



**NORTH TEXAS AEROSPACE
AND AVIATION TALENT PIPELINE STUDY**

EXECUTIVE SUMMARY



ACKNOWLEDGEMENTS

DALLAS FORT-WORTH REGIONAL AEROSPACE CONSORTIUM

The DFW Regional Aerospace Consortium would like to thank our members and partners:

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Airbus Helicopter

AllianceTexas - A Development of Hillwood

Arlington Chamber of Commerce

Bell Helicopter

Community Learning Center (CLC)

Co-Operative Industries Aerospace

C&S Propeller

**CTE Directors' Advisory Committee
representing 19 school districts**

GDC Technics

Elbit Systems of America

Fort Worth Chamber of Commerce

GE Manufacturing Solutions

Lockheed Martin Corporation

North Central Texas Council of Governments

Sagem Avionics

Sikorsky, A Lockheed Martin Company

Tarrant County College

Texas Manufacturing Assistance Center

Triumph Aerostructures – Vought Aircraft Division

Turbomeca, USA

University of Texas at Arlington

Wesco Air

Workforce Solutions for Tarrant County

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Loh-Sze Leung of Leung Consulting in Dallas, Texas authored this report. Leung Consulting provides a range of program development, research, and strategic planning services to philanthropic and nonprofit organizations across the country with a particular focus on workforce development and related issues.

This report relied heavily on the insights and feedback of local stakeholders. The author would like to express her appreciation to the employers, educators, community-based organizations, policymakers, researchers and practitioners in North Texas who informed the report and its findings.

The author and the Consortium would especially like to thank the leadership group of Tom Harris, Laura Hopkins, Brian Dalton, Jon Gustafson, Tricia Hiros, Brian Moeller, Betty Harvey, Judy McDonald, Jill Navarrete and Renee Parker for their insight, support and feedback.

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This document is the executive summary of a larger report, the 2017 North Texas Aerospace and Aviation Talent Pipeline Study, which can be accessed at <http://workforcesolutions.net/>



INTRODUCTION

Aerospace manufacturing 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 and have a significant impact on the local economy.ⁱ

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 new workers, as well as to upskill the current workforce.



(Images: FLYBY DFW Mobile App)

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 Council in North Texas convened by the region's workforce boards. ⁱⁱ





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;
- 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.

The full report, which can be accessed at www.workforcesolutions.net, draws from labor market information, education data, and interviews with industry leaders, educators and workforce professionals. It 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. The report also examines labor market supply for these industries in the region, including data on 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 workforce gaps.

The report concludes with a set of recommendations for stakeholders that builds on the foundation of work that has already been done to strengthen and support the workforce pipeline for the aerospace and air transportation industries in North Texas.

KEY FINDINGS

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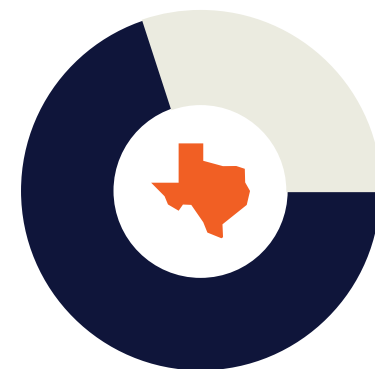
AEROSPACE INDUSTRY EMPLOYMENT AND JOB OPENINGS

- The aerospace industry employed 29,941 in North Texas in 2016. Nearly 7 in 10 jobs in the aerospace sector statewide are here North Texas. ⁱⁱⁱ
- Aerospace companies posted a total of 12,932 jobs in North Texas from March 2016-March 2017. ^{iv}
- The actual number of job openings in some occupations may exceed the number of job postings, as companies may hire for these positions primarily through word of mouth and referral, especially in operations, maintenance, and assembly.
- While the North Texas aerospace industry has experienced significant fluctuations over the last 5 years, employment in the industry has stabilized from 2014-16, and employers anticipate adding to their local workforce over the next 3-5 years.

