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# TEXAS EMERGING & EVOLVING OCCUPATIONS


*"Helping Texans Piece Together A Brighter Future Through Information"*



TEXAS EMERGING & EVOLVING OCCUPATIONS 1998

# Emerging and Evolving Occupations in Texas

*A Descriptive Analysis of Forty-seven Occupations*

April 1998

Developed by the
Texas State Occupational Information Coordinating Committee
for Students, Job-Seekers, Workforce Development Professionals, and Educators

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Norman M. Lewis, Jr.
Project Coordinator

# Executive Summary

Making career decisions in today's rapidly evolving workplace has become increasingly important, risky, and difficult for job-hunters. The jobs of today and the future will demand workers with new and higher levels of skills to meet the needs of business and industry. With new and developing technologies, the requisite skills needed for employment constantly change. Students planning future careers will need to identify and acquire the skills wanted by employers. Educators likewise must identify these changing skill requirements and incorporate them into training programs to ensure their students will be prepared for the workplace with marketable skills. Workers changing careers or looking for advancement in their current jobs must know what skills are in demand, update requisite skills that have grown rusty or obsolete, and acquire new skills as needed.

The problem facing these stakeholders is getting timely and detailed occupational information to make these important decisions. Much of the information available about jobs of the future is nothing more than speculative lists of occupational titles without meaningful detail. Occupational information that does provide some level of useful detail is often outdated and fails to recognize emerging occupations or evolving skill needs. The Texas SOICC recognized this weakness in the current occupational literature, and, in its mission to provide the best information available to job-hunters, undertook a study to identify emerging and evolving occupations in the Texas labor market. The goals of the study are to design a replicable methodology for identifying these occupations and collect descriptive information for occupations that are important to the stakeholders, including descriptions, requisite knowledge, skills, and abilities, wage data, education and training requirements, and employment forecasts.

In the first year of the study, a methodology was developed to identify target industries with the best possibility for employing emerging and evolving occupations. Using existing labor market information and industry payroll titles, a list of candidate occupations was created. The second year of the study, whose findings are presented in this report, focused on validating the candidate list with industry experts and collecting descriptive variables for the resulting list of emerging and evolving occupations. This is not offered as an exhaustive list of emerging and evolving occupations in the state. The focus of the study had to be reduced to meet allotted time and financial constraints. Therefore, **stakeholders should not take the occupations listed here as the only ones that are evolving and emerging in today's workplace**.

Forty-seven titles are presented in this report as occupations with emerging or evolving skills, duties, and/or tasks. These occupations are grouped into six industry-related clusters: (1) information technology; (2) electronics manufacturing; (3) services; (4) telecommunications; (5) transportation; and, (6) sanitation and environmental services. These six clusters and their related occupations are presented in the table on the following page. Descriptive information about industrial clusters and individual occupations follow in the text.

| Industry Cluster | Occupational Title |
|---|---|
| **Information Technology** | Computer Network Technician<br>Computer Programmer<br>Computer Security Specialist<br>Computer Support Technician<br>Computer System Analyst<br>Customer Service Specialist, Computer<br>Database Administrator<br>Data Processing Equipment Repairer<br>Local Area Network (LAN) / Wide Area Network (WAN) Administrator<br>Multimedia Specialist<br>Webmaster |
| **Electronics Manufacturing** | Automation/Robotics Technician<br>Laser Electro-Optical Technician<br>Semiconductor Equipment Operator<br>Semiconductor Equipment Technician |
| **Services** | Automatic Teller Machine Servicer/Clerk<br>Compliance Officer/Utilization Review Coordinator<br>Insurance Claims Clerk<br>Medical Eligibles Specialist<br>Provider Relations Specialist<br>Electronic Research Technician<br>Litigation Support Specialist<br>Meeting, Event, and Convention Planner |
| **Telecommunications** | Data Communications Technician<br>Direct Broadcast Satellite Services Technician<br>Fiber Optics Technician<br>Microwave Technician<br>Telecommunications Specialist<br>Videoserver Technician<br>Wireless Communication Technician |
| **Transportation** | Aviation Mechanic<br>Avionics Technician<br>Cartographer<br>Geographical Information System (GIS) Technician<br>Global Positioning System (GPS) Technician<br>Shipping and Transportation Manager<br>Warehouse Supervisor |
| **Sanitation and Environmental Services** | Air Monitoring/Emissions Technician<br>Chemical Waste Disposal Worker<br>Hazardous Materials (HAZMAT) Transportation Worker<br>Laboratory Services Technician<br>Noise Abatement Technician<br>Pollution Prevention Technician<br>Remediation Technician<br>Safety and Health Technician<br>Solid and Hazardous Waste Technician<br>Waste and Wastewater Technician |

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# Chapter 1
## Using Information About Emerging and Evolving Occupations

Changes in the Texas economy, indeed across the nation, are occurring at an incredible pace. Driven by advances in technology and changing regulatory policies, new industries[1] are being created with new kinds of duties and tasks. Many existing firms are adopting new production methods to remain competitive. These changes create a need for workers with new or updated combinations of knowledge, skills, and abilities (KSAs). Occasionally, a new combination of KSAs, duties, and tasks is so complete that an entirely new occupation is created.

The perpetual evolution of occupational KSAs and the speed at which the process occurs produces information gaps for stakeholders who use occupational information. This gap is exacerbated by the time lag between the collection and analysis of occupational characteristics and their dissemination to the public through printed career planning guides and occupational taxonomies such as the *Dictionary of Occupational Titles* (DOT) and the *Occupational Employment Statistics* (OES) program. All too often, by the time information gets into stakeholder's hands it is outdated. Adding to the information gap are the numerous lists of "hot jobs" for the future reported in the popular press. Typically, general circulation articles only provide speculative job titles without any discussion of requisite knowledge, skills, and abilities, or the type of education and training they require. These futurists often fail to describe the methods they used to develop these lists. The goal of this study is to close the information gap by providing timely and descriptive information about occupations identified as *emerging* and *evolving*. It uses a replicable methodology that will enable stakeholders to make informed decisions.

### DEFINING EMERGING AND EVOLVING OCCUPATIONS

Broadly defined, **emerging occupations** are those with combinations of knowledge, skills, abilities, duties, and tasks so new that they are not captured by entries in the current coding taxonomies such as the DOT and OES. **Evolving occupations** are those currently listed in such taxonomies, but whose combination of KSAs, duties, and tasks have changed significantly since the taxonomies were published. Developing an exhaustive list of occupations that falls into these broad definitions would require a detailed analysis of every industry and occupation in Texas. Given time and financial constraints, such an enormous undertaking was not possible. Therefore,

the study's scope had to be narrowed by refining the definitions of emerging and evolving occupations. A set of parameters, based on economic assumptions, was devised in the first year of the study to accomplish this task.[2]

The economic parameters or filters were used to pinpoint industries with the greatest potential for generating emerging and evolving occupations. Filters were chosen to identify industries projected to have strong growth and would give Texas a competitive edge on the world market. It was assumed that these same industries would be the most likely to stimulate emerging and evolving occupations. The industry parameters were:

- Projected percent change in employment between 1993 and 2000 would be above the state median.
- Projected absolute change in employment between 1993 and 2000 would be above the state median.
- Prevailing weekly industrial wages would be above the state median.
- Percentage of staffing-pattern from professional, paraprofessional, and technical fields (as defined by the OES) would be above the state median.
- The capital-to-labor ratio would be above the state median.

The parameters applied to candidate occupations were:

- Average earnings for the occupation must be sufficient to sustain a family of four in Texas above the poverty level (as defined by the U.S. Department of Health and Human Services).
- The Specific Vocational Preparation and Training (SVPT) time for the occupation should range from six months to and including an Associate's degree.
- The occupation is projected to have at least 100 annual openings in Texas through the year 2000.

An application of these filters narrowed the study to thirteen industries and resulted in a list of sixty-five candidate emerging and evolving occupations. Working closely with industry and educational stakeholders, information on these occupations was collected. With the help of employers in respective industries, occupations were identified as *emerging* or *evolving*. Emerging occupations are easier to identify through crosswalks against coding structures and taxonomies. Identification of evolving occupations depended greatly on stakeholder input because measuring the incremental change or evolution of KSAs over time is difficult. The validation and refinement process identified forty-seven occupations as *emerging* or *evolving*.

## THE STAKEHOLDERS

The results of this study can benefit several groups of stakeholders. **Job-seekers** may be current workers considering career changes, students planning their education, or new entrants into the

labor force deciding on career paths. Job-seekers can use the information as a resource in tandem with career planning guides. This information will help them identify occupations left out of planning guides due to the time lag already mentioned. Additionally, job-seekers can identify their personal KSAs that may need to be updated in order to change careers.

**Employers** can use the report to formalize requisite skill and educational requirements when creating job descriptions and announcements. Employers may use this information as a guidepost when designing an internal training curriculum or evaluating external training providers. This study also provides an avenue for employers to express emerging and unmet KSA needs in their industries to other stakeholders.

**Educators and curriculum developers** will find this study useful in identifying new skills that need to be taught to improve the match between the content of existing programs and employers' needs. This information also can serve as a beginning point for developing new programs for emerging occupations. By using timely, industry-validated occupational information, education and training programs can provide job-seekers with the KSAs employers need on a just-in-time basis.

Likewise, **professional career and employment intermediaries**, can use this information to enhance their understanding of labor market trends, industry requirements, and emerging and evolving occupations in their service regions. These stakeholders should impart occupational information included in this report to their clients. Additionally, they should direct their clients to the Emerging and Evolving Occupations website[3] to find the most current information and links to related sites providing information on occupations listed as emerging and evolving.

Finally, **economic developers** in local and state agencies can use this information planning and marketing for respective labor markets. Sub-state planners and analysts also may apply the methodology explained in this study by using local data to validate emerging and evolving occupations significant to their region.

## THE OCCUPATIONAL INFORMATION

The occupations presented in this report are grouped into six chapters, each chapter describing occupations from similar industries. Each chapter will contain a brief discussion of the market trends affecting those occupations. At the end of each chapter will be an *Occupational Fact Sheet* for each occupation identified as emerging or evolving in the industry being discussed. These fact sheets are designed to give a one-page snapshot containing eight pieces of relevant information about the occupation.

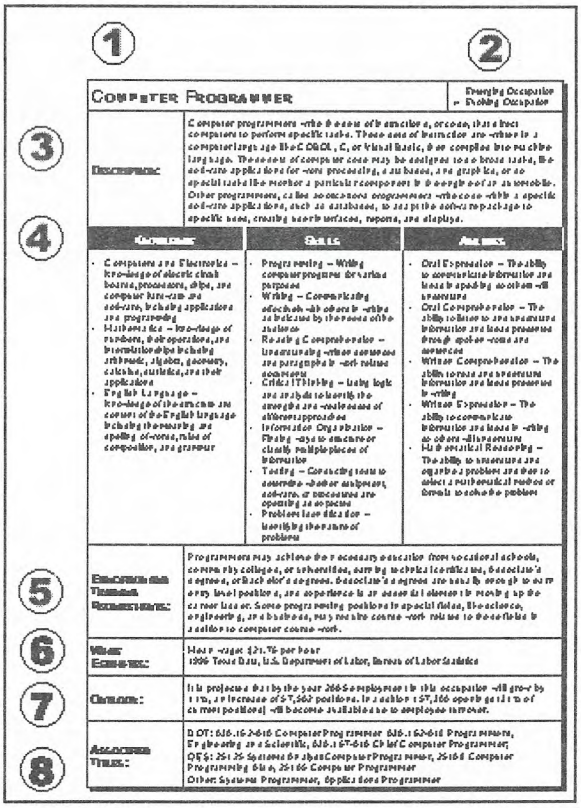


**Figure 1** Occupational Fact Sheets

As shown in figure 1, they are: (1) the occupation title; (2) a notation indicating whether the occupation is identified as emerging or evolving; (3) a brief description of the occupation; (4) the knowledge, skills, and abilities (KSAs) identified for the occupation; (5) education and training requirements for the occupation; (6) wage and salary estimates; (7) employment outlook; and, (8) associated titles including DOT, OES and payroll titles provided by employers or gleaned through literature review.

## 1. Occupation Title

The occupation title used in the report is **not** intended to be **the** definitive title for a particular occupation. It is common for employers to have their own firm-specific titles for an occupation beyond titles presented in federal occupational coding taxonomies. This results in a large number of descriptive titles for each occupation. The descriptive titles chosen for this report were the ones most often used in their respective fields or a synthesis of the most commonly used titles. Through the industry validation process, each title was evaluated to ensure it was sufficiently descriptive to be interpreted uniformly by stakeholders.

**2. Emerging or Evolving Flag**

Each occupation will be flagged as emerging or evolving based on the definitions previously outlined. It should not be surprising that there are fewer emerging occupations than evolving ones.

**3. Description**

The description is a brief narrative of the duties, tasks, and responsibilities for each occupation. In a few cases, the narrative is relatively long because several payroll titles were grouped under one occupational title. Information for these descriptions came from industry job descriptions, position opening announcements, career guides, and O*NET.[4]

**4. Knowledge, Skills and Abilities**

This section explains the requisite knowledge, skills, and abilities for each occupation. There is a growing trend to define jobs or occupations by their KSAs rather than descriptive titles because short titles provide too little information about an occupation. Using KSAs and other information (often collectively called skills standards) to describe an occupation provides more useful information for employers, job-seekers, educators, and occupational analysts. The KSA terms used in the occupational fact sheets come from the KSAs in the O*NET Content Model. These standardized terms likely will form the heart of national skills standards. They have already been adopted by the Texas Skills Standards Board for associating skills standards to occupations in Texas. A complete list of knowledge, skill, and ability terms can be found in Appendix A of this report.

**5. Education and Training Requirements**

This section of the occupational fact sheet explains the types of education, training, and licensing employers expect prospective employees to have. This is intended to be a general description of minimal, core requirements by most employers. Individual employers may have more stringent requirements based on their firm-specific needs. Also, local labor market conditions may affect minimum requirements by employers. In tight labor markets, employers may accept less training and education In areas or industries where a labor surplus exists, employers may demand higher levels of education and training. These requirements come from industry input, job opening announcements, and O*NET. Stakeholders are advised to dig deeper from more detailed information on specific employers' requirements before venturing forth on a job-search.

**6. Wage Estimates**

Every attempt was made to provide Texas wage information for emerging and evolving occupations identified herein. When Texas information was not available, regional (i.e.,

southwestern states) or national information is used. In some cases no meaningful wage information was available.

Texas wage information came from the Texas Workforce Commission Labor Market Information (TWC/LMI) unit. National wage information came from industry surveys and the Bureau of Labor Statistics (BLS). Regional wage information came from industry surveys available on the Internet. Wage information is reported as it was presented in source materials. Therefore, some occupation's wages are listed as hourly earnings, while some occupations list wage estimates as annual salaries. Because of unknown variables such as working hours, over-time, and benefits, no attempt was made to convert annual salaries to hourly wages or to compute annualized earnings estimates for every occupation.

Obtaining consistent wage estimate information is difficult. A number of factors create different wages for the same occupation in different areas or different companies. In using the wage information presented in this report, the reader should keep these factors in mind:

1. Wage information presented in this report are mean, or average, wages. Entry-level wages often are lower than the mean wage, especially in high-skilled occupations with advancement opportunities. Low-skilled occupations with little or no advancement exhibit little difference between entry-level and mean wages.

2. Texas is a very diverse state. Labor market conditions and, thus, wages vary from region to region. Overall average wages for the state may not accurately reflect the wages in exceptionally low and high wage regions.

3. Many occupations, especially professional and highly technical occupations, have a national or global labor market. Therefore, their wage rates in Texas are similar to national wage rates. National labor market trends may have more impact on these occupations than local markets will.

4. Although Texas is a "right-to-work state" as permitted under the Taft-Hartley Act, a union presence in some areas can have a significant impact on wages. Even within union shops, different tiers of wage rates based on seniority and contract changes over time can exist.

5. In some cases, significant gender-based differences in earnings persist. Much of the gender difference in earnings ostensibly is based on human capital theory which argues that wages are determined primarily by productivity-related characteristics, such as education, work experience, etc. Women tend to be concentrated in many lower paying occupations, thus skewing statistics which present overall male/female earnings differentials. Research indicates

that occupations employing higher percentages of women tend to be lower paying, all other factors held equal.

6. Differences in wage data collection and measurement techniques using varied multiple occupational coding systems make it difficult to know if available data refer to the same occupation, *vis-à-vis* a collection of jobs with the same set of hiring/skill requirements. As multiple individual employers perform this task, the possibility for lumping together persons with similar, but not identical, responsibilities are magnified. Nuances in job duties may reflect a differential in wage rates for a particular job not captured in these data.

7. Where survey techniques are used, the sample size for each occupational group is very important. The number of persons (employment) in an occupation may vary significantly from large occupations (sales clerk) to small occupations (veterinarians). The occupational sample size has a bearing on the validity or accuracy of inferences about average wages.

8. Occupational wages are, by necessity, an average wage through observation (survey, etc.). Wage rates for any specific employer may vary significantly for several reasons, e.g., greater or fewer job duties/responsibilities, exaggerated skill/hiring requirements, job duties not generally associated with a specific occupational title (non-related job duties), jobs within a high or low wage industry, hazardous or high risk assignments, etc. Therefore, average occupational wages, even within a smaller labor market, may not be representative of wages for any particular job.

9. The available supply of trained persons in an area also will have an effect on wages offered by employers. Interaction between supply and demand for workers, in theory, is a major factor in setting prevailing wages. Where there is a surplus of trained workers, competition by workers for jobs is high and employers can offer less money to get a qualified worker. Where there is a shortage of qualified workers, competition among employers for the available supply could cause wage rates to rise, at least in the short-run.

10. Most workers are employed by an organization and earn wages or salaries. However, some occupations have many self-employed workers who may earn profits from sole proprietorships and sales commissions. Some may have other sources of earnings. None of the data sources here include self-employed earnings which may be substantial, especially for professionals, commissioned sales persons, and many occupations in the information technology area.

11. The prevalence of contract or temporary workers also may affect a particular wage rate. Contract workers, in lieu of benefits, may earn a fixed price amount

higher or lower than the prevailing wage. Temporary workers may take home less because of the fees they pay to a temporary agency. Because of the way wages are reported, much of the information presented in this report does not reflect contract and temporary workers in an occupation.

**7. Outlook**

Where information is available, outlook information is presented for the occupation including projected growth and openings due to replacement. As with wages, Texas-specific employment projections were used if available; otherwise, information for the region or the nation was substituted. The source for Texas projections is the Texas Workforce Commission, Labor Market Information Unit. For U.S. projections, information from the Bureau of Labor Statistics is used. In some cases, projections were not available for the specific occupation and outlook information from industry observers was used.

**8. Associated Titles**

Much of the available information on occupations in the current taxonomies is tied to occupational specific codes, primarily the DOT and OES codes previously mentioned. This section provides those codes for occupations **similar to** the emerging and evolving occupations. They are **not** necessarily **exact** matches in description, duties, or KSAs. DOT and OES codes are presented so readers may crosswalk into additional resources for more information. Additionally, in preparing this report, there were a number of titles used by different firms for similar occupations. These employer payroll titles, captured through the SOICC employer survey for follow-up activities, also are provided. Finally, the new O*NET database includes "associated" titles that are similar to those used in this report. These titles were also included, where appropriate.

## Notes

1. The reader should keep in mind that "industry," as used in this report, should not be interpreted solely as the manufacturing sector. In this report, "industry" refers collectively to the major divisions of all goods and service producing activities of the economy as outlined in the *Standard Industrial Classification Manual.*

2. For a detailed explanation of the parameters and their application to industry and occupation data, see Terry Ramsey, *Emerging and Evolving Occupations in Texas: A Descriptive Analysis of Thirteen Targeted Industries in Texas with Listings of Emerging and Significantly Evolving Occupations* (Austin: Texas State Occupational Information Coordinating Committee, June 1996).

3. Point your browser to http://www.soicc.capnet.state.tx.us/emerge

4. O*NET is an electronic replacement to the *Dictionary of Occupational Titles*. It is being produced by the U.S. Department of Labor, Employment and Training Administration. The DOL-ETA used information from a variety of sources to create a more comprehensive and integrated database of occupational information. The Texas SOICC has incorporated O*NET into an occupational information database called OSCAR. OSCAR contains the O*NET Content Model and state level labor market information.

