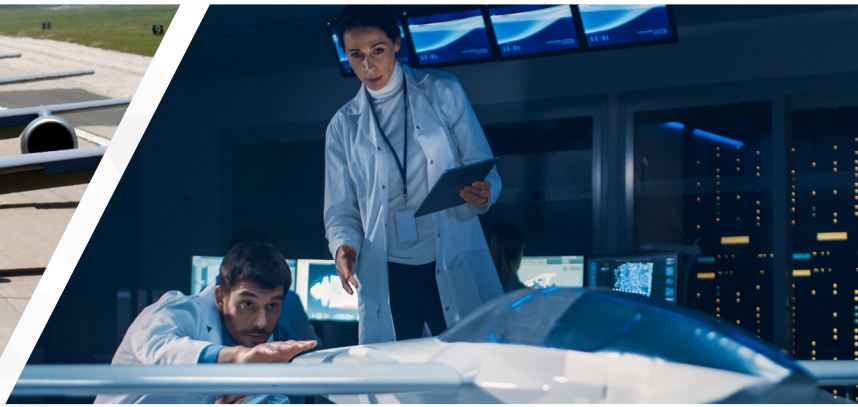


GREATER OKLAHOMA CITY
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GREATER OKLAHOMA CITY REGION AEROSPACE INDUSTRY

Industry Survey and Economic Impact Assessment
2020

Greater Oklahoma City Region Aerospace Industry

**Industry Survey and Economic Impact Assessment
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Contents

I.	INTRODUCTION AND SUMMARY	1
II.	SCOPE OF RESEARCH.....	5
III.	OKC REGION AEROSPACE INDUSTRY PROFILE	11
IV.	OKC REGION AEROSPACE EMPLOYERS AND WORKFORCE.....	15
V.	GREATER OKC AREA AEROSPACE OCCUPATION PROFILE.....	28
VI.	STATE-LEVEL AEROSPACE MARKETS	33
VII.	AEROSPACE ECONOMIC DEVELOPMENT POLICY.....	47
VIII.	FEDERAL PROCUREMENT IN OKLAHOMA AEROSPACE	52
IX.	ECONOMIC IMPACT OF AEROSPACE	61
X.	ENDNOTES	66

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Figures

Figure 1. Industry Classifications for Greater OKC Region Aerospace Profile.....	7
Figure 2. Greater Oklahoma City Region Aerospace Industry Profile (2020).....	11
Figure 3. Greater Oklahoma City Region Aerospace Detailed Industry Profile (2020)	12
Figure 4. Greater OKC Region Aerospace Sector Growth (2015 to 2020).....	13
Figure 5. Greater OKC Region Aerospace Industry by County (2020)	14
Figure 6. 25 Largest Greater OKC Region Aerospace Employers	15
Figure 7. Air Force Permanent Civilian Jobs by Occupation & High Demand – Tinker AFB.....	21
Figure 8. Permanent Civilian Jobs – FAA Center	23
Figure 9. Rankings of Key Aerospace Industry Employment by Occupation & State (2019).....	28
Figure 10. Average Annual Earnings by Aerospace-Related Occupation by State (2019)	29
Figure 11. Labor Force Key Aerospace Sector Occupations – Greater OKC Region	31
Figure 11. (Cont.) Labor Force in Key Aerospace Occupations – Greater OKC Region	32
Figure 12. Core Private Aerospace Industry Sectors by State (2019).....	35
Figure 13. State Rankings of Core Private Aerospace Industry Activity (2019)	36
Figure 14. U.S. & Oklahoma Core Private Aerospace Sectors (2000-2019).....	39
Figure 15. Public Sector Aerospace Employment by State (FY2020).....	41
Figure 16. Core Private and Public Sector Aerospace Employment.....	45
Figure 17. Oklahoma Engineer Workforce Tax Credit	47
Figure 18. Federal Procurement in Oklahoma by Major Department (FY2019).....	53
Figure 19. Federal Procurement by Agency in Greater OKC Region (FY2005-FY2019)	54
Figure 20. Oklahoma Procurement from Key Aerospace-Related Agencies	55
Figure 21. Federal Procurement for Key Aerospace-Related Agencies by State (FY2019).....	56
Figure 22. Oklahoma Aerospace-Specific Federal Procurement (FY2019)	57
Figure 23. Aerospace-Specific Federal Procurement by County (FY2019)	59
Figure 24. Largest Air Force/FAA/NASA Vendors in the 10-County Greater OKC Region (FY2019)	60
Figure 25. Greater OKC Region Aerospace Industry Economic Impacts (2020).....	63
Figure 26. Estimated State & Local Tax Revenue - Aerospace Activity (2020).....	65

GREATER OKC REGION AEROSPACE INDUSTRY

I. Introduction and Summary

Continuing the Legacy of Aerospace in the Greater OKC Region

The aerospace industry remains a large and vibrant component of the Greater Oklahoma City regional economy.¹ The region has a long history of aerospace-related defense activity ranging from early aircraft development and manufacturing to pilot training during World War II. Other early efforts included general aviation aircraft design and manufacturing.

Tinker Air Force Base (AFB) is now the hub of the region's aerospace sector and plays a key role in supporting U.S. defense readiness. Similarly, the FAA's Mike Monroney Aeronautical Center (FAA Center) continues to provide critical products and services that touch all aspects of the U.S. commercial and general aviation sectors.

The Greater Oklahoma City region also has a large and growing private aerospace sector with activities ranging from traditional maintenance, repair, and overhaul (MRO) to research and development on unmanned vehicles. Aircraft design and manufacturing has also returned to the region in recent years, particularly unmanned aerial vehicles.

Growing synergies between the region's core public sector aerospace entities and the growing number of private sector firms is creating a large and resilient base of aerospace activity along with a highly skilled and versatile workforce.

Purpose and Structure of the Report

Understanding the past, present and expected future growth patterns of the region's aerospace industry is important for policymakers and economic development officials who are actively working to grow the industry. This report contributes to this ongoing effort by providing a detailed profile of the industry and evaluating the economic contribution of the sector in 2020. The report also continues a long-standing research effort to evaluate the region's aerospace industry at approximately 5-year intervals.²

The 2020 report provides a detailed economic evaluation of the Greater Oklahoma City area aerospace industry from several perspectives. The report's key tasks are to:

1. Provide a listing of all aerospace establishments operating in the Greater OKC region;
2. Prepare a detailed economic profile of the firms comprising the region's aerospace sector;
3. Examine growth in the aerospace industry since the release of the 2015 report;
4. Evaluate the major aerospace employers in the region, including both public and private entities;
5. Examine the size and composition of the aerospace labor force in the region;
6. Compare the size and structure of Oklahoma's aerospace industry to competing states;
7. Evaluate federal contracting activity related to aerospace by vendors in the region; and
8. Prepare an assessment of the economic impacts the aerospace industry generates across the Greater Oklahoma City region.

Key Findings

Industry Size. Findings indicate that an estimated 291 public and private sector establishments were directly engaged in aerospace activity in the Greater Oklahoma City region in 2020. These employers produced an estimated \$7.2 billion in goods and services and paid \$3.4 billion in labor income to 43,250 workers.

Industry Growth. Significant growth has taken place in the Greater Oklahoma City region aerospace sector since the release of the 2015 aerospace report. Current estimates suggest the industry added 55 new aerospace establishments (23% gain) and more than 6,640 new employees (18% gain) between 2015 and 2020. Output within the industry increased \$2.3 billion (48% gain) and total labor income increased by \$734 million (28% gain) in the period.

Private sector growth managed to outpace the strong gains posted in the public sector. More importantly, the region's aerospace industry continues to find a better balance between public and private sector activity. Since the 2015 report, the private sector employment share increased from 19.7% to 24.7%, the private output share increased from 34.2% to 38.7%, and the private labor income share increased from 20.9% to 29.8%. Based on output and labor income, the private sector share of the aerospace sector in the region has now reached approximately one-third.

Key Industry Characteristics. In 2020, the overall structure of the Greater Oklahoma City Region aerospace sector is best characterized as having:

1. A large public sector presence, primarily federal government;
2. Deep resources in the maintenance, repair and overhaul (MRO) sector;
3. A significant base of public and private sector program management, supply chain and logistics activity;
4. A large, diverse and highly skilled aerospace labor force;
5. A growing presence among major defense and aerospace contractors;
6. A deep concentration of firms engaged in consulting, engineering and R&D;
7. A growing presence of aerospace and aviation-related software development;
8. An emerging presence of aircraft manufacturing, particularly unmanned aerial applications;
9. A large and growing base of federal contracting activity related to aerospace;
10. Healthy commercial and general aviation sectors; and
11. A strong state and local presence in aerospace and aviation education.

Major Employers. Tinker AFB with its more than 26,000 employees remains the centerpiece of the aerospace sector in the OKC region. Base personnel represent a dynamic mix of active-duty and reserve military personnel, permanent federal civilian employees and civilian contract workers. These workers represent the largest single concentration of aerospace-related employment in the region, as well as a large share of total aerospace employment statewide. Projected hiring by the Civilian Personnel Office at the base for fiscal year 2021 and fiscal year 2022 totals more than 2,600 positions (deemed in high demand).

The FAA Center is the second-largest aerospace employer in the region with more than 5,150 workers. The center is home to the highest concentration of FAA civil servants and contractors in one location outside Washington D.C. The large economic role of the facility is traced to its total operating budget of \$1.1 billion in fiscal year 2019. The FAA Center is a unique aerospace asset that plays a key role in national aviation policy, airport maintenance, air travel safety and aviation education. The center is also a major provider of shared services to organizations operating under the Department of Transportation as well as other

numerous federal organizations. Additionally, on a typical day, the FAA Academy at the center hosts up to 1,000 students.

Boeing is the second largest aerospace and defense contractor in the U.S. and has greatly expanded its presence in Oklahoma City in recent years. Boeing is the largest private aerospace employer in the region with approximately 3,660 employees and the largest federal contractor in the state.

Other major aerospace employers in the region include the Oklahoma Air National Guard (1,235 employees), Northrop Grumman (807 employees), CACI (400 employees), Southwest Airlines Reservations (360 employees), AAR Airframe Maintenance (322 employees) and Field Aerospace (280 employees).

Aerospace Occupations and Wages. Oklahoma continues to rank highly in the number of employees across key aerospace occupations. Ongoing growth in the sector is adding large numbers of highly skilled workers to the region, particularly engineers. Approximately 1,900 workers in engineering occupations were added to the Greater Oklahoma City region workforce between 2015 and 2020.

Wages for most aerospace occupations in Oklahoma remain highly competitive relative to other aerospace markets and reflect the low overall cost-of-living in the state. Wages in most aerospace occupations generally exceed the overall state average, with median hourly wages generally above \$20 per hour. The median hourly wage typically exceeds \$40 per hour for engineers, air traffic controllers, pilots and software developers. Median wages are below \$20 per hour in only a few key aerospace occupations, primarily air passenger airline services and some entry-level aircraft maintenance positions.

Oklahoma Aerospace Market Rankings. The 2020 report includes a benchmark comparison of state-level aerospace markets that captures both the private and public sides of the industry. The states have a widely varying mix of public and private sector aerospace activity. Public sector entities and jobs are often excluded from state-level comparisons of aerospace markets, an approach that fails to capture the strength of the Greater OKC market. The true extent of the aerospace market in states like Oklahoma with a high share of public sector activity is not well captured in existing industry comparisons.

For example, Oklahoma ranks highly based on private sector activity alone, but generally only receives an upper mid-tier ranking. Based on private sector size, Oklahoma's aerospace sector ranks among the top 20 states – 15th in the number of business establishments, 20th in employment and 20th in total wages paid in 2019. These rankings all exceed the state's rank as the 28th most populous state.

However, Oklahoma rises to the 10th largest aerospace market when both public and private sector aerospace employment are considered. The jump in rankings is driven by the state's position as the 5th largest concentration of public sector aerospace-related employment among the states. Oklahoma ranks 1st among the states in the number of civilian Air Force employees, with nearly all based at Tinker Air Force Base. It is this deep concentration of public sector aerospace jobs in Oklahoma that makes their inclusion so vital in comparative state-level studies of aerospace.

State and Local Policy. State and local policymakers remain committed to fostering growth in the industry and continue to pursue economic development efforts to grow aerospace in the Greater Oklahoma City Region. The Oklahoma Engineer Workforce Tax Credit remains an important incentive in attracting high-wage aerospace jobs to the region. The Oklahoma Legislature also recently approved a tax credit designed to boost the numbers of highly skilled workers in software development and cybersecurity. Large numbers of graduates from the state's public and private universities and completers of CareerTech aerospace programs continue to fill jobs in state aerospace firms.

Federal Procurement Trends. Federal contracting serves as a significant source of economic activity in Oklahoma and the Greater Oklahoma City region and is closely tied to aerospace activity, particularly at Tinker AFB. Total federal contracting by place of performance in the 10-county Greater Oklahoma City region is up 37% since the 2015 aerospace report, from \$1.96 billion to \$2.69 billion. Approximately 65% of total state contracting activity is traced to the 10-county Greater Oklahoma City region.

Total contracts issued by the Air Force and performed in the Greater OKC region totaled \$1.88 billion in fiscal year 2019 and comprised 45% of total contracting in the state from all federal sources. Across the Air Force, FAA, and NASA, or the three federal entities most closely tied to aerospace, vendors located in the 10-county region performed \$2 billion in contracts in fiscal year 2019. Some of these contracts only indirectly support aerospace activities. An alternative measure of federal contracts identifying goods and services that are directly aerospace-related, regardless of government agency, totaled \$1.62 billion in fiscal year 2019.

Economic Spillover Effects and Tax Impact. In terms of direct employment, approximately 43,250 workers in the region are employed directly in aerospace, with three-fourths (32,554) employed in public sector positions at Tinker AFB and the FAA Center. In total, an estimated 77,105 jobs statewide are provided either directly by the aerospace sector or supported indirectly through multiplier effects generated by the industry.

The \$3.4 billion in direct labor income paid to workers in the aerospace sector likewise generates substantial ripple effects as the income is earned and recirculated within the regional economy. An additional \$2.4 billion in labor income is earned by workers in other industries statewide, or a total earnings impact of \$5.8 billion in the region.

Aerospace establishments in the region generated an estimated \$7.23 billion in direct output of goods and services in 2020. Overall, either directly or indirectly through multiplier effects, aerospace activity in the Greater Oklahoma City region supported the production of \$11.6 billion in total output of goods and services in 2020.

The total direct and spillover effects traced to the aerospace industry are far larger in 2020 than in the 2015 report. Total employment traced to aerospace in the region increased from 67,583 to 77,105, a 14% increase over the past five years. The total labor income effect increased by more than \$1.7 billion, from \$4.1 billion to \$5.8 billion, or a 43% increase. Total output produced by the aerospace industry increased by an estimated 42% since 2015, from \$8.2 billion to \$11.6 billion.

Estimates suggest that the activity generated directly by the aerospace industry produced approximately \$300 million in tax payments to state and local government in 2020.

Aerospace Growth Trend Intact. Overall, the report finds that the aerospace industry in the 10-county Greater Oklahoma City region remains vibrant and has experienced considerable growth and development since the last evaluation of the sector in 2015. Trends in industry activity, firm relocations and expansions, state-level rankings, labor market development and federal procurement success suggest continued aerospace industry growth in the region going forward.

II. Scope of Research

A key activity underlying the development of the 2020 aerospace report is the compilation of a detailed listing of firms in the Greater Oklahoma City region that are directly and substantially engaged in the provision of aerospace-related goods and services. Key characteristics of each firm are collected or estimated, including output (or revenue), employment and labor income paid to workers. Proprietary and public databases are used in compiling the information along with direct contact with firms and consultation with industry professionals. The database of aerospace firms is then used to prepare an economic profile of the industry as well as estimates of the economic contribution of the industry to the Greater OKC area economy.

Aerospace Industry Analysis Framework. The process for compiling the firm-level database and aerospace industry profile for the OKC region is as follows:

Definition of Aerospace. In broadest terms, the *aerospace* industry comprises various forms of manmade air and space flight, along with the associated areas of manufacturing, maintenance and repair, research and development, engineering, consulting, logistics, other activities underlying air and space travel.³

The *aviation* sector is considered a subset of aerospace, referring only to the production, maintenance, development, and application of vehicles capable of atmospheric flight. For convenience, aviation is often divided into civil and military aviation, with civil aviation further subdivided into commercial and general aviation. Throughout the report, *aerospace* is used to denote all aspects of the industry, including the aviation sector.

Study Region. A comprehensive industry profile is developed for the 10-county Greater Oklahoma City region. The region is defined as a contiguous area in central Oklahoma that includes Canadian, Cleveland, Grady, Kingfisher, Lincoln, Logan, McClain, Oklahoma, Payne and Pottawatomie counties.⁴

Oklahoma County is roughly the geographic center of both the region and the state and represents the core of the industry. The region stretches from McClain County in the south to Payne County in the north. The region includes the seven component counties of the Oklahoma City Metropolitan Statistical Area (MSA) plus Kingfisher County to the northwest, Pottawatomie County to the southeast and Payne County to the northeast.

The study area captures both of the state's top-tier research universities (R1: Doctoral Universities), Oklahoma State University in Stillwater (Payne County) and the University of Oklahoma in Norman (Cleveland County).

In compiling economic impact estimates for the industry, direct and spillover economic effects are estimated for the same 10-county region. The economic impact estimates exclude aerospace activities located outside the region such as the private aerospace industry in the Tulsa area and Air Force bases in Enid and Altus.

Data Sources. Aerospace establishments are identified using both public and proprietary databases⁵ of employment and revenue for both private businesses and public sector entities operating in the 10-county region. Private firms are initially selected using NAICS industry codes affiliated with aerospace but are also identified using aviation-related keywords within firm names and known addresses for aviation hubs in the area. The initial pool of establishments is supplemented by adding those identified through discussions with aerospace industry officials and recent news reports, including firms newly located in the region. Airports and heliports are identified using online FAA databases and are included in the industry profile only if actively operated for public purposes.

The initial set of aerospace establishments is cleaned manually for duplicate entries, name changes, mergers and relocations and other recognized reporting errors. Each entity is evaluated through a combination of direct phone contact, online search and discussion with industry experts to determine if it is 1) directly and substantially engaged in the provision of aerospace-related goods and services and 2) actively operating within the region. Firms that are only indirectly related to the industry or serve in a minor support capacity are excluded. Some firms excluded from the survey are actively involved in Defense contracting to the Air Force and other federal departments but do not provide goods and services directly related to aerospace. The activity at firms that indirectly support the industry is nonetheless important and is captured in part through estimated economic spillover effects in the final section of the report.

Data Coverage. Both private and public sector employers are included throughout the report. Public sector employees include federal, state and local government employees. Federal employees include active-duty and Reserve/Guard military personnel, federal civilian employees and civilian contract workers. The largest concentrations of federal employees are located at federal installations in the region, particularly at Tinker AFB and the FAA Center. Members of Oklahoma Air National Guard and Air Force Reserve units are likewise tracked. Data are generally collected at the establishment level (e.g., some large aerospace contractors require multiple buildings in which to operate that are combined), but some data are tabulated at the establishment level and represent unique operating locations (e.g., FAA maintains locations at multiple airports in the region that are tracked separately).

Economic Measures. The industry profile and other estimates compiled in the report are based on estimates of the level of employment, labor income and output for each aerospace establishment. Employment covers primarily wage and salary workers but includes some self-employed proprietors reported in the data.

Labor income is a comprehensive measure of household earnings from work and includes both employee compensation (wages and salaries plus other supplements to wages and salaries) and the proprietor's self-employment income.

Output generally represents the market value of all goods and services produced and is closely related to total revenue for most establishments. For most service-providing firms, output is assumed equal to revenue. When output is not available for a firm, an estimate is formed using either output per employee from similar firms in the database (where available), estimates for the industry from federal datasets, or national ratios of output per employee adjusted for differentials between state and national ratios.

Estimates of employment and output are obtained primarily from proprietary firm-level databases used in the initial identification of aerospace firms. The reported employment and output estimates for each firm are evaluated to determine whether 1) total activity accurately reflects the current level of operation at each firm and 2) activity per worker is consistent with similar firms operating in the region. Adjustments are made to the database to reflect information provided by individual firms in phone contacts, feedback from industry officials, information in public reports, news reports of layoffs, mergers and relocations.

Labor income is estimated using either proprietary databases or information provided by individual firms in phone contacts, information in public reports, feedback from industry officials or average labor income per employee for the corresponding industry sector from federal datasets. Labor income and employment for both Tinker AFB and the FAA Center are derived from current and historical reports provided by representatives at each facility.

Custom Industry Groupings. In preparing the economic profile and economic impact estimates, aerospace establishments are classified into eight major groups and 25 subgroups as detailed in Figure 1.

The industry groupings are chosen to reflect the current structure and growth trend of the aerospace industry in the Greater Oklahoma City region. The groupings are similar to the broad industry sectors defined under the NAICS industry classification system but capture far more detailed components of the aerospace sector than possible when using NAICS. The NAICS system is based on a production-oriented concept whereby establishments are grouped into industries according to similarity in the processes used to produce goods or services. This approach tends to obscure many of the specialized activities taking place within the broader aerospace sector. The groupings used in the 2020 industry profile provide a more functional and descriptive view based on a firm’s primary product line or service provided.

Government is treated as a unique component of the industry due to the substantial presence of both Tinker AFB and the FAA Center. State and local government are tracked separately from federal government.

The eight major groups in Figure 1 are used throughout the report to develop estimates of the economic contribution of the aerospace sector. The 25 detailed subgroups are used to provide more industry detail in an accompanying digital directory of aerospace and aviation firms operating in the region.

Figure 1. Industry Classifications for Greater OKC Region Aerospace Profile	
Group	Subgroups
Air Transportation	Airport Services & Support Aircraft Finance, Title, Leasing, and Sales Aircraft Fleet Ownership and Rental Airports Airport Ground Transportation Air Passenger Transportation Medical Flight Air Freight
Education and Training	Aviation Education and Training Flight Training
Engineering, Consulting, Program Management, and Logistics	Software and Information Technology Engineering, Consulting, and R&D General Contracting Logistics, Supply Chain, and Customer Support
Government	State and Local Government Federal Government
MRO	Maintenance, Repair, and Overhaul
Manufacturing	Aircraft Parts and Components Manufacturing Unmanned Aerial Systems Aircraft Manufacturing
Supplies and Materials	Parts and Components Tools and Supplies
Other	Aerial Services (e.g., Spraying and Photography) Museums

Private Aerospace Sectors. A new section of the 2020 report provides a state-level evaluation of the aerospace sector that includes both the public and private sectors. State-level comparisons of aerospace activity often focus solely on private sector activity and overlook a large segment of the industry in the Greater OKC region.

To prepare a framework for valid comparison across states, we first use standard NAICS codes to define the core set of industry sectors that comprise the private aerospace industry. This approach is commonly used in other comparative state-level studies of the aerospace sector.⁶ Moreover, this standardized approach using NAICS codes is necessary because the firm-level data collection process used to prepare the industry profile for the Greater Oklahoma City region is not feasible for all states and the nation.

Three NAICS industry sectors – 3364 (Aerospace Product and Parts Manufacturing), 481 (Air Transportation), and 4881 (Support Activities for Air Transportation) – are viewed as comprising the core of the private sector aerospace industry. Two of the components are 4-digit sectors (3364 and 4881) while the third (481) is a more aggregated 3-digit sector. The three core sectors serve as a highly useful proxy for the overall private component of the industry because they are believed to jointly comprise at least 90% of private aerospace activity in the U.S.

