Career solutions for trained problem-solvers

by Elka Jones

If there were no problems, some people might face a real predicament: finding a new line of work.

Almost any job requires some problem-solving skills, but certain occupations revolve around workers' ability to solve problems. People in these problem-centered occupations welcome the chance to be solutions experts. Finding a way through or around predicaments allows them to think creatively and apply their knowledge to achieve a goal. Problem-solvers are investigators—they ask questions, analyze information, draw conclusions, and take action toward remedies or improvements.

Workers who are trained as solution seekers might consider problem-solving to be challenging, even enjoyable. That doesn't mean their jobs are easy. Constantly dealing with problems can be stressful, especially because some riddles have no resolution. But job satisfaction is more likely for those who choose a problem-solving occupation that fits well with their interests and talents.

This article can help you make that match by describing how problem-solving skills are applied in a variety of careers. Focusing on the broad occupational groupings of managerial, engineering, and repair, this article discusses what problem-solving workers do, what types of problems they encounter, and what kinds of training they need to enter and advance in these careers. It also explores other ways for problem-solvers to find profitable outlets for their talents. Suggested sources for more information are provided at the end.

Elka Jones is a contributing editor to the *OOQ*, (202) 691–5719.

Turning problems into paychecks

For workers who make a career of solving problems, dilemmas and obstacles are not a nuisance but a livelihood. Some workers actually create problems just so they can solve them. For example, a computer security specialist might create a computer virus and then release it, under controlled conditions, into an organization's computing system. Knowing how the system reacts to the test virus helps the specialist to identify potential vulnerabilities and prevent real viruses from causing damage in the future.

Other workers do not create problems, but they might seek them out to solve. Managerial, engineering, and repair occupations are three fields in which workers encounter problems as an integral part of their jobs. Each of these occupational groups has a different mission, and each comes with a unique set of puzzles.

Managers

Whether they work in an office building, at a fast-food restaurant, or on a construction site, nearly all managers solve problems to ensure that things run smoothly. These workers are

You think you've got problems? Managers, engineers, and repairers are glad you do. For these and other workers, solving problems is a livelihood.

hired to oversee a particular aspect of an organization, and problem-solving is an important part of this responsibility. Many sources, including the *Occupational Outlook Handbook*, reserve this title for higher level managers or for those who oversee supervisors. In this article, however, managers are more broadly defined to include workers whose jobs involve supervisory and decisionmaking functions.

Managers determine what needs to be done and how it should be accomplished, given constraints such as limited time or a limited budget. Then, they assign and oversee the work required to carry out their objectives.

Managers also attempt to avoid problems by anticipating difficult situations and preventing them from materializing. For instance, the manager of an organization's human resources department might look ahead to ensure that the company has enough workers. She might begin by researching retirement trends and discover that more than half of the company's workers will be eligible to retire in the next 5 years. Because the organization would be crippled by such a significant staff reduction, she considers ways for the human resources department to plan accordingly—gradually hiring more workers,

perhaps, or offering incentives to keep workers from retiring—to avert a crisis.

But no matter how carefully managers plan, problems arise. In fact, many managers say they face some type of problem every day. And when something goes wrong, employees and customers usually turn to a manager to right it.

Say you are a production manager for a company that makes and sells uniforms. You oversee the production of the uniforms. One day, a salesworker returns from his deliveries. He is upset with the production worker who provides the uniforms because of a recurring problem with his orders. An argument ensues, and both employees threaten to quit. It is your job as production manager to step in and resolve the conflict. What do you do?

You might approach the situation by identifying the problem and then deciding on a solution. First, you talk to the workers and learn that customers have been receiving the wrong-colored shirts and that letters are

missing on their nametags. Several questions occur to you: Was there a problem in processing the orders? Is there a problem with the machine that sews the names on the shirts? Or is this a personnel issue involving the salesworker and the production worker? You investigate and find that the first two hypotheses are true—the problems are with order processing and with the machine that sews on the nametags. Solving the problem requires improving order processing and repairing the nametag machine.

