The Texas Aerospace & Aviation Industry

2014

TEXAS WIDE OPEN FOR BUSINESS

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Aerospace & Aviation in Texas

Texas is one of the most important locations for the global aerospace and aviation industry. As home to the headquarters of two international airlines and two of the world's busiest airports, as well as NASA's world-famous Johnson Space Center, the state is key for many of the largest global aerospace and aviation companies.

The broad range of aerospace activities in Texas includes fighter plane and helicopter assembly, navigation instrument development, advanced spaceflight research, military pilot training, and commercial space travel. The aerospace and aviation industry directly employs more than 153,000 Texas workers at 1,300 firms. The output of the Texas aerospace manufacturing sector ranks second in the nation, and 17 of the 20 largest aerospace manufacturers in the world, including Boeing, EADS, and Lockheed Martin, have major operations in Texas.

Key Texas Aerospace Rankings

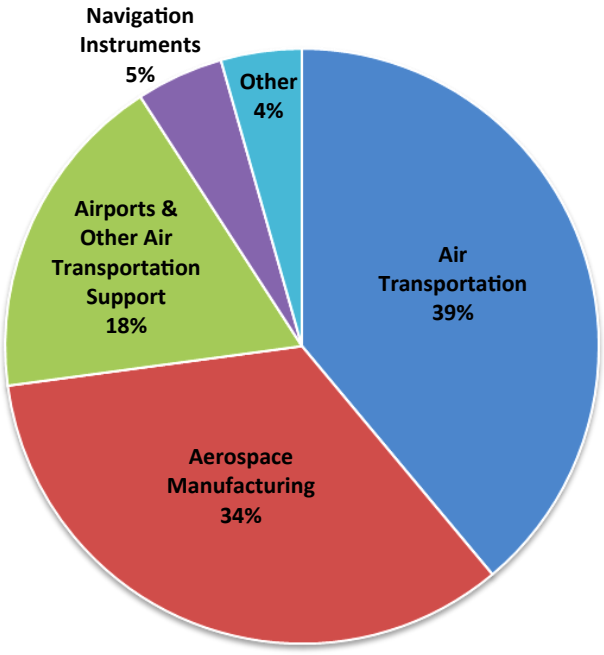
- **No. 1** in Air Transportation Jobs
- **No. 1** in Air Force Personnel
- **No. 2** in Aerospace Manufacturing Output

Geographically, the aerospace and aviation industry has a substantial presence in many regions of the state. In North Texas, the Dallas-Fort Worth region boasts the state's largest concentration of aerospace manufacturing workers, as well as the headquarters of American Airlines and Southwest Airlines. San Antonio, sometimes referred to as "Military City USA," is home to tens of thousands of U.S. Air Force personnel and is a major national hub for aircraft maintenance and overhaul. On the Gulf Coast, Houston is the legendary home to NASA mission control and dozens of related spaceflight contractor firms. Elsewhere in the state, one of the world's largest helicopter repair facilities resides in Corpus Christi, while the cities of Waco, Amarillo, El Paso, Wichita Falls, McAllen, and Harlingen all support manufacturing facilities for various Fortune 500 aerospace companies.

Aerospace and aviation directly employs more than **153,000** Texas workers

Texas Aerospace & Aviation Employment

First Quarter 2013, by Sector



Source: Texas Workforce Commission

Major Aerospace & Aviation Companies in Texas

Selected firms with engineering, manufacturing, or maintenance facilities in the state

Representative sample only

Sources: D&B, company websites

Industry Indicators

Sizing Up the Texas Air Transportation Industry*

$8.4 billion

Gross domestic product (GDP) of the Texas air transportation sector in 2011, a record for the state

No. 1

Texas' rank in the U.S. for both GDP and total employment in the air transportation sector

+33%

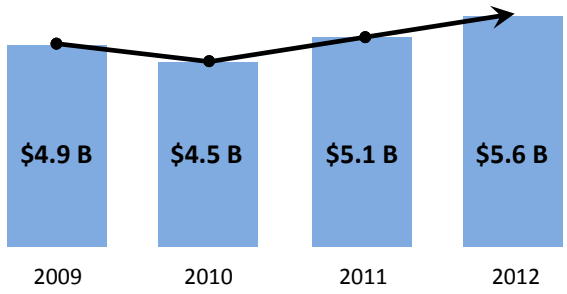
Growth of the Texas air transportation sector over the past decade, measured by real GDP

*Includes commercial airlines and air cargo operators
Source: U.S. Bureau of Economic Analysis

American Eurocopter EC145

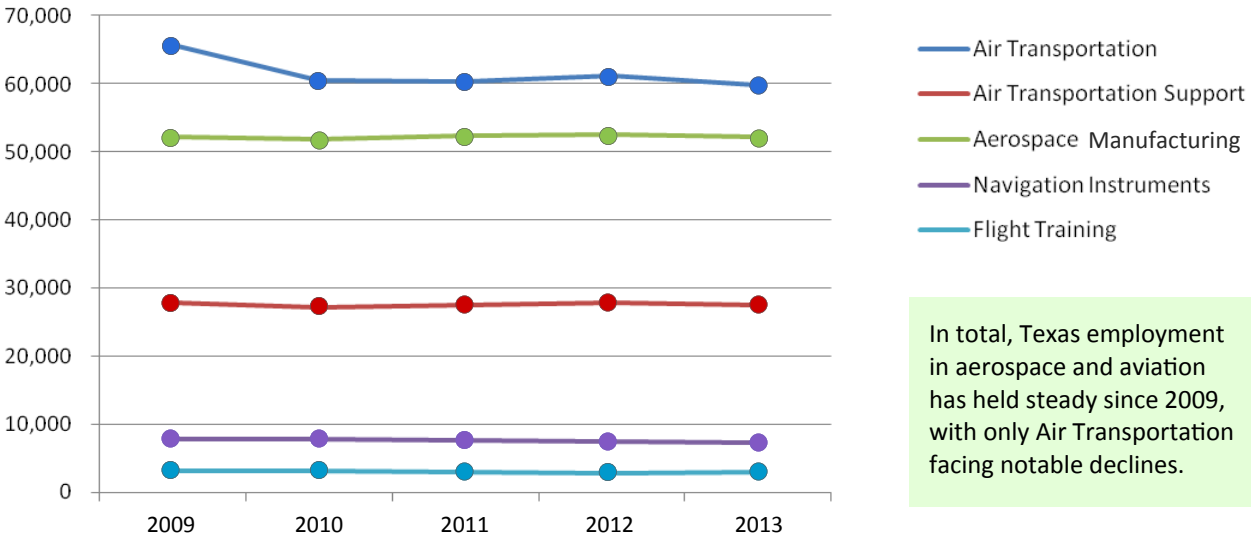
Aerospace Exports from Texas

Total value of shipments to international markets, in billions of U.S. dollars per year



Source: U.S. Dept. of Commerce

Texas Five-Year Employment Trends by Sector, 2009 to 2013



In total, Texas employment in aerospace and aviation has held steady since 2009, with only Air Transportation facing notable declines.

Source: Texas Workforce Commission. Q1 2009 to Q1 2013

State Government Initiatives

Business Incentive Programs

In 2003, the Texas Legislature created the $295 million **Texas Enterprise Fund (TEF)**, a "deal closing" fund created to attract businesses and new jobs to Texas. The Legislature reauthorized the TEF most recently in 2013. To date, the TEF has awarded more than $41 million to assist aerospace corporate expansions (see table at right).

In 2005, the Texas Legislature established the $200 million **Texas Emerging Technology Fund (TETF)** to back the commercialization of technological innovations across multiple industries, including IT. The TETF was reauthorized most recently in 2013. To date, over $8.8 million from the TETF have been awarded to aerospace and defense-related startups (see table at right).

The Texas **Office of Aerospace, Aviation & Defense**, within the Office of the Governor, Economic Development & Tourism Division, works closely with decision makers in the aerospace industry, other governmental agencies, and academic institutions to coordinate industry development efforts.

Texas Enterprise Fund
Aerospace & Aviation-Related Awards

Company	City	Award
Triumph Aerostructures (formerly Vought)	Dallas	$35,000,000
Raytheon	McKinney	$1,000,000
Lockheed Martin	Houston	$4,000,000
Trace Engines	Midland	$250,000
Rockwell Collins	Richardson	$839,196
	Total	**$41,089,196**

Texas Emerging Technology Fund
Aerospace & Aviation-Related Awards

Company	Collaborating University	Award
1st Detect	UNT	$1,800,000
Advitech	UT MD Anderson	$2,500,000
AgileMesh	UT Dallas	$2,000,000
Falcon International	UT Permian Basin	$850,000
StarVision Technologies	Texas A&M	$750,000
Global Contour	UNT	$950,000
	Total	**8,885,000**

New Space Flight Legislation

In 2013, the Texas Legislature passed multiple bills to nurture the growth of the commercial space industry in the state, including legislation limiting liability of space flight operators and the appropriation of $15 million to the state's Spaceport Trust Fund. For more details, see page 36.