29,941
AEROSPACE
EMPLOYEES IN
North Texas in 2016



12,932
AEROSPACE
JOBS POSTED IN
North Texas from
March 2016 - March 2017



7 in 10
AEROSPACE JOBS
are located in North Texas

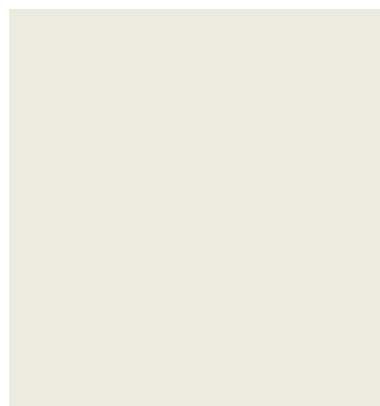
(Source: Emsi 2017.2)



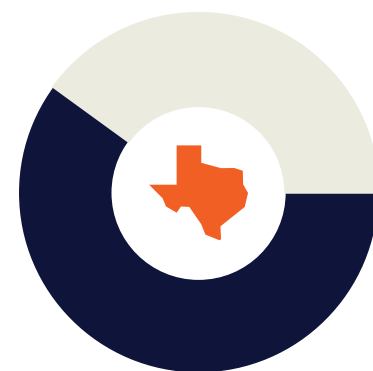
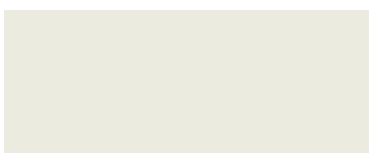
AIR TRANSPORTATION INDUSTRY EMPLOYMENT AND JOB OPENINGS

- The air transportation industry employed 45,712 in North Texas in 2016. Nearly 6 in 10 jobs in the air transportation sector statewide are here in North Texas. ^v
- Air transportation companies posted 10,510 jobs ^{vi} from March 2016 to March 2017. ^{vii}
- The actual number of openings may exceed the number posted. Openings for flight attendants and airline pilots are generally posted once, usually on an airline website, but generate many hires per posting. Mechanic, technician and maintenance jobs are often hired through word of mouth.
- The air transportation industry in North Texas experienced large employment declines both post-9/11 and during the Great Recession, but the industry has seen significant increases in employment from 2014-16 and is expected to continue growing over the next 3-5 years.

45,712
AIR TRANSPORTATION
EMPLOYEES IN
North Texas in 2016



10,510
AIR TRANSPORTATION
JOBS POSTED IN
North Texas from
March 2016 - March 2017



6 in 10
AIR TRANSPORTATION
JOBS
are located in North Texas

(Source: Emsi 2017.2)



AEROSPACE MANUFACTURING INDUSTRY TRENDS

- Aerospace companies are investing in increased automation, additive manufacturing, and advanced materials and sensors. This includes increased use of composites and 3-D printing in the manufacturing process.
- Flight control systems are evolving from analog to digital.
- Demand for unmanned aerial systems (UAS) is increasing, and the DFW region is a center for this type of growth. To support unmanned flight, manufacturers have gone beyond wired flight controls and are increasingly integrating using external, wireless remote controls.
- Aerospace companies are moving toward turnkey solutions that integrate design engineering, process development, supply chain management, manufacturing, installation, training and support.
- Aerospace companies are growing regional repair and sustainment operations.

AIR TRANSPORTATION INDUSTRY TRENDS

- Demand for air travel increased by 6.3 percent in 2016, the sixth consecutive year above five percent, far exceeding global economic growth expectations, and causing heightened demand for aircraft, engine, and parts manufacturing. ^{viii}
- Along with the major commercial airlines headquartered in the region, corporate aviation is a driver of growth in the air transportation sector in North Texas.
- Digital technologies are increasingly important in air transportation sales and marketing as well as in operations.
- As of February 2017, the state of Texas is second only to California in terms of the number of drone operators registered with the FAA. ^{ix}
- The DFW area has been identified by Uber as the planned pilot site for the 2020 launch of on-demand air transportation using electric vertical takeoff and landing (e-VTOL) aircraft. ^x

AEROSPACE AND AIR TRANSPORTATION WORKFORCE DEMAND

Manufacturing jobs are growing and changing due to new projects, new techniques, and new materials.