Sector 3364 (Aerospace Product and Parts Manufacturing) generally represents the aerospace sector as an aircraft manufacturing and maintenance industry. Sectors 481 (Air Transportation) and 4881 (Support Activities for Air Transportation) capture the broad scope of commercial and general aviation activity including passenger air travel.

The three core sectors can be reduced to their base 6-digit sectors, with the final group comprised of the following 14 6-digit NAICS sectors:

1. NAICS 3364: Aerospace Product and Parts Manufacturing

Includes six 6-digit NAICS sectors covering aircraft and aircraft parts manufacturing and guided missile and space vehicle-related 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 Manu.
- 336419 Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manu.

2. NAICS 481: Air Transportation

Includes five 6-digit NAICS sectors covering both scheduled and nonscheduled charter passenger and freight transportation by air.

- 481111 Scheduled Passenger Air Transportation
- 481112 Scheduled Freight Air Transportation
- 481211 Nonscheduled Chartered Passenger Air Transportation
- 481212 Nonscheduled Chartered Freight Air Transportation
- 481219 Other Nonscheduled Air Transportation

3. NAICS 4881: Support Activities for Air Transportation

Includes three 6-digit NAICS sectors capturing a range of support activities centered around flight control and the ground operation of airports.

- 488111 Air Traffic Control
- 488119 Other Airport Operations

488190 Other Support Activities for Air Transportation

Data using the 14 core 6-digit NAICS industry sectors is readily available in major federal economic databases, which allows for easy and reliable updates over time.

It is important to note that the three core NAICS sectors (3364, 481 and 4881) are clearly not the only sectors comprising the aerospace sector. Numerous other NAICS sectors are widely recognized as serving a direct role in aerospace and include:

- NAICS 333314: Optical Instruments
- NAICS 334511: Search and Detection Instrument Manufacturing
- NAICS 336360: Seating and Trim
- NAICS 423860: Wholesale Trade – Transportation Parts
- NAICS 441228: Aircraft Sales
- NAICS 532411: Aircraft Rental and Leasing
- NAICS 611512: Flight Training
- NAICS 611519: Air Traffic Control Schools
- NAICS 115112: Aerial Spraying
- NAICS 424720: Wholesale Trade – Petroleum

Most of these sectors are included in the comprehensive database and industry profile prepared for the Greater Oklahoma City region. However, they are excluded from the state-level industry comparisons for two reasons: 1) the industries, even when combined, are quite small relative to the core sectors, and 2) state-level data for these sectors are often suppressed in federal economic databases. Because these sectors are typically quite small relative to the three core sectors, they are believed to have little influence on the resulting state-level comparisons and rankings. Combined, the excluded sectors typically account for far less than 10% of direct employment within the broader aerospace and aviation industry. In most states, they account for less than 5% of total employment in the industry. Because of suppression in federal databases, using these industries would require either forming estimates for each sector in each state or using the same firm-level approach used in the Greater Oklahoma City region for each region. The first approach introduces considerable uncertainty into the state-level comparisons while the second is cost prohibitive.

Aerospace and COVID-19

The restrictive effects of COVID-19 on business activity have been highly visible in the U.S. aerospace sector, particularly passenger air travel and aircraft manufacturing. The economic profile of the Greater Oklahoma City region aerospace sector provided in this report does not adjust the results for the expected effects of COVID-19. The results generally capture the most recent operating year of results for most firms that were available in early 2020, a time frame not heavily influenced by the early stages of the pandemic. As a result, the 2020 aerospace report captures the steady state of the industry at the earliest stages of the pandemic and economic downturn.

Several risks and potential long-term effects of COVID-19 on the aerospace sector have surfaced as the pandemic has developed:

1. The ongoing pandemic has had a disproportionately negative impact on the commercial aviation sector, particularly passenger air travel. The volume of commercial air travel remains closely tied to the overall prevalence of COVID-19, with the sector expected to recover much of its lost activity only when a vaccine is widely available. Business travel is believed to have made at least an intermediate-term downshift in volume due to the widespread adoption of teleconferencing. Some reduction in business travel could be long-lived.

2. Federal cash infusions to the airline industry have greatly aided air carriers in surviving the collapse in passenger air travel and maintaining employment levels.
3. Commercial aircraft and parts manufacturing have both been hard-hit by the pandemic. Large numbers of aircraft deliveries have been canceled or delayed and the parts replacement cycle has slowed sharply along with passenger air miles flown.
4. The defense side of aerospace has been better positioned to address the market effects of the COVID outbreak, generally faring far better in the slowdown than commercial aircraft manufacturing and passenger air travel.

Several factors suggest that the Greater Oklahoma City region is well positioned relative to many aerospace hubs to respond to COVID-19:

1. The high share of public sector aerospace activity at both Tinker Air Force Base (AFB) and the Federal Aviation Administration (FAA) Mike Monroney Aeronautical Center (FAA Center) provides substantial stability to the region's aerospace base. These large federal entities are experiencing budget stability despite the pandemic.
2. Oklahoma City has far less dependence on air travel than many other regions of the country that have large hub airport operations, private MRO base operations or significant tourism-related air travel.
3. The presence of large private defense contractors with long-run contract programs in place has provided additional stability during the pandemic.
4. The overall economic rebound in the Oklahoma City metro area has outpaced the state recovery to date and is more national-like in pace.

III. OKC Region Aerospace Industry Profile

Figure 2 summarizes the structure of the 10-county Greater Oklahoma City region aerospace sector by major industry group in 2020.⁷ The profile provides key measures of business activity including the number of business establishments, employment, output, and labor income within each group.

The two major government installations in the region (Tinker AFB and the FAA Center) are listed separately in the government section. Figure 3 provides a more detailed economic profile across the 26 subgroups.

Industry Economic Profile

In terms of overall structure, the Greater Oklahoma City region aerospace market can be characterized as having a large public sector presence; a large and growing private maintenance, repair, and overhaul (MRO) sector; a significant concentration of aerospace engineering, consulting, and logistics firms; an air transportation sector consistent with population; and a nascent aircraft manufacturing presence.

An estimated 291 public and private sector establishments in the Greater OKC region were directly engaged in aerospace activity in 2020. These employers produced an estimated \$7.23 billion in goods and services and paid \$3.4 billion in labor income to approximately 43,250 workers.

A key characteristic of the regional and U.S. aerospace industry remains high average wages. The average labor income in aerospace in the Greater Oklahoma City region is approximately \$78,610 per worker in 2020. For comparison, labor income per worker in the industry is 30% higher than the overall average for all industries statewide (\$60,730) and 27% higher than the average for all industries in the 10-county region (\$61,692).

Figure 2. Greater Oklahoma City Region Aerospace Industry Profile (2020)

Major Group	Establish- ments	Employ- ment	Output (\$Mil)	Labor Income (\$Mil)
Government	10	32,554	\$4,436.0	\$2,385.2
Tinker Air Force Base (military, federal civilian, and contractors)	1	26,029	3,229.5	1,755.6
FAA Mike Monroney Aeronautical Center	1	5,159	1,105.7	563.5
All Other Government (federal, state, and local)	8	1,366	100.8	66.1
Maintenance, Repair, and Overhaul (MRO)	34	4,668	1,472.4	509.0
Engineering, Consulting, Program Management, and Logistics	53	2,901	617.9	275.2
Air Transportation (Airports, aircraft sales, and air travel)	105	1,942	443.3	142.1
Supplies and Materials	44	912	221.6	71.1
Education and Training	26	181	21.9	10.7
Manufacturing	5	47	14.4	4.0
Other (spraying, aerial services, and other)	14	47	6.1	2.7
Total	291	43,252	\$7,233.6	\$3,400.0

Notes: Major industry groups sorted by employment.

Source: Data Axel, Salesforce, D&B Hoovers, federal reports, Tinker AFB internal reports, FAA internal reports, direct verification of data, and RegionTrack estimates

Figure 3. Greater Oklahoma City Region Aerospace Detailed Industry Profile (2020)

Major Group	Subsector	Establish - ments	Employ- ment	Output (\$Mil)	Labor Income (\$Mil)
Air Transportation	Airport Services & Support	18	602	\$169.4	\$36.8
	Aircraft Finance, Title, Leasing, and Sales	23	199	38.3	12.9
	Aircraft Fleet Ownership and Rental	11	43	10.8	3.9
	Airports	23	94	13.8	4.3
	Airport Ground Transportation	6	38	7.1	1.9
	Air Passenger Transportation	11	698	141.8	62.4
	Medical Flight	3	18	4.3	1.5
	Air Freight	10	250	57.9	18.3
Education and Training	Aviation Education and Training	13	116	15.3	7.7
	Flight Training	13	65	6.6	3.0
Engineering, Consulting, Program Management, and Logistics	Software and Information Technology	11	146	36.3	14.5
	Engineering, Consulting, and R&D	34	2,108	474.3	209.6
	General Contracting	3	17	2.4	1.3
	Logistics, Supply Chain, and Customer Support	5	630	104.9	49.8
Government	State and Local Government	3	1,243	87.7	54.7
	Federal Government	7	31,311	4,348.3	2,330.5
Manufacturing	Aircraft Parts and Components Manufacturing	2	12	2.9	0.8
	Unmanned Aerial Systems	2	25	8.8	2.4
	Aircraft Manufacturing	1	10	2.7	0.8
MRO	Maintenance, Repair, and Overhaul	34	4,668	1,472.4	509.0
Other	Aerial Services	10	34	4.9	2.2
	Museum	3	8	0.7	0.3
	Other	1	5	0.5	0.2
Supplies and Materials	Parts and Components	41	874	209.9	67.8
	Tools and Supplies	3	38	25.5	8.0
Total		291	43,252	\$7,233.6	\$3,400.0

Notes: Major industry groups sorted by alphabetical order.

Source: Data Axel, Salesforce, D&B Hoovers, federal reports, Tinker AFB internal reports, FAA internal reports, direct verification of data, and RegionTrack estimates

The reported 32,554 government workers comprise 75% of the region's aerospace labor force. These workers include federal civilian workers, civilian contract workers, active-duty military and Reserve/Guard members. The activities at Tinker AFB include a large maintenance, repair, and overhaul (MRO) operation and a range of high-skill aerospace-related service occupations, with large numbers of workers engaged in program management and logistics activities.

The large public sector employment base at the FAA Center similarly provides a diverse mix of high-skill aerospace-related jobs, along with a significant number of workers who provide business support services. The labor forces located at the region's two large public sector facilities have an increasing amount of occupational overlap with the private side of the industry in the region.

Industry Growth Trend – 2015 to 2020. Significant growth has taken place in the Greater Oklahoma City region aerospace sector since the release of the region’s 2015 aerospace report. Figure 4 compares summary results from the current industry assessment with the 2015 report.

Current estimates suggest the industry added 55 new aerospace establishments (23% increase) and more than 6,600 new employees (18% increase) between 2015 and 2020.

Output within the industry increased \$2.34 billion (48% gain) in the period. Average output per firm increased 20% between 2015 and 2020, reaching \$24.9 million per establishment.

Total labor income paid by aerospace firms increased by \$734 million since 2015, or a 28% increase.

Figure 4. Greater OKC Region Aerospace Sector Growth (2015 to 2020)				
Report Year	Establishments	Output (\$Mil)	Labor Income (\$Mil)	Employment
2015	236	\$4,893.1	\$2,665.9	36,611
2020	291	\$7,233.6	\$3,416.4	43,370
Change	55	\$2,340.5	\$734.1	6,641
% Change	23.3%	47.8%	27.5%	18.1%

From a productivity viewpoint, output per worker increased to \$167,241, an increase of 25% over the past five years. Increased productivity supported an 8% increase in average labor income per worker since 2015, reaching approximately \$78,610 in 2020.

Private vs. Public Sector Growth. Growth has been substantial since the 2015 report in both the public and private sectors of the region’s aerospace industry.

Public sector aerospace establishments increased their output by \$1.2 billion (38% gain) since 2015. Hiring increased by 3,162 workers (11% gain) while labor income increased by \$277 million (13% gain) in the period.

Private sector growth managed to outpace the strong gains posted in the public sector. An additional 61 private sector establishments were added since the 2015 report with increased output of \$1.1 billion (67% gain). Private sector employment increased by nearly 3,500 (48% gain) since the 2015 report, with increased private labor income of \$457 million (82% gain).

More importantly, the region’s aerospace industry continues to find a closer balance between public and private sector activity. Since the 2015 report, the private sector employment share increased from 19.7% to 24.7%, the private output share increased from 34.2% to 38.7%, and the private labor income share increased from 20.9% to 29.8%.

The increased private sector shares are noteworthy given strong public sector growth in the period. The private sector now represents one-fourth of the region’s aerospace industry based on employment and approximately one-third of the sector based on labor income and output.

Aerospace Employment by County

Figure 5 partitions the aerospace industry profile among the ten counties comprising the Greater Oklahoma City region.

While all ten counties have some aerospace presence, the industry's core remains highly concentrated in Oklahoma County. Oklahoma County is home to nearly 60% of the region's aerospace employers, nearly 98% of the aerospace jobs in the region and more than 97% of the total output produced by the sector.

Most of the region's large public aerospace-related infrastructure is located within Oklahoma County, including Tinker AFB, the FAA Center, Will Rogers Air National Guard Base and Will Rogers World Airport.

Most of the largest private employers in the region, such as Boeing, Northrop Grumman, CACI, Southwest Airlines Reservation Center and AAR, are similarly located in Oklahoma County.

Figure 5. Greater OKC Region Aerospace Industry by County (2020)

County	Establishments		Employment		Output (\$Mil)		Total Employment	Aerospace as % of Total Employment
Canadian	20	6.9%	128	0.3%	\$25.5	0.4%	61,387	0.21%
Cleveland	28	9.6%	159	0.4%	31.6	0.4%	133,809	0.12%
Grady	3	1.0%	17	0.0%	2.8	0.0%	22,433	0.08%
Kingfisher	2	0.7%	2	0.0%	0.3	0.0%	12,029	0.02%
Lincoln	8	2.7%	48	0.1%	8.6	0.1%	13,490	0.36%
Logan	10	3.4%	72	0.2%	21.6	0.3%	16,950	0.42%
McClain	6	2.1%	12	0.0%	4.4	0.1%	17,771	0.07%
Oklahoma	176	60.5%	42,301	97.8%	7,048.3	97.4%	631,438	6.70%
Payne	27	9.3%	421	1.0%	68.2	0.9%	49,242	0.85%
Pottawatomie	11	3.8%	92	0.2%	22.4	0.3%	33,681	0.27%
10-County Region	291	100.0%	43,252	100.0%	\$7,233.6	100.0%	992,230	4.36%

Notes: Total employment by county is based on BEA's measure of total employment (wage & salary + proprietors) and includes military personnel.
Source: Bureau of Economic Analysis (BEA) and RegionTrack calculations

Most of the jobs located outside Oklahoma County are in aircraft maintenance and air transportation and primarily support local general aviation. These smaller aerospace firms are widely spread among the remaining counties.

Among the other counties, Cleveland County and Payne County have the largest number of aerospace firms, with 28 and 27 establishments, respectively. Both counties are home to a Tier 1 research university (University of Oklahoma in Cleveland County and Oklahoma State University in Payne County) which offers flight training and programs in aerospace engineering.

Canadian County is home to 20 aerospace establishments that serve a diverse mix of market segments including training, parts manufacturing and general aviation services.

Employment in aerospace comprised an estimated 4.4% of all employment in the Greater Oklahoma City region in 2020. The employment share is greatest at 6.7% in Oklahoma County but falls below 1% of total employment in the remaining counties. Payne County aerospace workers comprise nearly 1% of total county employment while the remaining counties fall below a 0.5% share.

IV. OKC Region Aerospace Employers and Workforce

Largest Aerospace Employers. The Greater Oklahoma City Region aerospace industry is comprised of approximately 20 large employers with more than 100 employees and approximately 270 small employers with fewer than 100 employees.

Figure 6 highlights the 25 largest aerospace-related employers in the Greater Oklahoma City Region. The region has three very large aerospace employers – Tinker AFB, the FAA Center, and Boeing – that employ a combined 80% of all aerospace workers in the 10-county region. Employment counts are a snapshot in time and subject to change.

Tinker AFB with its more than 26,000 employees remains the centerpiece of the aerospace sector in the Greater OKC region. The FAA Center is the second largest with more than 5,150 workers. These two large public sector facilities have operated in the region for decades and continue to serve as a catalyst for much of the continued private sector aerospace growth in the region. Boeing is the largest private sector aerospace employer in the Greater OKC region with more than 3,600 employees.

Figure 6. 25 Largest Greater OKC Region Aerospace Employers

Rank	Employer	Employment
1	Tinker Air Force Base	26,029
2	FAA Mike Monroney Aeronautical Center	5,159
3	Boeing Company	3,660
4	Oklahoma Air National Guard	1,235
5	Northrop Grumman	807
6	CACI	400
7	Southwest Airlines Reservations	360
8	AAR Airframe Maintenance	322
9	Field Aerospace	280
10	Meta Special Aerospace	225
11	Pratt & Whitney	220
12	Electro Enterprises Inc.	200
12	Serco	200
14	Booz Allen Hamilton	170
15	ASCO Aerospace USA LLC	160
16	Western Flyer Express Inc.	150
17	Long Wave Inc.	149
18	Olympic Security Svc.	145
19	Advancia Corp.	130
20	KBR	103
21	Express Jet	100
22	Aerobrazo Engineered Tech	90
23	Aero Components Inc.	80
24	Frontier Electronic Systems	80
25	ABM Parking Svc.	75
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The Oklahoma Air National Guard is the fourth largest aerospace-related employer with 1,235 personnel, including more than 800 part-time Guardsmen. Another traditional aerospace contractor, Northrop Grumman, has the fifth largest workforce with more than 800 workers in the region.

Other mid-size private sector firms employing 200 or more aerospace workers include CACI (400) Southwest Airlines Reservation Center (360), AAR Airframe Maintenance (322), Field Aerospace (280), Meta Special Aerospace (225), Pratt & Whitney (220), Electro Enterprises (200) and Serco (200).

Tinker AFB

In fiscal year 2019, Tinker AFB was the largest single-site employer in Oklahoma with a workforce that fluctuated between 26,000 and 27,000 workers. Base personnel represent a unique mix of active duty (~20%) and reserve military personnel (~5%), permanent federal civilian employees (~66%) and civilian contract workers (~9%). The labor force at Tinker AFB represents the largest single concentration of aerospace-related employment in the Greater Oklahoma City region, as well as a large share of total aerospace-related employment statewide.

Tinker AFB is home to over 40 major aerospace-related functions and units, including weapon system sustainment, life cycle management of weapon systems and operational flying activities. The following provides examples of several key units:

Air Force Sustainment Center (AFSC)

Tinker AFB is home to one of three sustainment complexes that are a part of the Air Force Sustainment Center (AFSC). The AFSC is headquartered at Tinker AFB and is tasked with maintaining weapon system readiness for air warfare. AFSC services include weapon depot maintenance, supply chain management and installation support. The AFSC provides critical sustainment for the Air Force's most sophisticated weapons systems, including A-10 Thunderbolt II, AC-130, B-1 Lancer, B-52 Stratofortress, C-5 Galaxy, C-17 Globemaster III, C-130 Hercules, E-3 Sentry, E-6 Mercury, E-8 Joint STARS, EC-130, F-15 Eagle, F-16 Falcon, F-22 Raptor, HC-130, HH-60 Pave Hawk, ICBM, KC-135 Stratotanker, MC-130, MH-53 Pave Low, RQ-4 Global Hawk, U-2 Dragon Lady and UH-1 Iroquois aircraft as well as a wide range of aircraft engines and component parts.

OC-ALC. The Oklahoma City Air Logistics Complex (OC-ALC) is the largest operating component of the base.⁸ The Complex performs programmed depot maintenance and modifications on KC-46, KC-135, B-1B, B-52, E-3 and Navy E-6 aircraft as well as maintenance, repair and overhaul for F100, F101, F108, F110, F117, F118, F119, F135 and TF33 engines and a wide variety of commodities for the Air Force, Navy, Marine Corps and foreign military sales. The Complex is also responsible for the development and sustainment of a diverse portfolio of mission-critical software for the Air Force and other customers, as well as worldwide aircraft battle damage repair capability for multiple weapon systems.

The Oklahoma City Air Logistics Complex is comprised of five major operating groups.

1. The *76th Aircraft Maintenance Group* (AMXG) performs depot maintenance on B-1 Lancer, B-52 Stratofortress, KC-135 Stratotanker, E-3 Sentry (AWACS), E-6 Mercury (Navy) and special mission fleet aircraft. The 76th AMXG performs all facets of depot maintenance, including full overhaul maintenance, FAA certified aircraft repairs, engineering services, aircraft modifications, depaint and paint services, flight testing and expeditionary depot repair teams. The group is currently preparing for the Air Force's next-generation tanker, the KC-46 Pegasus.

2. The *76th Commodities Maintenance Group* directs, manages and operates depot-level maintenance facilities in the repair and overhaul of Air Force, Navy and Foreign Military Sales aircraft and engine parts to serviceable condition. The group's portfolio includes the A-10, B-1, B-2, B-52, C-5, C-17, C-130, C-135, C-141, E-3, F-4, F-5, F-15, F-16, F-22, MQ-1, MQ-9 and T-38 weapons systems. The group also serves as the Air Force Technology Repair Center for air and fuel accessories, constant speed drives and oxygen-related components.
3. The *76th Maintenance Support Group* is responsible for maintaining one of DoD's largest industrial complexes on a 24/7 basis. It keeps the buildings, hangars, machines and equipment running so the depot can meet the warfighters' requirements. Structures range from World War II era buildings and hangars to state-of-the-art software and engine maintenance facilities and equipment. The group services include physical plant management, metrology, physical science laboratories, tools management, environmental oversight and long-range facility planning.
4. The *76th Propulsion Maintenance Group* is the DoD's foremost engine repair and overhaul center. It sustains most of the bomber, tanker, fighter and special mission aircraft engines in the Air Force, as well as some Navy and Foreign Military Sales engines. The group performs repairs on engines and major engine assemblies for the F100, F101, F107, F108, F110, F117, F118, F119, F137 and TF33.
5. The *76th Software Engineering Group* provides a range of software and systems engineering solutions. As part of the Air Force Sustainment Center Software Enterprise, the group provides the DoD with capabilities in operational flight programs, mission planning systems, space systems, ground-based radar, weapons support, mission support, jet engine testing, training and simulation systems and diagnostics and repair.

448th SCMW. The 448th Supply Chain Management Wing (SCMW) is headquartered at Tinker AFB and provides the planning and execution of depot-level repairable and consumable spare parts to sustain Air Force depot operations and more than 5,000 operational aircraft and 16,000 engines across the globe. The wing also provides spare parts to sustain the Intercontinental Ballistic Missile capability, a wide range of support equipment and Space and C3I systems. The 448th SCMW is a 'virtual' wing that operates remotely within three different time zones. The wing consists of civilian and military personnel dispersed at Tinker AFB (Oklahoma), Robins AFB (Georgia) and Hill AFB (Utah).

72nd Air Base Wing. The 72nd Air Base Wing provides mission support, civil engineering, medical, airfield operations, command post, explosive ordnance disposal, public affairs, equal opportunity and alternate dispute resolution and financial management services to active-duty military personnel, Guard and Reserve components, civilians, retirees and dependents.

The Air Force Life Cycle Management Center (AFLCMC)

Propulsion Directorate

The AFLCMC manages more than 22,000 engines installed on over 30 different weapon systems in support of the U.S. Air Force and 50 international partners. It provides life cycle management for engines to include system development, acquisition, fielding, sustainment and modernization to ensure warfighter readiness, affordability, safety and effectiveness needs are met.

