

► Institute of Textile Technology, 2551 Ivy Rd., Charlottesville, NC 22903-4614. Internet: <http://www.itt.edu>

For general information on the apparel industry, contact:

► American Apparel Manufacturers Association, 2500 Wilson Blvd., Suite 301, Arlington, VA 22201. Internet: <http://www.americanapparel.com>

For information about the custom-made prescription shoe business and training opportunities in this field, contact:

► Pedorthic Footwear Association, 7150 Columbia Gateway Dr., Suite G, Columbia, MD 21046. Internet: <http://www.pedorthics.org>

To receive a list of technical schools with accredited programs in upholstery, contact:

► Accrediting Commission of Career Schools and Colleges of Technology, 2101 Wilson Blvd., Suite 302, Arlington, VA 22201. Internet: <http://www.accsct.org>

Woodworkers

(O*NET 51-7011.00, 51-7021.00, 51-7031.00, 51-7032.00, 51-7041.01, 51-7041.02, 51-7042.01, 51-7042.02, 51-7099.99)

Significant Points

- Most woodworkers are trained on the job; basic machine operations may be learned in a few months, but becoming a skilled woodworker often requires 2 or more years.
- Employment is expected to grow more slowly than average—reflecting relatively slow growth among lesser skilled woodworkers.
- Job prospects will be best for highly skilled workers and those with knowledge of computerized numerical control machine tool operation.

Nature of the Work

In spite of the development of sophisticated plastics and other materials, the demand for wood products continues unabated. Helping to meet this demand are woodworkers. Woodworkers are found in industries that produce wood, such as sawmills and plywood mills; in industries that use wood to produce furniture, kitchen cabinets, musical instruments, and other fabricated wood products; or in small shops that make architectural woodwork, furniture, and many other specialty items.

All woodworkers are employed at some stage of the process through which logs of wood are transformed into finished products. Some of these workers produce the structural elements of buildings; others mill hardwood and softwood lumber; still others assemble finished wood products. They operate machines that cut, shape, assemble, and finish raw wood to make the doors, windows, cabinets, trusses, plywood, flooring, paneling, molding, and trim that are components of most homes. Others may fashion home accessories, such as beds, sofas, tables, dressers, and chairs. In addition to these household goods, woodworkers also make sporting goods, including baseball bats, racquets, and oars, as well as musical instruments, toys, caskets, tool handles, and thousands of other wooden items.

Production woodworkers set up, operate, and tend woodworking machines such as power saws, planers, sanders, lathes, jointers, and routers that cut and shape components from lumber, plywood, and other wood products. In sawmills, *sawing machine operators and tenders* set up, operate, or tend wood sawing machines that cut logs into planks, timbers, or boards. In plants manufacturing wood products, woodworkers first determine the best method of shaping and assembling parts working from blueprints, supervisors' instructions, or shop drawings that woodworkers themselves produce. Before cutting, they often must measure and mark the materials. They verify dimensions and may trim parts using hand tools such as

planes, chisels, wood files, or sanders to insure a tight fit. *Woodworking machine operators and tenders* set up, operate, or tend a specific woodworking machine such as drill presses, lathes, shapers, routers, sanders, planers, and wood-nailing machines. Lower skilled operators may merely press a switch on a woodworking machine and monitor the automatic operation whereas more highly skilled operators set up equipment, cut and shape wooden parts, and verify dimensions using a template, caliper, or rule.

The next step in the manufacturing process is the production of subassemblies using fasteners and adhesives. The pieces then are brought together to form a complete unit. The product is then finish sanded, stained, and, if necessary, coated with a sealer, such as lacquer or varnish. Woodworkers may perform this work in teams or be assisted by a helper.

Woodworkers have been greatly affected by the introduction of computer-controlled machinery. This technology has raised worker productivity by allowing one operator to simultaneously tend a greater number of machines. With computerized numerical controls (CNC), an operator can program a machine to perform a sequence of operations automatically, resulting in greater precision and reliability. The integration of computers with equipment has improved production speeds and capabilities, simplified setup and maintenance requirements, and increased the demand for workers with computer skills.

While this costly equipment has had a great impact on workers in the largest, most efficient firms, precision or custom woodworkers—who generally work in smaller firms—have continued to employ the same production techniques they have used for many years. Workers such as *cabinetmakers and bench carpenters; model makers and patternmakers; and furniture finishers* work on a customized basis, often building one-of-a-kind items. These highly skilled



Furniture and fixtures manufacturing firms employ 1 in 4 woodworkers.

precision woodworkers usually perform a complete cycle of tasks, cutting, shaping, preparing surfaces, and assembling prepared parts of complex wood components into a finished wood product. For this reason, these workers normally need substantial training and an ability to work from detailed instructions and specifications. In addition, they often are required to exercise independent judgment when undertaking an assignment.

