AEROSPACE
Colorado Industry Cluster Profile

The aerospace cluster includes companies that develop products and systems for commercial, military, and space applications. Colorado's aerospace companies provide a complete spectrum of research and development, design, and manufacture of guided missiles, space vehicles, satellites and other communications equipment, and navigation and detection instruments. Companies in the aerospace cluster also produce planetary spacecraft and launch systems and provide mission support.

Colorado is an aerospace center of excellence with support from four military commands, eight major space contractors, National Aeronautics and Space Administration (NASA) research activities, and several universities involved in expansive space research. Colorado has 150 businesses classified as aerospace companies, and in total more than 400 companies and suppliers providing space-related products and services. Direct employment in the aerospace cluster totals 24,890 private sector workers and approximately 28,750 military personnel. These 53,640 workers in the aerospace cluster support an additional 110,250 workers in all industries throughout Colorado, bringing direct and indirect employment supported by the aerospace cluster to 163,890 workers.

Colorado's aerospace companies played key roles in four major NASA missions and a number of other missions in 2011.

- Centennial-based United Launch Alliance (ULA) celebrated 12 launch successes in 2011, including an Atlas V rocket carrying NASA's Juno probe to Jupiter in August 2011. The solar-powered spacecraft was constructed by Lockheed Martin Space Systems Company to study the planet's upper atmosphere and investigate Jupiter's internal dynamics and will reach the planet in August 2016. ULA also launched a Delta II rocket in June 2011 to deliver the Aquarius/SAC-D spacecraft designed to measure Earth's climate system and map global ocean salinity.
- NASA launched the Gravity Recovery and Interior Laboratory (GRAIL) mission aboard ULA's Delta II rocket in September 2011. The dual spacecraft was constructed by Lockheed Martin Space Systems Company and will orbit the moon for several months to determine the structure of the lunar core and provide scientists with greater understanding of the moon's thermal evolution.
- Ball Aerospace & Technologies Corp. constructed its next generation Earth-observation satellite that flew aboard the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) in October 2011. Launched by a ULA Delta II rocket, NPP's mission bridges the older Earth Observing System (EOS) satellites and the next generation Joint Polar Satellite System (JPSS) to provide scientists and meteorologists with near-term weather data and a host of climate monitoring data.
- NASA launched the Mars Science Laboratory (MSL) in November 2011 as part of its long-term effort of robotic exploration on the planet. Lockheed Martin Space Systems Company constructed the protective aeroshell system for the MSL during its two-year mission to assess the planet's ability to support habitability. ULA's Atlas V served as the launch vehicle for MSL. Sierra Nevada Corporation Space Systems delivered the descent system that will lower the Curiosity rover to the planet's surface, and also built the precision gearbox assemblies that powers the rover's instruments needed to drill, collect, and analyze samples of the Martian soil.

Colorado serves as a catalyst for cultivating commercial spaceflight development and payload integration.

- In November 2011, Colorado Gov. John Hickenlooper announced the state's intent to pursue commercial spaceport designation, with Adams County's Front Range Airport a likely site for Colorado's first spaceport. Colorado was long viewed as too populous to support a spaceport, but rapidly changing technology is paving the way for horizontal launch facilities and a broad range of spaceport activity and commercial opportunities such as point-to-point launches and landings, suborbital flight, spacecraft R&D and manufacturing, crew training, Unmanned Aerial Vehicle activity, and platforms for advanced scientific research. Front Range Airport has begun the process of applying for a spaceport license, which could be granted by the Federal Aviation Administration by the end of 2012.
- Sierra Nevada Corporation, located in Louisville, is developing Dream Chaser, a space transportation system to carry passengers and cargo in sub-orbital and orbital flights, including trips to and from the International Space Station (ISS). In April 2011, the company received an $80 million contract from NASA for the ongoing development of Dream Chaser in the second round of NASA's Commercial Crew Development (CCDev) Program funding.
- In November 2011, ULA successfully completed the Design Equivalency Review, the second milestone for obtaining human spaceflight certification for the Atlas V rocket as part of NASA's CCDev Program.
- NASA awarded Highlands Ranch-based launch services company UP Aerospace Inc. two contracts to integrate and fly technology payloads on its SpaceLoft rocket for NASA's commercial, suborbital reusable platforms. NASA is purchasing flights from private companies for later use by scientists and engineers. UP Aerospace was one of seven companies selected for NASA contracts totaling $10 million.
- The Boeing Company selected ULA's Atlas V rocket to launch its Crew Space Transportation-100 (CST-100) vehicle. Boeing designated the CST-100 as a commercial spaceflight capsule and could be ready for test flights in 2015. Boeing is one of several entities designing commercial spaceflight vehicles for use on the Atlas V.
- Lockheed Martin Space Systems Company unveiled a virtual reality lab enabling engineers and technicians to test and validate products and processes before releasing them. The Collaborative Human Immersive Laboratory includes capabilities such as digital engineering, CAVE 3D visual computing environmental technologies, immersive engineering, and motion capture.
- Boulder-based Southwest Research Institute received a NASA contract to provide payload integration services to Virgin Galactic, XCOR, and Masten Space Systems. The award expands the company's 30-year history of suborbital research and payload integration expertise.
- NASA and ULA partnered to determine whether ULA's Atlas V rocket can effectively launch commercial space vehicles. If NASA tests can demonstrate the Atlas V's safety and reliability in a manned flight to the ISS, the rocket could prove useful for a host of companies pursuing commercial spaceflight. ULA and NASA will conduct the testing through a non-funded agreement.