Aerospace & Aviation Workforce

Texas' aerospace and aviation labor force is one of the largest in the nation, directly employing more than 153,000 workers. Within the industry, the largest subsector in the state is air transportation, which includes airlines, airport operations, and aircraft maintenance. This category accounts for about 57% of aerospace and aviation employment in Texas (see table below). Texas ranks number one in the U.S. for total direct air transportation jobs.

Additionally, the Texas workforce is significantly more specialized in aerospace manufacturing than most other U.S. states, measured by workers per capita. The share of the Texas workforce employed in aerospace manufacturing is 20% greater than the national average.

Aerospace & Aviation-Related Employment in Texas

First Quarter 2013

Sector (and Industry Code)	Employees	Firms	Average Annual Wage
Air Transportation (481)	59,691	357	$78,988
Airports & Other Air Transportation Support Activities (4881)	27,558	602	$62,036
Aircraft Manufacturing (336411)	36,865	50	$99,269
Aircraft Components Manufacturing (336412-336413)	13,603	124	$80,518
Guided Missiles & Space Vehicles Manufacturing (336414-336419)	1,570	2	NA
Search, Detection & Navigation Instruments (334511)	7,290	43	$90,792
Satellite Telecommunications (5174)	623	53	$95,316
Flight Training (611512)	2,986	74	$56,940
Space Research & Technology (927)	3,132	17	$109,096
TOTAL	**153,318**	**1,323**	**$80,958**

Source: Texas Workforce Commission

Education & Training

Aerospace and aviation education in Texas is supported by a highly developed network of higher education institutions around the state. Eleven of the state's public and private universities provide aeronautical programs offering degrees in aerospace engineering, aviation science, and related specialties. Elsewhere, 14 public and private colleges around Texas offer Federal Aviation Administration-approved aviation maintenance technology programs (see map, page 9). Texas also leads the nation in the number of workers employed in key aerospace and aviation occupations, including aircraft mechanics, avionics technicians, engine assemblers, and airfield operations specialists.

Texas has more aircraft mechanics and avionics technicians than any other state

Aerospace & Aviation-Related Degrees Awarded in Texas, 2008-2012

All Texas Public Institutions, All Degree Levels

Mechanical Engineering		7,258
Physics		1,732
Aerospace/Aeronautical Engineering		1,390
Aircraft Maintenance & Technology		1,847
Electronics & Communication Equipment Installation		297
Commercial Pilots		223
	TOTAL	**12,747**

Source: Texas Higher Education Coordinating Board

Texas Leads the Nation in Skilled Aerospace Occupations

Occupation	*Texas Rank*
Aircraft Mechanics	**No. 1**
Avionics Technicians	**No. 1**
Aircraft Assemblers	**No. 2**
Engine Assemblers	**No. 1**
Non-Scheduled Pilots	**No. 1**
Airfield Operations Specialists	**No. 1**

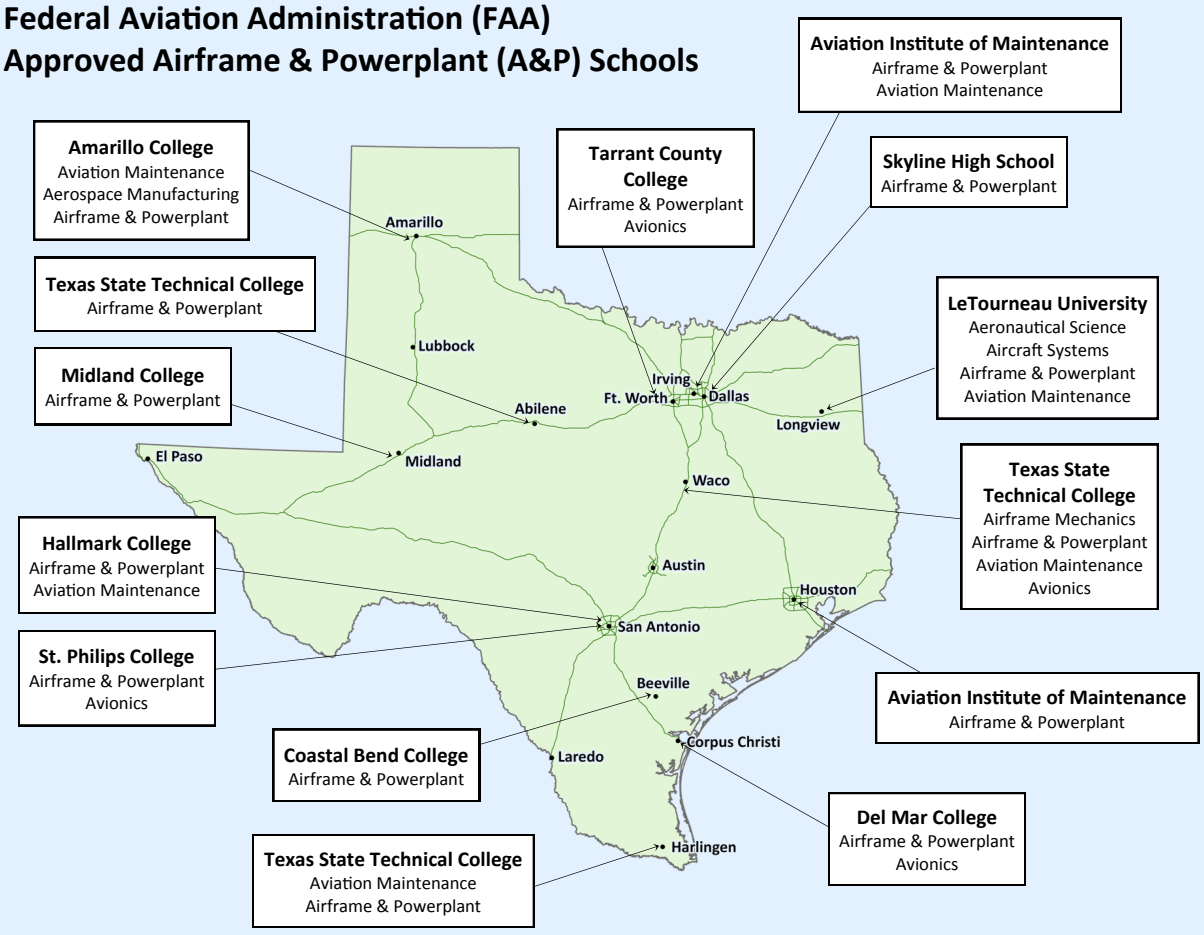
Source: U.S. Bureau of Labor Statistics

A structural repair specialist prepares the canopy of a T-38 Talon jet at Randolph Air Force Base, San Antonio.

Texas Lands Four Aerospace Engineering Schools in the Top 50

In 2013, *U.S. News & World Report* ranked the nation's top 50 aerospace engineering grad schools. Texas placed four on the list, including two in the top ten.

Federal Aviation Administration (FAA) Approved Airframe & Powerplant (A&P) Schools



Source: Federal Aviation Administration

Texas State Technical College (TSTC) is the single biggest provider of aerospace and aviation programs in Texas. At its primary aerospace campus in Waco, TX, TSTC operates the nation's largest airport owned by a public educational institution and offers a full range of FAA-approved programs including aviation maintenance, air traffic control, avionics, aircraft dispatch and aircraft pilot training. TSTC also offers aviation maintenance programs at its Harlingen and Abilene campuses.

ALAMO COLLEGES
ST. PHILIP'S COLLEGE

St. Philip's College, part of the **Alamo Colleges** system in San Antonio, TX, offers technical training in airframe and powerplant mechanics through its nationally-recognized Aerospace Academy. St. Phillips' Southwest Campus at Port San Antonio is the region's principal site for aerospace training and offers customized programs for San Antonio-area aviation employers such as Boeing and Chromalloy. In 2011, St. Phillips acquired an additional 30 acres of land within Port San Antonio to support its growing enrollment at the campus.

Aerospace R&D

Among Texas aerospace companies bidding for federal R&D contracts, Lockheed Martin led the way in fiscal year (FY) 2011, receiving more than $2.7 billion in contracts for projects at its Texas facilities.