Other AFLCMC

Other Tinker AFB AFLCMC organizations provide life cycle management for the E-3 AWACS, B-1 Lancer, B-52 Stratofortress, KC-10 Extender, KC-135 Stratotanker and KC-46 Pegasus aircraft and the Presidential and Executive fleet.

Operational Wings

507th Air Refueling Wing

The 507th is a reserve component flying unit of the Air Force based at Tinker AFB. The wing primarily flies the KC-135 Stratotanker which provides the core refueling capability for the Air Force and aerial refueling support to the Navy, Marine Corps and allied nations.

552nd Air Control Wing (AWACS)

The 552nd flies the Boeing E-3C Airborne Warning & Control System (AWACS) aircraft. AWACS are special mission aircraft equipped with a powerful airborne search and track radar system using a rotating dome mounted above the top of the rear fuselage.

Navy Strategic Communications Wing ONE and Task Group 114.2

Strategic Communications Wing ONE consists of three Navy squadrons and a Wing staff that provide maintenance, security, operations, administration, training and logistic support for the E-6B Mercury aircraft fleet. The Wing is comprised of approximately 1,200 military personnel, 65 permanent civilian federal employees and a limited number of civilian contract personnel.

Other

The 38th Cyberspace Engineering Installation Group

The 38th Cyberspace Engineering Installation Group, headquartered at Tinker Air Force Base, is the Air Force's premier engineering and installation group for the cyberspace domain. Tinker AFB is home to several components of the Group including the 38th Engineering Squadron and 38th Operations Support Squadron, along with serving as an operating location for the 38th Contracting Squadron at Joint Base San Antonio-Lackland.

Defense Logistics Agency

The Defense Logistics Agency is responsible for retail order management, planning, material management and storage and distribution of all items ordered through the depot supply account to support the Oklahoma City Air Logistics Complex repair facility for aircraft, engine and commodities.

Defense Information Systems Agency

The Defense Information Systems Agency (DISA) Defense Enterprise Computing Center, Oklahoma City is a combat support agency of the Department of Defense committed to providing enterprise-level information technology support and service capabilities to its mission partners. The agency provides, operates and assures command and control and information-sharing capabilities and a globally accessible enterprise information infrastructure in direct support to joint warfighters, national-level leaders and other mission and coalition partners across the full spectrum of military operations. DISA is focused on providing enterprise services, unified capabilities and mobility

options to support DOD operations anywhere, anytime. Through enterprise security architectures, smart computing options, and other leading-edge IT opportunities, DISA is the premier provider of IT services to meet the nation's defense needs.

Air Force Military Personnel. Of the 6,480 military personnel at Tinker AFB, 5,104 are active duty with the remaining 1,476 either Air Force Reserve or Air National Guard personnel. Military personnel at the base are primarily affiliated with the Air Force, but uniformed personnel from other services are represented on the base.

Only about 12.5% (810) of military personnel are reported as living on base, with most personnel and their families residing in surrounding communities. The 6,480 military personnel stationed at Tinker AFB along with their 4,660 dependents comprise a total of 11,140 military personnel and dependents.

Officers. Approximately 1,100 military personnel at the base are Air Force officers who work at high skill specialties that are largely aerospace related. Of the officers, approximately 250 are Pilots and Navigators, 500 are Air Battle Managers and Field Operations, 10 are Wing Commanders or Commanders and 10 are Aerospace Medicine. The remaining officers perform a range of specialties including engineering, logistics, cyber operations, intelligence, weather and others.

Enlisted. The nearly 3,400 enlisted Air Force personnel stationed at Tinker AFB primarily support the aviation and logistics mission of the base and have numerous high-skill specialties. Approximately 1,200 enlisted personnel are engaged directly in aerospace maintenance and 650 in air crew operations. Other specialties include command control systems (150), mission support (100), flight equipment (40), intelligence (40), material management (60), aerospace medicine (40) and engineering (20).

Civilian Air Force Personnel. The mission of Tinker AFB would not be possible without the numerous highly skilled civilians engaged in aerospace-related work at the base.

Figure 7 provides a detailed breakdown of employment by occupation for permanent, appropriated fund civilian Air Force personnel at the base at five-year intervals from 2005 to 2020.⁹ Figure 7 also includes the most recent hiring outlook for high-demand occupations at the base through fiscal years 2021 and 2022.

In fiscal year 2020, a reported 17,438 permanent civilian Air Force jobs were located at Tinker AFB. Slightly more than half (55%) of the civilian jobs are white-collar occupations with the remainder trade and craft positions (45%).

White-Collar Occupations. By major type, there are a reported 9,565 (55%) white-collar workers among permanent civilian Air Force personnel at the base. Numerous high-skill, white-collar occupations directly related to aerospace are held by civilians at the base, including specialties in engineering and architecture (2,250 jobs); information technology (464 jobs); mathematics and statistics (300 jobs); quality assurance, inspection, and grading (228); and physical sciences (55 jobs).

Other more general white collar specialties include business and industry (1,434), accounting and budget (369), and supply (379).

Trade and Craft Occupations. Civilians filled a reported 7,873 trade and craft jobs at Tinker AFB in fiscal year 2020, with a large share of these workers holding traditional aerospace occupations. Approximately 6,000 jobs are in metal work (1,987 jobs), aircraft overhaul (1,584 jobs), engine overhaul (636 jobs), electrical installation and maintenance (464 jobs), metal processing (429 jobs), painting (322), electronic equipment installation and equipment maintenance (403 jobs), machine tool work (357 jobs), fluid systems

maintenance (340 jobs), industrial equipment maintenance (213), pliable materials work (104) and industrial equipment operation (13).

Figure 7. Air Force Permanent Civilian Jobs by Occupation & High Demand – Tinker AFB

OPM Federal Occupations		Employment by Fiscal Year				High Demand Occupations
		2005	2010	2015	2020	FY21/FY22
Total Permanent Civilian Employment		13,562	14,200	13,888	17,438	2,614
White Collar Occupations		7,533	7,454	7,492	9,565	1,510
0	Miscellaneous Occupations	170	218	213	266	74
1	Social Science, Psychology, & Welfare	59	65	46	79	32
2	Human Resources Management	156	150	128	172	
3	General Admin, Clerical, & Office Services	1,952	2,073	1,945	2,410	255
4	Biological Sciences	2	2	2	4	
5	Accounting and Budget	250	278	278	369	44
6	Medical, Hosp., Dental, & Public Health	86	118	119	175	24
8	Engineering and Architecture	1,740	1,776	1,963	2,249	518
9	Legal and Kindred	26	22	22	28	6
10	Information and Arts	51	45	36	46	
11	Business and Industry	953	964	1,202	1,434	167
13	Physical Sciences	42	36	35	55	
14	Library and Archives	1	1	0	0	
15	Mathematics and Statistics	70	99	132	300	154
16	Equipment, Facilities, and Services	392	417	403	491	22
17	Education	86	78	88	161	22
18	Investigation	7	3	7	7	
19	Quality Assur., Inspection, & Grading	163	171	183	228	
20	Supply	910	562	334	379	36
21	Transportation	117	112	89	248	
22	Information Technology	300	264	267	464	156
Trade, Craft, or Labor Occupations		6,029	6,746	6,396	7,873	1,104
26	Electronic Equip Installation & Maintenance	369	364	352	403	28
28	Electrical Installation and Maintenance	314	445	393	464	32
31	Fabric and Leather Work	26	29	38	35	
33	Instrument Work	46	43	32	39	
34	Machine Tool Work	380	365	324	357	52
35	General Services and Support Work	106	205	132	12	
37	Metal Processing	599	463	380	429	37
38	Metal Work	1,102	1,546	1,539	1,987	520
41	Painting and Paperhanging	292	371	369	322	20
42	Plumbing and Pipefitting	19	22	21	27	
43	Pliable Materials Work	98	96	84	104	
46	Wood Work	12	11	12	25	
47	General Maintenance & Operations Work	1	1	2	14	
48	General Equipment Maintenance	27	32	26	44	
52	Miscellaneous Occupations	5	7	9	11	
53	Industrial Equipment Maintenance	138	140	135	213	25
54	Industrial Equipment Operation	27	22	12	13	
57	Transportation/Mobile Equip Operations	66	61	62	74	
58	Transportation/Mobile Equip Maintenance	3	0	0	24	
66	Armament Work	25	39	28	53	
69	Warehousing and Stock Handling	178	237	268	456	87
70	Packing and Processing	143	184	166	207	16
82	Fluid Systems Maintenance	441	377	301	340	30
86	Engine Overhaul	631	659	529	636	14
88	Aircraft Overhaul	981	1,027	1,182	1,584	243

Source: U.S. Office of Personnel Management - FedScope (pom.gov) and Tinker AFB FY2021/2022 Hiring Forecast

Related trade and craft occupations include warehousing and stock handling (456 jobs), industrial equipment maintenance (213) and packing and processing (207 jobs).

Civilian Employment Growth. Significant growth occurred in the number of civilian personnel at Tinker AFB the past five years. The number of permanent civilian personnel increased by 3,550 (26%) between 2015 and 2020. The number of both white collar and trade and craft occupations increased sharply since 2015. An estimated 2,073 white collar (27.7% gain) and 1,477 trade and craft (22.5% gain) civilian positions were added in the past five years.

The largest job gains among white-collar occupations include general administrative and clerical (465 jobs), engineering and architecture (286 jobs) and information technology (197 jobs).

Large job gains among trade and craft specialties since 2015 are directly tied to the aircraft maintenance, repair and overhaul mission of the base – metalwork (448 jobs), aircraft overhaul (402 jobs), engine overhaul (107 jobs), industrial equipment maintenance (78 jobs), electrical installation and maintenance (71 jobs), electronic equipment installation and maintenance (51 jobs), metal processing (49 jobs) and fluid systems maintenance (39 jobs).

Tinker AFB Hiring Outlook and High Demand Occupations.¹⁰

Future job expansion is anticipated at Tinker AFB in both the near- and long-term. Sources of expected new hires at the base include normal turnover, expanded MRO activities at the base and other factors.

KC-46 Pegasus. The recently added maintenance program for the new Boeing KC-46 Pegasus air refueling tanker is expected to contribute to future new hiring.¹¹ The construction of a new 156-acre campus on land acquired from Burlington Northern Santa Fe will eventually house 14 hangars for maintenance, repair and modification operations on the new tanker. The first hangar was completed in October 2019, and a second hanger is largely complete and scheduled to be turned over to the Air Force in late 2020. The planes will be based primarily at McConnell Air Force Base in Wichita, Kan. Training for pilots and fuel boom operators is underway at Altus Air Force Base in Oklahoma.

High Demand Occupations. Projected hiring by the Civilian Personnel Office at the base for fiscal years 2021 and 2022 totals more than 2,600 positions in high-demand occupations (1,510 white collar and 1,104 blue collar). A breakdown of the high-demand jobs by occupation is detailed along with current employment levels in Figure 7. The pace of new hiring for high-demand positions at the base is projected to remain steady at approximately 325 new workers per quarter over the next two fiscal years.

Approximately two-thirds (1,627) of the high-demand positions are classified as journeyman and the remaining one-third as developmental. Journeyman positions assume an individual would be work-ready and need little to no assistance in carrying out the work being performed. Developmental (DEV) positions assume individuals need additional training and/or assistance to be able to carry out the work being performed.

FAA – Mike Monroney Aeronautical Center

The FAA Center in Oklahoma City serves as the centralized service and support facility for the FAA and Department of Transportation (DOT). The FAA Center is a unique aerospace asset that plays a key role in national aviation policy, airport maintenance, air travel safety and aviation education.

FAA Activities. The center is a combination of diverse business units with operations ranging across most areas of the federal aviation transportation system. Several non-appropriated fund FAA lines of business have operations located at the center providing logistics functions, including maintenance, repair and

overhaul of FAA equipment; registry of aircraft; medical certification for pilots; navigational charting for flight paths; as well as aviation medical and human factors research.

Major groups of services provided at the FAA Center include technical training for air traffic controllers, technicians and engineers; financial, information systems security, technology and business services solutions for customers across the DOT and federal government; and facility management services to all tenants.

The FAA Center provides several unique services within the FAA, including:

1. **FAA Academy** – serves as the primary provider of technical training for the agency and the largest training facility within the DOT (76,000 total students attended the Academy in fiscal year 2019);
2. **FAA Logistics Center (FAALC)** – provides consulting, engineering, repair, distribution, and technical support for U.S. air traffic control systems;
3. **Enterprise Services Center (ESC)** – serves as one of four OMB-designated Shared Service Providers for financial services within the federal sector; and
4. **Civil Aerospace Medical Institute (CAMI)** – the medical certification, research, education, and occupational health wing of the FAA’s Office of Aerospace Medicine. The Institute studies the factors that influence human performance and safety in the aerospace environment.

A small number of non-FAA tenants are also located at the center, including the Air Force, Coast Guard, Transportation Safety Institute, Office of Inspector General and National Aeronautics and Space Administration (NASA).

Figure 8. Permanent Civilian Jobs – FAA Center

OPM Federal Occupational Classification		Positions
White Collar Occupations		3,006
0	Miscellaneous Occupations Group	11
1	Social Science, Psychology, and Welfare Group	23
2	Human Resources Management Group	58
3	General Admin, Clerical, & Office Serv Group	629
4	Biological Sciences Group	7
5	Accounting and Budget Group	350
6	Medical, Hospital, Dental, & Public Health Group	31
7	Engineering and Architecture Group	626
8	Legal and Kindred Group	120
10	Information and Arts Group	10
11	Business and Industry Group	64
13	Physical Sciences Group	157
14	Library and Archives Group	2
15	Mathematics and Statistics Group	25
16	Equipment, Facilities, and Services Group	14
17	Education Group	43
18	Investigation Group	86
19	Quality Assur., Inspection, & Grading Group	23
20	Supply Group	11
21	Transportation Group	356
22	Information Technology	358
Trade, Craft, or Labor Jobs		58
31	Fabric and Leather Work	2
35	General Services & Support Work Family	3
41	Painting and Paperhanging Family	4
43	Pliable Materials Work Family	2
46	Wood Work Family	3
69	Warehousing & Stock Handling Family	40
70	Packing and Processing Family	5
All Occupations		3,064

Notes: Includes only appropriated fund permanent civilian employees in FY2019
Source: FAA Mike Monroney Center and Office of Personnel Management

Budget and Operations. The large economic role of the FAA Center is traced to its total operating budget of \$1.1 billion in fiscal year 2019. The expansive campus is located on 1,057 acres on the grounds of Will Rogers World Airport and is comprised of 134 buildings with over 3.3 million square feet of space. FAA has a long-term lease with the City of Oklahoma City valued at approximately \$20 million annually for use of the airport property.¹²

FAA Center Employment. The FAA Center was home to a reported 5,159 federal civilian employees and contractors in fiscal year 2019. The workforce consists of 3,064 appropriated fund federal civilian employees, 2,062 contract workers and 33 employees at tenant organizations.

The FAA continues to maintain a very highly skilled workforce in Oklahoma City. The mix of occupations among permanent civilian employees at the center is detailed in Figure 8.¹³ Approximately 98% of the jobs are white collar and most require professional or other specialized training.

Employment is highly concentrated in three key occupational groups. The largest includes 629 jobs in general administrative, clerical and office services occupations. These jobs reflect the administrative nature of much of the activity at the center but have decreased substantially in number since the 2015 aerospace report. The second largest specialty area includes 626 engineering and architecture positions. The large pool of FAA engineers based in Oklahoma City provides scheduled and emergency technical support services to FAA customers nationwide. The 358 workers in the information technology group comprise the third largest specialty area.

Other large specialty occupation groups include transportation (356), accounting and budget (350), legal (120), physical sciences (157), investigation (86) and business and industry (64).

The Boeing Company

The ongoing expansion of Boeing in Oklahoma City is possibly the most important development in the region's aerospace sector in recent years. Boeing is the second largest aerospace and defense contractor in the U.S. and is the largest federal contractor in the state. Boeing is also now the largest private aerospace employer in the region with over 3,660 employees.

Employees at Boeing in Oklahoma City are industry leaders in large aircraft sustainment and modernization, providing products and services for government customers, both U.S. and international, including engineering, software, logistics services and aircraft maintenance support.

Boeing's history in Oklahoma dates to 1953 when the company opened an office with 10 employees adjacent to Tinker Air Force Base.¹⁴ By 2010, Boeing had built a substantial presence with a reported 700 workers in Oklahoma City.

Boeing announced in 2010 that it planned to relocate its B-1 program and C-130 avionics modernization program from Long Beach, Calif., to Oklahoma City. The move involved 550 workers providing engineering, contractor-logistics services and field support for military customers.

Boeing's expansion in Oklahoma City has continued over the past decade. The firm now operates an engineering center of excellence out of three buildings constructed in 2007, 2011 and 2012 near Tinker AFB with a total of more than 530,000 square feet.¹⁵

Oklahoma is now the 8th largest operating hub by employment for Boeing in the U.S.¹⁶ Washington remains the dominant hub, with Missouri and California the second and third largest locations. Oklahoma trails key aerospace hubs in South Carolina, Texas, Arizona and Pennsylvania. However, Oklahoma has now amassed greater Boeing employment than several leading aerospace hubs including Alabama, Colorado, Virginia, Florida, Oregon, Illinois and Georgia.

Oklahoma Air National Guard

Oklahoma's National Guard – composed of the Army National Guard and the Air National Guard – traces its roots to 1890 before to statehood. Oklahoma Army and Air National Guard units have a unique dual mission that consists of both Federal and State responsibilities.¹⁷

The Oklahoma Air National Guard (OKANG) serves as the air component for the State's militia and remains a key component of the Greater Oklahoma City aerospace sector. The OKANG consists of two Wings across the state – the 137th Special Operations Wing (SOW) in Oklahoma City and the 138th Fighter Wing in Tulsa, both headquartered with the Oklahoma National Guard Joint Force Headquarters, also in Oklahoma City. The 137th SOW is located at Will Rogers Air National Guard Base (ANGB) just west of Will Rogers World Airport.

The OKANG in Oklahoma City operated with a budget of approximately \$118 million in fiscal year 2020. Payroll comprises the largest portion of the budget, reaching \$54 million in fiscal year 2020. Additional operational expenses totaled \$26 million along with three formal training units that accounted for \$10.3 million annually.

The 137th SOW specifically attracts substantial federal funding to the region. In addition to operational expenditures, contract funding of approximately \$28 million supports aircraft maintenance, flight evaluations, Battlefield Airmen simulator management, flying and ground support. These activities facilitate diverse special operations training requirements locally, as well as for DoD special operators throughout U.S. Special Operations Command.

The highly skilled workforce at Will Rogers ANGB comprises a broad range of occupational skills including flight operations, intelligence, aeromedical evacuation, logistics, engineering, aircraft maintenance, communications, as well as many other support agencies. The OKANG reports total employment of 1,235 members for fiscal year 2020, consisting of 174 full-time active Guard and Reserve personnel, 176 full-time, dual-status federal employees with required ANG membership, 22 state employees and 863 part-time drill status Guardsman. Additional personnel are associated with a wide range of supporting contracts. Most full-time personnel reside in the Greater Oklahoma City region while part-time Guardsmen reside across the state – with some even residing regionally in nearby states.

Multiple permanent and tenant organizations are based at OKANG facilities in Oklahoma City, including:

- The **137th Special Operations Wing** (137th SOW) is a U.S. Air Force flying unit aligned under Air Force Special Operations Command and the Air National Guard. The wing supports worldwide missions, global special operations, and deployments through Air Force Special Operations Command, Air Combat Command (ACC), Air Mobility Command (AMC), U.S. Special Operations Command, and the 45th Infantry Brigade Combat Team (IBCT). The 137th SOW is also an internationally recognized and accredited training facility with formal in-house training units that produce highly trained Airmen to support manned intelligence, surveillance and reconnaissance (ISR), close air support, agile combat support, cyber and aeromedical evacuation. The 137th SOW is the home of the MC-12W, a manned airborne ISR platform with a 4-person crew that includes a pilot, co-pilot, combat systems officer and a tactical systems operator.
- The **137th Special Operations Group** (137th SOG) directs the training and deployment of the MC-12W ISR aircraft and crews, two intelligence squadrons, aeromedical evacuation, air support operations and advanced Battlefield Airmen training courses. The 137th SOG is home to both the

146th Air Support Operations Squadron (146th ASOS) and the **137th Aeromedical Evacuation Squadron** (137th AES). The 146th ASOS provides highly trained Tactical Air Control Party (TACP) specialists and air liaison officers who advise battlefield commanders on the best use of airpower, establishes and maintains command and control communications and provides controlled attack guidance for U.S. and coalition fixed-wing and rotary-wing aircraft. The 146th ASOS maintains a long-standing partnership with the 45th IBCT, which has a large footprint across the state of Oklahoma. The 137th AES provides time sensitive, mission critical en route care to patients to and between medical treatment facilities. The 137th AES is one of nine AES squadrons in the ANG and, along with the Air Force Reserves aeromedical evacuation (AE) squadrons, account for 70% of global AE missions. The 137th SOG has implemented and continues to develop international training courses as part of a broader national strategy to support NATO alliances. The 137th Combat Training Flight (137th CTF) leads courses in Initial Combat Skills Training for TACP specialists and the Joint Terminal Attack Controller Qualification Course (JTAC-QC), one of only two locations to host this training across the entire Air Force enterprise. In 2021, the 137th CTF welcomed its first international student from a partner NATO nation.

- The **137th Special Operations Medical Group** (137th SOMDG) provides personnel support for pre-deployment, post-deployment and in-garrison medical requirements at the 137th SOW. The Medical Group provides services in Flight Medicine, Dental, Optometry, Bio-environmental, Nursing Services, and Laboratory Services. The 137th SOMDG made significant contributions to the state at the beginning of the COVID-19 pandemic.
- The **137th Special Operations Mission Support Group** (137th SOMSG) provides vital day-to-day support for the personnel and infrastructure at Will Rogers ANGB. The 137th SOMSG maintains and improves base infrastructure through civil engineering, provides installation defense through security forces, communications, logistics and readiness and personnel force support services. The **205th Engineering Installation Squadron** was a former tenant at Will Rogers ANGB and is now a part of the SOMSG. The 205th is one of 16 engineering and installation squadrons in the Air Force, 15 of which are part of the Air National Guard. The 205th mobilizes to deploy resources to design, engineer and install cyber and C4I systems infrastructure throughout the world.
- The **306th Intelligence Squadron** (306th IS) is an ACC active-duty tenant unit at Will Rogers ANGB. The 306th IS trains and qualifies Airborne Cryptologic Operators to execute special operations missions worldwide. The colocation of the 306th with the 137th SOW puts intelligence operators in-training at the same location as a special operations ISR platform. When added to the 137th SOW's other capabilities, Will Rogers ANGB Airmen and others trained at the base provide battlefield commanders with a full-spectrum toolkit ranging from intelligence gathering to strike capabilities.

Along with supporting the nation's domestic and international defense missions, and assisting during times of disaster and civil unrest, 137th SOW Airmen also cooperate with federal, state and local governments in a range of activities including, but not limited to, security operations, border patrol, construction efforts, drug interdiction and firefighting. Guardsmen also regularly engage in specialized training missions overseas and with civilian authorities domestically.

Tinker Business and Industrial Park

A unique asset serving the region's aerospace firms is the Tinker Business and Industrial Park (TBIP), a sector-specific business park located in Midwest City adjacent to Tinker Air Force Base. The Park was established in 1989 with Boeing as its anchor tenant and now represents the largest concentration of private aerospace firms and technology companies in the region.

