

Industry Overview

The aerospace cluster includes a broad spectrum of companies, products, and systems for commercial, military, and civil space applications. These companies research, develop, design, and manufacture guided missiles, spacecraft, satellites and other communications equipment, as well as navigation and detection instruments. Companies in the aerospace cluster also produce planetary spacecraft and launch systems and provide mission support.

Colorado's aerospace cluster receives support from its abundance of high-tech companies, four military commands, eight major space contractors, National Aeronautics and Space Administration (NASA) research activities, and several universities involved in extensive space research. The state is also at the forefront of innovation and commercial space opportunities. Colorado has nearly 170 businesses classified as aerospace companies, and more than 400 companies and suppliers providing space-related products and services. Direct employment in the aerospace cluster throughout Colorado totals 25,120 private sector workers and approximately 27,740 military personnel.

The Denver South region¹ is a center of high-tech innovation, with support from a highly educated workforce, leading aerospace contractors, key aerospace businesses, and synergy between industry, commercialization, research, and workforce development. The region is home to many world-renowned aerospace leaders such as United Launch Alliance, Sierra Nevada Corporation, UP Aerospace Inc., and Surrey Satellite. Further, the region is well positioned between the diverse mix of Department of Defense military installations in Colorado Springs and Buckley Air Force Base in Aurora. These assets contribute to a higher concentration of aerospace employees than the nine-county Metro Denver and Northern Colorado region², making it an attractive location for companies to locate, expand, and remain competitive. Aerospace employment in the Denver South region represents 21 percent of all aerospace employment in the nine-county region and more than 12 percent of all aerospace companies in the nine-county region are located in Denver South.

2015 Industry Highlights

Launch Missions

The Denver South region's companies played a pivotal role in the development of multiple key space missions and numerous successful launches. Notable company announcements in 2015 included:

- With the launch of the Morelos-3 satellite, Centennial-based United Launch Alliance (ULA) celebrated its 100th successful, consecutive launch since the Boeing-Lockheed Martin Corp. joint venture formed in 2006. Morelos-3 is designed to be part of a Mexsat series of orbiters to improve telecommunications capabilities in remote parts of Mexico.
- Highlands Ranch-based UP Aerospace Inc. launched the 10th SpaceLoft rocket and the 4th mission for NASA's Flight Opportunities Program. The mission marked the debut of UP Aerospace's new Automated Payload Deployment System. The company is currently under contract to perform two additional missions for NASA in 2016.
- ULA launched three of the latest U.S. Air Force (USAF) Global Positioning System (GPS) satellites into orbit. Built by Boeing, these were the 9th, 10th, and 11th of the second-generation, modernized GPS satellites.
- ULA unveiled the design of its next-generation launch rocket, which will replace both the Atlas V and Delta IV launch vehicles. The Vulcan launch system will feature a reusable main engine and a redesigned second stage, and could be operational by 2019.
- ULA launched a NASA cargo mission onboard an Atlas V rocket on behalf of Dulles, Va.-based Orbital ATK, Inc. The company selected ULA to launch its International Space Station (ISS) cargo resupply

¹ The Denver South region consists of zip codes 80111, 80112, 80124, 80126, 80129, 80130, 80134, and 80237.

² 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.

obligations under its contract with NASA. ULA will launch a second NASA cargo mission for Orbital ATK in March 2016.

ULA received notable awards in 2015:

- NASA selected ULA to launch the Solar Probe Plus (SPP) mission aboard a Delta IV rocket. The SPP mission will be the first to fly through the sun's outer atmosphere—the corona—to find the source of the sun's solar wind and will also study what makes the corona so much hotter than the sun's surface. The SPP mission is scheduled to launch in July 2018.
- ULA received a \$132.4 million NASA contract to launch the Tracking and Data Relay Satellite-M (TDRS-M) on an Atlas V rocket to track phone calls and data traffic for the ISS. The TDRS-M satellite is from the third generation of the orbiters to be launched, and the last of three built by Boeing Space Systems under a NASA contract awarded in 2007.

