

and electronics installers and repairers. Engineering technicians also may repair electronic equipment as part of their duties.

Sources of Additional Information

For information on career opportunities, contact:

► International Brotherhood of Electrical Workers, Telecommunications Department, 1125 15th St. NW., Room 807, Washington, DC 20005.

► Communications Workers of America, 501 3rd St. NW., Washington, DC 20001. Internet: <http://www.cwa-union.org>

For information on careers and schools, contact:

► Electronics Technicians Association International, 502 North Jackson, Greencastle, IN 46135. Internet: <http://www.eta-sda.com>

► National Association of Radio and Telecommunications Engineers, P.O. Box 678, Medway, MA 02053. Internet: <http://www.narte.org>

Vehicle and Mobile Equipment Mechanics, Installers, and Repairers

Aircraft and Avionics Equipment Mechanics and Service Technicians

(O*NET 49-2091.00, 49-3011.01, 49-3011.02, 49-3011.03)

Significant Points

- The majority of these workers learn their job in 1 of about 200 trade schools certified by the Federal Aviation Administration.
- Opportunities should be favorable, but keen competition is likely for the best paying airline jobs.

Nature of the Work

To keep aircraft in peak operating condition, aircraft and avionics equipment mechanics and service technicians perform scheduled maintenance, make repairs, and complete inspections required by the Federal Aviation Administration (FAA).

Many aircraft mechanics, also called airframe, powerplant, and avionics aviation maintenance technicians, specialize in preventive maintenance. They inspect engines, landing gear, instruments, pressurized sections, accessories—brakes, valves, pumps, and air-conditioning systems, for example—and other parts of the aircraft, and do the necessary maintenance and replacement of parts. Inspections take place following a schedule based on the number of hours the aircraft has flown, calendar days since the last inspection, cycles of operation, or a combination of these factors. Large, sophisticated planes are equipped with aircraft monitoring systems, consisting of electronic boxes and consoles that monitor the aircraft's basic operations and provide valuable diagnostic information to the mechanic. To examine an engine, aircraft mechanics work through specially designed openings while standing on ladders or scaffolds, or use hoists or lifts to remove the entire engine from the craft. After taking an engine apart, mechanics use precision instruments to measure parts for wear and use x-ray and magnetic inspection equipment to check for invisible cracks. Worn or defective parts are repaired or replaced. Mechanics may also repair sheet metal or composite surfaces, measure the tension of control cables, and check for corrosion, distortion, and cracks in the fuselage, wings, and tail. After completing all repairs, they must test the equipment to ensure that it works properly.

Mechanics specializing in repairwork rely on the pilot's description of a problem to find and fix faulty equipment. For example, during a preflight check, a pilot may discover that the aircraft's fuel gauge does not work. To solve the problem, mechanics may troubleshoot the electrical system, using electrical test equipment to make sure that no wires are broken or shorted out, and replace



Aircraft mechanics inspect, maintain, and replace engines and other parts of the aircraft.

any defective electrical or electronic components. Mechanics work as fast as safety permits so that the aircraft can be put back into service quickly.

Some mechanics work on one or many different types of aircraft, such as jets, propeller-driven airplanes, and helicopters. Others specialize in one section of a particular type of aircraft, such as the engine, hydraulics, or electrical system. *Powerplant mechanics* are authorized to work on engines and do limited work on propellers. *Airframe mechanics* are authorized to work on any part of the aircraft except the instruments, powerplants, and propellers. *Combination airframe-and-powerplant mechanics*—called A & P mechanics—work on all parts of the plane, except instruments. The majority of mechanics working on civilian aircraft today are A & P mechanics. In small, independent repairshops, mechanics usually inspect and repair many different types of aircraft.

Avionics systems are now an integral part of aircraft design and have vastly increased aircraft capability. *Avionics technicians* repair and maintain components used for aircraft navigation and radio communications, weather radar systems, and other instruments and computers that control flight, engine, and other primary functions. These duties may require additional licenses, such as a radiotelephone license issued by the U.S. Federal Communications Commission (FCC). Because of technological advances, an increasing amount of time is spent repairing electronic systems, such as computerized controls. Technicians also may be required to analyze and develop solutions to complex electronic problems.

Working Conditions

Mechanics usually work in hangars or in other indoor areas, although they can work outdoors—sometimes in unpleasant weather—when hangars are full or when repairs must be made quickly. Mechanics often work under time pressure to maintain flight schedules or, in general aviation, to keep from inconveniencing customers. At the same time, mechanics have a tremendous responsibility to maintain safety standards, and this can cause the job to be stressful.

Frequently, mechanics must lift or pull objects weighing as much as 70 pounds. They often stand, lie, or kneel in awkward positions and occasionally must work in precarious positions on scaffolds or ladders. Noise and vibration are common when engines are being tested, so ear protection is necessary. Aircraft mechanics usually work 40 hours a week on 8-hour shifts around the clock. Overtime work is frequent.