The park spans two campuses and is located within minutes of the Oklahoma City Air Logistics Complex at the Base. Tenants represent a cluster of more than 40 firms ranging from private companies, public agencies, tribal entities, universities, laboratories and education and training providers. Top aerospace and defense contractors such as Pratt & Whitney, Lockheed Martin, Rockwell Collins, GE Aviation, Choctaw Defense, Rolls-Royce and others utilize space at TBIP.

TBIP is also home to the Aerospace Collaboration & Partnership Center (ACPC), offering uniquely structured office space to aerospace start-ups, small businesses or companies with a small Oklahoma footprint. Space is structured for small numbers of employees on a short, medium or long-term basis at a flat rate per person.

TBIP is currently certified as a U.S. Small Business Administration (SBA) HUBZone due to its location within a qualified Census tract.¹⁸ HUBZone status allows limited competition for certain contracts to businesses in these historically underutilized business zones. It also provides preferential consideration to HUBZone businesses in contracts with full and open competition.

V. Greater OKC Area Aerospace Occupation Profile

Future growth in the Greater Oklahoma City aerospace industry depends upon the continued availability of a highly-skilled workforce. The wage cost in the region relative to competing aerospace markets similarly plays a key role in the relative competitiveness of the region in capturing future industry growth.

This section of the report provides a detailed view of the existing aerospace workforce in the region. Data are provided on employment levels and average annual wage rates by detailed occupation covering both private sector and federal civilian government workers in aerospace-related jobs. Figures 9 and 10 provide a state-level comparison of employment levels and wage rates across several key aerospace occupations.

Aerospace Employment Comparison. Figure 9 examines employment levels and wage rates for four key aerospace occupations with varying skill requirements. The large, top-tier aerospace states of California, Texas, Washington, Georgia and Florida continue to lead in the number of employees in these categories as well as in most other aerospace-related occupations. These states tend to have both significant private aerospace manufacturing infrastructure and large-scale federal and military installations.

Nevertheless, Oklahoma continues to rank highly in the number of employees in these four key aerospace occupations. The state currently ranks 13th among the states with 1,660 aerospace engineers. This is roughly double the number reported in the 2015 report, pushing the state up from 18th to 13th. The number of aerospace engineers in a state is closely related to the level of research and development, manufacturing and space-related activity taking place. The Oklahoma City metropolitan area is home to a reported 790 of the state's 1,660 aerospace engineers, with recent gains led by Boeing's ongoing expansion in the region.

Oklahoma's 90 aerospace engineering and operations technicians rank 20th among the states. Aerospace engineering and operations technicians are most prevalent among states with large private aerospace manufacturing sites.

Figure 9. Rankings of Key Aerospace Industry Employment by Occupation & State (2019)

Aerospace Engineers (SOC 17-2011)			Aerospace Engineering & Operations Technicians (SOC 17-3021)			Aircraft Mechanics and Service Technicians (SOC 49-3011)			Avionics Technicians (SOC 49-2091)		
State	Jobs	Annual Wages	State	Jobs	Annual Wages	State	Jobs	Annual Wages	State	Jobs	Annual Wages
1 California	11,440	125,000	1 California	2,220	68,750	1 Texas	16,480	66,870	1 Washington	3,180	83,940
2 Washington*	6,680	137,550	2 Florida	1,520	58,830	2 California	13,800	71,890	2 Texas	2,970	64,110
3 Texas	6,140	126,740	3 Texas	1,380	66,350	3 Florida	13,490	65,350	3 Florida	2,260	58,000
4 Alabama	4,070	119,890	4 Ohio	960	67,420	4 Georgia*	7,490	66,540	4 California	1,620	75,740
5 Ohio	3,810	116,540	5 Arizona	920	64,100	5 Washington	6,070	69,430	5 Georgia	1,490	63,830
6 Florida	3,070	107,990	6 Georgia*	850	53,010	6 Arizona	4,740	65,700	6 Kansas	970	62,590
7 Maryland	2,810	135,400	7 Kansas	490	68,610	7 Oklahoma*	4,730	56,520	7 Alabama*	960	64,320
8 Kansas	2,450	106,300	8 Alabama	460	63,520	8 Illinois	4,610	68,700	8 Arizona	610	60,610
9 Georgia	2,430	112,670	9 Washington	430	97,130	9 North Carolina	4,400	62,740	9 Maryland	610	74,100
10 Colorado	2,230	125,070	10 Colorado	280	92,600	10 Ohio	4,150	63,580	10 Oklahoma*	540	55,760
11 New Jersey	2,100	116,740	11 New York	280	67,190	11 Michigan	3,520	57,410	11 Illinois	440	50,020
12 Virginia	1,830	123,290	12 New Jersey*	270	71,320	12 New York	3,410	71,360	12 New Jersey	430	70,230
13 Oklahoma	1,660	98,450	13 Maryland	230	76,670	13 Alabama*	3,150	64,230	13 North Carolina	370	55,130
14 Arizona	1,580	112,140	14 Indiana	220	72,410	14 Pennsylvania	2,650	72,340	14 Colorado	360	59,110
15 Connecticut	1,450	109,630	15 Virginia	200	76,650	15 Virginia	2,440	68,260	15 Nevada	310	64,790
16 Missouri	1,190	110,560	16 New Mexico	180	68,650	16 Maryland	2,370	74,060	16 Virginia	300	63,690
17 Utah	710	103,930	17 Tennessee	160	69,850	17 Kentucky	2,260	69,690	17 Louisiana	290	65,370
18 Pennsylvania	680	112,840	18 Utah	130	64,000	18 New Jersey	2,150	75,120	18 Missouri	280	73,780
19 New Mexico	610	102,430	19 Pennsylvania*	110	67,370	19 Nevada	2,010	79,010	19 Oregon	220	70,740
20 North Carolina	530	93,110	20 Oklahoma	90	70,630	20 Colorado	1,920	74,280	20 Pennsylvania	210	69,540

* Values are estimates of data suppressed by BLS.

Source: Bureau of Labor Statistics (BLS) Occupational Employment Statistics

Oklahoma ranks 7th in the employment of aircraft mechanics and service technicians with 3,570 workers, and 10th in avionics technicians with 540 workers. The higher rankings for Oklahoma on both occupations reflect the relatively larger role they play in aircraft MRO activity, one of the state's and region's strengths in aerospace. The Oklahoma City metro area is home to 2,350 aircraft mechanics and service technicians, approximately half the state total, and 360 avionics technicians, approximately two-thirds of the state total. These two occupations better reflect the overall presence of military and civilian aviation across the state and in the Greater Oklahoma City region.

Aerospace Wage Comparison. In general, wages in Oklahoma for most aerospace occupations are among the lowest in the major aerospace states and reflect the relatively low overall cost-of-living in the state. Figure 10 provides an additional comparison of the overall wage structure for an expanded set of aerospace-related occupations in Oklahoma and eight other traditional aerospace states.

Oklahoma's aerospace wages are well below the western states of California and Washington for all reported occupations and below the neighboring states of Texas and Kansas across most occupations. Oklahoma's aerospace wages are basically on par with Arizona and Florida, both of which are lower-cost-of-living Sun Belt states with more highly-developed aerospace sectors.

The average wage of \$98,450 for aerospace engineers in Oklahoma remains below the largest aerospace states. In the Oklahoma City metro area, aerospace engineers earned a reported average of \$97,970 per year in 2019.¹⁹

The labor market for aircraft mechanics and service technicians is highly developed in Oklahoma but still has the lowest average annual wage (\$56,520) among the comparison group. This was the case in the 2015 report as well. The average in the Oklahoma City metro area is slightly lower than the state at \$52,880 annually. This reflects in part the military wages paid to active-duty military personnel included in the wage comparison.

Oklahoma's wages for support occupations such as electricians, machinists, engine assemblers and welders are more reflective of a national market for these occupations. Wages in Oklahoma are highly comparable to those paid in the eight comparison states. Wages in the Oklahoma City metro area for most of the occupations in Figure 10 are generally 5-15% above the respective statewide average for each occupation.

Figure 10. Average Annual Earnings by Aerospace-Related Occupation by State (2019)

Occupation	AL	AZ	CA	CO	FL	KS	OK	TX	WA
Aerospace Engineer. & Operations Tech.	\$63,520	\$64,100	\$68,750	\$92,600	\$58,830	\$68,610	\$70,630	\$66,350	\$97,130
Aerospace Engineers	119,890	112,140	125,000	125,070	107,990	106,300	98,450	126,740	*138,770
Avionics Technicians	*63,830	60,610	75,740	59,110	58,000	62,590	*54,190	64,110	83,940
Aircraft Mechanics & Service Tech.	64,230	65,700	71,890	74,280	65,350	59,110	56,520	66,870	69,430
Electricians	47,490	49,350	70,460	55,050	45,720	54,750	51,950	52,230	71,160
Machinists	45,350	48,180	48,360	47,880	42,800	42,690	43,840	46,420	53,830
Engine & Other Machine Assemblers	45,990	41,260	40,080	39,750	32,670	38,310	36,570	41,100	45,740
Welders, Cutters, Solderers, & Brazers	40,910	44,070	47,910	49,870	41,650	43,710	43,600	46,940	53,960

* Values are estimates of data suppressed by BLS.

Source: Bureau of Labor Statistics (BLS) Occupational Employment Statistics

Profile of Greater OKC Region Key Aerospace Occupations

Figure 11 provides a more detailed profile of several key occupations in the aerospace sector in the Greater Oklahoma City region. The employment estimates in this section reflect total employment in each key aerospace-related occupation, whether workers are employed directly in aerospace or other industries. This provides an overall assessment of the depth of the labor market for each key occupation needed by aerospace employers.

The aerospace industry requires a diverse mix of workers with education requirements ranging from high school completion to a bachelor's degree. Most aerospace occupations require little work experience in the industry. However, most occupations require significant on-the-job training, often over multiple years.

Wages in most aerospace occupations in Oklahoma generally exceed the overall state average, with median hourly wages in aerospace generally above \$20 per hour. The median hourly wage typically exceeds \$40 per hour for engineers, air traffic controllers, pilots and software developers. Median wages are below \$20 per hour in only a few key aerospace occupations, primarily air passenger airline services and some entry-level aircraft maintenance positions.

Sixteen key aerospace occupations in Figure 11 have a current employment base in the Greater OKC region of more than 1,000 workers. All sixteen have added workers the past five years except machinists. Several of the sectors have added more than 500 workers the past five years including logisticians (+854 jobs); engineers—all others (+595 jobs); miscellaneous assemblers and fabricators (+583 jobs); software developers and software quality assurance (+574 jobs); welders, cutters, solderers, and brazers (+549 jobs); and inspectors, testers, sorters, samplers and weighers (+515 jobs).

Other occupations with a significant expansion of workers the past five years include maintenance workers—machinery (+401 jobs); coating, painting and spraying machine operators (+350 jobs); and electrical, electronic and electromechanical assemblers (+204 jobs).

The Greater Oklahoma City region has also greatly expanded the available supply of engineers since 2015. Additional engineering jobs by occupation include aerospace engineers (+260 jobs); electrical engineers (+214 jobs); industrial engineers (+124 jobs); mechanical engineers (+81 jobs); materials engineers (+36 jobs); and engineers—all others (+595 jobs). Approximately 1,900 workers in engineering occupations were added to the Greater Oklahoma City workforce between 2015 and 2020.

The amount of annual hiring is generally related to the size of the existing workforce within each occupation. The seven largest aerospace occupations have very active labor markets, with all adding approximately 1,000 new hires or more in 2020.

The industry faces the task of filling numerous openings and the replacement of a considerable number of existing workers in the near term. The seven largest aerospace occupations all had more than 250 job openings annually over the past five years. More than 500 job openings annually are found in miscellaneous assemblers and fabricators (598 jobs), welders, cutters, solderers, and brazers (519 jobs). These numbers do not necessarily account for the full demand or job openings associated with Tinker AFB.

Figure 11. Labor Force Key Aerospace Sector Occupations – Greater OKC Region

SOC Code	Standard Occupational Classification (SOC)	Employment				Median Hourly Earnings	Typical Entry Level Education	Work Experience Required	Typical On-The-Job Training
		2015	2020	Change	%Chg.				
15-1256	Software Developers & Software Quality Assurance	3,826	4,383	574	16.1%	\$42.98	Bachelor's degree	None	None
51-2098	Miscellaneous Assemblers and Fabricators	3,634	4,177	583	16.5%	\$15.21	High school	None	Moderate-term on-the-job training
51-4121	Welders, Cutters, Solderers, and Brazers	3,062	3,669	549	17.5%	\$20.75	High school	None	Moderate-term on-the-job training
49-3011	Aircraft Mechanics and Service Technicians	2,685	2,726	66	2.6%	\$25.66	Postsec. nondegree	None	None
13-1081	Logisticians	1,752	2,651	854	52.9%	\$37.05	Bachelor's degree	None	None
47-2211	Sheet Metal Workers	2,485	2,588	86	3.8%	\$25.84	High school	None	Apprenticeship
51-9061	Inspectors, Testers, Sorters, Samplers, & Weighers	1,539	2,056	515	32.7%	\$22.03	High school	None	Moderate-term on-the-job training
49-9041	Industrial Machinery Mechanics	1,686	1,808	146	9.0%	\$24.61	High school	None	Long-term on-the-job training
17-2072	Electronics Engineers, Except Computer	1,368	1,382	13	1.0%	\$44.88	Bachelor's degree	None	None
17-2199	Engineers, All Other	741	1,357	595	86.9%	\$45.46	Bachelor's degree	None	None
51-4041	Machinists	1,768	1,278	-418	-24.1%	\$23.39	High school	None	Long-term on-the-job training
51-2028	Electrical, Electronic, and Electromech. Assemblers	1,024	1,243	204	20.4%	\$18.27	High school	None	Moderate-term on-the-job training
49-9043	Maintenance Workers, Machinery	819	1,212	401	46.9%	\$22.23	High school	None	Long-term on-the-job training
11-9041	Architectural and Engineering Managers	978	1,133	160	17.4%	\$67.83	Bachelor's degree	5+ years	None
51-9124	Coating, Painting, & Spraying Machine Operators	730	1,096	350	47.9%	\$17.85	High school	None	Moderate-term on-the-job training
17-2141	Mechanical Engineers	995	1,077	81	8.4%	\$41.96	Bachelor's degree	None	None
17-2011	Aerospace Engineers	577	833	260	47.7%	\$47.62	Bachelor's degree	None	None
51-9161	Computer Numerically Controlled Tool Operators	835	824	17	2.1%	\$20.44	High school	None	Moderate-term on-the-job training
17-3023	Electrical & Elect. Eng. Technologists/Technicians	858	781	-68	-8.5%	\$32.89	Associate's degree	None	None
17-2071	Electrical Engineers	509	735	214	44.1%	\$45.16	Bachelor's degree	None	None
17-2112	Industrial Engineers	552	662	124	23.5%	\$42.26	Bachelor's degree	None	None
17-3026	Industrial Engineering Technologists & Technicians	490	587	85	19.1%	\$32.57	Associate's degree	None	None
51-4081	Multiple Mach. Tool Setters, Operators, & Tenders	761	572	-111	-15.0%	\$16.42	High school	None	Moderate-term on-the-job training
49-2091	Avionics Technicians	471	455	-29	-6.0%	\$26.30	Associate's degree	None	None
53-2011	Airline Pilots, Copilots, and Flight Engineers	289	388	84	26.0%	\$67.46	Bachelor's degree	<5 years	Moderate-term on-the-job training
51-2031	Engine and Other Machine Assemblers	378	327	-68	-18.6%	\$16.50	High school	None	Moderate-term on-the-job training
43-4181	Reserv. & Transport. Ticket Agents & Travel Clerks	395	326	-49	-13.0%	\$21.54	High school	None	Short-term on-the-job training
43-5011	Cargo and Freight Agents	216	290	59	30.3%	\$20.07	High school	None	Short-term on-the-job training
53-2021	Air Traffic Controllers	242	275	26	10.4%	\$50.74	Associate's degree	None	Long-term on-the-job training
53-2012	Commercial Pilots	284	221	-47	-16.9%	\$41.53	High school	None	Moderate-term on-the-job training
51-4111	Tool and Die Makers	176	167	-13	-8.1%	\$26.01	Postsec. nondegree	None	Long-term on-the-job training
17-2131	Materials Engineers	99	131	36	41.2%	\$44.20	Bachelor's degree	None	None
51-2011	Aircraft Struct., Surfaces, Rigging, & Systems	76	65	-17	-13.1%	\$19.34	High school	None	Moderate-term on-the-job training
53-6098	Aircraft Svc. Attendants & Transportation Workers	50	51	1	1.5%	\$15.67	High school	None	Short-term on-the-job training
17-3021	Aerospace Eng. & Oper. Technologists/Technicians	23	51	28	214.3%	\$38.76	Associate's degree	None	None
53-2022	Airfield Operations Specialists	34	47	14	62.0%	\$21.27	High school	None	Long-term on-the-job training
53-1041	Aircraft Cargo Handling Supervisors	27	36	6	32.6%	\$23.92	High school	<5 years	None

Source: EMSI Staffing Patterns 2020.4 (QCEW+Non-QCEW+Self-Employed)

Notes: These are key occupations for the six-digit NAICS codes in the core aerospace sectors. Includes both private and federal sector employers. However, employment counts are across all industries.

Figure 11. (Cont.) Labor Force in Key Aerospace Occupations – Greater OKC Region

SOC Code	Standard Occupational Classification (SOC)	Employment				Net Commuters	Hires (2020)	Separations (2020)	Avg Annual Openings (2015-20)	Total Regional Completions (2015-19)
		2015	2020	Change	%Chg.					
15-1256	Software Developers & Software Quality Assurance	3,826	4,383	574	16.1%	255	1,877	1,620	442	2,139
51-2098	Miscellaneous Assemblers and Fabricators	3,634	4,177	583	16.5%	59	3,575	3,610	598	0
51-4121	Welders, Cutters, Solderers, and Brazers	3,062	3,669	549	17.5%	-19	2,201	1,997	519	761
49-3011	Aircraft Mechanics and Service Technicians	2,685	2,726	66	2.6%	110	978	945	260	560
13-1081	Logisticians	1,752	2,651	854	52.9%	182	997	960	378	76
47-2211	Sheet Metal Workers	2,485	2,588	86	3.8%	231	1,760	1,669	315	0
51-9061	Inspectors, Testers, Sorters, Samplers, & Weighers	1,539	2,056	515	32.7%	-33	1,483	1,574	326	0
49-9041	Industrial Machinery Mechanics	1,686	1,808	146	9.0%	51	822	724	208	0
17-2072	Electronics Engineers, Except Computer	1,368	1,382	13	1.0%	118	329	344	102	1,473
17-2199	Engineers, All Other	741	1,357	595	86.9%	77	355	330	178	1,071
51-4041	Machinists	1,768	1,278	-418	-24.1%	-36	666	597	164	325
51-2028	Electrical, Electronic, and Electromech. Assemblers	1,024	1,243	204	20.4%	34	683	653	192	0
49-9043	Maintenance Workers, Machinery	819	1,212	401	46.9%	-44	624	596	187	0
11-9041	Architectural and Engineering Managers	978	1,133	160	17.4%	55	329	313	107	9,558
51-9124	Coating, Painting, & Spraying Machine Operators	730	1,096	350	47.9%	16	729	681	171	470
17-2141	Mechanical Engineers	995	1,077	81	8.4%	23	353	301	100	2,174
17-2011	Aerospace Engineers	577	833	260	47.7%	28	195	177	93	434
51-9161	Computer Numerically Controlled Tool Operators	835	824	17	2.1%	-15	359	352	115	264
17-3023	Electrical & Elect. Eng. Technologists/Technicians	858	781	-68	-8.5%	49	313	306	88	363
17-2071	Electrical Engineers	509	735	214	44.1%	34	217	180	83	1,456
17-2112	Industrial Engineers	552	662	124	23.5%	9	238	176	69	271
17-3026	Industrial Engineering Technologists & Technicians	490	587	85	19.1%	60	237	223	75	803
51-4081	Multiple Mach. Tool Setters, Operators, & Tenders	761	572	-111	-15.0%	-60	311	282	95	193
49-2091	Avionics Technicians	471	455	-29	-6.0%	5	138	127	42	325
53-2011	Airline Pilots, Copilots, and Flight Engineers	289	388	84	26.0%	-16	134	116	63	0
51-2031	Engine and Other Machine Assemblers	378	327	-68	-18.6%	31	178	196	61	2
43-4181	Reserv. & Transport. Ticket Agents & Travel Clerks	395	326	-49	-13.0%	-2	169	151	74	72
43-5011	Cargo and Freight Agents	216	290	59	30.3%	35	271	279	49	53
53-2021	Air Traffic Controllers	242	275	26	10.4%	2	79	75	35	0
53-2012	Commercial Pilots	284	221	-47	-16.9%	-10	100	84	36	0
51-4111	Tool and Die Makers	176	167	-13	-8.1%	19	70	64	21	0
17-2131	Materials Engineers	99	131	36	41.2%	6	32	29	15	14
51-2011	Aircraft Struct., Surfaces, Rigging, & Systems	76	65	-17	-13.1%	-45	39	18	12	594
53-6098	Aircraft Svc. Attendants & Transportation Workers	50	51	1	1.5%	3	39	25	9	0
17-3021	Aerospace Eng. & Oper. Technologists/Technicians	23	51	28	214.3%	9	20	14	10	822
53-2022	Airfield Operations Specialists	34	47	14	62.0%	9	18	15	8	0
53-1041	Aircraft Cargo Handling Supervisors	27	36	6	32.6%	11	22	19	7	76

Source: EMSI Staffing Patterns 2020.4 (QCEW+Non-QCEW+Self-Employed)

Notes: These are key occupations for the six-digit NAICS codes in the core aerospace sectors. Includes both private and federal sector employers. However, employment counts are across all industries.

VI. State-Level Aerospace Markets

Making state level comparisons of aerospace markets is challenging due to the widely varying mix of private and public sector aerospace-related establishments in each state. Many comparative studies of state aerospace markets focus primarily on private sector aerospace activity and exclude the public sector component of the market.

For Oklahoma, this practice ignores large public sector aerospace assets and tends to rank the state as only an upper middle-tier aerospace state. This section of the report addresses this gap by providing a more comprehensive measure of the combined private and public sector components of the aerospace industry in each state. This approach provides for a more holistic comparison that captures the widely varying mix of both private and public sector aerospace activity across the states.

There is also little consensus on which components of the private side of the aerospace industry should be included in comparative state-level studies. We identify a standardized group of core private aerospace sectors that capture the bulk of the private industry in each state. The private aerospace sectors are identified using both widely available federal datasets and standard NAICS sectors. This approach provides ample historical data for measuring trends over time, and the data can be easily maintained going forward.

Examining both the private and public sides of the aerospace sector demonstrates the critical importance of examining public sector aerospace activity in Oklahoma and many other states. For Oklahoma, the state rises to among the ranks of the ten largest aerospace states measured by employment when the state's full private and public sector employment base is considered. The state's aerospace industry also showed considerable stability during the COVID-19 slowdown relative to the performance of the industry in states with a far higher share of private aircraft manufacturing and maintenance and commercial air carriers.

Profile of the Core Private Aerospace Industry by State

As described in the scope section of the report, a comparative view of the core private aerospace industry is prepared using NAICS sectors 3464 (aerospace product and parts manufacturing), 481 (air transportation), and 4881 (support activities for air transportation). These three sectors are believed to capture at least 90% of the private sector aerospace activity across the states.²⁰ Again, other far smaller components of the aerospace industry are excluded because of their small relative size but do not affect the state rankings in a meaningful way.