Leading Federal Contractors for Aerospace R&D in Texas (FY 2011)

Company	Awarded
Lockheed Martin Corporation	$2,726,006,528
The Boeing Company	$833,308,978
United Space Alliance	$116,160,802
L-3 Communications Holdings	$83,774,655
Raytheon Company	$52,597,496
Textron	$21,044,546
Bell Boeing Joint Project	$15,580,442
Elbit Systems	$14,157,567

Source: Center for Effective Government

Texas Aerospace Patents

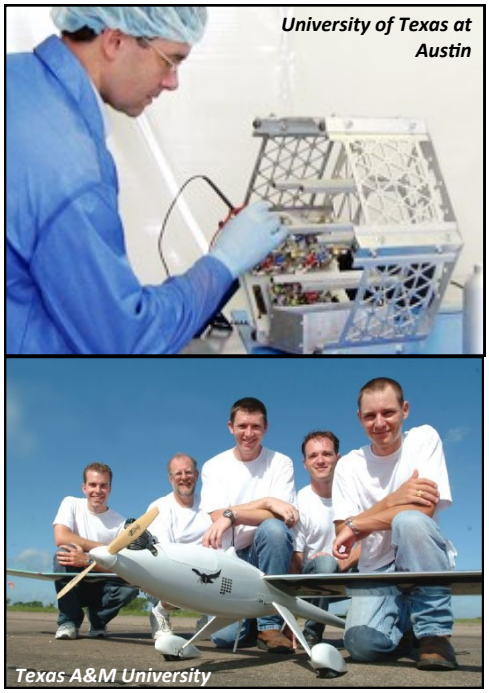
No. 4

Texas' national rank in 2012 for the number of new aerospace-related patents, according to the U.S. Patent and Trademark Office (USPTO).

+41%

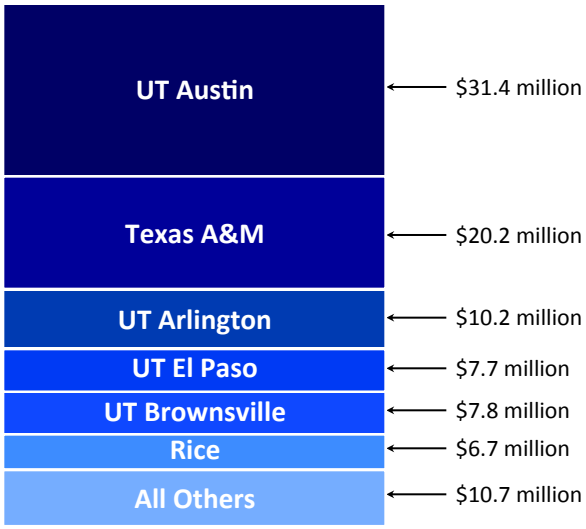
The rate of increase in aerospace-related patents issued in Texas during the period 2008-2012 compared to the previous five-year period

Source: U.S. Patent and Trademark Office



Aerospace R&D at Texas Universities

From 2010-2012, Texas universities dedicated nearly $95 million to aerospace technology research, according to the Texas Higher Education Coordinating Board. The University of Texas at Austin and Texas A&M University together accounted for more than half of the total expenditures in this field.

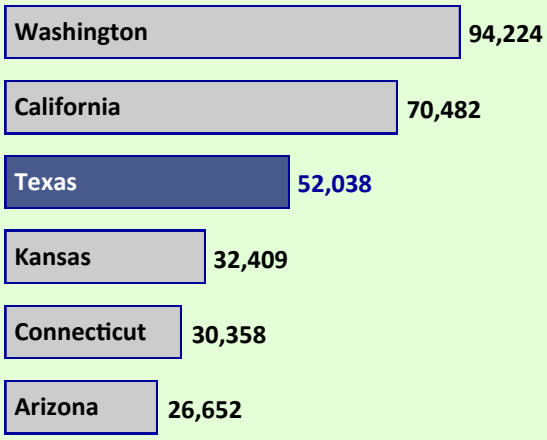


Aerospace Manufacturing

Lockheed Martin F-35

Texas has a long history as a core location for the global aerospace industry, and today 17 of the world's 20 largest aerospace companies have major operations in the state. Within the U.S., Texas is home to more than 10% of all aerospace manufacturing jobs. In particular, North Texas is one of the most highly concentrated regions of aircraft and aircraft parts production in the country. In the Dallas-Fort Worth metro area, anchored by heavy-weights like Lockheed Martin, Bell Helicopter, and L-3 Communications, the percentage of the work-force employed in aircraft manufacturing is nearly five times the national average. Elsewhere in the state, San Antonio, Amarillo, Wichita Falls, and Waco are additional hubs of diverse aerospace manufacturing, from parts fabrication to complete aircraft assembly and overhaul.

Texas Ranks No. 3 in the U.S. in Aerospace Manufacturing Employment*



**Excludes navigation instrument manufacturing*
Source: U.S. Bureau of Labor Statistics

Aerospace Product Manufacturing Employment
First Quarter 2013

Sector (Industry Code)	Employees	Firms	Average Annual Wage
Aircraft Manufacturing (336411)	36,865	50	$99,269
Aircraft Engines & Engine Parts Manufacturing (336412)	4,902	47	$65,052
Other Aircraft Parts & Equipment Manufacturing (336413)	8,701	77	$89,232
Guided Missiles & Space Vehicles Manufacturing (336414-336419)	1,570	2	NA
Search, Detection & Navigation Instruments (334511)	7,290	47	$90,792
TOTAL	**59,328**	**223**	**$95,124**

Source: Texas Workforce Commission

Lockheed Martin Aeronautics, Fort Worth

Lockheed Martin Moves 560 Jobs to Fort Worth

In December 2012, Lockheed Martin Aeronautics announced plans to move 560 jobs from Marietta, Georgia, to its Fort Worth, Texas, facility (see photo above). The jobs will support maintenance and upgrades on the company's F-22 Raptor fighter jet. Additionally, in nearby Grand Prairie, Lockheed Martin's Missile and Fire Control division began a $4 million expansion to its Patriot missile and Fire Control lab facilities.

Bell Helicopter Builds $27 Million Manufacturing Plant in Amarillo

In early 2013, Bell Helicopter wrapped up construction of its newest manufacturing facility in Amarillo, TX, which will assemble the Relentless 525 helicopter model. The $27 million expansion is expected to add 400 jobs to Bell's existing local workforce of more than 1,000. In 2012, the company also broke ground on a new $230 million headquarters complex in Fort Worth, TX.

Site of Bell Helicopter expansion, Amarillo

Bell Helicopter
A Textron Company

Texas Attracts Aerospace Investment from around the World

Selected foreign aerospace companies with operations in Texas

United Kingdom

BAE: Fort Worth & Austin, TX

GKN Aerospace: Irving, TX

BBA Aviation: Grapevine, TX (Dallas Airmotive)

Ultra Electronics: Austin, TX

France

SAFRAN: San Marcos, TX (CFan) & Grand Prairie, TX (Turbomeca)

Zodiac Aerospace: Gainesville, TX

The Netherlands

EADS: Grand Prairie, TX (Eurocopter)

