0%	16.9%
424610	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	90	72	(18)	(20%)	0.0%	22.8%
339116	Dental Laboratories	90	84	(6)	(7%)	0.0%	12.4%
314999	All Other Miscellaneous Textile Product Mills	88	83	(5)	(6%)	0.0%	12.4%
811420	Reupholstery and Furniture Repair	87	86	(1)	(1%)	0.0%	19.8%
337212	Custom Architectural Woodwork and Millwork Manufacturing	87	86	(1)	(1%)	0.0%	12.9%
327215	Glass Product Manufacturing Made of Purchased Glass	86	94	8	9%	0.0%	11.8%
322220	Paper Bag and Coated and Treated Paper Manufacturing	86	76	(10)	(12%)	0.0%	12.3%
335313	Switchgear and Switchboard Apparatus Manufacturing	86	85	(1)	(1%)	0.0%	10.3%
335931	Current-Carrying Wiring Device Manufacturing	85	68	(17)	(20%)	0.0%	12.0%
423410	Photographic Equipment and Supplies Merchant Wholesalers	85	69	(16)	(19%)	0.0%	22.4%
541830	Media Buying Agencies	85	112	27	32%	0.0%	18.5%
325998	All Other Miscellaneous Chemical Product and	85	70	(15)	(18%)	0.0%	14.0%

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	Preparation Manufacturing						
311991	Perishable Prepared Food Manufacturing	84	95	11	13%	0.0%	14.0%
453991	Tobacco Stores	84	103	19	23%	0.0%	13.0%
326291	Rubber Product Manufacturing for Mechanical Use	84	85	1	1%	0.0%	9.9%
336310	Motor Vehicle Gasoline Engine and Engine Parts Manufacturing	84	84	0	0%	0.0%	10.4%
485410	School and Employee Bus Transportation	84	90	6	7%	0.0%	3.6%
323120	Support Activities for Printing	83	58	(25)	(30%)	0.0%	16.8%
485991	Special Needs Transportation	83	126	43	52%	0.0%	13.5%
522190	Other Depository Credit Intermediation	83	71	(12)	(14%)	0.0%	22.5%
238170	Siding Contractors	82	89	7	9%	0.0%	10.7%
333318	Other Commercial and Service Industry Machinery Manufacturing	82	56	(26)	(32%)	0.0%	12.5%
611420	Computer Training	82	47	(35)	(43%)	0.0%	24.7%
424710	Petroleum Bulk Stations and Terminals	82	111	29	35%	0.0%	22.5%
337920	Blind and Shade Manufacturing	81	55	(26)	(32%)	0.0%	14.1%
621112	Offices of Physicians, Mental Health Specialists	81	96	15	19%	0.0%	8.0%
311513	Cheese Manufacturing	81	109	28	35%	0.0%	14.0%
624229	Other Community Housing Services	79	104	25	32%	0.0%	15.1%
211112	Natural Gas Liquid Extraction	79	108	29	37%	0.0%	11.4%
481219	Other Nonscheduled Air Transportation	79	100	21	27%	0.0%	77.5%
325110	Petrochemical Manufacturing	79	81	2	3%	0.0%	13.7%
424460	Fish and Seafood Merchant Wholesalers	78	87	9	12%	0.0%	25.2%
327999	All Other Miscellaneous Nonmetallic Mineral Product Manufacturing	78	91	13	17%	0.0%	13.1%
325320	Pesticide and Other Agricultural Chemical Manufacturing	77	87	10	13%	0.0%	16.5%
524130	Reinsurance Carriers	77	31	(46)	(60%)	0.0%	21.8%
485111	Mixed Mode Transit Systems	76	69	(7)	(9%)	0.0%	9.1%
334516	Analytical Laboratory Instrument Manufacturing	75	69	(6)	(8%)	0.0%	10.6%
711212	Racetracks	75	56	(19)	(25%)	0.0%	13.7%
424590	Other Farm Product Raw Material Merchant Wholesalers	75	76	1	1%	0.0%	32.3%

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451130	Sewing, Needlework, and Piece Goods Stores	75	72	(3)	(4%)	0.0%	10.8%
333912	Air and Gas Compressor Manufacturing	75	86	11	15%	0.0%	12.9%
532230	Video Tape and Disc Rental	74	16	(58)	(78%)	0.0%	29.2%
335314	Relay and Industrial Control Manufacturing	74	63	(11)	(15%)	0.0%	11.3%
451140	Musical Instrument and Supplies Stores	73	78	5	7%	0.0%	10.8%
337122	Nonupholstered Wood Household Furniture Manufacturing	73	80	7	10%	0.0%	12.4%
332311	Prefabricated Metal Building and Component Manufacturing	73	85	12	16%	0.0%	12.0%
311942	Spice and Extract Manufacturing	73	72	(1)	(1%)	0.0%	14.0%
325612	Polish and Other Sanitation Good Manufacturing	73	46	(27)	(37%)	0.0%	15.8%
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	72	65	(7)	(10%)	0.0%	10.4%
561740	Carpet and Upholstery Cleaning Services	71	59	(12)	(17%)	0.0%	7.3%
325120	Industrial Gas Manufacturing	71	65	(6)	(8%)	0.0%	13.4%
424110	Printing and Writing Paper Merchant Wholesalers	71	60	(11)	(15%)	0.0%	29.8%
221121	Electric Bulk Power Transmission and Control	71	86	15	21%	0.0%	21.5%
332119	Metal Crown, Closure, and Other Metal Stamping (except Automotive)	71	63	(8)	(11%)	0.0%	11.1%
333992	Welding and Soldering Equipment Manufacturing	70	60	(10)	(14%)	0.0%	13.1%
311514	Dry, Condensed, and Evaporated Dairy Product Manufacturing	70	75	5	7%	0.0%	14.7%
325211	Plastics Material and Resin Manufacturing	70	81	11	16%	0.0%	9.6%
327310	Cement Manufacturing	69	73	4	6%	0.0%	11.9%
561491	Repossession Services	69	78	9	13%	0.0%	29.2%
813219	Other Grantmaking and Giving Services	68	79	11	16%	0.0%	17.0%
624230	Emergency and Other Relief Services	68	72	4	6%	0.0%	14.5%
111000	Crop Production	67	76	9	13%	0.0%	3.6%
334310	Audio and Video Equipment Manufacturing	67	75	8	12%	0.0%	13.1%
339991	Gasket, Packing, and Sealing Device Manufacturing	67	68	1	1%	0.0%	14.6%
611692	Automobile Driving Schools	67	69	2	3%	0.0%	13.8%
322130	Paperboard Mills	67	69	2	3%	0.0%	10.1%
445291	Baked Goods Stores	66	75	9	14%	0.0%	12.4%

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112000	Animal Production and Aquaculture	66	64	(2)	(3%)	0.0%	3.4%
333249	Other Industrial Machinery Manufacturing	65	78	13	20%	0.0%	11.1%
325199	All Other Basic Organic Chemical Manufacturing	65	62	(3)	(5%)	0.0%	13.3%
327910	Abrasive Product Manufacturing	64	59	(5)	(8%)	0.0%	13.8%
311611	Animal (except Poultry) Slaughtering	63	57	(6)	(10%)	0.0%	13.7%
326160	Plastics Bottle Manufacturing	62	58	(4)	(6%)	0.0%	12.2%
325180	Other Basic Inorganic Chemical Manufacturing	61	79	18	30%	0.0%	15.1%
721211	RV (Recreational Vehicle) Parks and Campgrounds	61	80	19	31%	0.0%	31.8%
311421	Fruit and Vegetable Canning	61	61	0	0%	0.0%	13.9%
315210	Cut and Sew Apparel Contractors	61	56	(5)	(8%)	0.0%	9.8%
562920	Materials Recovery Facilities	61	77	16	26%	0.0%	20.6%
721214	Recreational and Vacation Camps (except Campgrounds)	61	61	0	0%	0.0%	31.9%
621391	Offices of Podiatrists	60	70	10	17%	0.0%	11.9%
326191	Plastics Plumbing Fixture Manufacturing	60	57	(3)	(5%)	0.0%	12.3%
312130	Wineries	60	81	21	35%	0.0%	14.0%
541930	Translation and Interpretation Services	60	62	2	3%	0.0%	21.4%
315990	Apparel Accessories and Other Apparel Manufacturing	59	49	(10)	(17%)	0.0%	11.9%
623990	Other Residential Care Facilities	59	59	0	0%	0.0%	5.5%
336510	Railroad Rolling Stock Manufacturing	59	60	1	2%	0.0%	11.6%
813312	Environment, Conservation and Wildlife Organizations	59	73	14	24%	0.0%	15.9%
336330	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing	59	71	12	20%	0.0%	10.4%
561492	Court Reporting and Stenotype Services	58	52	(6)	(10%)	0.0%	29.0%
713120	Amusement Arcades	58	71	13	22%	0.0%	8.9%
335210	Small Electrical Appliance Manufacturing	58	55	(3)	(5%)	0.0%	12.0%
485999	All Other Transit and Ground Passenger Transportation	58	78	20	34%	0.0%	13.5%
541320	Landscape Architectural Services	58	54	(4)	(7%)	0.0%	9.4%
221113	Nuclear Electric Power Generation	58	61	3	5%	0.0%	7.3%
326122	Plastics Pipe and Pipe Fitting Manufacturing	57	40	(17)	(30%)	0.0%	12.2%
812111	Barber Shops	57	73	16	28%	0.0%	5.1%
333999	All Other Miscellaneous General Purpose Machinery Manufacturing	57	39	(18)	(32%)	0.0%	13.1%