These examples demonstrate some of the ways in which managers use problem-solving skills. There are many types of problems and many opportunities for managers to solve them, because nearly every type of work that is done needs people to oversee it.

Whatever someone's interests, there is probably a management field that encompasses them. For people who like working with accounting and number problems, there are jobs in financial management for overseeing budgets, deciding when and how to loan and borrow money, and monitoring cash flow. Those who enjoy working in construction could pursue construction management and resolve issues that arise in planning and putting up buildings. And someone who likes computers might consider a career in computer and information systems management, supervising troubleshooters or determining the technology needs of an organization.

These are just some of the many types of management positions—and problems—that exist for solutions-minded people.

Working conditions. Managers typically have their own office space. But some managers spend a significant portion of their time outside of the office. Store managers might regularly work on the sales floor, for instance; engineering and natural science managers might frequent a laboratory.

Problem-solving and other work-related demands often require managers to put in long hours, which may include substantial evening and weekend work. Some management positions require frequent travel. Constantly having problems to resolve can cause the work to be stressful at times, as can related challenges such as tight deadlines and strained budgets.

Earnings. Depending on the kinds of tasks they oversee, managers have very different earnings. For example, managers who supervise retail salesworkers had median earnings of about $29,700 in 2002, with the top-earning 10 percent making more than $55,810 and the bottom-earning 10 percent making less than $18,380.

Managers who perform specialized tasks, usually within a larger company, frequently have earnings that are much higher than those. For instance, sales managers who supervise a company's entire sales department, including overseeing product distribution and analyzing sales statistics, had
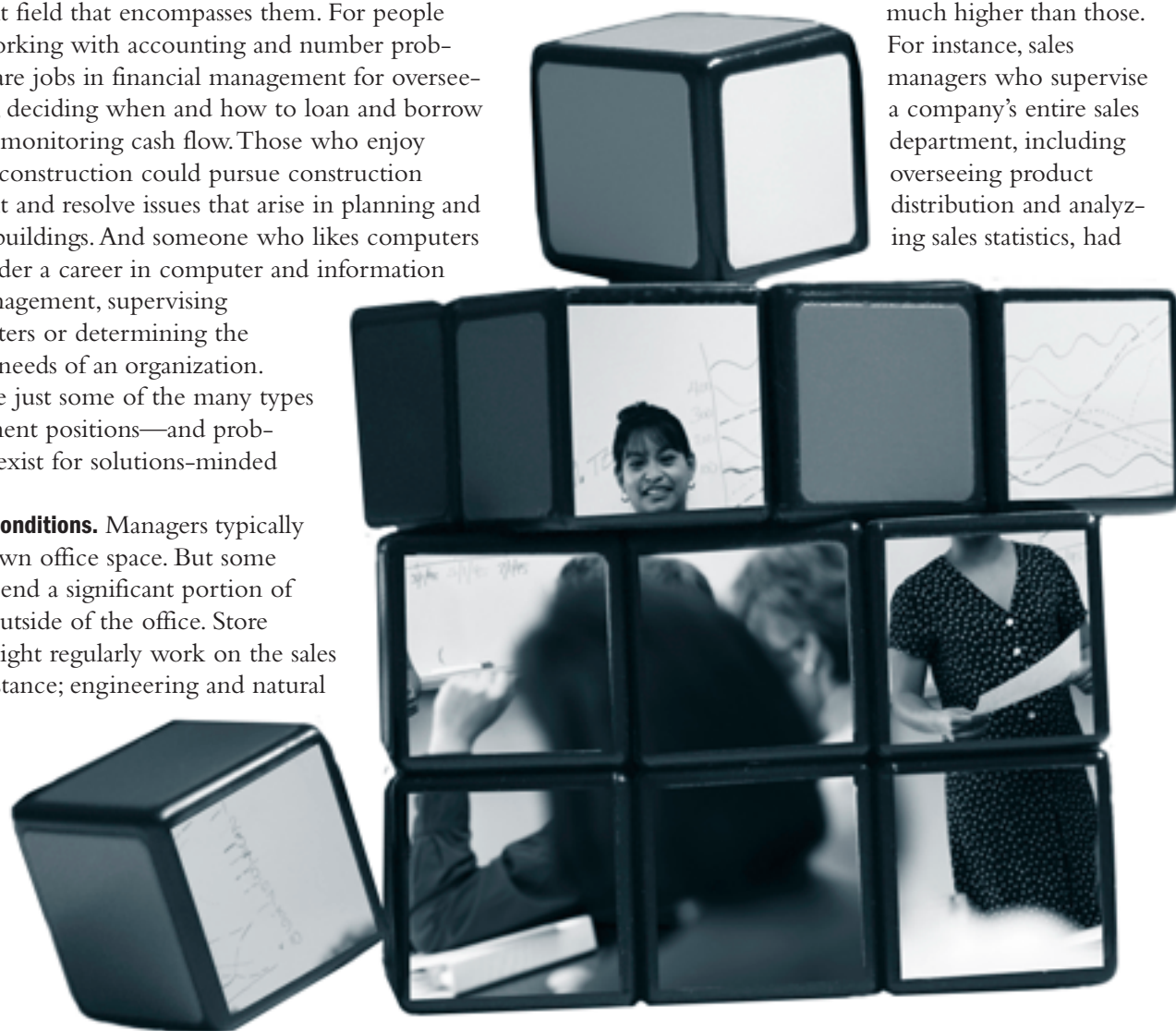
median earnings of $75,040, with the highest paid 10 percent earning more than $145,600 and the lowest paid 10 percent making less than $37,340. Managers of highly skilled workers usually also command higher earnings. Engineering managers, for example, had median earnings of about $90,930 in 2002, with the highest paid 10 percent earning over $141,380 and the lowest paid 10 percent earning less than $57,840.