Italy

Finmeccanica: Dallas & Arlington, TX

Israel

Elbit Systems: Fort Worth & San Antonio, TX

Singapore

ST Aerospace: San Antonio, TX

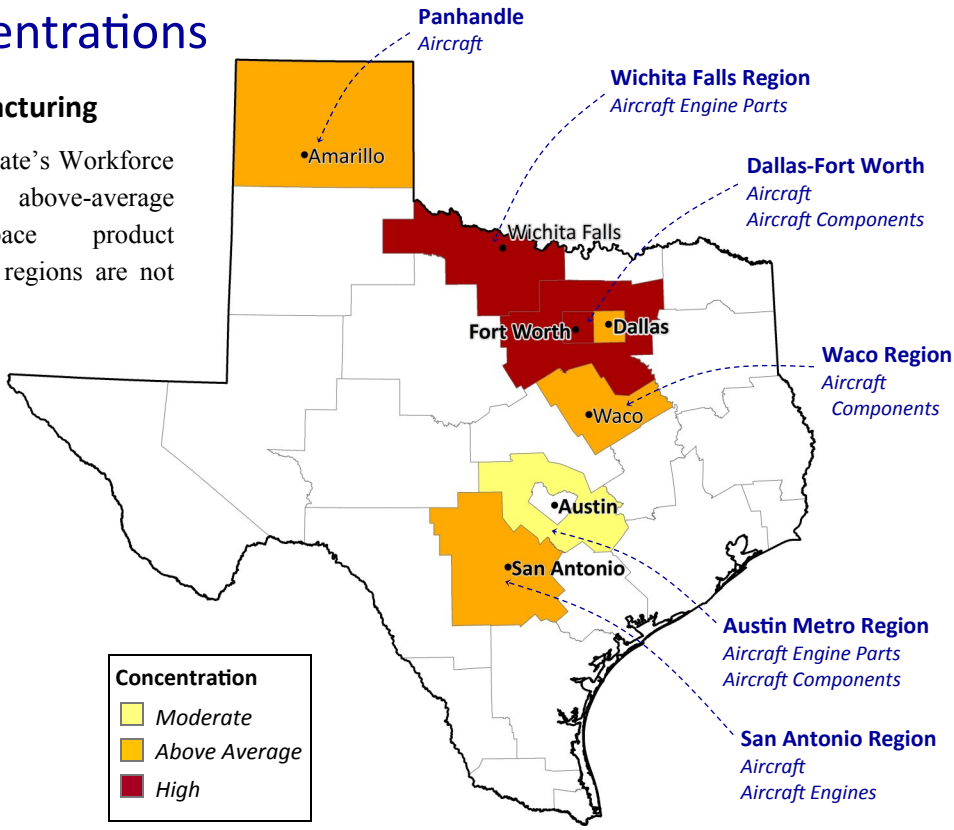
Workforce Concentrations

Aerospace Product Manufacturing

The map at right identifies the state's Workforce Development regions with above-average specializations in aerospace product manufacturing. The highlighted regions are not the only areas in Texas where workers in this sector can be found, but rather represent areas with the greatest concentrations relative to the size of the local labor force.

Regions with significant workforce concentrations in this sector are ranked as moderate, above average, or high.

Source: Texas Workforce Commission



10 Major Aerospace Manufacturers in Texas

Lockheed Martin

Primary Locations: The Aeronautics division's plant in Fort Worth assembles military aircraft such as the F-35 Joint Strike Fighter, while the Missile and Fire Control (MFC) Division in Grand Prairie develops defense and aerospace systems like the Patriot missile. With around 14,000 employees in the Dallas-Fort Worth area, Lockheed is the region's single largest manufacturing employer in any sector. Additionally, Lockheed operates a maintenance complex in San Antonio, an Information Systems division office in Houston, and MFC manufacturing sites in Lufkin and El Paso.

Approximate Statewide Employees: 18,000

L-3 Communications

Primary Locations: At the Mission Integration division in Greenville, L-3's largest Texas facility, nearly 6,000 employees design and install advanced aircraft electronics systems for government and military customers. The company's Platform Integration division in Waco provides maintenance and modification services, as well as equipment fabrication and assembly. Additional Texas sites include the ComCept electronics division in Rockwall, Link Simulation and Testing unit in Arlington, Unmanned Systems division in Carrollton, and AVISYS avionics facility in Austin.

Approximate Statewide Employees: 10,000

Bell Helicopter

Primary Locations: Headquartered in Fort Worth, Bell Helicopter is a subsidiary of aerospace giant Textron. Bell operates manufacturing plants at its main campus in Fort Worth, as well as in Grand Prairie and Amarillo. In a strategic alliance with Boeing, Bell manufacturers the U.S. military's V-22 Osprey, a unique tilt-rotor aircraft that combines the functionality of a helicopter and a turboprop plane.

Approximate Statewide Employees: 7,000

Bell-Boeing V-22 Osprey

The Boeing Company

Primary Locations: Boeing's aircraft maintenance and overhaul facility in San Antonio recently marked its 15th year in operation and is today the metro area's largest aerospace employer. In El Paso, the company's defense division manufactures aircraft electronics for various Boeing products. Additionally, Boeing's Space Exploration division operates from headquarters (HQ) in Houston, while its parts distribution subsidiary Aviall is based in Dallas.

Approximate Statewide Employees: 5,000

Raytheon

Primary Locations:
The HQ of Raytheon's Space and Airborne Systems division was relocated in 2013 from El Segundo, California, to the company's McKinney, Texas, campus, which also houses the Network Centric Systems division. Nearby Garland is the base for Raytheon's Intelligence and Information Systems unit, which the company acquired from E-Systems in 1995. Raytheon operates additional production facilities in Dallas and El Paso.

Approximate Statewide Employees: 9,000

United Technologies Corp. (UTC)

Primary Locations: UTC's Aerospace Systems division manufactures aircraft structural components at its plant in San Marcos, with smaller facilities located in Dallas and Houston. UTC subsidiary Pratt & Whitney refurbishes aircraft engine components in Wichita Falls and provides airfoil repair in Dallas, while fellow subsidiary Sikorsky runs a rotor blade development facility in Grapevine and an engineering center in Fort Worth.

Triumph Group

Primary Locations: The company's Aerostructures division, which occupies two former Vought Aircraft facilities in Grand Prairie, produces major structural components for Boeing, including airplane fuselage and tail sections. Triumph's newest facility, in nearby Red Oak, opened in 2013 to produce aircraft wings and integrated composite and metal airframes.

American Eurocopter

Primary Locations: A subsidiary of European aerospace giant EADS, American Eurocopter is headquartered at a 330,000-sq. ft. campus in Grand Prairie. The company is a major provider of helicopters for law enforcement, military, and civilian markets.

American Eurocopter UH-72A Lakota

BAE Systems

Primary Locations: The British aerospace and defense company's Electronics Systems division operates major facilities in both Fort Worth and Austin. The company's Intelligence & Security division works closely with the U.S. military from its offices in San Antonio.

SAFRAN

Primary Locations: In the DFW region, SAFRAN's helicopter subsidiary, Turbomeca USA, operates from its headquarters in Grand Prairie, while the Labinal division manufactures aerospace wiring in Denton. CFAN, a joint venture between SAFRAN and GE, makes aircraft engine parts south of Austin, in San Marcos. See Page 18 for more CFAN details.

Maintenance, Repair & Overhaul

Texas' aerospace manufacturing workforce also supports the state's many maintenance, repair, and overhaul (MRO) operations, where aircraft are modified and completed or components, like engines, are rebuilt. North Texas and San Antonio are home to some of the state's largest MRO facilities.

Major MRO Operations in Texas

- Boeing Global Services—*San Antonio*
- Kelly Aviation Center—*San Antonio*
  (Lockheed Martin/Rolls-Royce joint venture)
- L-3 Mission Integration—*Greenville*
- L-3 Platform Integration—*Waco*
- Elbit Systems (M7 Aerospace)—*San Antonio*
- Chromalloy—*San Antonio*
- Pratt & Whitney—*Grand Prairie*
- Standard Aero—*Dallas, Houston, San Antonio*
- BBA Aviation (Dallas Airmotive)—*Dallas*
- ST Aerospace—*San Antonio*
- Bombardier—*Dallas*
- Texas Aero Engine Service (TAESL)—*Ft. Worth*
  (American Airlines/Rolls-Royce joint venture)

Boeing San Antonio Lands Air Force One and 787 Dreamliner Projects

In early 2012, Boeing announced that its facility in San Antonio, TX, which is home to the world's largest free-standing aircraft hangar, would gain up to 400 jobs to support the maintenance of Air Force One, the 747s that fly the U.S. President.

The work was shifted from Wichita, Kansas, where Boeing closed an existing, higher-cost facility.

Earlier, in March 2011, Boeing flew the first of its much-anticipated 787s to San Antonio, where workers now complete aircraft modifications, including installation of electronic and mechanical equipment and upgrades to software systems.