# Chapter 2
## The "Contract and Flexible" Workforce[†]

During the course of collecting survey responses from business and industry contacts, several employers revealed that they do not hire employees directly; rather, they go through contracting, personnel services, temporary (including temp-to-hire) or consulting agencies. This trend was so prevalent among respondents that it deserves further investigation. Several consulting and contracting agencies were contacted for information on job descriptions for emerging and evolving occupations. These agencies proved to be a good source of timely information for both job descriptions and occupational demand forecasts. The results of the analysis indicate that this trend does indeed have a major impact on not only emerging and evolving occupations but also on how stakeholders might perceive their roles in the current and future labor market.

The purpose of this chapter is to highlight a prevalent trend in the labor force, a trend which involves hiring "contract and flexible" workers by companies reported in the personnel supply services industry. These workers include part-time workers, independent contractors, workers hired directly by companies for a temporary period and workers who get jobs through temporary help firms. This chapter explains this new workforce trend and specifically addresses the effects of this trend on the identification of emerging and evolving occupations.

Historically, employees went to work with a reasonable expectation that if they worked hard they would be able to build a career within and retire from the same company. Unfortunately, with corporate downsizing and outsourcing in the late 1980s and early 1990s , the employment conditions in America has changed, probably forever.

Changes in the international economy and rapid deployment of new technology has meant that the employment structure and business practices of many firms has been altered, in some cases radically, in order to remain competitive in an increasingly interrelated global environment.

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[†] This chapter was drafted initially by Arnold Williams and Richard Froeschle.

Leading-edge theories about the workplace of the future suggest that work may not be organized along occupational lines as it currently is; rather, work will be organized into discrete, short-term projects. Projects may be handled in the future by *ad hoc* teams whose members have broad skills and competencies for problem-solving. Industry-relevant skills and competencies—imparted to students by education and training providers—will prepare them for more interesting, diverse and challenging work at high wages although they may no longer be able to classify themselves within a narrow occupational title.[5]

While continued employment is never certain, possession of high level skills and knowledge provides a greater likelihood of holding a job. Those with low skill levels are finding it more difficult to secure and retain employment. This factor, combined with the demand for an increasingly flexible workforce, is challenging the notion of permanent/full-time employment.

The future business environment will favor companies that are flexible, efficient, and innovative. Markets are becoming more specialized as technology makes it possible to mass produce customized goods. In this setting, small providers of goods and services will define special corners of the marketplace and have a greater likelihood of thriving.[6]

Organizations of the future will keep a small, multi-disciplinary core of executives to lead the company and a small core of workers with specialized competencies such as marketing and finance. They will contract for other work and hire part-time labor as needed.

The result will be a continuing shift of jobs from large business to medium and smaller ones that form to take advantage of the contract and privatization trend. In fact, most of the new jobs in the 1990s have been created by "micro-businesses"—organizations with less than 20 people. The implications of this trend are significant, demanding a much more entrepreneurial workforce and a much higher degree of self-reliance while offering less job security.

Leaders of large companies will try to increase their competitiveness by imitating the more flexible policies and structures of small business. Successful large organizations of the future will decrease bureaucracy and simplify structures into small, informal units. They will change and adapt continuously. They will become more flexible and dynamic, able to move talent swiftly to areas where it is needed on short notice, either by reassigning staff or hiring temporary and contract employees.[7]

These changes are already manifest in the shrinking of the core workforce. The increasing use of temp-to-hire and contractual employees and, perhaps most significantly, the growing emergence of a "flexible workforce."

## WHAT IS MEANT BY A CONTRACT AND FLEXIBLE WORKFORCE?

According to Charles Handy, the new, more flexible workplace of the 21st century will be characterized by a workforce consisting of three distinct subsets.[8] The **core workforce** will be

employed, for the most part, in large businesses and the public sector. These workers will have more job security, but their jobs within more flexible organizations will change frequently as organizations change to remain competitive. To keep up with their changing work environment, core workers will need to become generalists, continually evolve with their employers and constantly acquire new specialized skills. They will be relatively well-paid, but their pay increasingly will be based on performance. This core workforce will also be increasingly staffed through the "temp-to-hire" method of personnel management.

The temp-to-hire method of personnel management is where a company hires new workers through a second party company (within the personnel supply services industry). These agencies make their money by charging employers and/or workers a percentage of the worker's fees. This is called a margin and usually averages about 20%, though instances of margins as high as 45% or as low as 10% have been seen.

These second party companies perform many duties of a human resources department. They test and screen candidates prior to placement. Client firms then have four options in regard to the future of the workers they screen. The client firm may buy the worker's contract from the leasing firm; it may wait until the contract expires and hire the worker as a core employee; it may continue to keep the worker as a contract employee through several contract renewals; or it may choose to let the contract expire and replace the contract worker with a new contract worker.

The second employment subset will be the **contractual workforce**. These workers will supply knowledge or skill-intensive services on a contractual, fee-for-service basis as needed, usually during peak periods or for specific projects and often on short notice. Many workers will offer back to the labor market the same services they once performed within downsized organizations. As contractors, they may have less job security and may have to be more entrepreneurial in managing their finances (i.e., budgeting for social security and income taxes, planning for retirement, providing health benefits). They also will have to be able to adjust to labor market fluctuations that cause either too little or too much demand for their current combination of KSAs.

The final category will be the **floating, flexible workforce.** This group will generally be comprised of youths, early retirees and lower-skilled adult workers. They will tend to work on a part-time, occasional basis in a series of temporary jobs with no career focus or security. Depending on the economy, they probably will experience longer spells of unemployment.

**A National Trend**

Handy also predicts that all workers will be constantly challenged to manage their own careers and to expand their skills continuously. They will move laterally through leaner, flatter organizations to tackle projects and problems as they arise. "Promotion may be across—not necessarily up—the organizational structure, and pay will be based increasingly on performance." Continuous learning will be required of everyone in the workforce. He also suggests that in this

environment, work arrangements will be more diverse in terms of hours, location and conditions, less employer-specific job security, and less formal employment relationships.

In 1995, Allison Thomson, an economist in the Office of Employment Projections within the Bureau of Labor Statistics, reported that 1.7 million Americans now work in the temporary help industry compared to 732,000 in 1985.[9] More recently, Samuel Sacco of the National Association of Temporary Agencies suggested this number was around 2.4 million. "This is nothing short of another industrial revolution going on in terms of how work is being structured and people are being paid." According to David Hofrichter, a company's workforce in more and more cases will consist of a core of highly skilled permanent workers aided by temporary employees brought in during peak periods or for special projects.

## USE OF TEMPORARIES IN TEXAS

Current Texas data indicate a significant employment increase in the personnel supply services industry. It is the third fasting growing industry in the state. Yet, no one has determined occupations are employed most frequently by "temp agencies" and, thus, we have no way of informing counselors or students about which occupations are driving this increase.

According to Mr. Sacco "the average number of temporaries on the job every day has climbed in Texas during the last seven years with the temporary agency payroll last year estimated at nearly $2 billion." He suggests that, on any given day, Texas has more than 155,000 temporary workers. Actual employment and wage data from the Texas Workforce Commission (TWC) indicate that Mr. Secco may have underestimated the impact of the temp industry in Texas. The TWC numbers indicate total wages in excess of $3.1 billion were paid to an annual average of 172,000 workers during 1996. Many of these workers are employed as helpers, movers, general office clerks, data entry specialists, and secretaries. Other affected occupations include management support occupations, information clerks, health technicians, registered nurses, assemblers and fabricators, home health aides, nursing aides, computer and semiconductor personnel, and engineering, manufacturing and science technicians. In reality, companies can hire a temporary worker to perform just about any job they wish and workers can choose to be temporaries in just about any job for which they qualify.

### How Does This Trend Affect Stakeholders In The Texas Labor Market?

One of the purposes of the SOICC's emerging and evolving occupations study was to create an ongoing method for identifying new high-growth occupations from industry-level employment and program follow-up data. Industrial employment data come primarily from unemployment insurance data collected on every employee covered under the Texas Unemployment Compensation Act (TCUA).

The current procedure for projecting occupational demand from the industrial employment data involves collecting information through the Occupational Employment Statistics (OES) survey.

The OES survey is used to develop occupational staffing patterns from employment counts provided by an employer survey. This mail and telephone follow-up survey helps state planners develop an accurate profile of occupational employment by industry. The Texas OES program is designed to survey most, but not all of the Texas labor force. It uses a nationally standardized process to collect information from a representative sample of employers. This information is subsequently used to ascertain current and projected employment levels by occupation.

The primary tool for projecting occupational employment information is the OES industry/occupation matrix, generated with state and selected national data. The OES program is designed to provide very detailed information on the occupational employment outlook for more than 700 occupations. This information is used in career guidance and employment planning and training programs. Outputs from the matrix program show base year employment, projected employment in the target year, and the estimated number of average annual job openings.[10] Occupational projections for Texas are based on these data.

This process may overlook the importance and the impact of temporary agencies. Currently, there are significant limitations in the state's system for documenting the use of contingent workers. To preface this discussion, a clear distinction should be drawn between staff leasing companies and temporary help agencies. Staff leasing companies generally provide long-term, contractual administrative services, such as payroll processing, to a client firm. In Texas, staff leasing firms are licensed by the Texas Department of Licensing and Regulation. Temporary help agencies are firms which supply contracted labor directly to client firms. This distinction is particularly important from a data perspective because workers supplied by staff leasing firms are classified and counted in the industry in which they *actually work.* Temporary help employees, however, are classified and counted as employees of the temporary help firm itself. Temporary agencies do not report which occupations they hire nor the industries where temporary employees are placed. Thus, state labor market information analysts currently have no way of documenting the occupational component of this new trend. The problem is compounded when we try to predict which industries actually hire temporaries or the occupations which appear to be growing.

One example is in the semiconductor industry. While working with a consortium of semiconductor manufacturers, the SOICC was asked why information on semiconductor-related occupations was not included in the publications we provide to public school counselors. The consortium representative told us that they face a major labor shortage and they cannot understand why it is so difficult for them to get information on their industry included in government publications. They predicted they will hire more than 4,000 new employees in the semiconductor industry in Texas over the next two years. Nonetheless, they have trouble convincing government officials that they should approve a program of study to prepare Texans for these new jobs.

Looking at labor market information, we discovered that raw data on companies in the semiconductor industry did not reflect the dramatic growth in employment they said they were

experiencing. After speaking at length with one representative of the consortium, it was realized that the semiconductor industry is known for using leasing and temporary companies to hire new employees. They use contract employment to adjust for seasonal variations in product demand. From a business perspective, this is a good decision. However, from a labor market analyst's point of view, these workers who physically work in the semiconductor industry are counted as if employed in the personnel supply services industry. This leaves actual semiconductor industry employment under-represented in most labor market reports.

Another example of this phenomenon occurred when the SOICC was contacted by an out-of-state company. It was considering relocating to Austin, Texas because of the city's reputation for being a "high-technology corridor." Unfortunately, labor market information showed that Austin employment in the high-tech industry was no higher than many other major cities in the United States. The individual who called seemed confused because she really believed that Austin was the right place for her company to relocate. Unfortunately, she could not prove this to her board of directors because she could not find any hard data to support her views. After explaining the prevalence of temp-to-hire and temporary/contract employment in Texas to her, she seemed more at ease about her company's prospects and the advantages of relocating to Austin.

These two examples are not isolated events. They raise the question, "How many other potential employers have been discouraged by limitations in the data (in respect to occupations hired or employed through temporary help agencies)?" It also provokes earnest discussions aimed at improving the labor market information (LMI) system with respect to such emerging business practices.

While labor market analysts develop alternate techniques to estimate employment, it is in the mutual best interest of government, leasing firms and primary contractors to address this anomaly in the data. Without such collaboration, industries which use large numbers of temporaries may soon find fewer appropriately skilled workers available because no data are available to justify creating related education and training programs. Public officials may be unable to document industry or occupational growth and miss opportunities to shape economic development policy, job placement, and workforce development programs better. Voluntary participation by leasing firms may delay a tighter regulatory environment and encourage the continued use of temporary workers as part of future business practices. Each of these parties has mutual responsibility and an opportunity to improve the system.

## THE FUTURE OF CONTRACTING AND TEMPORARY PERSONNEL SERVICES

Independent contractors represent almost 7 percent of the workforce and are being used with increasing frequency. The trend "... represents a structural change in how business is done. It is not just a cyclical change."[11]

In some cases, the independent contractors are hired simply to do the work that was previously done by "regular" employees. This activity recently put Microsoft Corporation in the headlines.

Microsoft used "independent contractors" for jobs like software tester and proofreader. However, a recent decision by the U.S. Court of Appeals for the 9th Circuit in San Francisco ordered Microsoft to pay employee benefits to hundreds of these so called "independent contractors" because they were treated as regular employees. In essence, this federal appeals court sent a warning to company leaders that it may not be acceptable to adopt hiring procedures which replace regular workers with independent contractors simply to avoid having to pay benefits.

Nonetheless, employers may be unwilling to reverse this trend. They have many reasons to use personnel supply services agency employees. These agencies shoulder some of the employer's human resource burdens by arranging interviews, negotiating with job-seekers, processing the payroll and administering contracts. As costs-cutting measures dominate the economy, the temporary concept have taken hold in accounting firms, software companies and law firms.[12] Companies that use temporary workers point out that "temps" enable them to ramp-up and downsize quickly, avoiding time-consuming recruiting and complicated layoffs. Several employers report that one use of the "contract and flexible workforce" is to maintain the morale in their permanent "core" workforce. These employers report that core employees feel they are more secure because they will not be the first to be laid off during any economic downturn.

While temporary agencies add value by meeting the needs of local employers, employees who *choose* to enter the contract or flexible workforce also benefit. The most obvious one is the chance to earn more money. If a worker has a particular mix of skills that are in short supply and is prepared to work long hours, earnings can be far higher than those in the core work force. Another major benefit is the opportunity it gives for widening skills and experience. Many agencies provide free classes to help workers update their skills. This arrangement also offers the worker who is unsure about his/her career choice an opportunity to "test the waters," doing different jobs in a multitude of work environments.

There are also disadvantages to being a contingent employee. Usually, no holiday or sick pay is available. Also, most temporary employees do not receive health benefits. Gaps of unemployment between contracts may occur. If a project is canceled or recession strikes, then non-core workers are the first to be laid off.

Counselors can help young people understand the business practices of temporary agencies in the context of their own career planning activities. Based on student follow-up from 1996, 3.6 percent of all four-year college graduates found their first jobs after completion in the personnel supply services industry; 4.6 percent of all two-year college completers did the same; and 9.0 percent of all persons unemployed and seeking work through an employment service found jobs in this industry. An even stronger message should be given to actual job-seekers. The average job-seeker thinks that companies hire through the traditional method of considering job applications, setting up interviews and making a selection at the end of this process. In fact, entry-level jobs in many companies may be made available only through a temporary or contract agency. For this reason, job-seekers must include these agencies in their career development strategies. Most of these agencies conduct assessment tests, personal interviews and provide

basic training prior to job placement. Applicants should consider temporary agencies as representatives of the would-be hiring companies. They should strive to make a positive impression about their experience, skills, and most importantly, their availability and dependability.

As we continue to build a better workforce development system in Texas, we cannot overemphasize the need for using both traditional and non-traditional job search strategies. Career and employment assistance professionals also must be aware of this new trend in order to provide the most effective guidance to their clients.

Those making career decisions must realize the limitations of current information about occupational demand and the impact of temporary help agencies. Given the prevalence of this business practice, the most straight-forward message we can give to job-seekers is to do their homework and recognize the importance and impact the "contract and flexible" workforce has on labor market dynamics and career choice.

## Notes

5. Marc Anderberg and R. D. Bristow, *Career Majors in Texas Public Education*, (Austin, Texas: Texas State Occupational Information Coordinating Committee, 1996) Chapter II.

6. Tom Peters, *Thriving on Chaos*, (New York: Alfred Knopf, 1987).

7. *Austin American Statesman* article quoting David Hofrichter, managing director of the Hay Group - a consulting group in Chicago.

8. Charles Handy, *The Age of Unreason*, (London: Business Books, 1989).

9. *Occupational Outlook Quarterly*, Spring 1995.

10. *Improved Career Decision Making in a Changing World*. Contributing authors: Dennis Engels ...{et al.}; editor, Judith M. Ettinger.

11. *Austin American Statesman*, December 10, 1995 quoting Jill Cochran, Cochran and Company - a provider of lawyers and Paralegals on contract.

12. *Ibid.*

# Chapter 3
## Occupations in Information Technology

Although most occupations fall into a specific industry sector, persons employed in *information technology (IT) occupations* work throughout all sectors of the economy. Information technology occupations are comprised of computer-related jobs engaged in either managing, storing, transmitting, or generating the information organizations use to make decisions as well as installing and repairing computer hardware and software used to perform such tasks. The rapid change in technology of the tools and skills used by IT workers makes many occupations in this career field excellent candidates for emerging or evolving occupations.

Recently, these occupations have been the subject of numerous articles and speeches touting the shortage of skilled IT workers to satisfy current demand. One recent survey suggests that 190,000 IT positions are currently unfilled because of a lack of skilled workers.[13] Other industry estimates put that figure between 200,000[14] and 400,000[15] unfilled jobs. Compounding this problem is the expectation that demand for IT workers will outpace supply for the next four to five years. Between 1996 and 1997 alone, the number of IT jobs in the U.S. grew by 13.8 percent.[16] The outcry about difficulties in filling IT positions prompted the federal government to get involved. In January 1998, the Clinton Administration announced it would invest $28 million in new initiatives to encourage training for more programmers and other IT professionals. The Department of Labor will provide $3 million in grants to schools, businesses, and local governments to retrain laid-off workers as programmers and another $8 million to create an Internet web site for posting job offers and résumés. The remaining $17 million will be provided by the Department of Commerce to bring technology resources and training to low-income persons.[17]

Traditionally, employment in many of these occupations, such as programmers, required a Bachelor's degree. With the current and forecasted shortage of IT workers, it is likely that shorter-term training programs will gain wider acceptance along side Baccalaureate degree programs. Such programs would include Associate's degrees,[18] technical school certificates, and even less formal self-study programs or other "learn by experience" routes. Still, there always will be a preference for formal training. It is difficult to determine whether less formal training alternatives can be adapted in a fashion to satisfy burgeoning demand.[19] Institutions that offer short-term training and have the ability to modify or expand their current programs are in a

position to provide training to help fill the gap between demand and supply. Meanwhile, employers are turning to workers trained abroad to fill the short-fall, as evidenced by a 450 percent increase in the number of foreign computer professionals entering the United States between 1988 and 1995.[20] Under current law, employers can sponsor a total of 65,000 immigrants per year, provided they have professional undergraduate degrees or substantial work experience, but they are only allowed to work in the U.S. for six years.[21] Despite this relative short period, these work visas can open the door for permanent residence status.

Despite the number of studies declaring a shortage of IT workers, some believe the numbers are inflated.[22] Exaggerated claims may be a political move to lower immigration restrictions and reduce wages or a way for the private sector to divert public monies to fund their specific training needs. The Institute of Electrical and Electronics Engineers (IEEE) is among those who dispute shortage claims. The IEEE feels that the problem is a **skills mismatch** caused by the rapid evolution of technology and the high cost of keeping the existing workforce up-to-date.[23] They feel that the gap can be filled by retraining the current workforce, particularly displaced engineers. Even if this argument proves to be correct, we will need more training and education programs, especially ones below the baccalaureate level, to provide the requisite skills for emerging or evolving occupations in information technology listed in this chapter.

Most of the occupations presented here are evolving—their skills require updating in light of new technologies. A few of these occupations are truly emerging—new occupations created because of changing technology or new ways of doing business. Emerging IT occupations are the results of two interlinked technologies: the world wide web and electronic commerce (E-commerce). With dramatic growth of the use of online services and local Internet Service Providers (ISPs) to access the Internet by consumers, businesses have found a new place to market goods and services.

First came corporate sites using web pages to promote and support their products. Interested customers would still call toll-free numbers to place orders or visit local retail outlets. From there, companies began letting customers make full transactions via the firm's web site. This includes commercial banking and other financial services, such as managing one's investment portfolio. Now, there are companies whose sole links to their customers are via the Internet and the world wide web. The most conspicuous of these is the online bookseller, *Amazon.com*.

Government also has moved to the Internet as a new marketplace. Many state, federal, and local agencies now use the Internet for many transactions; from driver's license renewals to bid application submissions. In the future, governments expect to handle, at least in part, five areas of electronic commerce: (1) tax filings; (2) vendor payments; (3) procurements; (4) licensing; and, (5) welfare benefits. Within these groups fall birth certificates, motor fuel tax filings, hunting licenses, ordering from online catalogs, and filing court documents.[24] This will speed up many government transactions and reduce administrative costs.