Employment and outlook. Managers accounted for well over 20 million U.S. jobs in 2000. Store managers and other managers of salesworkers held a significant proportion of these jobs, with more than 14 million people employed.

Many job openings for managers are expected through 2010 as current workers advance, leave the labor force permanently, or transfer to other occupations. However, competition for management positions is intense, especially for those that have the most attractive earnings potential and working conditions.

Job outlook varies, depending on the specific occupation and industry. Examples include computer and information systems managers, who are projected to have faster than average employment growth from 2000-10, and farm, ranch, and agricultural managers, who face slower than average growth prospects during the same decade.

Characteristics. Solving management problems requires special skills. The ability to communicate, both orally and in writing, is critical for most managers. Also important for managers is to have patience and strong interpersonal skills, because the types of problems that they solve often involve dealing with others. Creativity and flexibility are likewise important for seeking new solutions to sometimes routine problems. Furthermore, leadership ability is invaluable because making decisions, assigning tasks, and taking control are essential for problem-solvers in management positions.

So-called "hard" skills and knowledge are also critical for many managers. These include computer proficiency and other job-specific insight, such as healthcare knowledge for medical and health services managers.

Training and advancement. Experience is an almost universal necessity for all managers. Beyond that, requirements vary considerably. Much of a manager's expertise—including knowing how to handle common problems—is gained through experience and observation.

Most aspiring managers begin their careers in non-management positions and then, in part by discovering a knack for solving problems successfully, advance to

management. For example, a bank manager might begin working as a teller or loan officer, where he becomes familiar with the problems and practices of a bank. Then, after promotion to assistant manager or branch manager, he learns through experience to better understand the bank branch's employees and potential problems before earning another promotion to tackle the greater responsibilities—and bigger problems—of a larger bank.

For some managers, such as those in small retail establishments or fast-food restaurants, on-the-job training may be sufficient preparation. But workers in

There are many types of problems and many opportunities for managers to solve them.

many management positions have advanced education. Some employers strongly prefer to hire candidates who have a college degree in a field related to their industry. A bachelor's degree in advertising or journalism, for instance, is a common requirement for positions in advertising management.