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327211	Flat Glass Manufacturing	56	50	(6)	(11%)	0.0%	12.8%
486210	Pipeline Transportation of Natural Gas	55	62	7	13%	0.0%	12.3%
519190	All Other Information Services	54	53	(1)	(2%)	0.0%	19.4%
813311	Human Rights Organizations	54	60	6	11%	0.0%	15.5%
221115	Wind Electric Power Generation	54	59	5	9%	0.0%	22.4%
541360	Geophysical Surveying and Mapping Services	54	80	26	48%	0.0%	9.5%
532220	Formal Wear and Costume Rental	52	43	(9)	(17%)	0.0%	28.6%
212111	Bituminous Coal and Lignite Surface Mining	52	75	23	44%	0.0%	12.4%
561591	Convention and Visitors Bureaus	52	73	21	40%	0.0%	43.3%
512290	Other Sound Recording Industries	52	76	24	46%	0.0%	24.4%
541922	Commercial Photography	51	56	5	10%	0.0%	23.1%
611630	Language Schools	50	54	4	8%	0.0%	13.0%
532420	Office Machinery and Equipment Rental and Leasing	50	35	(15)	(30%)	0.0%	28.1%
424440	Poultry and Poultry Product Merchant Wholesalers	50	67	17	34%	0.0%	25.1%
812310	Coin-Operated Laundries and Drycleaners	50	58	8	16%	0.0%	9.4%
321214	Truss Manufacturing	50	55	5	10%	0.0%	10.8%
541350	Building Inspection Services	50	62	12	24%	0.0%	9.5%
326299	All Other Rubber Product Manufacturing	50	42	(8)	(16%)	0.0%	10.2%
333241	Food Product Machinery Manufacturing	49	53	4	8%	0.0%	11.1%
311930	Flavoring Syrup and Concentrate Manufacturing	49	52	3	6%	0.0%	14.6%
333517	Machine Tool Manufacturing	49	68	19	39%	0.0%	10.9%
325611	Soap and Other Detergent Manufacturing	48	49	1	2%	0.0%	15.7%
562991	Septic Tank and Related Services	48	55	7	15%	0.0%	19.2%
813940	Political Organizations	48	60	12	25%	0.0%	28.7%
333515	Cutting Tool and Machine Tool Accessory Manufacturing	47	53	6	13%	0.0%	10.7%
711410	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	47	41	(6)	(13%)	0.0%	21.7%
311920	Coffee and Tea Manufacturing	47	60	13	28%	0.0%	14.8%
333511	Industrial Mold Manufacturing	46	60	14	30%	0.0%	10.7%
311211	Flour Milling	46	53	7	15%	0.0%	13.1%
332613	Spring Manufacturing	46	51	5	11%	0.0%	12.7%
335929	Other Communication and Energy Wire Manufacturing	45	57	12	27%	0.0%	12.6%

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322212	Folding Paperboard Box Manufacturing	45	37	(8)	(18%)	0.0%	12.9%
519120	Libraries and Archives	45	47	2	4%	0.0%	19.6%
334417	Electronic Connector Manufacturing	45	59	14	31%	0.0%	8.3%
322299	All Other Converted Paper Product Manufacturing	44	50	6	14%	0.0%	11.7%
722514	Cafeterias, Grill Buffets, and Buffets	44	43	(1)	(2%)	0.0%	1.1%
332722	Bolt, Nut, Screw, Rivet, and Washer Manufacturing	44	45	1	2%	0.0%	10.7%
623210	Residential Intellectual and Developmental Disability Facilities	43	50	7	16%	0.0%	1.7%
325991	Custom Compounding of Purchased Resins	43	29	(14)	(33%)	0.0%	14.1%
424510	Grain and Field Bean Merchant Wholesalers	43	53	10	23%	0.0%	32.8%
311824	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	42	35	(7)	(17%)	0.0%	8.5%
321113	Sawmills	42	57	15	36%	0.0%	22.3%
212321	Construction Sand and Gravel Mining	42	32	(10)	(24%)	0.0%	14.3%
336214	Travel Trailer and Camper Manufacturing	42	48	6	14%	0.0%	10.9%
336212	Truck Trailer Manufacturing	42	31	(11)	(26%)	0.0%	11.2%
321999	All Other Miscellaneous Wood Product Manufacturing	41	33	(8)	(20%)	0.0%	14.3%
331110	Iron and Steel Mills and Ferroalloy Manufacturing	41	48	7	17%	0.0%	11.8%
713930	Marinas	41	46	5	12%	0.0%	10.5%
333120	Construction Machinery Manufacturing	41	39	(2)	(5%)	0.0%	11.7%
314994	Rope, Cordage, Twine, Tire Cord, and Tire Fabric Mills	41	46	5	12%	0.0%	12.6%
453930	Manufactured (Mobile) Home Dealers	40	29	(11)	(28%)	0.0%	12.8%
562112	Hazardous Waste Collection	40	47	7	18%	0.0%	21.3%
512191	Teleproduction and Other Postproduction Services	40	33	(7)	(18%)	0.0%	20.1%
335932	Noncurrent-Carrying Wiring Device Manufacturing	40	37	(3)	(8%)	0.0%	13.3%
333618	Other Engine Equipment Manufacturing	40	62	22	55%	0.0%	10.3%
333923	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing	39	53	14	36%	0.0%	12.9%
315280	Other Cut and Sew Apparel Manufacturing	39	38	(1)	(3%)	0.0%	9.4%
331513	Steel Foundries (except Investment)	39	32	(7)	(18%)	0.0%	9.9%
212311	Dimension Stone Mining and Quarrying	39	55	16	41%	0.0%	14.6%
811112	Automotive Exhaust System Repair	38	24	(14)	(37%)	0.0%	22.1%
561613	Armored Car Services	38	41	3	8%	0.0%	2.5%

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333314	Optical Instrument and Lens Manufacturing	38	28	(10)	(26%)	0.0%	12.4%
453920	Art Dealers	38	40	2	5%	0.0%	13.3%
485113	Bus and Other Motor Vehicle Transit Systems	37	47	10	27%	0.0%	9.5%
331222	Steel Wire Drawing	37	50	13	35%	0.0%	12.7%
562998	All Other Miscellaneous Waste Management Services	37	49	12	32%	0.0%	18.3%
115114	Postharvest Crop Activities (except Cotton Ginning)	37	46	9	24%	0.0%	11.5%
334513	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	37	31	(6)	(16%)	0.0%	10.5%
332431	Metal Can Manufacturing	37	39	2	5%	0.0%	10.2%
311225	Fats and Oils Refining and Blending	36	35	(1)	(3%)	0.0%	13.5%
333514	Special Die and Tool, Die Set, Jig, and Fixture Manufacturing	36	38	2	6%	0.0%	10.8%
335991	Carbon and Graphite Product Manufacturing	36	39	3	8%	0.0%	10.7%
524128	Other Direct Insurance (except Life, Health, and Medical) Carriers	36	27	(9)	(25%)	0.0%	15.5%
332420	Metal Tank (Heavy Gauge) Manufacturing	36	30	(6)	(17%)	0.0%	10.2%
621410	Family Planning Centers	36	44	8	22%	0.0%	7.1%
445292	Confectionery and Nut Stores	35	43	8	23%	0.0%	12.2%
332439	Other Metal Container Manufacturing	35	34	(1)	(3%)	0.0%	10.1%
551111	Offices of Bank Holding Companies	35	36	1	3%	0.0%	19.4%
339930	Doll, Toy, and Game Manufacturing	35	41	6	17%	0.0%	14.6%
314910	Textile Bag and Canvas Mills	35	28	(7)	(20%)	0.0%	12.6%
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing	35	33	(2)	(6%)	0.0%	11.5%
335110	Electric Lamp Bulb and Part Manufacturing	35	43	8	23%	0.0%	15.8%
332721	Precision Turned Product Manufacturing	34	38	4	12%	0.0%	10.5%
335311	Power, Distribution, and Specialty Transformer Manufacturing	34	44	10	29%	0.0%	11.5%
333995	Fluid Power Cylinder and Actuator Manufacturing	34	41	7	21%	0.0%	12.8%
337125	Household Furniture (except Wood and Metal) Manufacturing	34	42	8	24%	0.0%	12.8%
336370	Motor Vehicle Metal Stamping	34	49	15	44%	0.0%	10.4%
812113	Nail Salons	34	46	12	35%	0.0%	5.4%

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333921	Elevator and Moving Stairway Manufacturing	33	32	(1)	(3%)	0.0%	12.9%
325910	Printing Ink Manufacturing	33	35	2	6%	0.0%	13.9%
511199	All Other Publishers	33	38	5	15%	0.0%	19.2%
324191	Petroleum Lubricating Oil and Grease Manufacturing	33	35	2	6%	0.0%	11.9%
541420	Industrial Design Services	33	40	7	21%	0.0%	21.2%
522293	International Trade Financing	32	27	(5)	(16%)	0.0%	20.5%
541490	Other Specialized Design Services	32	34	2	6%	0.0%	20.3%
541199	All Other Legal Services	31	36	5	16%	0.0%	8.7%
532292	Recreational Goods Rental	31	35	4	13%	0.0%	29.0%
335121	Residential Electric Lighting Fixture Manufacturing	31	35	4	13%	0.0%	15.5%
334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing	31	19	(12)	(39%)	0.0%	8.2%
523140	Commodity Contracts Brokerage	31	37	6	19%	0.0%	15.0%
485310	Taxi Service	31	26	(5)	(16%)	0.0%	13.0%
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing	30	27	(3)	(10%)	0.0%	11.8%
713290	Other Gambling Industries	30	28	(2)	(7%)	0.0%	5.7%
315220	Men's and Boys' Cut and Sew Apparel Manufacturing	30	29	(1)	(3%)	0.0%	9.7%
332811	Metal Heat Treating	30	29	(1)	(3%)	0.0%	13.3%
454112	Electronic Auctions	30	41	11	37%	0.0%	31.9%
562219	Other Nonhazardous Waste Treatment and Disposal	29	37	8	28%	0.0%	17.0%
334514	Totalizing Fluid Meter and Counting Device Manufacturing	29	41	12	41%	0.0%	10.6%
311119	Other Animal Food Manufacturing	29	28	(1)	(3%)	0.0%	17.2%
339114	Dental Equipment and Supplies Manufacturing	29	40	11	38%	0.0%	12.9%
611410	Business and Secretarial Schools	28	11	(17)	(61%)	0.0%	24.3%
523130	Commodity Contracts Dealing	28	39	11	39%	0.0%	14.5%
311111	Dog and Cat Food Manufacturing	28	36	8	29%	0.0%	16.8%
332913	Plumbing Fixture Fitting and Trim Manufacturing	28	24	(4)	(14%)	0.0%	12.0%
313320	Fabric Coating Mills	27	27	0	0%	0.0%	12.9%
517410	Satellite Telecommunications	27	26	(1)	(4%)	0.0%	26.0%
722330	Mobile Food Services	27	36	9	33%	0.0%	5.2%
115210	Support Activities for Animal Production	27	31	4	15%	0.0%	6.2%