Research and Education Announcements

The Denver South region's educational facilities, universities, and research institutions offer world-renowned programs to educate and train the next generation of aerospace workers.

- Launched in the fall of 2015, the Wings Aerospace Academy is a middle and future high school charter founded by Wings Over the Rockies Air and Space Museum to prepare students for careers in the aviation and aerospace industries. The school has a strong focus on science, technology, engineering and mathematics (STEM) programs and will blend hands-on experiences with online learning.
- ULA unveiled a new program that will offer researchers with CubeSats the opportunity to broaden scientific research in space. ULA's Atlas V rockets will have a standardized payload container that can deploy as many as 24 CubeSats on each launch and University of Colorado Boulder (CU-Boulder) students will have a research CubeSat aboard the first flight. The CubeSat initiative will begin in early 2017.

Satellite Programs

The Denver South region's companies are at the forefront of satellite research, design, development, and supporting technologies. Key developments in 2015 included:

- Arapahoe County-based Bye Aerospace and Thornton-based Ascent Solar Technologies, Inc. partnered to develop the Mars solar electric survey (SOLESA) aircraft that will allow a closer investigation of the Martian surface with greater resolution and flexibility than the orbital satellites currently operating above the surface. With solar power provided by Ascent Solar, the Mars SOLESA will enable the vehicle to fly through the Martian atmosphere.
- ULA launched the U.S. Navy's fourth Mobile User Objective System (MUOS-4) satellite, built by Lockheed Martin Space Systems Co., to upgrade data and voice communications for the military. Launched aboard ULA's Atlas V rocket, the satellite will provide 16 times the network capacity for more than 55,000 military communication terminals worldwide.
- ULA successfully launched the USAF Space Command 5 (AFSPC-5) satellite via an Atlas V rocket. The rocket carried the X-37B Orbital Test Vehicle, a reliable, reusable, unmanned space test platform for the USAF. The Atlas V mission also included the Aft Bulkhead Carrier (ABC) carrying the National Reconnaissance Office's (NRO's) Ultra Lightweight Technology and Research Auxiliary Satellite (ULTRASat).
- Lockheed Martin was selected by Englewood-based EchoStar to provide commercial launch services for the EchoStar 19 communications satellite. Planned for launch in late 2016, the satellite will launch aboard a ULA Atlas V rocket and will help meet the growing demand for HughesNet® high-speed satellite internet service in North America.

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.

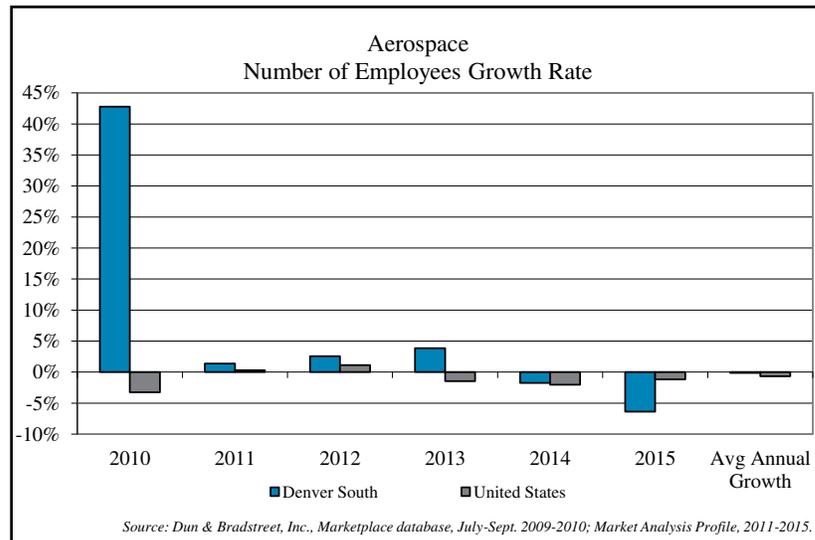
Aerospace Employment and Company Profile, 2015