A number of 2011 contract awards to Colorado aerospace companies continued to facilitate high-tech aerospace technologies.

- The National Geospatial-Intelligence Agency (NGA) awarded Longmont-based DigitalGlobe Inc. a $37.9 million contract to provide cloud-free mapping, online delivery of space images within 24 hours, and high-resolution images of high-priority sites. The real-time commercial imagery will serve defense and intelligence needs.
- Ball Aerospace received a $36 million military contract to create a missile launch monitoring program. The Moire Program is based on specialized optics and images and will also include real-time video. Nearly three-quarters of Ball's work on the program will occur in Broomfield and is slated for completion in 2013.
- The U.S. Air Force awarded Ball Aerospace a $17 million contract for data processing improvements on two military drones. The Ball team will provide radar, spectral capabilities, and new net-centric situational awareness capability to the Global Hawk and Predator drones.

- ShapeTech, a Colorado Springs-based engineering enterprise, was awarded a four-year, $5.5 million contract to provide modeling and simulation support to the U.S. Strategic Command's Exercise and Training Directorate. The contract will include software engineering, network engineering, and on-site modeling and simulation support for combatant commanders worldwide.
- Lockheed Martin Space Systems Company received a $2 million U.S. Air Force contract to support the Reusable Booster System (RBS) Flight and Ground Experiments program. Under the contract, Lockheed will build a demonstration version of the U.S. Air Force's RBS Pathfinder, which is a reusable booster rocket that could launch as early as 2015.
- NASA awarded two Colorado companies $1.2 million to study space refueling. Ball Aerospace and Lockeed Martin Space Systems Company will explore the possibility of refueling space vehicles with cryogenically stored fuels and the technologies associated with the refueling process.
- Boulder-based Next Giant Leap (NGL) received a $1 million contract from Massachusetts-based Draper Laboratories to advance its moon landing technology and pursue the $30 million Google Lunar X Prize in 2012. Under the contract, NGL will develop a guidance, navigation, and control system testbed for a moon landing vehicle. NGL is part of the Louisville-based incubator, eSpace.
- The U.S. Air Force Academy's Center for Space Situational Awareness Research received an $800,000 U.S. Air Force Office of Scientific Research grant to develop surveillance capability to track and detect space debris and other objects. The Academy research center will form a network of small telescopes for satellite tracking at Ft. Lewis College in Durango, Otero Junior College in La Junta, Colorado Mesa University in Grand Junction, and Northeast Junior College in Sterling. Under the grant, the four colleges will receive a permanent telescope observatory for research, course work, and open houses to inspire students to consider careers in science, technology, engineering, and mathematics.
- Littleton-based ADA Technologies received a $100,000 NASA contract to develop an advanced polymer material for spacecraft. The material will greatly increase the composite durability and damage tolerance, resulting in improved efficiency and increased lifespan of space exploration vehicles.

Other developments in Colorado's aerospace cluster included:

- The Colorado Association for Manufacturing and Technology (CAMT) selected Kentucky-based Cumberland & Western Resources as CAMT's development partner for the Aerospace and Clean Energy (ACE) Manufacturing and Innovation Park proposed for the former Agilent campus in Loveland. The initial project will include two 50,000-square-foot buildings that will house shared services including testing and laboratories. At completion, the four-building park will give companies access to existing research expertise and the assistance needed to rapidly commercialize aerospace and energy technologies.
- NASA granted Lockheed Martin Space Systems Company final approval to continue work on the Orion spacecraft. Orion's future had been uncertain as NASA cancelled Constellation, the spacecraft's parent project, in 2010. However, NASA decided to pursue the project and rebranded Orion as the Multi-Purpose Crew Vehicle (MPCV). Lockheed designed the craft to carry astronauts into deep space and is on schedule for its first flight test in 2013, operational flights in 2016, and manned flights in 2021. In conjunction with the MPCV's completion, NASA and shuttle rocket contractor Alliant Techsystems Inc. unveiled plans to build an $18 billion deep space rocket that will carry the MPCV into space. The Space Launch System—the largest U.S. rocket since the Saturn V rockets constructed for moon missions—will carry the six-person MPCV and will serve as a backup for ISS flights.
- Lockheed Martin Space Systems Company opened its new $35 million, 41,000-square-foot Space Operations Simulation Center. The center houses a full-sized replica of the ISS docking area that astronauts and engineers will use to test the MPCV, which will also be used as a rescue craft for astronauts at the ISS, and could be ready for use by 2016.
- DigitalGlobe Inc. selected Lockheed Martin's Commercial Launch Services to oversee the launch of the company's WorldView-3 satellite, with ULA providing an Atlas V rocket for the mission. Ball Aerospace and ITT Exelis will construct the WorldView-3 satellite to

collect high-resolution space images for various government agencies and private companies. The satellite will be DigitalGlobe's fourth satellite to be placed in orbit and is scheduled to launch in 2014.