Company List

Largest Aerospace Companies with Operations in Texas

By Parent Company Global Sales

Company Name	Primary Location(s)	Description	Global Sales (Millions)
General Electric	McAllen	*Aircraft engines & repair*	$147,360
Boeing	San Antonio, El Paso, Houston, Dallas	*Aircraft electronic systems, aircraft modification*	$81,700
EADS			$74,640
✈American Eurocopter	Grand Prairie	*Helicopters*	
Lockheed Martin	Ft. Worth, Grand Prairie, San Antonio, Houston, Lufkin	*Aircraft, missiles, space operations, aircraft engine overhaul*	$47,180
Honeywell International	Richardson	*Microcontrollers for aerospace*	$37,670
General Dynamics	Kilgore	*Satellite communications equipment*	$31,510
BAE Systems Inc.	Ft. Worth, Austin	*Aircraft electronic systems*	$28,810
Raytheon	McKinney, Garland, El Paso	*Aircraft electronic systems*	$24,410
Alcoa (formerly Howmet)	Wichita Falls	*Aircraft engine parts*	$23,700
Finmeccanica			$22,750
✈DRS Technologies	Dallas	*Aircraft electronic systems*	
✈Augusta Westland	Arlington	*Helicopters*	
Rolls-Royce			$19,640
✈Kelly Aviation (Lockheed)	San Antonio	*Aircraft engines & repair*	
✈TAESL (American Airlines)	Fort Worth (Alliance)	*Aircraft maintenance & repair*	
SAFRAN			$18,270
✈Turbomeca	Grand Prairie	*Helicopters*	
✈CFAN	San Marcos	*Aircraft engine parts*	
Bombardier Aerospace	Dallas, Richardson	*Aircraft maintenance & repair*	$16,770
United Technologies (UTC)			$13,960
✈Pratt & Whitney	Grand Prairie, Wichita Falls	*Aircraft engine parts & repair*	
✈Sikorsky Aircraft	Ft. Worth, Grapevine	*Helicopter components*	
✈UTC Aerospace Systems	San Marcos	*Aircraft structural components*	
L-3 Communications	Greenville, Waco, Arlington	*Avionics design, aircraft modification*	$13,146
Textron			$12,240
✈Bell Helicopter	Ft. Worth, Amarillo	*Helicopters (Corporate HQ)*	
✈Cessna Aircraft	San Antonio	*Aircraft maintenance & repair*	
GKN	Irving	*Aircraft parts, (U.S. Corporate HQ)*	$10,520
Gulfstream Aerospace	Dallas	*Aircraft interior completions*	$6,910
Rockwell Collins	Richardson	*Aircraft electronic systems*	$4,310
Zodiac Aero. (formerly Weber)	Gainesville	*Aircraft seating*	$4,310
Triumph Group	Dallas	*Aircraft structural components*	$3,700
Elbit Systems	San Antonio, Ft. Worth	*Aircraft electronics, repair, modification*	$2,890
Beechcraft	Houston	*Aircraft maintenance & repair*	$2,440
BBA Aviation	Grapevine	*Aircraft maintenance & repair*	$2,180
Ultra Electronics	Austin	*Aircraft electronic systems*	$1,230
Chromalloy Gas Turbine	San Antonio	*Aircraft maintenance & repair*	$1,160

Representative sample only. Sources: D&B, company websites

More Aerospace Expansions

Sikorsky Aircraft Grows at New Rotor Blade Facility in Grapevine

Built in 2008 on DFW Airport property in Grapevine, TX, the $36 million facility houses a new rotor blade testing and repair facility for Sikorsky's Composite Technology Inc. (CTI) subsidiary. CTI, which employs more than 300, is the only worldwide "Blade Repair Center of Excellence" certified by AgustaWestland, Bell Helicopter, Eurocopter, and others. The facility averages delivery of more than 3,700 refurbished rotor blades per year. In 2012, the company announced the completion of a $15 million high-tech whirl tower at the facility, which tests rotor blades in real-world conditions.

Sikorsky
A United Technologies Company

Recaro Aircraft Seating Doubles Capacity at Fort Worth Plant

In February 2013, the aircraft seating manufacturer Recaro celebrated the expansion of its Fort Worth, TX, plant, which produces seats for customers such as American Airlines. Prior to the expansion, Recaro was capable of building 20,000 passenger seats a year. The company expects to reach 29,000 seats in 2013 and 40,000 a year in the following years. Originally established in 1998, the plant remains the German company's largest production facility in the world.

RECARO

San Marcos' CFAN Ramps up Production to Supply Boeing

Now employing approximately 550 workers, San Marcos, TX-based CFAN ramped up hiring in 2011 and 2012 to meet the demand of one of its major accounts, Boeing's Dreamliner aircraft. CFAN produces jet-engine fan blades from carbon-composite material. Formed in 1991, the company is a 50/50 joint venture between GE Aviation and French aerospace company SAFRAN.

SAFRAN
AEROSPACE · DEFENCE · SECURITY

Air Transportation

Texas is home to the largest air transportation workforce in the nation, with the state's airlines, airports, and related support services directly employing more than 87,000. Dallas-Fort Worth is home to the headquarters of two international air carriers, **American Airlines** and **Southwest Airlines**. A third, **United Airlines**, operates a major hub in Houston.

13% of all U.S. air transportation jobs are in Texas

Nationally, the past decade was a turbulent one for the industry. Between 2001 and 2012, as the sector weathered the bankruptcies and consolidations of multiple major airlines, U.S. carriers cut jobs by more than 26% around the country. Texas' airline industry fared slightly better during this period, with employment contracting by about 20%.

Texas is home to six of the top 50 busiest airports in the U.S., by passengers boarded annually. These include No. 4 Dallas/Fort Worth (DFW) and No. 11 George Bush Intercontinental Houston (IAH).

Texas-based Sabre Dominates Air-Travel Software and Technology

Based in Southlake, TX, software maker Sabre powers the world's No. 1 travel reservation network. Originally developed as **American Airlines**' internal reservation system, Sabre eventually grew into its own division, which was spun off as a free-standing company in 1996. Its Travelocity.com is one of the world's leading travel websites, while Sabre Airline Solutions is the largest provider of software and IT consulting services to the air transportation industry.

Sabre | Airline Solutions

Air Transportation Employment
First Quarter 2013

Sector (Industry Code)	Employees	Firms	Average Annual Wage
Passenger Air Transportation (481111, 481211, 481219)	57,806	260	$79,402
Freight Air Transportation (481112, 481212)	1,885	97	$66,034
Airport Operations (48811)	11,667	181	$56,420
Other Air Transportation Support Activities (48819)	15,891	426	$66,404
TOTAL	**87,249**	**964**	**$73,673**

Source: Texas Workforce Commission

Texas-Based Airlines

American Airlines (AA) and American Eagle

- Headquarters: Fort Worth, TX
- Largest hub: Dallas/Fort Worth International Airport (DFW)
- U.S. Employees: 60,000
- Revenue (2012): $24.9 billion
- Relocated HQ from New York City to Fort Worth in 1979
- AA is fourth largest U.S. airline by total passengers
- Operates American Airlines Flight Academy near DFW

Southwest Airlines

- Headquarters: Dallas, TX
- Major hub: Dallas Love Field (DAL)
- U.S. Employees: 46,000
- Revenue (2012): $17.1 billion
- Third largest U.S. airline by total passengers
- The nation's largest low-fare carrier
- Opened 800-employee customer support center in San Antonio in 2012

Other Commercial Carriers with Texas Hubs

United Airlines

- Merged with Houston-based Continental in 2010 to create United Continental Holdings
- Revenue (2012): $37 billion
- Largest hub located at George Bush Intercontinental Houston (IAH)
- Estimated Employees in Texas: 17,000

UNITED

ExpressJet Holdings

- Operates as regional carrier United Express from its hub at George Bush Intercontinental Houston (IAH)
- Revenue (2012): $565 million
- Headquartered in Houston until acquisition by Atlanta-based Atlantic Southeast Airlines in 2010.

EXPRESSJET

Texas Commercial Airports

27 destinations with scheduled service on commercial airlines in 2012

Source: Federal Aviation Administration (FAA)

Southwest Airlines Begins $100 million Headquarters Expansion in Dallas

The Dallas-based airline broke ground in September 2012 on its new $100 million headquarters and maintenance complex near Love Field airport. The office expansion will add more than 490,000-sq. ft. to the existing corporate campus. Southwest expects to create up to 1,000 new jobs over the next few years. The airline acquired Atlanta-based competitor AirTran in 2011, which provided Southwest with routes to Mexico and the Caribbean, its first-ever international routes.

Major Texas Airports

U.S. rank

#4

Dallas/Fort Worth International (DFW)

Passengers Boarded (2012): 28 million

U.S. Rank: No. 4 busiest

World Rank: No. 8 busiest

Hub Carrier: American Airlines/American Eagle (82% DFW market share combined)

Notable: Accessible to every major city in the U.S. within four hours

Cargo Volume Annually: 650,000 tons

Top International Exports Shipped:

- ✈Semiconductors and Related Equipment
- ✈Telecom Equipment
- ✈Aircraft Components

#11

George Bush Intercontinental Houston (IAH)

Passengers Boarded (2012): 19 million

U.S. Rank: No. 11 busiest

World Rank: No. 26 busiest

Hub Carrier: United (the airline's largest hub)

Cargo Volume Annually: 450,000 tons

Top International Exports Shipped:

- ✈Telecom Equipment
- ✈Machinery for Drilling
- ✈Aircraft Components

Notable: Offers more direct flights to Mexico than any other U.S. airport

William P. Hobby Houston (HOU)

#32

Passengers Boarded (2012): 5 million

U.S. Rank: No. 32 busiest

The smaller of Houston's two commercial airports, Hobby focuses on domestic flight traffic. However, in May 2012, the Houston City Council approved a deal for Southwest Airlines to build a $100 million international facility at Hobby in order to begin operating flights to Mexico, Central America, and South America in 2015.