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561611	Investigation Services	27	27	0	0%	0.0%	2.6%
324121	Asphalt Paving Mixture and Block Manufacturing	27	36	9	33%	0.0%	11.8%
327212	Other Pressed and Blown Glass and Glassware Manufacturing	26	22	(4)	(15%)	0.0%	11.7%
424520	Livestock Merchant Wholesalers	26	18	(8)	(31%)	0.0%	27.7%
326112	Plastics Packaging Film and Sheet (including Laminated) Manufacturing	26	36	10	38%	0.0%	12.6%
337211	Wood Office Furniture Manufacturing	25	15	(10)	(40%)	0.0%	11.9%
325992	Photographic Film, Paper, Plate, and Chemical Manufacturing	25	23	(2)	(8%)	0.0%	13.9%
335122	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	25	26	1	4%	0.0%	15.2%
812921	Photofinishing Laboratories (except One-Hour)	25	12	(13)	(52%)	0.0%	9.6%
621491	HMO Medical Centers	24	32	8	33%	0.0%	7.1%
493130	Farm Product Warehousing and Storage	24	27	3	13%	0.0%	42.1%
541340	Drafting Services	23	18	(5)	(22%)	0.0%	9.2%
331492	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)	23	29	6	26%	0.0%	12.2%
611513	Apprenticeship Training	23	26	3	13%	0.0%	21.5%
326121	Unlaminated Plastics Profile Shape Manufacturing	23	22	(1)	(4%)	0.0%	12.3%
312140	Distilleries	23	32	9	39%	0.0%	13.6%
325411	Medicinal and Botanical Manufacturing	23	22	(1)	(4%)	0.0%	11.2%
488320	Marine Cargo Handling	23	31	8	35%	0.0%	47.9%
323117	Books Printing	23	15	(8)	(35%)	0.0%	16.9%
333924	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing	22	24	2	9%	0.0%	12.9%
322121	Paper (except Newsprint) Mills	22	23	1	5%	0.0%	10.0%
326130	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing	22	20	(2)	(9%)	0.0%	12.9%
321211	Hardwood Veneer and Plywood Manufacturing	22	29	7	32%	0.0%	12.4%
316998	All Other Leather Good and Allied Product Manufacturing	21	19	(2)	(10%)	0.0%	9.7%
332111	Iron and Steel Forging	21	21	0	0%	0.0%	10.8%
812191	Diet and Weight Reducing Centers	21	11	(10)	(48%)	0.0%	5.4%

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487110	Scenic and Sightseeing Transportation, Land	21	24	3	14%	0.0%	25.9%
312113	Ice Manufacturing	21	22	1	5%	0.0%	14.7%
442291	Window Treatment Stores	21	22	1	5%	0.0%	17.5%
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	21	24	3	14%	0.0%	13.3%
711120	Dance Companies	20	19	(1)	(5%)	0.0%	15.6%
336611	Ship Building and Repairing	20	24	4	20%	0.0%	11.9%
212312	Crushed and Broken Limestone Mining and Quarrying	20	19	(1)	(5%)	0.0%	14.6%
331524	Aluminum Foundries (except Die-Casting)	20	20	0	0%	0.0%	9.0%
324110	Petroleum Refineries	20	13	(7)	(35%)	0.0%	11.8%
311340	Nonchocolate Confectionery Manufacturing	20	26	6	30%	0.0%	11.6%
327110	Pottery, Ceramics, and Plumbing Fixture Manufacturing	20	22	2	10%	0.0%	14.6%
327410	Lime Manufacturing	19	21	2	11%	0.0%	13.5%
711219	Other Spectator Sports	19	13	(6)	(32%)	0.0%	13.4%
335312	Motor and Generator Manufacturing	19	18	(1)	(5%)	0.0%	11.4%
512240	Sound Recording Studios	19	16	(3)	(16%)	0.0%	23.8%
333993	Packaging Machinery Manufacturing	19	18	(1)	(5%)	0.0%	13.1%
333244	Printing Machinery and Equipment Manufacturing	19	10	(9)	(47%)	0.0%	11.2%
451212	News Dealers and Newsstands	19	27	8	42%	0.0%	9.0%
337124	Metal Household Furniture Manufacturing	19	14	(5)	(26%)	0.0%	13.1%
519110	News Syndicates	19	17	(2)	(11%)	0.0%	20.0%
332994	Small Arms, Ordnance, and Ordnance Accessories Manufacturing	18	25	7	39%	0.0%	11.5%
332996	Fabricated Pipe and Pipe Fitting Manufacturing	18	15	(3)	(17%)	0.0%	11.5%
221320	Sewage Treatment Facilities	18	23	5	28%	0.0%	20.7%
315240	Women's, Girls', and Infants' Cut and Sew Apparel Manufacturing	18	<10	Insf. Data	Insf. Data	0.0%	10.0%
331315	Aluminum Sheet, Plate, and Foil Manufacturing	18	28	10	56%	0.0%	13.3%
562119	Other Waste Collection	18	<10	Insf. Data	Insf. Data	0.0%	22.0%
331511	Iron Foundries	17	14	(3)	(18%)	0.0%	7.9%
448320	Luggage and Leather Goods Stores	17	13	(4)	(24%)	0.0%	7.0%
332410	Power Boiler and Heat Exchanger Manufacturing	16	<10	Insf. Data	Insf. Data	0.0%	10.1%
333994	Industrial Process Furnace and Oven Manufacturing	16	17	1	6%	0.0%	12.9%

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811430	Footwear and Leather Goods Repair	16	17	1	6%	0.0%	19.0%
321992	Prefabricated Wood Building Manufacturing	15	13	(2)	(13%)	0.0%	12.4%
311999	All Other Miscellaneous Food Manufacturing	15	<10	Insf. Data	Insf. Data	0.0%	13.8%
335222	Household Refrigerator and Home Freezer Manufacturing	15	22	7	47%	0.0%	12.2%
339940	Office Supplies (except Paper) Manufacturing	15	<10	Insf. Data	Insf. Data	0.0%	14.9%
712120	Historical Sites	14	13	(1)	(7%)	0.0%	15.1%
333519	Rolling Mill and Other Metalworking Machinery Manufacturing	14	13	(1)	(7%)	0.0%	10.8%
316210	Footwear Manufacturing	14	19	5	36%	0.0%	5.0%
423520	Coal and Other Mineral and Ore Merchant Wholesalers	14	24	10	71%	0.0%	25.9%
327331	Concrete Block and Brick Manufacturing	13	<10	Insf. Data	Insf. Data	0.0%	10.7%
332510	Hardware Manufacturing	13	<10	Insf. Data	Insf. Data	0.0%	11.6%
337214	Office Furniture (except Wood) Manufacturing	13	12	(1)	(8%)	0.0%	12.7%
314110	Carpet and Rug Mills	13	11	(2)	(15%)	0.0%	12.5%
525110	Pension Funds	12	<10	Insf. Data	Insf. Data	0.0%	32.4%
327213	Glass Container Manufacturing	12	17	5	42%	0.0%	11.4%
512120	Motion Picture and Video Distribution	12	<10	Insf. Data	Insf. Data	0.0%	19.4%
332911	Industrial Valve Manufacturing	12	14	2	17%	0.0%	11.8%
327420	Gypsum Product Manufacturing	12	<10	Insf. Data	Insf. Data	0.0%	13.8%
311821	Cookie and Cracker Manufacturing	12	17	5	42%	0.0%	8.6%
311230	Breakfast Cereal Manufacturing	11	18	7	64%	0.0%	12.1%
311423	Dried and Dehydrated Food Manufacturing	11	13	2	18%	0.0%	13.8%
335129	Other Lighting Equipment Manufacturing	11	<10	Insf. Data	Insf. Data	0.0%	15.3%
486910	Pipeline Transportation of Refined Petroleum Products	11	15	4	36%	0.0%	10.9%
325314	Fertilizer (Mixing Only) Manufacturing	11	13	2	18%	0.0%	18.6%
487210	Scenic and Sightseeing Transportation, Water	11	19	8	73%	0.0%	23.9%
532411	Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing	11	13	2	18%	0.0%	28.9%
512199	Other Motion Picture and Video Industries	11	13	2	18%	0.0%	20.8%
486110	Pipeline Transportation of Crude Oil	11	<10	Insf. Data	Insf. Data	0.0%	12.0%
321912	Cut Stock, Resawing Lumber, and Planing	10	10	0	0%	0.0%	11.9%
327992	Ground or Treated Mineral and Earth Manufacturing	10	11	1	10%	0.0%	12.5%

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331512	Steel Investment Foundries	10	<10	Insf. Data	Insf. Data	0.0%	9.5%
325212	Synthetic Rubber Manufacturing	10	11	1	10%	0.0%	10.3%
332919	Other Metal Valve and Pipe Fitting Manufacturing	10	11	1	10%	0.0%	11.5%
336991	Motorcycle, Bicycle, and Parts Manufacturing	10	<10	Insf. Data	Insf. Data	0.0%	14.9%
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	<10	<10	Insf. Data	Insf. Data	0.0%	9.9%
221330	Steam and Air-Conditioning Supply	<10	<10	Insf. Data	Insf. Data	0.0%	25.0%
445220	Fish and Seafood Markets	<10	<10	Insf. Data	Insf. Data	0.0%	13.0%
325193	Ethyl Alcohol Manufacturing	<10	11	Insf. Data	Insf. Data	0.0%	12.5%
325130	Synthetic Dye and Pigment Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	15.2%
333991	Power-Driven Handtool Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	10.0%
711190	Other Performing Arts Companies	<10	<10	Insf. Data	Insf. Data	0.0%	16.7%
334112	Computer Storage Device Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	7.6%
334416	Capacitor, Resistor, Coil, Transformer, and Other Inductor Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	8.9%
333997	Scale and Balance Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	13.3%
325220	Artificial and Synthetic Fibers and Filaments Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	11.1%
335912	Primary Battery Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	14.3%
321114	Wood Preservation	<10	<10	Insf. Data	Insf. Data	0.0%	21.2%
336612	Boat Building	<10	<10	Insf. Data	Insf. Data	0.0%	10.8%
339995	Burial Casket Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	15.8%
339994	Broom, Brush, and Mop Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	13.0%
321213	Engineered Wood Member (except Truss) Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	14.3%
321219	Reconstituted Wood Product Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	10.0%
313230	Nonwoven Fabric Mills	<10	<10	Insf. Data	Insf. Data	0.0%	8.7%
313240	Knit Fabric Mills	<10	0	Insf. Data	Insf. Data	0.0%	0.0%
313310	Textile and Fabric Finishing Mills	<10	<10	Insf. Data	Insf. Data	0.0%	13.8%
339993	Fastener, Button, Needle, and Pin Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	15.4%
339992	Musical Instrument Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	15.0%
902619	All Other Schools and Educational Support Services (State Government)	<10	11	Insf. Data	Insf. Data	0.0%	10.9%