- 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. ^{xi} This amounts to 6% growth in regional sector employment without accounting for the impact on suppliers and related businesses.
- The use of composites and 3-D printing changes the mix of manufacturing skills required and increases the need for technicians trained in adhesive and bonding materials, repairing and maintaining composites, and techniques for testing these materials.
- The move to turnkey solutions demands employees with more advanced and additive manufacturing skills.
- Increased sustainment and maintenance operations in aerospace create demand for workers with high-end custom design, manufacturing and repair skills rather than "drill and fill" assembly.

Technology skills are in demand due to improvements and increased utilization of technology in manufacturing, operations, maintenance and repair and marketing/sales.

- Growth occupations include systems software developers, application developers, computer systems analysts, robotics, electrical engineering and data management and analytics.
- Demand will continue to grow as a result of greater utilization of drones and other UAS.



Four of the top ten "opportunity occupations" in DFW, as identified by the Federal Reserve Bank ^{xii}, have significant employment in the aerospace and/or air transportation sectors.

- Air transportation occupations include reservation and transportation ticket agents and travel clerks and avionics technicians.
- Aerospace occupations include adhesive bonding machine operators and tenders and aerospace operations and engineering technicians.

Air transportation jobs will grow as air traffic increases across commercial, corporate and on-demand parts of the sector.

- Growth occupations include pilots, mechanics and technicians as well as ground crew.
- The development and launch of e-VTOLs will increase demand for operators and technicians with the skills to fly and service these vehicles.

EXAMPLES OF GROWING, HARD TO HIRE OCCUPATIONS

Description	Employed in Aerospace or Air Transportation in 2016	Average Annual Openings, 2016-2022
Aircraft Mechanics and Service Technicians	6,975	267
Airline Pilots	4596	153
Commercial Pilots	1025	56
Software Developers, Systems Software	996	566
Computer-Controlled Machine Tool Operators, Metal and Plastic	896	143
Logisticians	757	105
Software Developers, Applications	619	1,024
Computer Systems Analysts	589	1,070
Electrical Engineers	335	131
Adhesive Bonding Machine Operators and Tenders	99	16
TOTALS	16,788	3,515

(Source: Emsi 2017.2)

EXAMPLES OF GROWING, BUT NOT AS HARD TO HIRE OCCUPATIONS

Description	Employed in Aerospace or Air Transportation in 2016	Average Annual Openings, 2016-2022
Inspectors, Testers, Sorters, and Weighers	1,803	418
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	1,553	435
Machinists	1,446	325
Mechanical Engineers	891	226
Avionics Technicians	758	27
TOTALS	13,426	1,698

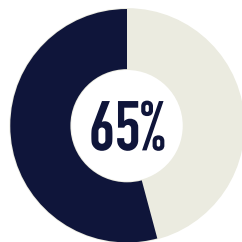
(Source: Emsi 2017.2)