- Lockheed Martin Space Systems Company began assembling and testing the next generation of Global Positioning System (GPS) satellites at its Waterton Campus facility. The U.S. Air Force selected the company to design and build the prototype next generation GPS III satellite that will improve upgradeability, increase lifespan, and offer a more powerful signal. A prototype model is scheduled to launch in May 2014.
- Ball Aerospace opened a $4.1 million expansion to its Westminster manufacturing facility. The company will use the additional 28,000 square feet to manufacture 48,000 stealth antennas for Lockheed Martin's F-35 Lighting II fighter jet. Ball also started expansion of its aerospace satellite manufacturing facility in Boulder. The company's expansions will improve its position to attract antenna systems, video technology business, and improve productivity.
- Lockheed Martin Space Systems Company unveiled plans for an $800 million space probe that will collect organic material from asteroid 1999 RQ36 and return it to Earth for analysis in 2023. The NASA mission, called the Origins-Spectral Interpretation-Security-Regolith Explorer (OSIRIS-REx), will launch in 2016 and will be the space agency's third planetary exploration mission. The asteroid mission will also bring at least $3 million in funding to University of Colorado Boulder's (CU-Boulder) research team to study the asteroid's mass and gravity.
- California-based XCOR Aerospace Inc. and ULA partnered to develop lighter-weight, lower-cost rocket engines. Partially as a result of successful results achieved in 2010 to develop new aluminum alloy engine nozzle technology using modern manufacturing techniques, the new engine technology could lead to more-capable space flights and new engines for ULA's Atlas V and Delta IV launch vehicles.

Colorado's research institutions and federal laboratories offer world-renowned excellence in innovative space technologies to the aerospace industry.

- The National Science Foundation Association of Universities for Research in Astronomy selected CU-Boulder to house the National Solar Observatory (NSO) headquarters. The NSO is currently building the 4-meter Advanced Technology Solar Telescope, which is scheduled to begin observations from Maui, Hawaii, in 2016. The NSO plans to add scientists, engineers, and administration staff to manage all data analysis and instrument development.
- eSpace: The Center for Space Entrepreneurship is a partnership between CU-Boulder and Sierra Nevada Corporation's Space Systems Group. eSpace provides entrepreneurial space companies the support to commercialize aerospace technologies and develop a diversified 21st century workforce to catalyze their growth. Companies involved in one of the Boulder center's two programs, the eSpace Incubator, generated a 362 percent return on the incubator's investment since October 2010. The second program, the Straight to Space workforce initiative, has helped find aerospace job placement for workers since its inception.
- The state of Colorado, CAMT, and NASA signed the Space Act Agreement in 2010. The agreement—the first of its kind in the nation—created the Technology Acceleration Program (TAP) to shorten the time between product development and production of aerospace and cleantech technologies by allowing existing companies to leverage existing NASA and National Renewable Energy Laboratory (NREL) resources. Additionally, the partnership will help grow the state's workforce and engage in joint development projects in these industries.
- The National Oceanic and Atmospheric Administration (NOAA) and the University Corporation for Atmospheric Research (UCAR) are dedicated to exploring and monitoring the Earth's atmosphere. The Cooperative Institute for Research in the Atmosphere (CIRA) is a partnership between NOAA and Colorado State University (CSU). CIRA provides global and regional climate research, satellite observations, and air quality measurements.
- The Laboratory for Atmospheric and Space Physics (LASP) at CU-Boulder serves as one of the country's premier laboratories for designing, building, and controlling spacecraft and scientific instruments. A proven training ground for future space scientists and

engineers, LASP is the only research institution that has designed and built space instruments for NASA that have been launched to every planet in the solar system. NASA awarded LASP a $6.7 million contract in 2010 to design testing instruments for Solar Probe Plus, a fast-traveling spacecraft that will approach the sun and gather data on solar radiation. LASP will develop the probe's antennae, data processing equipment, and other spacecraft components. The Solar Probe Plus is scheduled to launch in 2018.

- In 2010, NASA granted LASP approval to start building a Mars space probe mission. NASA awarded LASP the largest research award in CU-Boulder's history totaling $485 million for the Mars Atmosphere and Volatile Evolution, or MAVEN, mission. The MAVEN mission will gather data about the planet's atmosphere and its potential for harboring life. Lockheed Martin Space Systems Company is constructing the MAVEN probe and will most likely launch in 2013 using ULA's Atlas V rocket for the nine-month mission.
- The Space Foundation is a Colorado Springs-based organization that supports all sectors of the space community across the globe. Founded in 1983, the Space Foundation is a leader in space activities, educational support, major space events, and space research and development. The Space Foundation also hosts the annual National Space Symposium, which is considered the premier forum for aerospace in the nation. The 27th National Space Symposium in 2011 had the best attendance, the most expansive exhibits, and the greatest diversity of events in the symposium's history. Symposium events included nearly 100 speakers, inspiring awards, programs for New Generation young space professionals, and special programs and events for 1,800 local students and 95 teachers from 18 states. In all, the symposium had representation from 39 countries.
- The Space Foundation and CSU at Pueblo (CSU-Pueblo) partnered to provide internship opportunities, in-service instruction, distance education, and service and research opportunities to pre-K-12 educators and students. Under the agreement, the Space Foundation will provide space-related internship opportunities for students enrolled at CSU-Pueblo and will deliver Space Across the Curriculum courses to pre-K-12 educators to improve their science teaching skills and increase awareness of space careers. CSU-Pueblo will also create an emphasis on space studies through its continuing education programs and School of Education's Master of Education program.