Managers, especially those who plan or oversee large projects or departments, often earn master's degrees in management to advance. The most common degree is a master of business administration (MBA) degree. In MBA programs, students learn about financial, personnel, and organizational management, and they practice solving problems. Other advanced degrees, such as a master's degree in engineering management, nonprofit management, or technology management, are tailored to specific industries.

Many management positions have advancement potential. Store managers may be promoted to higher level management positions in areas where their sales knowledge and problem-solving expertise can be of value, such as positions in advertising, marketing, or purchasing. Higher level managers can advance from first- to mid- to top-level management positions. For example, a first-level administrative services manager might advance to become director of administrative services and then eventually be named executive vice president for administrative services. A few top-level managers could advance to higher executive positions, such as chief executive officer, chief financial officer, or chief information officer.

Engineering occupations

People in engineering apply scientific knowledge to practical problems. In seeking out new and better ways to do or make things, engineering workers solve a wide range of problems. Engineers, engineering technicians, and engineering technologists are discussed together here. But some sources, including the *Occupational Outlook Handbook*, refer to technologists in descriptions of engineers or engineering technicians.

Engineering workers usually focus their problem-solving skills on creating something new or making something better. They might work to make a better pesticide or improve the way in which oil is extracted from deep under the ocean. Their designs and problem-solving expertise are behind the bridges we cross and the

> In seeking out new and better ways to do or make things, engineering workers solve a wide range of problems.

airplanes we fly. In fact, many of the things we use or see around us have had problems worked out of them through engineering.

Often, engineers, engineering technicians, and engineering technologists work as a team. In doing so, workers in each occupational group use problem-solving skills, but in different ways. Engineers generally lead the team in its problem-solving efforts, and technologists and technicians help to make the engineers' concepts a reality.

Engineers design all sorts of products and equipment; they develop systems and methods using complex mathematics and scientific knowledge. The specific jobs performed by technologists and technicians vary greatly. In fact, even their job titles vary.

To illustrate the different ways in which these engineering workers solve problems, imagine yourself working as part of an engineering team. Your goal is to create a new toy, one that bounces higher than any other bouncing toy ever made. You have previously developed several less bouncy toys, which you now have as models to work with. The team initially meets as a group to discuss ideas and formulate strategies for completing the project.

As an engineer, you evaluate the team's ideas and create a design for the new toy. You might consider a few questions to help in the problem-solving. How were the

other toys designed? What controls the height of the toys' bounce? What can be done to make the toy bounce higher? Identifying what you need to improve is the first step in solving the problem. You disassemble the model toys and discover that the key to their bouncing is the shape of several internal springs. The next step in your problem-solving exercise is to determine how to shape the springs for maximum bounce. Using your knowledge of physics and springs, and working closely with the engineering technologist, you draw up a new design.

If you are an engineering technologist, you might help the engineer to refine the design by performing some calculations or running a computer simulation. You might also help to determine how to construct the toy by researching production techniques. Perhaps you identify a problem with the feasibility of the engineer's design: the new springs cannot be made the way the engineer intended, given available machinery. You present the problem to the engineer and work together to find a solution.

As an engineering technician, you might inspect and test the finished product. Under the supervision of the other team members, you might construct testing machinery and solve resulting problems, such as figuring out how to ensure that the test is accurate. If you find a problem—maybe the toy still does not bounce quite high enough—you try to identify its source, discussing it with the other team members.

Working together, your team finds a solution to the problem and creates a recordbreaking bouncing toy.

This simplified example illustrates the process and methods that engineering workers sometimes use to solve problems. In the real world, most engineers, engineering technologists, and engineering technicians deal with very complex problems. As a result, these workers usually specialize. Electronics specialization is the most common type, but there are also a variety of other specialties for engineering problem-solvers, such as civil, agricultural, aerospace, and biomedical engineering.