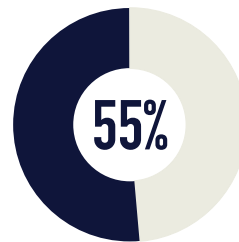
LABOR SUPPLY

AEROSPACE AND AIR TRANSPORTATION LABOR SUPPLY

EMPLOYEES AGE 45 AND OLDER

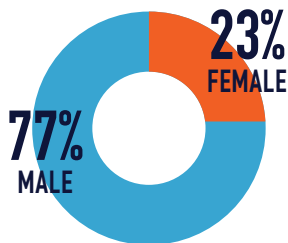


AEROSPACE

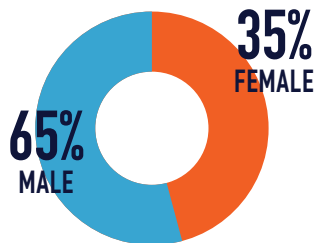


AIR TRANSPORTATION

CURRENT WORKFORCE GENDER

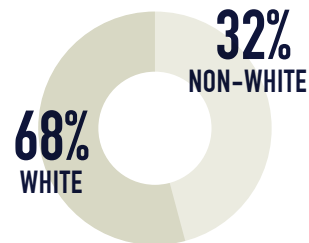


AEROSPACE

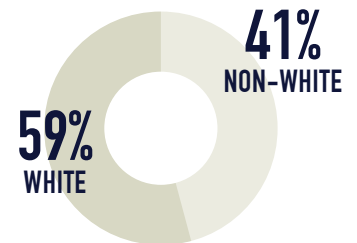


AIR TRANSPORTATION

CURRENT WORKFORCE ETHNICITY



AEROSPACE



AIR TRANSPORTATION

(Source: Emsi 2017.2)

Key Concerns

Aging workforce and retirements

- 65% of aerospace industry employees are 45 or older.
- 55% of air transportation employees are 45 or older.
- 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.

Current workforce and talent pipeline does not reflect the diversity of our region

- 77% of employees in the aerospace industry are male, and 68% are white.
- 65% of employees in the air transportation industry are male, and 59% are white.
- Employers understand the value of and want to expand the number of women and under-represented populations in their workforces.



Small number of K-12 students in relevant CTE courses

- For the 402,500 high school students in Regions 10 and 11, there were about 85,000 enrollments in all Information Technology; Manufacturing; Transportation, Distribution and Logistics (TDL); or Science, Technology, Engineering and Math (STEM) courses combined. ^{xiv}
- Across both regions, there were 768 enrollments in the Project Lead the Way ^{xv} aerospace engineering course; 202 enrollments in Aircraft Technology; and 35 enrollments in Advanced Aircraft Technology.

The number of graduates from key technical programs is insufficient to meet industry demand for these workers.

- Technical programs are not generating enough graduates to meet demand for commercial and airline pilots; adhesive bonding machine operators and tenders; aircraft assemblers; aircraft mechanics and service technicians, particularly programs that prepare candidates for A&P certification; and machinists, including CNC machinists.
- The number of graduates from software developer, applications developer and computer network/software systems programs is insufficient to meet employer demand for these positions.

Both employers and job seekers could benefit from more organized and greater numbers of internships, apprenticeships and other work experience programs

- Employers prefer to hire individuals with work experience.
- There is broad agreement among educators, workforce training providers and employers about the importance of providing opportunities for students to gain real-world, hands-on experience, and the need for more such programs.
- While some large employers offer structured, formal internship programs, many others operate on an ad hoc basis and rely on individual relationships with particular education institutions, between an instructor and specific supervisors or departments for implementation.

Key Assets

Leading post-secondary programs are offering and developing in-demand aerospace and air transportation degrees and certificates

- In 2016, North Texas post-secondary institutions awarded more than 5,000 non-business degrees in the 31 programs related to aerospace and aviation technical occupations. *xvi*
- Many of these institutions have or are planning to launch specific programs designed to meet the needs of the aerospace and aviation industries.

A number of school districts in the region have high school aviation programs and partner with local employers to offer work experience and internships.

- The ISDs with the greatest numbers of students enrolled in aviation programs are Dallas, Fort Worth, Irving, McKinney and Desoto ISDs. *xvii*

Employers are engaged with community-based programs as well as the post-secondary and K-12 systems to design and support education and training programs.