Working Conditions

Working conditions vary by industry and specific job duties. In primary industries, such as logging and sawmills, working conditions are physically demanding, due to the handling of heavy, bulky material. Workers in these industries also may encounter excessive noise and dust and other air pollutants. However, the use of ear-plugs and respirators may partially alleviate these problems. Also, rigid adherence to safety precautions minimizes risk of injury from contact with rough wood stock, sharp tools, and power equipment. The risk of injury also is lowered by the installation of computer-controlled equipment, which reduces the physical labor and hands-on contact with machinery.

In secondary industries, such as furniture and kitchen cabinet manufacturing, working conditions also depend on the industry and the particular job. Employees who operate machinery often must wear ear and eye protection, follow operating safety instructions, and use safety shields or guards to prevent accidents. Those who work in the finishing area must either be provided with an appropriate dust or vapor mask, a complete protective safety suit, or work in a finishing environment that removes all vapors and particulate matter from the atmosphere. Prolonged standing, lifting, and fitting heavy objects are common characteristics of the job.

Employment

Woodworkers held about 409,000 jobs in 2000. Self-employed woodworkers, mostly cabinetmakers and furniture finishers, accounted for 10 percent of these jobs. Employment among detailed woodworking occupations was distributed as follows:

Cabinetmakers and bench carpenters	159,000
Woodworking machine setters, operators, and tenders, except sawing	103,000
Sawing machine setters, operators, and tenders, wood	57,000
Furniture finishers	45,000
All other woodworkers	35,000
Model makers and patternmakers, wood	10,000

More than 7 out of 10 woodworkers were employed in manufacturing industries. Among these woodworkers, 27 percent were found in establishments fabricating household and office furniture and fixtures and 40 percent worked in lumber and wood products, manufacturing a variety of raw, intermediate, and finished wood stock. Wholesale and retail lumber dealers, furniture stores, reupholstery and furniture repair shops, and construction firms also employ woodworkers.

Woodworking jobs are found throughout the country. However, production jobs are concentrated in the South and Northwest, close to the supply of wood, whereas furniture makers are more prevalent in the East. Custom shops can be found everywhere, but generally are concentrated in or near highly populated areas.

Training, Other Qualifications, and Advancement

Most woodworkers are trained on the job, picking up skills informally from experienced workers. Some acquire skills through vocational education or by working as carpenters on construction jobs. Others may attend colleges or universities that offer training in areas including wood technology, furniture manufacturing, wood engineering, and production management. These programs prepare

students for positions in production, supervision, engineering, and management.

Beginners usually observe and help experienced machine operators. They may supply material to or remove fabricated products from machines. Trainees also do simple machine operating jobs, while at first closely supervised by experienced workers. As beginners gain experience, they perform more complex jobs with less supervision. Some may learn to read blueprints, set up machines, and plan the sequence of the work. Most woodworkers learn basic machine operations and job tasks in a few months, but becoming a skilled woodworker often requires 2 or more years.

Employers increasingly seek applicants with a high school diploma or the equivalent, because of the growing sophistication of machinery and the constant need for retraining. Persons seeking woodworking jobs can enhance their employment and advancement prospects by completing high school and receiving training in mathematics, science, and computer applications. Other important qualities for entrants in this occupation include mechanical ability, manual dexterity, and the ability to pay attention to detail.

Advancement opportunities often are limited and depend upon availability, seniority, and a worker's skills and initiative. Sometimes experienced woodworkers become inspectors or supervisors responsible for the work of a group of woodworkers. Production workers often can advance into these positions by assuming additional responsibilities and by attending workshops, seminars, or college programs. Those who are highly skilled may set up their own woodworking shops.

Job Outlook

Overall employment of woodworkers is expected to grow more slowly than the average for all occupations through the year 2010—reflecting relatively slow growth among lesser-skilled woodworking machine setters, operators, and tenders, except sawing, and furniture finishers. On the other hand, employment of higher-skilled woodworkers—including model makers and patternmakers, wood; sawing machine setters, operators, and tenders, wood; and cabinetmakers and bench carpenters—is expected to grow about as fast as the average for all occupations. In addition, thousands of openings will arise each year because of the need to replace experienced woodworkers who transfer to other occupations or leave the labor force.

Demand for woodworkers will stem from increases in population, personal income, and business expenditures, in addition to the continuing need for repair and renovation of residential and commercial properties. Therefore, opportunities should be particularly good for woodworkers who specialize in such items as moldings, cabinets, stairs, and windows. Due to increasingly automated manufacturing processes, prospects will be best for highly skilled woodworkers with knowledge of CNC machine tool operation.

Several factors may limit the growth of woodworking occupations. Technological advances, like robots and CNC machinery, will continue to increase productivity among woodworkers, preventing employment from rising as fast as the demand for wood products, particularly in the mills and manufacturing plants where many processes can be automated. In addition, some jobs in the United States will be lost as imports continue to grow and as U.S. firms move some production to other countries. Also, the demand for wood may be reduced somewhat, as materials such as metal, plastic, and fiberglass continue to be used in many products as alternatives to wood. Environmental measures designed to control various pollutants used in, or generated by, woodworking processes also may adversely impact employment.