Working conditions. Most engineers, engineering technicians, and engineering technologists work at least 40 hours a week, generally in office buildings, laboratories, or manufacturing or industrial plants. Some, such as those who work in civil engineering, spend time seeking solutions outside, and they may frequently travel for onsite assessment of whatever problems they are working on. Engineering workers may face considerable pressure when problems must be solved within tight deadlines.

Some engineering workers risk exposure to chemicals or toxic materials or hazards from equipment.

Earnings. Starting salaries for new engineers are among the highest in any field, and many engineering technicians also have earnings that are higher than the average for all occupations. Specific earnings data for engineering technologists are not available because the Bureau of Labor Statistics (BLS) counts these workers among engineering technicians.

Earnings vary by specialty. For engineers, median annual earnings ranged from $83,370 for petroleum engineers to $50,700 for agricultural engineers. Earnings also vary within specialties. For instance, the top-earning 10 percent of petroleum engineers made more than $127,950, and the bottom 10 percent earned less than $49,010. In contrast, the highest and lowest earning 10 percent of agricultural engineers made more than $87,220 and less than $35,590.

For engineering technicians, earnings ranged from a median of $51,650 for aerospace engineering and operations technicians to $36,850 for environmental engineering technicians. Engineering technicians' earnings also varied within specialties, with the highest paid 10 percent of aerospace engineering and operations technicians earning more than $73,480 and the lowest paid 10 percent earning less than $34,820; the highest and lowest earning environmental engineering technicians made more than $60,390 and less than $22,980.

Employment and outlook. There were about 1.5 million engineers and about 519,000 engineering technicians employed in 2000. Specific BLS data are not available for engineering technologists, although they are included within employment estimates for engineers or engineering technicians. Engineering workers are employed largely in manufacturing industries, where they solve problems relating to transportation equipment, electronic and other electrical equipment, and industrial machinery and equipment, among other types.

Employment prospects vary for engineering workers. With the number of graduates from engineering programs expected to remain relatively stable, engineers should encounter favorable job opportunities. However, overall employment of engineers is expected to grow more slowly than the average for all occupations from 2000 through 2010. Specific employment outlook varies by specialty. Faster than average employment growth is projected in fields that are expected to present an increasing number of engineering problems, such as biomedical and computer hardware engineering, with slower than average growth projected in fields in which fewer new problems are expected to be solved.

Overall employment of engineering technicians is expected to grow about as fast as the average for all occupations. The employment outlook for these workers will also vary by specialty, with new specializations such as water quality control and environmental technology among the ones expected to encounter more new problems and, therefore, greater growth.