As commercial transactions move in this direction, the need for more complex and interactive web sites has emerged. Additionally, with the transfer of confidential information including account numbers to credit cards and bank accounts needed to make these transactions, the need for secure communications has increased dramatically. Security measures involve keeping hackers from collecting information as it is transferred from a customer's home computer to vendors and to keep hackers out of vendors' databases containing confidential information about their customers. In fact, an on-line survey conducted by the Intranet Institute identified security as the most important issue facing businesses that use the Internet and intranets.

The dynamic nature of all IT occupations makes identifying and assigning discrete occupational characteristics to individual occupations difficult. Occupational titles themselves can vary greatly from firm to firm. In many instances, an individual may perform work under two or more of the occupational titles reported herein, in whole or in part. Crossing over from one information technology occupation to another is not rare or difficult and may be a means of promotion and advancement for many workers in this field.

The occupations identified in the information technology sector as emerging or evolving are:

- Computer Network Technician
- Computer Programmer
- Computer Security Specialist
- Computer Support Specialist
- Computer System Analyst
- Customer Service Specialist, Computer
- Database Administrator
- Data Processing Equipment Repairer
- Local Area Network (LAN) / Wide Area Network (WAN) Administrator
- Multimedia Specialist
- Webmaster

# COMPUTER NETWORKING TECHNICIAN

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:** Computer networking technicians install, support, maintain, and troubleshoot computer software and/or hardware relating to networked computers. They report to a LAN/WAN administrator or manager.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar | • Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Programming – Writing computer programs for various purposes<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Problem Identification – Identifying the nature of problems<br>• Operations Analysis – Analyzing needs and product requirements to create a design<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Information Gathering – Knowing how to find information and identifying essential information | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | According to the *1993 Occupational Outlook Handbook*, there is no universally accepted way to prepare for a job as a computer network technician. Prior work experience is very important. Certifications from software and hardware vendor provided courses is a plus. A possible education path would be an Associate's degree in electronic communication or computer science. |
| **WAGE ESTIMATES:** | Though the wage is highly sensitive to local labor market conditions, network technicians can earn $20,000 - $37,500 per year. |
| **OUTLOOK:** | No employment outlook for this specific occupation at the time of printing. Generally, as firms depend more and more on networked computers, one should expect a positive scenario for entrants into the field. |
| **ASSOCIATED TITLES:** | Network Administrator, Network Engineer, Certified Novell Engineer (CNE) |

# COMPUTER PROGRAMMER

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Computer programmers write the sets of instructions, or code, that direct computers to perform specific tasks. These sets of instruction are written in a computer language like COBOL, C, or Visual Basic, then compiled into machine language. These sets of computer code may be designed to do broad tasks, like software applications for word processing, databases, and graphics, or do special tasks like monitor a particular component in the engine of an automobile. Other programmers, called *applications programmers* write code within specific software applications, such as databases, to adapt the software package to specific uses, creating user interfaces, reports, and displays.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar | • Programming – Writing computer programs for various purposes<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Problem Identification – Identifying the nature of problems | • Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Programmers may achieve the necessary education from vocational schools, community colleges, or universities, earning technical certificates, Associate's degrees, or Bachelor's degrees. Associate's degrees are usually enough to earn entry level positions, and experience is an essential element in moving up the career ladder. Some programming positions in special fields, like science, engineering, and business may require course work related to those fields in addition to computer course work. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $17.35 per hour<br>Source: Texas Workforce Commission-LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for computer programmers was 27,500. It is projected that by the year 2005 employment in this occupation will grow by 6,500 positions. In addition 8,635 openings (31% of current positions) will become available by the year 2005 due to employee turnover.<br>Source: Texas Workforce Commission, LMI Unit |
| **ASSOCIATED TITLES:** | DOT: 030.162-010 Computer Programmer 030.162-018 Programmers, Engineering and Scientific, 030.167-010 Chief Computer Programmer;<br>OES: 25125 Systems Analyst/Computer Programmer, 25108 Computer Programming Aide, 25105 Computer Programmer<br>Other: Systems Programmer, Applications Programmer |

# COMPUTER SECURITY SPECIALIST

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:**

Computer security specialists plan, coordinate, and implement security measures for information systems to regulate access to computer data files and prevent unauthorized modification, destruction, or disclosure of information. As business relies more and more on the transfer of electronic information, from selling its products to employees exchanging e-mails containing sensitive firm information, the need to secure the company's computerized data is increasing. Security specialists are responsible for the security of this information by setting up Internet firewalls, encrypting data files, and establishing secure websites for sales transactions.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems | • Programming – Writing computer programs for various purposes<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Implementation Planning – Developing approaches for implementing an idea<br>• Idea Generation – Generating a number of different approaches to problems<br>• Mathematics – Using mathematics to solve problems<br>• Technology Design – Generating or adapting equipment and technology to serve user needs<br>• Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Operations Analysis – Analyzing needs and product requirements to create a design<br>• Problem Identification – Identifying the nature of problems | • Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense.<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer) |

**EDUCATION AND TRAINING REQUIREMENTS:**

Formal training programs, especially in areas dealing with web technologies, are just beginning to surface in community colleges and senior colleges. Many of the specialists now employed developed their knowledge by experience, and were "ex-hackers." In the future, most candidates will have at least an Associate's degree in a computer related field with special course work.

**WAGE ESTIMATES:**

The 1997 national median salary for computer security specialists was $56,800.
Source: DataMasters, 1997 Computer Industry Salary Survey

**OUTLOOK:**

Outlook information specific to this occupation was not available at the time of printing.

**ASSOCIATED TITLES:**

DOT: 033.162-010 Computer Security Coordinator, 033.162-014 Data Recovery Planner, 033.362-010 Computer Security Specialist;
Other: Disaster Recovery Analyst

# COMPUTER SUPPORT TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Computer support technicians install, support, and maintain computer hardware and/or software. They may work for a particular vendor, specializing in that vendor's products, or they may work for a company in any number of industries providing support to computer users within the firm. In the latter case, their knowledge will be more broad across software and hardware. Support technicians may also run help desks, where users may call or write to get assistance with a specific question as well as provide on-site support.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Customer and Personal Service – Knowledge of principles and processes for providing customer and personal services including needs assessment techniques, quality service standards, alternative delivery systems, and customer satisfaction evaluation techniques | • Instructing – Teaching others how to do something<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Problem Identification – Identifying the nature of problems<br>• Operations Analysis – Analyzing needs and product requirements to create a design<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Programming – Writing computer programs for various purposes | • Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Speech Clarity – The ability to speak clearly so that it is understandable to a listener<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Many individuals working in this field are self-trained or learned on the job, but many technical schools, vocational schools, and community colleges offer courses or Associate's degree programs for this occupation. Formal training would be a plus in obtaining a job. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $17.67<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for Computer Support Specialists was 4,500. It is projected that by the year 2005 employment in this occupation will grow by 103%, an increase of 4,650 positions. Additionally, 550 openings (12% of current positions) will become available over this period due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT 032.132-010 User Support Analyst Supervisor, 032.262-010 User Support Analyst, 033.162-018 Tech Support Specialist, 039.264-010 Microcomputer Support Specialist<br>OES: 25104 Computer Support Specialist |

# COMPUTER SYSTEM ANALYST

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Computer system analysts coordinate with management, network administrators, and computer users within a company to determine the proper hardware, software, and reporting requirements to meet the information needs of the organization. They coordinate with vendors for demonstrations and seminars, work with purchasing departments to obtain equipment and lease agreements, and design flowcharts outlining the flow of information within the company. In many firms, systems analysts must have some business administration knowledge. Systems analysts may work within a firm's management information systems department or in a consultant firm that provides these services to other firms.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar<br>• Administration and Management – Knowledge of principles and processes involved in business and organizational planning, coordination, and execution. This includes strategic planning, resource allocation, manpower modeling, leadership techniques, and production methods | • Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Programming – Writing computer programs for various purposes<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Operations Analysis – Analyzing needs and product requirements to create a design<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Information Gathering – Knowing how to find information and identifying essential information | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | An Associate's degree in computer science with 1-3 years of experience working with networks, minicomputers, microcomputers, and related operating systems. Some firms may require a Bachelor's degree. Certification through software/hardware vendor provided training would be a plus, and in some cases a requirement. Persons in this career field should expect continuing education on new technologies through vendor sponsored courses and workshops. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $21.76 per hour<br>Source: Texas Workforce Commission, LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for Systems Analyst was 31,300. It is projected that by the year 2005 employment in this occupation will grow by 115%, an increase of 36,100 positions. In addition 3,740 openings (12% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 030.167.014 Systems Analyst<br>OES: 25102 Computer Systems Analyst, 25125 Systems Analyst/Computer Programmer |

# CUSTOMER SERVICE SPECIALIST, COMPUTER

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Customer support specialists provide assistance to customers, clients, or members of a firm or organization. They respond to customer inquiries and complaints through a firm's toll-free number, technical support telephone number, written correspondence, or email. They provide the lower level of tech support, product information, and quotations by using computerized databases or reference books. For questions beyond their expertise, they direct customers to technicians or other personnel that can help them.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Customer and Personal Service – Knowledge of principles and processes for providing customer and personal services including needs assessment techniques, quality service standards, alternative delivery systems, and customer satisfaction evaluation techniques<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar<br>• Sales and Marketing – Knowledge of principles and methods involved in showing, promoting, and selling products or services. This includes marketing strategies and tactics, product demonstration and sales techniques, and sales control systems | • Speaking – Talking to others to effectively convey information<br>• Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Problem Identification – Identifying the nature of problems<br>• Service Orientation – Actively looking for ways to help people<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Information Gathering – Knowing how to find information and identifying essential information | • Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Speech Clarity – The ability to speak clearly so that it is understandable to a listener<br>• Number Facility – The ability to add, subtract, multiply, or divide quickly and correctly |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | There was no standardized training or education route for persons in these positions. Requirements may be dependent on the area where the customer service specialist works. |
| **WAGE ESTIMATES:** | According to a 1995 ASP/Softletter Tech Support survey, the national median salary for customer service specialists was $27,000. This wage may vary greatly, depending on geographic region and the industry where the specialist is employed. |
| **OUTLOOK:** | An employment outlook specific for this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 239.362-014 Customer Service Representative |

# DATABASE ADMINISTRATOR

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Database administrators are responsible for the oversight of a company's computer database files, such as inventory, accounting, payroll, mailing lists, and customer account files. They design, maintain, and repair these databases, which may require the knowledge of a computer programming language like COBOL or a proprietary database platform like dBase or Oracle. They work closely with other management personnel to develop reports from information in the database to provide information for decision-making. They have access to all the firms confidential information, and must pass security clearance checks, and will oversee level of access to the information by others in the firm.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Administration and Management – Knowledge of principles and processes involved in business and organizational planning, coordination, and execution. This includes strategic planning, resource allocation, manpower modeling, leadership techniques, and production methods | • Programming – Writing computer programs for various purposes<br>• Mathematics – Using mathematics to solve problems<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Operations Analysis – Analyzing needs and product requirements to create a design<br>• Instructing – Teaching others how to do something<br>• Technology Design – Generating or adapting equipment and technology to serve user needs<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Problem Identification – Identifying the nature of problems | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense.<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem |

**EDUCATION AND TRAINING REQUIREMENTS:**

An Associate's degree or Bachelor's degree in computer science or business information systems is usually preferred by employers, but some individuals are able to move into the database administrator's position from other technical fields within the company. Larger firms may require senior database administrators to have a Bachelor's or a Master's degree in management information systems.

**WAGE ESTIMATES:**

1996 Texas mean wage: $21.68 per hour
Source: Texas Workforce Commission - LMI Unit

**OUTLOOK:**

In 1994, employment in Texas for database administrators was 1,250. It is projected that by the year 2005 employment in this occupation will grow by 112%, an increase of 1,400 positions. Over this same period, 275 openings (22% of current positions) will become available due to employee turnover.

**ASSOCIATED TITLES:**

DOT: 039.162-010 Database Administrator, 039.162-014 Database Design Analyst; OES: 25199 Computer Scientists, Not elsewhere classified

# DATA PROCESSING EQUIPMENT REPAIRER

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Data processing equipment repairers are responsible for the repair and preventative maintenance of computers, components, and peripheral equipment. They will periodically check, clean, and adjust mechanical and electro-mechanical computers according to manufacturer's specifications. These technicians should be able to quickly diagnose problems and make essential repairs, minimizing the equipment's downtime. Repairs can range from tightening loose cable connections and soldering loose connections to replacing printed circuit boards.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance | • Repairing – Repairing machines or systems using the needed tools<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Operation Monitoring – Watching gauges, dials, or other indicators to make sure a machine is working properly<br>• Science – Using scientific methods to solve problems<br>• Problem Identification – Identifying the nature of problems<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Installation – Installing equipment, machines, wiring, or programs to meet specifications | • Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.<br>• Inductive Reasoning – The ability to combine separate pieces of information, or specific answers to problems, to form general rules or conclusions. It includes coming up with a logical explanation for why a series of seemingly unrelated events occur together.<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Those entering this field will typically be required to possess an Associate's Degree in electronics technology or related field or certificate from a vocational program. Military training is also acceptable. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $12.61 per hour<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for Data Processing Equipment Repairers was 9,150. It is projected that by the year 2005 employment in this occupation will grow by 47%, an increase of 4,300 positions. Over this same period, 2,750 openings (30% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 828.261-022 Electronics Mechanic<br>OES: 85705 Data Processing Equipment Repairer, 85717 Electronics Repairer - Communication and Industrial Equipment |

# Local Area Network (LAN) and Wide Area Network (WAN) Administrator

Emerging Occupation
✔ Evolving Occupation

**Description:** LAN/WAN administrators are responsible for the overall networked computer system inside a firm. They participate in the planning of the system, make recommendations for the purchase of new equipment and components, and software, and direct the work of network technicians and computer support staff. They report the fiscal impact of system changes to managers, track upgrade and replacement projects, and write proposals for the firm's future network needs. In smaller organizations they may also do the work of the network technician.

| Knowledge | Skills | Abilities |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar<br>• Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems | • Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Programming – Writing computer programs for various purposes<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Problem Identification – Identifying the nature of problems<br>• Operations Analysis – Analyzing needs and product requirements to create a design<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Information Gathering – Knowing how to find information and identifying essential information | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

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| **Education and Training Requirements:** | An Associate's degree or better in electronic communication or computer science or a vocational school certificate with 3-4 years work experience in networking or other computer technical fields would be minimal for these positions. Vendor specific certifications may also be required by some employers. WAN administrators may require FCC licensing. |
| **Wage Estimates:** | According to a DataMaster survey, LAN and WAN Administrator's median salary in 1997 was $53,500. |
| **Outlook:** | Though no outlook information was available at the time of printing specifically for this occupation, computer related jobs are expected to have above average growth through the year 2005. As more companies rely on networks, the need for administrators will likely be significant. |
| **Associated Titles:** | Systems Administrator, Network Administrator |

# MULTIMEDIA SPECIALIST

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:**

These technicians combine the use of audio, video, graphics, and text to provide and disseminate information to others in an aesthetic manner. Often, their final output is distributed on CD ROM's, as catalogs, training sessions, books on disk, and tutorials. By combining graphics, audio files, animation, and video components, the product of multimedia specialists can often make stronger impacts than printed guides or tutorials. Multimedia specialists must have an understanding of the production of audio files, video, animation design and computer graphics, as well as how to edit and enhance these files for use in a multimedia presentation. They must also be competent with computer hardware and software, not only on the production side, but on the user side as well, to insure the product will run properly on any given computer. As multimedia moves to the Internet, many multimedia specialists may do work comparable to that of a webmaster.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Communications and Media – Knowledge of media production, communication, and dissemination techniques and methods including alternative ways to inform and entertain via written, oral, and visual media<br>• Design – Knowledge of design techniques, principles, tools and instruments involved in the production and use of precision technical plans, blueprints, drawings, and models<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar | • Programming – Writing computer programs for various purposes<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Operation and Control – Controlling operations of equipment or systems<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Idea Generation – Generating a number of different approaches to problems | • Originality – The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem<br>• Fluency of Ideas – The ability to come up with a number of ideas about a given topic. It concerns the number of ideas produced and not the quality, correctness, or creativity of the ideas.<br>• Visualization – The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged<br>• Visual Color Discrimination – The ability to match or detect differences between colors, including shades of color and brightness<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Formal training programs for multimedia technicians are not wide-spread, other than an individual class. Prior experience in the field or related fields seem to be the most valued asset by potential employers. Most employers will also expect at minimum an Associate's degree in electronic technology or computer science. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was unavailable. For a similar occupation, audio-visual specialist, the 1996 Texas mean hourly wage was $15.15.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Employment outlook specific to multimedia specialists was not available at the time of printing. In general, there is an increase in the use of multimedia presentations in long-distance learning, training, computer hardware/software tutorials, and other educational materials and the increased usage of multimedia on the Internet. With this increase, it would follow that a demand for specialists in the field would be significant. |
| **ASSOCIATED TITLES:** | Electronic Publishing Support Specialist, Audio/Visual Production Technician, Multimedia Technology Specialist |

# WEBMASTER

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:**

Webmasters are responsible for developing and maintaining the world wide web (WWW) servers and one or more webpages for a company. They must be familiar with hypertext markup language (HTML), Perl, and Java coding languages. They are part-time programmers, network technicians, and customer support specialists. The web pages they design may be part of the Internet, available to outside users, or an intranet, which is similar to Internet pages, but only available to users within the company. Some webmasters also serve as the firm's email postmaster, overseeing the firm's email server. Some employers are beginning to refer to webmasters, especially those designing pages, as **multimedia technology specialists**.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Communications and Media – Knowledge of media production, communication, and dissemination techniques and methods including alternative ways to inform and entertain via written, oral, and visual media<br>• Design – Knowledge of design techniques, principles, tools and instruments involved in the production and use of precision technical plans, blueprints, drawings, and models<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar | • Programming – Writing computer programs for various purposes<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Operation and Control – Controlling operations of equipment or systems<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Idea Generation – Generating a number of different approaches to problems | • Originality – The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem<br>• Fluency of Ideas – The ability to come up with a number of ideas about a given topic. It concerns the number of ideas produced and not the quality, correctness, or creativity of the ideas.<br>• Visualization – The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged<br>• Visual Color Discrimination – The ability to match or detect differences between colors, including shades of color and brightness<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Formal training programs for webmasters are just emerging. Presently, a potential webmaster's experience and portfolio of designs are more important in hiring decisions than degrees or certifications. Most current webmasters have trained by experimenting with web page design on their own. As technical schools and community colleges develop or adopt curriculum plans for this field, formal training will become more of a requirement. |
| **WAGE ESTIMATES:** | From a survey of webmasters and employers, the average salary was between $1,900 and $2,900 per month. Most of the people in positions have had several years experience in computer related fields. |
| **OUTLOOK:** | Though no specific outlook information was available about the field at the time of printing, based on increasing usage of the web and Internet by businesses to conduct their transactions and market their products or services, the future for webmasters should be very positive and job demand on the rise. |
| **ASSOCIATED TITLES:** | DOT: 141.061-018 Graphic Designer; OES: 25105 Computer Programmer;<br>Other: Electronic Publishing Support Specialist, Mulitmedia Specialist, Webpage Designer |

## Notes

13. U.S. Department of Commerce, Office of Technology Policy, *America's New Deficit: The Shortage of Information Technology Workers*. ([Washington, D.C.]: U.S. Department of Commerce, Office of Technology Policy, 1997), 3, citing "Help Wanted: The IT Workforce Gap at the Dawn of a New Century," The Information Technology Association of America.

14. Jeff Moad, "Study: Labor Shortage to Plague IT for Years," *PCWeek Online*, July 2, 1997, (http://www.zdnet.com/pcweek/news/0630/02estaff.html).

15. Amy Harmon, "With Boom in High Technology, Software Jobs Go Begging," *New York Times On The Web*, 13 January 1998, (http://www.nytimes.com/library/cyber/week/011398shortage.html)

16. Moad, "Study: Labor Shortage to Plague IT for Years."

17. Harmon, "With Boom in High Technology, Software Jobs Go Begging."

18. Margret Johnston, "Government Report Spells Out Programmer Shortage," *InfoWorld Electric*, 9 January 1998. (http://www.infoworld.com/cgi-bin/displayStory.pl?98019.eshortage.htm).