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113110	Timber Tract Operations	<10	<10	Insf. Data	Insf. Data	0.0%	2.4%
903619	All Other Schools and Educational Support Services (Local Government)	<10	<10	Insf. Data	Insf. Data	0.0%	4.0%
113310	Logging	<10	<10	Insf. Data	Insf. Data	0.0%	21.4%
336999	All Other Transportation Equipment Manufacturing	<10	11	Insf. Data	Insf. Data	0.0%	14.3%
316992	Women's Handbag and Purse Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	8.3%
316110	Leather and Hide Tanning and Finishing	<10	<10	Insf. Data	Insf. Data	0.0%	12.5%
336992	Military Armored Vehicle, Tank, and Tank Component Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	13.3%
811411	Home and Garden Equipment Repair and Maintenance	<10	<10	Insf. Data	Insf. Data	0.0%	15.8%
313210	Broadwoven Fabric Mills	<10	<10	Insf. Data	Insf. Data	0.0%	8.6%
721191	Bed-and-Breakfast Inns	<10	<10	Insf. Data	Insf. Data	0.0%	12.5%
721199	All Other Traveler Accommodation	<10	<10	Insf. Data	Insf. Data	0.0%	12.9%
721310	Rooming and Boarding Houses	<10	<10	Insf. Data	Insf. Data	0.0%	9.7%
115112	Soil Preparation, Planting, and Cultivating	<10	10	Insf. Data	Insf. Data	0.0%	11.1%
322291	Sanitary Paper Product Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	11.4%
712190	Nature Parks and Other Similar Institutions	<10	<10	Insf. Data	Insf. Data	0.0%	14.5%
713210	Casinos (except Casino Hotels)	<10	<10	Insf. Data	Insf. Data	0.0%	6.8%
335221	Household Cooking Appliance Manufacturing	<10	10	Insf. Data	Insf. Data	0.0%	11.9%
115111	Cotton Ginning	<10	<10	Insf. Data	Insf. Data	0.0%	12.0%
335911	Storage Battery Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	11.8%
336340	Motor Vehicle Brake System Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	8.3%
322110	Pulp Mills	<10	<10	Insf. Data	Insf. Data	0.0%	8.7%
336350	Motor Vehicle Transmission and Power Train Parts Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	9.8%
313110	Fiber, Yarn, and Thread Mills	<10	<10	Insf. Data	Insf. Data	0.0%	5.3%
336120	Heavy Duty Truck Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	6.7%
325311	Nitrogenous Fertilizer Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	25.0%
312230	Tobacco Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	20.0%
114210	Hunting and Trapping	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%
334517	Irradiation Apparatus Manufacturing	<10	14	Insf. Data	Insf. Data	0.0%	9.5%
483113	Coastal and Great Lakes Freight Transportation	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%
311351	Chocolate and Confectionery Manufacturing from Cacao	<10	0	Insf. Data	Insf. Data	0.0%	0.0%

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	Beans						
332112	Nonferrous Forging	<10	<10	Insf. Data	Insf. Data	0.0%	9.7%
212319	Other Crushed and Broken Stone Mining and Quarrying	<10	<10	Insf. Data	Insf. Data	0.0%	14.3%
331529	Other Nonferrous Metal Foundries (except Die-Casting)	<10	<10	Insf. Data	Insf. Data	0.0%	7.4%
333243	Sawmill, Woodworking, and Paper Machinery Manufacturing	<10	0	Insf. Data	Insf. Data	0.0%	0.0%
512132	Drive-In Motion Picture Theaters	<10	<10	Insf. Data	Insf. Data	0.0%	3.5%
333242	Semiconductor Machinery Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	10.6%
333316	Photographic and Photocopying Equipment Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	16.7%
332114	Custom Roll Forming	<10	<10	Insf. Data	Insf. Data	0.0%	11.1%
331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, and Extruding	<10	<10	Insf. Data	Insf. Data	0.0%	12.0%
212393	Other Chemical and Fertilizer Mineral Mining	<10	<10	Insf. Data	Insf. Data	0.0%	13.9%
311411	Frozen Fruit, Juice, and Vegetable Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	14.3%
311422	Specialty Canning	<10	0	Insf. Data	Insf. Data	0.0%	20.0%
523210	Securities and Commodity Exchanges	<10	<10	Insf. Data	Insf. Data	0.0%	20.0%
332117	Powder Metallurgy Part Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	10.6%
332215	Metal Kitchen Cookware, Utensil, Cutlery, and Flatware (except Precious) Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%
213113	Support Activities for Coal Mining	<10	<10	Insf. Data	Insf. Data	0.0%	12.9%
212313	Crushed and Broken Granite Mining and Quarrying	<10	<10	Insf. Data	Insf. Data	0.0%	16.7%
331314	Secondary Smelting and Alloying of Aluminum	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%
221111	Hydroelectric Power Generation	<10	<10	Insf. Data	Insf. Data	0.0%	13.8%
333111	Farm Machinery and Equipment Manufacturing	<10	14	Insf. Data	Insf. Data	0.0%	11.9%
311520	Ice Cream and Frozen Dessert Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	14.5%
311314	Cane Sugar Manufacturing	<10	0	Insf. Data	Insf. Data	0.0%	12.5%
212291	Uranium-Radium-Vanadium Ore Mining	<10	<10	Insf. Data	Insf. Data	0.0%	8.7%
331410	Nonferrous Metal (except Aluminum) Smelting and Refining	<10	<10	Insf. Data	Insf. Data	0.0%	11.5%
213115	Support Activities for Nonmetallic Minerals (except Fuels) Mining	<10	0	Insf. Data	Insf. Data	0.0%	0.0%
221114	Solar Electric Power Generation	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%

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512220	Integrated Record Production/Distribution	<10	<10	Insf. Data	Insf. Data	0.0%	28.6%
512210	Record Production	<10	<10	Insf. Data	Insf. Data	0.0%	28.6%
332993	Ammunition (except Small Arms) Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	10.0%
512230	Music Publishers	<10	<10	Insf. Data	Insf. Data	0.0%	26.7%
213114	Support Activities for Metal Mining	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%
331523	Nonferrous Metal Die-Casting Foundries	<10	<10	Insf. Data	Insf. Data	0.0%	9.2%
326220	Rubber and Plastics Hoses and Belting Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	10.0%
212399	All Other Nonmetallic Mineral Mining	<10	<10	Insf. Data	Insf. Data	0.0%	18.2%
212325	Clay and Ceramic and Refractory Minerals Mining	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%
525990	Other Financial Vehicles	<10	<10	Insf. Data	Insf. Data	0.0%	16.3%
525910	Open-End Investment Funds	<10	<10	Insf. Data	Insf. Data	0.0%	18.4%
115116	Farm Management Services	<10	<10	Insf. Data	Insf. Data	0.0%	11.1%
483211	Inland Water Freight Transportation	<10	14	Insf. Data	Insf. Data	0.0%	17.8%
333611	Turbine and Turbine Generator Set Units Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	7.1%
483212	Inland Water Passenger Transportation	<10	<10	Insf. Data	Insf. Data	0.0%	25.0%
483112	Deep Sea Passenger Transportation	<10	0	Insf. Data	Insf. Data	0.0%	0.0%
483111	Deep Sea Freight Transportation	<10	<10	Insf. Data	Insf. Data	0.0%	50.0%
325414	Biological Product (except Diagnostic) Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	12.0%
311911	Roasted Nuts and Peanut Butter Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	13.6%
525920	Trusts, Estates, and Agency Accounts	<10	<10	Insf. Data	Insf. Data	0.0%	18.2%
333911	Pump and Pumping Equipment Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	13.5%
311813	Frozen Cakes, Pies, and Other Pastries Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	9.0%
333612	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing	<10	<10	Insf. Data	Insf. Data	0.0%	10.7%
311710	Seafood Product Preparation and Packaging	<10	<10	Insf. Data	Insf. Data	0.0%	16.7%
325613	Surface Active Agent Manufacturing	<10	0	Insf. Data	Insf. Data	0.0%	0.0%
562213	Solid Waste Combustors and Incinerators	<10	12	Insf. Data	Insf. Data	0.0%	16.7%
311613	Rendering and Meat Byproduct Processing	<10	<10	Insf. Data	Insf. Data	0.0%	11.4%
487990	Scenic and Sightseeing Transportation, Other	<10	<10	Insf. Data	Insf. Data	0.0%	50.0%
488111	Air Traffic Control	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%
326212	Tire Retreading	<10	<10	Insf. Data	Insf. Data	0.0%	7.6%
326211	Tire Manufacturing (except Retreading)	<10	<10	Insf. Data	Insf. Data	0.0%	9.7%
486990	All Other Pipeline Transportation	<10	<10	Insf. Data	Insf. Data	0.0%	7.7%

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525120	Health and Welfare Funds	<10	<10	Insf. Data	Insf. Data	0.0%	0.0%
212324	Kaolin and Ball Clay Mining	<10	<10	Insf. Data	Insf. Data	0.0%	14.3%
525190	Other Insurance Funds	<10	0	Insf. Data	Insf. Data	0.0%	35.3%
485112	Commuter Rail Systems	<10	<10	Insf. Data	Insf. Data	0.0%	18.2%
315190	Other Apparel Knitting Mills	0	0	0	0%	0.0%	0.0%
336415	Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing	0	0	0	0%	0.0%	0.0%
114112	Shellfish Fishing	0	0	0	0%	0.0%	0.0%
212299	All Other Metal Ore Mining	0	0	0	0%	0.0%	0.0%
336419	Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing	0	0	0	0%	0.0%	0.0%
212391	Potash, Soda, and Borate Mineral Mining	0	0	0	0%	0.0%	0.0%
212392	Phosphate Rock Mining	0	0	0	0%	0.0%	0.0%
902611	Elementary and Secondary Schools (State Government)	0	0	0	0%	0.0%	0.0%
113210	Forest Nurseries and Gathering of Forest Products	0	0	0	0%	0.0%	0.0%
332992	Small Arms Ammunition Manufacturing	0	0	0	0%	0.0%	0.0%
311512	Creamery Butter Manufacturing	0	0	0	0%	0.0%	0.0%
332991	Ball and Roller Bearing Manufacturing	0	0	0	0%	0.0%	0.0%
812922	One-Hour Photofinishing	0	0	0	0%	0.0%	0.0%
321212	Softwood Veneer and Plywood Manufacturing	0	0	0	0%	0.0%	0.0%
114111	Finfish Fishing	0	0	0	0%	0.0%	0.0%
901200	Federal Government, Military	0	0	0	0%	0.0%	0.0%
336112	Light Truck and Utility Vehicle Manufacturing	0	0	0	0%	0.0%	0.0%
311213	Malt Manufacturing	0	0	0	0%	0.0%	0.0%
488310	Port and Harbor Operations	0	0	0	0%	0.0%	0.0%
334613	Blank Magnetic and Optical Recording Media Manufacturing	0	0	0	0%	0.0%	0.0%
115310	Support Activities for Forestry	0	0	0	0%	0.0%	0.0%
713920	Skiing Facilities	0	0	0	0%	0.0%	0.0%
311221	Wet Corn Milling	0	0	0	0%	0.0%	0.0%
221117	Biomass Electric Power Generation	0	0	0	0%	0.0%	0.0%
488390	Other Support Activities for Water Transportation	0	0	0	0%	0.0%	0.0%
488330	Navigational Services to Shipping	0	0	0	0%	0.0%	0.0%