Although BLS does not project
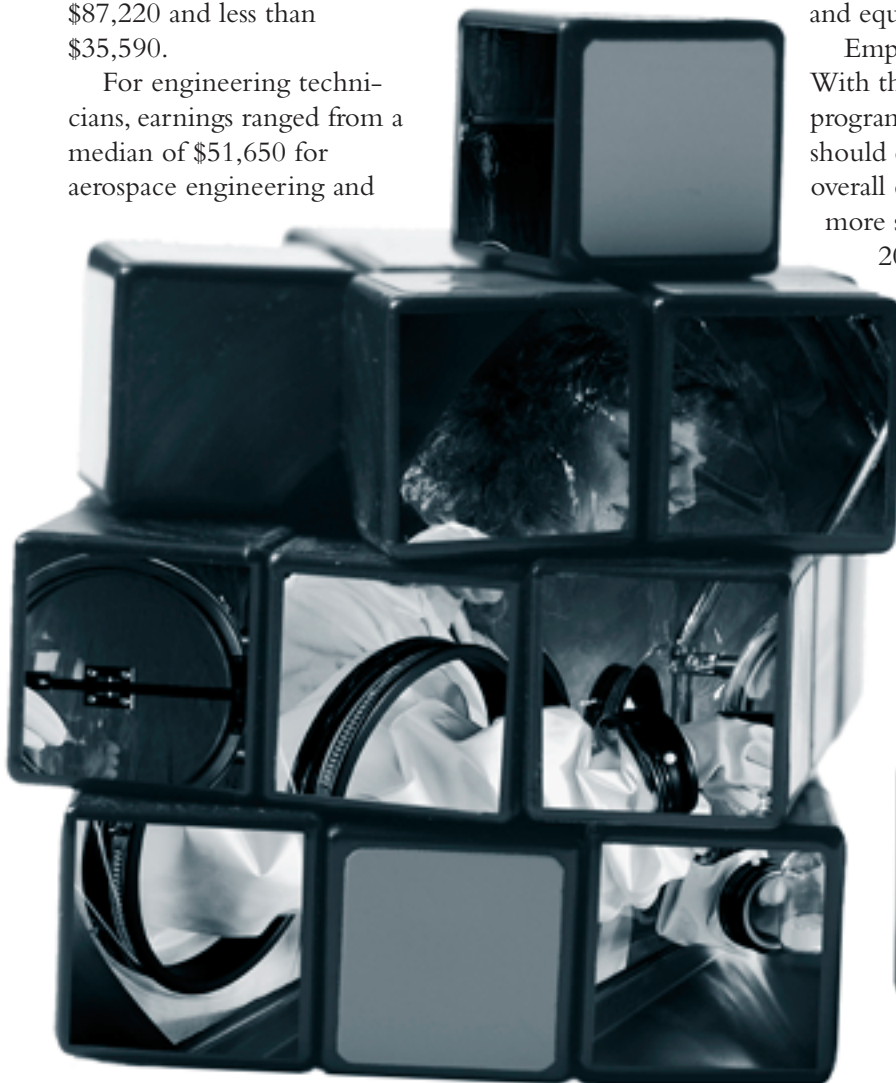
employment for engineering technologists, the limited information available suggests that these workers also should have favorable job opportunities.

Characteristics. Engineering workers rely on their knowledge of science, math, and engineering to research or develop feasible solutions. Problem-solving requires an understanding of these disciplines, which are integral components of engineering. Like other problem-solvers, engineering workers should be inquisitive and have good analytical skills. Creativity also is important in engineering occupations, as is the ability to communicate and work with others to solve problems.

Preparation and advancement. Engineering workers, due to the nature of the problems they solve, often must have formal training beyond high school. Most engineers earn a bachelor's degree in engineering, typically specializing in a field such as civil, electrical, or mechanical engineering.

Employers often prefer to hire engineering technicians and technologists who have formal postsecondary training. And, like engineers, these workers frequently specialize. Some engineering technologists have a 4-year bachelor's degree in engineering technology, which is different from—and not interchangeable with—a degree in engineering. Engineering technicians may hold an associate degree in engineering technology.

Engineering workers usually start out solving problems under the supervision of more experienced workers. As they gain practical experience and become increasingly adept at identifying solutions, they are gradually assigned to more difficult projects involving more complex problems, at which time they also may be given greater autonomy in solving those problems. Some may advance to supervisory positions. Engineers sometimes become technical specialists; other times, they advance to engineering management or move into other managerial or sales positions.

Repairers

Repair workers fix all sorts of things that are broken or not working properly. In addition to solving problems through repair, many repairers also prevent problems through routine maintenance and installation. Repairers also may be called technicians or service technicians, and some repairers are still referred to as mechanics.

Anyone who has ever been without modern conveniences such as electricity or air-conditioning can appreciate the problem-solving talents of repairers. These workers uncover the underlying causes of problems—and, in doing so, help to eliminate them. The specifics of their jobs vary, depending on the types of things that they fix.

An important part of most repairers' work is trouble-shooting to identify problems. Repairers often discover what is wrong by testing things or taking them apart and examining them. To find problems, repairers need to understand how things work.

The other critical part of a repairer's problem-solving tasks is determining how to restore things to working order. This may involve fixing or replacing components that are old or broken. In some cases, problems can be resolved simply by cleaning or oiling components or parts. Some repairers, such as watch repairers, might make the parts they need when replacement parts are not available elsewhere.

