

Motor Vehicle and Parts Manufacturing

(NAICS 3361, 3362, 3363)

SIGNIFICANT POINTS

- Although 22 percent of jobs are located in Michigan, especially in the Detroit area, plants and jobs are increasingly being located in other parts of the country.
- Average earnings are very high compared with those in other industries.
- Employment is highly sensitive to cyclical swings in the economy.
- Employment is expected to grow more rapidly in firms that manufacture motor vehicle parts, bodies, and trailers than in firms that make complete vehicles.

Nature of the Industry

The motor vehicle is an intricate series of systems, subsystems, and components assembled into a final product. Each manufactured part or component is integrated into the vehicle; none is developed to exist separately. Vehicles are constantly changing as new technology or reengineered components are incorporated, and as new and updated models are designed in response to changing consumer preferences. Motor vehicle and parts manufacturers must continually evolve to maximize efficiency and provide products that consumers want in a highly competitive market.

Motor vehicles—passenger cars, sport utility vehicles (SUVs), pickup trucks and vans, heavy-duty trucks, buses, and other special-purpose motor vehicles ranging from limousines to garbage trucks—play a central role in our society. Most U.S. residents rely on them daily to travel to work or school, shop, or visit family and friends. Businesses depend on motor vehicles to transport people and goods. The United States is the world’s largest marketplace for motor vehicles because of the size and affluence of its population. According to the U.S. Department of Transportation, almost 230 million motor vehicles—nearly 136 million automobiles, 95 million trucks, and 777,000 buses—were registered in the United States in 2003. The number of light trucks—including vans, pickup trucks, and SUVs—has shown especially steady growth since the mid- to late 1980s.

Making the vehicles we drive is only a small part of the story in the motor vehicle and parts manufacturing industry. In 2004, about 9,400 establishments manufactured motor vehicles and parts; these ranged from small parts plants with only a few workers to huge assembly plants that employ thousands. Table 1 shows that about 7 out of 10 establishments in the industry manufactured motor vehicle parts—including electrical and electronic equipment; gasoline engines and parts; brake systems; seating and interior trim; steering and suspension components; transmission and power train parts; air-conditioners; and motor

vehicle stampings, such as fenders, tops, body parts, trim, and molding. Other establishments specialized in manufacturing truck trailers; motor homes; travel trailers; campers; and car, truck, and bus bodies placed on separately purchased chassis.

The motor vehicle and parts manufacturing industry in the United States has become increasingly integrated into the international economy. In fact, “domestic” vehicles often are produced using the components, manufacturing plants, and distribution methods of other nations around the world, as U.S. and foreign manufacturers of motor vehicles benefit from strategic alliances in the design, production, and distribution of vehicles and parts. Collaboration in manufacturing practices has dramatically increased productivity and improved efficiency. These cooperative practices also have resulted in manufacturers from the United States, Europe, and the Pacific Rim working closely with parts suppliers and locating production plants in the countries in which they plan to sell their vehicles, to reduce distribution time and costs. Foreign motor vehicle and parts makers with production sites in the United States are known as “domestic internationals” and account for a growing share of U.S. production and employment.

Globalization of the industry has boosted competition among U.S. motor vehicle manufacturers, prompting innovations in product design and in the manufacturing process. Manufacturers have rapidly designed and produced new models aimed at niches in the market. Firms also must be fast and flexible in implementing new production techniques, such as replacing traditional assembly lines with modern systems using computers, robots, and interchangeable platforms. Plants designed for production flexibility put resources in the right place at the right time, allowing manufacturers to shift to new models quickly and efficiently.

Motor vehicle and parts manufacturers have a major influence on other industries in the economy. As major consumers of steel, rubber, plastics, glass, and other basic materials, they create jobs in industries that produce those materials. The production of motor vehicles also spurs employment growth in other industries, including automobile and other motor vehicle dealers; automotive repair and maintenance shops; gasoline stations; highway construction companies; and automotive parts, accessories, and tire stores.

Table 1. Percent distribution of establishments and employment in motor vehicle and parts manufacturing by detailed industry sector, 2004

Industry sector	Establishments	Employment
Total	100.0	100.0
Motor vehicle parts manufacturing	68.9	62.1
Motor vehicle body and trailer manufacturing	25.9	14.9
Motor vehicle manufacturing	5.1	23.1

Working Conditions

In 2004, about 33 percent of workers in the motor vehicle and parts manufacturing industry worked, on average, more than 40

hours per week. Overtime is especially common during periods of peak demand. Most employees, however, typically work an 8-hour shift: either from 7 a.m. to 3:30 p.m. or from 4 p.m. to 12:30 a.m., with two breaks per shift and a half-hour for meals. A third shift often is reserved for maintenance and cleanup.