In addition to research assets, the aerospace cluster also has the support of public-private partnerships. The Colorado Space Coalition (CSC), a group of industry stakeholders, works to make Colorado a center of excellence for space. 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.

Military Bases

Colorado is home to a diverse mix of Department of Defense (DoD) military installations that foster important synergies between private aerospace companies and government entities.

- **Buckley Air Force Base** in Aurora is home to the 460th Space Wing and supports more than 81 tenant organizations that represent all branches of the military. Tenants are located both on and off base.
- **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 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), and the 302nd Airlift Wing (AFRC), as well as a number of other smaller tenant units. The 21st Space Wing 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 agencies activities.
    - **Schriever Air Force Base** is the home of the 50th Space Wing as well as the Space Innovation and Development Center (SIDC), the 310th Space Wing (AFRC), the Missile

Defense Integration and Operations Center (MDIOC), the Joint Functional Component Command – Integrated Missile Defense (JFCC-IMD), and numerous tenant organizations. The 50th Space Wing is responsible for the operation and support of more than 170 DoD satellites and 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 for the U.S. Air Force. The Academy is home to the 10th Air Base Wing responsible for providing base-level support activities, including medical, engineering, communications, base logistics, fire response, services, security, and other key support for military and civilian personnel. The Academy has 14 research centers and two Air Force policy institutes dedicated to science, air, space, renewable energy, cyber warfare response, and national and space security and conducts more than $52 million in research annually in the areas of aeronautics and astronautics. With nearly 90 Cooperative Research and Development Agreements, the Academy's cadets and faculty contribute to academic and commercial research, defense-related projects, and partner with supporting agencies.

Military Aerospace Profile

Government Installation	Personnel
Buckley Air Force Base	9,600
U.S. Air Force Academy	7,760
Peterson Complex*	8,470
Schriever Air Force Base	2,920
Total Employment	**28,750**

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

Private Aerospace Economic Profile

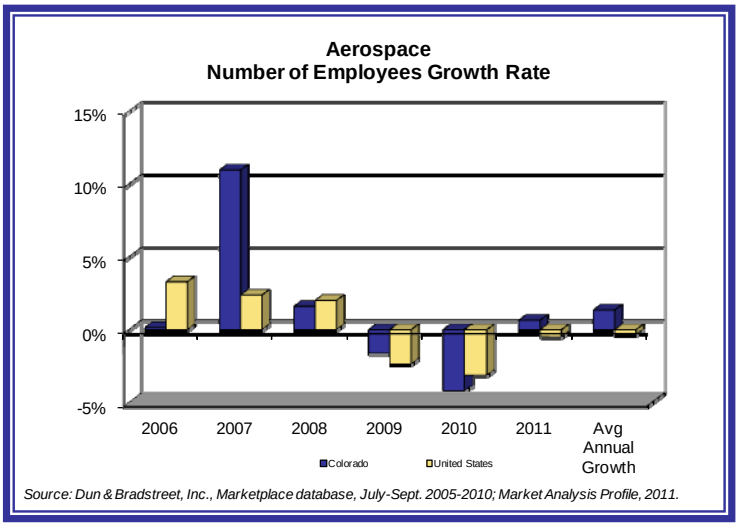
The aerospace cluster consists of 19, six-digit North American Industry Classification System (NAICS) codes including search, detection, and navigation instrument manufacturing; guided missile and space vehicle manufacturing; satellite telecommunications; and research and development.

Colorado ranked first in the nation for its 2011 concentration of private aerospace employment. Colorado's aerospace cluster ranked second out of the 50 states in total private sector employment.

	Colorado	U.S.
Direct Employment, 2011	24,890	356,270
Number of Direct Companies, 2011	150	4,970
One-Year Direct Employment Growth, 2010-2011	0.6%	-0.5%
Five-Year Direct Employment Growth, 2006-2011	6.9%	-1.7%
Avg. Annual Direct Employment Growth, 2006-2011	1.3%	-0.3%
Direct Employment Concentration	1.0%	0.2%

Note: Data reflects only private aerospace employment in Colorado and excludes military employment.
Sources: Dun & Bradstreet, Inc. Marketplace database, July-Sept. 2006-2010; Market Analysis Profile, 2011; Development Research Partners.

Private Aerospace Employment



Source: Dun & Bradstreet, Inc., Marketplace database, July-Sept. 2005-2010; Market Analysis Profile, 2011.

- In 2011, aerospace companies accounted for one percent of Colorado's total employment base, compared with a 0.2 percent concentration nationally.
- The aerospace cluster directly employed about 24,890 workers in Colorado.
- Total Colorado aerospace employment increased 6.9 percent between 2006 and 2011, compared with a 1.7 percent decline nationwide. Aerospace employment growth in Colorado averaged 1.3 percent per year over the past five years.
- Approximately 92 percent of Colorado's aerospace employees manufactured search and navigation equipment or guided missiles and space vehicles.
- Most of Colorado's aerospace employees worked in Arapahoe (32 percent), Jefferson (23 percent), El Paso (21 percent), and Boulder (19 percent) Counties.