Economic activity in each of the three core private sectors is detailed in Figure 12 for each state and the nation. Economic measures include the number of business establishments, wage and salary employment and total annual wages. State rankings by total establishments, employment and annual wages are provided in Figure 13.

Nation. Based on the standardized definition of private aerospace, there were approximately 17,250 business establishments operating in the three core private aerospace sectors in the U.S. in 2019. These firms employed 1.27 million workers earning a total of \$113 billion in annual wages. Average annual wages in the sector reached \$89,258 per worker in 2019. The average private aerospace firm is relatively small with only about 75 employees.

Oklahoma. Oklahoma reported 317 private aerospace establishments with 19,038 employees earning \$1.56 billion in annual wages in 2019. Average wages within the core aerospace sectors reached \$82,172 in Oklahoma in 2019, about 8% below the national average. The average private aerospace firm in the state employed about 60 workers, slightly below national estimates. For comparison, estimates from the

aerospace industry profile detailed earlier in the report for the Greater Oklahoma City region found an estimated 10,840 private sector aerospace workers earning \$1.0 billion in annual labor income.

Other States by Industry Concentration. Measured by NAICS 3364 (manufacturing and maintenance activity), the largest manufacturing-intensive aerospace markets are generally Washington, California, Texas, Connecticut, Arizona, Florida, Kansas, Ohio and Georgia. These are the traditional leading private aerospace markets for aircraft engineering and assembly, supplying both the defense and commercial aviation markets.

NAICS 3364 (manufacturing and maintenance activity) is a far more important factor in determining the total size of the industry than either NAICS 481 (air transportation) or 4881 (support activities for air transportation). Activity captured by NAICS 481 and 4881 is highly correlated with population, with larger states typically having larger commercial and general aviation sectors. There is some added concentration of employment in air transportation (NAICS 481) in states having either large commercial airline hubs or extensive tourism activity such as Georgia, California, Texas, Illinois, Florida and New York.

Similarly, states with extensive airline maintenance and service facilities (or large shares in sector 4881) include California, Florida, Texas, Illinois, Nevada and Arizona.

Figure 12. Core Private Aerospace Industry Sectors by State (2019)

State	Establishments				Wage & Salary Employment				Annual Wages (\$Mil.)			
	NAICS Sector			Total	NAICS Sector			Total	NAICS Sector			Total
	3364	481	4881		3364	481	4881		3364	481	4881	
Alabama	79	66	142	287	13,010	686	3,536	17,232	\$1,215.9	\$50.2	\$250.6	\$1,516.7
Alaska	10	199	83	292	121	6,222	1,381	7,723	4.4	402.5	55.3	462.1
Arizona	134	123	246	502	30,682	14,196	7,572	52,450	3,322.6	1,107.1	429.2	4,858.9
Arkansas	27	45	110	181	4,045	744	1,138	5,926	259.0	31.9	48.0	338.9
California	629	584	787	2,000	77,956	58,577	33,331	169,864	8,653.4	5,686.3	1,625.7	15,965.4
Colorado	40	109	200	348	8,117	16,739	5,625	30,481	1,126.4	1,596.8	231.3	2,954.5
Connecticut	142	63	83	288	31,917	1,099	1,211	34,226	3,766.5	102.2	77.8	3,946.5
Delaware	6	28	39	72	654	185	581	1,419	50.1	21.4	49.0	120.6
Dist. of Columbia	1	23	9	33	6	70	62	139	0.7	8.8	5.1	14.7
Florida	386	678	947	2,011	25,814	45,888	28,389	100,091	2,597.6	3,777.8	1,319.7	7,695.0
Georgia	113	164	219	496	21,011	30,681	4,876	56,569	1,997.1	3,381.8	226.1	5,605.0
Hawaii	2	74	79	155	13	10,115	2,536	12,663	1.2	744.0	83.1	828.2
Idaho	27	66	69	162	507	1,455	892	2,854	26.1	73.0	51.9	150.9
Illinois	52	266	205	522	3,739	39,740	8,155	51,634	275.4	3,709.7	358.6	4,343.7
Indiana	49	89	143	281	6,309	3,316	2,987	12,612	601.8	199.4	157.3	958.4
Iowa	9	37	70	115	2,025	380	808	3,214	102.7	17.7	24.9	145.3
Kansas	156	38	120	314	33,182	337	1,469	34,988	2,607.5	18.9	78.6	2,704.9
Kentucky	27	62	103	193	3,314	2,843	3,750	9,906	236.6	215.7	269.2	721.5
Louisiana	19	103	98	220	1,298	2,576	1,809	5,682	116.0	173.8	79.6	369.5
Maine	6	29	42	77	1,687	260	697	2,644	166.6	10.3	24.7	201.6
Maryland	39	63	107	209	2,400	5,900	3,553	11,854	221.3	580.9	224.8	1,027.1
Massachusetts	29	139	90	258	11,003	9,689	3,335	24,026	1,490.6	764.7	135.9	2,391.2
Michigan	64	165	127	355	5,789	15,192	4,457	25,437	434.2	1,459.4	235.8	2,129.5
Minnesota	38	97	99	234	1,296	14,240	1,461	16,996	93.2	1,258.2	71.6	1,423.0
Mississippi	15	38	91	144	1,313	195	1,870	3,378	97.0	10.5	131.7	239.2
Missouri	50	83	144	277	17,406	4,518	2,917	24,842	2,014.5	273.9	137.6	2,426.1
Montana	9	55	68	132	288	820	808	1,915	20.5	31.8	35.1	87.3
Nebraska	11	33	60	104	579	481	2,301	3,360	30.5	26.0	120.9	177.4
Nevada	17	72	151	240	513	8,076	6,166	14,755	34.8	736.1	364.1	1,135.0
New Hampshire	11	37	40	88	1,486	503	470	2,460	117.1	41.2	29.7	188.0
New Jersey	24	138	124	285	1,594	18,327	6,419	26,340	122.9	1,802.3	276.2	2,201.4
New Mexico	19	46	71	135	696	1,208	1,138	3,043	66.4	55.8	73.0	195.3
New York	81	321	235	637	5,188	35,031	13,376	53,595	419.5	3,204.3	556.8	4,180.7
North Carolina	42	122	213	377	6,746	15,820	6,949	29,515	596.1	1,208.7	356.4	2,161.3
North Dakota	5	18	50	72	695	126	660	1,481	52.0	4.6	25.8	82.4
Ohio	152	150	216	518	20,078	10,183	5,778	36,038	2,135.1	1,169.0	317.7	3,621.8
Oklahoma	69	62	186	317	13,545	1,441	4,052	19,038	1,183.7	102.3	278.4	1,564.4
Oregon	47	88	100	235	3,628	5,404	2,224	11,257	324.8	396.6	82.8	804.2
Pennsylvania	63	169	155	387	10,375	13,310	4,168	27,852	1,111.3	1,122.2	157.8	2,391.3
Rhode Island	1	26	23	50	4	387	255	645	1.0	20.3	3.8	25.1
South Carolina	49	95	105	248	7,381	1,097	1,944	10,422	738.3	44.6	97.6	880.6
South Dakota	3	27	42	71	49	246	439	734	8.9	11.8	20.1	40.7
Tennessee	35	105	134	274	2,348	2,732	2,924	8,003	158.0	159.4	172.5	490.0
Texas	235	501	814	1,549	49,412	64,237	26,344	139,992	5,521.1	6,277.4	1,725.9	13,524.4
Utah	73	75	80	227	7,795	7,415	1,556	16,767	634.0	722.9	57.3	1,414.3
Vermont	7	13	28	48	1,441	119	242	1,801	110.5	5.4	10.9	126.8
Virginia	51	165	184	399	1,942	14,060	6,934	22,936	175.5	1,190.6	293.2	1,659.3
Washington	198	129	183	510	88,483	15,933	6,434	110,849	10,529.0	1,473.5	341.2	12,343.7
West Virginia	10	20	35	65	2,282	96	563	2,940	184.1	4.1	32.2	220.4
Wisconsin	25	60	114	199	1,395	1,995	2,093	5,483	100.6	110.3	81.2	292.1
Wyoming	4	29	33	66	55	457	208	720	2.2	19.5	6.4	28.1
United States	3,382	5,980	7,891	17,252	532,609	505,340	232,839	1,270,788	55,856.3	45,617.5	11,916.0	113,389.8

Source: Bureau of Labor Statistics (QCEW Survey) and Census Bureau (County Business Patterns)

Figure 13. State Rankings of Core Private Aerospace Industry Activity (2019)

State	Employment	Rank	Establishments	Rank	Annual Wages	Rank	Average Wage	Rank
Alabama	17,232	21	287	19	\$1,516,749,781	21	\$88,019	12
Alaska	7,723	32	292	17	462,139,290	32	59,838	41
Arizona	52,450	7	502	8	4,858,909,444	6	92,639	11
Arkansas	5,926	33	181	34	338,892,749	34	57,191	42
California	169,864	1	2,000	2	15,965,382,140	1	93,989	10
Colorado	30,481	12	348	14	2,954,517,440	11	96,930	8
Connecticut	34,226	11	288	18	3,946,486,591	9	115,306	1
Delaware	1,419	47	72	45	120,625,189	45	85,022	15
Dist. of Columbia	139	51	33	51	14,663,206	51	105,872	3
Florida	100,091	4	2,011	1	7,695,028,943	4	76,880	26
Georgia	56,569	5	496	9	5,605,029,321	5	99,083	6
Hawaii	12,663	25	155	36	828,213,293	28	65,403	37
Idaho	2,854	41	162	35	150,930,282	42	52,890	46
Illinois	51,634	8	522	5	4,343,743,207	7	84,125	18
Indiana	12,612	26	281	21	958,367,286	26	75,991	29
Iowa	3,214	38	115	40	145,261,288	43	45,203	49
Kansas	34,988	10	314	16	2,704,925,220	12	77,311	24
Kentucky	9,906	30	193	33	721,455,856	30	72,830	32
Louisiana	5,682	34	220	30	369,463,466	33	65,020	38
Maine	2,644	42	77	43	201,631,232	38	76,255	28
Maryland	11,854	27	209	31	1,027,064,203	25	86,646	13
Massachusetts	24,026	18	258	24	2,391,161,509	15	99,523	5
Michigan	25,437	16	355	13	2,129,487,159	18	83,715	20
Minnesota	16,996	22	234	28	1,422,975,954	22	83,722	19
Mississippi	3,378	36	144	37	239,243,846	36	70,829	35
Missouri	24,842	17	277	22	2,426,053,347	13	97,661	7
Montana	1,915	44	132	39	87,338,263	46	45,601	48
Nebraska	3,360	37	104	41	177,441,097	41	52,803	47
Nevada	14,755	24	240	26	1,134,991,063	24	76,921	25
New Hampshire	2,460	43	88	42	188,036,752	40	76,445	27
New Jersey	26,340	15	285	20	2,201,382,743	16	83,576	21
New Mexico	3,043	39	135	38	195,291,619	39	64,181	39
New York	53,595	6	637	4	4,180,651,807	8	78,004	23
North Carolina	29,515	13	377	12	2,161,306,447	17	73,227	31
North Dakota	1,481	46	72	44	82,401,481	47	55,658	43
Ohio	36,038	9	518	6	3,621,822,136	10	100,499	4
Oklahoma	19,038	20	317	15	1,564,407,314	20	82,172	22
Oregon	11,257	28	235	27	804,213,844	29	71,444	34
Pennsylvania	27,852	14	387	11	2,391,266,591	14	85,857	14
Rhode Island	645	50	50	49	25,100,709	50	38,891	51
South Carolina	10,422	29	248	25	880,552,584	27	84,489	16
South Dakota	734	48	71	46	40,701,853	48	55,490	44
Tennessee	8,003	31	274	23	489,958,025	31	61,225	40
Texas	139,992	2	1,549	3	13,524,371,164	2	96,608	9
Utah	16,767	23	227	29	1,414,268,865	23	84,351	17
Vermont	1,801	45	48	50	126,834,643	44	70,418	36
Virginia	22,936	19	399	10	1,659,304,299	19	72,345	33
Washington	110,849	3	510	7	12,343,652,844	3	111,356	2
West Virginia	2,940	40	65	48	220,403,734	37	74,957	30
Wisconsin	5,483	35	199	32	292,098,324	35	53,277	45
Wyoming	720	49	66	47	28,138,294	49	39,099	50
United States	1,270,788		17,252		\$113,389,808,244		\$89,228	

Source: Bureau of Labor Statistics (QCEW Survey) and Census Bureau (County Business Patterns)

Core Private Sector Rankings. Figure 13 ranks the states by the number of establishments, employment and wages paid across the core private aerospace sectors.

Across all three core private sectors, Oklahoma's ranks among the top 20 states. The state is 15th in the number of establishments, 20th in employment and 20th in total wages paid in 2019. Average annual wages paid rank 22nd. The state's core private aerospace rankings on all measures exceed the state's rank as the 28th most populous state.

Across the three core sectors, Oklahoma has a relatively higher concentration of NAICS 3364 (aerospace product and parts manufacturing), a lower concentration of NAICS 481 (air transportation) and a higher concentration of NAICS 4881 (support activities for air transportation). More than 70% of Oklahoma's private sector aerospace employment is in NAICS 3364. The state's 13,545 employees in NAICS 3364 rank a competitive 11th among the states. The state ranks only 31st based on the 1,441 air transportation employees working in NAICS 481 but ranks 17th based on 4,052 employees in NAICS 4881.

In other words, the state's private sector aerospace mix reflects a relatively high level of manufacturing- and maintenance-related activity, far less commercial air traffic, and more air transportation services in Oklahoma than in states of comparable size.

The five largest private sector aerospace markets by employment are California, Texas, Washington, Florida and Georgia. All five states have diversified markets with a large share of all three core private sectors. High concentrations within NAICS 3364 (aerospace product and parts manufacturing) are evident among the leaders, all with large aerospace-related manufacturing sectors. Washington and California have a far larger share of NAICS 3364 than the other states.

Among the top five states, Texas, Florida and Georgia also have relatively high concentrations of NAICS 481 (air transportation), which reflects major airports, airline hubs and substantial air passenger travel.

Core Private Sector Growth. Figure 14 provides an overview of growth in the core private aerospace sectors for both Oklahoma and the nation in the two decades from 2000 to 2019. Activity is measured for the number of establishments, employment and total annual wages.

Both the U.S. and Oklahoma core private aerospace sectors have experienced volatility over time but remain in a general long-run uptrend. The trend and pace of growth in Oklahoma are both highly consistent with overall long-run trends at the national level. The core private aerospace sectors nationally and in Oklahoma can be characterized as having a steadily growing number of establishments, moderate growth in employment, and strong growth in total annual wages. Average annual wages per worker are growing rapidly as a result.

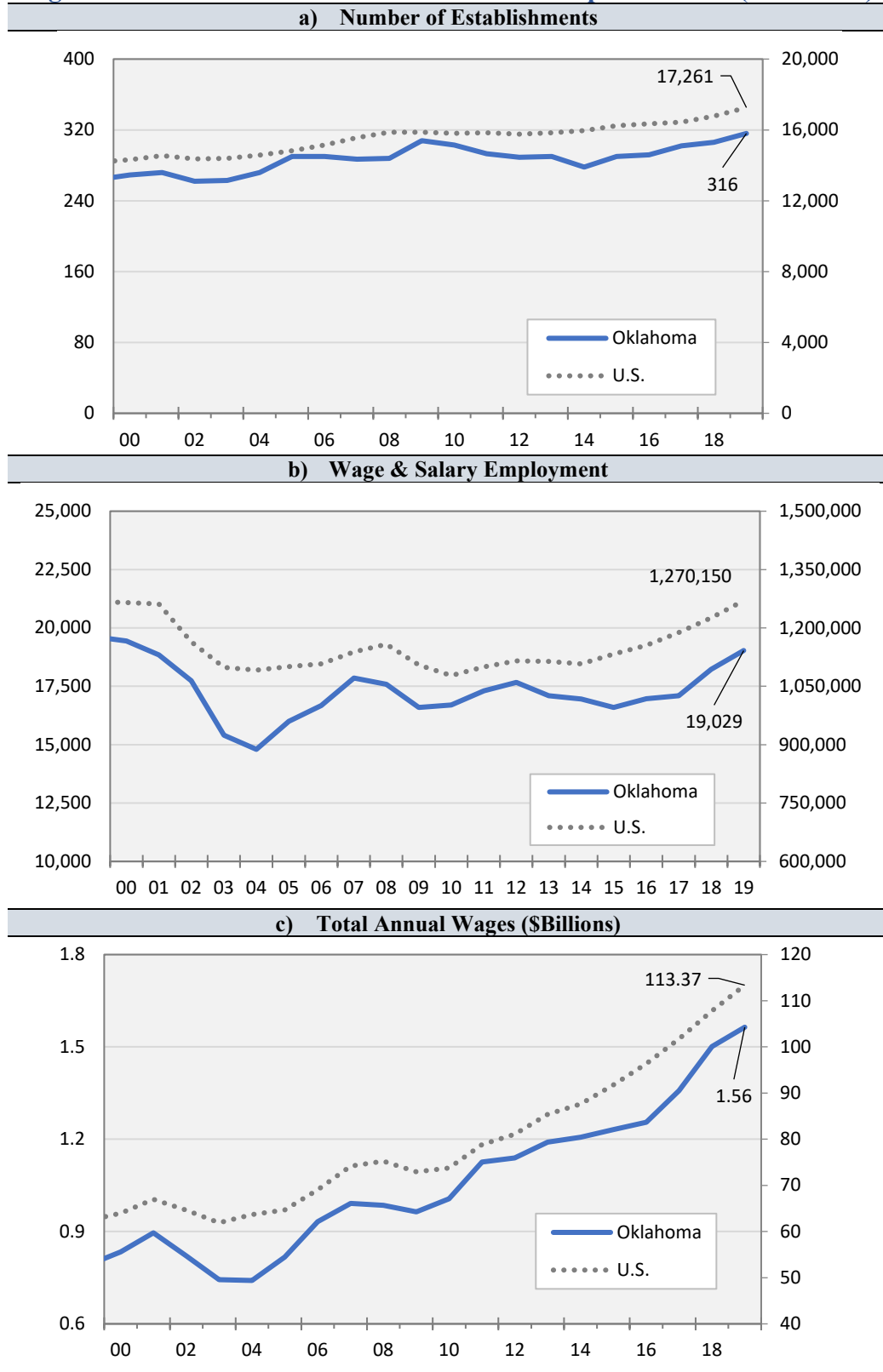
The number of establishments at both the state and U.S. levels remains in a relatively slow uptrend for the past two decades. Establishment growth in Oklahoma has slightly outpaced growth at the national level since 2014. The state added a reported 47 new private establishments between 2015 and 2019, a 16% increase.

Employment is down slightly at the state and national levels over the full period but is up steadily since 2004 after experiencing a sharp drop in the early 2000s. Both the state and nation have posted strong core private sector job growth since 2015, with the nation adding nearly 63,000 core private sector aerospace jobs and the state adding almost 2,500.

Growth is most evident in wages paid to core private sector aerospace workers. The state and nation have enjoyed a significant long-run uptrend since 2000 with slowing only in recessionary periods. Total wages

paid by core private sector aerospace employers nearly doubled between 2000 and 2019 at both the state and national levels.

Figure 14. U.S. & Oklahoma Core Private Aerospace Sectors (2000-2019)



Notes: Employment data are annual averages of monthly data on a calendar year basis
Source: Bureau of Labor Statistics and RegionTrack tabulations

Public Sector Aerospace Employment. The state rankings developed in the prior section confirm an upper middle-tier placement of Oklahoma’s aerospace market when viewed solely by its private sector component. Oklahoma generally ranks among the top 20 states and exceeds its expected rank based on population.

Again, the concern with examining only private sector aerospace activity in Oklahoma is that it overlooks the state’s strong competitive position in public sector aerospace. In the Greater Oklahoma City region, public sector workers comprise the backbone of the aerospace sector. Using only the private sector also fails to capture the natural synergies between the private and public sectors of the industry. Many firms in the region are engaged in both private and public sector aerospace activities. The activities underway at public sector aerospace entities are often functionally equivalent to those in the private sector. This includes transferable labor market skills, common infrastructure and equipment and similar maintenance and repair activities.

The role of public sector aerospace activity is often overlooked in other states as well. As in Oklahoma, this activity is most often tied to the mission of the Air Force and other entities including the Air National Guard and Air Force Reserve units. However, in Oklahoma and a few other states, it extends beyond military applications to the FAA and other federal aerospace-related entities.

Defining Public Sector Aerospace

In this section of the report, we prepare state-level rankings that capture public sector aerospace activity in Oklahoma and the other states. The public sector estimates are then combined with the core private sector rankings developed in the prior section to evaluate the size and overall composition of the combined aerospace sector in Oklahoma relative to other states.

Public sector aerospace activity is measured using five distinct segments of the public sector workforce:

1. active-duty Air Force personnel
2. permanent civilian Air Force employees
3. Air Force reserve personnel
4. Air National Guard personnel, and
5. permanent civilian FAA employees

These five groups of public sector employees are directly and deeply involved in aerospace activities but are frequently excluded from state-level reviews of aerospace markets.

Figure 15 summarizes state-level employment in each of the five aerospace-related segments in fiscal year 2020. The five public sector components are listed in order from largest to smallest by national employment, with active-duty Air Force personnel the largest and permanent civilian FAA employees the smallest. The categories exclude some small amounts of aerospace employment in other branches of the Armed Forces.

Across all five sectors, approximately 660,000 workers were employed nationally by public sector aerospace entities. That equates to roughly half the 1.27 million workers in the core private aerospace sectors.

Approximately 275,000 public sector aerospace workers were active-duty Air Force personnel and 168,200 permanent Air Force civilian workers.

The smaller segments include 105,000 Air National Guard personnel and 68,500 Air Force Reserve members. Finally, 43,200 public sector aerospace-related workers are permanent FAA civilian employees.