Although working conditions have improved in recent years, some production workers still are subject to uncomfortable conditions. Heat, fumes, noise, and repetition are not uncommon in this industry. In addition, many workers come into contact with oil and grease and may have to lift and fit heavy objects. Employees also may operate powerful, high-speed machines that can be dangerous. Accidents and injuries usually are avoided when protective equipment and clothing are worn and safety practices are observed.

Newer plants are more automated and have safer, more comfortable conditions. For example, these plants may have ergonomically designed work areas and job tasks that accommodate the worker's physical size and eliminate awkward reaching and bending and unnecessary heavy lifting. Workers typically function as part of a team, doing more than one job and thus reducing the repetitiveness of assembly line work.

Workers in this industry experience higher rates of injury and illness than do workers in most other industries. In 2003, cases of work-related injury and illness averaged 15.2 per 100 full-time workers in motor vehicle manufacturing, 12.2 in motor vehicle body and trailer manufacturing, and 9.0 in motor vehicle parts manufacturing—compared with 6.8 in all manufacturing industries and 5.0 in the entire private sector.

As in other industries, professional and managerial workers normally have clean, comfortable offices and are not subject to the hazards of assembly line work. Improved ergonomics help office and administrative support workers avoid repetitive strain injuries, but employees using computer terminals for long periods may develop eye strain and fatigue.

Employment

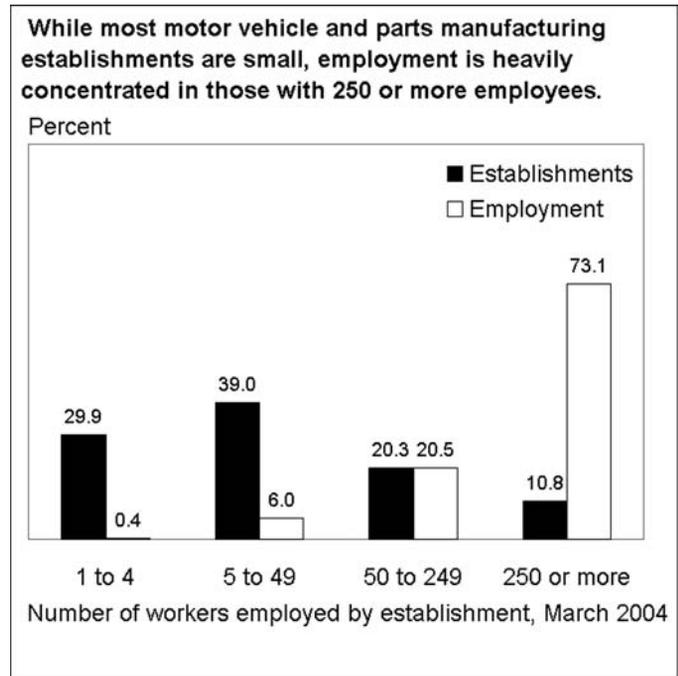
Motor vehicle and parts manufacturing was among the largest of the manufacturing industries in 2004, providing 1.1 million jobs. The majority of jobs, about 62 percent, were in firms that make motor vehicle parts. About 23 percent of workers in the industry were employed in firms assembling complete motor vehicles, while about 15 percent worked in firms producing truck trailers; motor homes; travel trailers; campers; and car, truck, and bus bodies placed on separately purchased chassis.

Although motor vehicle and parts manufacturing jobs are scattered throughout the Nation, certain States account for the greatest numbers of jobs. Michigan, for example, accounts for 22 percent of all jobs. Combined, Michigan, Ohio, and Indiana include 46 percent of all the jobs in this industry. Other States that account for significant numbers of jobs include California, Tennessee, Texas, Kentucky, and Missouri.

Employment is concentrated in a relatively small number of very large establishments. About 73 percent of motor vehicle and parts manufacturing jobs were in establishments employing 250 or more workers (chart 1). Motor vehicle manufacturing employment, in particular, is concentrated in large establishments, whereas many motor vehicle parts manufacturing jobs are found in small and medium-sized establishments.