Picture yourself as a car repairer, or automotive service technician, to see how repairers combine the two elements of problem-solving. Each morning when you go to work, you can expect to find lots of cars—and their problems—waiting for you. People turn to you when, say, their vehicle's "check engine" light stays on, the brakes squeak, or the ignition hesitates.

Initially, a car's owner describes a problem, and you begin with diagnostic tests to make sure that all of the car's systems and components work. You might test-drive

the car to get a better feel for what might be wrong; part of your problem-solving involves ruling out possible sources of trouble. After you know what is *not* causing the problem, it might be easier to figure out what *is* causing it. You might consult mechanical or technical reference manuals. Special tools and equipment, such as electronic diagnostic equipment for the car's electrical system, can help you to pinpoint the nature of the problem. You also must determine which is better—installing new parts or repairing old ones—and make a recommendation to the car owner.

After you identify and fix the problem, your work is done for that vehicle. Time to move on to the next and the next, repeating the problem-solving process for each.

There are a variety of career opportunities for people who like to deconstruct things, solve the problem, and then reconstruct them. Video game machines, electronic home entertainment equipment, and musical instruments are just a few examples of things that require the problem-solving expertise of repairers.

Working conditions. Repair shops are one of the most common employment settings for repairers. Depending on the type of problem they specialize in, repairers may spend a significant portion of their time onsite to solve problems. Some may work primarily indoors in well-lighted workspaces; others may spend the majority of their time outside. Work settings might be noisy, and repairers might have to work in awkward positions, do heavy lifting, or work with heavy or dirty parts. In addition, repairers use tools extensively. Repairers in some specialties may need to purchase and be proficient in using a variety of tools.

Earnings. Earnings of repairers vary greatly and depend on factors such as skill requirements and the type of repair work done. Electrical and electronics repairers need considerable knowledge of electrical equipment and electronics, for example, and their earnings reflect that: they were among the highest paid of all repairers, with powerhouse, substation, and relay electrical and electronics repairers having the highest median annual earnings, about $51,690. Repairers in specialties that did not require as much training earned less; for instance, earnings for tire repairers and changers, $20,160 at the median, were among the lowest.

Demand also dictates earnings. Specialties that are in higher demand—such as heating, air conditioning, and refrigeration mechanics and installers, who had median annual earnings of $34,900—pay better than do those

that are less in demand, such as bicycle repairers, whose median annual earnings were $19,230.

Employment and outlook. More than 5 million people were employed in installation, maintenance, and repair occupations in 2000. According to the Current Population Survey, 8 percent of mechanics and repairers were self-employed in 2002. Self-employment varied by specialty. For specialties in which the cost or impracticality of self-employment is high, including aircraft and avionics equipment repairers, self-employment was low. For others, such as small engine mechanics, home appliance repairers, and automotive service technicians, up to 25 percent of workers were self-employed.

Employment prospects also vary by specialty. For example, employment of heating, air-conditioning, and refrigeration mechanics and installers is expected to increase faster than the average for all occupations over the 2000-10 decade, and employment of home appliance repairers is expected to grow more slowly than the average. Opportunities are expected to be limited for repairers whose jobs concentrate on problems not worth fixing, as it becomes more practical to replace rather than

Repairers uncover the underlying causes of problems—and, in doing so, help to eliminate them.

to repair broken items that are relatively inexpensive, such as radios and watches. However, job openings for all types of repairers should arise from the need to replace workers who transfer to other occupations or who retire or leave the labor force for other reasons.

Characteristics. Problem-solving for repairers often requires specific talents and depends on the specialty. Some repairers need good mechanical skills and must be able to understand diagrams and instructions to solve mechanical problems; others must have knowledge of electrical equipment and electronics for solving problems that arise from these sources.

Repairers should also like working with their hands and be comfortable working with the tools. Basic math and computer skills also are important, as is the ability to communicate problems, possible solutions, and information about expenses to customers.

Preparation and advancement. Many repairers learn how to fix things primarily through on-the-job training.