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221118	Other Electric Power Generation	0	0	0	0%	0.0%	0.0%
324199	All Other Petroleum and Coal Products Manufacturing	0	0	0	0%	0.0%	0.0%
333913	Measuring and Dispensing Pump Manufacturing	0	0	0	0%	0.0%	0.0%
325413	In-Vitro Diagnostic Substance Manufacturing	0	0	0	0%	0.0%	0.0%
315110	Hosiery and Sock Mills	0	0	0	0%	0.0%	0.0%
115113	Crop Harvesting, Primarily by Machine	0	0	0	0%	0.0%	0.0%
325194	Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing	0	<10	Insf. Data	Insf. Data	0.0%	0.0%
333996	Fluid Power Pump and Motor Manufacturing	0	0	0	0%	0.0%	0.0%
311212	Rice Milling	0	<10	Insf. Data	Insf. Data	0.0%	0.0%
485119	Other Urban Transit Systems	0	0	0	0%	0.0%	0.0%
483114	Coastal and Great Lakes Passenger Transportation	0	0	0	0%	0.0%	0.0%
221116	Geothermal Electric Power Generation	0	0	0	0%	0.0%	0.0%
721120	Casino Hotels	0	0	0	0%	0.0%	0.0%
114119	Other Marine Fishing	0	0	0	0%	0.0%	0.0%
322122	Newsprint Mills	0	0	0	0%	0.0%	0.0%
336213	Motor Home Manufacturing	0	0	0	0%	0.0%	0.0%
325312	Phosphatic Fertilizer Manufacturing	0	0	0	0%	0.0%	0.0%
333112	Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing	0	0	0	0%	0.0%	0.0%
331313	Alumina Refining and Primary Aluminum Production	0	0	0	0%	0.0%	0.0%
212234	Copper Ore and Nickel Ore Mining	0	0	0	0%	0.0%	0.0%
313220	Narrow Fabric Mills and Schiffli Machine Embroidery	0	0	0	0%	0.0%	0.0%
311313	Beet Sugar Manufacturing	0	0	0	0%	0.0%	0.0%
212231	Lead Ore and Zinc Ore Mining	0	0	0	0%	0.0%	0.0%
212222	Silver Ore Mining	0	0	0	0%	0.0%	0.0%
335228	Other Major Household Appliance Manufacturing	0	0	0	0%	0.0%	0.0%
335224	Household Laundry Equipment Manufacturing	0	0	0	0%	0.0%	0.0%
212112	Bituminous Coal Underground Mining	0	0	0	0%	0.0%	0.0%
311224	Soybean and Other Oilseed Processing	0	0	0	0%	0.0%	0.0%
511191	Greeting Card Publishers	0	0	0	0%	0.0%	0.0%
212221	Gold Ore Mining	0	0	0	0%	0.0%	0.0%
212210	Iron Ore Mining	0	0	0	0%	0.0%	0.0%

NAICS	Industry	Occupation Group Jobs in Industry (2016)	Occupation Group Jobs in Industry (2022)	Change (2016 - 2022)	% Change (2016 - 2022)	% of Occupation Group in Industry (2016)	% of Total Jobs in Industry (2016)
212113	Anthracite Mining	0	0	0	0%	0.0%	0.0%
336414	Guided Missile and Space Vehicle Manufacturing	0	0	0	0%	0.0%	0.0%

C.vii – Air Transport Top Posted Occupations

Occupation (SOC)	Total Postings (Mar 2016 - Mar 2017)	Unique Postings (Mar 2016 - Mar 2017)
Management Analysts	4,124	745
Computer Systems Analysts	4,532	613
Computer Occupations, All Other	4,375	575
Market Research Analysts and Marketing Specialists	3,107	558
Operations Research Analysts	2,019	445
First-Line Supervisors of Office and Administrative Support Workers	1,666	349
Software Developers, Applications	2,214	332
Customer Service Representatives	1,360	308
Managers, All Other	1,434	289
First-Line Supervisors of Mechanics, Installers, and Repairers	1,091	243
Financial Analysts	1,784	233
Accountants and Auditors	1,455	219
Public Relations Specialists	837	196
Business Operations Specialists, All Other	751	179
Marketing Managers	1,025	178
Training and Development Specialists	803	178
Network and Computer Systems Administrators	1,024	164
Computer User Support Specialists	810	160
Purchasing Managers	808	155
Flight Attendants	1,447	145
Aerospace Engineers	784	137
Production, Planning, and Expediting Clerks	667	132
Aircraft Mechanics and Service Technicians	431	132
First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	494	123
Industrial Engineers	625	122
Web Developers	985	117
Reservation and Transportation Ticket Agents and Travel Clerks	732	116
Computer and Information Systems Managers	619	110
Transportation, Storage, and Distribution Managers	464	107
Stock Clerks and Order Fillers	333	105
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	497	99
First-Line Supervisors of Production and Operating Workers	333	88
Purchasing Agents, Except Wholesale, Retail, and Farm Products	289	86
Airline Pilots, Copilots, and Flight Engineers	440	85
Financial Managers	359	77
Postsecondary Teachers	279	74
Executive Secretaries and Executive Administrative Assistants	341	73
Information Security Analysts	330	72
Logisticians	265	71
General and Operations Managers	277	68
Human Resources Managers	438	63
Instructional Coordinators	234	63
Bookkeeping, Accounting, and Auditing Clerks	372	63
Maids and Housekeeping Cleaners	231	61
Technical Writers	205	57

Occupation (SOC)	Total Postings (Mar 2016 - Mar 2017)	Unique Postings (Mar 2016 - Mar 2017)
Securities, Commodities, and Financial Services Sales Agents	253	50
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	293	50
Human Resources Specialists	201	49
Laborers and Freight, Stock, and Material Movers, Hand	209	49
Maintenance and Repair Workers, General	168	47

C.viii – Air Transport Hard Skills

Skill	Relevance Score	Postings with Skill
Federal Aviation Administration	5.83	669
Revenue Management	1.85	328
Innovation	1.37	3,194
Analysis	0.92	2,442
Microsoft PowerPoint	0.90	1,251
Microsoft Office	0.71	1,335
Microsoft Excel	0.62	1,627
Authorization (Computing)	0.55	343
Communications	0.55	3,389
Management	0.53	5,043
Research	0.48	1,710
Agile Software Development	0.40	634
Methodologies	0.40	627
Economics	0.36	447
Aviation	0.35	276
Operations	0.34	2,511
Maintenance	0.32	1,767
Office Suite	0.32	620
Problem Solving	0.31	1,553
Forecasting	0.31	547
Microsoft Access	0.30	1,062
Testing	0.26	1,522
Presentations	0.26	1,316
Reports	0.25	1,378
Project Management	0.25	681
Computer Sciences	0.25	530
Information Systems	0.22	505
Engineering	0.22	1,292
Written Communication	0.21	1,128
Business Process	0.20	492
Mathematical Optimization	0.20	244
Management Information Systems	0.20	218
Business Requirements	0.18	333
Linguistics	0.18	775
Change Management	0.17	311
Scrum (Software Development)	0.16	277
Administration	0.16	1,455

Skill	Relevance Score	Postings with Skill
Microsoft Outlook	0.16	579
Prioritization	0.16	556
Verbal Communication Skills	0.15	526
Business Administration	0.14	305
Information Security	0.14	1,336
Documentation	0.14	849
SQL (Programming Language)	0.14	437
Financial Analysis	0.13	227
Data Analysis	0.12	419
Application Development	0.12	264
Java (Programming Language)	0.12	418
Confidentiality	0.12	447
Authorization (Medical)	0.11	240

Appendix D – Labor Supply Tables

D.i – Educational Requirements

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017.Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On-The-Job Training
43-4181	Reservation and Transportation Ticket Agents and Travel Clerks	7,404	8546	87%	7,493	7,980	487	6%	9.9%	\$18.49	High school diploma or equivalent	None	Short-term on-the-job training
49-3011	Aircraft Mechanics and Service Technicians	6,975	7,664	91%	7,019	7,923	904	13%	9.3%	\$29.22	Postsecondary nondegree award	None	None
53-2031	Flight Attendants	6,072	6093	100%	6,007	6,741	734	12%	7.9%	\$27.82	High school diploma or equivalent	Less than 5 years	Moderate-term on-the-job training
53-2011	Airline Pilots, Copilots, and Flight Engineers	4,596	4,834	95%	4,385	4,747	362	8%	5.8%	\$72.98	Bachelor's degree	Less than 5 years	Moderate-term on-the-job training
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	3,590	67258	5%	3,665	4,058	393	11%	4.8%	\$11.69	No formal educational credential	None	Short-term on-the-job training
43-5011	Cargo and Freight Agents	2,056	5455	38%	2,137	2,347	210	10%	2.8%	\$21.52	High school diploma or	None	Short-term on-the-job