19. U.S. Department of Commerce, Office of Technology Policy, *America's New Deficit*, 3.

20. Johnston, "Government Report Spells Out Programmer Shortage."

21. U.S. Department of Commerce, Office of Technology Policy, *America's New Deficit: The Shortage of Information Technology Workers*, 26.

22. U.S. General Accounting Office, Health, Education, and Human Services Division, *Information Technology: Assessment of the Department of Commerce's Report on Workforce Demand and Supply*. GAO/HEHS-98-106R ([Washington, D.C.]: U.S. General Accounting Office, March 20, 1998).

23. U.S. Department of Commerce, Office of Technology Policy, *America's New Deficit*, 26; and Edward Yourdon, *Decline & Fall of the American Programmer* (Englewood Cliffs, New Jersey: Prentice Hall/Yourdon Press, 1993).

24. Todd Newcombe. "Government Internet Commerce Takes Root," *Government Technology*, March 1998, p. 15.

# Chapter 4
## Occupations in the Electronics Manufacturing Industry

The electronics manufacturing sector, especially the production of semiconductors, is important to the Texas economy. Texas is the second largest producer in the U.S. behind California. Almost 50 percent of the industry's 1994 employment was in California, Texas, and Oregon.[25] The high-tech manufacturing sector (which also includes software production and telecommunication manufacturing) employed 30 percent more people in Texas in 1997 than did the energy sector, with which the state is typically associated.[26]

Many high-tech firms take advantage of cost-reducing automation and robotics technology, which is continually becoming more sophisticated. As more robotic manufacturing equipment is used in the workplace, and as their technology changes, specialized technicians will be needed to both manufacture, install, and maintain the equipment. The constantly advancing technology of robotic systems requires technicians who can retrain and develop new skills. This signals their inclusion as an evolving occupation.

Laser technology also has become important across many industries. Lasers are used in a wide variety of applications in manufacturing, medicine, telecommunications, consumer goods, and defense hardware. Constant research to develop new types of lasers, with varying characteristics generated from different source materials, has made the field highly volatile. Given expanding uses of lasers in different environments and the changing technologies, laser electro-optical technician is the second of the four occupations identified in this chapter as emerging or evolving in the electronics manufacturing industry.

The final two emerging or evolving occupations in this industry are engaged in semiconductor manufacturing. Though only two occupation titles are listed for semiconductor production, these two titles actually encompass several jobs. Production workers often are given payroll or job titles by the specific operation they perform in the production process. Production workers are frequently cross-trained for several production processes, for which the basic educational prerequisites are the same. Salaries are comparable across specialties within production stages. For these reasons, all of the production titles have been combined under the title **semiconductor equipment operators**. A complete listing of the various specialties captured under this umbrella title can be found at the end of this section. The second occupational grouping listed for the

semiconductor industry, **semiconductor equipment technicians**, are employees who maintain and repair the equipment used in manufacturing semiconductors. Semiconductor equipment technician salaries are slightly higher than equipment operators. In some firms, an individual may be an equipment operator and technician, not only producing chips at some stage but also maintaining the production equipment. To understand these occupations better, especially the operators, examining the production process would be useful.

Semiconductors, typically made from silicon (which is a purified sand), are fundamental components in most of today's electronic devices—from high-tech defense systems to common household appliances. They are most frequently associated with personal computers. Semiconductors are not perfect conductors of electricity, as the name suggests, and when electric current is applied, the nature of the semiconductor will change in a predictable manner, making them useful in electric circuits.

Producing a semiconductor may take several weeks to several months, depending on the number of circuits and layers on the chip. The first stage requires melting silicon at high temperatures. Some impurities, called dopants, may be added at this stage to create pre-specified properties in the semiconductor. A seed crystal is then added to allow the mixture to crystalize in a desired manner.

Crystal ingots from this process are sawed into thin wafers. These wafers are then processed until they are completely flat and one side is highly polished. It is vital to the process that the polished surfaces remain completely free of foreign particles. Therefore, this work is done in a clean-room, free of dust. Workers wear sterile protective suits to prevent contaminating the wafers. Wafers may then be processed in a reactor or oven depending on the intended use of the semiconductor. This is known as the epitaxial process. Additional dopants and silicon may be added in gas form to create a thin layer on the surface of the wafer.

The next production stage involves placing integrated circuits on the surface of the wafer. This is done by a variety of technologies including diffusion, thin films, oxidation, photolithography, deposition, and etching. These processes involve adding a thin layer of an oxide material. A light-sensitive coating is applied over this layer, then a mask or template of the desired circuit is placed over the wafer. Light is beamed onto the wafer, sensitizing areas not covered by the mask. Each wafer is then placed in a chemical bath developing the sensitized area forming a circuit. This stage is repeated for each circuit needed, creating a new layer each time. The wafer is then tested for desired electrical properties and to check that it meets the users' needs.

Wafers that pass inspection are cut into individual dies or chips using precise diamond saws. The chips are placed in ceramic or plastic shells that have connectors that resemble wire legs. These legs will connect the semiconductor to other components. Finally, the chips undergo "actual use" testing, or "burn-in," before leaving the factory. Some firms perform all these stages of production. Others may only perform one stage before sending wafers to other firms for further processing.

Associated Occupation of Titles for Semiconductor Equipment Operators

| DOT Code | Title |
|---|---|
| 590.262-010 | Crystal Growing Technician |
| 590.252-010 | Test Technician, Semiconductor Processing |
| 590.282-010 | Epitaxial Reactor Technician |
| 590.362-018 | Group Leader, Semiconductor Processing |
| 590.362-022 | Microelectronics Technician |
| 590.364-010 | Lead Worker, Wafer Production |
| 590.382-014 | Crystal Grower |
| 590.382-018 | Epitaxial Reactor Operator |
| 590.382-022 | Ion Implant Machine Operator |
| 590.384-010 | Charge Preparation Processor |
| 590.684-014 | Electronic Component Processor |
| 590.684-022 | Semiconductor Processor |
| 590.384-026 | Etcher-Stripper, Semiconductor Wafers |
| 590.384-042 | Integrated Circuit Fabricator |
| 590.685-070 | Diffusion Furnace Operator, Semiconductor |
| 590.685-074 | Etch Operator, Semiconductor Wafers |
| 590.685-078 | Etcher |
| 590.685-086 | Metallization Equipment Tender, Semiconductor |
| 677.382-018 | Crystal Slicer |
| 677.687-014 | Crystal Mounter |
| 679.362-010 | Crystal Machining Coordinator |
| 679.384-010 | Seed Core Operator |
| 726.361-022 | Repairer, Probe Test Card, Semiconductor |
| 726.684-034 | Assembler, Semiconductor |
| 726.685-046 | Saw Operator, Semiconductor Wafers |
| 726.685-066 | Bonder, Semiconductor |
| 726.687-030 | Loader, Semiconductor Dies |
| 726.687-042 | Sealer, Semiconductor Packages |
| 726.687-046 | Wafer Breaker, Semiconductor |

| OES | Title |
|---|---|
| 92902 | Electronic Semiconductor Processor |

Several occupations originally considered for this study were not included in the final list of emerging and evolving occupations for the electronics manufacturing industry. Information about these occupations was insufficient to provide much detail beyond just titles and abstract descriptions. We could not determine whether they were truly emerging or evolving occupations. This does not mean they can be discounted completely, since they may meet the requirements, but it will fall on the reader at this time to pursue additional information about these titles. They are **miniaturization technician**, **circuit card testers**, and **high-definition television (HDTV) technicians**.

The four occupations identified as emerging and evolving for the electronics manufacturing industry are:

- Automation/Robotics Technician
- Laser Electro-Optical Technician
- Semiconductor Equipment Operator
- Semiconductor Equipment Technician

# AUTOMATION/ROBOTICS TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Automation/Robotics technicians are usually either maintenance or engineering technicians in robotics. They may work for robot manufacturers, suppliers, distributors or the companies using robotic equipment. Those working for manufacturers of robotic equipment are part of the design team and work closely with the engineers. They are the hands-on team members. If they are employed by the supplier and distributor, they help with installations, programming, and user training. The technicians may also perform maintenance support for the supplier's customer and install upgrades or peripheral equipment. The technicians who work for companies that use robotics equipment troubleshoot, maintain or interface with automated or robotics technology. Some tasks might include installing and servicing equipment, wet processors, microprocessor work stations, computer operated robots, manufacturing components and calibration work stations for repair or maintenance.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance<br>• Design – Knowledge of design techniques, principles, tools and instruments involved in the production and use of precision technical plans, blueprints, drawings, and models<br>• Engineering and Technology – Knowledge of equipment, tools, mechanical devices, and their uses to produce motion, light, power, technology, and other applications | • Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Repairing – Repairing machines or systems using the needed tools<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Speaking – Talking to others to effectively convey information<br>• Problem Identification – Identifying the nature of problems | • Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Visualization – The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Extent Flexibility – The ability to bend, stretch, twist, or reach out with the body, arms, and/or legs |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Most employers expect applicants to have an Associate's degree in electronics technology or equivalent technical or military training, in addition to a solid background in both mathematics and the physical sciences. Technicians often find it valuable to take additional courses and study technical manuals to stay current in the frequent changes and developments in the field of electronics. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, electrical/electronic technicians, the 1996 Texas mean hourly wage was $15.44.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 638.261-010 Automated Equipment Engineer-Technician, 638.261-018 Manufacturer's Service Representative, 638.261-026 Field Service Technician, 869.261-014 Mechanical-Test Technician |

# LASER ELECTRO-OPTICAL TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Laser electro-optical technicians test, operate, repair, and maintain lasers, fiber optics, and the systems that use or incorporate lasers. They work under the supervision of scientists or engineers. They sometimes use computers to design, set up, track, and maintain the fabrication of fibers. The technicians use electrical and laser safety practices and are required to take precise notations and keep detailed records of their work. Some technicians work in the production of lasers and laser systems. The production technicians clean and align optical elements (lenses, prisms, and mirrors), check electronic subassemblies and the power supply, and prepare plasma tube, crystal rod, dye cell, or semiconductor chips used to form the laser's beam. Unlike typical assembly work, laser production requires the technician to draw upon a knowledge of fundamental principles to make independent decisions and judgements.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Engineering and Technology – Knowledge of equipment, tools, mechanical devices, and their uses to produce motion, light, power, technology, and other applications<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications | • Science – Using scientific methods to solve problems<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Mathematics – Using mathematics to solve problems<br>• Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Technology Design – Generating or adapting equipment and technology to serve user needs | • Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Finger Dexterity – The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Firms will require at least a certificate in electrical or electronic technology, but most firms will expect a candidate to have an Associate's degree in electrical and electronic technology with course work in laser technology. |
| **WAGE ESTIMATES:** | Specific wage information was unavailable for Laser electro-optical technicians at the time of printing. The mean wage for electronic engineering technicians in Texas was $15.44 in 1996.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information for Laser Technicians was unavailable. In 1994, employment in Texas for Electrical Engineering Technicians was 24,100. It is projected that by the year 2005 employment in this occupation will grow by 35%, an increase of 8,400 positions. Over this same period, 5,775 openings (24% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 019.261-034 Laser Technician<br>OES: 22505 Electrical Engineering Technicians |

# SEMICONDUCTOR EQUIPMENT OPERATOR

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Semiconductor equipment operators work in "clean room" environments operating equipment used to manufacture or fabricate semiconductor wafers or one of their components. Though there is some degree of specialization in the various manufacturing processes, research indicates that most of those employed in semiconductor manufacturing are cross-trained among the specialties and receive comparable salaries, regardless of specialization. Since job knowledge, skills, and abilities are also similar, the manufacturing specialties are listed here together as **semiconductor equipment operators**.

## KNOWLEDGE

- Production and Processing – Knowledge of inputs, outputs, raw materials, waste, quality control, costs, and techniques for maximizing the manufacture and distribution of goods
- Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming
- Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications
- Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance
- Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods

## SKILLS

- Product Inspection – Inspecting and evaluating the quality of products
- Operation and Control – Controlling operations of equipment or systems
- Operation Monitoring – Watching gauges, dials, or other indicators to make sure a machine is working properly
- Science – Using scientific methods to solve problems
- Troubleshooting – Determining what is causing an operating error and deciding what to do about it
- Mathematics – Using mathematics to solve problems
- Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected
- Equipment Selection – Determining the kind of tools and equipment needed to do a job
- Reading Comprehension – Understanding written sentences and paragraphs in work related documents
- Writing – Communicating effectively with others in writing as indicated by the needs of the audience
- Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed
- Monitoring – Assessing how well one is doing when learning or doing something

## ABILITIES

- Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.
- Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)
- Finger Dexterity – The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects
- Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions
- Wrist-Finger Speed – The ability to make fast, simple, repeated movements of the fingers, hands, and wrists
- Arm-Hand Steadiness – The ability to keep the hand and arm steady while making an arm movement or while holding the arm and hand in one position

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| **EDUCATION AND TRAINING REQUIREMENTS:** | The minimum requirement for some positions is a high school diploma and may require some vocational training or job-related course work. Better paying positions and advancement will require an Associate's degree in electronics technology or semiconductor manufacturing technology. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $8.89 per hour.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for Electronic Semiconductor Processors was 7,100. It is projected that by the year 2005 employment in this occupation will grow by 12%, an increase of 850 positions. Over this same period, 1,815 openings (26% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | Chemical vapor deposition technicians, diffusion/doping technicians, dry etch technicians, ion implant technicians, oxidation technicians, packing technicians, photolithography/ microlithography technicians, photonics technicians, electro-optical technicians, process technicians, thin film technicians, wafer preparation technicians, and wet etch technicians (For a more detailed list, consult the text portion of this report.) |

# SEMICONDUCTOR EQUIPMENT TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Semiconductor equipment technicians monitor, maintain, and perform a variety of complex repairs on wafer and semiconductor fabrication equipment to ensure uninterrupted production flow. They perform periodic preventative maintenance procedures as defined by equipment specifications. They provide technical assistance in the form of troubleshooting, installation, diagnostics, adjustment, repair, modification, assembly, and calibration of equipment according to layout plans, blueprints, manuals, drawings, and verbal or written instructions. They perform electrical and mechanical maintenance for related equipment, tools, cable assemblies, and fixtures. These technicians are also required to write technical reports on maintenance, repairs, and recommendations for upgrading equipment. Technicians are usually broadly trained over production equipment technologies, but in the workplace they may specialize in a particular technology.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance<br>• Engineering and Technology – Knowledge of equipment, tools, mechanical devices, and their uses to produce motion, light, power, technology, and other applications<br>• Production and Processing – Knowledge of inputs, outputs, raw materials, waste, quality control, costs, and techniques for maximizing the manufacture and distribution of goods<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming | • Repairing – Repairing machines or systems using the needed tools<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Problem Identification – Identifying the nature of problems<br>• Operation Monitoring – Watching gauges, dials, or other indicators to make sure a machine is working properly<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Product Inspection – Inspecting and evaluating the quality of products | • Visualization – The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Manual Dexterity – The ability to quickly make coordinated movements of one hand, a hand together with its arm, or two hands to grasp, manipulate, or assemble objects<br>• Finger Dexterity – The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Entry level candidates should possess an Associate's degree in electronics technology, electronics manufacturing, or semiconductor technology. |
| **WAGE ESTIMATES:** | The average annual starting salary for these occupations range from $20,000 to $27,000. Candidates with some experience can earn from $27,000 to $45,000 per year. |
| **OUTLOOK:** | Because of the widespread use of semiconductors in consumer goods, industrial equipment, and military equipment the strong demand for semiconductors should generate significant demand for semiconductor equipment technicians. |
| **ASSOCIATED TITLES:** | Wet Chemical Process Equipment Technicians, EDS (Test) Maintenance Technicians, Calibration Technicians, Dry Etch Maintenance Technicians, Chemical Vapor Deposition Maintenance Technician, Metrology Equipment Technician |

## Notes

25. Francisco A. Moris, "Semiconductors: The Building Blocks of the Information Revolution, *Monthly Labor Review*, August 1996, p. 9.

26. Anne Reifenberg, "Biggest Industry in Texas? You'll Be Sorry You Asked," *Wall Street Journal Interactive Edition*, June 28, 1998 (http://www.wsj.com).

# Chapter 5
## Occupations in the Service Industry

Occupations in the service sector typically are described as low paying with little advancement opportunity. The image that quickly comes to mind is a teenager flipping burgers at a local fast food restaurant. Unfortunately, this is a poor example because occupational statistics collected for restaurant employment actually are reported in the retail sector, not the service sector. While the service sector has a disproportionate number of low paying jobs, some of the highest paid occupations also are found there. The service sector includes allied health professions (including physicians), the legal profession, firms developing and publishing computer software, engineering firms, and educational institutions. In this study, occupations from the finance, insurance, and real estate (F.I.R.E) sector have been combined with these other service sector occupations. While F.I.R.E. is a separate sector, the occupations are associated more with providing services than tangible goods, so it makes some sense to combine the two sectors for the purpose at hand.

The financial sector and business services sector had strong growth in Texas in 1997.[27] Only one occupation from the financial sector met the criteria for this study—**automatic teller machine (ATM) servicer/clerk**. Although the KSAs required to service ATMs may not be entirely new, the combination of KSAs is. This makes ATM servicer/clerks a unique occupation. These positions are captured in the current occupational coding taxonomies under titles like electronic data processing (EDP) equipment repairers. The combination of computer, telecommunication, and electro-mechanical KSAs separate ATM servicer/clerks from the rest. Since the occupational title is not part of the current taxonomies, it meets the definition of an emerging occupation.

Because of increased ATM use, this has become a distinct specialty among EDP equipment repairers. Between 1984 and 1994, the number of transactions in the banking industry conducted through ATMs increased by 137 percent.[28] In addition to the typical cash vending ATMs, these devices are being used in increasing numbers as point-of-sale (POS) transaction alternatives to cash and checks. Most retail outlets now have ATM devices at the register, allowing customers to pay for products with credit cards and debit cards, which automatically debits the customer's bank account. This includes the use of credit card operated gasoline pumps at many service stations and convenience stores. The State of Texas also uses ATM devices in the distribution of purchasing power to food stamp recipients through its Lone Star Card program.

Occupational demand in the insurance sector has grown, especially in companies involved with managed health care programs, which include Heath Maintenance Organizations (HMOs). The national trend toward managed health care has increased concerns about the oversight of patient care. Companies providing health care insurance are looking for workers with higher levels of skills and knowledge. All occupations in the insurance sector identified as evolving in this study are associated with firms engaged in managed health care.

The fact that Texans have been slow to move to managed health care compared to the national average[29] would suggest HMOs will expand marketing efforts across the state to increase the number of customers and attract physicians to join the programs. **Provider relations specialists** in essence are marketing personnel that work to strengthen relations between the HMO, medical treatment providers, and HMO customers. They negotiate and administer contracts between providers and purchasers.

**Medical eligibles specialists** process the paperwork of new applicants and patient admissions. They also determine eligibility in light of the HMO policy standards. **Insurance claims clerks** process paperwork of covered individuals. They make sure all required documentation has been submitted. They also arrange reimbursement to the medical treatment provider or customer as needed.

As HMOs are profit-driven organizations, cost-controls are vital to their profitability. Advances in technology, new medical diagnosis and treatment techniques typically are developed at high costs. With the cornucopia of treatment options available, many patients feel the newest, and often most costly, treatment is the only satisfactory option. To help manage these costs, there is a growing demand for **compliance officers** and **utilization review coordinators** by HMOs.[30] Utilization reviewers, typically a hospital based position to monitor appropriate resource use, are now in demand by a variety of employers, including managed health care organizations, and insurance companies. In fact, firms that specialize in utilization review offer their services on a contract basis to other firms as well as to patients who want to make sure all prescribed procedures are necessary. Utilization reviewers often have nursing degrees or other medical training. They must be know medical terminology and treatment options.

The last three occupations from the services industry come from legal and business services. The first, **litigation support specialist**, emerged because of increased technology use in both criminal and civil trials. Following the adage that "a picture paints a thousand words," attorneys now use animated reconstructions of crimes, traffic accidents, and other events as alternative methods to sway juries. These reconstructions often are computer-generated multimedia presentations. Other visual aids include computerized slide presentations that allow more dynamic presentation of information than traditional overhead transparencies do. While litigation support specialists use knowledge of the law, computers, design, and audio-visual techniques to produce presentations, they are not necessarily paralegals. In larger firms, litigation support specialists may specialize exclusively in developing multimedia presentations. In smaller firms,

litigation support specialists might be required to have paralegal training and perform duties of both jobs, including legal research, preparing briefs, and filing documents with the court.

