



Aerospace Engineering Overview

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The Field

Aerospace engineers create machines, from airplanes that weigh over a half a million pounds to spacecraft that travel over 17,000 miles an hour. They design, develop, and test aircraft, spacecraft, and missiles and supervise the manufacture of these products. Aerospace engineers who work with aircraft are called aeronautical engineers, and those working specifically with spacecraft are astronautical engineers.

Aerospace engineers develop new technologies for use in aviation, defense systems, and space exploration, often specializing in areas such as structural design, guidance, navigation and control, instrumentation and communication, or production methods. They often use computer-aided design (CAD) software, robotics, and lasers and advanced electronic optics. They also may specialize in a particular type of aerospace product, such as commercial transports, military fighter jets, helicopters, spacecraft, or missiles and rockets. Aerospace engineers may be experts in aerodynamics, thermodynamics, celestial mechanics, propulsion, acoustics, or guidance and control systems.

Aerospace engineers typically are employed in the aerospace product and parts industry, although their skills are becoming increasingly valuable in other fields. For example, in the motor vehicles manufacturing industry, aerospace engineers design vehicles that have lower air resistance and, thus, increased fuel efficiency.

Preparation

A bachelor's degree in engineering is required for almost all entry-level engineering jobs. College graduates with a degree in a physical science or mathematics occasionally may qualify for some engineering jobs, especially in specialties in high demand. Most engineering degrees are granted in electrical, electronics, mechanical, chemical, civil, or materials engineering. However, engineers trained in one branch may work in related branches. For example, many aerospace engineers have training in mechanical engineering. This flexibility allows employers to meet staffing needs in new technologies and specialties in which engineers may be in short supply. It also allows engineers to shift to fields with better employment prospects or to those that more closely match their interests. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and science. Most programs include a design course, sometimes accompanied by a computer or laboratory class or both.

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Note: Some resources in this section are provided by the US Department of Labor, Bureau of Labor Statistics.

Admission Requirements

Admissions requirements for undergraduate engineering schools include a solid background in mathematics (algebra, geometry, trigonometry, and calculus) and science (biology, chemistry, and physics), and courses in English, social studies, humanities, and computer and information technology. Bachelor's degree programs in engineering typically are designed to last 4 years, but many students find that it takes between 4 and 5 years to complete their studies. In a typical 4-year college curriculum, the first 2 years are spent studying mathematics, basic sciences, introductory engineering, humanities, and social sciences. In the last 2 years, most courses are in engineering, usually with a concentration in one branch. For example, the last 2 years of an aerospace program might include courses in fluid mechanics, heat transfer, applied aerodynamics, analytical mechanics, flight vehicle design, trajectory dynamics, and aerospace propulsion systems. Some programs offer a general engineering curriculum; students then specialize in graduate school or on the job.



Co-ops

Internships and Coops provide students with a great opportunity to gain real-world experience while still in school. In addition to giving students direct experience in the field they are considering, interaction with others in the field can help provide perspective on career path options.

Alternate Degree Paths

Some engineering schools and 2-year colleges have agreements whereby the 2-year college provides the initial engineering education, and the engineering school automatically admits students for their last 2 years. In addition, a few engineering schools have arrangements whereby a student spends 3 years in a liberal arts college studying pre-engineering subjects and 2 years in an engineering school studying core subjects, and then receives a bachelor's degree from each school. Some colleges and universities offer 5-year master's degree programs. Some 5-year or even 6-year cooperative plans combine classroom study and practical work, permitting students to gain valuable experience and to finance part of their education.

Graduate Training

Graduate training is essential for engineering faculty positions and many research and development programs, but is not required for the majority of entry-level engineering jobs. Many engineers obtain graduate degrees in engineering or business administration to learn new technology and broaden their education. Many high-level executives in government and industry began their careers as engineers. It is important to select a degree program that has been accredited.



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Accreditation

Those interested in a career in aerospace engineering should consider reviewing engineering programs that are accredited by the Accreditation Board for Engineering and Technology, Inc. (ABET). ABET accreditation is based on an evaluation of an engineering program's student achievement, program improvement, faculty, curricular content, facilities, and institutional commitment. Most offer Bachelor's degrees, but a few offer Master's Degrees. The following is a current list of universities offering accredited degree programs in Aerospace Engineering.