Employment

Aircraft mechanics and service technicians held about 173,000 jobs in 2000; fewer than 10 percent were avionics technicians. About two-thirds of all salaried mechanics worked for airlines or airports and flying fields, about 12 percent worked for the Federal Government, and about 9 percent worked for aircraft assembly firms. Most of the rest were general aviation mechanics, the majority of whom worked for independent repairshops or for companies that operate their own planes to transport executives and cargo. Few mechanics were self-employed.

Most airline mechanics work at major airports near large cities. Civilian mechanics employed by the Armed Forces work at military installations. Large proportions of mechanics who work for aircraft assembly firms are located in California or in Washington State. Others work for the FAA, many at the facilities in Oklahoma City, Atlantic City, Wichita, or Washington, DC. Mechanics for independent repairshops work at airports in every part of the country.

Training, Other Qualifications, and Advancement

The majority of mechanics who work on civilian aircraft are certificated by the FAA as “airframe mechanic,” “powerplant mechanic,” or “avionics repair specialist.” Mechanics who also have an inspector’s authorization can certify work completed by other mechanics and perform required inspections. Uncertificated mechanics are supervised by those with certificates.

The FAA requires at least 18 months of work experience for an airframe, powerplant, or avionics repairer’s certificate. For a combined A & P certificate, at least 30 months of experience working with both engines and airframes is required. Completion of a program at an FAA-certificated mechanic school can substitute for the work experience requirement. Applicants for all certificates also must pass written and oral tests and demonstrate that they can do the work authorized by the certificate. To obtain an inspector’s authorization, a mechanic must have held an A & P certificate for at least 3 years. Most airlines require that mechanics have a high school diploma and an A & P certificate.

Although a few people become mechanics through on-the-job training, most learn their job in 1 of about 200 trade schools certified by the FAA. About one-third of these schools award 2- and 4-year degrees in avionics, aviation technology, or aviation maintenance management.

FAA standards established by law require that certificated mechanic schools offer students a minimum of 1,900 actual class hours. Courses in these trade schools normally last from 24 to 30 months and provide training with the tools and equipment used on the job. Aircraft trade schools are placing more emphasis on technologies such as turbine engines, composite materials—including graphite, fiberglass, and boron—and aviation electronics, which

are increasingly being used in the construction of new aircraft. Less emphasis is being placed on old technologies, such as woodworking and welding. Additionally, employers prefer mechanics who can perform a variety of tasks.

Some aircraft mechanics in the Armed Forces acquire enough general experience to satisfy the work experience requirements for the FAA certificate. With additional study, they may pass the certifying exam. In general, however, jobs in the military services are too specialized to provide the broad experience required by the FAA. Most Armed Forces mechanics have to complete the entire training program at a trade school, although a few receive some credit for the material they learned in the service. In any case, military experience is a great advantage when seeking employment; employers consider trade school graduates who have this experience to be the most desirable applicants.

Courses in mathematics, physics, chemistry, electronics, computer science, and mechanical drawing are helpful, because they demonstrate many of the principles involved in the operation of aircraft, and knowledge of these principles is often necessary to make repairs. Courses that develop writing skills also are important because mechanics often are required to submit reports.

FAA regulations require current experience to keep the A & P certificate valid. Applicants must have at least 1,000 hours of work experience in the previous 24 months or take a refresher course. As new and more complex aircraft are designed, more employers are requiring mechanics to take ongoing training to update their skills. Recent technological advances in aircraft maintenance necessitate a strong background in electronics—both for acquiring and retaining jobs in this field. FAA certification standards also make ongoing training mandatory. Every 24 months, mechanics are required to take at least 16 hours of training to keep their certificate. Many mechanics take courses offered by manufacturers or employers, usually through outside contractors.

Aircraft mechanics must do careful and thorough work that requires a high degree of mechanical aptitude. Employers seek applicants who are self-motivated, hard-working, enthusiastic, and able to diagnose and solve complex mechanical problems. Agility is important for the reaching and climbing necessary to do the job. Because they may work on the tops of wings and fuselages on large jet planes, aircraft mechanics must not be afraid of heights.

As aircraft mechanics gain experience, they may advance to lead mechanic (or crew chief), inspector, lead inspector, or shop supervisor positions. Opportunities are best for those who have an aircraft inspector’s authorization. In the airlines, where promotion often is determined by examination, supervisors sometimes advance to executive positions. Those with broad experience in maintenance and overhaul might become inspectors with the FAA. With additional business and management training, some open their own aircraft maintenance facilities. Mechanics learn many different skills in their training that can be applied to other jobs, and some transfer to other skilled repairer occupations or electronics technician jobs.

Job Outlook

The outlook for aircraft and avionics equipment mechanics and service technicians should be favorable over the next 10 years. The likelihood of fewer entrants from the military and a large number of retirements, point to good employment conditions for students just beginning training.