**Electronic research technicians** are also derivatives of the explosive growth of electronic information. It seems that every transaction, from purchasing goods in a department store to registering a marriage license, is recorded and saved in some electronic database. There are also large archives of news reports, journal articles, reports, case law, and other documents that may have originally appeared in print or in electronic form. These electronic archives may be publically accessible; others, such as *Westlaw*, and *Lexis/Nexis* may be fee-based. Information retrieved from these databases can be used by businesses developing marketing strategies, attorneys preparing legal briefs, authors conducting research for books or articles, or by private detectives and law enforcement personnel trying to track fugitives or other missing persons. Some electronic research technicians may find employment within a firm as a staff member with research responsibilities. Others may work in companies that specialize in electronic information research and contract with other companies to provide their services. These technicians must be inquisitive and be aware of all the growing number of esoteric or highly specialized databases available to them.

The final occupation from the service industry is **meeting, event, and convention planner**. Planners organize events for professional organizations, trade groups, service organizations, enthusiast groups, veterans organizations, weddings, reunions, etc. Most organizations have national and regional meetings or conferences once or twice a year. These meetings can attract participants in the thousands—especially at trade shows. Local authorities encourage the convention industry because they believe tourist dollars can boost a faltering or stagnant economy. Tourists inject outside dollars into a local economy, resulting in greater net benefit than an increase in the turnover of local dollars. Some organizations and large corporations have sufficient need and funds to maintain in-house planners and meeting organizers. Event planners also may find employment with local chambers of commerce, convention and visitors bureaus, hotels, or convention centers. In larger metropolitan areas, some firms specialize in organizing and planning conventions and events for others.

The duties of meeting, event and convention planners can vary depending on where they work. In general, planners must locate and negotiate contracts for meeting sites, negotiate lodging prices with hotels, work with caterers, arrange shuttle transportation between venues and activities, plan entertainment, and arrange audio-visual equipment for conference presenters. For large trade shows, where a number of vendors set up booths, planners may have to organize additional telephone lines to the show's site and arrange electrical outlets for individual booths. Planners working for visitors and convention bureaus, hotels, and convention centers also may spend a great deal of time marketing their facilities or general location and amenities.

In general, all planners must be able to develop and work within budgets and organize themselves and others. They must have excellent marketing abilities. They need to know not only about local venues, but also how those compare to competitive facilities and attractions

nationwide. Planners working with international associations may find it beneficial to be multilingual or have local interpreters at their disposal. In larger convention planning firms or departments, the staff may specialize in a particular part of the overall process. Those working in smaller organizations will be responsible for all of the planner duties. Persons interested in this career field should be comfortable working with people. They will need above average oral and written communication skills. Additionally, most planners will not work standard 8:00-5:00 business hours; they may have to work evenings and weekends to resolve *ad hoc* problems.

# AUTOMATIC TELLER MACHINE SERVICER/CLERK

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:** Automatic Teller Machine (ATM) servicers and clerks install ATMs, replenish the machines with cash, receipt paper, and other materials, and restore malfunctioning ATMs to working order. They may also participate in the marketing of the machines encouraging more people to utilize their services. ATM servicers and clerks may work for depository institutions like banks and credit unions or firms in the business service sector providing ATM machines to outlets like grocery stores and department stores.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming | • Mathematics – Using mathematics to solve problems<br>• Problem Identification – Identifying the nature of problems<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Monitoring – Assessing how well one is doing when learning or doing something<br>• Information Organization – Finding ways to structure or classify multiple pieces of information | • Number Facility – The ability to add, subtract, multiply, or divide quickly and correctly<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | There is no specific formal education for these positions. However, since ATM clerks deal with money and figures, they must have a background in mathematics and/or accounting. ATM servicers may be trained to service several types of equipment, or they may work for a particular vendor and be trained only on their machines and service them for several clients. |
| **WAGE ESTIMATES:** | ATM clerks may earn between $8.00 and $12.20 per hour.<br>ATM servicers, depending on training and work requirements, may earn from $6.60 to $15.00 per hour. |
| **OUTLOOK:** | Employment outlook information was unavailable for this occupation at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 726.381-014 Electronic Equipment Repairer<br>Other: Operations Electronic Banking Specialist |

# COMPLIANCE OFFICER/UTILIZATION REVIEW COORDINATOR

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Utilization review coordinators are generally nurses who assess the extent to which medical services are provided in compliance with the standards set by the firm's policies. They review a patient's hospital record to ensure that proper cost-effective treatment was provided, reviewing hospital records to ensure that resources are utilized efficiently, and screening admissions for medical necessity and appropriateness of services. Utilization review coordinators may work for insurance companies, business service providers, health service providers, social service agencies, and management service organizations.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Medicine and Dentistry – Knowledge of the information and techniques needed to diagnose and treat injuries, diseases, and deformities. This includes symptoms, treatment alternatives, drug properties and interactions, and preventive health-care measures<br>• Clerical – Knowledge of administrative and clerical procedures and systems such as word processing systems, filing and records management systems, stenography and transcription, forms design principles, and other office procedures and terminology<br>• Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications | • Problem Identification – Identifying the nature of problems<br>• Mathematics – Using mathematics to solve problems<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Speaking – Talking to others to effectively convey information<br>• Solution Appraisal – Observing and evaluating the outcomes of a problem solution to identify lessons learned or redirect efforts<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Product Inspection – Inspecting and evaluating the quality of products | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem<br>• Number Facility – The ability to add, subtract, multiply, or divide quickly and correctly<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Person's employed in these positions will have at least an Associate's degree in nursing or a related field and some work experience as a practicing nurse. Some organizations also provide certification for persons employed in this field. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $15.54 per hour.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information for this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 079.262-010 Utilization Review Coordinator; Case Manager, Utilization Review RN |

# INSURANCE CLAIMS CLERK

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Insurance claims clerks process patient charges and other paperwork necessary to receive reimbursement from insurance companies or other third-party payers. They prepare claims for processing and provide staff support for the claims department.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Clerical – Knowledge of administrative and clerical procedures and systems such as word processing systems, filing and records management systems, stenography and transcription, forms design principles, and other office procedures and terminology<br>• Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar | • Speaking – Talking to others to effectively convey information<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Mathematics – Using mathematics to solve problems<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience | • Number Facility – The ability to add, subtract, multiply, or divide quickly and correctly<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | A high school diploma or equivalent would provide the minimal education for entry-level positions. For advancement, firms may require additional work experience, vocational course work, or an Associate's degree in a business related field. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $10.16 per hour.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for Insurance Claims Clerks was 6,500. It is projected that by the year 2005 employment in this occupation will grow by 29%, an increase of 1,900 positions. Over this same period, 825 openings (13% of current positions) will become available due to employee turnover between 1994 and 2005. |
| **ASSOCIATED TITLES:** | DOT: 205.367-018 Claims Clerk II, 241.362-010 Claims Clerk I<br>OES: 53311 Insurance Claims Clerks |

# MEDICAL ELIGIBLES SPECIALIST

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Medical eligibles specialists process the paperwork necessary for admission of new patients or clients (in health services) or for new applicants (in finance and insurance companies). They determine applicant eligibility and may handle inquiries from prospective applicants, patients, or clients. Medical eligibles specialists work for insurance firms, health care services, social services, and management services. Medical eligibles specialists who work in a hospital may be called **admitting clerks**, **admitting registrars**, or **patient representatives**. In hospitals, their responsibilities may include handling reservations for rooms, assigning beds, explaining hospital policies to patients, fee collection, and handling telephone calls.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Medicine and Dentistry – Knowledge of the information and techniques needed to diagnose and treat injuries, diseases, and deformities. This includes symptoms, treatment alternatives, drug properties and interactions, and preventive health-care measures<br>• Clerical – Knowledge of administrative and clerical procedures and systems such as word processing systems, filing and records management systems, stenography and transcription, forms design principles, and other office procedures and terminology<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar<br>• Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems | • Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Speaking – Talking to others to effectively convey information<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Social Perceptiveness – Being aware of others' reactions and understanding why they react the way they do | • Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Speech Clarity – The ability to speak clearly so that it is understandable to a listener<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | A high school diploma or equivalent would provide the minimal education for entry-level positions. For advancement, firms may require additional work experience, vocational course work, or an Associate's degree in a business related field. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, insurance policy processing clerks, the 1996 Texas mean hourly wage was $10.83.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 205.362-018 Hospital Admitting Clerk;<br>OES: 53314 Insurance Policy Processing Clerk<br>Other: Interview Clerks, Patient Representatives |

# PROVIDER RELATIONS SPECIALIST

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Provider relations specialists use backgrounds in marketing or finance to establish and maintain relations between health care providers (physicians, clinics, and hospitals) and purchasers (HMOs or insurance companies). They are responsible for recruiting health care providers and for negotiating and administering contracts between providers and purchasers. Provider relations representatives may work for insurance companies, management services firms, and health care providers.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Sales and Marketing – Knowledge of principles and methods involved in showing, promoting, and selling products or services. This includes marketing strategies and tactics, product demonstration and sales techniques, and sales control systems<br>• Customer and Personal Service – Knowledge of principles and processes for providing customer and personal services including needs assessment techniques, quality service standards, alternative delivery systems, and customer satisfaction evaluation techniques | • Speaking – Talking to others to effectively convey information<br>• Persuasion – Persuading others to approach things differently<br>• Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Social Perceptiveness – aware of others' reactions and understanding why they react the way they do<br>• Mathematics – Using mathematics to solve problems<br>• Negotiation – Bringing others together and trying to reconcile differences<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Identification of Key Causes – Identifying the things that must be changed to achieve a goal | • Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Number Facility – The ability to add, subtract, multiply, or divide quickly and correctly<br>• Speech Clarity – The ability to speak clearly so that it is understandable to a listener |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | This occupation requires training in vocational schools, related on-the-job experience, or an Associate's degree. Some may require a Bachelor's degree. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, public relations specialist, 1996 Texas the mean hourly wage was $17.86.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Employment outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 250.257-010 Sales Agent - Insurance;<br>OES: 34008 Public Relations Specialist<br>Sales Representative (Medical and Insurance), Account Representative/Manager, Marketing Manager |

# ELECTRONIC RESEARCH TECHNICIAN

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:** Electronic research technicians specialize in accessing information electronically, identifying pertinent research and formatting it for situational analysis. They search the Internet, online public and proprietary databases for information, news, other research, and data. Service tasks range from performing electronic clipping services to more comprehensive research services that access major databases worldwide for information and research relevant to a specific client's needs and business objectives.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Communications and Media – Knowledge of media production, communication, and dissemination techniques and methods including alternative ways to inform and entertain via written, oral, and visual media<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar | • Active Learning – Working with new material or information to grasp its implications<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Speaking – Talking to others to effectively convey information<br>• Judgment and Decision Making – Weighing the relative costs and benefits of a potential action<br>• Systems Perception – Determining when important changes have occurred in a system or are likely to occur | • Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Fluency of Ideas – The ability to come up with a number of ideas about a given topic. It concerns the number of ideas produced and not the quality, correctness, or creativity of the ideas.<br>• Inductive Reasoning – The ability to combine separate pieces of information, or specific answers to problems, to form general rules or conclusions. It includes coming up with a logical explanation for why a series of seemingly unrelated events occur together.<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | No information was available on the education and training requirements for this occupation. Persons interested in this career will likely be required to pursue vocational training beyond the high school diploma, and may be required to complete an Associate's degree in computer science, information systems, or in a research related field. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, broadcast news analyst, the 1996 Texas mean hourly wage was $9.66.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information for this specific occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 194.362-022 News Gathering Technician;<br>Other: Electronic Information Specialist, Data Acquisition and Verification Technician |

# LITIGATION SUPPORT SPECIALIST

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Litigation support specialists are a specialized type of paralegal. Legal firms describe them as part investigator, researcher, and paralegal. They generally perform background work for lawyers who specialize in litigation. This involves researching appropriate legal precedents, legal articles, and other relevant materials. Litigation support specialists may also be required to prepare legal arguments, file pleading and other documents with the court or clerk's office, and manage case files. Evolving areas for litigation support specialists are audio/visual and multimedia skills. It is becoming more common in civil and criminal cases for attorneys to take advantage of audio/visual presentations and multimedia reenactments and simulations to capture the attention of jurors and make their case before them. Therefore, litigation support specialist may now require additional technical skills in preparing audio and video tapes, creating and editing computer graphics and multimedia presentations and operation of various presentations equipment.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Law, Government and Jurisprudence – Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process<br>• Clerical – Knowledge of administrative and clerical procedures and systems such as word processing systems, filing and records management systems, stenography and transcription, forms design principles, and other office procedures and terminology<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Communications and Media – Knowledge of media production, communication, and dissemination techniques and methods including alternative ways to inform and entertain via written, oral, and visual media | • Information Gathering – Knowing how to find information and identifying essential information<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Negotiation – Bringing others together and trying to reconcile differences<br>• Speaking – Talking to others to effectively convey information | • Written Comprehension — The ability to read and understand information and ideas presented in writing<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | At the entry level, applicants must have a high school diploma and some secretarial experience. Many firms require more formal training in legal studies and paralegal course work and completion of a paralegal certificate, Associate's degree, or Bachelor's degree. Many of the formal programs are offered by community colleges and four-year colleges as afternoon and evening programs. Certification is available and may aid in advancement. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $14.84 per hour.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for Paralegals and Legal Assistants was 7,250. It is projected that by the year 2005 employment in this occupation will grow by 41%, an increase of 3,000 positions. Over this same period, 825 openings (11% of current positions) will become available due to employee turnover between 1994 and 2005. |
| **ASSOCIATED TITLES:** | DOT: 119.267-026 Paralegal; Legal Assistant, Reenactment Specialist<br>OES: 28305 Paralegals |

# MEETING, EVENT, AND CONVENTION PLANNER

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Meeting, event, and convention planners' duties may cover a wide range of skills. In general, such planners develop programs, market events or conventions, budget the event, choose locations, make travel arrangements, arrange entertainment, plan menus and choose caterers, arrange lodging, ensure availability of audio-visual equipment, and registration of attendees to the events. In larger organizations, each task may be assigned to an individual planner. In smaller organizations, planners will be responsible for several of the duties, and in some cases all of these duties. Planners must be able to organize themselves and other sub-contractors, create and follow budgets, and be able to cope with last minute changes or difficulties to ensure the event runs smoothly and effectively.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Administration and Management – Knowledge of principles and processes involved in business and organizational planning, coordination, and execution. This includes strategic planning, resource allocation, manpower modeling, leadership techniques, and production methods<br>• Customer and Personal Service – Knowledge of principles and processes for providing customer and personal services including needs assessment techniques, quality service standards, alternative delivery systems, and customer satisfaction evaluation techniques | • Coordination – Adjusting actions in relation to others' actions<br>• Speaking – Talking to others to effectively convey information<br>• Management of Personnel Resources – Motivating, developing, and directing people as they work, identifying the best people for the job<br>• Problem Identification – Identifying the nature of problems<br>• Implementation Planning – Developing approaches for implementing an idea<br>• Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Time Management – Managing one's own time and the time of others<br>• Service Orientation – Actively looking for ways to help people | • Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Speech Clarity – The ability to speak clearly so that it is understandable to a listener<br>• Speech Recognition – The ability to identify and understand the speech of another person |

**EDUCATION AND TRAINING REQUIREMENTS:**

Many individuals currently working as meeting, event, and convention planners began performing these tasks as secretaries and administrative assistants. Experience can be obtained by working in offices that plan such events or by working in the hotel/restaurant industry with facilities that hold such events. After three years work experience, planners can qualify to sit for the Certified Meeting Professional (CMP) exam. Though certification is not a requirement, it would benefit a planner desiring to seek advanced positions with higher pay.

**WAGE ESTIMATES:**

Corporate planners: $35,520 per year
Association planners: $34,250 per year
Health care planners: $31,750 per year
Government, education, and religious planners: $32, 500 per year
Source: *Meeting Manager*, October 1993

**OUTLOOK:**

In 1994, employment in the United States for Meetings and Convention Planners was 885,537. It is projected that by the year 2005 employment in this occupation will grow by 23%, an increase of 199,386 positions. Over this same period, 165,594 openings (19% of current positions) will become available due to employee turnover between 1994 and 2005.

**ASSOCIATED TITLES:**

DOT: 169.117-022 Meeting Planner, 187.167-078 Convention Manager

## Notes

27. Sheila Dolmas and Mine Yücel, "The 1997 Texas Economy Beats Expectations," *The Southwest Economy* 1 (January/February 1998) Federal Reserve Bank of Dallas.

28. Stephen A. Rhoades, "Bank Mergers and Industrywide Structure, 1980-94," Board of Governors of the Federal Reserve System *Staff Studies* (February 1996); quoted in Rebecca S. Demsetz, "Human Resource Needs in the Evolving Financial Sector," *Current Issues in Economics and Finance*, 3, no. 13 (November 1997) Federal Reserve Bank of New York: 2.

29. John Duca, "A Tale of Three Supply Shocks, National Inflations and the Region's Economy," *The Southwest Economy*," 2 (March/April 1997) Federal Reserve Bank of Dallas.

30. Tonya Hongsermeier, M.D., M.B.A., "Utilization Review Enabling Managed Care to Balance Cost and Quality," *Managed Healthcare News* (November 1996).

# Chapter 6
## Occupations in the Telecommunications Industry

It is true that we are in the *Information Age*. Although occupations typically associated with this phrase were presented in Chapter 1, several other related occupations exist. Just as the delivery of goods requires a developed system of roads and rail, information dissemination requires a sound delivery network. As the amount of information being distributed electronically increases, the demand for transmission methods with higher capacities and faster transfer capabilities increases. When these demands are met with new technologies, technicians within the industry will find a growing need for new combinations of KSAs and/or duties.

Like occupations in information technology, occupations presented in this chapter face a national market—not just limited to Texas. In 1996, revenue generation in the industry grew nationally by 11.1 percent.[31] The services side made up 75 percent of this total and grew by 9 percent. The equipment side grew faster, at a rate of 17.8 percent. In 1997, the sales of telecommunication equipment rose another 20 percent.[32]

Seven occupations from this industry were validated as either emerging or evolving. In developing this list of occupations, it came to light that numerous payroll titles are used by various firms for the same occupation or combination of occupations. This made it difficult to draw clear lines completely distinguishing some of these occupations from one another. Readers should keep in mind that in the work environment, the duties and tasks and the related KSAs of several of these occupations may be included under one payroll title by a given firm. The seven occupations are **data communications technician**, **direct broadcast satellite (DBS) services technician**, **fiber optics technician**, **microwave technician**, **telecommunications specialist**, **videoserver technician**, and **wireless communications technician**.

Data communications technicians work with telecommunication networks that primarily deal with data transfer. Increased use of wide area networks (WANs) and the growth of the Internet have stimulated the ancillary development of new ways to transmit larger amounts of information at higher rates of speed. Data transmitting capacity is referred to as *bandwidth*. The development of new network interfaces or accesses to achieve this goal has required that data communications technicians learn new sets of KSAs. Sufficiently explaining the technologies would require technical knowledge beyond the general audience for whom this report is

intended, but those interested in this occupation should at least be aware of the terms. The emerging technologies facing data communications technicians are **frame relay, asynchronous transfer mode (ATM), integrated services digital network (ISDN),** and **switched multimegabit data service (SMDS).**[33]

Direct broadcast satellite services technicians install and repair equipment used to receive direct transmissions from satellites. The largest market for these systems is for the delivery of television programs to subscribers. Because such information is highly compressed, up to 200 channels can be broadcast from one orbital position, thereby allowing for smaller, fixed-position satellite dishes.[34] Though originally designed as an alternative to cable television, DBS technology is being introduced to deliver high-speed business information and Internet services to desktop computers.[35]

Fiber optics technicians install fiber optic cables and attach connections on the ends of cables (terminating) so they may connect to computers or other devices. Fiber optics provide high bandwidth, encouraging their use in data-intensive applications. They are used in inter-office trunking, local area networks, and submarine telecommunications trunks. Long distance providers have replaced microwave transmission with fiber optic cabling in some areas.[36]

Microwave technology was predominantly used in the competitive long-distance telephone industry as a less costly alternative to copper land lines. Where feasible, fiber optic cables have replaced microwaves. The dramatic growth in cellular phones, however, has increased the demand for microwave communications technology, interconnecting cellular telephone switches. Between 1995 and 1996, the wireless communications services industry increased revenue by 23.3 percent. Both microwave technicians and wireless communications technicians are affected by these changes.