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| <ul style="list-style-type: none">• Air Force Institute of Technology (Master's)• The University of Alabama in Huntsville• The University of Alabama• Arizona State University• University of Arizona• Auburn University• Boston University• California Polytechnic State University, San Luis Obispo• California State Polytechnic University, Pomona• California State University, Long Beach• University of California, Davis• University of California, Irvine• University of California, Los Angeles• University of California, San Diego• Case Western Reserve University• University of Central Florida• University of Cincinnati• Clarkson University• University of Colorado at Boulder• Embry-Riddle Aeronautical University - Daytona Beach• Embry-Riddle Aeronautical University - Prescott• Florida Institute of Technology• University of Florida• Georgia Institute of Technology• University of Illinois at Urbana-Champaign• Illinois Institute of Technology• Iowa State University• The University of Kansas• University of Maryland College Park• Massachusetts Institute of Technology• University of Michigan | <ul style="list-style-type: none">• University of Minnesota-Twin Cities• Mississippi State University• Missouri University of Science and Technology• Naval Postgraduate School (Master's)• State University of New York at Buffalo• North Carolina State University at Raleigh• University of Notre Dame• The Ohio State University• Oklahoma State University• The University of Oklahoma• Pennsylvania State University• Princeton University• Purdue University at West Lafayette• Rensselaer Polytechnic Institute• Saint Louis University• San Diego State University• San Jose State University• University of Southern California• Syracuse University• University of Tennessee at Knoxville• Texas A & M University• University of Texas at Arlington• University of Texas at Austin• Tuskegee University• United States Air Force Academy• United States Naval Academy• Virginia Polytechnic Institute and State University• University of Virginia• Washington University• University of Washington• West Virginia University• Western Michigan University• Wichita State University |
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Day in the Life

Beginning engineering graduates usually work under the supervision of experienced engineers and, in large companies, also may receive formal classroom or seminar-type training. As new engineers gain knowledge and experience, they are assigned more difficult projects with greater independence to develop designs, solve problems, and make decisions. Engineers may advance to become technical specialists or to supervise a staff or team of engineers and technicians. Some may eventually become engineering managers or enter other managerial or sales jobs.

Teams and Coworkers

Almost all jobs in engineering require some sort of interaction with coworkers. Whether they are working in a team situation, or just asking for advice, most engineers have to have the ability to communicate and work with other people. Engineers should be creative, inquisitive, analytical, and detail-oriented. They should be able to work as part of a team and to communicate well, both orally and in writing. Communication abilities are important because engineers often interact with specialists in a wide range of fields outside engineering.

Tasks

Aerospace engineers develop new technologies for use in aviation, defense systems, and space exploration, often specializing in areas such as structural design, guidance, navigation and control, instrumentation and communication, or production methods. They often use computer-aided design (CAD) software, robotics, and lasers and advanced electronic optics. They also may specialize in a particular type of aerospace product, such as commercial transports, military fighter jets, helicopters, spacecraft, or missiles and rockets. Aerospace engineers may be experts in aerodynamics, thermodynamics, celestial mechanics, propulsion, acoustics, or guidance and control systems.

The Workplace

Aerospace engineers typically are employed in the aerospace product and parts industry, although their skills are becoming increasingly valuable in other fields. For example, in the motor vehicles manufacturing industry, aerospace engineers design vehicles that have lower air resistance and, thus, increased fuel efficiency.

Earnings

Earnings for engineers vary significantly by specialty, industry, and education. Even so, as a group, engineers earn some of the highest average starting salaries among those holding bachelor's degrees. According the U.S. Department of Labor, Bureau of Labor Statistics, the median income for aerospace engineers is \$87,610. The lowest 10% earned \$59,610. The highest 10% earned \$124,550.

In terms of starting salaries, the average starting salary for aerospace engineers who have earned a Bachelor's degree is \$53,408, while those with a Master's were offered \$62,459. Ph.D. aerospace engineers received average starting salaries of \$73,814.

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Employment

According to the U.S. Bureau of Labor Statistics, aerospace engineers hold about 90,000 jobs. This represents 6% of the 1.5 million jobs held by engineers in the U.S. Most worked in the aerospace product and parts manufacturing industries. Federal Government agencies, primarily the U.S. Department of Defense and the National Aeronautics and Space Administration, provided 10 percent of jobs. Architectural, engineering and related services, scientific research and development services, and navigational, measuring, electromedical, and control instruments manufacturing industry firms accounted for most of the remaining jobs. The following is a partial list of employers of Aerospace Engineers:

<ul style="list-style-type: none">• 3M Company• AAI Corporation• Advanced Products Corporation• Aerojet• Air Liquide-Medal L.P.• Allfast Fastening Systems, Inc.• American Pacific Corporation• Analytical Graphics, Inc.• Angeles Composite Technologies, Inc.• Argo-Tech Corporation• Armor Holdings Aerospace & Defense, Inc.• ATK• Aviall, Inc.• B&E Precision Aircraft Components• B.H. Aircraft Company, Inc.• BAE SYSTEMS North America• Barnes Aerospace• Brek Manufacturing Company• Celestica Corporation• Click Bond, Inc.• Cobham Aerospace Systems Group• Computer Sciences Corporation• Crane Aerospace & Electronics• Cubic Corporation• Curtiss-Wright Corporation• Dassault Falcon Jet Corporation• Doncasters, Inc.• DRS Technologies, Inc.• Ducommun Incorporated• DuPont Company• Eaton Aerospace LLC• Eclipse Aviation• EDO Corporation• EFW Inc.• Embraer Aircraft Holding Inc.• Erickson Air-Crane Incorporated• ESIS, Inc.• Esterline Technologies• Exostar LLC• Federation Inc.	<ul style="list-style-type: none">• Flight Safety International Inc.• General Atomics Aeronautical Systems, Inc.• General Dynamics Corporation• General Electric Company• GKN Aerospace, Aerostructures• Goodrich Corporation• Hamilton Sundstrand• Harris Corporation• HEICO Corporation• Hexcel Corporation• HITCO Carbon Composites• Honeywell L-3 Communications Holdings, Inc.• Laser Technology Inc.• IBM Corporation• ITT Industries Defense and Electronics• LMI Aerospace Inc.• Lockheed Martin Corporation• Martin-Baker America Inc.• McKechnie Aerospace Structures Group• MOOG Inc.• NASA• Natel Engineering Co. Inc.• National Machine Group• National Technical Systems• Northrop Grumman Corporation• NYLOK Corporation• Omega Aerial Refueling Services, Inc.• Oracle• Orbital Sciences Corporation• Parker Aerospace• PerkinElmer, Inc.• Pratt & Whitney• Proficiency Inc.• Raytheon Company• Remmele Engineering, Inc.• Rockwell Collins• Rolls-Royce North America Inc.• RTI International Metals, Inc.	<ul style="list-style-type: none">• Science Applications International Corporation• Shaw Aero Devices, Inc.• Sikorsky• Silicon Graphics, Inc.• SITA• SM&A• Smiths Aerospace Actuation Systems• Space Exploration Technologies Corporation• Stellax Aerostructures, Inc.• Suntron Corporation• Swales Aerospace• Teleflex Inc.• Textron Inc.• The Boeing Company• The Purdy Corporation• Titan Corporation• Triumph Group, Inc.• Turbine Engine Components Technologies Corp.• United Defense• United Technologies Corporation• Vought Aircraft Industries, Inc.• W. L. Gore & Associates, Inc.• Woodward Governor Company
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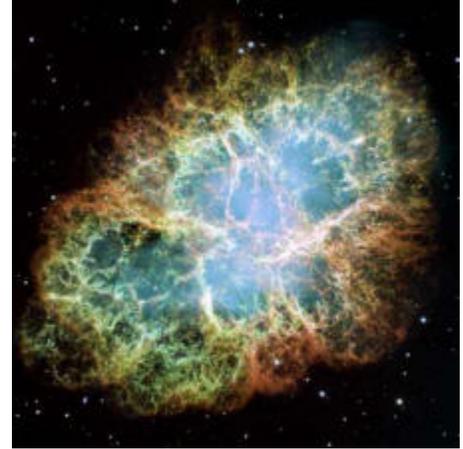
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Career Path Forecast

According to the U.S. Department of Labor, Bureau of Labor Statistics, aerospace engineers are expected to have 10 percent growth in employment between 2006 and 2016, about as fast as the average for all occupations. Increases in the number and scope of military aerospace projects likely will generate new jobs. In addition, new technologies expected to be used on commercial aircraft produced during the next decade should spur demand for aerospace engineers. The employment outlook for aerospace engineers appears favorable. The number of degrees granted in aerospace engineering has declined for many years because of a perceived lack of opportunities in this field. Although this trend has reversed, new graduates continue to be needed to replace aerospace engineers who retire or leave the occupation for other reasons.



Professional Organizations

Professional organizations and associations provide a wide range of resources for planning and navigating a career in Aerospace Engineering. These groups can play a key role in your development and keep you abreast of what is happening in your industry. Associations promote the interests of their members and provide a network of contacts that can help you find jobs and move your career forward. They can offer a variety of services including job referral services, continuing education courses, insurance, travel benefits, periodicals, and meeting and conference opportunities. The following is a partial list of professional associations serving aerospace engineers and employers.

Aerospace and Electronics Systems Society of the IEEE (www.ieee-aess.org)

Members of the Aerospace & Electronic Systems Society (AESS) of the IEEE are interested in the design, integration, test, and analysis of large, complex systems consisting of major subsystems that contain dissimilar electronic devices.

Aerospace Industries Association (www.aia-aerospace.org)

The Aerospace Industries Association represents the nation's leading manufacturers and suppliers of civil, military, and business aircraft, helicopters, UAVs, space systems, aircraft engines, missiles, materiel, and related components, equipment, services, and information technology.

American Astronautical Society (<http://astronautical.org/>)

American Astronautical Society (AAS) is an independent scientific and technical group in the United States exclusively dedicated to the advancement of space science and exploration. The society is also committed to strengthening the global space program through cooperation with international space organizations.

American Institute of Aeronautics and Astronautics (www.aiaa.org)

With more than 31,000 members, AIAA is the world's largest professional society devoted to the progress of engineering and science in aviation, space, and defense.

Society of Flight Test Engineers (www.sfte.org)

The Society of Flight Test Engineers is a fraternity of engineers, whose principal professional interest is the flight testing of aircraft and missiles.

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