Wages

Colorado's aerospace cluster payroll totaled $2.8 billion in 2010. The 2010 average annual salary for an aerospace worker in Colorado was $113,830, compared with the national average of $90,870.

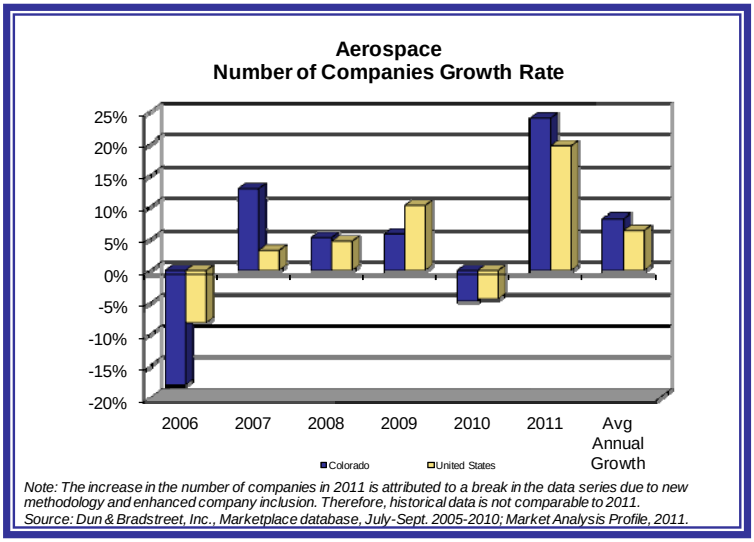
Colorado Occupational Salaries, 2010 Annual Average

Aerospace Engineers	$101,610
Atmospheric and Space Scientists	$99,510
Software Developers, Systems Software	$97,430
Aerospace Engineering and Operations Technicians	$63,620
Computer-Controlled Machine Tool Operators, Metals and Plastic	$37,920

Source: U.S. Bureau of Labor Statistics, State Occupational Employment and Wage Estimates, May 2010, www.bls.gov.

Private Aerospace Companies

- About 150 aerospace companies operated in Colorado in 2011.
- Seventy percent of Colorado's aerospace companies manufactured search and navigation equipment (45 percent) and optical instruments and lenses (25 percent).
- About 47 percent of Colorado's aerospace companies employed fewer than 10 people, while 14 percent employed 250 or more.
- Seventy-four percent of the state's aerospace companies were located in Boulder (26 percent), El Paso (18 percent), Arapahoe (17 percent), and Jefferson Counties (13 percent).



Note: The increase in the number of companies in 2011 is attributed to a break in the data series due to new methodology and enhanced company inclusion. Therefore, historical data is not comparable to 2011.
Source: Dun & Bradstreet, Inc., Marketplace database, July-Sept. 2005-2010; Market Analysis Profile, 2011.

Major Aerospace Contractors

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

- **Ball Corporation** employs about 3,500 people in Colorado. Of these workers, about 2,100 are employed by **Ball Aerospace & Technologies Corp.** in Boulder County. The company provides imaging and communications equipment, climate monitoring technology, software, and services to its government and commercial aerospace customers. www.ballaerospace.com

- **The Boeing Company** employs more than 2,400 workers in Colorado and has several major defense activities around the state, including missile defense, space and intelligence support, services and support operations, and cyber operations, as well as Boeing military aircraft at Fort Carson. www.boeing.com

- **ITT Exelis** has two divisions in Colorado. The **Exelis Mission Systems Division** in Colorado Springs employs nearly 600 people and provides government, commercial, and international customers solutions for missile defense, satellite communications, climate monitoring, command, and control. The division also provides full logistics support services and supplies GPS navigation systems. The **Exelis Visual Information Solutions** group employs 160 people in Boulder. The company provides software solutions, data products, and training for commercial, research, and government markets. www.exelisinc.com

- **Lockheed Martin** employs more than 9,100 people in Colorado, nearly 5,400 of whom work at the **Space Systems Company** unit headquartered in Jefferson County. Space Systems designs, develops, tests, and manufactures advanced technology systems for its government and commercial customers. The company also develops products ranging from human space flight systems and navigation, meteorological, and communications systems to laser radar 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, information technology, marine and space systems, and battle management. The company also works with advanced aircraft, unmanned aerial vehicles, naval vessels, and space technology. Northrop Grumman employs more than 2,300 people throughout Colorado. www.northropgrumman.com

- **Raytheon Company** employs nearly 2,500 people throughout the state, with the majority of employees concentrated 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 and growing presence in Colorado. SNC's **Space Systems Group**, located in Louisville, develops small spacecraft mechanical subsystems, satellite components, and space propulsion systems for government and commercial customers. The company's **Intelligence, Surveillance and Reconnaissance Group** in Centennial provides products and services for a variety of airborne systems. SNC employment in Colorado is approaching 600 with plans to add additional employees in the next few years. www.sncorp.com

- **United Launch Alliance (ULA)** is a joint venture between Lockheed Martin's Atlas and Boeing's Delta launch divisions and celebrated its fifth year of operation in December 2011. ULA employs about 1,700 of its 3,600-person U.S. workforce at its Centennial headquarters. Most of ULA's management, engineering, and mission support functions are concentrated in Colorado, while most assembly and integration operations are concentrated in Alabama, Texas, and California. Since company formation in 2006, ULA has celebrated 56 successful Delta II, Delta IV, and Atlas V rocket launches. www.ulalaunch.com