Telecommunications specialists typically oversee a business's telephone system, sometimes including both voice and data communications. With the increase in options available to users, including voice-mail, conferencing, and video-telephony, larger organizations often employ persons to keep up with the changes in available equipment. They make recommendations for equipment update or replacement when needed. Telecommunications specialists also may be required to manage an on-site telephone switch, adding new telephones as needed, reassigning telephone numbers, building voice mailboxes, etc.

Videoserver technicians setup and operate equipment used to transmit audio and imagery information for videoconferencing. The teleconferencing industry exceeded $5 billion in revenues for the first time in 1996, and is expected to maintain record growths through 1998.[37] Teleconferencing is widely used by companies to hold meetings with offices around the globe or to broadcast presentations of new products or training. Universities use the technology in distance-learning applications, allowing students in isolated areas to enroll in classes and participate in classroom activities. Public and private organizations distribute lectures and conferences and other meetings through videoconferencing. Attorneys now even take depositions

using the new technology. As society becomes more skilled in the use of computers, and the need to disseminate information quickly grows, other uses of videoconferencing will likely be developed.

# DATA COMMUNICATIONS TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Data network communications specialists design, install, and maintain network communications equipment to provide intra-connectivity to local area networks over long distances using emerging broadband technologies like frame relay and asynchronous transfer mode (ATM).

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance | • Repairing – Repairing machines or systems using the needed tools<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Problem Identification – Identifying the nature of problems | • Manual Dexterity – The ability to quickly make coordinated movements of one hand, a hand together with its arm, or two hands to grasp, manipulate, or assemble objects<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | Salary information specific for this occupation was not available, but the national median annual wages for the broader category Electronic Repairers, Communications and Industrial Equipment is $30,316. |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | 823.261-030 Data Communications Technician, Network Control Technician |

# DIRECT BROADCAST SATELLITE SERVICES TECHNICIAN

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:**

Direct broadcast satellite (DBS) services technicians operate and maintain electronic broadcast transmission equipment in providing direct satellite connections to homes and businesses, as in direct-to-home television. Services provided in this industry not only include television transmission but also data transmission for business users. Other DBS services technicians install, configure, and repair reception systems (customer premises equipment or CPE) at the customer's site, including running cable, attaching satellite dishes and making connections to decoders, televisions, and computers.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance | • Repairing – Repairing machines or systems using the needed tools<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Problem Identification – Identifying the nature of problems | • Manual Dexterity – The ability to quickly make coordinated movements of one hand, a hand together with its arm, or two hands to grasp, manipulate, or assemble objects<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. Technicians working on the broadcast end may require FCC licensing. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, telephone/cable TV installer, the 1996 Texas mean hourly wage was $13.07.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 823.261-022 Antenna Installer, Satellite Communications, 821.281-010 Cable TV Installer, 194.062-010 Television Technician;<br>OES: 34028 Broadcast Technician, 85702 Telephone/Cable Installer |

# FIBER OPTICS TECHNICIAN

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:**

Fiber optics technicians design, install, and repair fiber optic cable systems and connections (terminations) in business and home applications for data and voice uses. Some technicians may work in specialized fields, such as aircraft manufacturing or work in broader areas such as laying fiber optic cabling for computer networks, cable television, or telephone networks. Installations may be indoors or outdoors.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Engineering and Technology – Knowledge of equipment, tools, mechanical devices, and their uses to produce motion, light, power, technology, and other applications | • Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Repairing – Repairing machines or systems using the needed tools<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Problem Identification – Identifying the nature of problems<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job | • Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Finger Dexterity – The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects<br>• Manual Dexterity – The ability to quickly make coordinated movements of one hand, a hand together with its arm, or two hands to grasp, manipulate, or assemble objects<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, electrical/electronic technicians, the 1996 Texas mean hourly wage was $15.44.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 823.261-030 Data Communications Technician<br>Other: Telecommunications Technician |

# MICROWAVE TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Microwave technicians are electronics technicians who specialize in the principles and applications of electronic microwave systems typically found in telecommunications, radar systems and military electronic detection or counter-measure systems. These workers apply theory and practical techniques to develop, test, install and service an ever-increasing number of applications of electronic-microwave equipment. Some typical job tasks for microwave technicians include setting up, calibrating or operating instruments for microwave and power control systems, conducting experiments and assisting technical engineers in the development of experimental equipment for linear and/or digital systems.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance | • Repairing – Repairing machines or systems using the needed tools<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Problem Identification – Identifying the nature of problems | • Manual Dexterity – The ability to quickly make coordinated movements of one hand, a hand together with its arm, or two hands to grasp, manipulate, or assemble objects<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Technicians must understand electronics theory and be able to apply it. As a result, formal training in electronics is almost always required. Most employers expect applicants to have an Associate's degree in electronics technology or equivalent technical or military training, in addition to a solid background in both mathematics and the physical sciences. Technicians often find it valuable to take additional courses and study technical manuals to stay current in the frequent changes and developments in the field of electronics. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, electrical/electronic technicians, the 1996 Texas mean hourly wage was $15.44.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | As the communications industry continues to grow, the need for transmission technicians will follow, including microwave technicians. This would include those in the manufacturing of microwave equipment, the use of the equipment, and its repair. |
| **ASSOCIATED TITLES:** | Telecommunications Technician |

# TELECOMMUNICATIONS SPECIALIST

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Telecommunication specialists research, test, evaluate, and recommend communications hardware and software. They monitor system performance and identify areas of operation which need upgraded equipment, such as voice mail systems, modems, fiber optic cable, telephone switching units, and telephone sets. They meet with vendors to learn about available products and services, test and evaluate these services to determine reliability and compatibility with existing systems. They may conduct surveys to determine user needs, and write procedures for the installation, use, and problem solving of the communication system. Telecommunication specialists also instruct users on the operation and features of the telecommunications equipment.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance | • Operations Analysis – Analyzing needs and product requirements to create a design<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Identification of Key Causes – Identifying the things that must be changed to achieve a goal<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Instructing – Teaching others how to do something<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Judgment and Decision Making – Weighing the relative costs and benefits of a potential action | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer) |

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|---|---|
| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Some may require a Bachelor's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | The 1997 national median salary for telecommunications specialists was $32,900. DataMasters, 1997 Computer Industry Salary Survey |
| **OUTLOOK:** | It is projected that by the year 2005 employment in the U.S. for this occupation will grow by 89%, an increase of 129,523 positions. Over the same period, 11,187 openings (8% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 823.261-030 Data Communications Technician, 031.262-010 Data Communications Analyst; Telecommunication Facility Examiner, Telephone and Cable Television Line Installers and Repairers, Communication Equipment Mechanics, Installers and Repairers |

# VIDEOSERVER TECHNICIAN

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:**

Videoserver technicians maintain, service, set up, and dismantle equipment used in teleconferencing technology including synchronizing the text and video used in Internet multimedia teleconferencing. They may work for large companies who conduct business via teleconferences, government agencies and educational institutions who sponsor lectures, presentations and distance learning, or communications services firms that provide these services to these types of users.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance | • Operations Analysis – Analyzing needs and product requirements to create a design<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Identification of Key Causes – Identifying the things that must be changed to achieve a goal<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Instructing – Teaching others how to do something<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Judgment and Decision Making – Weighing the relative costs and benefits of a potential action | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer) |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. Technicians working on the broadcast end may require FCC licensing. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, audio-visual specialist, the 1996 Texas mean hourly wage was $15.15.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Employment outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | Video Conferencing Technician |

# WIRELESS COMMUNICATIONS TECHNICIAN

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:** Wireless communications technicians install, maintain, repair and tune cellular communications equipment including cellular telephones, transmission and receiving equipment, and transmission antennas.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance | • Operations Analysis – Analyzing needs and product requirements to create a design<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Identification of Key Causes – Identifying the things that must be changed to achieve a goal<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Instructing – Teaching others how to do something<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Judgment and Decision Making – Weighing the relative costs and benefits of a potential action | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Some may require a Bachelor's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, electrical/electronic technicians, the 1996 Texas mean hourly wage was $15.44.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | Cellular Communications Technician, Telecommunications Technician |

## Notes

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32. "U.S. Telecom Factory Sales Climb to $46.2 Billion at End of Third Quarter 1997," Telecommunication Industry Association Press Release, 97-93, November 13, 1997.

33. Ray Horak, *Communications Systems & Networks: Voice, Data, and Broadband Technologies*, (New York: M&T Press, 1997) Chapter 11.

34. Richard R. Peterson,"Direct Broadcast Satellite: A New Generation of Television in America," January 14, 1998 (http://www.dbsdish.com /dbs/a0.html).

35. "Adaptec and Media4 Offer High-Bandwidth Satellite Networking Solutions Worldwide; Adaptec Signs Supplier Agreement with Media 4 for Distribution of Satellite Express Products," *Excite News*, March 18, 1998 (http://excite.com/news/bw/980318/adaptec).

36. Horak, *Communications Systems & Networks*, 55.

37. "ITCA Forecasts Record Growth for the Teleconferencing Industry in 1998," International Teleconferencing Association Press Release, January 5, 1998.

# Chapter 7
## Occupations in the Transportation Industry

Moving goods and people from place to place is a significant part of the Texas economy. Texas' size, geographic location, and diverse economy are key factors in the importance of transportation to the state. In 1997, transportation sector employment grew at a 5.3 percent annual rate.[38] With many communities isolated from large metropolitan markets by miles of open road, the exchange of goods requires the transport of large volumes over long distances. The occupations selected as emerging and evolving from the transportation sector can be grouped into three clusters: (1) aviation maintenance; (2) geographic information; and (3) transportation, warehousing, and distribution.

### AVIATION MAINTENANCE

Eleven of the one hundred U.S. airports with the highest enplanements in 1993 were in Texas.[39] These eleven airports handled 49,495,914 enplanements which accounted for 11 percent of the U.S. total. Additionally, in 1996, 5 percent of the tonnage of air cargo transported in the U.S. landed at Texas airports.[40] In addition to commercial aircraft, there are a large number of privately owned aircraft in Texas. The state is also home to numerous military facilities, several of which support active and reserve flying wings. All of these aircraft must undergo periodic maintenance reviews and equipment overhauls, requiring highly skilled mechanics and technicians.

As manufacturers develop new flight control and information systems, much of the existing fleets are retrofitted. Installing and repairing these new systems require new sets of knowledge and skills for aviation technicians. Some of these new systems, as well as new directives from regulatory agencies, will require technicians to take on new duties and tasks. This includes much of the military aircraft inventory which add the additional element of sophisticated weapons systems. Several of the military bases contract aircraft maintenance to private companies providing employment for civilian technicians. Two occupations from the aviation maintenance segment met the criteria for evolving occupations, **aircraft mechanics** and **avionics technicians**. Aircraft mechanics specialize on engine and structural systems maintenance and repair. Avionics technicians are responsible for the electrical systems including communication, navigation,

instrumentation equipment, and electronic flight controls. Avionics technicians also are responsible for weapons systems on miliary aircraft.

## GEOGRAPHIC INFORMATION

Three occupations from the cluster of geographic information occupations met the criteria for emerging or evolving occupations— **cartographer**, **geographic information systems (GIS) technician**, and **global positioning systems (GPS) technician**. Emerging technologies from the information technology sector and telecommunications have created new combinations of KSAs for these occupations. With these new KSAs, the geographic information field has created new technologies and systems that have been the impetus for evolving and emerging occupations in the other transportation clusters.

Cartographers design and lay out maps. Traditionally, cartographers used pen and ink drafting techniques to design maps from information gathered from surveys. Cartographers now use computer aided design (CAD) and information not only from surveys, but geographic information systems, global positioning systems, and satellite photographs such as Landsat. These new maps can be updated more frequently than maps created from traditional sources and are more accurate, allowing the maps to provide more useful and timely information to government planners, farmers, foresters, and geologists.[41]

Geographic information systems technicians design integrated systems using geographic databases. GIS information has a wide range of uses in addition to cartography as already mentioned. GIS is used to create digital maps for city planners, utility service providers and marketing firms. Users can pinpoint specific locations on a map by entering in addresses or telephone numbers. They can identify larger regions using area codes and postal zip codes.

By relating geographic coordinate databases with databases containing demographic information, maps can easily be created showing distributions of the population by income, age, spending habits, family size or any other demographic variable. Such information can be useful in planning future sites for public facilities including schools, fire stations, and public transportation routes. Businesses can use GIS for locating optimal outlet sites and targeting areas for direct advertising. Public utilities use GIS to keep track of underground transmission lines and pipes to help prevent others from damaging them during excavations. GIS systems also are used in managing emergency service response and traffic planning.

Smaller GIS databases are incorporated into computer software to provide digital mapping to the general public for planning trips, identifying preferred routes based on travel time, road type, travel distance, and points of interests. By entering preferences, users can generate travel directions, road maps, and time-tables for vacation and business trips. GIS is being combined with other technologies, including global positioning and telecommunications to create additional uses as described below.

Global positioning systems technician is the only occupation of the three that met the criteria for an emerging occupation. Originally developed for use in national defense, consumer applications of GPS are in their infancy, but are growing rapidly. Between 1996 and 2003, the GPS commercial market is forecasted to grow from $366 million to $3.5 billion.[42] GPS technology allows users to tune into radio transmissions from 24 satellites operated by the Department of Defense using special receivers that use the signal to calculate and display the time, three-dimensional position, and velocity anywhere on or near the earth with pinpoint accuracy.

The applications for this technology seem endless, especially when GPS is combined with other technologies. Its primary use as part of weapons guidance systems has given way to many commercial uses. Hikers and boaters can use inexpensive, hand-held receivers in conjunction with maps to remain certain of their exact position at all times. Farmers are using receivers in tractors and harvesters to identify with precision areas in their fields with high and low production, allowing them to allocate irrigation and fertilizer more efficiently. Surveyors use GPS information for more exact measurements in laying out roads, pipelines, and property boundaries.

GPS receivers, in conjunction with geographic information system databases and wireless communication, are the heart of two emerging systems—*intelligent transportation systems* (ITS) and *intelligent vehicle highway systems* (IVHS). Automobile manufactures already are putting initial versions of these systems in place (i.e., GM Onstar, Lincoln Guidestar, and Ford RESCU). Anticipated uses of these systems as they evolve and become standard equipment include:

- **Navigation** - Computers built into vehicles will be able to use GPS receivers to identify the vehicle's position, then communicate with geographical information databases through cellular communications to display street maps to guide drivers.

- **Airbag Deployment Notification** - Using built-in GPS receivers and cellular communications, vehicle computers can notify emergency services automatically when an airbag is deployed, providing police, fire, and ambulance services with the exact location of the vehicle.

- **Stolen Vehicle Tracking** - Again through wireless communications, owners of stolen vehicles will be able to activate an identification beacon that uses GPS information to provide the vehicle's exact location.

- **Road Condition Information** - In tandem with online displays or designated frequencies on a vehicle's radio, a GPS system can provide current road conditions, construction, and traffic situations to a driver, and with geographical information systems provide alternative routes.

## TRANSPORTATION, DISTRIBUTION, AND WAREHOUSING

Texas is big and many of its populated areas are isolated from one another by miles of highway. Therefore, a great amount of goods must be shipped around the state to get them to market. According to the most recent information on commodity flows, 882 million tons of cargo valued at $452 billion originated in Texas.[43] This accounted for 9 percent of the weight and 8 percent of the value of national commodity flows. Because of its diverse economy and size, most of the transported goods never leave the state. Many manufacturers find the final consumers of their output within the state. In fact, 84 percent of the total tonnage of transported goods originating in Texas is shipped to points within the state.[44] The majority of this cargo, 68 percent, was shipped by truck.

Texas' central geographic position within North America enhances the importance of the distribution and warehousing of goods. With a solid transportation system of interstate highways and sharing a border with Mexico, Texas is an ideal site for warehousing goods bound for consumer markets or to firms for further manufacturing.[45] Trucking and warehousing employment grew at a 6.1 percent annual rate in 1997.[46]

Two occupations, **shipping and transportation manager** and **warehouse supervisor**, from this segment of the transportation industry were validated as evolving occupations. In larger firms, these may be unique occupations. In some smaller firms, the duties and tasks of these two occupations may be combined under one payroll title. As previously mentioned, GIS and GPS technologies are being used by businesses that manage trucking fleets and the movements of goods. Shipping and transportation managers and warehouse managers increasingly will have to be familiar with these systems to ensure that the resources they manage are being used in the most effective manner. Competition will require that shipments arrive on time and arrive with the right cargo. In addition to new technologies, new management techniques including *just-in-time* inventory management are being employed. These place additional requirements on transportation and shipping managers and warehouse supervisors to develop enhanced logistical skills and just-in-time inventory control systems.

# AVIATION MECHANIC

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Aviation mechanics adjust, align, and calibrate aircraft systems, using hand tools, gauges, and test equipment. They examine and inspect engines or other components for cracks, breaks, or leaks. Mechanics also test engine and system operations, using testing equipment, and listen to engine sounds to detect and diagnose malfunctions. They may also repair, replace, and rebuild aircraft structures, functional components, and parts, such as wings and fuselage, rigging, and hydraulic units. Mechanics service and maintain aircraft systems by performing tasks, such as flushing crankcase, cleaning screens, greasing moving parts, and checking brakes. These duties may require removing engines from aircraft or installing engines, using hoist or forklift truck. Mechanics must be able to read and interpret aircraft maintenance manuals and specifications to determine feasibility and method of repairing or replacing malfunctioning or damaged components and modify aircraft structures and systems.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance<br>• Engineering and Technology – Knowledge of equipment, tools, mechanical devices, and their uses to produce motion, light, power, technology, and other applications | • Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Repairing – Repairing machines or systems using the needed tools<br>• Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Operation Monitoring – Watching gauges, dials, or other indicators to make sure a machine is working properly<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Problem Identification – Identifying the nature of problems | • Manual Dexterity – The ability to quickly make coordinated movements of one hand, a hand together with its arm, or two hands to grasp, manipulate, or assemble objects<br>• Arm-Hand Steadiness – The ability to keep the hand and arm steady while making an arm movement or while holding the arm and hand in one position<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense.<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training. Technical certificates and Associate's degrees may be required, as well as Federal Aviation Administration (FAA) certification. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $14.94<br>Source: Texas Workforce Commission, LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for aircraft mechanics was 9,850. It is projected that by the year 2005 employment in this occupation will grow by 3,700 positions. Over this same period, 3,300 openings (33.5% of current positions) will become available due to turnover. |
| **ASSOCIATED TITLES:** | DOT: 621.281-014 Airframe-and-Powerplant Mechanics; Aircraft Engine Specialists<br>OES: 85323 Aircraft Mechanic, 85326 Aircraft Engine Specialist |

# AVIONICS TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Avionics technicians test, install, and maintain, aviation electronics including instrumentation, communication, navigational, warning, and control devices and equipment. Those working in military facilities would also be responsible for working on weaponry systems.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Engineering and Technology – Knowledge of equipment, tools, mechanical devices, and their uses to produce motion, light, power, technology, and other applications | • Troubleshooting – Determining what is causing an operating error and deciding what to do about it<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected<br>• Installation – Installing equipment, machines, wiring, or programs to meet specifications<br>• Operation and Control – Controlling operations of equipment or systems<br>• Repairing – Repairing machines or systems using the needed tools<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed<br>• Operation Monitoring – Watching gauges, dials, or other indicators to make sure a machine is working properly<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job | • Finger Dexterity – The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Visualization – The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training. Additionally, some employers may require an Associate's degree and Federal Aviation Administration (FAA) licensing. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, electrical installers/repairers, the 1996 Texas mean hourly wage was $14.13.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Employment outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 825.261-018 Electrician, Aircraft, 825.381-010 Aircraft Mechanic, Electrical and Radio, 829.281-018 In-flight Refueling System Repairer<br>OES: 85728 Electrical Installers/Repairers |