	Denver South	United States
Direct employment, 2015	4,110	346,090
Number of direct companies, 2015	20	5,090
One-year direct employment growth, 2014-2015	-6.4%	-1.2%
Five-year direct employment growth, 2010-2015	-0.7%	-3.3%
Avg. annual direct employment growth, 2010-2015	-0.1%	-0.7%
Direct employment concentration	1.7%	0.2%

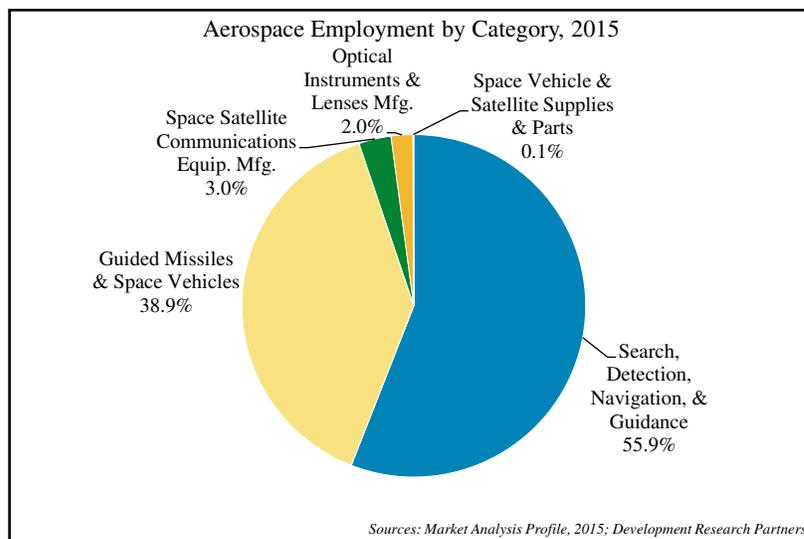
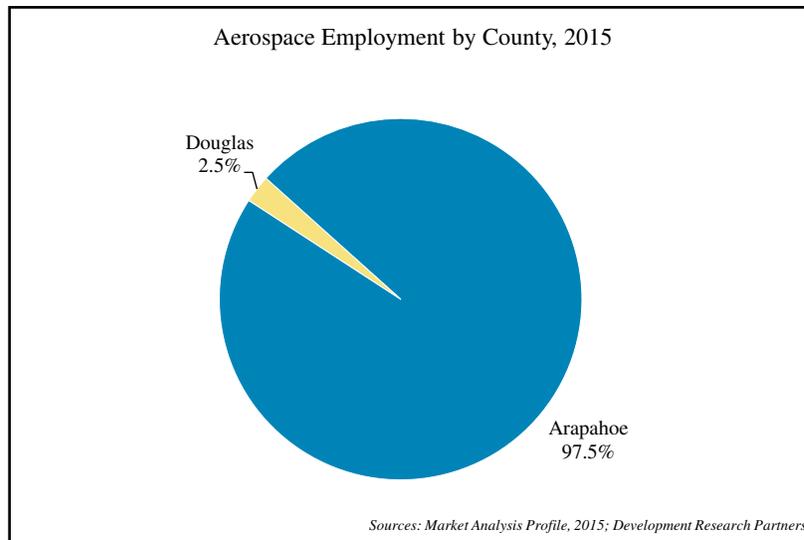
Sources: Dun & Bradstreet, Inc. Marketplace database, July-Sept. 2009-2010; Market Analysis Profile, 2011-2015; Development Research Partners.

Private Aerospace Employment

The Denver South region’s aerospace cluster directly employed about 4,110 workers in 2015. Employment in the region’s aerospace cluster decreased 6.4 percent, compared with a 1.2 percent decrease at the national level. This represented the loss of about 280 aerospace workers in the Denver South region due to company restructurings. From 2010 to 2015, employment in the region’s aerospace cluster fell 0.7 percent, compared with a 3.3 percent decline nationwide. Aerospace companies employed 1.7 percent of the region’s total employment base, compared with a 0.2 percent employment concentration nationwide.



Approximately 20 aerospace companies operated in the Denver South region in 2015. Nearly 27 percent of the region’s aerospace companies employed fewer than 10 people, while 20 percent employed 250 or more.