Although much of repairers' knowledge is gained from observing or assisting more experienced workers, formal apprenticeships or training programs in technical or vocational schools also are common ways to acquire the knowledge for applying problem-solving skills. For instance, most automotive service technicians and mechanics learn by helping experienced workers, but some also complete training in high school or in a postsecondary vocational program. Additionally, for some repair positions, employers prefer to hire workers who are certified or who have more advanced training, such as an associate degree. Certification is required for aircraft and avionics equipment mechanics and technicians, who may hold 2- or 4-year degrees in avionics, aviation technology, or aviation maintenance management.

Beginning repairers usually start with simple tasks and work their way up to solving more complicated problems. With experience, some repairers become troubleshooting specialists who help other repairers diagnose difficult problems. Others might advance to repair supervisor positions, and still others may decide to open their own repair shop.

to reach their financial goals, such as saving for college or retirement, by recommending adjustments in savings patterns or investment choices, for example. Customer service representatives in insurance agencies also assist people with financial decisions, especially those that involve risks related to car or home ownership. Loan counselors help debtors to find ways of repaying money they owe.

Medical and health. Healthcare workers solve others' problems related to illness or injury. Through diagnosis and treatment, medical professionals such as doctors and physicians' assistants help resolve people's health-related problems. Nurses also treat health problems by providing care to those who are sick or injured. Pharmacists fill prescriptions for medicines, recommend over-the-counter treatments, and offer advice about medical supplies.

Research. Researchers look for answers. Biological or medical scientists are life scientists who might work to develop a new drug that benefits cancer patients. Atmospheric scientists, or meteorologists, are physical scientists who study the atmosphere, perhaps to help prevent or identify problems resulting from severe weather. Economists, who are social scientists, might

Other opportunities for problem-solvers

As illustrated in the occupational descriptions on the previous pages, problem-solvers are similar in applying their skills and knowledge to particular situations. No matter what their jobs are, they go through the same basic process: they identify the problem, determine what needs to be done, set a goal, and work step-by-step to a solution. The following are some other career possibilities for problem-solvers.

Computers. Problem-solvers help people and organizations effectively use technology. Examples include computer support specialists, who provide computer users with technical assistance and support for computer hardware, software, or systems problems; systems analysts, who assist organizations in determining computer needs; and database administrators, who often help companies find solutions for organizing and storing data.

Financial. Some problem-solvers help others with monetary or investment concerns. Financial advisors help people find solutions

sources of additional information for about 90 percent of jobs in the economy. The *Handbook* is available in many libraries and career counseling offices and is also online: **www.bls.gov/ocohome.htm**.

Career counselors also can help you explore occupations to match your type of problem-solving skills and interests. Many counselors administer assessment tests that relate personal characteristics to specific careers. Counselors are available at many schools and one-stop career centers. To find a one-stop career center in your area, use the U.S. Department of Labor's service locator, online at **www.servicelocator.org**, or call toll free 1 (877) US-2JOBS (872-5627).

Another career resource for problem-solvers is the Occupational Information Network, or O★NET, an online database that describes hundreds of occupations in detail. Visitors search for occupations that use their knowledge, skills, and abilities—including the abilities they use to solve problems. Ask about O★NET access at your career center or local library, or set your browser to **online.onetcenter.org**.   ∞Q

study the ways in which a society tackles the problem of distributing scarce resources.

Social services. Opportunities to help people resolve personal problems often fall under social services. Paralegals and lawyers help others with legal problems. Counselors provide advice and support on life issues that range from jobseeking efforts to relationship difficulties. Social workers aid those who face social obstacles such as inadequate housing or serious illness or disability.

Resources

Nearly all jobs have problems that need solutions. Whatever your interests, you should be able to find an outlet for using problem-solving skills at work.

For specific details about occupations, including the ones discussed in this article, refer to the *Occupational Outlook Handbook*. It provides information on the nature of the work, working conditions, employment and job outlook, earnings, training requirements, and