# CARTOGRAPHER

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Cartographers compile, evaluate, design, draft, and oversee the production of new or revised maps and charts using surveys, aerial photographs, and satellite images. They may also conduct research in mapping techniques and procedures.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Geography – Knowledge of various methods for describing the location and distribution of land, sea, and air masses including their physical locations, relationships, and characteristics<br>• Design – Knowledge of design techniques, principles, tools and instruments involved in the production and use of precision technical plans, blueprints, drawings, and models<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming | • Mathematics – Using mathematics to solve problems<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Product Inspection – Inspecting and evaluating the quality of products<br>• Operations Analysis – Analyzing needs and product requirements to create a design<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Synthesis/Reorganization – Reorganizing information to get a better approach to problems or tasks<br>• Equipment Selection – Determining the kind of tools and equipment needed to do a job<br>• Solution Appraisal – Observing and evaluating the outcomes of a problem solution to identify lessons learned or redirect efforts | • Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Far Vision – The ability to see details at a distance<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Number Facility – The ability to add, subtract, multiply, or divide quickly and correctly |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | A minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations. Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training. Employers may require an Associate's degree in a related field. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage for survey/mapping scientists: $17.58 per hour<br>Source: Texas Workforce Commission, LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for survey/mapping scientists was 4,200. It is projected that by the year 2005 employment in this occupation will grow by 1,450 positions. Over this same period, 1,210 openings (28.85% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 018.261-010 Cartographic Drafter, 018.261-026 Photogrammetrist, 018.262-010 Field Map Editor<br>OES: 22311 Survey/Mapping Scientist, 22521 Survey/Mapping Technician<br>Other: Mapping Technicians |

# GEOGRAPHIC INFORMATION SYSTEMS (GIS) TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Design and coordinate development of integrated geographical information systems database of spatial and non-spatial data; develop analyses and presentation of this data, applying knowledge of geographic information system. GIS technicians may work in preparing digital maps and plotting maps from digital data. They may work for government agencies, such a planning departments, utility companies, survey firms, mineral exploration, or shipping and delivery firms.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Geography – Knowledge of various methods for describing the location and distribution of land, sea, and air masses including their physical locations, relationships, and characteristics<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming | • Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Mathematics – Using mathematics to solve problems<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Implementation Planning– Developing approaches for implementing an idea<br>• Systems Evaluation – Looking at many indicators of system performance, taking into account their accuracy<br>• Speaking – Talking to others to effectively convey information<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents | • Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Speech Clarity – The ability to speak clearly so that it is understandable to a listener<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Spatial Orientation – The ability to know one's location in relation to the environment, or to know where other objects are in relation to one's self |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | A minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations. Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training. Employers may require an Associate's degree in a related field. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage for survey/mapping scientists: $17.58 per hour<br>Source: Texas Workforce Commission, LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for survey/mapping scientists was 4,200. It is projected that by the year 2005 employment in this occupation will grow by 1,450 positions. Over the same period, 1,210 openings (28.85% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 019.062-010 Geographic Information Systems Specialist<br>OES: 22311 Survey/Mapping Scientist, 22521 Survey/Mapping Technician<br>Other: Mapping Technicians |

# GLOBAL POSITIONING SYSTEMS (GPS) TECHNICIAN

✔ Emerging Occupation
Evolving Occupation

**DESCRIPTION:** GPS technicians install, maintain, repair, and use electronic equipment that sends and receives electronic signals via satellites to determine the exact position a sending unit is on Earth. These devices are used in navigation for airplanes, ships and boat, and ground vehicles. Some technicians will analyze GPS signals and use digital maps to locate the position of the sending signal.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Geography – Knowledge of various methods for describing the location and distribution of land, sea, and air masses including their physical locations, relationships, and characteristics<br>• Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming<br>• Telecommunications – Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems | • Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Mathematics – Using mathematics to solve problems<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Implementation Planning– Developing approaches for implementing an idea<br>• Systems Evaluation – Looking at many indicators of system performance, taking into account their accuracy<br>• Speaking – Talking to others to effectively convey information<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents | • Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Speech Clarity – The ability to speak clearly so that it is understandable to a listener<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Spatial Orientation – The ability to know one's location in relation to the environment, or to know where other objects are in relation to one's self |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | A minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations. Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training. Employers may require an Associate's degree in a related field |
| **WAGE ESTIMATES:** | 1996 Texas mean wage for survey/mapping scientists: $17.58 per hour<br>Source: Texas Workforce Commission, LMI Unit |
| **OUTLOOK:** | In 1994, employment in Texas for survey/mapping scientists was 4,200. It is projected that by the year 2005 employment in this occupation will grow by 1,450 positions. Over the same period, 1,210 openings (28.85% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | OES: 22311 Survey/Mapping Scientist, 22521 Survey/Mapping Technician<br>Other: Mapping Technicians |

# SHIPPING AND TRANSPORTATION MANAGER

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Shipping and transportation managers directly supervise and coordinate activities of transportation and material-moving machine and vehicle operators. May supervise helpers assigned to these workers. Manager/Supervisors are generally found in smaller establishments where they perform both supervisory and management functions, such as accounting, marketing, and personnel work, and may also engage in the same work as the workers they supervise.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Transportation – Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including their relative costs, advantages, and limitations<br>• Administration and Management – Knowledge of principles and processes involved in business and organizational planning, coordination, and execution. This includes strategic planning, resource allocation, manpower modeling, leadership techniques, and production methods<br>• Personnel and Human Resources – Knowledge of policies and practices involved in personnel/human resource functions. This includes recruitment, selection, training, and promotion regulations and procedures; compensation and benefits packages; labor relations and negotiation strategies; and personnel information systems<br>• Economics and Accounting – Knowledge of economic and accounting principles and practices, the financial markets, banking, and the analysis and reporting of financial data | • Management of Material Resources – Obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work<br>• Speaking – Talking to others to effectively convey information<br>• Coordination – Adjusting actions in relation to others' actions<br>• Mathematics – Using mathematics to solve problems<br>• Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Some may require a Bachelor's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | Mean wage: $14.11 per hour; median wage: $13.26 per hour<br>1996 Texas Data, U.S. Department of Labor, Bureau of Labor Statistics |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 222.137-030 Shipping and Receiving Supervisor, 550.137-018 Supervisor, Shipping, 184.117-014 Director, Transportation, 184.167-226 Superintendent, Transportation, 184.167-266 Transportation Maintenance Supervisor; First-line Supervisors and Managers-Transportation and Material Moving Machine and Vehicle Operators |

# WAREHOUSE SUPERVISOR

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Warehouse supervisors plan, direct, and coordinate the storage and distribution operations within an organization or the activities of organizations that are engaged in storing and distributing materials and products. Duties include conferring with department heads to coordinate warehouse activities, such as production, sales, records control, and purchasing; planning, developing, and implementing warehouse safety and security programs and activities; reviewing invoices, work orders, consumption reports, and demand forecasts to estimate peak delivery periods and issue work assignments; supervising the activities of workers engaged in receiving, storing, testing, and shipping products or materials; and interviewing, selecting, and training warehouse and supervisory personnel.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Administration and Management – Knowledge of principles and processes involved in business and organizational planning, coordination, and execution. This includes strategic planning, resource allocation, manpower modeling, leadership techniques, and production methods<br>• Personnel and Human Resources – Knowledge of policies and practices involved in personnel/human resource functions. This includes recruitment, selection, training, and promotion regulations and procedures; compensation and benefits packages; labor relations and negotiation strategies; and personnel information systems<br>• Transportation – Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including their relative costs, advantages, and limitations<br>• Production and Processing – Knowledge of inputs, outputs, raw materials, waste, quality control, costs, and techniques for maximizing the manufacture and distribution of goods | • Implementation Planning – Developing approaches for implementing an idea<br>• Speaking – Talking to others to effectively convey information<br>• Problem Identification – Identifying the nature of problems<br>• Idea Generation – Generating a number of different approaches to problems<br>• Management of Personnel Resources – Motivating, developing, and directing people as they work, identifying the best people for the job | • Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, communications, transportation, and utility manager, the 1996 Texas mean hourly wage was $21.93.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Employment outlook information specific for this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 184.167-114 Manager, Warehouse; Storage and Distribution Manager |

## Notes

38. Dolmas and Yücel, "The 1997 Texas Economy Beats Expectations."

39. Federal Aviation Administration online statistics, http://www.faa.gov.

40. U.S. Department of Commerce, Bureau of Transportation Statistics, *Freight Transportation in Texas: Selected Data from Federal Sources* ([Washington, D.C.]: U.S. Department of Commerce, Bureau of Transportation Statistics, October 1996), 7.

41. "Landsat's Views of a Changing Earth," *National Geographic*, Vol. 192, No.5 (November 1997).

42. "These Stocks Point in the Right Direction," *Kiplinger's Personal Finance Magazine*, March 1998.

43. U.S. Department of Commerce, Bureau of Transportation Statistics, *Freight Transportation in Texas: Selected Data from Federal Sources*, 7.

44. Ibid., 7.

45. Fiona Sigalla, "D/FW Metroplex Leads the State," *The Southwest Economy*, Issue 1 (January/February 1998).

46. Dolmas and Yücel, "The 1997 Texas Economy Beats Expectations."

# Chapter 8
## Occupations in the Sanitation and Environmental Services Industry

The occupations presented to this point have, for the most part, represented responses to changes in technology. These changes in technology, in turn, resulted from the ever-growing demand for consumer goods; all of which point to a higher standard of living as these new goods and services become available to the consumer. But as with every economic transaction, external costs come with adoption of these new technologies.

A production economy is built on waste and obsolescence. Waste and pollution are natural by-products of production. They are the necessary evil of goods production in the economy, whether they are the final goods and services for consumers or the intermediate industrial materials used in producing the final goods. Many of these waste and pollution by-products are highly toxic. They cannot simply be discarded in an ordinary landfill by low-skilled workers.

In addition to special disposal facilities to handle varieties of toxic wastes, more attention also is being paid to municipal landfills. Municipalities are faced with declining capacity in existing sites. As regulations become more stringent, it is increasingly difficult to create new ones. They are constrained not only by what can be placed in the landfills, but also strict regulations on construction sometimes place prohibitive costs on building new sites. Municipalities must find ways to manage facilities better. This in turn, means they need to have more skilled and knowledgeable workers.

Environmental concerns are not limited to solid wastes. Other areas being addressed are air pollution, water pollution, and noise pollution. Concerns are not just with industrial offenders. Municipalities in some areas are putting tighter restrictions on air pollution by requiring automobile exhaust inspections and restricting the use of wood-burning fireplaces in new residential construction. Water, especially in some parts of Texas, is a scarce commodity. Providing high quality water for consumer use puts a heavy burden on local governments. Pollution of the water systems comes not only from industrial waste, but from agricultural runoff through pesticides and fertilizers and from consumers emptying all types of chemicals into wastewater systems. These toxins must be removed before the water can be used by consumers downstream.

Noise pollution is a growing concern for municipal planners. Controlling noise pollution, or "noise abatement," always has been a concern for airports. Residents in the flight path of proposed new sites or expanding facilities worry about noise generated by approaching and departing aircraft. Concern about unwanted noise has moved beyond airports. As municipal planners struggle with building larger arteries to move people into city centers or industrial parks from burgeoning bedroom communities, residents in these outlying areas are not only concerned with the increased traffic, but the noise it creates. Transportation planners must devise methods to abate noise with baffle fencing or by planting trees to act as barriers.

All these issues translate into the need for more technicians. As the complexity of the problems grow, so does the need for more highly trained and skilled workers—not only for workers that handle the waste materials or treat the water supply. With increased regulation of pollutants and the costs of cleanups, industry and municipalities must employ skilled workers to monitor emissions more closely.

The reader should realize that there may be some overlap among the occupations in some firms. An employee actually may perform the duties of one or more of the occupations listed. In larger firms, the duties may become more specialized. For many occupations, employees work for a goods-producing firm, a consulting firm, or a regulatory agency. The emerging and evolving occupations for this sector of the economy are:

- Air Monitoring/Emissions Technician
- Chemical Waste Disposal Worker
- Hazardous Materials (HAZMAT) Transportation Worker
- Laboratory Services Technician
- Noise Abatement Technician
- Pollution Prevention Technician
- Remediation Technician
- Safety and Health Technician
- Solid and Hazardous Waste Technician
- Waste and Wastewater Technician

# AIR MONITORING/EMISSIONS TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Air monitoring/emissions technicians perform laboratory and field tests to monitor environmental resources and determine sources of pollution, under direction of environmental scientists. They collect air samples for testing. They may recommend remediation treatment to resolve pollution problems.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods<br>• Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar | • Science – Using scientific methods to solve problems<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Mathematics – Using mathematics to solve problems<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Information Organization – Finding ways to structure or classify multiple pieces of information | • Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Number Facility – The ability to add, subtract, multiply, or divide quickly and correctly<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer) |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, chemical technicians, the 1996 Texas mean hourly wage was $16.08.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | In 1994, employment in the U.S. for Environmental Science Technicians was 228,925. It is projected that by the year 2005 employment in this occupation will grow by 14%, an increase of 30,935 positions. Over the same period, 47,850 openings (21% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 012.261.010 Air Analyst, 029.261-014 Pollution Control Technician;<br>OES: 24599 Science Technician, Not Elsewhere Classified<br>Other: Environmental Science Technician, Air Pollution Auditor, Air Quality Technician |

# CHEMICAL WASTE DISPOSAL WORKER

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Operates machines and equipment to package, store, or transport loads of waste materials, loads and unloads materials into containers and onto trucks, using hoists or forklift, drives truck to convey contaminated waste to designated sea or ground location, mixes and pours concrete into forms to encase waste material for disposal, follows prescribed safety procedures and complies with federal laws regulating waste disposal methods, records number of containers stored at disposal site, and specifies amount and type of equipment and waste disposed, cleans contaminated equipment for reuse, using detergents and solvents, sandblasters, filter pumps and steam cleaners.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Transportation – Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including their relative costs, advantages, and limitations<br>• Production and Processing – Knowledge of inputs, outputs, raw materials, waste, quality control, costs, and techniques for maximizing the manufacture and distribution of goods<br>• Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods<br>• Public Safety and Security – Knowledge of weaponry, public safety, and security operations, rules, regulations, precautions, prevention, and the protection of people, data, and property<br>• Law, Government and Jurisprudence – Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process | • Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches | • Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations. |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an Associate's or Bachelor's degree could be needed. Employees in these occupations need anywhere from a few months to one year of working with experienced employees. |
| **WAGE ESTIMATES:** | Entry level wages for these occupations range from $7.75 - $10.50 per hour. |
| **OUTLOOK:** | It is projected that by the year 2005 employment in the U.S. for this occupation will grow by 9%, an increase of 18,350 positions. Over the same period, 41,305 openings (21% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 921.663-034 Irradiated Fuel Handlers; 955.383-010 Waste Disposal Workers<br>OES: 97989 Transportation Equipment Operator, Not Elsewhere Classified |

# HAZARDOUS MATERIAL (HAZMAT) TRANSPORTATION WORKER

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** HAZMAT transportation workers load, transport, and unload hazardous materials from production facilities to disposal sites. Because of the hazardous nature of their cargo to the public safety, they require additional training beyond that of a typical truck driver. They must know how to handle the materials, know authorized transportation routes for these materials, emergency procedures in case of an accident or spill, and the proper disposal of the materials.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Transportation – Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including their relative costs, advantages, and limitations<br>• Production and Processing – Knowledge of inputs, outputs, raw materials, waste, quality control, costs, and techniques for maximizing the manufacture and distribution of goods<br>• Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods<br>• Public Safety and Security – Knowledge of weaponry, public safety, and security operations, rules, regulations, precautions, prevention, and the protection of people, data, and property<br>• Law, Government and Jurisprudence – Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process | • Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Operation and Control – Controlling operations of equipment or systems<br>• Equipment Maintenance – Performing routine maintenance and determining when and what kind of maintenance is needed | • Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Static Strength – The ability to exert maximum muscle force to lift, push, pull, or carry objects<br>• Spatial Orientation – The ability to know one's location in relation to the environment, or to know where other objects are in relation to one's self<br>• Reaction Time – The ability to quickly respond (with the hand, finger, or foot) to one signal (sound, light, picture, etc.) when it appears<br>• Response Orientation – The ability to choose quickly and correctly between two or more movements in response to two or more signals (lights, sounds, pictures, etc.). It includes the speed with which the correct response is started with the hand, foot, or other body parts<br>• Far Vision – The ability to see details at a distance |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations may require a high school diploma or GED certificate. Vocational training will likely be required to obtain appropriate licencing to operate truck and trailer rigs, as well as formal course work and certification in the handling and transportation of hazardous materials from and Environmental Protection Agency (EPA) approved program, including special certification from the Texas Department of Public Safety. |
| **WAGE ESTIMATES:** | Entry-level wages range from $7.00 and hour to $13.29, depending on route distance and the type of cargo. Experienced workers can earn up to $15.97 per hour. |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 903.683-010 Explosives Truck Driver, 905-663.014 Heavy Truck Driver<br>OES: 97102 Heavy Truck Driver |

# LABORATORY SERVICES TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Laboratory services technicians perform chemical and physical laboratory tests on collected samples to assess compliance with pollution standards, using test instruments; conduct standardized tests to ensure materials and supplies used throughout power supply system meet processing and safety specifications; examine and analyze material for presence and concentration of contaminants such as asbestos in the environment, using a variety of microscopes; calculate amount of pollutant in samples or compute air pollution or gas flow in industrial processes using chemical and mathematical formulas; determine amounts and kinds of chemicals to use in destroying harmful organisms and removing impurities from purification systems; and prepare reports, summaries, and charts, that interpret test results and recommend changes.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods<br>• Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications<br>• English Language – Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar | • Science – Using scientific methods to solve problems<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Mathematics – Using mathematics to solve problems<br>• Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Judgment and Decision Making – Weighing the relative costs and benefits of a potential action | • Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions |

**EDUCATION AND TRAINING REQUIREMENTS:**

These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.

**WAGE ESTIMATES:**

1996 Texas mean wage: $16.08 per hour
Source: Texas Workforce Commission, LMI Unit

**OUTLOOK:**

It is projected that by the year 2005 employment in the U.S. for this occupation will grow by 14%, an increase of 30,935 positions. Over the same period, 47,850 openings (21% of current positions) will become available due to employee turnover.

