

Industry Overview

Colorado is an aerospace center of excellence, paving the way for new discovery in the frontier of space. The state has a rich history in aerospace development and is at the forefront of space travel, exploration, and leading aerospace research. In addition to its strategic location, the state's educated workforce, dynamic atmosphere for business growth, and hub of high-tech innovation have revolutionized the state's growing aerospace industry. Combined, these assets support Colorado's position as a top aerospace state. In fact, Colorado ranked second in the nation in 2016 for both private aerospace employment as a percentage of total employment, and in total private-sector employment.



Colorado's aerospace industry includes a broad range of companies, products, and systems for commercial, military, and civil space applications. Colorado's aerospace companies research, develop, design, and manufacture guided missiles, spacecraft, satellites and communications equipment, as well as navigation and detection instruments. Colorado companies also produce planetary spacecraft and launch systems, and provide mission support. The state's companies and public agencies have achieved some of the most innovative advancements in space exploration technology in recent history and are leading the nation's major commercial, civil, and military space missions and projects.

Eight of the nation's top aerospace contractors have significant operations in the state, leading the country's space projects. Along with major U.S. Department of Defense (DoD) facilities and the National Aeronautics and Space Administration (NASA) research and development activities, the state's universities are home to leading aerospace programs.

Colorado continues to experience growth in aerospace, with nearly 180 businesses classified as aerospace companies, and more than 400 companies and suppliers providing space-related products and services. Direct employment in the aerospace cluster totals 25,500 private sector workers and approximately 29,090 military personnel. These 54,590 workers in the aerospace cluster support an additional 133,690 workers in all industries throughout Colorado, bringing direct and indirect employment supported by the aerospace cluster to 188,280 workers. Further, Colorado's aerospace cluster payroll exceeded \$3.4 billion.

The majority of Colorado's key aerospace businesses, facilities, and research institutions are located in the nine-county Metro Denver and Northern Colorado region.¹ The region's 20,020 private sector aerospace workers represent about 78.5 percent of all aerospace workers in Colorado. The region's 130 aerospace companies represent 74 percent of the state's total companies in the cluster.

Private Aerospace Economic Profile

The aerospace cluster consists of 19, six-digit North American Industry Classification System (NAICS) codes including search, detection, and navigation instrument manufacturing; guided missile and space vehicle manufacturing; satellite telecommunications; and research and development.

The nine-county region ranked second in the nation for its 2016 concentration of private aerospace employment. The region's aerospace cluster ranked first out of the 50 largest metro areas in total private-sector employment.²

¹ The nine-county region is comprised of two principal areas, Metro Denver and Northern Colorado. Metro Denver consists of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, and Jefferson counties. Northern Colorado consists of Larimer and Weld counties.

² Employment concentration is the private aerospace cluster employment in a region expressed as a percent of total employment in all industries in the same region. Employment concentration is calculated and ranked for the 50 largest metropolitan statistical areas (MSAs). Private-sector employment is the number of employees in the industry cluster in a region. No multiplier effects are included. Private-sector employment is estimated and ranked for the 50 largest MSAs.

Aerospace Employment and Company Profile, 2016

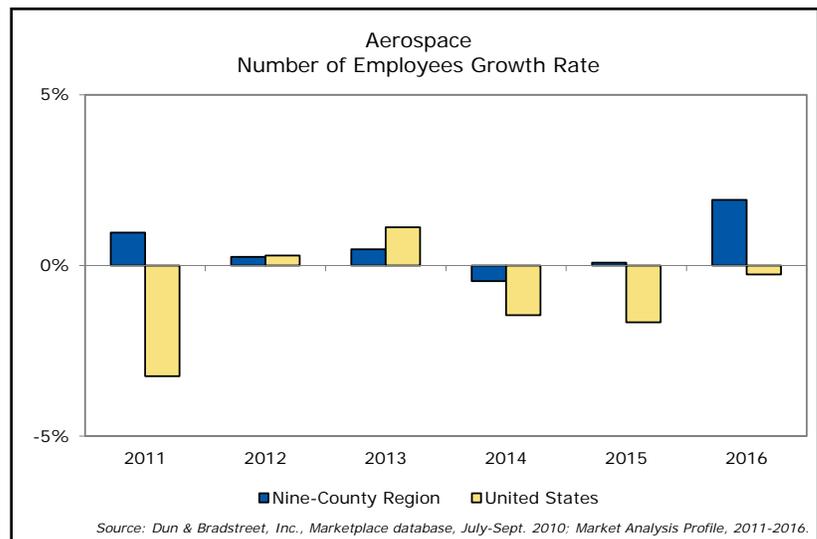
	Nine-County Region	United States
Direct employment, 2016	20,020	347,470
Number of direct companies, 2016	130	5,270
One-year direct employment growth, 2015-2016	1.9%	-0.9%
Five-year direct employment growth, 2011-2016	2.3%	-3.2%
Avg. annual direct employment growth, 2011-2016	0.5%	-0.6%
Direct employment concentration	0.9%	0.2%

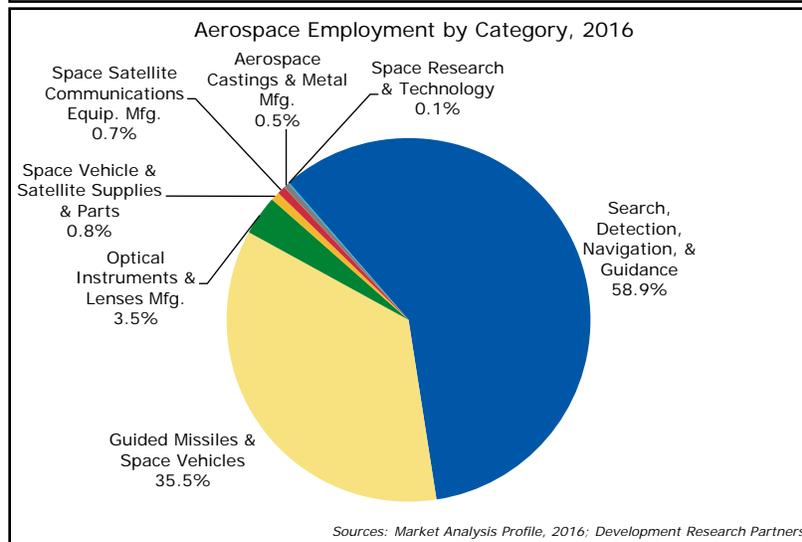
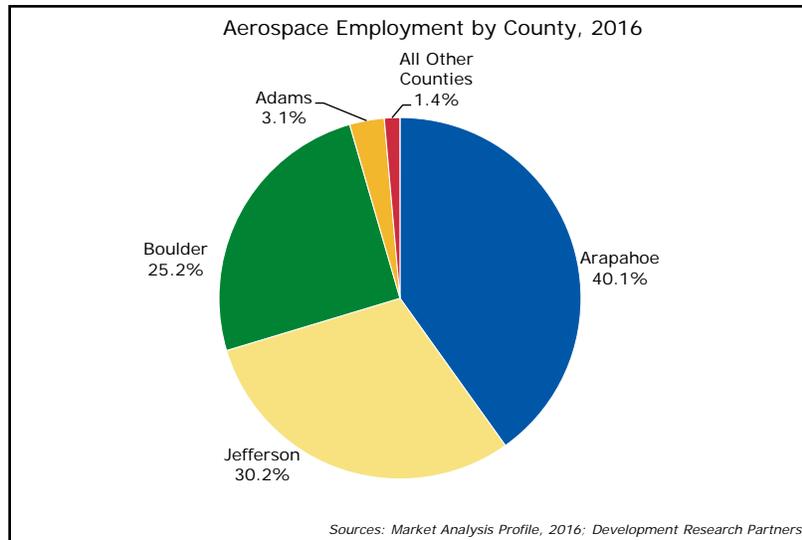
Sources: Dun & Bradstreet, Inc. Marketplace database, July-Sept. 2010; Market Analysis Profile, 2011-2016; Development Research Partners.

Aerospace Employment

The nine-county region's aerospace cluster directly employed about 20,020 workers in 2016. Employment in the region's aerospace cluster rose 1.9 percent between 2015 and 2016, compared with a 0.9 percent decrease at the national level. From 2011 to 2016, employment in the region's aerospace cluster increased 2.3 percent, compared with a 3.2 percent decline nationwide. Nearly 6 percent of the nation's aerospace employment is located in the region. Additionally, aerospace companies employed 0.9 percent of the region's total employment base, compared with a 0.2 percent employment concentration nationwide.