Employment data in this statement do not include workers related to automotive research and development (R&D) who work in separate establishments. Under the North American Industry

Classification System (NAICS), workers in R&D establishments that are not part of a manufacturing facility are included in a separate industry—research and development in the physical, engineering, and life sciences. This industry is covered in the statement on scientific research and development services, elsewhere in the *Career Guide*. However, given the importance of R&D work to the motor vehicle and parts manufacturing industry, occupations and issues related to R&D are discussed in the following sections even though some of their employment is not included in the employment data in this statement. Many of these jobs are located in Michigan.



Occupations in the Industry

Prior to assembling components in the manufacturing plant, extensive design, engineering, testing, and production planning go into the manufacture of motor vehicles. These tasks often require years to complete and cost millions of dollars.

Using artistic talent, computers, and information on product use, marketing, materials, and production methods, *commercial and industrial designers* create designs they hope will make the vehicle competitive in the marketplace. Designers use sketches and computer-aided design techniques to create computer models of proposed vehicles. These computer models eliminate the need for physical body mockups in the design process because they give designers complete information on how each piece of the vehicle will work with others. Workers may repeatedly modify and redesign models until the models meet engineering, production, and marketing specifications. Designers working in parts production increasingly collaborate with manufacturers in the initial design stages to integrate motor vehicle parts into the design specifications for each vehicle.

Engineers—who form the largest professional contingent in the industry—play an integral role in all stages of motor vehicle manufacturing. They oversee the building and testing of the engine, transmission, brakes, suspension, and other mechanical and electrical components. Using computers and assorted models, instruments, and tools, engineers simulate various parts of

the vehicle to determine whether each part meets cost, safety, performance, and quality specifications. *Mechanical engineers* design improvements for engines, transmissions, and other working parts. *Electrical and electronics engineers* design the vehicle's electrical and electronic systems, as well as industrial robot control systems used to assemble the vehicle. *Industrial engineers* concentrate on plant layout, including the arrangement of assembly line stations, material-moving equipment, work standards, and other production matters.

Under the direction of engineers, *engineering technicians* prepare specifications for materials, devise and run tests to ensure product quality, and study ways to improve manufacturing efficiency. For example, testing may reveal how metal parts perform under conditions of heat, cold, and stress, and whether emissions-control equipment meets environmental standards. Finally, prototype vehicles incorporating all the components are built and tested on test tracks, on road simulators, and in test chambers that can duplicate almost every driving condition, including crashes.

Computer systems analysts work with computer systems to improve manufacturing efficiency. After working out the many details involved, computer specialists help put in place the machinery and tools required for assembly line production of the vehicle.

Management workers establish guidelines for the design of motor vehicles to provide direction for the teams of experts in engineering, design, marketing, sales, finance, and production. From the earliest stages of planning and design, these specialists help assess whether the vehicle will satisfy consumer demand, meet safety and environmental regulations, and prove economically practical to make. These executives also serve as public representatives for the company; they are the face of the company.

Industrial production managers oversee *first-line supervisors and managers of production and operating workers*. These supervisors oversee inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators. They coordinate a variety of manufacturing processes and production activities, including scheduling, staffing, equipment, quality control, and inventory control.

Production workers account for about 64 percent of motor vehicle and parts manufacturing jobs (table 2). *Assemblers and fabricators* and *metal workers and plastic workers* put together various parts to form subassemblies, and then put the subassemblies together to build a complete motor vehicle. Most assemblers in this industry are *team assemblers*, who may work on a variety of tasks as needed. Some may perform other routine tasks such as mounting and inflating tires; adjusting brakes; and adding gas, oil, brake fluid, and coolant. Metal parts are welded, plastic and glass parts are molded and cut, seat cushions are sewn, and many parts are painted. Many manufacturing processes are highly automated; robots, computers, and programmable devices are an integral part of motor vehicle manufacturing. Throughout the manufacturing process, "statistical process control" (teamwork and quality control) is emphasized. From initial planning and design to final assembly, numerous tests and inspections ensure that vehicles meet quality and safety standards. Modern manufacturing facilities integrate interchangeable tools on the assembly line so that they can quickly be changed to meet the needs of various models and specifications.