SOC	Description	Employed in Industry Group (2016 2017.Q2	Total Jobs in Region 2016 (2017. Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
17- 2011	Aerospace Engineers	1,899	2,836	67%	1,892	1,859	(33)	(2%)	2.5%	\$51.22	equivalent Bachelor's degree	None	training None
51- 9061	Inspectors, Testers, Sorters, Samplers, and Weighers	1,803	12839	14%	1,789	1,855	66	4%	2.4%	\$17.69	High school diploma or equivalent	None	Moderate- term on- the-job training
51- 2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	1,553	1610	96%	1,543	1,602	59	4%	2.0%	\$21.68	High school diploma or equivalent	None	Moderate- term on- the-job training
51- 4041	Machinists	1,446	7860	18%	1,442	1,568	126	9%	1.9%	\$17.68	High school diploma or equivalent	None	Long-term on-the-job training
43- 4051	Customer Service Representatives	1,211	84286	1%	1,233	1,372	139	11%	1.6%	\$16.07	High school diploma or equivalent	None	Short-term on-the-job training
43- 1011	First-Line Supervisors of Office and Administrative Support Workers	1,128	39875	3%	1,164	1,272	108	9%	1.5%	\$27.88	High school diploma or equivalent	Less than 5 years	None
43- 5061	Production, Planning, and Expediting Clerks	1,072	10642	10%	1,073	1,139	66	6%	1.4%	\$21.95	High school diploma or equivalent	None	Moderate- term on- the-job training
17- 2112	Industrial Engineers	1,071	5,365	20%	1,067	1,157	90	8%	1.4%	\$44.06	Bachelor's degree	None	None

SOC	Description	Employed in Industry Group (2016 2017.Q2)	Total Jobs in Region 2016 (2017. Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
53- 2012	Commercial Pilots	1,025	1352	76%	1,065	1,447	382	36%	1.4%	\$42.72	High school diploma or equivalent	None	Moderate- term on- the-job training
15- 1133	Software Developers, Systems Software	996	15,206	7%	992	1,008	16	2%	1.3%	\$49.12	Bachelor's degree	None	None
51- 4011	Computer- Controlled Machine Tool Operators, Metal and Plastic	896	3097	29%	893	1,031	138	15%	1.2%	\$18.08	High school diploma or equivalent	None	Moderate- term on- the-job training
17- 2141	Mechanical Engineers	891	5,320	17%	888	1,020	132	15%	1.2%	\$44.67	Bachelor's degree	None	None
13- 1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	807	7,648	11%	803	832	29	4%	1.1%	\$29.81	Bachelor's degree	None	Long-term on-the-job training
49- 2091	Avionics Technicians	758	895	85%	743	845	102	14%	1.0%	\$26.96	Associate's degree	None	None
13- 1081	Logisticians	757	4,233	18%	756	771	15	2%	1.0%	\$34.90	Bachelor's degree	None	None
13- 1199	Business Operations Specialists, All Other	706	20,457	3.45%	708	740	32	5%	0.9%	\$36.90	Bachelor's degree	None	None
11- 1021	General and Operations Managers	692	53,706	1.29%	687	787	100	15%	0.9%	\$55.84	Bachelor's degree	5 years or more	None

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017.Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On-The-Job Training
51-1011	First-Line Supervisors of Production and Operating Workers	691	12954	5%	686	705	19	3%	0.9%	\$28.00	High school diploma or equivalent	Less than 5 years	None
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	686	11333	6%	691	795	104	15%	0.9%	\$31.30	High school diploma or equivalent	Less than 5 years	None
15-1132	Software Developers, Applications	619	21,032	2.94%	618	634	16	3%	0.8%	\$49.19	Bachelor's degree	None	None
15-1121	Computer Systems Analysts	589	23,751	2.48%	590	636	46	8%	0.8%	\$42.71	Bachelor's degree	None	None
51-2092	Team Assemblers	551	21318	3%	549	562	13	2%	0.7%	\$13.30	High school diploma or equivalent	None	Moderate-term on-the-job training
43-5081	Stock Clerks and Order Fillers	549	52034	1%	553	605	52	9%	0.7%	\$11.85	No formal educational credential	None	Short-term on-the-job training
53-6099	Transportation Workers, All Other	524	644	81%	477	626	149	31%	0.6%	\$19.80	High school diploma or equivalent	None	Short-term on-the-job training
49-9071	Maintenance and Repair Workers, General	519	35442	1%	519	573	54	10%	0.7%	\$17.06	High school diploma or equivalent	None	Long-term on-the-job training
43-5071	Shipping, Receiving, and	489	21590	2%	486	511	25	5%	0.6%	\$13.42	High school diploma or	None	Short-term on-the-job

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017.Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On-The-Job Training
	Traffic Clerks										equivalent		training
53-6051	Transportation Inspectors	446	1268	35%	453	499	46	10%	0.6%	\$35.22	High school diploma or equivalent	None	Moderate-term on-the-job training
41-3099	Sales Representatives, Services, All Other	424	33968	1%	437	497	60	14%	0.6%	\$25.36	High school diploma or equivalent	None	Moderate-term on-the-job training
13-2011	Accountants and Auditors	421	39,130	1.08%	421	459	38	9%	0.6%	\$34.95	Bachelor's degree	None	None
39-6011	Baggage Porters and Bellhops	401	802	50%	381	496	115	30%	0.5%	\$9.92	High school diploma or equivalent	None	Short-term on-the-job training
17-2199	Engineers, All Other	387	2,589	15%	386	399	13	3%	0.5%	\$48.14	Bachelor's degree	None	None
17-2072	Electronics Engineers, Except Computer	383	6,244	6%	381	396	15	4%	0.5%	\$48.54	Bachelor's degree	None	None
53-7061	Cleaners of Vehicles and Equipment	377	10061	4%	366	445	79	22%	0.5%	\$10.43	No formal educational credential	None	Short-term on-the-job training
51-9122	Painters, Transportation Equipment	355	1572	23%	342	384	42	12%	0.5%	\$21.08	High school diploma or equivalent	None	Moderate-term on-the-job training
53-6061	Transportation Attendants, Except Flight Attendants	346	610	57%	338	390	52	15%	0.4%	\$10.90	High school diploma or equivalent	None	Short-term on-the-job training
51-	Multiple	336	2874	12%	335	333	(2)	(1%)	0.4%	\$14.48	High school	None	Moderate-

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017. Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
4081	Machine Tool Setters, Operators, and Tenders, Metal and Plastic										diploma or equivalent		term on- the-job training
17- 2071	Electrical Engineers	335	4,168	8%	333	337	4	1%	0.4%	\$44.66	Bachelor's degree	None	None
11- 3071	Transportation, Storage, and Distribution Managers	327	3363		337	383	46	14%	0.4%	\$45.87	High school diploma or equivalent	5 years or more	None
11- 9041	Architectural and Engineering Managers	324	3,272	10%	323	335	12	4%	0.4%	\$66.57	Bachelor's degree	5 years or more	None
43- 6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	310	51931	1%	310	342	32	10%	0.4%	\$16.05	High school diploma or equivalent	None	Short-term on-the-job training
13- 1151	Training and Development Specialists	308	7,827	3.94%	313	336	23	7%	0.4%	\$30.23	Bachelor's degree	Less than 5 years	None
37- 2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	283	50730	1%	278	346	68	24%	0.4%	\$10.08	No formal educational credential	None	Short-term on-the-job training
43- 3031	Bookkeeping, Accounting, and Auditing Clerks	280	40,73 2	1%	280	288	8	3%	0.4%	\$18.89	Some college, no degree	None	Moderate- term on- the-job

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017. Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
													training
13-1071	Human Resources Specialists	279	14,827	1.88%	280	288	8	3%	0.4%	\$29.60	Bachelor's degree	None	None
13-1111	Management Analysts	278	13,324	2.09%	278	288	10	4%	0.4%	\$41.37	Bachelor's degree	Less than 5 years	None
51-4121	Welders, Cutters, Solderers, and Brazers	277	10360	3%	276	285	9	3%	0.4%	\$17.26	High school diploma or equivalent	None	Moderate-term on-the-job training
11-3051	Industrial Production Managers	276	3,433	8%	274	279	5	2%	0.4%	\$47.16	Bachelor's degree	5 years or more	None
51-2022	Electrical and Electronic Equipment Assemblers	271	5987	5%	271	277	6	2%	0.4%	\$12.66	High school diploma or equivalent	None	Moderate-term on-the-job training
13-2051	Financial Analysts	264	8,910	2.96%	265	276	11	4%	0.4%	\$38.55	Bachelor's degree	None	None
17-3021	Aerospace Engineering and Operations Technicians	256	403	64%	257	267	10	4%	0.3%	\$28.08	Associate's degree	None	None
49-9041	Industrial Machinery Mechanics	255	5229	5%	254	294	40	16%	0.3%	\$23.47	High school diploma or equivalent	None	Long-term on-the-job training
43-4199	Information and Record Clerks, All Other	249	3813	7%	260	280	20	8%	0.3%	\$17.41	High school diploma or equivalent	None	Short-term on-the-job training
43-6011	Executive Secretaries and Executive	243	13290	2%	244	238	(6)	(2%)	0.3%	\$27.08	High school diploma or equivalent	Less than 5 years	None

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017. Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
	Administrative Assistants												
49-9043	Maintenance Workers, Machinery	241	2827	9%	231	288	57	25%	0.3%	\$20.05	High school diploma or equivalent	None	Moderate-term on-the-job training
53-1011	Aircraft Cargo Handling Supervisors	240	332	72%	245	270	25	10%	0.3%	\$23.28	High school diploma or equivalent	Less than 5 years	None
53-2022	Airfield Operations Specialists	239	313	76%	234	277	43	18%	0.3%	\$34.48	High school diploma or equivalent	None	Long-term on-the-job training
17-3026	Industrial Engineering Technicians	231	1,601	14%	230	233	3	1%	0.3%	\$33.06	Associate's degree	None	None
17-2131	Materials Engineers	224	843	27%	224	239	15	7%	0.3%	\$46.24	Bachelor's degree	None	None
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	216	1235	17%	215	187	(28)	(13%)	0.3%	\$13.90	High school diploma or equivalent	None	Moderate-term on-the-job training
15-2031	Operations Research Analysts	215	3,565	6%	215	258	43	20%	0.3%	\$39.36	Bachelor's degree	None	None
51-9198	Helpers--Production Workers	215	13440	2%	213	214	1	0%	0.3%	\$10.86	No formal educational credential	None	Short-term on-the-job training