Major Aerospace Companies

- Echostar
www.echostar.com
- IHS Aerospace & Defense
<http://aero-defense.ihs.com>
- Jeppesen
www1.jeppesen.com
- Lockheed Martin
www.lockheedmartin.com
- SEAKR Engineering, Inc.
www.seakr.com
- Sierra Nevada Corporation
www.sncorp.com
- Surrey Satellite Technology US LLC
www.sst-us.com
- Trimble Rockies
www.trimble.com
- United Launch Alliance
www.ulalaunch.com
- UP Aerospace Inc.
www.upaerospace.com

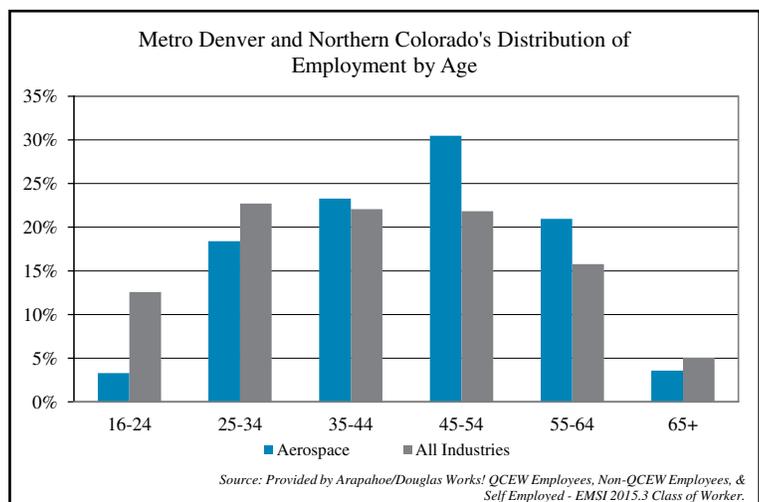
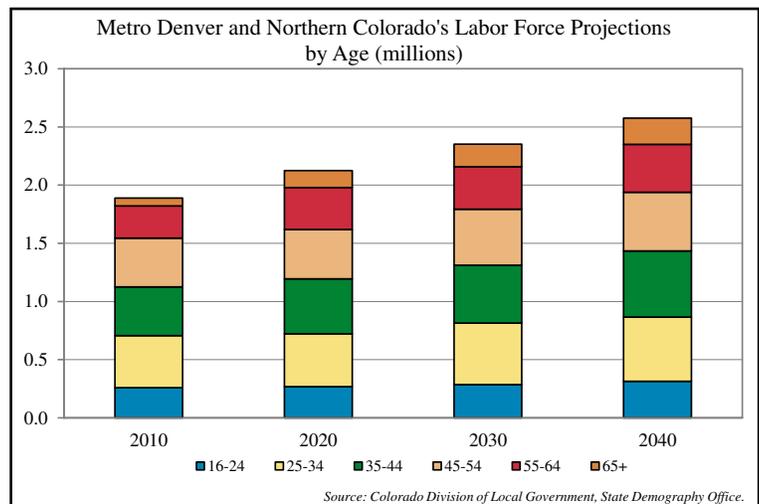
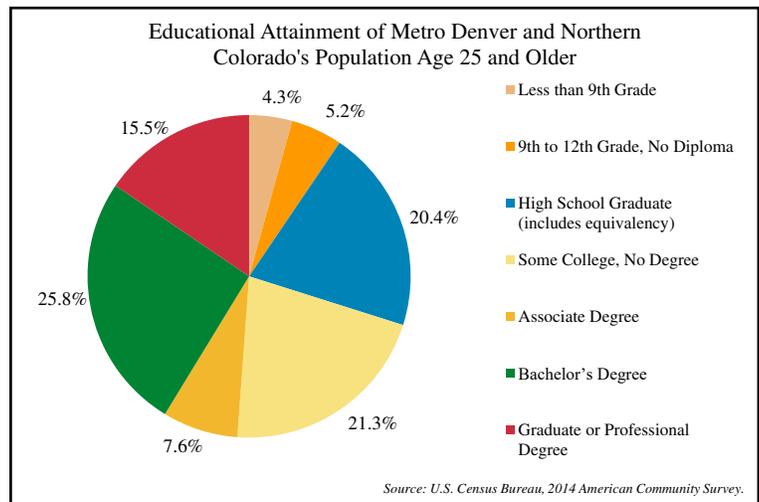
Aerospace Workforce Profile