About 130 aerospace companies operated in the nine-county region in 2016, a 4.8 percent increase from 2015. The region's aerospace cluster has a stronger concentration of large companies than any other industry in the region. Approximately 56 percent of the region's aerospace companies employed fewer than 10 people (87.4 percent for all industries), while 12.2 percent employed 250 or more (0.3 percent for all industries).





Major Aerospace Contractors

Eight of the country's major space contractors have a significant presence in Colorado. These companies support the U.S. Department of Defense (DoD) to procure, place, and manage national space assets for the military. They also provide manned and unmanned spacecraft, instrumentation, and ground control services for the National Aeronautics and Space Administration (NASA) and other agencies.

- Ball Aerospace & Technologies Corp.**, based in Boulder, employs more than 2,300 workers in Colorado, and is known for its contributions in support of space and Earth science, exploration, national security and intelligence, and tactical programs. Ball Aerospace pioneers discoveries that enable its customers to perform beyond expectation and protect what matters most. Ball Aerospace creates innovative space solutions, enables more accurate weather forecasts, drives insightful observations of our planet, delivers actionable data and intelligence, and ensures those who defend our freedom go forward bravely and return home safely. www.ballaerospace.com
- The Boeing Company** has more than 1,800 employees at several locations throughout Colorado with the largest concentrations in Arapahoe County and Colorado Springs. Core business activities include: Jeppesen, a subsidiary of Boeing that provides navigational information to commercial, business, and military aviation; strategic missile defense systems, including Ground-based Midcourse Defense; space and intelligence and Global Positioning System (GPS) support; and Boeing military aircraft support at Fort Carson. Boeing spent nearly \$481 million with 214 Colorado suppliers in 2015. www.boeing.com
- Harris Corporation** has offices in Englewood, Broomfield, and Colorado Springs, altogether employing nearly 1,200 people. The **Critical Networks** segment provides managed services for air traffic

management, energy and maritime communications, ground network operation and sustainment, as well as information technology and engineering services. The **Communications Systems** segment provides tactical and airborne radios, night vision technology, and defense and public safety networks, while the **Electronic Systems** segment provides electronic warfare, avionics, wireless technology, C4I, and undersea systems and aerostructures. The **Space and Intelligence Systems** segment serves the nation's space superiority mission out of Colorado Springs, is represented on the GPS Operational Control System program, and also includes the **Geospatial Solutions** group which provides software solutions and services for data and image analysis, visualization, image delivery, and rapid development for commercial, research, and government markets. www.harris.com

- **Lockheed Martin** employs more than 8,600 people in Colorado. Of these workers, about 5,200 are employed at the **Space Systems Company** unit headquartered in Jefferson County. Space Systems designs, develops, tests, and manufactures advanced technology systems for its government, international, and commercial customers. The company also develops products ranging from human space flight systems and navigation, meteorological, and communications satellites to ground station and missile defense systems. www.lockheedmartin.com
- **Northrop Grumman** provides a diverse portfolio of products and services related to systems integration, missile systems and national security technologies, defense electronics, marine and space systems, and battle management. The company also works with advanced aircraft, unmanned aircraft vehicles, naval vessels, and space technology. Northrop Grumman employs more than 2,100 people throughout Colorado. www.northropgrumman.com
- **Raytheon Company** employs about 2,800 people throughout the state, with the majority of employees located in Aurora. Raytheon Company manages spacecraft missions and analyzes post-launch data through a variety of technologies including radio frequency, GPS, communications and intelligence, and electro-optical/infrared. www.raytheon.com
- **Sierra Nevada Corporation (SNC)** has a significant presence in Colorado, employing over 1,000 people in the state. SNC's **Space Systems** business area, located in Louisville, develops subsystems and components for space applications, is a prime contractor for small satellites, and owns and operates the *Dream Chaser*[®] spacecraft. The company's two Centennial divisions—the **Intelligence, Surveillance and Reconnaissance** and the **Information and Sensor Solutions**—provide products and services for a variety of airborne systems. www.sncorp.com
- **United Launch Alliance (ULA)** celebrated its 10th year of operation in 2016 and is the nation's premier launch company. ULA employs about 1,300 of its 3,400-person U.S. workforce at its Centennial headquarters. ULA's program management, engineering, and mission support functions are concentrated in Colorado. This includes development of ULA's new Vulcan Centaur rocket, which will launch in 2019. With its current and heritage launch vehicles, ULA has more than 100 years of combined launch experience, including launch of every operational GPS satellite and exploration of every planet in the solar system. Since ULA's formation in 2006, ULA's rockets have successfully delivered more than 110 satellites to orbit that provide critical capabilities for troops in the field, aid meteorologists in tracking severe weather, enable personal device-based GPS navigation, and unlock the mysteries of our solar system. www.ulalaunch.com

Additional Major Private Aerospace Companies

- ABSL Space Products
www.abslspaceproducts.com
- DigitalGlobe, Inc.
www.digitalglobe.com
- IHS Markit Aerospace, Defense & Security
www.ihs.com
- Intrex Aerospace
www.intrexcorp.com
- Merrick & Company
www.merrick.com
- Research Electro-Optics, Inc.
www.reoinc.com
- Rocky Mountain Instrument Company
www.rmico.com
- Science Applications International Corp.
www.saic.com
- SEAKR Engineering, Inc.
www.seakr.com
- Surrey Satellite Technology US LLC
www.sst-us.com
- Trimble Rockies
www.trimble.com
- UP Aerospace Inc.
www.upaerospace.com

Military Aerospace Profile

Colorado is home to a diverse mix of U.S. Department of Defense (DoD) military installations and major command centers that foster important synergies between private aerospace companies and government entities. The state is also a national hub for cybersecurity and opened the National Cybersecurity Center in Colorado Springs in 2016, a first-of-its-kind partnership between industry, nonprofits, government entities, and academia. The state's military installations significantly contribute to the economy, providing an annual economic impact of \$27 billion to the Colorado economy and employing more than 170,000 military and defense-related civilian personnel—or 5.2 percent of the state's workforce. Additionally, 7.5 percent of Colorado's labor income is derived from DoD employment and 6.5 percent of the state's Gross State Product is DoD-related.

Colorado plays a leading role in supporting cutting-edge defense assets such as the F-35 program. The F-35 is the fifth-generation fighter jet, which is designed to perform air defense missions and ground attack. Ball Aerospace is home to the high-tech manufacturing facility that develops, builds, and tests the F-35 antenna suite. The company expects to manufacture nearly 50,000 antennas for the program through 2040. Throughout the state, the F-35 has 22 suppliers and supports 750 direct and indirect jobs, providing an annual economic impact of \$60 million to the state's economy.

- **Buckley Air Force Base** in Aurora is home to the 460th Space Wing and supports more than 83 tenant organizations that represent all branches of the military. Tenants are located both on and off the base. The base is also home to the Aerospace Data Facility-Colorado, one of the nation's three satellite ground stations operated by the National Reconnaissance Office. The facility is a multi-mission ground station responsible for supporting worldwide defense operations and multi-agency collection, analysis, reporting, and dissemination of intelligence information. The base also hosts the Colorado Air National Guard 120th Fighter Squadron and its F-16C fighters.
- **Air Force Bases** in Colorado Springs include Peterson Air Force Base, Cheyenne Mountain Air Force Station, and Schriever Air Force Base.
 - **Peterson Air Force Base** is the home of the 21st Space Wing (SW) as well as the North American Aerospace Defense Command (NORAD), the U.S. Northern Command (USNORTHCOM), Air Force Space Command (AFSPC), U.S. Army Space and Missile Defense Command/U.S. Army Forces Strategic Command (SMDC/ARSTRAT), the 302nd Airlift Wing, as well as a number of other smaller tenant units. The 21st SW is responsible for worldwide missile warning, space control, and missile defense.
 - **Cheyenne Mountain Air Force Station** is owned and operated by Air Force Space Command. It hosts the NORAD and USNORTHCOM Alternate Command Center and other national security activities.
 - **Schriever Air Force Base** is the home of the 50th SW as well as the Space Innovation and Development Center (SIDC), the 310th Space Wing, the Missile Defense Integration and Operations Center (MDIOC), the Joint Functional Component Command for Integrated Missile Defense (JFCC-IMD), and numerous tenant organizations. The 50th SW is responsible for the operation and support of 175 DoD satellites and installation support to 16 major tenant units. The 50th SW provides space combat capability through command, control, operations, and support of communication, navigation, warning, surveillance, and weather satellite weapons systems.
- The **United States Air Force Academy** in Colorado Springs was established in 1954 as an accredited college to educate officers in the U.S. Air Force. The 10th Air Base Wing is the host wing for the Air Force Academy and provides base-level support activities including medical, engineering, base logistics, fire response services, communications, security, and other key support for more than 25,000 military and civilian personnel. The Academy hosts more than 20 research centers, institutes, and multi-disciplinary research groups with more than 400 professionals and faculty dedicated to space, science, air, and atmospheric research, as well as modeling and simulation. Further, the Academy leads the Air Force in cooperative research and development agreements, allowing federal labs and industry partners to share resources. The Academy's economic impact totaled nearly \$1 billion in fiscal year 2015.