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017.Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On-The-Job Training
15-1142	Network and Computer Systems Administrators	185	12,885	1.44%	187	201	14	7%	0.2%	\$40.12	Bachelor's degree	None	None
53-7051	Industrial Truck and Tractor Operators	177	18043	1%	177	185	8	5%	0.2%	\$13.51	No formal educational credential	None	Short-term on-the-job training
11-9199	Managers, All Other	176	5,817	3.03%	175	190	15	9%	0.2%	\$58.02	Bachelor's degree	Less than 5 years	None
11-3021	Computer and Information Systems Managers	172	7921	2.17%	173	178	5	3%	0.2%	\$68.60	Bachelor's degree	5 years or more	None
43-5032	Dispatchers, Except Police, Fire, and Ambulance	165	5690	3%	168	196	28	17%	0.2%	\$17.61	High school diploma or equivalent	None	Moderate-term on-the-job training
49-9098	Helpers--Installation, Maintenance, and Repair Workers	163	4782	3%	158	185	27	17%	0.2%	\$13.81	High school diploma or equivalent	None	Short-term on-the-job training
15-1143	Computer Network Architects	162	5,430	2.98%	162	171	9	6%	0.2%	\$50.55	Bachelor's degree	5 years or more	None
17-3023	Electrical and Electronics Engineering Technicians	161	4,990	3.23%	159	168	9	6%	0.2%	\$28.01	Associate's degree	None	None
33-9032	Security Guards	158	31359	1%	154	172	18	12%	0.2%	\$11.66	High school diploma or equivalent	None	Short-term on-the-job training

SOC	Description	Employed in Industry Group (2016 2017.Q2	Total Jobs in Region 2016 (2017. Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
11-3011	Administrative Services Managers	157	6181	2.54%	159	176	17	11%	0.2%	\$47.93	Bachelor's degree	Less than 5 years	None
17-3029	Engineering Technicians, Except Drafters, All Other	156	1,803	9%	155	157	2	1%	0.2%	\$26.51	Associate's degree	None	None
13-2099	Financial Specialists, All Other	150	3,121	5%	149	146	(3)	(2%)	0.2%	\$32.31	Bachelor's degree	None	Moderate-term on-the-job training
17-3027	Mechanical Engineering Technicians	149	1,754	8%	149	159	10	7%	0.2%	\$23.85	Associate's degree	None	None
51-4111	Tool and Die Makers	148	689	21%	147	140	(7)	(5%)	0.2%	\$25.30	High school diploma or equivalent	None	Long-term on-the-job training
53-1031	First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	146	6862	2%	145	174	29	20%	0.2%	\$26.17	High school diploma or equivalent	Less than 5 years	None
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	145	4828	3%	144	121	(23)	(16%)	0.2%	\$14.07	High school diploma or equivalent	None	Moderate-term on-the-job training

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017.Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On-The-Job Training
17-3013	Mechanical Drafters	143	1,267	11%	142	133	(9)	(6%)	0.2%	\$28.80	Associate's degree	None	None
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	142	595	24%	142	123	(19)	(13%)	0.2%	\$18.43	High school diploma or equivalent	None	Moderate-term on-the-job training
15-1131	Computer Programmers	141	8,639	1.63%	143	141	(2)	(1%)	0.2%	\$39.49	Bachelor's degree	None	None
11-3031	Financial Managers	140	9985	1.40%	140	147	7	5%	0.2%	\$63.09	Bachelor's degree	5 years or more	None
53-1021	First-Line Supervisors of Helpers, Laborers, and Material Movers, Hand	138	4944	3%	136	163	27	20%	0.2%	\$22.84	High school diploma or equivalent	Less than 5 years	None
15-1151	Computer User Support Specialists	138	23,037	0.60%	139	149	10	7%	0.2%	\$23.48	Some college, no degree	None	None
51-2041	Structural Metal Fabricators and Fitters	133	1818	7%	132	133	1	1%	0.2%	\$15.57	High school diploma or equivalent	None	Moderate-term on-the-job training
41-4012	Sales Representatives , Wholesale and Manufacturing, Except Technical and	131	41543	0%	130	137	7	5%	0.2%	\$28.72	High school diploma or equivalent	None	Moderate-term on-the-job training

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017.Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On-The-Job Training
	Scientific Products												
51-2023	Electromechanical Equipment Assemblers	130	1745	7%	130	126	(4)	(3%)	0.2%	\$13.73	High school diploma or equivalent	None	Moderate-term on-the-job training
51-2031	Engine and Other Machine Assemblers	127	904	14%	127	138	11	9%	0.2%	\$18.61	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	125	562	22%	124	147	23	19%	0.2%	\$25.03	High school diploma or equivalent	None	Long-term on-the-job training
47-2211	Sheet Metal Workers	124	3415	4%	122	131	9	7%	0.2%	\$16.14	High school diploma or equivalent	None	Apprenticeship
11-2022	Sales Managers	120	8302	1.45%	120	130	10	8%	0.2%	\$63.06	Bachelor's degree	Less than 5 years	None
13-1161	Market Research Analysts and Marketing Specialists	119	12147	0.98%	120	134	14	12%	0.2%	\$33.71	Bachelor's degree	None	None
15-1199	Computer Occupations, All Other	117	5,045	2.32%	117	136	19	16%	0.2%	\$47.53	Bachelor's degree	None	None
13-2031	Budget Analysts	115	1,250	9%	116	119	3	3%	0.2%	\$38.84	Bachelor's degree	None	None

SOC	Description	Employed in Industry Group (2016) 2017.Q2	Total Jobs in Region 2016 (2017. Q2)	% of Jobs in Region that are in Aerospace /Aviation	Employed in Industry Group (2016)2	Employed in Industry Group (2026)	Change (2016 - 2026)	% Change (2016 - 2026)	% of Total Jobs in Industry Group (2016)	Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On- The-Job Training
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	113	605	19%	112	95	(17)	(15%)	0.1%	\$20.63	High school diploma or equivalent	None	Moderate-term on-the-job training
13-1041	Compliance Officers	113	6,045	1.87%	112	119	7	6%	0.1%	\$34.06	Bachelor's degree	None	Moderate-term on-the-job training
11-3061	Purchasing Managers	109	1,442	8%	108	111	3	3%	0.1%	\$56.62	Bachelor's degree	5 years or more	None
53-3032	Heavy and Tractor-Trailer Truck Drivers	108	49777	0%	107	132	25	23%	0.1%	\$18.41	Postsecondary nondegree award	None	Short-term on-the-job training
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	106	2225	5%	104	110	6	6%	0.1%	\$25.74	Postsecondary nondegree award	None	Long-term on-the-job training
49-9099	Installation, Maintenance, and Repair Workers, All Other	106	3037	3%	103	120	17	17%	0.1%	\$17.16	High school diploma or equivalent	None	Moderate-term on-the-job training
13-1051	Cost Estimators	103	5,614	1.83%	103	107	4	4%	0.1%	\$29.76	Bachelor's degree	None	None
53-2021	Air Traffic Controllers	95	408	23%	95	115	20	21%	0.1%	\$60.12	Associate's degree	None	Long-term on-the-job

D.ii – CIP Codes and Completions

CIP Code	Program	Regional Completions (2016)	Regional Openings (2016)	Median Hourly Earnings	Regional Jobs (2016)	Regional Jobs (2022)	%Jobs Change (2016-2022)
52.0301	Accounting	2,433	2,780	\$35.32	45,324	51,853	14%
14.0201	Aerospace, Aeronautical and Astronautical/Space Engineering	69	246	\$59.30	6,108	6,164	1%
47.0607	Airframe Mechanics and Aircraft Maintenance Technology/Technician	155	376	\$27.58	10,168	10,622	4%
49.0102	Airline/Commercial/Professional Pilot and Flight Crew	1	228	\$68.54	6,186	6,370	3%
27.0301	Applied Mathematics, General	0	54	\$46.52	754	941	25%
04.0201	Architecture	95	274	\$54.49	5,686	6,290	11%
47.0603	Autobody/Collision and Repair Technology/Technician	138	326	\$20.33	5,676	6,533	15%
47.0609	Avionics Maintenance Technology/Technician	0	70	\$23.21	2,504	2,491	(1%)
14.0501	Bioengineering and Biomedical Engineering	157	163	\$65.31	3,451	3,709	7%
52.0201	Business Administration and Management, General	5,265	6,367	\$47.64	117,741	133,634	13%
52.0101	Business/Commerce, General	1,032	6,016	\$49.73	110,743	125,664	13%
15.1302	CAD/CADD Drafting and/or Design Technology/Technician	0	69	\$24.94	2,655	2,792	5%
14.0701	Chemical Engineering	0	177	\$64.88	3,837	4,096	7%
04.0301	City/Urban, Community and Regional Planning	14	175	\$62.93	3,782	4,068	8%
14.0801	Civil Engineering, General	202	399	\$49.32	8,449	9,120	8%
11.0101	Computer and Information Sciences, General	1,795	3,359	\$44.50	66,529	77,134	16%
14.0901	Computer Engineering, General	171	2,848	\$48.73	54,125	62,701	16%
11.0201	Computer Programming/Programmer, General	109	4,350	\$39.06	89,232	101,762	14%
11.0701	Computer Science	170	5,001	\$41.38	102,203	116,889	14%
11.0901	Computer Systems Networking and Telecommunications	335	3,305	\$34.88	67,544	77,996	15%
15.1301	Drafting and Design Technology/Technician,	108	79	\$24.81	3,049	3,208	5%

CIP Code	Program	Regional Completions (2016)	Regional Openings (2016)	Median Hourly Earnings	Regional Jobs (2016)	Regional Jobs (2022)	%Jobs Change (2016-2022)
	General						
14.1001	Electrical and Electronics Engineering	838	483	\$50.81	13,684	13,920	2%
47.0101	Electrical/Electronics Equipment Installation and Repair, General	0	201	\$17.80	4,375	4,844	11%
52.0801	Finance, General	1,199	2,342	\$40.99	41,283	47,711	16%
52.1001	Human Resources Management/Personnel Administration, General	162	1,569	\$32.03	28,351	31,928	13%
14.3501	Industrial Engineering	201	385	\$51.57	8,638	9,072	5%
47.0303	Industrial Mechanics and Maintenance Technology	0	1,149	\$18.30	21,184	23,868	13%
11.0103	Information Technology	144	3,946	\$46.14	72,959	85,605	17%
52.0203	Logistics, Materials, and Supply Chain Management	178	296	\$38.65	7,596	8,228	8%
48.0501	Machine Tool Technology/Machinist	0	789	\$15.49	22,586	22,449	(1%)
15.0613	Manufacturing Engineering Technology/Technician	11	306	\$40.21	7,269	7,492	3%
14.1801	Materials Engineering	90	511	\$40.27	9,729	10,673	10%
27.0101	Mathematics, General	403	54	\$46.72	749	935	25%
14.1901	Mechanical Engineering	658	733	\$41.34	14,517	15,820	9%
47.0000	Mechanics and Repairers, General	0		Insf. Data	Insf. Data	Insf. Data	Insf. Data
11.0804	Modeling, Virtual Environments and Simulation	0	1,695	\$46.16	30,847	35,441	15%
11.1001	Network and System Administration/Administrator	33	2,970	\$35.42	64,600	73,722	14%
52.0202	Purchasing, Procurement/Acquisitions and Contracts Management	0	398	\$48.40	7,809	8,837	13%
48.0508	Welding Technology/Welder	485	501	\$17.17	10,979	11,509	5%