Employment in all woodworking specialties is highly sensitive to economic cycles. During economic downturns, workers are subject to layoffs or a reduction in hours.

Earnings

Median hourly earnings of cabinetmakers and bench carpenters were \$10.83 in 2000. The middle 50 percent earned between \$8.69 and \$13.72. The lowest 10 percent earned less than \$7.24, and the highest 10 percent earned more than \$17.21. Median hourly earnings in the industries employing the largest numbers of cabinetmakers and bench carpenters in 2000 are shown below:

Partitions and fixtures	\$12.24
Furniture and homefurnishings stores	11.15
Millwork, plywood, and structural members	10.75
Household furniture	9.83

Median hourly earnings of sawing machine setters, operators, and tenders, wood were \$10.23 in 2000. The middle 50 percent earned between \$8.40 and \$12.60. The lowest 10 percent earned less than \$7.12, and the highest 10 percent earned more than \$15.36. Median hourly earnings in the industries employing the largest numbers of sawing machine setters, operators, and tenders, wood in 2000 are shown below:

Sawmills and planing mills	\$10.56
Millwork, plywood, and structural members	10.36
Household furniture	9.88

Median hourly earnings of woodworking machine setters, operators, and tenders, except sawing were \$10.00 in 2000. The middle 50 percent earned between \$8.19 and \$12.32. The lowest 10 percent earned less than \$6.95, and the highest 10 percent earned more than \$14.88. Median hourly earnings in the industries employing

the largest numbers of woodworking machine setters, operators, and tenders, except sawing in 2000 are shown below:

Millwork, plywood, and structural members	\$10.36
Household furniture	10.05
Sawmills and planing mills	9.83
Miscellaneous wood products	9.37
Wood containers	8.30

In 2000, median hourly earnings were \$10.34 for furniture finishers and \$9.48 for all other woodworkers.

Some woodworkers, such as those in logging or sawmills who are engaged in processing primary wood and building materials, are members of the International Association of Machinists. Others belong to the United Brotherhood of Carpenters and Joiners of America.

Related Occupations

Carpenters also work with wood. In addition, many woodworkers follow blueprints and drawings and use machines to shape and form raw wood into a final product. Workers who perform similar functions working with other materials include sheet metal workers, structural and reinforcing iron and metal workers, computer control programmers and operators, machinists, and tool and die makers.

Sources of Additional Information

For information about woodworking occupations, contact local furniture manufacturers, sawmills and planing mills, cabinetmaking or millwork firms, lumber dealers, a local office of one of the unions mentioned above, or the nearest office of the State employment service.

Other Production Occupations

Dental Laboratory Technicians

(O*NET 51-9081.00)

Significant Points

- Employment should increase slowly, as the public's improving dental health requires fewer dentures but more bridges and crowns.
- Dental laboratory technicians need artistic aptitude for detailed and precise work, a high degree of manual dexterity, and good vision.

Nature of the Work

Dental laboratory technicians fill prescriptions from dentists for crowns, bridges, dentures, and other dental prosthetics. First, dentists send a specification of the item to be fabricated, along with an impression (mold) of the patient's mouth or teeth. Then, dental laboratory technicians, also called dental technicians, create a model of the patient's mouth by pouring plaster into the impression and allowing it to set. Next, they place the model on an apparatus that mimics the bite and movement of the patient's jaw. The model serves as the basis of the prosthetic device. Technicians examine the model, noting the size and shape of the adjacent teeth, as well as gaps within the gumline. Based upon these observations and the dentist's specifications, technicians build and shape a wax tooth or teeth model, using small hand instruments called wax spatulas and wax carvers. They use this wax model to cast the metal framework for the prosthetic device.

After the wax tooth has been formed, dental technicians pour the cast and form the metal and, using small hand-held tools, prepare the surface to allow the metal and porcelain to bond. They then apply porcelain in layers, to arrive at the precise shape and color of a tooth. Technicians place the tooth in a porcelain furnace to bake the porcelain onto the metal framework, and then adjust the shape and color, with subsequent grinding and addition of porcelain to achieve a sealed finish. The final product is a nearly exact replica of the lost tooth or teeth.

In some laboratories, technicians perform all stages of the work, whereas in other labs, each technician does only a few. Dental laboratory technicians can specialize in one of five areas: Orthodontic appliances, crowns and bridges, complete dentures, partial dentures, or ceramics. Job titles can reflect specialization in these areas. For example, technicians who make porcelain and acrylic restorations are called *dental ceramists*.

Working Conditions

Dental laboratory technicians generally work in clean, well-lit, and well-ventilated areas. Technicians usually have their own workbenches, which can be equipped with Bunsen burners, grinding and polishing equipment, and hand instruments, such as wax spatulas and wax carvers.

The work is extremely delicate and time consuming. Salaried technicians usually work 40 hours a week, but self-employed technicians frequently work longer hours.

Employment

Dental laboratory technicians held about 43,000 jobs in 2000. Most jobs were in commercial dental laboratories, which usually are