Defense and Aerospace-Related Personnel Profile, 2016

<u>Government Installation</u>	<u>Personnel</u>
Buckley Air Force Base	9,500
Peterson Complex*	8,410
U.S. Air Force Academy	7,270
Schriever Air Force Base	3,910
Total Employment	29,090

*Peterson Complex total includes personnel at Peterson Air Force Base and Cheyenne Mountain Air Force Station (including NORAD, USNORTHCOM, AFSPC, and SMDC/ARSTRAT).

2016 INDUSTRY MILESTONES

The nine-county region is at the forefront of the nation's major commercial, civil, and military space missions and projects. Examples of these collaborative projects and their progress are highlighted below.

Dream Chaser®

Louisville-based Sierra Nevada Corporation's (SNC) Space Systems business area continued to work rigorously on the Dream Chaser spacecraft through significant collaboration with other Colorado-based aerospace companies. The Dream Chaser is a winged, lifting-body spacecraft designed for both crewed and uncrewed missions to low Earth orbit (LEO) including providing cargo resupply to the International Space Station (ISS) for the National Aeronautics and Space Administration (NASA), as well as international and commercial space missions. Program developments in 2016 included:

- In January, SNC was selected under NASA's Commercial Resupply Services 2 (CRS2) contract to provide a minimum of six service missions to ISS from 2019 through 2024. SNC's Dream Chaser Cargo System will provide up to 5,500 kilograms of upmass, as well as both return and disposal services.
- SNC passed the first two Integration Certification milestones under NASA's CRS2 contract. NASA assessed and approved SNC's detailed approach for delivering cargo and scientific research material to the ISS using the Dream Chaser spacecraft through 2024. SNC's Dream Chaser capabilities will subject payloads to less stress while landing, and will allow scientists to access research samples in as little as three hours after wheel-stop.
- The Dream Chaser spacecraft was prepared for transport to NASA's Armstrong Flight Research Center in California where it will undergo additional atmospheric flight testing. Program upgrades and initial hardware testing were successfully completed in Louisville. Upon arrival, SNC will begin a series of pre-flight ground evaluations to verify and validate the vehicle's system and subsystem designs. After successful ground testing, the spacecraft will begin free-flight testing.
- SNC's Space Systems added over 100 new employees in 2016 and will continue to increase its staff significantly in Louisville during 2017. SNC will also add manufacturing space to serve as the production home for the Dream Chaser.

Global Positioning System (GPS)

- Lockheed Martin Space Systems Co. received a \$395 million contract to build the ninth and tenth Global Positioning System (GPS) III satellites for the U.S. Air Force (USAF) at the company's advanced satellite manufacturing facility in Jefferson County. GPS III—the most powerful GPS satellite ever built—will deliver three-times better accuracy, provide up to eight-times improved anti-jamming capabilities, and extend spacecraft life to 15 years. The company's flexible, modular design for GPS III will allow the satellite to evolve to address changing mission needs and incorporate new technology as it becomes available in the future. The USAF plans to launch the first GPS III satellite in 2018.
- Raytheon completed both a qualification and a Critical Design Review milestone as part of its development of the GPS Next Generation Operational System (GPS OCX). The GPS OCX is the ground command and control system that will manage GPS satellites with significantly improved accuracy and precision, while providing unprecedented levels of cybersecurity. The company successfully completed

component-level testing of the OCX Black Wide Area Network (BWAN), which provides network connectivity to external interfaces for OCX.

- Harris supports the GPS mission in Colorado by developing and integrating the satellite navigation payloads for GPS III, and is providing the key navigation processing elements and precision monitor station receivers for the GPS OCX program.

The Imaging X-ray Polarimetry Explorer (IXPE) Mission

NASA has selected a science mission that will allow astronomers to explore, for the first time, the hidden details of some of the most extreme and exotic astronomical objects, such as stellar and supermassive black holes, neutron stars, and pulsars. The mission, slated for launch in 2020, will cost \$188 million. Principal Investigator Martin Weisskopf of NASA's Marshall Space Flight Center in Huntsville, Ala., will lead the mission. Ball Aerospace will provide the spacecraft and mission integration.

InSight

The Mars InSight lander, a NASA Discovery-class mission to understand the processes that shaped rocky planets such as Mars and Earth, was rescheduled to launch in 2018 on a ULA Atlas V rocket. Lockheed Martin Space Systems Co. constructed the Mars lander spacecraft for the mission. The team will also provide flight operations for the spacecraft.

Joint Polar-Orbiting Satellite System

- Ball Aerospace successfully completed environmental testing on the JPSS-1 satellite. The JPSS-1 is the nation's next polar-orbiting, environmental satellite scheduled for launch in 2017. The JPSS-1 will continue the accurate and timely collection of operational polar-orbiting weather and climate data currently provided by the Ball-built National Oceanic and Atmospheric Administration (NOAA)/NASA Suomi National Polar-orbiting Partnership satellite.
- Ball Aerospace received a NOAA contract to build ozone-monitoring instruments for the next-generation of weather satellites. Under the initial \$214 million contract, Ball Aerospace will develop, test, and deliver the Ozone Mapping and Profile Suite technology for the Joint Polar Satellite System (JPSS-3) and JPSS-4 missions. The contract is potentially worth \$421 million, with the work to be performed over a 10-year period. This contract builds on the success of the JPSS-1 contract.

Juno

After a five-year, 1.76-billion-mile journey, Colorado-built Juno reached Jupiter and was inserted into elliptical polar orbit. Launched in 2011 by ULA, NASA's \$1.1 billion spacecraft is the first solar-powered mission to Jupiter and was constructed by Lockheed Martin Space Systems Co. to study the planet's upper atmosphere and investigate the planet's internal dynamics. Juno's flight operations are controlled by a joint team at Lockheed Martin's Mission Support Area near Denver and NASA's Jet Propulsion Laboratory (JPL) in Pasadena, Calif.

SNC celebrated the early successes of Juno as it stabilized its orbit around Jupiter and began powering on the company's electronic-free thermal devices. The thermal louver technology is critical in regulating the spacecraft's temperature without drawing power away from its scientific payloads.

Mars

- Lockheed Martin celebrated 40 years since the first successful Mars landing with its Viking spacecraft, the first U.S. spacecraft to land on another planet. Viking 1 and 2 were the most complex interplanetary missions of their time. In partnership with NASA and the Langley Research Center, Lockheed Martin designed, built, and tested the two landers at its facility near Denver.
- NASA selected SNC and Lockheed Martin Space Systems Co. among six companies to design ground prototypes and concepts for deep space habitats on Mars over the next 24 months. The companies will expand commercial development of space in LEO under the Next Space Technologies Exploration Partnerships-2 (NextSTEP-2), a program to produce habitats that could support astronauts working and living outside Earth's orbit.

Mars 2020

- SNC's Space Systems Group was awarded multiple contracts by NASA's JPL to build critical hardware for NASA's Mars 2020 rover. This is the 13th time the company will be helping to build hardware for a mission to Mars and will design and manufacture the Descent Brake, as well as actuators for the robotic arm and sample caching system.
- NASA selected ULA to launch its Mars 2020 rover on an Atlas V rocket in the summer of 2020. The \$2 billion Mars rover is scheduled to land on the planet in 2021 to explore the Martian surface for two years.
- Lockheed Martin was chosen by NASA's JPL to build the aeroshell and heat shield for the Mars 2020 rover. The aeroshell system will protect the rover during its cruise to Mars and during the dramatic descent to the surface. The aeroshell is very similar to the system the company developed for NASA's Curiosity rover.