Table 2. Employment of wage and salary workers in motor vehicle and parts manufacturing by occupation, 2004 and projected change, 2004-14
(Employment in thousands)

Occupation	Employment, 2004		Percent change, 2004-14
	Number	Percent	
Total, all occupations	1,109	100.0	5.6
Management, business, and financial occupations	70	6.3	12.0
Top executives	9	0.8	8.9
Business operation specialists, all other	15	1.4	19.1
Professional and related occupations	84	7.6	14.1
Industrial engineers	18	1.6	21.5
Mechanical engineers	12	1.0	14.1
Engineers, all other	18	1.6	9.6
Engineering technicians, except drafters, all other	11	1.0	11.9
Construction and extraction occupations	33	3.0	8.5
Electricians	18	1.6	8.5
Installation, maintenance, and repair occupations	74	6.7	8.9
Electrical and electronics installers and repairers, transportation equipment	1	0.1	9.7
Electronic equipment installers and repairers, motor vehicles	1	0.1	9.0
Recreational vehicle service technicians	1	0.1	9.0
Industrial machinery mechanics	13	1.1	9.4
Maintenance and repair workers, general	22	2.0	9.1
Millwrights	9	0.9	8.7
Production occupations	705	63.5	4.4
First-line supervisors/managers of production and operating workers	37	3.3	9.3
Engine and other machine assemblers .	16	1.5	8.5
Team assemblers	204	18.4	9.6
Assemblers and fabricators, all other ...	67	6.0	-0.1
Computer-controlled machine tool operators, metal and plastic	15	1.3	10.2
Forging machine setters, operators, and tenders, metal and plastic	7	0.6	-0.1
Machine tool cutting setters, operators, and tenders, metal and plastic	63	5.6	-6.2
Machinists	25	2.2	10.0
Model makers, metal and plastic	2	0.2	1.4
Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic	16	1.4	-0.5
Multiple machine tool setters, operators, and tenders, metal and plastic	19	1.7	10.2
Tool and die makers	21	1.9	9.6
Welders, cutters, solderers, and brazers	35	3.2	9.5
Welding, soldering, and brazing machine setters, operators, and tenders	12	1.1	10.0
Metal workers and plastic workers, all other	12	1.1	-13.9
Inspectors, testers, sorters, samplers, and weighers	36	3.2	-0.7
Painting workers	16	1.5	6.3
Production workers, all other	37	3.3	-14.5
Transportation and material moving occupations	69	6.2	1.1
Industrial truck and tractor operators	24	2.2	1.5
Laborers and material movers, hand	33	3.0	0.1

Note: May not add to totals due to omission of occupations with small employment

Although robots perform most of the welding, *welding, soldering, and brazing workers* still are needed for some welding and for maintenance and repair duties. *Machinists* produce precision metal parts that are made in numbers too small to produce with automated machinery. *Tool and die makers* produce tools, dies, and special guiding and holding devices used in machines. *Computer-controlled machine tool operators* use computer-controlled machines or robots programmed to manufacture parts of different dimensions automatically.

Workers in other production occupations run various machines that produce an array of motor vehicle bodies and parts. These workers set up and operate machines and make adjustments according to their instructions. In computer-controlled systems, they monitor computers controlling the machine processes and may have little interaction with the machinery or materials. Some workers specialize in one type of machine; others operate more than one type.

Grinding and polishing workers use handtools or hand-held power tools to sand and polish metal surfaces, and *painting workers* paint surfaces of motor vehicles. *Sewing machine operators* sew together pieces of material to form seat covers and other parts.

Throughout the manufacturing process, *inspectors, testers, sorters, samplers, and weighers* ensure that motor vehicles and parts meet quality standards. They inspect raw materials, check parts for defects, check the uniformity of subassemblies, and test-drive vehicles. *Helpers* supply or hold materials or tools, and clean work areas and equipment.

Motor vehicle operators and material moving workers are essential to keeping the plant running smoothly. *Industrial truck and tractor operators* carry components, equipment, and other materials from factory warehouse and outdoor storage areas to assembly areas. *Truck drivers* carry raw materials to plants, components and materials between plants, and finished motor vehicles to dealerships for sale to consumers. *Laborers and hand freight, stock, and material movers* manually move materials to and from storage areas, loading docks, delivery vehicles, and containers. *Machine feeders and offbearers* feed materials into, or remove materials from, machines or equipment on the assembly line, and *hand packers and packagers* manually package or wrap materials.

Workers in construction, installation, maintenance, and repair occupations set up, maintain, and repair equipment. *Electricians* service complex electrical equipment. *Industrial machinery mechanics* and *machinery maintenance workers* maintain machinery and equipment to prevent costly breakdowns and, when necessary, perform repairs. *Millwrights* install and move machinery and heavy equipment according to the factory's layout plans. *Automotive service technicians and mechanics* fix bodies, engines, and other parts of motor vehicles, industrial trucks, and other mobile heavy equipment.