Austin-Bergstrom Int'l (AUS)

#36

Passengers Boarded (2012): 4.6 million

U.S. Rank: No. 36 busiest

Austin's international airport opened in 1999 on the site of the former Bergstrom Air Force Base. In 2013, the Austin City Council announced plans for a $62 million expansion project, which will add 55,000 sq. ft. of space to the airport's main terminal.

Austin-Bergstrom International Airport

San Antonio International (SAT)

#44

Passengers Boarded (2012): 4 million

U.S. Rank: No. 44 busiest

San Antonio International's Terminal A is currently undergoing a comprehensive, $35 million renovation project scheduled for completion in 2014. In 2010, SAT opened the newly constructed, $134 million Terminal B, which replaced an older, existing facility.

SAN ANTONIO AIRPORT SYSTEM

Dallas Love Field (DAL)

#45

Passengers Boarded (2012): 3.9 million

U.S. Rank: No. 45 busiest

Love Field, the metro area's second commercial airport, hosts the headquarters of Southwest Airlines. Love is currently undergoing a $520 million "modernization program" which, when complete in 2015, will have entirely rebuilt the historic airport, adding an all-new lobby, baggage claim area, and 20-gate terminal.

After Law's Repeal, Love Field to Expand Reach in 2014

In October 2014, airlines operating from Dallas Love Field will be allowed to fly nonstop to any other U.S. city for the first time in 34 years, when the Wright Amendment, a federal law limiting flights at Love Field since 1980, will expire. The number of domestic flights and available nonstop routes from the airport is expected to increase dramatically, especially on dominant carrier Southwest.

Texas Industrial Airports Anchor Multimodal Logistics Hubs

Fort Worth Alliance Airport

Fort Worth Alliance Airport (AFW), which anchors the master-planned Alliance Texas development, is the world's first purely industrial airport. Opened in 1996, the airport covers nearly 1,200 acres and accommodates air cargo, corporate aviation, and military needs.

- 11,000-foot runway to accommodate all types of commercial traffic
- U.S. Foreign Trade Zone designation with U.S. Customs on site
- Connected to Union Pacific and BNSF rail, including BNSF's Alliance Intermodal Facility
- Access to US interstate highway I-35W and Texas state highway SH-170

Port San Antonio

Port San Antonio's industrial airport at Kelly Field (SKF) is a master-planned 1,900-acre industrial complex and international logistics center, centrally located in San Antonio. Created from the former Kelly Air Force Base, the port was established in its current form in 2007.

- 11,500-foot runway
- 89,600-s.f. Class A air-cargo terminal
- U.S. Foreign Trade Zone designation with U.S. Customs on site
- Access to three interstate highways—I-35, I-10, and I-37
- Connected to Union Pacific and BNSF rail

Government Aviation & Defense

From aerospace research and flight training, to military aircraft development and space exploration, Texas is an epicenter of government and defense-related aviation. NASA's Johnson Space Center in Houston and the 15 active military bases around the state are a testament to Texas' importance to the country's aerospace and defense initiatives.

The history of global military aviation began in Texas in 1910, when the first ever military flights took place at Fort Sam Houston in San Antonio. Today, Texas is host to the nation's largest population of active duty military personnel, with more than 131,000 serving in the ranks of the U.S. Army, Air Force, and Navy. Texas is an especially important location for the country's defense aviation operations, as the U.S. Air Force stations 60% more active personnel in Texas than in any other state.

Texas is home to six active Air Force bases and three naval air stations (see page 28). Additionally, private defense, space, and civil contractors employ tens of thousands in Texas in aircraft and avionics manufacturing, defense R&D, and maintenance and overhaul (see table below).

Leading Aerospace-Related Defense Contractors in Texas (2012)

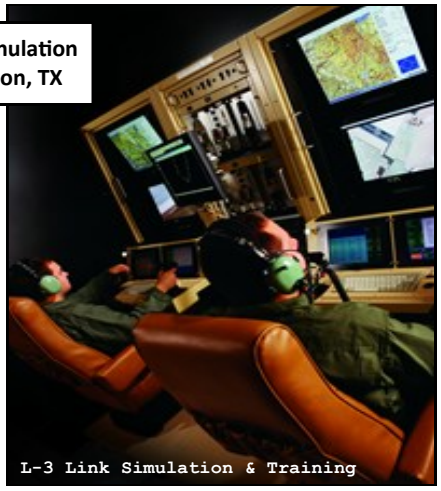
Company	Primary Texas Contract Sites	Major Federal Programs
American Eurocopter	Grand Prairie	U.S. Customs AS350 law enforcement helicopters
Bell Helicopter Textron	Fort Worth	Navy UH-1Y Yankee and AH-1Z Viper helicopters
Bell-Boeing Joint Project	Amarillo, Fort Worth	V-22 Osprey tiltrotor
The Boeing Company	Houston, San Antonio	NASA International Space Station, Air Force KC-135 Stratotanker and C-17 Globemaster maintenance
Elbit Systems	San Antonio, Fort Worth	Army C-23 maintenance, fire control equipment
Lockheed Martin	Fort Worth, Grand Prairie, San Antonio, Houston	F-35 Lightning II, F-16, Patriot missile, multi-aircraft maintenance, NASA Johnson Space Center
L-3 Communications	Greenville, Arlington, Waco, Rockwall,	Air Force RC-135 maintenance, "Big Safari" logistics program, Army AVCATT simulators
Raytheon	McKinney, Garland	Army night-vision and surveillance equipment
Rockwell Collins	Richardson	Navy E-6B aircraft communication electronics
United Space Alliance	Houston	NASA Space Program Operating Contract (SPOC)
United Technologies Corp.	Houston	NASA Extra-Vehicular Activities (EVA) program

Source: Center for Effective Government

Defense Products & Services

Defense contractors in Texas specialize in a wide range of aerospace products and services, with fighter plane and helicopter assembly, defense R&D, and MRO services topping the list. Below are a few examples.

Flight Simulation
Carrollton, TX



L-3 Link Simulation & Training

Manufacturing
Fort Worth, TX

Bell AH-1Z

Maintenance & Overhaul
San Antonio, TX

Boeing C-17

Manufacturing
Grand Prairie, TX

Lockheed Martin
PAC-3 Missile

Maintenance & Overhaul
San Antonio, TX

Boeing KC-135 Stratotanker

Manufacturing
Amarillo, TX

Bell-Boeing V-22 Osprey

Engineering & Design
Carrollton, TX

L-3 Unmanned Viking 400

Representative sample only

Top Five Texas Aerospace Products or Services Purchased by the Federal Government (FY 2012)

	Category	Dollar Value	Leading Texas Contractor
1	Fixed-Wing Aircraft (Airplanes)	$3.64 billion	Lockheed Martin Aeronautics
2	Rotary-Wing Aircraft (Helicopters)	$2.18 billion	Bell-Boeing Joint Project
3	Defense Aircraft R&D	$1.26 billion	Lockheed Martin Aeronautics
4	Maintenance & Overhaul of Aircraft & Parts	$1.01 billion	L-3 Communications
5	Guided Missile Components	$753 million	Lockheed Martin Missile & Fire Control

U.S. Air Force Bases in Texas

Sheppard Air Force Base

Location: Wichita Falls

Total Personnel: 10,000

Units: 82nd Training Wing, 80th Flying Training

Sheppard AFB is the largest and most diverse training base in the Air Education and Training Command (AETC). The 82nd Training Wing produces more than 62,000 graduates annually.

Goodfellow Air Force Base

Location: San Angelo

Total Personnel: 7,300

Units: 17th Training Wing

The 17th Training Wing is responsible for training more than 14,000 firefighting, intelligence, surveillance, and reconnaissance personnel annually.

Dyess Air Force Base

Location: Abilene

Total Personnel: 5,100

Units: 7th Bomb Wing , 317th Airlift Group

Dyess AFB is home to B1-B bomber combat crew training. Additionally, the 7th Maintenance Group provides repair and parts fabrication for the base's aircraft fleet.

Laughlin Air Force Base

Location: Del Rio

Total Personnel: 3,100

Units: 47th Flying Training Wing

Laughlin AFB, the busiest airfield in the U.S. Air Force, produces about one-third of all new Air Force pilots each year—approximately 325 annually.

Joint Base San Antonio

In 2010, the Department of Defense (DoD) implemented the recommendation of the federal government's Base Realignment and Closure Commission (BRAC) to combine three major military installations in San Antonio—Fort Sam Houston, Lackland Air Force Base, and Randolph Air Force Base. The resulting Joint Base San Antonio is today the single largest DoD installation, with the U.S. Air Force as its lead agency.

Total Joint Base Personnel: 83,100

Lackland Air Force Base

Location: West San Antonio

Units: 802nd Mission Support Group, 37th Training Wing, Twenty-Fourth Air Force (cybersecurity unit), etc.