MAVEN

Mars Atmospheric and Volatile Evolution (MAVEN) is a prime example of Colorado's leadership in space exploration with the entire mission and spacecraft being built and launched by Colorado organizations including Lockheed Martin Space Systems Co., CU Boulder's Laboratory for Atmospheric and Space Physics (LASP), Harris Corporation, and United Launch Alliance (ULA). MAVEN launched in November 2013 and entered Mars' orbit in September 2014.

Orion

Lockheed Martin Space Systems Co. is the prime contractor building the Orion Multi-Purpose Crew Vehicle, NASA's first spacecraft designed for long-duration, human-rated deep space exploration. Orion will transport humans to interplanetary destinations beyond LEO, such as the moon, asteroids, and eventually Mars as early as 2023. Project developments in 2016 included:

- Orion moved forward into assembly, integration, and testing to ready the spacecraft for its uncrewed Experimental Mission-1 in 2018 by NASA's new Space Launch System. Orion completed a series of structural tests including pressurized volume, water landing, docking capability, safety technologies, and logistics management to make future vehicles re-usable for several flights. Lockheed Martin is also developing and testing software in Jefferson County that will be used on Orion's computers and flight systems during its unmanned lunar voyage.

OSIRIS-REx

NASA's OSIRIS-REx mission will travel to asteroid Bennu, study it in detail, and return a sample to Earth—a first for NASA. Lockheed Martin Space Systems Co. designed and built NASA's OSIRIS-REx spacecraft and is also providing mission operations. The seven-year, 4.4-billion-mile mission successfully launched aboard a ULA Atlas V in September 2016. A team of CU Boulder scientists will lead the radio science investigation for the mission, which will study and return a sample of a carbonaceous asteroid to Earth for detailed analyses in 2023 that could determine the origin of the solar system.

Space-based Missions

- Ball Aerospace was selected by NASA to study a new space telescope that will be launched in mid-2020. The company will develop a concept study for the Wide Field Infrared Survey Telescope (WFIRST), which will have a view 100 times bigger than that of NASA's Hubble Space Telescope.
- ULA partnered with Nevada-based Bigelow Aerospace to develop and deploy experimental, inflatable space habitats that could be ready for launch as soon as 2020. Bigelow Aerospace, along with ULA, plans to build one or two 12,000-square-foot habitats in LEO.
- Lockheed Martin Space Systems Co. partnered with research teams on three new interplanetary missions. The first project will orbit Venus, the second will descend through Venus' atmosphere, and the third will travel and study a Trojan-class asteroid that floats near Jupiter. The three projects are among five competing for NASA's next round of Discovery mission program funding.
- Denver-based York Space Systems signed a \$60 million launch agreement with Tucson-based Vector Space Systems. The agreement covers six launches between 2019 and 2022, with the option to extend to include 14 more missions. York Space Systems is establishing a satellite factory in Centennial designed to produce small satellite bodies weekly and have the final satellites assembled in about a month.

- High-tech hardware designed and built at CU Boulder's BioServe Space Technologies for biomedical experiments was successfully launched aboard the commercial SpaceX Dragon capsule to the ISS. The hardware will support experiments ranging from the mitigation of bone loss in space to the effects of low gravity on stem cell-derived heart cells.

Colorado's aerospace companies are transforming the future of space with next generation launch systems.

- ULA's next-generation Vulcan Centaur rocket, set to launch in 2019, will help transform the future of space launch, making it more affordable, accessible, and commercialized. The Vulcan Centaur will have an American engine and eventually an Advanced Cryogenic Evolved Stage (ACES) upper stage, giving it more capability than any other rocket on the market.
- ULA received a \$46.6 million USAF contract to develop prototypes of its Vulcan Centaur rocket with two Blue Origin BE-4 engines, the primary path for the new launch vehicle, as well as propulsion for ULA's ACES upper stage. Aerojet Rocketdyne also received USAF funding to develop its AR-1 engine, which also could power the Vulcan Centaur booster.
- In 2016, ULA successfully launched 12 missions aboard its Delta IV and Atlas V rockets, including a resupply mission to the ISS and missions to support military communications, GPS, and the National Reconnaissance Office.

Satellite Programs

- Lockheed Martin Space Systems Co. secured a contract with Japan-based SKY Perfect JSAT Corp. to build a commercial communications satellite. The JCSAT-17 satellite will include a flexible processor to adjust the satellite's position to focus on an area of high need.
- ULA launched the U.S. Navy's fifth Mobile User Objective System (MUOS-5) satellite, built by Lockheed Martin Space Systems Co., to improve data and voice communications for the military. Launched aboard ULA's Atlas V rocket, the satellite is the final satellite in the five-satellite constellation that will provide 16 times the network capacity for more than 55,000 military communication terminals worldwide.
- ULA launched the WorldView-4 satellite for Westminster-based DigitalGlobe. WorldView-4 is a companion to its WorldView-3 satellite. The satellite, built by Lockheed Martin, will more than double DigitalGlobe's coverage of the world's highest resolution imagery and increase the rate at which it grows its 16-year library of time-lapse, high-resolution imagery. WorldView-4 will orbit Earth every 90 minutes, traveling 17,000 miles per hour and capturing more than 680,000 square kilometers of the Earth's surface daily.
- NOAA's next generation Geostationary Operational Environmental Satellite-R (GOES-R) weather satellites launched in November 2016 by ULA. The satellite, designed and built by Lockheed Martin Space Systems Co., will provide accurate, real-time weather forecasts and early warning products to NOAA using an instrument suite designed and built by CU Boulder's LASP known as the Extreme Ultraviolet and X-ray Irradiance Sensors (EXIS). Lockheed Martin also designed and built the Solar Ultraviolet Imager and the Geostationary Lightning Mapper instruments that will fly aboard each of the four spacecrafts in the GOES-R Series.
- SNC's Space Systems deployed and completed all in-orbit checkout procedures of the final 11 satellites for the ORBCOMM Generation 2 (OG2) constellation after their December 2015 launch. SNC also provided the solar arrays and drive mechanisms and the satellite dispenser to Southwest Research Institute in support of their eight satellite CYGNSS mission for NASA, which launched in December 2016.
- CU Boulder's LASP built and operated the Miniature X-ray Solar Spectrometer (MinXSS) CubeSat, which successfully deployed from the ISS. MinXSS will operate for up to 12 months and will study solar flares, active regions, the quiescent sun, and the relationship between solar activity and the Earth's upper atmosphere.
- India-based Antrix Corp. Ltd. launched two weather satellites developed by Boulder-based PlanetiQ. The company's microsatellites will use radio occultation to measure global temperature pressure and water vapor in the atmosphere, and electron density in the ionosphere. Antrix plans to launch 10 additional satellites in 2017.
- Lockheed Martin Space Systems Co., Arab Satellite Communications Organization, and King Abdulaziz City for Science and Technology completed the Critical Design Review of its Arabsat 6A and Hellas-Sat-4/SaudiGeoSat-1 satellites. With manufacturing underway, the satellites will move further into the production process to provide advanced telecommunications capabilities, including television, Internet, telephone, and secure communications to the Middle East, Africa, and Europe. The satellites are expected to launch in 2018.

- Englewood-based Surrey Satellite Technology US LLC and Boston, Mass.-based BridgeSat Inc. partnered to develop a free-space optical communications system that will provide secure data downlinks from satellites. Surrey will build the flight laser terminal units that will communicate with BridgeSat's global ground network, providing transmit data at up to 10 gigabits per second, per link.
- ULA successfully launched a Delta IV rocket carrying the USAF Space Command 6 (AFSPC-6) mission. The AFSPC-6 mission included twin Geosynchronous Space Situational Awareness Program (GSSAP) spacecraft, which collects space situational awareness data for more accurate tracking and characterization of man-made orbiting objects.

Global Aerospace Agreements

- SNC's Space Systems signed a Memorandum of Understanding with the United Nations (UN) Office for Outer Space Affairs (UNOOSA) to provide affordable opportunities for UN member states to conduct experiments in space. Under the agreement, SNC will dedicate at least one Dream Chaser mission that will host payloads to test microgravity science and space equipment for member countries.
- DigitalGlobe and Saudi Arabia-based TAQNIA and King Abdulaziz City for Science and Technology created a joint venture to develop and operate at least six small optical Earth observation satellites. The satellites, capable of detecting objects of less than one meter in diameter, will launch in 2018 and 2019.
- DigitalGlobe partnered with PSMA Australia to map the locations and characterize the physical attributes of more than 15 million structures across the continent of Australia. The mapping will have applications for insurance risk modelling, urban planning and services delivery, business intelligence, and policy development.