Job opportunities are likely to be the best at small commuter and regional airlines, at FAA repair stations, and in general aviation. Wages in these companies tend to be relatively low, so there are fewer applicants for these jobs than for those with the major airlines. Also, some jobs will become available as experienced mechanics leave for higher paying jobs with airlines or transfer to

another occupation. At the same time, aircraft are becoming increasingly sophisticated in general aviation and in regional carriers, boosting the demand for qualified mechanics. Mechanics will face competition for jobs with large airlines because the high wages and travel benefits that these jobs offer attract more qualified applicants than there are openings. Prospects will be best for applicants with significant experience. Mechanics who keep abreast of technological advances in electronics, composite materials, and other areas will be in greatest demand. The number of job openings for aircraft mechanics in the Federal Government should decline as the size of the U.S. Armed Forces is reduced.

Employment of aircraft mechanics is expected to increase about as fast as the average for all occupations through the year 2010. A growing population and rising incomes are expected to stimulate the demand for airline transportation, and the number of aircraft is expected to grow. However, employment growth will be somewhat restricted as consolidation within the air carrier industry continues and as productivity increases due to greater use of automated inventory control and modular systems, which speeds repairs and parts replacement.

Most job openings for aircraft mechanics through the year 2010 will stem from replacement needs. Each year, as mechanics transfer to other occupations or retire, several thousand job openings will arise. Aircraft mechanics have a comparatively strong attachment to the occupation, reflecting their significant investment in training and a love for aviation. However, because aircraft mechanics' skills are transferable to other occupations, some mechanics leave for work in related fields.

During recessions, declines in air travel force airlines to curtail the number of flights, which results in less aircraft maintenance and, consequently, layoffs for aircraft mechanics.

Earnings

Median hourly earnings of aircraft mechanics and service technicians were about \$19.50 in 2000. The middle 50 percent earned between \$15.65 and \$23.65. The lowest 10 percent earned less than \$12.06, and the highest 10 percent earned more than \$26.97. Median hourly earnings in the industries employing the largest numbers of aircraft mechanics and service technicians in 2000 were:

Air transportation, scheduled	\$21.57
Aircraft and parts	19.77
Air transportation, nonscheduled	19.16
Federal Government	19.11
Airports, flying fields, and services	16.26

Median hourly earnings of avionics technicians were about \$19.86 in 2000. The middle 50 percent earned between \$16.31 and \$24.01. The lowest 10 percent earned less than \$13.22, and the highest 10 percent earned more than \$27.02.

Mechanics who work on jets for the major airlines generally earn more than those working on other aircraft. Airline mechanics and their immediate families receive reduced-fare transportation on their own and most other airlines.

Almost one-half of all aircraft mechanics, including those employed by some major airlines, are covered by union agreements. The principal unions are the International Association of Machinists and Aerospace Workers and the Transport Workers Union of America. Some mechanics are represented by the International Brotherhood of Teamsters.

Related Occupations

Workers in some other occupations that involve similar mechanical and electrical work are electricians, electrical and electronics installers and repairers, and elevator installers and repairers.

Sources of Additional Information

Information about jobs with a particular airline can be obtained by writing to the personnel manager of the company.

For general information about aircraft and avionics equipment mechanics and service technicians, write to:

- ▶ Professional Aviation Maintenance Association, 1707 H St. NW., Suite 700, Washington, DC 20006.

For information on jobs in a particular area, contact employers at local airports or local offices of the State employment service.

Automotive Body and Related Repairers

(O*NET 49-3021.00, 49-3022.00)

Significant Points

- To become a fully skilled automotive body repairer, formal training is desirable in addition to on-the-job training because advances in technology have greatly changed the structure, components, and materials used in automobiles.
- A fully skilled automotive body repairer must have good reading and basic mathematics and computer skills to follow instructions and diagrams in print and computer-based technical manuals.

Nature of the Work

Thousands of motor vehicles are damaged in traffic accidents every day. Although some of these vehicles are beyond repair, others can be made to look and drive like new. Automotive body repairers straighten bent bodies, remove dents, and replace crumpled parts that cannot be fixed. They repair all types of vehicles but work mostly on cars and small trucks, although some work on large trucks, buses, or tractor-trailers.

Automotive body repairers use special equipment to restore damaged metal frames and body sections. Repairers chain or clamp frames and sections to alignment machines that use hydraulic pressure to align damaged components. "Unibody" vehicles, designs built without frames, must be restored to precise factory specifications for the vehicle to operate correctly. To do so, repairers use benchmark systems to make accurate measurements of how much each section is out of alignment and hydraulic machinery to return the vehicle to its original shape.

Body repairers remove badly damaged sections of body panels with a pneumatic metal-cutting gun or by other means, and weld in replacement sections. Repairers pull out less serious dents with a hydraulic jack or hand prying bar or knock them out with handtools or pneumatic hammers. They smooth out small dents and creases in the metal by holding a small anvil against one side of the damaged area, while hammering the opposite side. They also remove very small pits and dimples with pick hammers and punches in a process called metal finishing.

Body repairers also repair or replace the plastic body parts increasingly used on new model vehicles. They remove damaged panels and identify the family and properties of the plastic used on the vehicle. With most types of plastic, repairers can apply heat from a hot-air welding gun or by immersion in hot water and press the softened panel back into its original shape by hand. They replace plastic parts that are badly damaged or very difficult to repair.