- Employers including Lockheed Martin, Bell Helicopter, Airbus, Safran and others offer internships, participate in Project Lead the Way (PLTW) and PLTW Coding Day; inform high school aviation and manufacturing programs; and sponsor the Robotics Education and Competition, among other activities.
- The DFW Regional Aerospace Consortium is 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.
- Local employers worked closely with the Community Learning Center (CLC) in Fort Worth, a community-based organization and technical school certified by the State of Texas, to design the Manufacturing and Aircraft Assembly Training Program (MAAT), which trains jobseekers to work with composites, advanced bonding, and aircraft assembly.

Key employers are leading efforts to address succession, diversity and talent pipeline challenges.

- Lockheed Martin, Elbit Systems, American Airlines and Southwest Airlines, and others have active programs in place to identify, recruit for and skill-up diverse employees to fill their talent pipelines.

SELECT POST-SECONDARY AND COMMUNITY-BASED AEROSPACE AND AVIATION PROGRAMS IN NORTH TEXAS

Institution	Specialized Offerings for Aerospace and Aviation
Community Learning Center (CLC)	Advanced Material Repair (AMR); aircraft assembly, composite bonding, MSSC Certified Logistics Associate and Technician, MSSC Certified Production Technician, Manufacturing & Aerospace Assembly Training Program (MAAT)
Dallas County Community College District (DCCCD)	Logistics, materials and supply chain management, welding, Computer systems networking, autobody collision and repair. Exploring partnerships to start aerospace engineering technician and maintenance programs for the 2018-19 academic year
Tarrant County College (TCC) – Erma C. Johnson Hadley Northwest Center of Excellence for Aviation, Transportation and Logistics	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. Launched new non-credit NDI/NDT program in the fall of 2017 as well as a Part 142 simulator maintenance technician program.
Tarrant County College Opportunity Center (TCC)	Next Generation Aerospace Manufacturing Training program
Texas State Technical College (TSTC) - Waco	Aviation maintenance, pilot training, aircraft dispatch, avionics, industrial maintenance, logistics, welding, and electrical maintenance.
University of North Texas (UNT)	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
University of Texas-Arlington (UTA)	Aerospace Engineering ^{xvii} , industrial engineering, mechanical engineering
University of Texas-Dallas (UTD)	Systems Engineering and Management, particularly at the graduate level; software engineering; computer science



SUPPLY, DEMAND AND GAP ANALYSIS

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 near-term workforce gaps and/or tight labor supply.

However, given the expected future growth and aging workforce in the aerospace and air transportation sectors, as well as the gender and racial/ethnic demographics of the sector, compared with the demographics of the region, companies cannot be complacent about labor supply. Companies need to plan for coming waves of retirements and build a longer-term talent pipeline that can 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 in all occupations.

New graduate supply does not meet employer demand for occupations like avionics technicians, aircraft mechanics, airline pilots, commercial pilots, aerospace engineers, CNC machinists, adhesive bonding machine operators and tenders, and computer application developers. In these cases, the majority of labor supply is currently coming from churn in existing workers or Unemployment Insurance (UI) applicants who may or may not be currently available for work and may not have the right skills for open positions.

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. The number of new graduates in these fields is insufficient to meet regional demand overall. Aerospace and aviation employers need to aggressively market their positions to IT graduates and collaborate with employers in other industries to increase the number of completions in these programs.



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.

Read the recommendations below to see how **YOU** can get involved!

AIR TRANSPORTATION AND AEROSPACE COMPANIES

- 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) Participate in and support industry outreach efforts, such as the North Central Texas Council of Governments (NCTCOG) aviation and aerospace speakers bureau, which increase the visibility of industry opportunities and trends.
- 3) Increase investments in incumbent worker training and succession planning.
- 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 support high quality CTE programs 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.

EDUCATORS, WORKFORCE AND COMMUNITY ORGANIZATIONS

- 1) Utilize the 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.