Many companies choose locations because of the available workforce. With nearly half of the nine-county region's 3.7 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, 41.3 percent are college graduates and 90.5 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 migration. The region's population is expected to grow 59.9 percent from 2010 to 2040, driving a 36.3 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 Denver South region's aerospace industry employs 4,110 people and includes a large pool of talented, well-educated, and highly skilled workers. The aerospace cluster has a larger share of employees (74.7 percent) that are between the ages of 35 and 64 years old in the nine-county region, compared with the age distribution across all industries in the region (59.7 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 2014 average annual salary for an aerospace worker in the nine-county region was \$128,120, compared with the national average of \$103,570. Further, aerospace workers in the nine-county region earned 24 percent more than the national average. Total nine-county payroll in the aerospace cluster exceeded \$2.5 billion in 2014.

Metro Denver and Northern Colorado Aerospace Occupation & Salary Profile, 2015

10 Largest Aerospace Occupations in Metro Denver and Northern Colorado	Total Working Number of Applicants Across All Industries (2015)	Available Applicants (2015)	Number of Graduates (2014)	Median Salary	10th Percentile Salary	25th Percentile Salary	75th Percentile Salary	90th Percentile Salary
1. Aerospace engineers	2,116	75	177	\$120,203	\$77,230	\$96,720	\$144,747	\$168,480
2. Business operations specialists, all other	33,049	705	42	\$72,259	\$38,646	\$51,958	\$95,805	\$124,238
3. Mechanical engineers	5,526	231	541	\$83,741	\$52,478	\$66,560	\$112,486	\$140,816
4. Software developers, systems software	9,863	192	795	\$103,002	\$66,789	\$83,554	\$124,883	\$149,822
5. Software developers, applications	19,367	374	724	\$98,467	\$62,046	\$78,749	\$120,474	\$145,434
6. Atmospheric & space scientists	1,493	18	48	\$91,832	\$60,008	\$73,424	\$114,046	\$137,758
7. Biological technicians	2,229	74	0	\$43,888	\$31,429	\$35,755	\$55,869	\$68,640
8. Electronics engineers, except computer	4,149	75	398	\$95,971	\$61,714	\$75,109	\$122,616	\$147,950
9. Industrial engineers	2,445	104	6	\$88,317	\$55,536	\$70,637	\$108,534	\$128,502
10. Chemists	1,589	81	281	\$73,590	\$39,749	\$51,168	\$101,005	\$124,155

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 Works!; QCEW Employees, Non-QCEW Employees, & Self Employed - EMSI 2015.3 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 nearly 380 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://highered.colorado.gov>.

- Colorado School of Mines www.mines.edu
- Metropolitan State University of Denver www.msudenver.edu
- University of Denver www.du.edu
- Colorado State University www.colostate.edu
- Regis University www.regis.edu
- University of Northern Colorado www.unco.edu
- Colorado State University Global Campus www.colostate.edu
- University of Colorado: Boulder, Denver www.cu.edu
- University of Phoenix-Colorado www.phoenix.edu

Key Reasons for Aerospace Companies to Locate in the Denver South Region and the Surrounding Nine-County Region