Figure 15. Public Sector Aerospace Employment by State (FY2020)

Duty State	Air Force				Air Guard/Reserve				FAA Permanent Civilians	Total Public Sector		
	Active Duty		Permanent Civilian		Air National Guard		Air Force Reserve					
Alabama	2,858	33	2,399	18	2,424	11	1,406	21	223	35	9,310	27
Alaska	7,922	12	2,421	17	2,176	19	378	31	1,094	12	13,991	15
Arizona	11,242	6	3,375	11	2,566	10	2,527	7	523	24	20,233	10
Arkansas	3,656	26	1,055	29	1,943	26	389	30	162	38	7,205	33
California	19,088	3	9,940	7	4,809	3	7,603	1	3,421	3	44,861	3
Colorado	9,183	10	5,811	9	1,775	30	3,234	5	1,002	14	21,005	8
Connecticut	35	47	179	50	1,169	41	1	44	141	40	1,525	48
Delaware	3,582	27	1,014	31	1,049	46	1,546	16	25	51	7,216	32
District of Columbia	1,769	34	334	44	1,314	36	233	33	3,676	2	7,326	30
Florida	23,571	2	12,847	5	2,107	23	6,804	2	2,513	5	47,842	2
Georgia	9,499	8	15,272	4	2,819	8	3,155	6	2,335	6	33,080	4
Hawaii	5,569	19	1,336	25	2,314	15	758	29	352	29	10,329	22
Idaho	3,545	28	587	40	1,339	35	28	38	117	46	5,616	34
Illinois	4,469	23	2,837	14	2,905	7	1,541	17	1,627	9	13,379	17
Indiana	75	43	735	38	1,915	28	1,510	19	812	17	5,047	40
Iowa	27	49	331	45	1,921	27	0	46	178	37	2,457	45
Kansas	3,150	32	952	33	2,158	21	769	28	722	18	7,751	29
Kentucky	243	37	240	47	1,252	37	4	42	299	32	2,038	47
Louisiana	5,296	21	1,611	23	1,529	31	1,300	24	308	30	10,044	23
Maine	11	51	206	49	1,071	45	0	46	131	44	1,419	49
Maryland	8,629	11	3,052	13	1,870	29	1,894	12	399	28	15,844	12
Massachusetts	1,213	35	3,282	12	2,077	24	2,031	10	444	27	9,047	28
Michigan	100	42	669	39	2,393	12	1	44	650	20	3,813	41
Minnesota	56	46	822	34	2,262	17	1,442	20	853	16	5,435	36
Mississippi	6,503	17	2,478	16	2,598	9	1,553	15	123	45	13,255	18
Missouri	4,316	25	1,193	27	2,229	18	1,046	27	658	19	9,442	26
Montana	3,410	30	749	37	922	51	21	40	156	39	5,258	39
Nebraska	5,785	18	2,578	15	986	49	323	32	140	41	9,812	25
Nevada	10,544	7	1,687	22	1,195	40	1,254	26	305	31	14,985	13
New Hampshire	31	48	294	46	1,092	44	0	46	649	21	2,066	46
New Jersey	4,969	22	1,979	20	2,368	14	2,322	8	1,604	10	13,242	19
New Mexico	12,278	5	3,649	10	984	50	230	34	494	26	17,635	11
New York	419	36	1,967	21	5,579	1	1,286	25	1,842	7	11,093	21
North Carolina	6,653	16	1,194	26	1,456	32	1,521	18	509	25	11,333	20
North Dakota	7,598	13	1,089	28	1,156	42	37	37	135	42	10,015	24
Ohio	5,509	20	15,527	3	5,052	2	3,544	4	1,035	13	30,667	6
Oklahoma	7,519	14	17,837	1	2,171	20	1,823	13	3,260	4	32,610	5
Oregon	143	40	464	41	2,381	13	115	35	262	33	3,365	42
Pennsylvania	226	38	1,044	30	4,087	4	1,313	23	620	22	7,290	31
Rhode Island	61	45	166	51	1,008	47	2	43	65	47	1,302	51
South Carolina	9,262	9	2,047	19	1,227	39	2,181	9	257	34	14,974	14
South Dakota	3,431	29	751	36	1,108	43	22	39	64	48	5,376	38
Tennessee	163	39	1,005	32	3,423	5	8	41	889	15	5,488	35
Texas	34,294	1	17,051	2	3,390	6	6,096	3	3,889	1	64,720	1
Utah	4,370	24	12,749	6	1,449	34	1,350	22	560	23	20,478	9
Vermont	62	44	236	48	987	48	0	46	44	50	1,329	50
Virginia	12,418	4	6,191	8	1,456	32	2,004	11	1,438	11	23,507	7
Washington	6,805	15	1,404	24	1,973	25	1,797	14	1,832	8	13,811	16
West Virginia	18	50	377	43	2,112	22	0	46	132	43	2,639	44
Wisconsin	127	41	417	42	2,287	16	0	46	189	36	3,020	43
Wyoming	3,249	31	783	35	1,243	38	54	36	53	49	5,382	37
United States	274,951		168,213		105,076		68,456		43,211		659,907	

Source: Department of Defense Manpower Center and Office of Personnel Management

Oklahoma Public Sector Aerospace. The results in Figure 15 indicate that Oklahoma is home to 32,610 public sector aerospace-related employees, the 5th largest concentration among the states. It is this deep concentration of public sector aerospace jobs in Oklahoma that makes their inclusion so vital in comparative state-level studies of aerospace. The breadth and depth of the Oklahoma aerospace market simply cannot be captured otherwise.

Remarkably, only Texas (64,720), Florida (47,842), California (44,861) and Georgia (33,080) have a larger pool of public sector aerospace-related employment. These four states are all traditional aerospace and defense industry leaders. Oklahoma along with these four states and Ohio form a top tier of six states measured by public sector aerospace jobs. Each of the six states has between 30,000 and 65,000 public sector aerospace workers, far outpacing the remaining states.

A second tier of four states have between 20,000 and 24,000 public sector aerospace workers – Virginia (23,507), Colorado (21,005), Utah (20,478) and Arizona (20,233).

Among the top 10 states based on public sector jobs, Oklahoma, Virginia and Utah all have more public sector aerospace employment than core private sector jobs. It is especially critical to evaluate the role of public sector aerospace activity in these three states.

Air Force – Active Duty and Civilian. Air Force personnel have long played a key role in aerospace activity in Oklahoma and the Greater Oklahoma City region. Measured by the number of active-duty Air Force personnel, the state ranks 14th with 7,519 in fiscal year 2020. A reported 5,104 of the active-duty Air Force personnel in the state are stationed at Tinker AFB.

More importantly, Oklahoma ranks 1st among the states in the number of permanent civilian Air Force employees, with nearly all based at Tinker Air Force Base. Much of the strength of the overall state aerospace labor force is traced to 17,837 highly skilled permanent civilian Air Force employees working in Oklahoma. Oklahoma has consistently ranked at or near the top among the states the past two decades, currently rivaled only by 2nd-ranked Texas.²¹

Permanent civilian Air Force workers are highly concentrated around the nation's Air Force bases and located in only a handful of states in addition to Oklahoma. These include Texas (17,051), Ohio (15,527), Georgia (15,272), Florida (12,847), Utah (12,749) and California (9,940). Far smaller concentrations are found in Virginia (6,191) and Colorado (5,811).

Civilian Air Force workers employed at Tinker AFB have a range of occupational specialties. The presence of these civilian workers greatly enhances the competitive labor market for aerospace workers statewide and in the Greater Oklahoma City region. These workers possess technical skills and industry knowledge that transition easily between both public and private sector aerospace employers.

Air National Guard/Air Force Reserve. Air Guard and Air Force Reserve personnel are no less important a component of the aviation market across the states. State-level Air National Guard units typically maintain active air wings in support of the defense mission of the Air Force. This personnel includes flight crew, flight operations and management, aircraft maintenance specialists, intelligence, medical and many other specialties.

Concentrations of Air Guard personnel tend to be greater in larger states, but also reflect proximity to large Air Force bases. Every state has an active Air National Guard with total personnel typically ranging from 1,000 to 3,000. Oklahoma ranks 20th with 2,171 Air National Guard members and 13th among the states with 1,823 Air Force Reserve personnel in fiscal year 2020. States with large numbers of active-duty Air

Force personnel tend to have higher numbers of Reserve personnel. Approximately 20 states have very small numbers of Air Force Reserve personnel.

Civilian FAA Personnel. The significant size of the FAA Center in Oklahoma City elevates Oklahoma to 4th among the states and the District of Columbia with 3,260 permanent civilian FAA workers in fiscal year 2020. Oklahoma trails only Texas (3,889), the District of Columbia (3,676) and California (3,421) in permanent FAA employees.

It is important to note that the state comparison of FAA employment in this section does not include the nearly 2,000 additional non-appropriated fund contract employees working at the FAA Center or similar contract workers at other FAA facilities in other states.²² When contract workers and long-term FAA students are included, the FAA Center in Oklahoma City ranks as the largest single-site concentration of FAA workers outside of the District of Columbia.

Private and Public Sector Aerospace Employment. The aerospace market in many states, including Oklahoma, takes on a far different profile when both core private and public sector activities are considered. Figure 16 provides rankings of combined private and public sector aerospace employment across the states.

The change in rankings is evident in Oklahoma where a combined 51,600 workers comprise the private and public sector aerospace labor market. Oklahoma rises from the 20th largest market when measured by core private sector employment to the 10th largest when public sector aerospace workers are added to the labor pool.

The top tier of the combined market is dominated by the four largest traditional aerospace states of California (214,725), Texas (204,712), Florida (147,933) and Washington (124,660). Of these four, California, Texas and Florida have very large numbers of both private and public sector aerospace employees. However, Washington's high ranking is traced primarily to private sector employment largely related to Boeing commercial jet production. Washington has the 3rd highest number of private aerospace employees but only the 16th highest number of public sector personnel, roughly opposite the rankings of Oklahoma.

Seven additional states (including Oklahoma) comprise a second tier, with each having between 50,000 and 100,000 combined core private and public sector aerospace personnel. The group includes Georgia (89,649), Arizona (72,683), Ohio (66,705), Illinois (65,013), New York (64,688), Oklahoma (51,648) and Colorado (51,486).

Three additional states have more than 40,000 private and public sector aerospace workers – Virginia (46,443), Kansas (42,739) and North Carolina (40,808).

The rankings in Figure 16 highlight the vital role of public sector employment in the structure of the Oklahoma aerospace industry. As Oklahoma moves from 20th to 10th when public sector employment is added, it supplants the large commercial aircraft producing state of Kansas in the top 10.

Among all states, Oklahoma and New Mexico enjoy the largest improvement in rank when public sector workers are included in aerospace employment. Oklahoma's move from 20th to 10th and New Mexico's improvement from 39th to 29th are traced primarily to large Air Force installations. Both states are home to major Air Force bases employing large numbers of federal civilian workers.

However, the role of public sector employment is important in other states as well. For example, Delaware, Utah and Virginia also have a large Air Force presence and similarly advance in the rankings when public

sector employment is considered. When public sector jobs are considered, Virginia moves up from 19th to 12th, Utah advances from 23rd to 16th and Delaware rises from 47th to 39th.

Conversely, when public sector aerospace jobs are included, New York drops from 6th to 9th, Kansas drops from 10th to 13th, and Connecticut drops from 11th to 17th. These traditional leading aerospace states have substantial core private sector employment but are home to relatively few public sector aerospace jobs.

Figure 16. Core Private and Public Sector Aerospace Employment

State	Core Private Sector (2019)		Public Sector (FY2020)		Core Private + Public	
	Employment	Rank	Employment	Rank	Employment	Rank
California	169,864	1	44,861	3	214,725	1
Texas	139,992	2	64,720	1	204,712	2
Florida	100,091	4	47,842	2	147,933	3
Washington	110,849	3	13,811	16	124,660	4
Georgia	56,569	5	33,080	4	89,649	5
Arizona	52,450	7	20,233	10	72,683	6
Ohio	36,038	9	30,667	6	66,705	7
Illinois	51,634	8	13,379	17	65,013	8
New York	53,595	6	11,093	21	64,688	9
Oklahoma	19,038	20	32,610	5	51,648	10
Colorado	30,481	12	21,005	8	51,486	11
Virginia	22,936	19	23,507	7	46,443	12
Kansas	34,988	10	7,751	29	42,739	13
North Carolina	29,515	13	11,333	20	40,848	14
New Jersey	26,340	15	13,242	19	39,582	15
Utah	16,767	23	20,478	9	37,245	16
Connecticut	34,226	11	1,525	48	35,751	17
Pennsylvania	27,852	14	7,290	31	35,142	18
Missouri	24,842	17	9,442	26	34,284	19
Massachusetts	24,026	18	9,047	28	33,073	20
Nevada	14,755	24	14,985	13	29,740	21
Michigan	25,437	16	3,813	41	29,250	22
Maryland	11,854	27	15,844	12	27,698	23
Alabama	17,232	21	9,310	27	26,542	24
South Carolina	10,422	29	14,974	14	25,396	25
Hawaii	12,663	25	10,329	22	22,992	26
Minnesota	16,996	22	5,435	36	22,431	27
Alaska	7,723	32	13,991	15	21,714	28
New Mexico	3,043	39	17,635	11	20,678	29
Indiana	12,612	26	5,047	40	17,659	30
Mississippi	3,378	36	13,255	18	16,633	31
Louisiana	5,682	34	10,044	23	15,726	32
Oregon	11,257	28	3,365	42	14,622	33
Tennessee	8,003	31	5,488	35	13,491	34
Nebraska	3,360	37	9,812	25	13,172	35
Arkansas	5,926	33	7,205	33	13,131	36
Kentucky	9,906	30	2,038	47	11,944	37
North Dakota	1,481	46	10,015	24	11,496	38
Delaware	1,419	47	7,216	32	8,635	39
Wisconsin	5,483	35	3,020	43	8,503	40
Idaho	2,854	41	5,616	34	8,470	41
Dist. of Columbia	139	51	7,326	30	7,465	42
Montana	1,915	44	5,258	39	7,173	43
South Dakota	734	48	5,376	38	6,110	44
Wyoming	720	49	5,382	37	6,102	45
Iowa	3,214	38	2,457	45	5,671	46
West Virginia	2,940	40	2,639	44	5,579	47
New Hampshire	2,460	43	2,066	46	4,526	48
Maine	2,644	42	1,419	49	4,063	49
Vermont	1,801	45	1,329	50	3,130	50
Rhode Island	645	50	1,302	51	1,947	51
United States	1,270,788		659,907		1,930,695	

Source: Bureau of Labor Statistics (QCEW Survey), Census Bureau (County Business Patterns), Department of Defense Manpower Center, and Office of Personnel Management

Similarly, Connecticut, Michigan, Minnesota, Indiana, Oregon, Iowa, Kentucky, West Virginia, Wisconsin, New Hampshire, Maine and Vermont all experience large declines in rank when public sector employment is considered. These states generally have little public sector aerospace employment.

Both Connecticut and Michigan, two traditional aerospace states, are frequently ranked well ahead of Oklahoma based only on private sector employment but trail far behind based on combined employment.

VII. Aerospace Economic Development Policy

Aerospace Economic Development Incentives

Along with the state, the Greater Oklahoma City area local government and economic development entities are committed to providing a highly supportive landscape for the aerospace sector. Aerospace has been identified in many policy studies as a targeted growth sector for the state and the Greater Oklahoma City region. The sector is viewed as highly compatible with current industry and labor force assets as well as the overall growth strategy of the region.

The state most recently enacted the Oklahoma Aerospace Commerce Economic Services (ACES) program in 2018 to establish a common statewide goal for the growth of the state's aerospace industry.²³ The purpose of ACES is to create a partnership of service providers to respond more effectively to the needs of the aviation, aerospace, and defense industries in the areas of education, training, research, and economic development.

The Greater Oklahoma City Chamber, in partnership with the City of Oklahoma City, Oklahoma County, member counties of the Greater Oklahoma City Partnership and The Alliance for Economic Development of Oklahoma City, actively recruits and supports the growth of existing aerospace firms. The organizations also partner to support the development and promotion of properties that provide runway access and resources for aerospace companies, as well as legislative issues that could positively impact the industry. Additionally, the Chamber maintains a team of business recruiters that focus on aerospace, as well as a specific on-staff liaison to federal, military and private sector aerospace organizations in the industry.

The state of Oklahoma offers a range of financial incentives for aerospace firms choosing to relocate to or expand in Oklahoma.²⁴ These include general programs available to employers in all industry sectors as well as targeted incentives designed specifically for the aerospace sector.

Oklahoma Engineer Workforce Tax Credits

The state currently offers an engineer tax credit that benefits both employees and employers in the aerospace sector (*see Figure 17*). Aerospace companies hiring engineers in a variety of fields can receive a tax credit

Figure 17. Oklahoma Engineer Workforce Tax Credit

Employer Benefits:

- **New Engineer Graduates:**
 - 50% Tax Credit for Reimbursed Tuition Costs
 - For First 4 Years of Employment
- **Hire Oklahoma Graduates:**
 - Up to 10% of Wages Paid During First 5 Years of Employment
 - Maximum of \$12,500 per Employee Annually
- **Hire Non-Oklahoma Graduates:**
 - Up to 5% of Wages Paid During First 5 Years of Employment
 - Maximum of \$12,500 per Employee Annually

Employee Benefits:

- Eligibility: Current Employed Aerospace Engineers
- Eligible to Receive Individual Tax Credit
- Up to \$5,000 per Year for 5 Years

equal to 5% of the compensation paid to an engineer and 10% if the engineer graduated from an Oklahoma college or university, plus another credit of up to 50% of the tuition reimbursed to an employee. Additionally, the engineer hired can receive a personal income tax credit of \$5,000 per year.

Software/Cybersecurity Workforce Tax Credit

The state offers a tax credit targeted at growing the number of software development and cybersecurity jobs in the state. The aerospace industry is increasingly dependent upon workers with skills in software design, cybersecurity, and other areas of information technology. Information technology-related occupations are numerous at Tinker AFB, the FAA Center and private sector employers.

The tax credit provides up to \$2,200 annually for qualifying employees who receive a degree from an accredited institution, or \$1,800 annually for qualifying employees who are awarded a certificate from a technology center. To receive the credit, employees must meet strict educational requirements and obtain employment in a qualified industry for a qualified employer. The credit can be claimed for no more than seven years and cannot be claimed simultaneously by an individual claiming the tax credit for aerospace engineers.

Aerospace and Aviation Education Programs

Educational entities across the state and in the Greater Oklahoma City region are committed to supporting the development of the extensive range of skilled workers needed by the aerospace sector.

A broad mix of aerospace-related education and training has long been provided by the state's public and private universities and CareerTech system. These students receive general and specialized aerospace training for both blue- and white-collar occupations.

As a result of these ongoing efforts, large numbers of graduates from the state's universities and CareerTech technology centers continue to fill jobs in state aerospace firms.

University of Oklahoma

The University of Oklahoma (OU) remains at the forefront of aerospace and aviation education and is a key educational component of the aerospace and aviation industry in the Greater Oklahoma City region. Located just 30 minutes from downtown Oklahoma City, Tinker Air Force Base, Will Rogers World Airport and the FAA's Monroney Aeronautical Center, OU is accessible for most aerospace workers and employers in the region.

OU Aviation Studies. The OU Extended Campus School of Aviation Studies offers a bachelor's degree with a major in aviation with four aviation concentrations – professional pilot, aviation management-flying, aviation management-nonflying and aviation management-air traffic control. The program is designed for students who plan to pursue a range of careers in aviation. The aviation curriculum is closely mapped to the needs and demands of the aviation industry and follows OU's general education guidelines.

Destination 225° University Pathway. The Destination 225° University pathway is designed for collegiate aviators who attend a Southwest Airlines partner university or complete a Southwest Airlines Campus Reach Internship. The program provides a pathway for equipping participants with the skills to become a First Officer at Southwest Airlines.

FAA Center of Excellence. In 2016, the FAA awarded a new Center of Excellence co-led by the University of Oklahoma, Wichita State University and Embry-Riddle Aeronautical University. The center's academic members and its industry partners are responsible for conducting research and development on technical

training for air traffic controllers, aviation safety inspectors, engineers, pilot, and technicians. The center represents a long-term cost-sharing partnership between academia, industry, and government. The project enables the FAA to work with center members to conduct research in airspace and airport planning and design, environment and aviation safety, as well as to engage in other efforts to assure a safe and efficient air transportation system.

Aerospace Engineering. The School of Aerospace and Mechanical Engineering is one of seven schools within the Gallogly College of Engineering at the University of Oklahoma. The School offers both a Bachelor of Science (BS) and Master of Science (MS) in Aerospace Engineering, as well as a combined 5-year BS/MS in Aerospace Engineering. The School's graduate division offers a Ph.D. degree in Aerospace Engineering. OU's aerospace engineering program is the first in the nation with an emphasis on multidisciplinary Intelligent Aerospace Systems.

OU has enrolled approximately 200 students in its undergraduate aerospace engineering program the past five years and an additional 650 mechanical engineering students. Approximately 35 students were enrolled in the master's programs and approximately 30 students in the Ph.D. programs in Aerospace and Mechanical Engineering in the past five years.

Other Aerospace-Related Engineering Fields. The Gallogly College of Engineering also offers both a Bachelor of Science (BS) and Master of Science (MS) degree in electrical and computer engineering. A Ph.D. degree in electrical and computer engineering is offered through the graduate division of the School of Electrical and Computer Engineering. The College provides both undergraduate and graduate degrees in several additional engineering fields with direct application in aerospace. These fields include Materials Engineering, Computer Science, Engineering Physics, Industrial Engineering and Telecommunications Engineering.

Executive MBA in Aerospace and Defense. The Gene Rainbolt Graduate School of Business at the University of Oklahoma recently launched a new executive MBA program designed to develop the managerial and leadership skills of the aerospace and defense workforce. The program is based in Oklahoma City and allows students to complete the program in one year while working.

Oklahoma State University

Oklahoma State University (OSU) prepares both undergraduate and graduate students for a range of careers in aerospace-related industries.

Aerospace Engineering. The OSU College of Engineering, Architecture and Technology offers undergraduate degrees in aerospace engineering. A dual degree option is offered with mechanical engineering with the possibility of graduating in four years. OSU also offers Master of Science and Ph.D. degrees in Aerospace Engineering.

Other Aerospace-Related Engineering Fields. The School of Electrical and Computer Engineering at Oklahoma State University offers a Bachelor of Science in Electrical Engineering, a Bachelor of Science in Computer Engineering and a dual degree in both electrical and computer engineering. At the graduate level, the Master of Science in Electrical Engineering and Master of Engineering in Electrical Engineering are offered. The School also offers a robust Ph.D. program in Electrical Engineering to research-oriented graduate students.

Other aerospace-related engineering at OSU offerings include undergraduate and graduate degrees in Materials Science and Engineering, Computer Science, Industrial Engineering and Mechanical Engineering.

Aerospace Administration and Operations. OSU offers undergraduate students the Bachelor of Science in Aerospace Administration and Operations with four concentrations:

1. Aviation management - prepares students for management positions in the aerospace industry;
2. Aerospace security - prepares students for careers in aviation/aerospace security management fields;
3. Professional pilot - prepares students for careers in flight operations in both the general aviation and the air carrier segments of the aviation industry; and
4. Technical service management - builds on an individual's technical experience in aircraft maintenance or avionics to prepare students for management positions in all segments of the industry.

Unmanned Systems Research Institute. The OSU College of Engineering, Architecture, and Technology is home to the Unmanned System Research Institute (USRI). USRI is a multidisciplinary and multi-institution research entity collaborating on developing future unmanned technologies, including land-based and underwater solutions. The FAA recently granted USRI the first approval in the U.S. to fly an unmanned fixed-wing aircraft swarm within national airspace.²⁵

The Institute is fully integrated with the student learning experience at OSU. A student team recently designed and built a turbo-electric drone engine as part of a program sponsored by the U.S. Army.²⁶ Defense contractor Navatek recently awarded a research grant to USRI to fund internships that will focus on the development and testing of new technologies for unmanned aircraft systems and related technology.²⁷

OSU Discovery. Baker Hughes recently donated its research and innovation center in the Oklahoma City Innovation District to Oklahoma State University to foster a learning environment to benefit both students and industry professionals. The location of the facility in the Innovation District will unite higher education, research, energy, aerospace and advanced manufacturing in one location. OSU will collaborate with industry experts to grow its mechanical, industrial and aerospace engineering programs. The center will house hands-on learning opportunities in mechanical, aerospace, electrical, chemical and petroleum engineering that allow students to tackle real-world problems in a state-of-the-art facility.

Oklahoma CareerTech

CareerTech technology centers in the Greater Oklahoma City region offering aerospace programs include Canadian Valley, Francis Tuttle, Metro Tech, Gordon Cooper, Mid Del and Moore-Norman.²⁸ These programs include an Aerospace Maintenance pathway with majors in aircraft electronics, aerospace technician, general aviation, airframe mechanic, power plant mechanic, aviation sheet metal technician and aviation composites technician.

CareerTech recently introduced a STEM pathway for the Applied Engineer. Students are immersed in both engineering concepts and aerospace and aviation related applications. CareerTech also offers programs in Computer Science, Pre-Engineering and Robotics Engineering, with pathways to higher education.