Additional Major Private Aerospace Companies

- ABSL Space Products
  www.abslspaceproducts.com
- Aeroflex Incorporated
  www.aeroflex.com
- DigitalGlobe, Inc.
  www.digitalglobe.com
- GeoEye, Inc.
  www.geoeye.com
- Global Near Space Services
  www.globalnearspace.com
- Honeywell Technology Solutions
  www.honeywell.com
- IHS Aerospace & Defense
  http://aero-defense.ihs.com
- L-3 Communications
  www.l-3com.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
- UP Aerospace Inc.
  www.upaerospace.com

Key Reasons for Aerospace Companies to Locate in Colorado

Colorado is a top aerospace location offering:

1. The ability to recruit and retain technical and scientific employees

- Of Colorado's adult population, about 36 percent has completed a bachelor's or higher-level degree. That makes Colorado the second-most highly educated state in the nation behind Massachusetts. (U.S. Census Bureau, 2010 American Community Survey)
- Colorado ranked 14th in the number of science and engineering graduate students per 1,000 individuals ages 25 to 34 years old in 2007. Universities such as the Colorado School of Mines, the University of Colorado Boulder (CU-Boulder), and Colorado State University (CSU) all offer competitive science and engineering doctorate programs and research facilities. (National Science Foundation, 2011)
- Colorado ranked 11th in the number of patents issued per one million people in 2010. A high number of patents indicate a high rate of innovation. (U.S. Patent and Trademark Office, 2011; U.S. Bureau of Economic Analysis, 2011)
- Colorado ranked among the top five states in the nation for entrepreneurship in 2010, according to the annual *Kauffman Index of Entrepreneurial Activity*. The index measures the percentage of the adult, non-business owner population that starts new businesses. Colorado's fifth-highest ranking indicates increased innovation with the ability to attract potential investors. (Ewing Marion Kauffman Foundation, 2011)
- Colorado ranked fifth in a Harris survey that asked more than 2,400 U.S. adults where they would most like to live. Colorado ranked third-highest as a desired home state for younger respondents ages 18 to 34. Denver ranked as the 10th-most favored city in a separate Harris survey. (Harris Interactive, 2011)
- The U.S. Department of Labor awarded the Colorado Department of Labor and Employment (CDLE) a $5 million grant in 2011 to retrain and prepare 800 workers for careers in advanced manufacturing, information technology, and STEM (scientific, technology, engineering, and math) capabilities, with a focus on aerospace. The state will partner with local workforce centers, businesses, and nonprofit organizations to target workers for training and skill advancement.

2. Proximity to vendors and customers

- Colorado recipients received more than $1.5 billion in National Aeronautics and Space Administration (NASA) prime contracts in 2010, earning the state a fourth-place ranking

nationally. Major award recipients included Lockheed Martin, Ball Aerospace & Technologies Corp., and the University of Colorado, which received the fourth-largest amount of research funding among public educational institutions in 2010. (National Aeronautics and Space Administration, 2011)

- Colorado's aerospace cluster is anchored by eight large prime contractors: Ball Aerospace, The Boeing Company, ITT Exelis, Lockheed Martin, Northrop Grumman, Raytheon, Sierra Nevada Corporation, and United Launch Alliance.
- Major military operations in the state include Buckley AFB, Peterson AFB, Schriever AFB, and Cheyenne Mountain Air Force Station. In addition, the U.S. Air Force Academy is located outside of Colorado Springs.
- Cheyenne Mountain Air Force Station hosts the NORAD and USNORTHCOM Alternate Command Center and serves as a training site for crew qualification.
- Prime contractors and military installations support more than 400 space-related businesses in Colorado. (Colorado Space Coalition, 2011)
- The U.S. Department of Defense awarded Colorado a Procurement Technical Assistance Center (PTAC) in 2009. The Center provides assistance to businesses in marketing products and services to prime contractors and the federal, state, and local governments at no or nominal cost. The central office for Colorado's PTAC is located in Colorado Springs and a satellite office is located in Jefferson County.

3. Proximity to colleges/universities

- Two academic institutions in Colorado offer nationally ranked aerospace programs or degrees:
  - CU-Boulder offers the nation's 12th-ranked aerospace engineering doctorate program. Strengthening CU-Boulder's position in aerospace engineering are its space research programs, numerous aerospace-focused research centers, and membership in the U.S. Air Force Space Education Consortium. (*U.S. News & World Report*, 2010)
  - The U.S. Air Force Academy in Colorado Springs ranked second among schools that do not offer doctoral degrees for its undergraduate aerospace engineering program and offers majors ranging from astronautical engineering to space operations and computer science. (*U.S. News & World Report*, 2010; Colorado Space Coalition, 2011)
- The University of Colorado system received record research and development expenditures totaling more than $684 million in fiscal year 2009. The university ranked 12th among the nation's public universities for research and development awards and ranked fifth for federally funded research expenditures. (National Science Foundation, 2011)
- CU-Boulder's Laboratory for Atmospheric and Space Physics is the only research institution that has designed and built space instruments for NASA that have launched to every planet in the solar system.
- eSpace: The Center for Space Entrepreneurship—a partnership between the University of Colorado and Sierra Nevada Corporation's Space Systems Group—is a not-for-profit organization dedicated to creating new entrepreneurial space companies, commercializing aerospace technologies created within these companies, and developing the aerospace workforce to support them. Since forming in 2009, the center has created three successful aerospace programs: eSpace Incubator, Straight to Space workforce initiative, and the Venture Design program.
- The Colorado School of Mines' 8th Continent Project is a comprehensive effort to integrate space technology and resources in the global economy. Developed in 2008, the project links developing aerospace companies with investors, legal resources, and public relations assistance to develop the next generation of space business ventures.
- Metropolitan State College of Denver's Robert K. Mock World Indoor Airport is a large flight training and simulation laboratory that features the Advanced Aviation & Aerospace Flight Training program. The laboratory's 18 computer stations utilize AGI Corporation's Satellite Toolkit software system for simulating space missions and orbital dynamics.