Spaceport Colorado

Colorado is actively working to establish horizontal launch capabilities in the state. In 2016, Front Range Airport continued the application process for certification from the FAA to operate as a horizontal-launch spaceport facility. The subsequent designation for Spaceport Colorado, which may be granted in 2017, fulfills a 2011 declaration by Gov. John Hickenlooper of Colorado's intent to become a spaceport state. These efforts will increase Colorado's competitiveness in the aerospace industry and support new opportunities in the future growth of commercial space research and transportation. Plans for Spaceport Colorado include the development of an aerospace and technology park to support a broad range of activities and commercial opportunities, including research and development, testing and evaluation, manufacturing, crew training, scientific research, commercial space and aerospace education, suborbital flight, and point-to-point travel. Spaceport Colorado has an abundance of surrounding land and convenient access to Denver International Airport and the state's sizeable aerospace industry, research universities, and talented aerospace workforce.

Research and Education Announcements

The nine-county region's robust educational system and research centers help prepare the future aerospace workforce with vital skills through innovation, mentorship, and professional experience.

- Lockheed Martin Space Systems Co. committed \$3 million over four years to the University of Colorado Boulder (CU Boulder) to establish academic curriculum focused on technologies for communications and radar systems. The funding will be used for engineering course work in radio frequency technologies, which are used in military and civilian systems ranging from Global Positioning Systems (GPS) to mobile phones. CU Boulder established the Lockheed Martin Radio Frequency Space Systems Research Center, which will aim to increase engineering expertise and support in-demand skills in the aerospace industry.
- CU Boulder launched its new Space Minor program. The program, a component of CU Boulder's Grand Challenge: *Our Space. Our Future*, will allow undergraduate students regardless of major to obtain a minor that complements their major degree with a set of five space-related courses.
- Lockheed Martin and CU Boulder launched the inaugural Mentor Lunch during National Engineers Week to inspire and motivate future engineers and celebrate the contributions of engineering professionals. The event featured speed mentoring and tours of various engineering facilities on campus for high school and college students from across the nation.
- A Colorado State University (CSU)-based research team won the top prize in NASA's DEVELOP program for their satellite imagery monitoring cheatgrass burned from the Arapaho fire in Wyoming.

DEVELOP is a training and development project sponsored by NASA's Earth Science Applied Sciences Program where interns work on Earth science research projects.

- A hypervelocity dust accelerator for studying micrometeorite impacts opened at CU Boulder's Institute for Modeling Plasma, Atmospheres, and Cosmic Dust (IMPACT). The accelerator tags each particle's mass, speed, and charge used for research activities and calibrates dust instruments for space applications.
- The University Corporation for Atmospheric Research (UCAR) was awarded a three-year, \$2.8 million cooperative agreement with the National Science Foundation (NSF) to oversee the EarthCube Science Support Office. EarthCube provides over 2,500 contributors with a common cyberinfrastructure to collect, access, analyze, and share all forms of geosciences data and related resources.
- CU Boulder and Fort Lewis College were two of six colleges to receive part of a \$24 million NSF imaging science grant. The schools will launch the Science and Technology Center on Real-Time Functional Imaging center (STROBE), which will be headquartered at CU Boulder. The center is designed to tackle major scientific challenges that have the potential to transform imaging science and technology through integrated advanced imaging methods using electrons, X-rays, and super-resolution microscopy.

The nine-county region is home to major science, technology, engineering, and mathematics (STEM) initiatives in aerospace including:

- **Colorado STEM Education Roadmap**, developed by the Colorado Education Initiative, collaborates with key aerospace industry stakeholders to position Colorado as the most innovative state for growing a talent pipeline through STEM education and experiences.
- **Wings Aerospace Academy** is an online, tuition-free charter school for sixth through eighth grade students. Launched in the fall of 2015, the Academy provides aerospace experiences via the Elevate Academy with hands-on, aerospace-based STEM curricula provided by Wings Over the Rockies.
- The **Center for STEM Learning** at CU Boulder partners with and features dozens of STEM programs around the country and within CU Boulder to improve STEM education and serve as a resource for such efforts. In addition, CU Boulder and the University of Massachusetts Amherst are partnering to create a national network of about 200 campus STEM education centers.
- The **Colorado Space Grant Consortium (CSGC)** is a recipient of the National Space Grant and Fellowship Program to increase student and faculty engagement in STEM at community colleges and technical schools. The CSGC provides Colorado students access to space through innovative courses, real-world, hands-on telescope and satellite programs, and interactive outreach programs.
- The Colorado Space Business Roundtable's **Colorado Aerospace Internship Initiative** is a two-week immersive program designed to expose students to a "day in the life" of an employee at various aerospace organizations.
- The Boulder-based **Space Science Institute** produces pioneering projects including exhibits, digital learning experiences, and workshops designed to engage scientists in education reform.

Industry Infrastructure Support

The nine-county region's organizations and professional associations are dedicated to advancing the thriving aerospace industry.

- The Colorado Space Coalition (CSC), a group of industry stakeholders, works to promote Colorado as a leader in the aerospace industry. The Coalition—including aerospace companies, military leaders, academic groups, and economic development organizations—promotes the state's significant aerospace assets nationally and advances legislation vital to industry growth and success.
- The Colorado Space Business Roundtable (CSBR) is an independent, nonprofit organization promoting the growth of space and space-related industry in Colorado, with particular focus on small space businesses. CSBR members include a broad cross-section of the Colorado space community including industry, government, and academia that support the space industry with services, advocacy, and procurement. The CSBR leads annual business development road trips throughout the state of Colorado to help connect major space contractors, business leaders, economic development professionals, and STEM advocates with small business owners, college students, and entrepreneurs.
- BioServe Space Technologies is a NASA-funded Center in CU Boulder's Department of Aerospace Engineering Sciences that focuses on space life science research and engineering. BioServe's current role in the field of microgravity life science research on the ISS is unmatched. For nearly 30 years, BioServe has designed, built, and flew over 70 different research payloads on over 40 space flight

missions and has a full suite of space flight certified hardware available for use by its customers and partners. BioServe receives approximately \$2.5 million per year in research grants and contracts.

- ADAPT, the Alliance for the Development of Additive Processing Technologies, is a Colorado consortium focused on helping member manufacturers become global leaders in metal additive manufacturing. ADAPT members have greater opportunities to realize the full potential of additive manufacturing, respond quickly to market demands, and compete more effectively. Launched in December of 2015 as an industry-academic-government consortium, this collaborative effort addresses data-driven challenges in additive metals manufacturing.
- The CU Boulder AeroSpace Ventures (ASV) initiative creates a collaborative environment in which CU Boulder's aerospace engineering and earth and space science faculty, students, and industrial researchers work together to solve complex problems that lead to new discoveries and innovations. Through this initiative, CU Boulder combines aerospace vehicle innovations and science discoveries for local and global measurements to advance solutions in climate, weather, and space environment.
- EWI's new site in Loveland, part of the Colorado FourFront network for industry, serves aerospace customers directly in Colorado with advanced nondestructive examination and quality measurement technology. This capability is backed by EWI's national network of centers headquartered in Columbus, OH, with the company matching its expertise to the needs of manufacturers to serve as a valuable extension of clients' innovation and research and development teams.
- The Colorado Chapter for Citizens for Space Exploration comprises private citizens, small business owners, students, teachers, space and non-space business representatives, and county and municipal officials. The Chapter actively promotes awareness of the benefits of America's Human Space Exploration Program and support for NASA.

Cross-Cluster Convergence

Collaboration across the state's industries including aerospace, software, energy, and bioscience has fueled innovation, discoveries, and advancements.