Training and Advancement

Faced with technological advances and the continued need to cut costs, manufacturers increasingly emphasize continuing education and cross-train many workers—that is, they train workers to do more than one job. This has led to a change in the profile of the industry's workers. Standards for new hires are higher now than in the past. Employers increasingly require at least a high school diploma as the number of unskilled jobs declines, and most motor vehicle manufacturers administer lengthy

examinations when hiring assemblers. Manual dexterity will continue to be necessary for many production jobs, but employers also look for employees with good communication and math skills, as well as an aptitude for computers, problem solving, and critical thinking. Because many plants now emphasize the team approach, employees interact more with coworkers and supervisors to determine the best way to get the job done. They are expected to work with much less supervision than in the past and to be responsible for ensuring that their work conforms to guidelines.

Opportunities for training and advancement vary considerably by occupation, plant size, and sector. Training programs in larger auto and light truck assembly plants usually are more extensive than those in smaller parts, truck trailer, and motor home factories. Production workers receive most of their training on the job or through more formal apprenticeship programs. Training normally takes from a few days to several months and may combine classroom with on-the-job training under the guidance of more experienced workers. Attaining the highest level of skill in some production jobs requires several years, however. Training often includes courses in health and safety, teamwork, and quality control. With advanced training and experience, production workers can advance to inspector or to more skilled production, craft, operator, or repair jobs.

Skilled production workers—such as tool and die makers, millwrights, machinists, pipefitters, and electricians—normally are hired on the basis of previous experience and, in some cases, a competitive examination. Alternatively, the company may train inexperienced workers in apprenticeship programs that last up to 5 years and combine on-the-job training with classroom instruction. Typical courses include mechanical drawing, tool designing and programming, blueprint reading, shop mathematics, hydraulics, and electronics. Training also includes courses on health and safety, teamwork, quality control, computers, and diagnostic equipment. With training and experience, workers who excel can advance to become supervisors or managers.

Motor vehicle manufacturers provide formal training opportunities to all workers, regardless of educational background. Manufacturers offer some classes themselves and may pay tuition for workers who enroll in colleges, trade schools, or technical institutes. Workers sometimes can get college credit for training received on the job. Subjects of company training courses range from communication skills to computer science. Formal educational opportunities at postsecondary institutions range from courses in English, basic mathematics, electronics, and computer programming languages to work-study programs leading to associate, bachelor's, and graduate degrees in engineering and technician specialties, management, and other fields.

Outlook

Overall wage and salary employment in the motor vehicle and parts manufacturing industry is expected to increase by 6 percent over the 2004-14 period, compared with 14 percent for all industries combined. While employment in motor vehicle manufacturing is expected to grow very slowly, firms manufacturing motor vehicle parts, bodies, and trailers are expected to add more jobs. Employment is expected to increase by only 2 percent in motor vehicle manufacturing, with increases of 6 percent in motor vehicle parts manufacturing and 8 percent in motor vehicle body and trailer manufacturing.

Growth in firms that manufacture motor vehicle parts, bod-

ies, and trailers will generate many job openings, as will the departure of workers who retire or transfer to jobs in other industries. Not all of the motor vehicle manufacturing workers who leave the industry will be replaced, however, and many of the new workers will be hired for occupations different from those vacated by departing employees.

Employment in the motor vehicle and parts manufacturing industry is expected to grow with demand for motor vehicles and parts, but jobs will be lost due to productivity increases. The growing intensity of international and domestic competition has increased cost pressures on manufacturers. In response, they have sought to improve productivity and quality with high-technology production techniques including computer-assisted design, production, and testing. Increasing productivity should meet much of the demand created by the increasing output of the motor vehicle and parts manufacturing industry, resulting in slow job growth. Moreover, the industry is increasingly turning to contract employees in an effort to reduce costs. Contract workers are less costly to hire and lay off than are permanent employees; contract jobs also serve as a screening tool for candidates for permanent jobs that are more complex and require more skills.

Growth in demand for domestically manufactured motor vehicles could be limited by a number of factors, such as improvements in vehicle quality and durability, which extend longevity, and more stringent safety and environmental regulations, which increase the cost of producing and operating motor vehicles. Continued efforts to reduce costs also may drive some manufacturers to import parts. However, manufacturing output is expected to continue to grow over the projection period to replace existing vehicles and meet the demand for new vehicles as the driving population grows.