Lackland AFB provides both basic pilot training for enlisted recruits and advanced technical training for Air Force pilots.

Randolph Air Force Base

Location: Northeast San Antonio

Units: 902nd Mission Support Group, 12th Flying Training Wing, 359th Medical Group, etc.

Randolph AFB serves as the headquarters of the U.S. Air Force's Air Education and Training Command (AETC)

Fort Sam Houston

Location: North Central San Antonio

Home to: U.S. Army North, U.S. Army South, Army Medical Command, Army Medical Department Center and School, 502nd Air Base Wing, etc.

Fort Sam Houston houses the DoD's largest hospital and its only Level I trauma center.

U.S. Army & Navy Aviation in Texas

Fort Hood (Killeen, TX)

Total Personnel: 68,200

Units: III Corps, First Army Division West, etc.

The base is home to one of the largest combat aviation training areas in the world, comprising 15,900 sq. mi. of air space across four counties, and enabling U.S. and allied military helicopter crews to train in real-world environments.

Fort Bliss (El Paso, TX)

Total Personnel: 40,000

Units: 1st Armored Division, 32nd Army Air & Missile Defense, 11th Air Defense Artillery, etc.

Fort Bliss sits within the DoD's single largest contiguous airspace and is home to the longest runway owned by the U.S. Army.

Naval Air Station JRB Fort Worth

Total Personnel: 18,600

Units: 10th Air Force, 301st Fighter Wing, 14th Marine Regiment, etc.

NAS JRB Fort Worth trains and equips air crews and aviation ground support personnel. The base also provides runway access to the adjacent Lockheed Martin Fort Worth plant.

Naval Air Station Corpus Christi

Total Personnel: 7,300

Units: Training Air Wing FOUR, Naval Air Training Command

NAS Corpus Christi trains up to 600 Naval pilots each year. The installation also houses Corpus Christi Army Depot, one of the world's largest helicopter repair facilities.

Naval Air Station Kingsville

Total Personnel: 1,700

Units: Training Air Wing TWO

Complementing the nearby NAS Corpus Christi, NAS Kingsville also provides Naval pilot training. Each year, tenant Training Wing TWO trains 50% of the Navy and Marine Corps' jet/strike pilots.

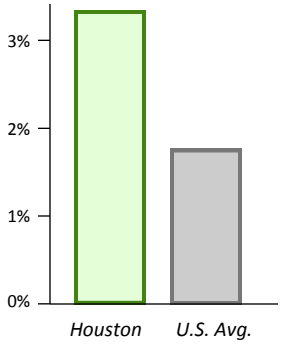
Space Travel & Exploration

International Space Station

Texas has played a long role in the history of human spaceflight. Since NASA's Project Gemini in 1965, Houston's Johnson Space Center has served as the primary flight control center for all U.S. manned space missions, including the Apollo, Space Shuttle, and International Space Station programs. Today, companies in Texas are leading the way in commercial spaceflight technology, developing the next generation of transport systems.

While Houston, with its large concentration of diverse engineering talent, registers as the epicenter of Texas' space technology industry, space-craft manufacturing and testing is happening around the state, from Harlingen in the Rio Grande Valley, to McGregor in Central Texas, and Midland and Van Horn in West Texas.

Engineers as a Percentage of Total Workforce



Source: U.S. BLS

Leading NASA Contractors in Texas (2012)

Company	Texas Site	Major NASA Programs
Barrios Technology	Houston	Orion Project Integration
The Boeing Company	Houston	International Space Station
CSC	Houston	Aircraft maintenance & modification
Jacobs Engineering Group	Houston	Johnson Space Center—Engineering Science
L-3 Communications	Houston	Automation Robotics and Simulation
Lockheed Martin	Houston	Johnson Space Center—Operations
MEI Technologies	Houston	Electrical systems engineering
Oceaneering	Houston	Constellation space suit & related hardware
Raytheon	Houston	Neutral Buoyancy Lab (NBL), Space Vehicle Mockup Facility (SVMF)
SAIC	Houston	Safety & Mission Assurance Support
United Space Alliance (USA)	Houston	Space Program Operating Contract (SPOC)
United Technologies Corp.	Houston	Extra-Vehicular Activities (EVA) program
Wyle Laboratories	Houston	Bioastronautics

Source: Center for Effective Government

NASA Johnson Space Center

For the past 50 years, NASA's Lyndon B. Johnson Space Center (JSC) in Houston has led the U.S. and the world through leaps in human discovery. The JSC was established in 1961 as the Manned Spaceflight Center and the home of Mission Control for the U.S. human space flight program. In 1973, the complex was renamed in honor of the late U.S. President and Texas native, Lyndon B. Johnson. Together, Houston and JSC share an identity around the world as geographic landmarks of space travel and scientific breakthrough.

Johnson Space Center employs **14,000** workers in Houston.

Today JSC leads NASA's **International Space Station** operations under a multinational contract in place through 2020. JSC also leads the development of the **Orion** crew vehicle, which NASA is designing to carry astronauts to new destinations in deep space. JSC is also playing a vital role in the future of space exploration through its technology development and commercial partnerships, as well as its management of NASA's **Commercial Crew and Cargo Program**, which invests financial and technical resources into the private-sector space transportation industry.

In 2013, Johnson Space Center managed an annual budget of $5.1 billion, with nearly $2.3 billion of that expended on contracts with Texas-based businesses. JSC directly employs about 3,000 workers in Houston, most of whom are engineers and scientists, while around 50 contractor firms employ an additional 11,000 workers at the space center.

NASA officially retired its space shuttle fleet in 2011 after 30 years of service in order to focus on future programs aimed at sending astronauts to new destinations beyond earth's orbit. Over the past several years, this major shift in space program direction has led to job realignment and reductions around the country at

Johnson Space Center's sprawling campus occupies 1,620 acres southeast of downtown Houston.

shuttle-related NASA facilities and their contractors, particularly in Florida. While NASA-related jobs in Houston declined by an estimated 20% between 2007 and 2013, JSC still employs approximately 14,000 in the region. Additionally, the strong economy of the Houston region has helped absorb the changes at NASA, and a study by the University of Houston-Clear Lake estimated unemployment in the Houston Bay Area at 6% in mid-2013—more than a full point below the national average.

Space Station Flight Control Room at Johnson Space Center

JSC Core Capabilities

- **Health and Human Performance**
  - Biomedical Research
  - Extreme Environment Exposure
- **Robotics & Automation**
  - Exploration Mobility Systems
  - Robotic Work Assistance
- **Human Systems Integration**
  - Cockpit Design
  - Habitability Design
- **Computational Analysis**
  - Computational Fluid Dynamics Lab
  - Structural Dynamics Lab
  - Computational Electromagnetics Lab
- **Systems Testing**
  - Thermal Vacuum Chamber
  - Electromagnetic Interference Testing
- **Life Support**
  - Water Testing and Recovery
  - Space Suit Systems Lab
- **Integrated Vehicle Systems**
  - Power Systems & Propulsion
  - Avionics, Communication & Software
- **Safety & Risk Assessment**
  - Material Testing & Failure Analysis
  - Counterfeit Parts Detection

Source: NASA

Johnson Space Center Accelerates Technology Commercialization

The Johnson Space Center has a long history of partnering with industry and academia in order to share technological innovations. Today, as NASA plans for its next phase of human spaceflight, JSC is opening its unique facilities, with more than 50 years of accumulated knowledge and expertise, in order to accelerate the transfer of technologies.

In early 2011, JSC established the Strategic Opportunities and Partnership Development Office, which aims to spin technology out of NASA to benefit U.S. industry. JSC's competencies and off-the-shelf technologies span a range of industries, including aerospace, life sciences, telecommunications, electronics, and consumer products, that can be leveraged by both academia and commercial interests.

During the past five years, JSC has developed over 1,000 new technologies, resulting in:

- Over 50 patents issued to JSC and its partners
- Collaboration on more than 90 tech partnerships
- More than 280 Small Business Innovation Research (SBIR) and Small Business Technology Transfer contracts awarded

Houston's United Space Alliance Supports International Space Station

Headquartered in Houston, United Space Alliance (USA) is one of the world's leading spaceflight operations companies. USA was the lead contractor for the operations and processing of NASA's iconic Space Shuttles until the final lift-off in 2011. The company formed in 1996 as a joint venture between Boeing and Lockheed Martin in response to NASA's consolidation of multiple space shuttle contracts under a single entity. USA supported mission operations, astronaut and flight controller training, flight software development, and vehicle launch and recovery. Today the company leads training and planning for the International Space Station at Johnson Space Center in Houston.