- The National Solar Observatory (NSO) relocated its headquarters from Tucson, Ariz. to Boulder. The move was motivated by the NSO's latest undertaking—the Daniel K. Inouye Solar Telescope—which is the largest telescope in the world and will revolutionize the future of solar physics. The NSO plans to hire up to 70 scientists, engineers, and staff with an annual payroll of about \$20 million.
- Lockheed Martin Space Systems Co. released new software to help speed relief to victims of natural disasters across the globe. The software, called HelpNowMap.com, helps provide clear data to residents, first-responders, and aid agencies on the ground after floods, earthquakes, hurricanes, and other natural disasters. The program uses satellite imagery from DigitalGlobe as the base layer for a heat map of human need and infrastructure damage.
- DigitalGlobe partnered with Amazon Web Services, CosmiQ Works, and NVIDIA to launch an open-data initiative to improve image analysis tools. SpaceNet will be an online, publically available repository of over 60 million satellite imagery and labeled training data to advance the development of machine learning and deep learning algorithms.
- Centennial-based Allosource collaborated with NASA and the JPL to conduct microbial research that could help improve medical care for astronauts in space. The ongoing project studies the effects of zero gravity on antibiotic resistant genes in microorganisms taken from the ISS and will help scientists and medical staff to more efficiently prescribe antibiotics on the ISS. Allosource also continues to provide advanced microbial research in tissue processing on various Mars missions.

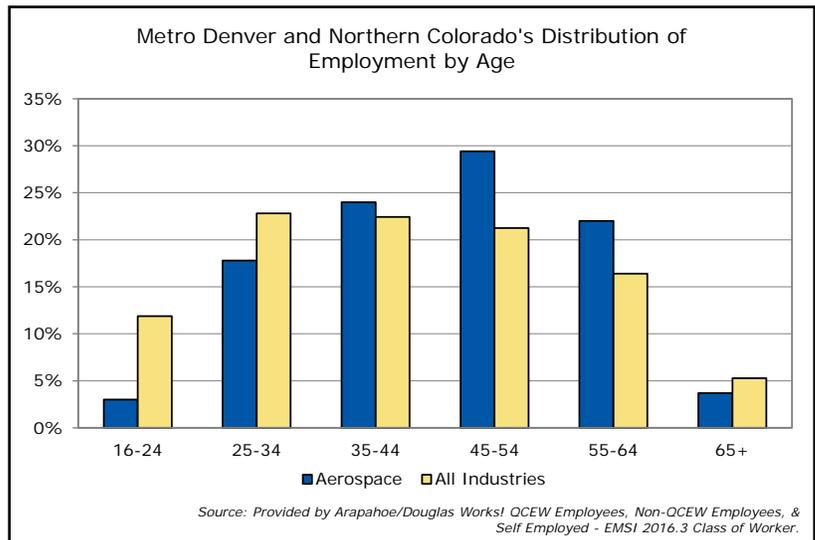
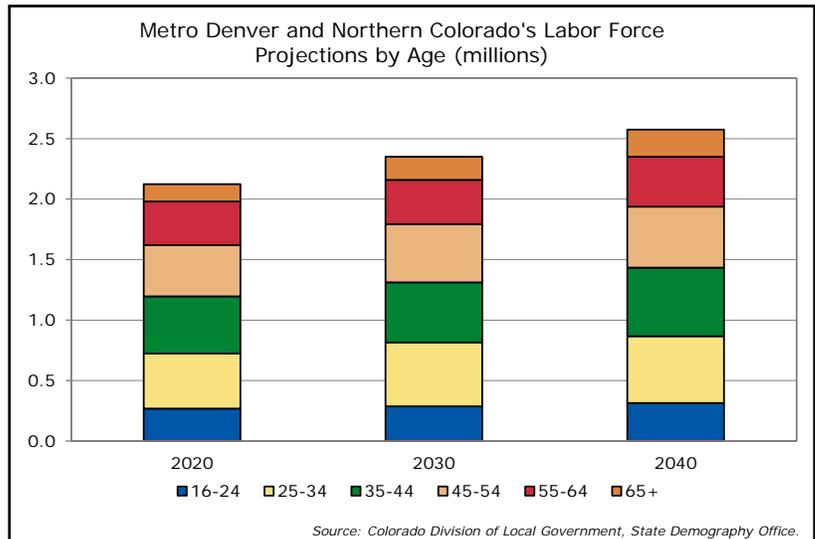
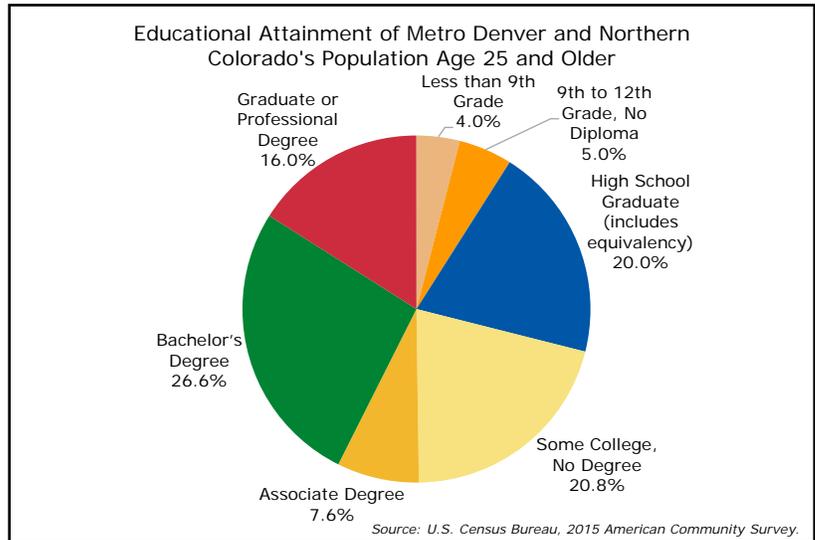
Private Aerospace Workforce Profile

Many companies choose locations because of the available workforce. With nearly half of the nine-county region's 3.8 million residents under the age of 35, employers can draw from a large, young, highly educated, and productive workforce. Of the region's adult population, 42.6 percent are college graduates and 91 percent have graduated from high school. The state has the nation's second-most highly educated workforce as measured by the percentage of residents with a bachelor's degree or higher.

The attractiveness of the region draws new residents through in-migration. The region's population is expected to grow 31 percent from 2020 to 2040, driving a 21.2 percent increase in the region's labor force over the same period. It is important to note the changing composition of the workforce supply as the baby boomers begin to retire, which will pose implications for businesses whose employee pool includes significant numbers of these workers.

The nine-county region's aerospace industry employs 20,020 people and includes a large pool of talented, well-educated, and highly skilled workers. The aerospace cluster has a larger share of employees (75.4 percent) that are between the ages of 35 and 64 years old, compared with the age distribution across all industries in the region (60.1 percent).

The aerospace workforce supply consists of four main components: those currently working in the industry; those doing a similar type of job in some other industry; the unemployed; and those currently in the education pipeline. The Metro Denver and Northern Colorado Occupation & Salary Profile below includes the 10 largest aerospace occupations in the region. For these 10 largest occupations, the chart details the total number of workers employed in that occupation across all industries, the number of available applicants that would like to be working in that occupation, the number of recent graduates that are qualified for that occupation, and the median and sample percentile annual salaries.



Wages

Wages in the aerospace cluster are among the highest across all industry clusters. The 2015 average annual salary for an aerospace worker in the nine-county region was \$133,840, compared with the national average of \$107,450, 25 percent more than the national average. Total nine-county payroll in the aerospace cluster exceeded \$2.6 billion in 2015.

Metro Denver and Northern Colorado Aerospace Occupation & Salary Profile, 2016

10 Largest Aerospace Occupations in Metro Denver and Northern Colorado	Total Working Across All Industries (2016)	Number of Available Applicants (2016)	Number of Graduates (2015)	Median Salary	10th Percentile Salary	25th Percentile Salary	75th Percentile Salary	90th Percentile Salary
1. Aerospace engineers	2,047	79	180	\$122,827	\$77,003	\$95,572	\$157,211	\$194,197
2. Business operations specialists, all other	33,547	1,510	50	\$79,615	\$41,759	\$54,434	\$97,749	\$126,953
3. Mechanical engineers	5,533	138	721	\$85,096	\$56,118	\$68,661	\$112,174	\$141,503
4. Software developers, systems software	10,829	184	1,038	\$108,739	\$68,046	\$86,965	\$128,679	\$154,997
5. Biological technicians	2,465	20	1	\$43,578	\$29,106	\$34,426	\$56,637	\$69,687
6. Software developers, applications	19,949	339	921	\$103,454	\$65,735	\$81,356	\$122,826	\$148,422
7. Atmospheric & space scientists	1,460	12	47	\$93,238	\$61,100	\$74,679	\$115,857	\$140,114
8. Electronics engineers, except computer	4,938	123	441	\$101,396	\$64,980	\$77,300	\$122,914	\$150,057
9. Industrial engineers	2,768	69	4	\$90,696	\$57,010	\$72,137	\$113,205	\$135,370
10. Natural sciences managers	1,252	104	3,068	\$126,982	\$87,944	\$105,550	\$157,165	\$259,747