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

- Of Colorado's adult population, more than 38 percent has completed a bachelor's or higher-level degree, making Colorado the second-most highly educated state in the nation behind Massachusetts. (U.S. Census Bureau, 2014 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)
- Denver South's surrounding counties (Arapahoe, Denver, and Douglas) issued 339 patents per 1 million people in 2013, slightly below the 422 patents issued per 1 million people in the U.S. (U.S. Patent and Trademark Office, 2015; U.S. Bureau of Economic Analysis, 2015)
- Denver ranked as the third-best city for college graduates, with millennials (ages 20-34) representing 26 percent of the total population. (Rent.com, 2015)
- Lone Tree ranked among the 10 best places in Colorado for millennial job seekers and eight of the 10 cities are within commuting distance to Denver. (NerdWallet, 2015)
- The Denver-Aurora-Broomfield metropolitan statistical area ranked first overall for economic development and job growth in the "Leading Locations for 2015" list. Areas recognized in the study have strong pro-business environments and a highly skilled workforce. (*Area Development*, 2015)
- Metro Denver ranked as the fourth-best metro area for science, technology, engineering, and mathematics (STEM) professionals in 2015. Metro Denver ranked fourth for the projected number of STEM jobs needed in 2018 and seventh for openings per capita for STEM graduates. (WalletHub, 2015)

2. Proximity to vendors and customers

- Four of Metro Denver's eight prime contractors have significant operations in the Denver South region: The Boeing Company, Lockheed Martin, Sierra Nevada Corporation, and United Launch Alliance.
- Metro Denver is home to Buckley Air Force Base, a major military operation which is home to the 460th Space Wing and supports more than 83 tenant organizations that represent all branches of the military. The base also hosts the Colorado Air National Guard 120th Fighter Squadron and its F-16C fighters.
- Colorado ranked second nationwide in National Aeronautics and Space Administration (NASA) prime contract awards—more than \$1.8 billion—in 2014, or 14 percent of the nation's total. The University of Colorado (seventh) and Colorado State University (52nd) ranked among the top-100 public educational institutions for NASA research awards in 2014. (NASA, 2015)

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. In 2015, the Colorado Legislature formed a bipartisan Aerospace and Defense Caucus to further support the continued expansion of aerospace and defense within the state.
- The Advanced Industries (AI) Accelerator Programs include four types of grants and a global business support program to 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. These industries account for nearly 30 percent of the state's wage earnings and nearly 35 percent of the state's total exports. (The Colorado Office of Economic Development and International Trade, 2015)

- 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 supplies. (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 important in initiating commercial spaceflight activities in the state.

4. Low to moderate costs of doing business

- Colorado's simplified corporate income tax structure based on single-factor apportionment 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)
- Colorado's tax climate ranked eighth in the nation for entrepreneurship and small business. (Small Business & Entrepreneurship Council, 2015)
- Denver South's office rental rates averaged \$21.62 per square foot in the first quarter of 2016, making the region's office market highly competitive with other major markets in the U.S. Denver South has more than 42 million square feet of office space and roughly 5,000 acres of ready-to-be-developed land. (CoStar Realty Information, Q1 2016; Denver South Economic Development Partnership, 2015)
- Denver ranked among the top-five safest cities for natural disasters in 2014. (HomeownersInsurance.com, 2014)

5. Pro-business and flexible state and local governments

- Metro Denver ranked No. 1 among *Forbes'* 2015 "Best Places for Business and Careers." Four other Colorado metropolitan areas were included on the list. The Fort Collins metro area ranked 10th, Boulder ranked 26th, Greeley ranked 33rd, and Colorado Springs ranked 37th. (*Forbes*, 2015)
- Denver ranked as the 10th-most business-friendly city in 2014 and had the third-best business climate among the nation's 100 largest cities. (MarketWatch.com, 2015)
- Colorado ranked fourth in *CNBC's* annual "Top States for Business" in 2015 and the state earned top-10 rankings in the categories that measure the economy (third), technology and innovation (fifth), access to capital (eighth), and quality of life (ninth). (*CNBC*, 2015)
- Colorado ranked fourth in both innovation and entrepreneurship, and high-tech performance. The state also ranked among the top-10 states for economic performance and talent pipeline. (National Chamber Foundation, 2015)
- Colorado ranked as the No. 5 small-business-friendly state in the nation. Fort Collins and Boulder ranked among the top-10 cities nationally, earning "A" grades for overall friendliness. (Thumbtack.com, 2015; Ewing Marion Kauffman Foundation, 2015)

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