- CSU is nationally recognized for its programs and institutes dedicated to atmospheric science and research. The university is also home to the Cooperative Institute for Research in the Atmosphere (CIRA), which was established in 1980 as the mechanism to promote synergisms between university scientists and its ongoing partnership with the National Oceanic and Atmospheric Administration (NOAA). Since its inception, CIRA has expanded and diversified its mission to coordinate with other federal agencies including NASA, the National Park Service, the U.S. Forest Service, the Federal Aviation Administration (FAA), the Environmental Protection Agency, and the Department of Defense. (Colorado State University, 2011)
- The FAA established a Center of Excellence for Commercial Space Transportation, of which CU-Boulder is a key member. The center focuses on four research areas including commercial human space flight, space commerce, space launch operations and traffic management, and launch vehicle systems. The center is a partnership of government, industry, and academic institutions that will address current and future challenges of commercial space transportation.
- Three institutions in Colorado—CU-Boulder, the Colorado School of Mines, and the University of Denver—are members of the Universities Space Research Association, with graduate programs in space sciences or engineering.
- CU-Boulder is the only university outside of the Naval Postgraduate School to have two astronaut alumni on its faculty. Former astronauts Jim Voss and Joe Tanner serve as faculty in the Department of Aerospace and Engineering Sciences and bring 43 years of combined experience at NASA. (University of Colorado, 2011)
- The U.S. Air Force Space Command designated the University of Colorado Colorado Springs as the Space Education Consortium's lead university, which provides courses and curriculum throughout the country to educate the nation's future aerospace workforce. (Colorado Space Coalition, 2011)
- CU-Boulder has several hundred faculty, support staff, and undergraduate and graduate students involved in space-related research, including designing, building, and controlling space instruments and experiments. (University of Colorado, 2011)
- Sixteen of the 19 University of Colorado astronaut alumni have flown on 40 NASA space missions as of 2011, making it one of the highest alumni participation rates among universities in the NASA space program. (University of Colorado, 2011)

4. Low to moderate costs of doing business

- Colorado offers a simple corporate income tax structure based on single-factor apportionment, which allows companies to pay taxes based solely on their sales in the state. Along with few regulatory burdens, Colorado's corporate income tax rate of 4.63 percent is one of the lowest and most competitive tax structures in the nation. (State of Colorado; The Tax Foundation)
- The Tax Foundation ranked Colorado's combined state and local tax burden 12th lowest in the nation in 2009. The percentage of a Coloradan's income paid to state and local taxes represented 8.6 percent of resident per capita income, compared with 9.8 percent of national per capita income. (The Tax Foundation, 2011)
- Colorado ranked sixth in the 2011 *ALEC-Laffer State Economic Competitiveness Index*, which evaluates the link between states' policies and economic performance. Low taxes on income, property and business, restrictive government spending, and the absence of an estate tax boosted Colorado's ranking. (American Legislative Exchange Council, 2011)

5. Pro-business and flexible state and local governments

- Colorado ranked fifth overall on *Forbes*' 2011 "Best States for Business and Careers" list. Rankings were based on each state's business costs and regulations, economy, labor supply, quality of life, and growth prospects. Colorado received its highest rankings for labor supply (first overall) and economic climate and quality of life (10th overall). (*Forbes*, 2011)
- Colorado ranked fifth among the nation's top states for business, according to an annual ranking by *CNBC*. The ranking evaluated each state's composite scores on 43 metrics in

10 broad categories, and Colorado earned top 10 rankings in the categories that measure business friendliness (sixth), quality of life (seventh), and workforce (seventh). (*CNBC*, 2011)