Notes: The number of available applicants is a point-in-time measurement of the number of people who have registered in Colorado's workforce development system's statewide database, Connecting Colorado, as being able and available to work in a particular occupation. Results should be interpreted with caution since registration in Connecting Colorado is self-reported. In addition, the skills rubric may assign up to four occupation codes for each registrant. Therefore, the number of available applicants could be inflated. *Source: Provided by Arapahoe/Douglas Workst; QCEW Employees, Non-QCEW Employees, & Self Employed - EMSI 2016.3 Class of Worker.*

Education & Training

Colorado's higher education system provides an excellent support system for businesses in the region. There are 28 public higher education institutions in Colorado, of which seven four-year and six two-year public institutions offering comprehensive curricula are located in the nine-county region. In addition, there are more than 100 private and religious accredited institutions and more than 350 private occupational and technical schools offering courses in dozens of program areas throughout the state. Although not exhaustive, a list of the major, accredited educational institutions with the greatest number of graduates for each of the 10 largest aerospace occupations in the nine-county region are included below. A directory of all higher education institutions with corresponding websites may be accessed via <http://higher.ed.colorado.gov>.

- Colorado School of Mines
www.mines.edu
- Colorado State University
www.colostate.edu
- Colorado State University Global Campus
www.colostate.edu
- Front Range Community College
www.frontrange.edu
- Metropolitan State University of Denver
www.msudenver.edu
- Regis University
www.regis.edu
- University of Colorado: Boulder, Denver
www.cu.edu
- University of Denver
www.du.edu
- University of Northern Colorado
www.unco.edu

Key Reasons for Aerospace Companies to Locate in the Nine-County Region

The region is a top aerospace location offering:

- 1. The ability to recruit and retain technical and scientific employees and entrepreneurial talent**
 - Colorado has one of the nation's most educated workforces, ranking second among the 50 states for percentage of residents (39.2 percent) with a bachelor's degree or higher. (U.S. Census Bureau, 2015 American Community Survey)
 - Colorado ranked ninth for the number of science, engineering, and health graduate students per 1,000 individuals ages 25 to 34 years old in 2013. (National Science Foundation, 2015)
 - Colorado ranked fifth for the number of scientists and engineers as a share of all occupations in 2014. (National Science Foundation, 2015)
 - Colorado ranked ninth in the number of patents issued per 1 million people in 2015. (U.S. Patent and Trademark Office, 2016; U.S. Bureau of Economic Analysis, 2016)
 - The first U.S. Department of Commerce United States Patent and Trademark Office west of the Mississippi opened in Denver in 2014 due to the state's educated workforce, innovative ecosystem, and entrepreneurial culture. (U.S. Patent and Trademark Office, 2016)
 - The Denver-Aurora-Broomfield metropolitan area ranked among the top 10 for economic development and job growth in the "Leading Locations for 2016" list. Areas recognized in the study exhibited economic strength and capacity to support business prosperity. (*Area Development*, 2016)
 - Metro Denver ranked as the fourth-best metro area for science, technology, engineering, and mathematics (STEM) professionals in 2016. Metro Denver ranked seventh for the projected number of STEM jobs needed by 2020. (WalletHub, 2016)
 - Denver ranked among the top 10 "Best Cities for Young Professionals" in 2016. Denver's healthy job growth rate and highly educated population contributed to its notable rank. (*Forbes*, 2016)
 - Boulder ranked sixth among the "Best Cities for New College Grads" in 2016. The city's growing tech hub, student and young professional population, and amenities contributed to its notable rank. (Zumper, 2016)
 - Metro Denver ranked as the fourth-best metro area for young entrepreneurs in 2016. The metro area received accolades for its highly educated population and high rate of small business loans. (NerdWallet, 2016)
 - Boulder and Fort Collins ranked among the top five most-educated metro areas in the nation in 2016. (ValuePenguin.com, 2016)
- 2. Proximity to vendors and customers**
 - Colorado ranked third nationwide in National Aeronautics and Space Administration (NASA) prime contract awards totaling nearly \$1.8 billion in 2015, or 14 percent of the nation's total. The University of Colorado (sixth) and Colorado State University (39th) ranked among the top 100 public educational institutions for NASA research awards in 2015. (NASA, 2016)
 - The nine-county region's aerospace cluster is anchored by eight large prime contractors: Ball Aerospace, The Boeing Company, Harris Corporation, Lockheed Martin, Northrop Grumman, Raytheon, Sierra Nevada Corporation, and United Launch Alliance.
 - Colorado is a host to major military operations including Buckley AFB, Peterson AFB, Schriever AFB, and Cheyenne Mountain Air Force Station. In addition, the U.S. Air Force Academy is located just outside of Colorado Springs.
 - Cheyenne Mountain Complex serves as NORAD and USNORTHCOM's Alternate Command Center and as a training site for crew qualification.
 - Colorado has 16 Procurement Technical Assistance Centers (PTAC) located throughout the state to assist Colorado businesses with prime contractors and federal, state, and local governments at nominal or no cost. In 2015, PTAC's 2,800 active businesses received \$8.8 billion and generated 6,260 jobs.
- 3. Business organizations and public policy programs designed to encourage industry growth**
 - Maj. Gen. Jay Lindell was appointed in 2013 by Gov. Hickenlooper as Colorado's Aerospace and Defense Industry Champion, to oversee implementation of the state's aerospace strategic plan and assist aerospace businesses, defense installations, and research institutions.
 - Aerospace Day at the Colorado Capitol occurs annually to recognize the industry's importance to the state's economic growth. Formed in 2015, the state's bipartisan Aerospace and Defense Caucus further supports the continued expansion of aerospace and defense in Colorado.

- The Advanced Industries Accelerator (AIA) Programs promote growth and sustainability in Colorado's advanced industries, including advanced manufacturing, aerospace, bioscience, electronics, energy and natural resources, infrastructure engineering, and technology and information. Since 2013, the AIA program has granted over \$35 million to nearly 230 organizations. These industries account for nearly 30 percent of the state's wage earnings, nearly 30 percent of the total sales revenue across all industries, and nearly 35 percent of the state's total exports. (The Colorado Office of Economic Development and International Trade, 2016)
- Personal property used in an orbital space facility, a space propulsion system, satellite, or space station is exempt from sales and use taxes. The exemption encourages capital investment in aerospace manufacturing suppliers. (Exemption clarified in Colorado House Bill 14-1178)
- To further pave the way for Spaceport Colorado, legislation passed in 2012 will help expand the state's aerospace economy. Senate Bill 35 (2012) limited the liability for public and private entities holding a Federal Aviation Administration license for spaceflight activities. The legislation is an important first step in initiating commercial spaceflight activities in the state.

4. Proximity to colleges/universities

- Two academic institutions in Colorado offer nationally ranked aerospace programs or degrees:
 - The University of Colorado Boulder's (CU Boulder) aerospace engineering sciences graduate program ranked among the top four programs in the nation by the National Research Council and eighth by *U.S. News & World Report* in 2016. (National Research Council, 2010; *U.S. News & World Report*, 2016)
 - The U.S. Air Force Academy in Colorado Springs ranked first in the nation for an undergraduate aerospace engineering program where a doctoral degree is not offered. (*U.S. News & World Report*, 2016)
 - The U.S. Air Force Academy ranked fifth among the "Top 21 STEM Colleges of 2016." (*Forbes*, 2016)
- CU Boulder's Laboratory for Atmospheric and Space Physics is the only university-based institution in the world to have designed and built space instruments for NASA that have been launched to all eight planets and Pluto.
- CU Boulder is home to over a dozen aerospace-related units on campus and attracts over \$100 million in annual aerospace-related research expenditures.
- CU Boulder is the only university outside of the Naval Postgraduate School to have two astronaut alumni on its faculty. Eighteen NASA astronauts are CU Boulder affiliates (graduates, postdocs, and faculty). (University of Colorado, 2016)
- The University of Colorado ranked fourth among U.S. universities in the number of astronaut alumni, excluding military academies. The University of Colorado is home to 20 astronaut alumni. (University of Colorado, 2016; NASA, 2016)
- Three Metro Denver universities are members of the Universities Space Research Association, with graduate programs in space sciences or engineering: CU Boulder, Colorado School of Mines, and the University of Denver. (Colorado Space Coalition, 2016)