D.iii – Institutional Completions

Institution	All Certificates	All Degrees	All Completions
The University of Texas at Dallas	320	3,016	3,336
The University of Texas at Arlington	23	2,284	2,307
Tarrant County College District	950	326	1,276
University of North Texas	12	1,129	1,141
Southern Methodist University	0	1,126	1,126
Texas A & M University-Commerce	0	912	912
Texas Woman's University	22	638	660
University of Dallas	169	349	518
Richland College	389	129	518
Texas Christian University	0	505	505
Tarleton State University	0	428	428
Dallas Baptist University	16	395	411
DeVry University-Texas	15	311	326
Eastfield College	208	78	286
Mountain View College	204	73	277
Collin County Community College District	93	172	265
North Lake College	186	77	263
El Centro College	189	48	237
Lincoln College of Technology-Grand Prairie	234	0	234
Brookhaven College	128	73	201
Amberton University	0	174	174
Navarro College	56	93	149
Northwood University-Texas	0	135	135
Cedar Valley College	85	29	114
University of North Texas at Dallas	0	99	99
Aviation Institute of Maintenance-Dallas	72	0	72
Texas Wesleyan University	0	50	50
ITT Technical Institute-Richardson	0	44	44
Remington College-Dallas Campus	0	43	43
Southwestern Assemblies of God University	0	43	43
M T Training Center	40	0	40
ITT Technical Institute-Arlington	0	31	31
Vista College-Online	3	24	27
Argosy University-Dallas	0	21	21
Southwestern Adventist University	0	20	20
ITT Technical Institute-DeSoto	0	18	18
Weatherford College	10	7	17
Brown Mackie College-Dallas	0	16	16
Peloton College	13	0	13
Paul Quinn College	0	10	10
Dallas Christian College	0	10	10
Remington College-Fort Worth Campus	0	8	8
Brightwood College-Arlington	0	6	6
Bakke Graduate University	0	1	1
University of Texas Southwestern Medical Center	0	1	1
	3,437	12,952	16,389

Appendix E – Selected Aerospace and Air Transportation Occupations

Growing aerospace and air transportation occupations go beyond aerospace engineering and aircraft assembly and manufacturing. A few examples are highlighted below.

E.i - Logistics and Supply Chain

Most large aerospace and air transportation companies employ logistics and supply chain managers and analysts. They may also contract out to external firms such as supply chain managers, freight forwarders, and others. Logistics and supply chain management positions occupations are projected to grow within the North Texas aerospace industry and adjacent industries over the next several years, especially as companies move to more turnkey solutions.

Logistician

Logisticians oversee activities including purchasing, shipping and transportation, inventory, warehousing, and delivery. They may even direct the movement of a range of aviation or airport related goods, people, or supplies, from common consumer goods to military supplies.

On the job you will:

- Develop business relationships with aviation suppliers and customers
- Work to understand customers' needs and how to meet them
- Direct the allocation of aviation organization and airport materials, supplies, and finished products
- Design strategies to minimize the cost or time required to move goods
- Review the success of logistical functions and identify areas for improvement
- Present aviation performance data to management
- Propose improvements to aviation and airport management and customers
- Stay current on advances in aviation logistics technology and incorporate new technologies into procedures

Education and Training

Aviation logistics workers can qualify for positions in aviation or aerospace with an associate's degree in business or engineering or by taking courses on logistics. However, as logistics becomes increasingly complex, more companies prefer to hire workers who have at least a bachelor's degree. Many logisticians have a bachelor's or master's degree in business, finance, industrial engineering, or supply chain management.

Source: <http://nctaviationcareers.com/careers/aviation-logistician>

E.ii - Software and Systems Developers, Software Engineers

Large aerospace and air transportation companies expressed an acute need for software and systems developers, software engineers, and computer scientists. These are growing occupations within the aerospace and air transportation industries, especially as companies invest more in technology, innovation and research and development and as industry trends like fly-by-wire and unmanned aircraft gain traction. Software developers and engineers may have the opportunity to work on flight simulation, avionics simulation, and flight control systems.

Sample Job Description: Embedded Software Engineer

Job Duties:

- Design and test of Flight Control System (FCS) and Avionics System with embedded software and complex hardware
- System and software design, requirements management, systems specifications, verification and validation testing, and documentation for system and software requirements in a laboratory or desktop simulation environment
- Perform formal software development through design for requirements and requirements verification with C/C code and MathWorks toolsets
- Develop and update requirements and verification traceability in DOORS
- Conduct software integration and testing on target hardware
- Develop, implement, document, and review Low-Level Test (LLT) and High-Level Test (HLT) software cases and expected results
- Perform LLT and HLT execution on desktop environment and target electronic hardware integrated with real sensors and actuators in a lab environment

Position Requirements:

Bachelor's Degree is required. Major in Computer Engineering, Software Engineering, or Computer Science is preferred. Bachelor's Degree in Physics, Electrical, Aerospace, or Mechanical Engineering will be considered with sufficient software development experience. Master's Degree in the Engineering disciplines mentioned above is preferred. Experience with embedded software development and testing. Minimum 2 years experience. Familiarity with commercial and military qualification and certification of aircraft systems.

Source: https://www.glassdoor.com/job-listing/embedded-software-engineer-cessna-JV_IC1139993_KO0,26_KE27,33.htm?jl=2367288255

E.iii - Technician—maintenance and Repair

Repair and maintenance technicians are growing occupations. Aircraft mechanics and technicians with A&P certificates are in particular demand. Many technicians work with composite materials, are extremely detail oriented, and finish products by hand. Some employers even discussed recruiting nontraditional candidates, such as cake decorators, artists and others who are detail-oriented and have good hand-eye coordination for these roles.

Sample Job Description: Blade Technician

Perform fabrication, repair and/or modification of aircraft rotor blades working from three-dimensional blueprints, sketches, diagrams and other similar documents or sources. Weigh, measure and mix resins, coloring agents and catalyst in accordance with established formulas. Layout and cut fabrics using cutting patterns or scale. Apply compound on form manually and position fabric on compound. Use squeeze tool to remove air pockets and lumps to shape and obtain a smooth surface. Apply additional layers of compound and fabrics to build up required number of layers. Sand contoured surfaces to finish molded accessories using handtools and select other abrasive tools according to operation and dimensions specified. Visually and tactually inspect surfaces for flaws and smoothness.

Duties: Perform assembly, installation, repair or replacement of aircraft electrical/electronic components and systems in the manufacture, maintenance or refurbishing of aircraft. Perform inspection, functional and operational check of complete systems to verify proper functioning of components and systems.

1. Maintain close working relationship with assigned lead regarding schedules, priorities, availability of parts, supplies and tools.
2. Use various hand tools, power equipment, measuring devices, test equipment, and paint equipment and instructions as required.
3. Ensure compliance with company and customer specifications and FAA regulations as required.
4. Complete forms and records pertaining to completion of assigned work.
5. Maintain responsibility to keep scrap at minimum levels.
6. This position description is not intended to be all-inclusive and employee will also perform other tasks as assigned.

Qualifications: Education HS diploma or equivalent. Some trade school desirable. An A & P license is desired. Experience Minimum of four years related experience (Blades repair); some experience may be substituted for education normally acquired in the attainment of an A&P.

Source: <http://www.careerbuilder.com/job/J3L32V74ZBSYNVNL330>

E.iv - Electro-mechanical Technician

Electro-mechanical technician is a small but growing occupation within aerospace, air transportation and other relevant industries such as Semiconductor and Related Device Manufacturing; Engineering Services; Support Activities for Oil and Gas Operations; and Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing.

Electro-mechanical technicians operate, test, maintain, or calibrate unmanned, automated, servo-mechanical, or electromechanical equipment, including drones or unmanned aircraft. They may also assist engineers in testing and designing robotics or drone equipment.

Sample Job Description: Operations Technician

The Special Programs Operations Technician primarily functions as a mechanic on manned and/or unmanned aircraft. Position is capable of executing all maintenance actions to support on-time delivery of service to our customer.

Duties and Responsibilities

- Completes aircraft and engine maintenance as required or needed
- Follows established and normal aviation safety procedures and processes
- Maintains complete and accurate maintenance records
- Conducts scheduled inspections and completes follow-up as required
- Inspects engines, landing gear, instruments, brakes, valves, air conditioning, pumps, pressurized sections, and other aircraft related systems.
- Completes necessary maintenance and repairs/replacements on the aircraft, its subsystem and components with established aviation safety procedures and processes.
- Repairs sheet metal or composite surfaces and assemblies
- Checks for corrosion, distortion and cracks in the fuselage, wing, tail and other subassemblies with applicable instructions and directives
- Interprets technical data from blue prints and engineering specifications.

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Sample Job Description: Operations Technician - Continued

Qualifications

- High School Diploma or better
- Five to ten years' experience performing work as a FAA Certified Mechanic
- Medium or Class 3 UAV maintenance experience
- Possesses an Aircraft Inspector (IA) certificate
- Experience on DoD/fixed wing manned/unmanned aircraft
- Experience with Rotax engines
- Ability to obtain and maintain a DoD security clearance
- Ability to obtain and FAA Class III physical
- FAA issued Mechanic certificate with Airframe and Power Plant ratings
- Ability to work in a team environment
- Ability to read engineering drawings
- FAA repair station experience required and Quality Assurance experience preferred
- Knowledge of manual necessary to perform job
- Skilled using basic hand tools, operate ground support equipment, troubleshoot engine electrical/electronic systems and measuring using a variety of basic and precision measuring devices related to the job
- Ability to work under austere working conditions and in harsh environments

Source:<https://workforcenow.adp.com/jobs/apply/posting.html?client=4214&jobId=53484&source=IN>