Other Aerospace Degree and Certificate Completion Options

A range of additional aerospace related degree and certificate programs are currently offered at other public and private universities in the region. Many of these specialized degree options are targeted at aerospace firms and their employees.

Oklahoma Christian University prepares workers for careers in aerospace through both undergraduate and graduate degree programs in electrical engineering and computer engineering. Emphasis options are available in software engineering along with minor fields in computer science, mathematics and software engineering.

Many aerospace programs are joint offerings through Oklahoma education institutions. For example, through the Aviation Alliance at Tinker AFB, Langston University and the University of Oklahoma offer a baccalaureate degree program.

The Oklahoma Department of Commerce recently established a Center of Excellence for Workforce Development for Aerospace and Cybersecurity with one of the sites designated at Rose State College in Midwest City near Tinker AFB.

Metro Technology Centers and Rose State College recently announced a partnership to create life-long learning opportunities for students pursuing careers in the aerospace industry. Students who earn their FAA A&P Certificate through Metro Tech will qualify for credit hours toward an associate degree at Rose State College. Students have two aerospace options to choose from – an Associate in Applied Science (A.A.S.) degree or an Associate in Arts (A.A.) degree.

Embry-Riddle Aeronautical University operates a branch campus near Tinker AFB where it offers a range of undergraduate and graduate degree and certification programs across multiple aerospace fields.

VIII. Federal Procurement in Oklahoma Aerospace

Federal contracting serves as a significant source of economic activity in Oklahoma, and a large portion of this activity is closely tied to aerospace. Much of the state's aerospace contracting activity is concentrated in the Greater Oklahoma City region and primarily traced to Tinker Air Force Base and the U.S. Air Force.

Measuring Procurement Activity

Federal aerospace-related contracting is evaluated in this section from two distinct perspectives.

The first focuses on contracting by those federal agencies whose mission is most closely tied to aerospace activity. Three federal agencies operating in the region are believed to have aerospace activity as its primary mission – Air Force, FAA and NASA.

While this approach captures all the contracting activity related to these three major federal government entities with deep aerospace roots, there are two concerns with using this agency level approach. First, many purchases by the three agencies are unrelated, or only indirectly related, to the aerospace mission of each group. Second, many other agencies make smaller amounts of aerospace-related purchases of goods and services that are excluded using this approach.

The second approach addresses this concern by examining only federal contracts for goods and services that have a direct tie to aerospace, regardless of the agency responsible for the contract. This approach is far more labor intensive but provides a more refined view of the amount of federal contracting directly related to aerospace activity. This approach, however, ignores the broader range of contract purchases made by these key aerospace-driven agencies and can understate their overall economic impact within the region.

Contracting data in this section of the report primarily reflects contracts with a place of performance in the state of Oklahoma, or the Greater Oklahoma City region when noted. Contract values are based on annual action obligation amounts per contract on a fiscal year basis. The data presented highlight recent trends in federal contracting in the state and region, the distribution of funding by agency, the geographic distribution of vendors, and the largest contractors operating in the region.

Total Procurement Activity

Figure 18 illustrates the significant economic role played by federal contracting across the state and in the 10-county Greater Oklahoma City region. In fiscal year 2019, federal procurement contracts totaling \$4.18 billion in current obligations were performed within Oklahoma. The state ranks 29th among the states in total federal contracting, roughly equal to the state's rank as 28th in population.

By geography, approximately 65% (\$2.69 billion) of total state contracting activity is traced to the 10-county Greater Oklahoma City region. More than 90% (\$2.46 billion) of the contracts issued in the 10-county region were performed in Oklahoma County alone.

By major agency, the Department of Defense (DoD) is the largest federal contracting entity within the state. Nearly 80% (\$3.31 billion) of the value of all contract work performed statewide in fiscal year 2019 was issued by DoD agencies. Among DoD departments, the Air Force remains the primary source of federal contracts. Air Force contracts totaled \$1.88 billion in fiscal year 2019 and comprised 45% of total contracting in the state from all federal sources. Eighty-seven percent of all Air Force contract work in Oklahoma was performed in the 10-county Greater OKC region, with most of the remainder attributable to Vance and Altus Air Force bases.

Figure 18. Federal Procurement in Oklahoma by Major Department (FY2019)

Federal Department	State of Oklahoma	10-County OKC Region	Oklahoma County
Department of Defense:			
Air Force	\$1,881,359,647	\$1,633,405,929	\$1,601,158,98
Army	685,019,292	263,331,525	253,070,35
Navy	205,541,640	160,677,816	137,958,48
Defense Logistics Agcy.	125,616,520	59,215,042	49,023,16
Other Dept. of Defense	410,797,088	3,704,981	-1,685,67
Total Dept. of Defense	\$3,308,334,187	\$2,120,335,293	\$2,039,525,30
Non-Department of Defense:			
Agriculture	40,858,247	2,670,148	278,46
Commerce	16,857,379	15,731,393	154,15
General Services Admin.	78,912,046	30,871,668	6,209,69
Health and Human Services	82,701,155	40,722,692	22,072,52
Homeland Security	20,157,514	4,734,185	4,286,34
Housing and Urban Development	9,549,464	8,626,048	8,576,24
Interior	35,022,244	3,056,744	2,306,39
Justice	43,621,242	38,018,144	25,146,28
Labor	30,496,971	11,148,233	19,27
NASA	39,840,212	39,415,038	11,95
Transportation (including FAA)	329,591,799	317,713,463	302,919,23
Veterans	68,354,759	37,170,099	36,115,83
All Other Agencies	72,283,142	17,274,977	16,807,40
Total Non-Dept. of Defense	\$868,246,174	\$567,152,833	\$424,903,80
Total Procurement	\$4,176,580,361	\$2,687,488,126	\$2,464,429,10
Notes: Procurement by place of performance in Oklahoma, regardless of vendor location. Source: FPDS-NG and SAM.GOV			

The DoD share of total contract value equals 79% (\$2.12 billion) of total contracting in the 10-county region and 83% (\$2.04 billion) of the total in Oklahoma County. Air Force contracts totaled \$1.63 billion in the 10-county Greater Oklahoma City region and \$1.60 billion in Oklahoma County.

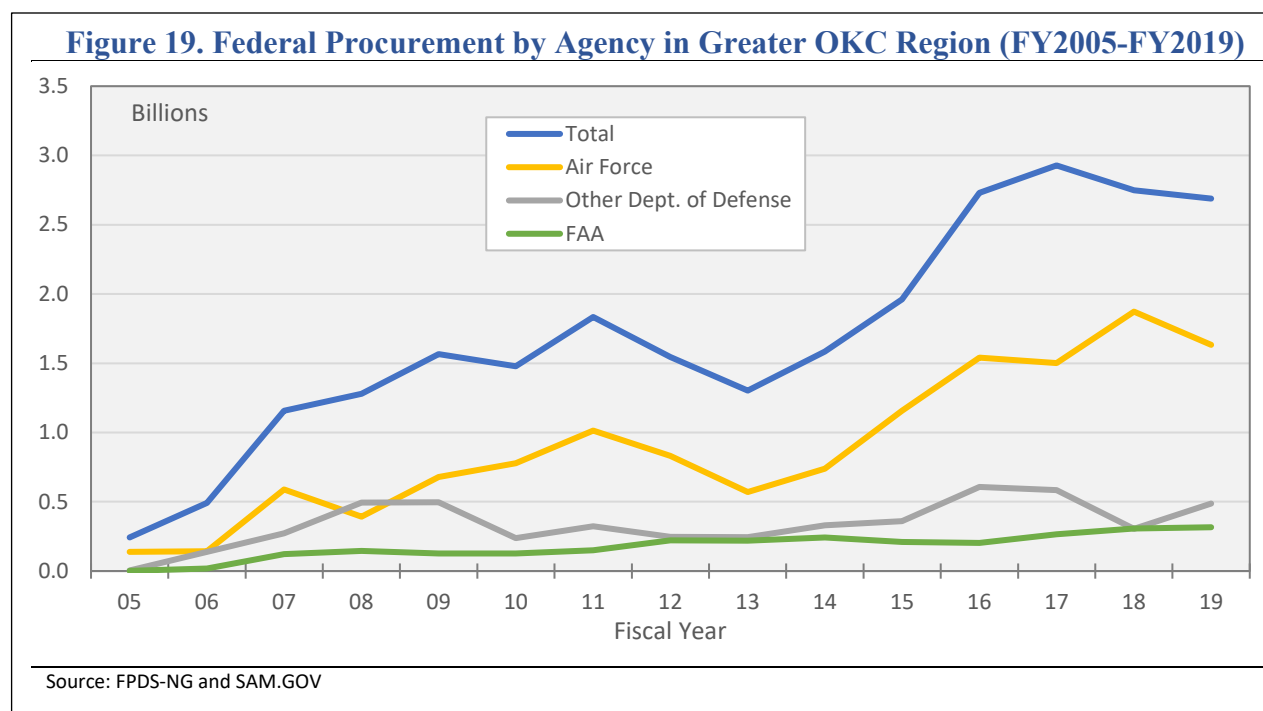
Trends in Greater OKC Region Federal Contracting. Total federal contracting in the 10-county Greater Oklahoma City Region is up substantially since the 2015 aerospace report (*see Figure 19*). The region is also outperforming national trends for federal contracting by key aerospace-related agencies.

Total contracting in the region increased 37% from \$1.96 billion to \$2.69 billion in the period. The region's gain slightly exceeded the 34% national gain in the period.

Air Force contracting performed in the Greater OKC region increased 50.1% since the 2015 report, from \$1.16 billion to \$1.63 billion. This exceeds the 43% gain in Air Force contracting nationally in the period.

FAA contracting in the region increased 50% since the 2015 report, rising from \$210.7 million to \$316.2 million. For comparison, national FAA contracting declined by 0.6% since the 2015 report.

All other DoD contracting in the Greater Oklahoma City region has remained relatively flat since 2005.



Oklahoma Procurement by Aerospace-Related Agencies

Figure 20 provides a multi-year overview of federal contracting activity by the Air Force, FAA, and NASA performed in the state and the Greater Oklahoma City area. The data provide historical measures in FY2005 and FY2010 as well as annual contracting amounts from FY2015 to FY2019.

It is important to note that the methodology used in Figure 20 measures the total amount of contracting engaged in by the three aerospace-related agencies rather than purchases of goods and services used directly in aerospace applications regardless of the agency making the expenditure. This alternative approach to identifying federal aerospace contracts is evaluated in the following section of the report.

Air Force, FAA, and NASA Procurement. Across the Air Force, FAA, and NASA, vendors in Oklahoma performed \$2.24 billion in combined contracts in FY2019. Approximately \$2.0 billion were performed in the Greater Oklahoma City region and \$1.90 billion performed in Oklahoma County alone.

Air Force. Air Force procurement of \$1.88 billion is the dominant component of the FY2019 total. Air Force procurement declined in FY2019 from a recent high of \$2.11 billion in FY2018 but remains well above prior trend levels. Air Force procurement doubled between FY2010 and FY2019 and increased 42% between FY2015 and FY2019.

FAA. FAA procurement remains far smaller than Air Force activity but remains a critical component of total federal contracting in Oklahoma and the Greater Oklahoma City region. FAA contracts in Oklahoma reached a record high of \$322 million in fiscal year 2019, a 45% increase from fiscal year 2015 and more than double the level from fiscal year 2010. Most of the FAA contracting activity was performed by vendors located in the 10-county region, primarily in Oklahoma County.

NASA. A far smaller but mostly forward-looking dimension of federal procurement activity in the region is NASA contracting. Approximately \$40 million in NASA contracts were performed in Oklahoma in fiscal year 2019. These contracts were fulfilled primarily in Cleveland County by the University of Oklahoma providing R&D services on a space observatory project. The issuance of NASA contracts in Oklahoma is

a relatively recent event. Only small amounts of NASA contracts were active in Oklahoma prior to fiscal year 2017.

Figure 20. Oklahoma Procurement from Key Aerospace-Related Agencies

	FY2005	FY2010	FY2015	FY2016	FY2017	FY2018	FY2019
Department	State of Oklahoma						
Air Force	811,179,539	927,491,382	1,326,646,483	1,733,069,904	1,726,656,506	2,112,132,545	1,881,359,647
FAA	1,907,246	149,850,661	223,486,669	215,558,578	269,478,009	308,556,766	322,134,018
NASA	1,474,134	2,558,867	2,446,634	1,249,195	10,455,737	21,178,025	39,840,212
Total	814,560,918	1,079,900,911	1,552,579,785	1,949,877,676	2,006,590,252	2,441,867,337	2,243,333,877
Department	10-County Greater OKC Region						
Air Force	138,602,843	777,581,218	1,156,785,440	1,541,624,378	1,502,461,708	1,872,696,999	1,633,405,929
FAA	1,623,246	127,112,130	210,740,273	202,387,156	266,011,637	306,609,635	316,233,384
NASA	339,198	61,769	51,966	85,285	9,128,666	21,149,557	39,415,038
Total	140,565,286	904,755,117	1,367,577,679	1,744,096,820	1,777,602,012	2,200,456,191	1,989,054,351
Department	Oklahoma County						
Air Force	138,568,503	772,995,384	1,149,877,059	1,517,831,394	1,475,348,144	1,850,200,615	1,601,158,980
FAA	1,623,246	122,926,565	204,563,952	198,235,741	244,003,195	256,027,930	301,584,067
NASA	26,018	44,259	18,226	13,984	6,810	55,455	11,950
Total	140,217,766	895,966,208	1,354,459,237	1,716,081,119	1,719,358,149	2,106,284,000	1,902,754,998

Source: FPDS-NG and SAM.GOV

Notes: Includes purchases from each aerospace-related federal agency, regardless of the use of the good or service in direct aerospace activity.

State Rankings for Air Force, FAA, and NASA Procurement. Figure 21 provides comparative state rankings for contracting with each of the three key agencies and the combined total amount of contracting in FY2019. Oklahoma's combined \$2.24 billion in contracting for the Air Force, FAA, and NASA ranks the state 14th in FY2019.

Oklahoma ranks 12th in Air Force contracting with \$1.88 billion in FY2019. This primarily reflects the large size of the aerospace operation at Tinker AFB. The leading states in Air Force contracting are all large traditional defense industry states and home to major Air Force installations. California and Texas are the two largest Air Force contracting states by a substantial margin. Air Force contracting is concentrated primarily in 18 states, each with \$1 billion or more in Air Force contracts in FY2019.

Oklahoma ranks 4th in FAA contracting with \$322 million in FY2019, traced largely to the presence of the FAA Center in Oklahoma City. Only the District of Columbia, Virginia, and Florida are home to more FAA contracting than Oklahoma. New Jersey, Massachusetts, Maryland and Kansas are the only other states to have approximately \$100 million or more in FAA contracts in FY2019.

Oklahoma ranks 19th in NASA contracting with \$39.8 million in FY2019. This ranks well above the state's relative position as the 28th most populous state. NASA contracting is dominated by California which is home to nearly one-third of the agency's total contracting dollars in FY2019. Other large NASA contracting states include Alabama, Maryland, Colorado, Texas, Florida and Virginia. These states are all home to major NASA installations.

Figure 21. Federal Procurement for Key Aerospace-Related Agencies by State (FY2019)

State	Air Force		FAA		NASA		Total	
	Obligations	Rank	Obligations	Rank	Obligations	Rank	Obligations	Rank
California	\$11,233,345,397	1	\$73,021,300	9	\$4,515,617,816	1	\$15,821,984,523	1
Texas	8,509,411,196	2	36,601,421	15	1,268,921,194	5	9,814,933,828	2
Virginia	5,639,817,935	3	575,933,912	2	952,284,211	7	7,168,036,064	3
Florida	4,687,439,685	5	424,908,753	3	1,187,305,410	6	6,299,653,856	4
Colorado	4,090,074,728	6	43,194,418	11	1,336,219,687	4	5,469,488,850	5
Missouri	4,800,736,893	4	7,469,036	27	29,434,615	21	4,837,640,575	6
Massachusetts	3,788,457,488	8	227,423,710	6	115,265,986	14	4,131,147,198	7
Washington	3,930,703,339	7	15,063,535	23	54,029,806	17	3,999,796,710	8
Maryland	1,693,951,978	13	189,579,048	7	1,515,047,142	3	3,398,578,188	9
Georgia	2,870,516,091	9	17,112,063	21	6,638,634	32	2,894,266,817	10
Alabama	1,204,996,729	16	2,611,258	35	1,554,633,208	2	2,762,241,246	11
Ohio	2,337,119,287	10	3,525,401	33	255,827,782	10	2,596,472,514	12
Connecticut	2,308,909,835	11	1,638,595	41	27,564,284	23	2,338,112,766	13
Oklahoma	1,881,359,647	12	322,134,018	4	39,840,212	19	2,243,333,893	14
Arizona	1,589,046,136	14	37,626,071	14	199,742,757	11	1,826,414,992	15
District of Columbia	322,627,588	30	1,032,927,029	1	126,794,943	13	1,482,349,591	16
Nevada	1,353,334,651	15	2,454,498	36	-23,708,437	51	1,332,080,763	17
Utah	1,015,405,092	18	7,147,370	28	300,658,494	9	1,323,211,003	18
Illinois	1,167,121,247	17	59,910,732	10	10,490,352	27	1,237,522,358	19
New York	857,491,698	19	38,745,872	13	132,032,409	12	1,028,270,010	20
Mississippi	576,874,637	24	1,858,969	40	421,364,733	8	1,000,098,403	21
New Jersey	571,593,663	25	319,136,539	5	17,484,808	25	908,215,040	22
Pennsylvania	809,819,224	20	20,799,474	18	63,282,310	16	893,901,046	23
Indiana	683,127,575	21	14,308,829	24	105,219,762	15	802,656,210	24
New Mexico	671,170,710	22	18,250,659	20	30,902,895	20	720,324,307	25
Alaska	585,658,432	23	36,475,510	16	10,165,345	28	632,299,326	26
New Hampshire	566,108,587	26	24,278,571	17	25,243,651	24	615,630,853	27
Nebraska	519,076,268	27	1,491,609	42	2,884,768	38	523,452,714	28
South Carolina	427,856,739	28	11,138,196	25	1,127,313	43	440,122,301	29
Tennessee	396,862,917	29	3,054,887	34	7,162,205	31	407,080,072	30
Kansas	193,316,124	35	93,465,310	8	10,066,295	29	296,847,772	31
Minnesota	241,192,785	32	20,422,424	19	4,322,534	35	265,937,794	32
Iowa	257,215,016	31	2,251,917	39	1,024,184	44	260,491,186	33
Michigan	230,612,407	33	15,488,192	22	14,311,845	26	260,412,499	34
Montana	199,151,156	34	4,122,176	31	2,398,002	40	205,671,398	35
North Carolina	132,859,941	37	38,881,429	12	5,324,114	34	177,065,533	36
West Virginia	131,622,957	38	-639,708	51	40,416,797	18	171,400,135	37
Hawaii	141,757,520	36	5,077,542	30	1,720,436	41	148,555,564	38
Louisiana	105,118,255	40	6,960,474	29	27,903,401	22	139,982,198	39
South Dakota	108,809,476	39	567,685	47	2,502,015	39	111,879,262	40
North Dakota	67,053,550	41	1,456,762	43	1,206,783	42	69,717,179	41
Idaho	56,788,112	42	1,453,523	44	433,751	50	58,675,472	42
Kentucky	48,354,999	44	3,558,895	32	3,907,798	36	55,821,767	43
Wyoming	52,053,353	43	337,588	48	916,520	47	53,307,552	44
Delaware	45,370,043	45	282,859	49	3,195,587	37	48,848,584	45
Arkansas	35,344,007	46	1,333,437	45	1,002,584	45	37,680,119	46
Oregon	25,589,866	47	2,409,108	37	6,484,830	33	34,483,888	47
Wisconsin	15,562,553	48	9,256,338	26	8,229,815	30	33,048,780	48
Vermont	8,618,120	49	79,720	50	869,438	48	9,567,377	49
Rhode Island	6,428,417	50	763,434	46	974,317	46	8,166,264	50
Maine	992,930	51	2,384,001	38	464,130	49	3,841,151	51
United States	\$73,171,895,131		\$3,779,734,389		\$14,427,153,470		\$91,378,782,990	

Source: SAM.GOV

Oklahoma Procurement of Aerospace-Specific Goods and Services

A second approach to measuring aerospace related federal contracting is to identify purchases of goods and services that are used directly in aerospace-related activities, regardless of the agency making the purchase.

Again, this approach overcomes two concerns with the procurement data as tabulated in the prior section and provides a more direct measure of federal procurement for aerospace-related goods and services rather than aerospace-related agencies.

Determining the exact amount of federal purchases of aerospace goods and services involves a detailed examination of each federal contract performed within Oklahoma. In fiscal year 2019, this involves 45,416 individual action obligation orders.²⁹

The task is simplified by using readily identifiable NAICS codes and product or service descriptions specifically related to aerospace. All NAICS codes and descriptions believed to be only loosely related to aerospace are excluded.

Aerospace-related codes and descriptions are used to identify action obligation orders for goods and services valued at \$1.92 billion statewide in fiscal year 2019 (*see Figure 22*). This is about 14% less than the \$2.24 billion in total expenditures by the Air Force, FAA, and NASA in fiscal year 2019 in the prior section of the report.

Figure 22 summarizes the purchases of aerospace goods and services by contracting agency, share of total contracting, and share of aerospace contracts fulfilled by Oklahoma-based vendors in fiscal year 2019.

Figure 22. Oklahoma Aerospace-Specific Federal Procurement (FY2019)			
Federal Agency	State of Oklahoma	10-County Region	Oklahoma County
Air Force	\$1,339,615,702	\$1,181,492,782	\$1,174,370,920
FAA	85,937,004	82,804,018	81,798,188
NASA	39,347,596	39,163,494	11,950
Other Department of Defense	444,128,571	303,194,011	284,703,144
All Other Federal Agencies	13,924,187	9,875,617	7,958,364
Total Aerospace-Related	\$1,922,953,060	\$1,616,529,923	\$1,548,842,565
Total Procurement	\$4,176,580,361	\$2,687,488,126	\$2,464,429,107
Aerospace Share of Total Procurement	46.0%	60.2%	62.8%
Total Aerospace Procurement Performed by Oklahoma-based vendors	\$1,411,663,698	\$1,227,029,064	\$1,162,127,493
Share of Aerospace-Related Procurement Performed by Oklahoma-based vendors	73.4%	75.9%	75.0%
Notes: Aerospace-related procurement is determined by examining NAICS industry codes and product or service descriptions for each contract with an action obligation in fiscal year 2019. Contracts deemed issued to Oklahoma-based vendors specify an operating entity with an address located in Oklahoma.			
Source: FPDS-NG and SAM.GOV and RegionTrack calculations			

The contracts identified capture a range of goods and services including aircraft maintenance and repair, tools, parts, equipment, machinery, fuel, research and development, and construction projects related directly to aviation. Yet other contracts provide federal funding for municipal airports, aviation training, aviation-related human research, and other non-military applications.

The contracts identified as specifically for aerospace goods and services account for slightly less than half (46.0%) of the total value of procurement activity of \$4.18 billion in the state in fiscal year 2019.

Approximately three-fourths of the contracting work was performed by Oklahoma-based vendors. Of the \$1.92 billion in total aerospace-related contracting, 73.4 % (\$1.41 billion) was performed by vendors with an operating address in Oklahoma.