5. Low to moderate costs of doing business

- Colorado has one of the nation's most favorable corporate income tax structures. The state's corporate income tax rate of 4.63 percent is one of the lowest in the nation and is based on single-factor apportionment, which allows companies to pay taxes based solely on their sales in the state. (State of Colorado; The Tax Foundation)
- Colorado has the nation's ninth-best tax climate for entrepreneurship and small business. (Small Business & Entrepreneurship Council, 2016)
- Metro Denver office rental rates averaged \$29.52 per square foot in the fourth quarter of 2016, making the region's office market highly competitive with other major markets in the U.S. (CoStar Realty Information, The CoStar Office Report, 4Q 2016)

6. Pro-business and flexible state and local governments

- Metro Denver ranked No. 1 among *Forbes'* 2016 "Best Places for Business and Careers" for the second-straight year. Four other Colorado metropolitan areas were included on the list. The Colorado Springs metro area ranked 12th, Fort Collins ranked 18th, Boulder ranked 26th, and Greeley ranked 51st. (*Forbes*, 2016)
- Colorado ranked No. 3 in *CNBC's* annual "America's Top States for Business" in 2016. The state earned top-10 rankings in the categories that measure workforce (first), the economy (second),

technology and innovation (eighth), access to capital (eighth), and business friendliness (ninth). (CNBC, 2016)

- Colorado has the nation's ninth-best tax climate for entrepreneurship and small business. (Small Business & Entrepreneurship Council, 2016)
- Colorado ranked among the top five "Best States for Small Business Friendliness" in 2016. Fort Collins received an "A" grade and Denver received an "A-" grade for overall friendliness. (Thumbtack.com, 2016; Ewing Marion Kauffman Foundation, 2016)

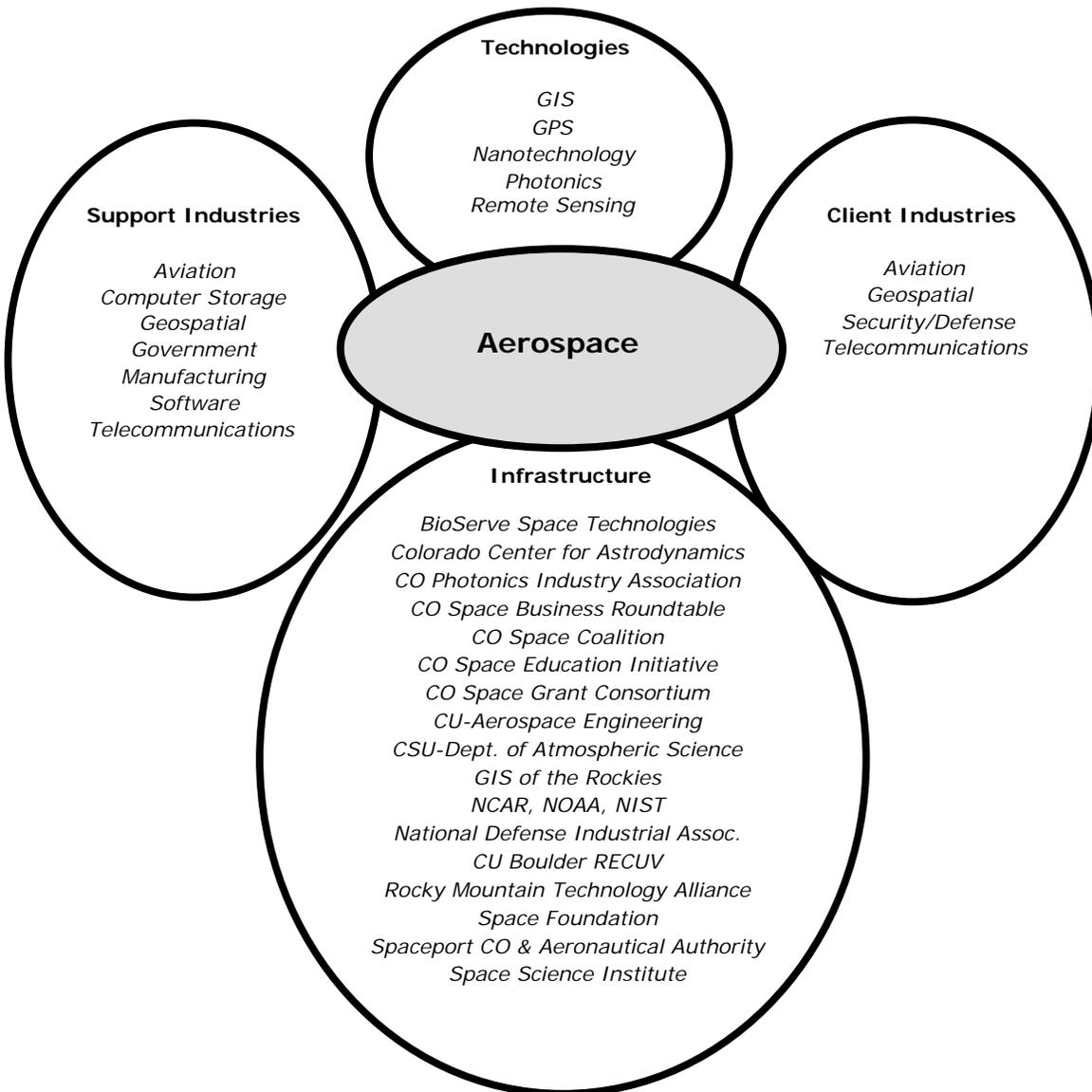
Aerospace Industry Cluster Definition

NAICS Code*	NAICS Description	SIC Code	SIC Description
331512 (P)	Steel investment foundries	3324-9901	Aerospace investment castings, ferrous mfg.
331524 (P)	Aluminum foundries (except die-casting)	3365-0201	Aerospace castings, aluminum mfg.
331529 (P)	Other nonferrous metal foundries (except die-casting)	3369-9901	Aerospace castings, nonferrous: except aluminum mfg.
332111 (P)	Iron & steel forging	3462-05	Missile & ordnance forgings mfg.
332112 (P)	Nonferrous Forging	3463-02	Nonferrous missile & ordnance forgings mfg.
332313 (P)	Plate work mfg.	3443-1104	Space simulation chambers, metal plate mfg.
332813 (P)	Electroplating, plating, polishing, anodizing & coloring	3471-0204	Decontaminating & cleaning of missile or satellite parts mfg.
332993 (P)	Ammunition (except small arms) mfg.	3483-0101	Arming & fusing devices for missiles mfg.
332993 (P)	Ammunition (except small arms) mfg.	3483-9910	Missile warheads mfg.
333314 (P)	Optical instrument & lens mfg.	3827	Optical instruments & lenses
334220 (P)	Radio & television broadcasting & wireless communications equipment mfg.	3663-9910	Space satellite communications equipment mfg.
334511	Search, detection, navigation, guidance, aeronautical, & nautical system & instrument mfg.	3812	Search, detection, navigation, guidance
336414	Guided missile & space vehicle mfg.	3761	Guided missiles & space vehicles
336415	Guided missile & space vehicle propulsion unit & propulsion unit parts mfg.	3764	Space propulsion units & parts
336419	Other guided missile & space vehicle parts & aux. equipment mfg.	3769	Space vehicle equipment NEC
339113 (P)	Surgical appliance & supplies mfg.	3842-0113	Space suits mfg.
423860 (P)	Transportation equipment & supplies (except motor vehicle) merchant wholesalers	5088-0300	Aircraft & space vehicle supplies & parts - wholesale trade
423860 (P)	Transportation equipment & supplies (except motor vehicle) merchant wholesalers	5088-0305	Guided missiles & space vehicles – wholesale trade
423860 (P)	Transportation equipment & supplies (except motor vehicle) merchant wholesalers	5088-0307	Space propulsion units & parts – wholesale trade
517919 (P)	All other telecommunications	4899-9902	Missile tracking by telemetry or photography
541712 (P)	Research and development in the physical, engineering, and life sciences (except biotechnology)	3761	Guided missiles and space vehicles
927110	Space research and technology	9661	Space research and technology
927110	Space research and technology	4789-9902	Space flight operations, except government

*(P) indicates that only part of the NAICS industry category is represented in the industry cluster definition.

Note: NEC indicates "not elsewhere classified."

Aerospace Industry Cluster Relationships



For additional information, contact us:



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