Employment in motor vehicle and parts manufacturing is highly sensitive to cyclical swings in the economy. During periods of economic prosperity, consumers are more willing and able to purchase expensive goods such as motor vehicles, which may require large down payments and extended loan payments. During recessions, however, consumers are more likely to delay such purchases. Motor vehicle manufacturers respond to these changes in demand by hiring or laying off workers.

Expanding factory automation, robotics, efficiency gains, and the need to cut costs are expected to keep employment from growing as fast as output. Increases in efficiency and automation will cause employment declines in some occupations, particularly in production occupations. Employment of office and administrative support workers will decline due to expanding office and warehouse automation. Automation and continued global competition, however, are expected to produce job growth for industrial engineers, industrial production managers, business operations specialists, and computer specialists. Manufacturers will increasingly turn to these workers for further innovation in reducing costs and enhancing competitive advantage.

Earnings

Average weekly earnings of production or nonsupervisory workers in the motor vehicle and parts manufacturing industry are relatively high. At \$1,217 per week, earnings of production workers in establishments that manufacture complete motor vehicles were among the highest in the Nation in 2004. Workers in establishments that make motor vehicle parts averaged \$872 weekly, and those in motor vehicle body and trailer manufacturing earned

\$690 per week, compared with \$659 for workers in all manufacturing industries, and \$529 for those in the entire private sector. Earnings in selected occupations in transportation equipment manufacturing, which comprises motor vehicle and parts manufacturing and aerospace product and parts manufacturing, appear in table 3.

Table 3. Median hourly earnings of the largest occupations in transportation equipment manufacturing, May 2004

Occupation	Transportation equipment	All industries
Industrial engineers	\$31.15	\$31.26
Production workers, all other.....	24.12	11.38
First-line supervisors/managers of production and operating workers	24.10	21.51
Assemblers and fabricators, all other.....	23.85	11.90
Maintenance and repair workers, general	19.66	14.77
Inspectors, testers, sorters, samplers, and weighers	18.51	13.66
Machinists	17.56	16.33
Welders, cutters, solderers, and brazers.....	15.55	14.72
Team assemblers	13.79	11.42
Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	13.46	12.45

These hourly earnings may increase during overtime or special shifts. Workers generally are paid 1.5 times their normal wage rate for working more than 8 hours a day or more than 40 hours a week, or for working on Saturdays. They may receive double their normal wage rate for working on Sundays and holidays. The largest manufacturers and suppliers often offer other benefits, including paid vacations and holidays; life, accident, and health insurance; education allowances; nonwage cash payment plans, such as performance and profit-sharing bonuses; and pension plans. Some laid-off workers in the motor vehicle and parts manufacturing industry have access to supplemental unemployment benefits, which can provide them with nearly full pay and benefits for up to several years, depending on the worker's seniority.

In 2004, about 3 out of 10 workers in motor vehicle and parts production were union members or were covered by union contracts, more than double the proportion of workers in all manufacturing industries and all workers in the private sector. Workers in motor vehicle production were more likely to be members of unions than were workers in parts production. The primary union in the industry is the United Automobile, Aerospace, and Agricultural Implement Workers of America, also known as the United Auto Workers (UAW). Nearly all production workers in motor vehicle assembly plants, and most of those in motor vehicle parts plants, are covered by collective bargaining agreements negotiated by the UAW. Other unions—including the International Association of Machinists and Aerospace Workers of America, the United Steelworkers of America, and the International Brotherhood of Electrical Workers—cover certain plant locations or specified trades in the industry.

Sources of Additional Information

Information on employment and training opportunities in the motor vehicle and parts manufacturing industry is available from local offices of State employment services, employment offices of motor vehicle and parts manufacturing firms, and locals of the unions mentioned above.

Detailed information on most occupations in this industry,

including the following, appears in the 2006-07 edition of the *Occupational Outlook Handbook*:

- Commercial and industrial designers
- Drafters
- Electricians
- Engineering technicians
- Engineers
- Industrial machinery mechanics and maintenance workers
- Industrial production managers
- Inspectors, testers, sorters, samplers, and weighers
- Machine setters, operators, and tenders—metal and plastic
- Machinists
- Material moving occupations
- Painting and coating workers, except construction and maintenance
- Tool and die makers
- Welding, soldering, and brazing workers