Boeing-Lockheed JV Assembles Rocket Components in Harlingen

Formed in 2006, United Launch Alliance (ULA) is a joint venture between Boeing and Lockheed Martin that provides spacecraft launch services to NASA and the U.S. Department of Defense. The company manufactures expendable launch systems, which send satellites into orbit but can be used only once.

ULA operates three manufacturing facilities in the U.S., including a plant in Harlingen, TX, which fabricates and assembles payload fairings and adapters for the Atlas V expendable launch vehicle. Payload fairings are key components that protect the launch vehicle's payload during ascent and are later discharged outside the earth's atmosphere. The plant forms the core of the Rio Grande Valley aerospace sector and employs about 200 workers.

Houston Engineering Firm Propels NASA Technology

Barrios Technology is a small engineering firm founded in Houston in 1980 to serve the aerospace industry. Today the company is one of NASA's leading contractors at Johnson Space Center, supporting commercial space transportation through its services to the International Space Station mission, including certifications for space station commercial crew and visiting vehicles.

Barrios also supports Boeing's development of the CST-100 crew capsule for NASA's Commercial Crew Program. Barrios' software engineers are responsible for designing, developing, and testing Boeing's commercial crew vehicle flight software, which provides the ability to communicate with, navigate, and control the CST-100 capsule.

Commercial Space Industry

In recent years, the traditional government-monopoly model of space travel has begun opening to the private sector, as startup companies have become capable of designing and launching competitive space systems.

Today, Texas is home to development and test sites of multiple commercial space firms, including SpaceX, Blue Origin, and XCOR, that are leading the way in cargo, satellite, and tourism transport.

SpaceX test facility, McGregor, Texas

SpaceX

Space Exploration Technologies (SpaceX) designs, manufactures, tests, and launches satellites and spacecraft for orbit and cargo transport. The company aims to eventually shuttle astronauts to and from the International Space Station (ISS). In early 2012, SpaceX completed an office and launch pad expansion at its McGregor, TX, rocket development facility, where the company conducts engine tests for its Falcon 9 launch vehicle. In May 2012, SpaceX became the first private company to send a spacecraft to the ISS, when the Falcon 9 delivered a Dragon cargo capsule, another of the company's products, to the space station. SpaceX, based in Hawthorne, CA, was founded by Elon Musk, who also started PayPal and Tesla Motors. SpaceX is currently considering a location on the Gulf Coast near Brownsville, Texas, for a future spacecraft launch facility. While SpaceX has not yet made a final decision about where in the U.S. the planned facility will be located, the company has placed the Texas site on its short list of final contenders.

NASA Commercial Space Investment Program Based in Houston

In the wake of the retired shuttle program, NASA has ramped up programs to support the U.S. commercial space transportation industry. Based at **Johnson Space Center** in Houston, the Commercial Crew and Cargo Program Office (C3PO) invests in the development of private transportation systems capable of ferrying both cargo and human crews to the International Space Station. For some of the most promising private space ventures, including SpaceX and Blue Origin, NASA may serve as a lead investor during development, as well as a customer of transportation services. Furthermore, NASA provides technical assistance as the companies develop.

Blue Origin

Blue Origin is a private aerospace company started in 2000 by Amazon.com founder Jeff Bezos to develop a lower-cost system for human spaceflight. Blue Origin's New Shepard reusable launch vehicle is a rocket-propelled, vertical take-off, vertical-landing spacecraft designed for suborbital space tourism. Based in Washington state, the company conducts all flight tests of prototype vehicles at its launch facility in West Texas' Culberson County. In late 2012, Blue Origin marked a milestone when it successfully tested a NASA-backed Crew Capsule escape rocket, designed to propel crew away from the launch pad in cases of pre-launch emergency.

Blue Origin

XCOR Aerospace

In July 2012, spacecraft developer XCOR Aerospace announced the location of its new Commercial Space Research and Development headquarters in Midland, TX. XCOR designs and produces reusable launch vehicles, rocket engines and rocket propulsion systems, and plans to create 100 jobs at the new facility, located at the Midland International Airport.

XCOR Aerospace

Texas Legislature Passes Spaceflight Legislation in 2013

- House Bill 2623 removes a major hurdle for future coastal launch facilities in Texas, including a potential SpaceX project near Brownsville. The bill enables the temporary closing of a beach or a beach access point in order to launch rockets at or near the site.
- House Bill 1791 provides noise ordinance and liability protection consistent with federal regulations to facilitate the operation of spaceflight activities in Texas.
- The Legislature appropriated $15 million to the state's existing Spaceport Trust Fund, in order to help finance infrastructure needed to establish a spaceport in Texas. The funds will be allocated by the state to eligible Spaceport Development Corporations to assist private launch operators with plans to develop spaceport facilities in the state.

Houston Proposes Spaceport at Ellington Field

In 2013, the Houston Airport System presented a plan to the Houston City Council envisioning future spaceport development at the city's Ellington Field, a Joint Reserve Base and former NASA training facility. Once operational, the spaceport would support reusable launch vehicles, with potential use for space tourism, R&D services, astronaut training, and more.

Ellington Field Spaceport rendering

Life Sciences in Microgravity

As a hub of both space technology and medical research, Houston has developed an advanced network of facilities and experts that combine the two fields. In addition to NASA's Johnson Space Center, Houston is home to the Texas Medical Center, the world's largest medical complex with more than 71,500 students and 92,500 employees. These facilities, along with multiple private companies in Texas, generate a wide range of spaceflight-related medical research, which can be applied to solving human health challenges—both in space and here on earth.

Life Science Research at Johnson Space Center

Johnson Space Center (JSC) is NASA's premier center for human spaceflight and related medical research. The space center possesses unique knowledge and capabilities for the study of human health and performance issues—particularly those related to survival in extreme and harsh environments. NASA collaboration expertise is available in the areas of biomedical research and engineering, biostatistics, cardiovascular and exercise physiology, microbiology, neuroscience, nutrition, immunology, bone and mineral research, and more. Unique research facilities at JSC include space environmental laboratories, customized test beds, tissue engineering labs, extreme environment analog facilities, and reduced microgravity environments. Research in this field has generated technology developments ranging from wound treatment, to biosensors for microbial monitoring, to cell growth technologies. NASA connects with other life science research partners through its Human Health and Performance Center, a virtual forum that enables organizations to collaborate with NASA on issues of human health and performance for space flight, commercial aviation, and challenging environments on Earth.

Johnson Space Center is NASA's lead **medical research** facility

Johnson Space Center biomedical research lab

Wyle Labs

NASA contractor Wyle Labs contributes to the JSC human spaceflight program in Houston under NASA's Bioastronautics contract. Wyle supports the International Space Station and provides services for human adaptation, habitability, space medicine, and more.

Astrogenetix

Astrogenetix works to commercialize biotech breakthroughs derived from microgravity discoveries, including commercially viable biomarkers. The Austin-based company has gained expertise by sending over 1,500 NASA science experiments into space. Astrogenetix is one of the first commercial entities to hold a Space Act Agreement with NASA for use of the International Space Station for R&D and industrial processing purposes.

National Space Biomedical Research Institute (NSBRI)

The NSBRI is a unique non-profit research consortium established in 1997 by NASA. It consists of over 70 agencies, universities, and institutions to develop health-related solutions to support long-duration human space exploration. The NSBRI is governed by a consortium of 12 U.S. institutions, including Texas-based **Baylor College of Medicine** (the lead institution), **Rice University**, and **Texas A&M University**. The institute's research addresses key technologies required to enable and enhance exploration. In particular, NSBRI scientists and physicians are developing technologies to provide medical monitoring, diagnosis and treatment in the extreme environments that will be faced during exploration missions. NSBRI discoveries also impact medical care on Earth. The institute works to transfer its space health solutions to patients suffering from similar conditions, including osteoporosis, muscle wasting, shift-related sleep disorders, balance disorders and cardiovascular problems. NSBRI funds more than 60 peer-reviewed science, technology, and education projects at leading institutions across the nation.

Photos courtesy of NSBRI

Baylor College of Medicine Center for Space Medicine (CSM)

Established in 2008, CSM partners with the NSBRI, Rice University, and NASA to provide a unique, interdisciplinary academic program engaging investigators, physicians, students and others in the fields of biomedical science and medicine. The CSM works to foster biomedical discovery, enhance the field of space medicine, and train space biomedical scientists and physicians of the future. The Center's goal is to be an international leader in space biomedical research and education, and to excel in discoveries relevant to life both in space and on Earth.

Texas at Aerospace and Aviation Trade Events

AeroTest America Expo in Fort Worth, Texas

The State of Texas works to promote the advancement of its aerospace and aviation sector in part by attending industry trade shows and expos around the world.

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