STUDENTS AND PARENTS

- 1) Explore careers and educational opportunities in aviation and aerospace on the NCTCOG's Aviation Careers website.
- 2) Download the DFW Regional Aerospace Consortium's FLYBY DFW gaming app. ^{xix}
- 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>).

More detail on these and other recommendations can be found in the full report (www.workforcesolutions.net).

CONCLUSION

The aerospace and aviation sectors in North Texas contribute 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 and innovation both in the manufacturing process and in the operation of manned and unmanned 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.

For more information, contact the DFW Regional Aerospace Consortium:

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Phone: **817.413.4473**

Endnotes

- i* Emsi 2017.2
- ii* WFS Tarrant County, WFS Dallas; WFS North Central Texas
- iii* Emsi 2017.2
- iv* Emsi 2017.2. Job postings are released by companies hoping to attract applicants. Postings are voluntary and therefore only represent the jobs that employers choose to advertise online. This results in certain jobs being overrepresented by job postings in relation to the actual number of positions available, while other jobs are underrepresented.
- v* Emsi 2017.2
- vi* Emsi 2017.2
- vii* See note above on job posting data.
- viii* "Aerospace Manufacturing Attractiveness Rankings," PWC, August 2017.
- ix* "Number of drone registered with FAA, State/County maps," Learning RC, May 2017. Accessed on September 29, 2017 at <http://learningrc.com/number-of-drones/>; "FAA Releases Drone Registration location Data," Federal Aviation Administration, July 2016. Accessed on September 29, 2017 at <https://www.faa.gov/news/updates/?newsId=85548>.
- x* "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>.
- xi* "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>
- xii* According to the Federal Reserve Bank, "opportunity occupations" are jobs that have not generally required a four-year college degree and that pay at least the national annual median wage (around \$35,500 in 2014), adjusted for cost of living differences.
- xiii* According to interviewees, those with A&P certificates are in particularly high demand.
- xiv* Texas Education Agency Enrollment Data for Region 10 and 11. Accessed September 29, 2017 at https://rptsvr1.tea.texas.gov/adhocrpt/Standard_Reports.html
- xv* 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.
- xvi* Emsi 2017.2
- xvii* Author interview with Ernest Huffman, NCTCOG, April 2017.
- xviii* Emsi 2017.2. All regional completions in aerospace engineering in 2015 were from UT-Arlington.
- xix* FLYBY DFW is available at no cost on iTunes and GooglePlay.

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

COMMUNITY LEARNING CENTER

Sam Dekich

Angela Traiforos

COOPERATIVE INDUSTRIES

Dottie Muldowney

DALLAS COUNTY COMMUNITY COLLEGE DISTRICT

Roy L. Bond

Ben Magill

Tim Samuels

Joyce Williams

ELBIT SYSTEMS

Alicia Cooper

Teresa Pallas

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LOCKHEED MARTIN

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Ernest Huffman

ORBITAL ATK

Michael Ogle

PRATT WHITNEY

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Kady Donaghey, Crowley ISD

Annette Duvall, Crowley ISD

Suzanne Murr, Azle ISD

Susan Patterson, Arlington ISD

Mary Smith, Aledo ISD

Allison Vinson, Birdville ISD

SAGEM AVIONICS

Tarese Jackson

SIKORSKY

Kumi Wright

SOUTHWEST AIRLINES

Rodney Blake

TARRANT COUNTY COLLEGE DISTRICT

Darrell Erby

Clint Grant

Keva Montrose

TEXAS JET

Reed Pigman

TEXAS MANUFACTURING ASSISTANCE CONSORTIUM

Frank Groenteman

TEXAS STATE TECHNICAL COLLEGE

Marcus Balch

Steve Pape

V. Carson Pearce

TRIUMPH AIR SYSTEMS

Bill McDonough

Norm Porter

UNIVERSITY OF NORTH TEXAS

Steve Joiner

UNIVERSITY OF TEXAS – DALLAS

Rajiv Shah

Steve Yurkovich

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