For the 10-county Greater Oklahoma City region, contracts valued at \$1.62 billion were identified as procuring goods and services directly used in aerospace applications. Approximately 60% of the value of all contracts issued in the 10-county region is traced to aerospace; 75.9% of the value of total aerospace contracts is traced to vendors with an operating address in Oklahoma.

For Oklahoma County, contracts for direct aerospace goods and services were valued at \$1.14 billion, or 62.8% of the value of total procurement in the county in fiscal year 2019. Seventy-five percent of the aerospace-related contracts in Oklahoma County were performed by vendors located in Oklahoma.

Aerospace-Specific Federal Procurement Across the 10-County Region

Although Oklahoma County dominates aerospace contracting activity within the 10-county region, several smaller yet significant pockets of activity are visible within the federal procurement data.

Figure 23 details the distribution of federal aerospace-related contracting activity by city in each of the 10 counties in the Greater Oklahoma City region. The estimates reflect the \$1.62 billion in federal spending on goods and services that are directly related to aerospace activity, regardless of the contracting federal agency.

In Oklahoma County, the city of Oklahoma City accounts for more than 96% (\$1.50 billion) of county-wide aerospace-specific federal contracting. An additional \$38.9 million is performed in Edmond and \$14.2 million at Tinker Air Force Base. Limited aerospace contracting is present in other cities within Oklahoma county.

Cleveland County is home to the largest concentration of aerospace-specific activities in the region outside of Oklahoma County. Contracts awarded to firms in Norman, Moore, and the Oklahoma City portion of Cleveland County totaled nearly \$53 million in FY2019. This activity represents half (50.8%) of all federal contracts performed by firms in the county in the period.

Firms located in Shawnee in Pottawatomie County received a total of \$6.3 million in federal aerospace-specific contracts in FY2019. Vendors in Stillwater in Payne County were awarded \$5.1 million in contracts.

Other cities with aerospace-specific firms securing smaller federal contracts in FY2019 include Stroud in Lincoln County (\$1.0 million), Guthrie in Logan County (\$2.2 million), and Piedmont in Canadian County (\$268,000).

No vendors in Grady, Kingfisher, and McClain counties received any federal aerospace-specific contract awards in FY2019.

Figure 23. Aerospace-Specific Federal Procurement by County (FY2019)

Region	Total Federal Procurement	Aerospace & Aviation-Related	Aerospace & Aviation Share
State of Oklahoma	\$4,176,580,361	\$1,922,953,060	46.0%
10-County Region	\$2,687,488,126	\$1,616,529,923	60.2%
Canadian County	20,466,675	292,558	1.4%
Mustang	1,560,772	24,600	1.6%
Piedmont	277,300	267,958	96.6%
Other	18,628,602	0	0.0%
Cleveland County	104,011,246	52,794,752	50.8%
Moore	578,528	578,528	100.0%
Norman	94,987,104	49,637,738	52.3%
Oklahoma City	7,391,158	2,578,486	34.9%
Other	1,054,457	0	0.0%
Grady County	24,851,856	0	0.0%
Kingfisher County	15,073,692	0	0.0%
Lincoln County	1,378,431	1,039,741	75.4%
Stroud	1,041,541	1,039,741	99.8%
Other	336,890	0	0.0%
Logan County	12,471,497	2,176,253	17.4%
Guthrie	12,345,866	2,176,253	17.6%
Other	125,631	0	0.0%
McClain County	291,298	0	0.0%
Oklahoma County	2,464,430,625	1,548,842,565	62.8%
Edmond	51,614,405	38,925,274	75.4%
Moore	212,114	212,114	100.0%
Oklahoma City	2,248,506,404	1,495,553,748	66.5%
Tinker AFB	162,409,787	14,151,429	8.7%
Other	1,687,916	0	0.0%
Payne County	35,165,979	5,057,598	14.4%
Stillwater	34,964,847	5,057,598	14.5%
Other	201,131	0	0.0%
Pottawatomie County	9,348,345	6,326,458	67.7%
Shawnee	8,978,792	6,326,458	70.5%
Other	369,553	0	0.0%

Source: FPDS-NG and SAM.GOV and RegionTrack calculations

Largest Aerospace Vendors in the Greater OKC Region

The Greater Oklahoma City region has a large and diverse group of firms engaged in federal aerospace contracting. Figure 24 lists the top 25 vendors to the Air Force, FAA, and NASA for contracts with a place of performance within the 10-county Greater Oklahoma City region in FY2019.

The top 25 vendors were awarded 83% (\$1.65 billion) of the \$1.99 billion in total contracts issued by the Air Force, FAA, and NASA in the period. The average contract value for the top 25 vendors is more than \$140 million but is heavily influenced by Boeing's dominant share of total contracts.

The remaining 955 aerospace vendors received only 17% of total aerospace contracts with a combined value of \$336.0 million in FY2019. The average contract value for these vendors was \$351,800.

Boeing is the largest single contracting entity to the three federal agencies in the 10-county region and the largest single federal contractor in the state. Boeing's total obligation value of \$1.11 billion in FY2019 is roughly 56% of all contracting performed for the Air Force, FAA, and NASA in the 10-county region in FY2019. It is also more than one-fourth of all contracting performed statewide for all federal agencies.

Much of the overall rise in total federal contracting in the Greater OKC region since FY2015 is traced to the expansion of Boeing's activities at Tinker AFB. Boeing's federal contracting activity for the Air Force, FAA, and NASA has increased 76% since FY2015, rising from \$628.7 million to \$1.11 billion.

Other traditional aerospace contractors such as Robinson Aviation (\$40.8 million) and Northrop Grumman (\$16.1 million) largely specialize in aircraft MRO services.

Other firms among the top 25 vendors in the 10-county Greater Oklahoma City region include construction companies, training companies, engineering firms, logistics companies, energy providers, and contracting consultants.

Figure 24. Largest Air Force/FAA/NASA Vendors in the 10-County Greater OKC Region (FY2019)

Rank	Vendor Name	Contract Value
1	The Boeing Company	\$1,105,026,446
2	Afognak Native Corporation	57,467,350
3	Bering Straits Native Corporation	44,270,094
4	Robinson Aviation (RVA) Inc.	40,796,906
5	University of Oklahoma	39,551,544
6	Mowa-Barlovento	38,336,388
7	ASRC Federal System Solutions LLC	38,025,483
8	Flintco LLC	36,953,991
9	Indigenous Technologies LLC	26,292,217
10	Strategic Mission Systems LLC	20,340,158
11	Advanced Construction Services Inc.	19,722,664
12	Science Applications International Corp.	18,418,652
13	Delaware Resource Group of OK LLC	17,810,626
14	CDW Corporation	17,267,494
15	Northrop Grumman Corporation	16,123,295
16	Dale Rogers Training Center Inc.	15,098,198
17	Gideon Contracting Limited Liability Co.	14,984,411
18	Unicom Government Inc.	13,719,605
19	OGE Energy Corp.	11,930,280
20	KBR Inc.	11,299,846
21	Tehama LLC and HDR Joint Venture	11,119,536
22	AECOM Technology Corporation	10,314,585
23	Objectstream Inc.	9,630,173
24	Long Wave Inc.	9,624,813
25	Leader Communications Inc.	8,945,125
Top 25 Vendors		\$1,653,069,881
All Other Vendors		\$335,984,471
All Vendors		\$1,989,054,351

Notes: Includes only contracts issued by the Air Force, FAA, and NASA
Source: FPDS-NG and SAM.GOV and RegionTrack calculations

IX. Economic Impact of Aerospace

The direct activity of the 291 aerospace establishments identified as operating in the Greater Oklahoma City region generates substantial economic ripple, or spillover, effects in other industry sectors across the region. High average wages, the capital-intensive nature of the industry, a substantial use of high-skilled labor, extensive training and education requirements, and the natural clustering of aerospace companies in the region all work to create strong economic linkages between the industry and the broader regional economy.

Measuring Economic Spillover Effects from Aerospace

The spillover economic impact these aerospace establishments have on the region can be estimated in terms of additional jobs, labor income, and output of goods and services supported in other industries in the region. Economic impact multipliers are commonly used to estimate the effect of a change in economic activity in a given industry on the broader regional or national economy.³⁰

Most economic impact multipliers are derived from a detailed input-output model of a regional economy that maps the various spending flows between firms, households, and governments.³¹ It is important to note that economic multipliers in this report represent estimates of gross economic effects and do not account for any public or private costs associated with the aerospace sector.

Employment multipliers provide an estimate of the number of jobs generated in the Greater Oklahoma City regional economy as new jobs are added in the aerospace sector. Similarly, *labor income* multipliers provide an estimate of the amount of additional household earnings generated in the broader economy per new dollar of labor income received by aerospace employees. *Output* multipliers provide an estimate of the change in output in the Greater Oklahoma City area economy per dollar of new output (or revenue) generated within the aerospace industry.

In interpreting multipliers, a given change in economic activity taking place within the aerospace industry is deemed the *direct* effect. Direct effects include the employment, labor income, and output of goods and services generated directly by the 291 aerospace firms and their employees in the Greater Oklahoma City region.

The direct effect, in turn, produces both *indirect* and *induced* spillover effects which are estimated using multipliers. The indirect effects are the employment, income, and goods and services generated as a result of aerospace establishments making purchases from firms in other industries within the region. The induced effects describe the economic activity generated by new household spending resulting from compensation generated from both the direct and indirect effects.

The key mechanisms behind the indirect and induced, or spillover, effects are the purchases made by aerospace establishments from other businesses in the region and the spending of earned income within the region by aerospace workers.

The direct, indirect, and induced effects provide a convenient way of describing the overall multiplier effects that occur as establishments in the aerospace industry produce goods and services (direct effects), then impact those firms that support and supply the sector (indirect effects), and then finally impact the broader regional economy as worker's incomes and spending patterns are affected (induced effects).

Estimated Effects. Figure 25 provides estimates of economic multiplier effects generated in the Greater Oklahoma City economy from direct activity in the aerospace industry in 2020. Again, these are gross

measures of economic spillover and do not account for any public or private costs to the region (including incentives) associated with the aerospace sector.

Figure 25. Greater OKC Region Aerospace Industry Economic Impacts (2020)

<i>Direct Effect</i>			
Major Group	Employment	Labor Income (\$Mil)	Output (\$Mil)
Government	32,554	\$2,385.2	\$4,436.0
Tinker Air Force Base (military, federal civilian, and contractors)	26,029	\$1,755.6	\$3,229.5
FAA Mike Monroney Aeronautical Center	5,159	563.5	1,105.7
All Other Government (federal, state, and local)	1,366	66.1	100.8
Maintenance, Repair, and Overhaul (MRO)	4,668	509.0	1,472.4
Engineering, Consulting, Program Management, and Logistics	2,901	275.2	617.9
Air Transportation (Airports, aircraft sales, and air travel)	1,942	142.1	443.3
Supplies and Materials	912	71.1	221.6
Education and Training	181	10.7	21.9
Manufacturing	47	4.0	14.4
Other (spraying, aerial services, and other)	47	2.7	6.1
Total Direct Effects	43,252	\$3,400.0	\$7,233.6
<i>Multiplier Effects (Indirect + Induced)</i>			
Major Group	Employment	Labor Income (\$Mil)	Output (\$Mil)
Government	23,585	\$1,405.9	\$2,236.5
Tinker Air Force Base (military, federal civilian, and contractors)	18,741	1,035.8	1,711.6
FAA Mike Monroney Aeronautical Center	4,024	332.5	475.5
All Other Government (federal, state, and local)	820	37.7	49.4
Maintenance, Repair, and Overhaul (MRO)	2,474	468.3	1,281.0
Engineering, Consulting, Program Management, and Logistics	4,497	335.8	352.2
Air Transportation (Airports, aircraft sales, and air travel)	2,486	125.1	323.6
Supplies and Materials	629	50.5	146.2
Education and Training	89	5.6	9.0
Manufacturing	80	6.3	11.8
Other (spraying, aerial services, and other)	14	1.0	1.3
Total Indirect and Induced Effect	33,853	\$2,398.4	\$4,361.7
<i>Total Effects (Direct + Indirect + Induced)</i>			
Major Group	Employment	Labor Income (\$Mil)	Output (\$Mil)
Government	56,139	\$3,791.2	\$6,672.5
Tinker Air Force Base (military, federal civilian, and contractors)	44,770	2,791.4	4,941.1
FAA Mike Monroney Aeronautical Center	9,183	896.0	1,581.2
All Other Government (federal, state, and local)	2,186	103.8	150.2
Maintenance, Repair, and Overhaul (MRO)	7,142	977.3	2,753.5
Engineering, Consulting, Program Management, and Logistics	7,398	611.0	970.1
Air Transportation (Airports, aircraft sales, and air travel)	4,428	267.2	766.9
Supplies and Materials	1,541	121.6	367.8
Education and Training	270	16.3	30.9
Manufacturing	127	10.3	26.2
Other (spraying, aerial services, and other)	61	3.7	7.4
Total Effects (Direct + Indirect + Induced)	77,105	\$5,798.4	\$11,595.2

Source: IMPLAN Input-Output Model and RegionTrack calculations

In terms of direct employment, 43,252 workers in the region are employed directly in aerospace, with the majority employed in public sector positions at Tinker AFB and the FAA Center. These workers indirectly support an additional 33,853 jobs across the Greater Oklahoma City region (the sum of indirect and induced employment). In total, an estimated 77,105 jobs in the region are provided either directly by the aerospace sector or supported indirectly through multiplier effects generated by the industry. In other words, each direct job in the aerospace sector supports approximately 0.8 additional jobs in the broader regional economy.

The \$3.4 billion in direct labor income paid to aerospace workers likewise generates substantial ripple effects as the income is earned and recirculated within the regional economy. The estimates in Figure 25 indicate that an additional \$2.4 billion in labor income earned by workers in other industries statewide is supported by direct activity in the aerospace sector, or a total earnings impact of \$5.8 billion in the region. Each dollar of labor income earned by workers in aerospace supports an addition \$0.70 in labor income in the 10-county region across all industry sectors.

The output of goods and services in the region is similarly stimulated by the presence of the industry. The multiplier effects in Figure 25 indicate that aerospace establishments in the region generate an estimated \$7.2 billion in direct output of goods and services, resulting in estimated multiplier effects (both indirect and induced) of \$4.4 billion in additional output of goods and services in other industries in the region. Overall, either directly or indirectly through multiplier effects, aerospace activity in the Greater Oklahoma City region supports the production of \$11.6 billion in total output of goods and services in 2020. This suggests that each dollar of output produced directly by the aerospace sector generates an additional \$0.60 in spillover output across the region.

Growth in Total Impact. The total direct and spillover effects traced to the aerospace industry are far larger than in the 2015 report. The total employment effect of aerospace in the region increased from 67,583 to 77,105, a 14% increase the past five years. The total labor income effect increased by more than \$1.5 billion, from \$4.06 billion to \$5.8 billion, or a 43% increase. Total output traced to the aerospace sector increased by 43% since 2015, from \$8.16 billion to \$11.6 billion.

Estimated Tax Effects

The activities of the aerospace industry in turn produce significant additional tax revenue for state and local governments in the region. Revenue estimates are detailed in Figure 26 and reflect estimates of tax payments made directly by firms in the aerospace industry and their workers. Estimates include taxes paid on the purchases of taxable goods subject to both sales and use tax, motor vehicles, and real and personal property.

The tax estimates are estimated using an IMPLAN input-output model for the 10-county Greater Oklahoma City region and estimates of tax shares from the Oklahoma Tax Commission. The tax scenario is based on the labor income specified at the IMPLAN industry level for each of the major groups comprising the aerospace industry.³²

In total, the activity generated directly by the industry produces an estimated \$300.3 million in tax payments to state and local government in 2020. This equates to approximately 4.1% of total direct output generated by the industry. Again, it is important to note that the estimated tax effects are gross measures and do not account for public or private costs associated with the aerospace sector such as tax exemptions or incentives.³³

The largest source of tax revenue is an estimated \$159 million in sales and use tax revenue, which comprises a little more than half the total tax revenue generated by the aerospace sector. Sales and use tax revenue

received by the state is 30% (\$90 million) of total revenue while sales and use tax received by local taxing jurisdictions (\$69 million) is 23% of total taxes generated.

The second largest source of revenue is personal income tax payments to state government of approximately \$114 million, or more than one-third of total taxes generated. Personal income taxes represent approximately 3.4% of the estimated \$3.42 billion in total annual labor income earned directly by workers in the aerospace industry.

Motor vehicle taxes received by the state total an estimated \$8.7 million, or 3% of total taxes generated by the sector. Real and personal property taxes to local government total an estimated \$12.2 million in 2020. Corporate income tax is the smallest source of added tax revenue and generates an estimated \$4.4 million in 2020.

Figure 26. Estimated State & Local Tax Revenue - Aerospace Activity (2020)

Type of Tax	Tax Revenue (\$Mil)	% of Total Tax Revenue
Personal Income Tax	\$114.2	38.3%
Corporate Income Tax	4.4	1.5%
Motor Vehicle Tax	8.7	2.9%
Real and Personal Property Tax	12.2	4.1%
Sales and Use Tax:		
State	89.8	30.1%
Local	69.1	23.2%
Total Sales and Use Tax	\$158.9	53.2%
Total State and Local Tax Revenue	\$298.4	100.0%

Source: Bureau of Economic Analysis, IMPLAN Input-Output Model, Oklahoma Tax Commission, and RegionTrack estimates

X. Endnotes

1 The Oklahoma Historical Society provides an overview of the history of aerospace and aviation activity in Oklahoma. See: <https://www.okhistory.org/publications/enc/entry.php?entry=AV004>

2 See: Greater Oklahoma City Region Aerospace Industry - Industry Survey and Economic Impact Assessment. Greater Oklahoma City Chamber and RegionTrack Inc. June 2016.

3 The U.S. Dept. of Defense (DoD) defines aerospace as of, or pertaining to, Earth's envelope of atmosphere and the space above it; two separate entities considered as a single realm for activity in launching, guidance, and control of vehicles that will travel in both entities. See the DoD Dictionary of Military Terms, U.S. Department of Defense: http://www.dtic.mil/doctrine/dod_dictionary/.

4 Kingfisher, Payne, and Pottawatomie Counties are not component counties of the Oklahoma City Metropolitan Statistical Area (MSA) as defined by the Census Bureau.

5 Aerospace establishments are initially identified using the September 2020 version of the DataAxel U.S. Business database for the 10-county Greater Oklahoma City region. Other proprietary databases including Salesforce and D&B Hoovers are used to identify firms and collect contact information. Other industry information was gathered locally by RegionTrack economists, Greater Oklahoma City Chamber staff, and members of the Greater Oklahoma City Partnership.

6 See, for example, state reports for: Kentucky (<https://kcma.ky.gov/Documents/2017%20Kentucky%20Aerospace%20-%20Aviation%20Study.pdf>); Georgia (<https://www.georgia.org/sites/default/files/wp-uploads/2016/11/Economic-Impact-of-aerospace-2015-7.24.17-FINAL.pdf>), and Florida (<https://commons.erau.edu/edt/51/>).

7 The estimates largely reflect activity in place in early 2020 prior to the onset of the pandemic.

8 See: <https://www.tinker.af.mil/About-Us/Fact-Sheets/Display/Article/384764/oklahoma-city-air-logistics-complex/>

9 The estimates in Figure 7 are derived from the Office of Management Personnel reports while other estimates are provided by Tinker AFB.

10 See: Tinker Air Force Base Fiscal Year 2021/2022 Hiring Forecast. Available from the Tinker Air Force Base Civilian Personnel Office. The forecast covers external hires in Air Force activities at Tinker Air Force Base (AFB) in Fiscal Years (FY) 2021 and 2022 (1 October 2020 through 30 September 2022). It does not include hiring in other federal agencies located at Tinker AFB, i.e., Defense Information Systems Agency, Defense Logistics Agency, Department of the Navy or private sector contractors performing work at Tinker AFB. It also does not project employment for Non-Appropriated Fund Activity (NAF) facilities at Tinker AFB including, bowling centers, golf courses, community centers, and arts and crafts activities.

11 See: <http://www.okenergytoday.com/2020/08/more-jobs-expected-as-result-of-kc-46-tanker-expansion-at-tinker-afb/>

12 The lease provides for the use of the property and structures and includes some ongoing maintenance and repair of structures. See: <https://www.transportation.gov/sites/dot.gov/files/docs/mission/budget/304496/faa-fy2019cj-budgetfinal508compliant.pdf>

13 Detailed employment by occupation data is available only for the approximately 3,100 federal civilian employees at the FAA Center.

14 See: <https://www.industryweek.com/the-economy/public-policy/article/21956178/oklahoma-in-a-prime-position-for-aerospace-growth>

15 See: <https://gthokc.com/california-group-buys-boeing-okc-campus-for-125-million/>; and <https://www.prnewswire.com/news-releases/boeing-okc-campus-sells-to-california-investors-300983183.html>

16 See: <https://www.boeing.com/company/general-info/#!/state>. Employment numbers include all full-time and part-time employees, contingent labor, employees on leaves of absence 90 days or less, and the workforce of our subsidiary businesses. Numbers are net of additions and reductions.

17 For the State, Army and Air National Guard forces are commanded by the Governor through the state Adjutant General. State missions may include helping communities deal with floods, tornadoes, hurricanes, wildfires, and security support in times of civil unrest. For federal missions, the Army and Air National Guard can be activated by the President of the United States and are then commanded by the combatant commander for their designated operating theatre.

18 A map of SBA HUBZones is available online at: <https://maps.certify.sba.gov/hubzone/map#center=39.828200,-98.579500&zoom=5>

19 Metropolitan area wage rates are reported from the 2019 release of the Occupational Employment Statistics by the Bureau of Labor Statistics (BLS).

20 Data are annual averages derived primarily from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) program. Where QCEW data is suppressed, estimates are informed by data in the Census County Business Patterns survey and raked to match national totals.

21 Source: Interactive Demographic Analysis System (IDEAS) - Air Force Personnel Center

22 No centralized data source is available to identify non-appropriated federal workers at FAA facilities.

23 See the text of House Bill 2578 online at: http://webserver1.lsb.state.ok.us/cf_pdf/2017-18%20ENR/hB/HB2578%20ENR.PDF

24 See: <https://www.okcommerce.gov/doing-business/business-relocation-expansion/incentives/>

25 https://news.okstate.edu/articles/engineering-architecture-technology/2019/osus_usri_receives_first_faa_authorization_to_fly_in_swarms.html

26 <https://oklahoman.com/article/5672125/osu-students-design-and-build-innovative-engine-for-drones>

27 <https://news.okstate.edu/articles/communications/2020/osu-partners-with-navatek-to-create-unmanned-systems-research-internship-program.html>

28 Moore Norman Technology Center has announced plans to offer an Aviation Maintenance Technician program beginning in 2022.

29 The estimates include all procurement contracts with an action obligation declared in fiscal year 2019 and with place of performance in Oklahoma are included.

30 Caution must be exercised when using input-output multipliers to estimate the total economic activity “supported” by an existing industry or firm. Input-output multipliers are intended to predict the change in region-wide economic activity that results from an incremental change in a given industry within a regional economy.

31 State- and region-level multipliers are typically estimated by adjusting, or regionalizing, national purchasing patterns for a given industry sector such that they better reflect the actual economic flows within the states.

32 Labor income is specified individually for Tinker AFB and the FAA Center in the model using military-federal government and non-military federal government, respectively. Other government providers are assumed to reflect non-military federal government activity. The remaining sectors are specified using the most representative IMPLAN industry sector.

33 For example, the tax estimates are not adjusted for the state Aerospace Industry Engineer Workforce Tax Credit (for either employers or employees) or other state tax credits the firms may be eligible for.



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