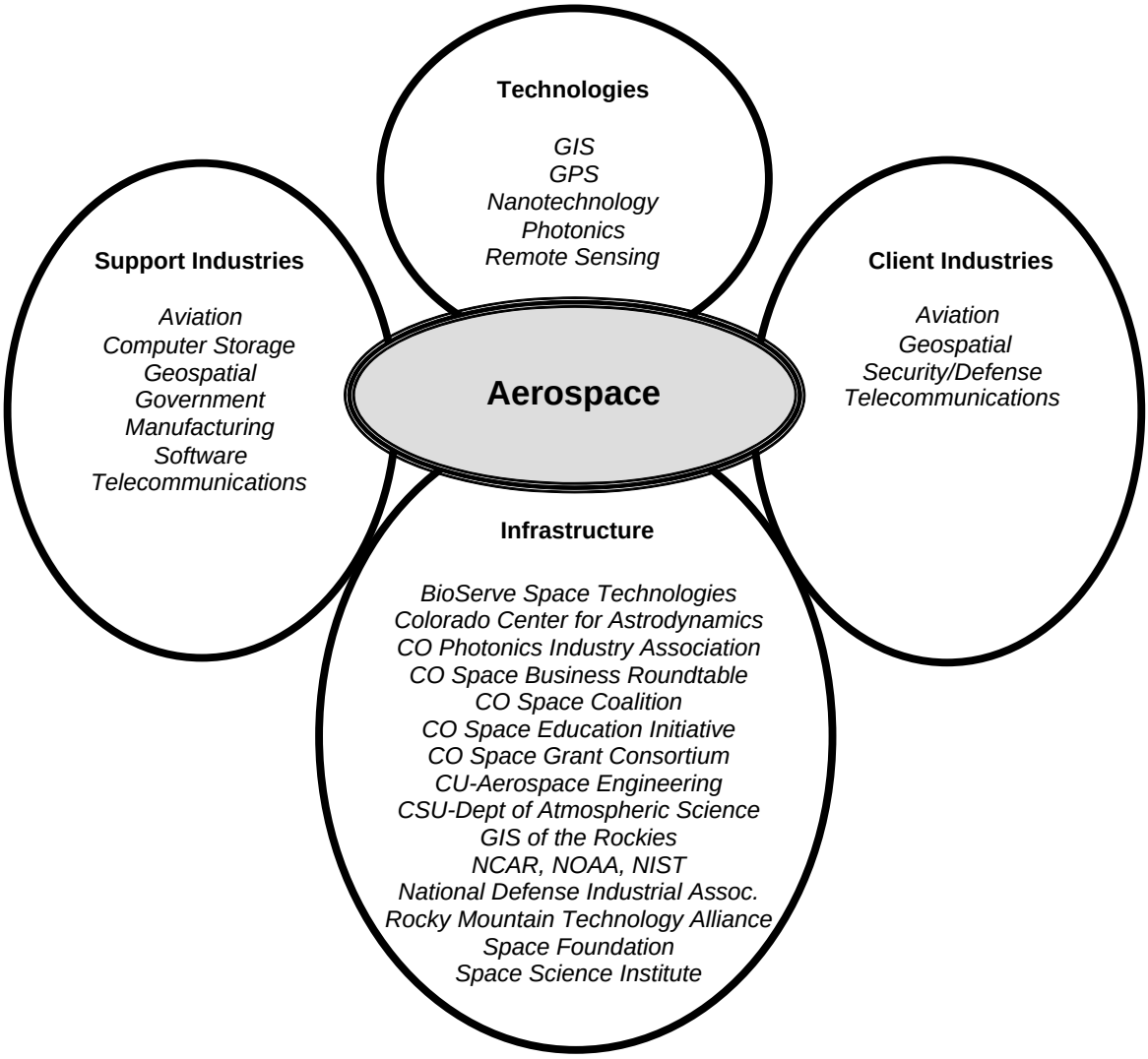
- Colorado ranked second in entrepreneurship and innovation and seventh in workforce development and training, according to the U.S. Chamber of Commerce and the National Chamber Foundation's *Enterprising States* report. The state also received notable recognition in the infrastructure and tax and regulation categories. States with top rankings support job growth and emphasize business-friendly policy, training, infrastructure, and entrepreneurship. (National Chamber Foundation, 2011)
- Colorado has the nation's 10th-best tax climate for small businesses and entrepreneurs, according to the Small Business & Entrepreneurship Council's "Business Tax Index 2011." The index examines each state's tax policies on 18 metrics ranging from rates of property, income, and sales taxes to unemployment insurance taxes and levies on online commerce. (Small Business & Entrepreneurship Council, 2011)
- Colorado has one of the nation's most small business friendly environments. The state ranked among the top 10 in the Small Business & Entrepreneurship Council's 2011 "Small Business Survival Index," which considers property rights, healthcare and energy costs, individual and corporate tax rates, and government spending. The state ranked most favorably for taxes on capital gains and corporate income. (Small Business & Entrepreneurship Council, 2011)
- The Colorado Innovation Network (COIN)—a privately funded alliance designed to foster new technology development across the state's existing and emerging industries—launched in 2011. COIN is part of Gov. John Hickenlooper's economic development plan, Blueprint Colorado, and will eventually operate from a business incubator in the Denver Tech Center.
- The University of Colorado and local entrepreneurs partnered to form a statewide movement to connect new startup companies with entrepreneurial resources as part of the nationwide Startup America Partnership. The initiative—Startup Colorado—will focus on six goals during the first year. The goals include spreading Boulder's entrepreneurial community to Fort Collins, Denver, and Colorado Springs, creating an entrepreneurial summer camp in Boulder for college students, supporting entrepreneurial education, evaluating barriers entrepreneurs face, engaging larger companies in the entrepreneurial ecosystem, and building the Startup Colorado website. (Startup America Partnership, 2011)

Aerospace 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.
331528	(P)	Other nonferrous 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 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 & 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 Cluster Relationships



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