**ASSOCIATED TITLES:**

DOT: 019.261-030 Laboratory Technician, 022.26-010 Chemical Laboratory Technician, 029.262-030 Microscopist, Asbestos, 029.361-018 Laboratory Assistant, 022.261-022 Chemist, Wastewater Treatment Plant;
OES: 22599, Engineering Technicians, Not Elsewhere Classified, 24505 Chemical Technicians
Other: Environmental Science Technician

# NOISE ABATEMENT TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Noise abatement technicians monitor noise levels coming from industrial sites, airports, roadways, and public areas, and analyze their impact on residential areas and protected natural sites. They will help in the design and implementation of remedies, such as diversion of traffic and artificial and natural barriers. They work under the supervision of civil and acoustic engineers.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Engineering and Technology – Knowledge of equipment, tools, mechanical devices, and their uses to produce motion, light, power, technology, and other applications<br>• Design – Knowledge of design techniques, principles, tools and instruments involved in the production and use of precision technical plans, blueprints, drawings, and models<br>• Building and Construction – Knowledge of materials, methods, and the appropriate tools to construct objects, structures, and buildings<br>• Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications | • Information Gathering – Knowing how to find information and identifying essential information<br>• Judgment and Decision Making – Weighing the relative costs and benefits of a potential action<br>• Mathematics – Using mathematics to solve problems<br>• Science – Using scientific methods to solve problems<br>• Idea Evaluation – Evaluating the likely success of an idea in relation to the demands of the situation<br>• Operations Analysis – Analyzing needs and product requirements to create a design | • Number Facility – The ability to add, subtract, multiply, or divide quickly and correctly<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.<br>• Mathematical Reasoning – The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | Entry-level wages from noise abatement technicians range from $7.75 to $10.50 per hour. |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 005.261-014 Civil Engineering Technician, 019.291-018 Facility Planner<br>OES: 22502 Civil Engineering Technician |

# POLLUTION PREVENTION TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Pollution prevention technicians inspect solid waste disposal and treatment facilities, wastewater treatment facilities, or other water courses or sites for conformance with regulations. They inspect establishments to ensure that handling, storage, and disposal of fertilizers, pesticides, and other hazardous chemicals conform with regulations. They may conduct field tests and collect samples for laboratory analysis, examine and obtain permits, licenses, applications, and create records to ensure compliance with licensing requirements. These technicians also conduct research on hazardous waste management projects to determine magnitude of disposal problem, treatment, and disposal alternatives and costs. Pollution prevention technicians must maintain a current understanding of laws and statutes to determine control requirements.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods<br>• Public Safety and Security – Knowledge of weaponry, public safety, and security operations, rules, regulations, precautions, prevention, and the protection of people, data, and property<br>• Law, Government and Jurisprudence – Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process | • Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Judgment and Decision Making – Weighing the relative costs and benefits of a potential action<br>• Speaking – Talking to others to effectively convey information<br>• Science – Using scientific methods to solve problems<br>• Visioning – Developing an image of how a system should work under ideal conditions | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences |

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|---|---|
| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, chemical technicians, the 1996 Texas mean hourly wage was $16.08.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | It is projected that by the year 2005 employment in the U.S. this occupation will grow by 12%, an increase of 18,107 positions. Over the same period, 30,635 openings (20% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 168.267-054 Inspector-Industrial Waste, 168.267-090 Inspector-Water Pollution Control, 168.267-098 Pesticide-Control Inspector, 168.267-110 Sanitation Inspector;<br>OES: 21911 Compliance Officer, except construction;<br>Other: Environmental Compliance Inspector; Energy and Conservation Technician, Waste Minimization Technician, Facility Environmental Technician |

# REMEDIATION TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:** Remediation technicians locate and remove hazardous materials, such as asbestos, lead, leaking underground storage tanks, or hazardous spills. They often wear HAZMAT suits using protective eyewear and breathing respirators to protect themselves from contamination. They are responsible for sampling materials, sealing off removal sites, and placing hazardous materials into sealed containers approved for disposal.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods<br>• Building and Construction – Knowledge of materials, methods, and the appropriate tools to construct objects, structures, and buildings<br>• Public Safety and Security – Knowledge of weaponry, public safety, and security operations, rules, regulations, precautions, prevention, and the protection of people, data, and property<br>• Law, Government and Jurisprudence – Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process | • Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Writing – Communicating effectively with others in writing as indicated by the needs of the audience<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches | • Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions |

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| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools and, related on-the-job experience. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. Some materials, such as asbestos removal, may require special certificates or licensing. |
| **WAGE ESTIMATES:** | 1996 Texas mean wage: $9.56 per hour<br>Source: Texas Workforce Commission, LMI Unit |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 869.684-082 Asbestos Removal Worker<br>Other: Asbestos Abatement Worker, Decontamination Technician, Lead Abatement Worker, Leaking Underground Storage Tank (LUST) Worker, Remediation Specialist |

# SAFETY AND HEALTH TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Safety and health technicians investigate adequacy of ventilation, exhaust equipment, lighting, and other conditions which may affect employee health, comfort, or efficiency. They conduct evaluations of exposure to ionizing and nonionizing radiation and to noise. They may collect samples of dust, gases, vapors, and other potentially toxic materials for analysis and recommend measures to ensure maximum employee protection. These technicians collaborate with engineers and physicians to institute control and remedial measures for hazardous and potentially hazardous conditions of equipment. They arrange and conduct educational meetings to instruct employees in matters pertaining to occupational health and prevention of accidents. Technicians prepare reports including observations, analysis of contaminants and recommendations for control and correction of hazards and review physicians' reports and conduct worker studies to determine if diseases or illnesses are job related. They may also be responsible for designing natural and industrial disaster response plans for the company.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Public Safety and Security – Knowledge of weaponry, public safety, and security operations, rules, regulations, precautions, prevention, and the protection of people, data, and property<br>• Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods | • Information Gathering – Knowing how to find information and identifying essential information<br>• Reading Comprehension – Understanding written sentences and paragraphs in work related documents<br>• Speaking – Talking to others to effectively convey information<br>• Science – Using scientific methods to solve problems<br>• Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches<br>• Active Listening – Listening to what other people are saying and asking questions as appropriate<br>• Mathematics – Using mathematics to solve problems<br>• Solution Appraisal – Observing and evaluating the outcomes of a problem solution to identify lessons learned or redirect efforts | • Written Comprehension – The ability to read and understand information and ideas presented in writing<br>• Oral Expression – The ability to communicate information and ideas in speaking so others will understand<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.<br>• Written Expression – The ability to communicate information and ideas in writing so others will understand<br>• Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences |

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|---|---|
| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations require training in vocational schools, related on-the-job experience, or an Associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, inspector/compliance officer, the 1996 Texas mean hourly wage was $15.54.<br>Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 079.161-010 Industrial Hygienist; Occupational Health and Safety Specialist;<br>Other: Emergency Response Technician, Hazardous Material Technician, Health Physics Technician |

# SOLID AND HAZARDOUS WASTE TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Solid and hazardous waste technicians monitor and inventory the output of these materials in a factory, assure proper packaging, arrange for removal and disposal at an approved facility and maintain logs to comply with federal, state, and local regulation regarding these materials. Technicians working at disposal sites must oversee the unloading and proper disposal of the materials and monitor the disposal site or facility for leaking containers and keep records in compliance with regulatory agencies.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Transportation – Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including their relative costs, advantages, and limitations<br>• Production and Processing – Knowledge of inputs, outputs, raw materials, waste, quality control, costs, and techniques for maximizing the manufacture and distribution of goods<br>• Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods<br>• Public Safety and Security – Knowledge of weaponry, public safety, and security operations, rules, regulations, precautions, prevention, and the protection of people, data, and property<br>• Law, Government and Jurisprudence – Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process | • Operation and Control – Controlling operations of equipment or systems<br>• Operation Monitoring – Watching gauges, dials, or other indicators to make sure a machine is working properly<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Mathematics – Using mathematics to solve problems<br>• Problem Identification – Identifying the nature of problems<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected | • Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

| | |
|---|---|
| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an Associate's and/or special licensing may be required. Employees in these occupations need anywhere from a few months to one year of working with experienced employees. |
| **WAGE ESTIMATES:** | Wage information specific to this occupation was not available. For a similar occupation, transportation/material moving operators, the 1996 Texas mean hourly wage was $10.70. Source: Texas Workforce Commission - LMI Unit |
| **OUTLOOK:** | Outlook information specific to this occupation was not available at the time of printing. |
| **ASSOCIATED TITLES:** | DOT: 168.267-086 Hazardous Waste Management Specialist, 168.267-054 Industrial Waste Inspector, 184.167-078 Solid Waste Disposal Manager, 955.383-010 Waste Disposal Attendant<br>Other: Hazardous Waste Technician, Infections Waste Technician, Recycling Technician, Solid Waste Technician, Solid Waste Landfill Technician, Bio-solids Management Technician |

# WATER AND WASTEWATER TECHNICIAN

Emerging Occupation
✔ Evolving Occupation

**DESCRIPTION:**

Waste and wastewater technicians operate and control pollution treatment equipment to clean, purify, and neutralize water for human consumption. They operate equipment to remove harmful domestic and industrial pollution from wastewater in sewage treatment plants. Technicians inspect equipment and monitor operating conditions, meters, and gauges to determine load requirements and detect malfunctions. They add chemicals, such as ammonia, chlorine, and lime, to disinfect and deodorize water and other liquids. They collect and test water and sewage samples, using test equipment and color analysis standards. They record operational data, personnel attendance, and meter and gauge readings on specified forms. Some technicians may direct and coordinate plant workers engaged in routine operations and maintenance activities.

| KNOWLEDGE | SKILLS | ABILITIES |
|---|---|---|
| • Chemistry – Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods<br>• Mechanical – Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance<br>• Production and Processing – Knowledge of inputs, outputs, raw materials, waste, quality control, costs, and techniques for maximizing the manufacture and distribution of goods | • Operation and Control – Controlling operations of equipment or systems<br>• Operation Monitoring – Watching gauges, dials, or other indicators to make sure a machine is working properly<br>• Information Organization – Finding ways to structure or classify multiple pieces of information<br>• Mathematics – Using mathematics to solve problems<br>• Problem Identification – Identifying the nature of problems<br>• Information Gathering – Knowing how to find information and identifying essential information<br>• Testing – Conducting tests to determine whether equipment, software, or procedures are operating as expected | • Information Ordering – The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.<br>• Problem Sensitivity – The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.<br>• Near Vision – The ability to see details of objects at a close range (within a few feet of the observer)<br>• Control Precision – The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions<br>• Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |

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|---|---|
| **EDUCATION AND TRAINING REQUIREMENTS:** | These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an Associate's and/or special licensing may be required. Employees in these occupations need anywhere from a few months to one year of working with experienced employees. |
| **WAGE ESTIMATES:** | National median annual wages for water and sewage treatment plant operators is $25,792 |
| **OUTLOOK:** | In 1994, employment in the U.S. for Water Treatment Plant and System Operators was 95,314. It is projected that by the year 2005 employment in this occupation will grow by 9%, an increase of 9,012 positions. Over the same period, 20,966 openings (22% of current positions) will become available due to employee turnover. |
| **ASSOCIATED TITLES:** | DOT: 954.382-014 Water Treatment Plant Operator, 955.362-010 Wastewater Treatment Plant Operator, 955.382-010 Clarifying Plant Operator, 955.382-014 Wastewater Treatment Plant Operator;<br>OES: 95002 Waste/Wastewater Treatment Plant Operator<br>Other: Water Treatment Plant and System Operator |

# Appendix A:
## Glossary of Knowledge, Skills, and Abilities‡

**Knowledge** - Knowledge is a set of facts and principles need to address problems and issues in particular parts of a job.

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| **Administration and Management** | Knowledge of principles and processes involved in business and organizational planning, coordination, and execution. This includes strategic planning, resource allocation, manpower, modeling, leadership techniques, and production methods. |
| **Biology** | Knowledge of plant and animal living tissue, cells, organisms, and entities, including their functions, interdependencies, and interactions with each other and the environment. |
| **Building and Construction** | Knowledge of materials, methods, and the appropriate tools to construct objects, structures, and buildings. |
| **Chemistry** | Knowledge of the composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger, signs, production techniques, and disposal methods. |
| **Clerical** | Knowledge of administrative and clerical procedures and systems such as word processing systems, filing and records management systems, stenography and transcription, forms design principles, and other office procedures and terminology. |
| **Communications and Media** | Knowledge of production, communication, and dissemination techniques and methods including alternative ways to inform and entertain via written, oral, and visual media. |
| **Computers and Electronics** | Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming. |

‡Definitions and descriptive text are taken from the Knowledge, Skills, and Abilities Questionnaires ©1995 Utah Department of Employment Security.

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| **Customer and Personal Service** | Knowledge of principles and processes for providing customer and personal services including needs assessment techniques, quality service standards, alternative delivery systems, and customer satisfaction evaluation techniques. |
| **Design** | Knowledge of design techniques, principles, tools and instruments involved in the production and use of technical plans, blueprints, drawings, and models. |
| **Economics and Accounting** | Knowledge of economic and accounting principles and practices, the financial markets, banking, and the analysis and reporting of financial data. |
| **Education and Training** | Knowledge of instructional methods and training techniques including curriculum design principles, learning theory, group and individual teaching techniques, design of individual development plans, and test design principles. |
| **Engineering and Technology** | Knowledge of equipment, tools, mechanical devices, and their uses to produce motion, light, power, technology, and other applications. |
| **English Language** | Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar. |
| **Fine Arts** | Knowledge of theory and techniques required to produce, compose, and perform works of music, dance, visual arts, drama, and sculpture. |
| **Food Production** | Knowledge of techniques and equipment for planting, growing, and harvesting of food for consumption including crop rotation methods, animal husbandry, and food storage/handling techniques. |
| **Foreign Language** | Knowledge of the structure and content of a foreign (non-English) language including the meaning and spelling of words, rules of composition and grammar, and pronunciation. |
| **Geography** | Knowledge of various methods for describing the location and distribution of land, sea, and air masses including their physical locations, relationships, and characteristics. |
| **History and Archeology** | Knowledge of past historical events and their causes, indicators, and impact on particular civilizations and cultures. |
| **Law, Government, and Jurisprudence** | Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process. |

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| **Mathematics** | Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications. |
| **Mechanical** | Knowledge of machines and tools, including their designs, uses, benefits, repair, and maintenance. |
| **Medicine and Dentistry** | Knowledge of the information and techniques needed to diagnose and treat injuries, diseases, and deformities. This includes symptoms, treatment alternatives, drug properties and interactions, and preventative health-care measures. |
| **Personnel and Human Resources** | Knowledge of policies and practices in personnel/human resource functions. This includes recruitment, selection, training, and promotion regulations and procedures; compensation and benefits packages; labor relations and negotiation strategies; and personnel information systems. |
| **Philosophy and Theology** | Knowledge of different philosophical systems and religions, including their basic principles, values, ethics, ways of thinking, customs, and practices, and their impact on human culture. |
| **Physics** | Knowledge and prediction of physical principles, laws, and applications including air, water, material dynamics, light, atomic principles, heat, electric theory, earth formations, and meteorological and related natural phenomena. |
| **Production and Processing** | Knowledge of inputs, outputs, raw materials, waste, quality control, costs, ans techniques for maximizing the manufacture and distribution of goods. |
| **Psychology** | Knowledge of human behavior and performance, mental processes, psychological research methods, and the assessment and treatment of behavioral and affective disorders. |
| **Public Safety and Security** | Knowledge of weaponry, public safety, and security operations, rules, regulations, precautions, prevention, and the protection of people, data, and property. |
| **Sales and Marketing** | Knowledge of principles and methods involved in showing, promoting, and selling products or services. This includes marketing strategies and tactics, product demonstration and sales techniques, and sales control systems. |
| **Sociology and Anthropology** | Knowledge of group behavior and dynamics, societal trends and influences, cultures, their history, migrations, ethnicity, and origins. |
| **Telecommunications** | Knowledge of transmission, broadcasting, switching, control, and operation of telecommunication systems. |

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| **Therapy and Counseling** | Knowledge of information and techniques needed to rehabilitate physical and mental ailments and to provide career guidance including alternative treatments, rehabilitation equipment and its proper use, and methods to evaluate treatment effects. |
| **Transportation** | Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including their relative costs, advantages, and limitations. |

**Skills** - Some of the skills are developed over time and are used not only to do work but to learn other skills. Other skills are important for performance on many jobs.

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| **Active Learning** | Working with new material or information to grasp its implications. |
| **Active Listening** | Listening to what other people are saying and asking questions as appropriate. |
| **Coordination** | Adjusting actions in relation to others' actions. |
| **Critical Thinking** | Using logic and analysis to identify the strengths and weaknesses of different approaches. |
| **Equipment Maintenance** | Performing routine maintenance and determining when and what kind of maintenance is needed. |
| **Equipment Selection** | Determining the kind of tools and equipment needed to do a job. |
| **Idea Evaluation** | Evaluating the likely success of an idea in relation to the demands of the situation. |
| **Idea Generation** | Generating a number of different approaches to problems. |
| **Identification of Downstream Consequences** | Determining the long-term outcomes of a change in operations. |
| **Identification of Key Causes** | Identifying the things that must be changed to achieve a goal. |
| **Implementation Planning** | Developing approaches for implementing an idea. |
| **Information Organization** | Finding ways to structure or classify multiple pieces of information. |
| **Information Gathering** | Knowing how to find information and identifying essential information. |

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| **Installation** | Installing equipment, machines, wiring, or programs to meet specifications. |
| **Instructing** | Teaching others how to do something. |
| **Judgement and Decision Making** | Weighing the relative costs and benefits of a potential action. |
| **Learning Strategies** | Using multiple approaches when learning or teaching new things. |
| **Management of Material Resources** | Obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work. |
| **Management of Personnel Resources** | Motivating, developing, and directing people as they work, identifying the best people for the job. |
| **Management of Financial Resources** | Determining how money will be spent to get the work done, and accounting for these expenditures. |
| **Mathematics** | Using mathematics to solve problems. |
| **Monitoring** | Assessing how well one is doing when learning or doing something new. |
| **Negotiation** | Bringing others together and trying to reconcile differences. |
| **Operation Monitoring** | Watching gauges, dials, or other indicators to make sure a machine is working properly. |
| **Operation Analysis** | Analyzing needs and product requirements to create a design. |
| **Operation and Control** | Controlling operations of equipment or systems. |
| **Persuasion** | Persuading others to approach things differently. |
| **Problem Identification** | Identifying the nature of problems. |
| **Product Inspection** | Inspecting and evaluating the quality of products. |
| **Programming** | Writing computer programs for various purposes. |
| **Reading Comprehension** | Understanding written sentences and paragraphs in work related documents. |
| **Repairing** | Repairing machines or systems using needed tools. |
| **Science** | Using scientific methods to solve problems. |
| **Service Orientation** | Actively looking for ways to help people. |

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| **Social Perceptiveness** | Being aware of others' reactions and understanding why they react the way they do. |
| **Solution Appraisal** | Observing and evaluating the outcomes of a problem solution to identify lessons learned or redirect efforts. |
| **Speaking** | Talking to others to effectively convey information. |
| **Synthesis/Reorganization** | Reorganizing information to get a getter approach to problems or tasks. |
| **Systems Perceptions** | Determining when important changes have occurred in a system or are likely to occur. |
| **Systems Evaluation** | Looking at many indicators of system performance, taking into account their accuracy. |
| **Technology Design** | Generating or adapting equipment and technology to serve user needs. |
| **Testing** | Conducting tests to determine whether equipment, software, or procedures are operating as expected. |
| **Time Management** | Managing one's own time and the time of others. |
| **Troubleshooting** | Determining what is causing an operating error and deciding what to do about it. |
| **Visioning** | Developing an image of how a system should work under ideal conditions. |
| **Writing** | Communicating effectively with others in writing as indicated by the needs of the audience. |

## **Abilities** - An ability is an attribute that influences performance on a variety of tasks.

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| **Arm-Hand Steadiness** | The ability to keep the hand and arm steady while making an arm movement or while holding the arm and hand in one position. |
| **Auditory Attention** | The ability to focus on a single source of auditory (hearing) information in the presence of other distracting sounds. |
| **Category Flexibility** | The ability to produce many rules so that each rule tells how to group (or combine) a set of things in a different way. |
| **Control Precision** | The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions. |

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|---|---|
| **Deductive Reasoning** | The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense. |
| **Depth Perception** | The ability to judge which of several objects is closer or farther away from the observer, or to judge the distance between an object and the observer. |
| **Dynamic Flexibility** | The ability to quickly and repeatedly bend, stretch, twist, or reach out with the body, arms, and/or legs. |
| **Dynamic Strength** | The ability to exert muscle force repeatedly or continuously over time. This involves muscular endurance and resistance to muscle fatigue. |
| **Explosive Strength** | The ability to use short bursts of muscle force to propel oneself (as in jumping or sprinting), or to throw an object. |
| **Extent Flexibility** | The ability to bend, stretch, twist, or reach out with the body, arms, and/or legs. |
| **Far Vision** | The ability to see details at a distance. |
| **Finger Dexterity** | The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects. |
| **Flexibility of Closure** | The ability to identify or detect a known pattern (a figure, object, work, or sound) that is hidden in other distracting material. |
| **Fluency of Ideas** | The ability to come up with a number of ideas about a given topic. It concerns the number of ideas produced and **not** the quality. |
| **Glare Sensitivity** | The ability to see objects in the presence of glare or bright lighting. |
| **Gross Body Coordination** | The ability to coordinate the *movement of the arms, legs, and torso together* in activities where the whole body is in motion. |
| **Gross Body Equilibrium** | The ability to keep or regain one's body balance or stay upright when in an unstable position. |
| **Hearing Sensitivity** | The ability to detect or tell the difference between sounds that vary over broad ranges of pitch and loudness. |
| **Inductive Reasoning** | The ability to combine separate pieces of information, or specific answers to problems, to form general rules or conclusions. It includes coming up with a logical explanation for why a series of seemingly unrelated events occur together. |

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| **Information Ordering** | The ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations. |
| **Manual Dexterity** | The ability to quickly make coordinated movements of one hand, a hand together with the arm, or two hands to grasp, manipulate, or assemble objects. |
| **Mathematical Reasoning** | The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem. |
| **Memorization** | The ability to remember information such as words, numbers, pictures, and procedures. |
| **Multilimb Coordination** | The ability to coordinate movements of two or more limbs together (for example, two arms, tow legs, or one leg and one arm) while sitting, standing, or lying down. It does **not** involve performing the activities while the body is in motion. |
| **Near Vision** | The ability to see details of objects at a close range (within a few feet of the observer). |
| **Night Vision** | The ability to see under low light conditions. |
| **Number Facility** | The ability to add, subtract, multiply, or divide quickly. |
| **Oral Expression** | The ability to communicate information and ideas in speaking so others will understand. |
| **Oral Comprehension** | The ability to listen to and understand information and ideas presented though spoken words and sentences. |
| **Originality** | The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem. |
| **Perceptual Speed** | The ability to quickly and accurately compare letters, numbers, objects, pictures, or patterns. The things to be compared may be presented at the same time or one after the other. This ability also includes comparing a presented object with a remembered object. |
| **Peripheral Vision** | The ability to see objects or movement of objects to one's side when the eyes are focused forward. |
| **Problem Sensitivity** | The ability to tell when something is wrong or is likely to go wrong. It does **not** involve solving the problem, only recognizing there is a problem. |
| **Rate Control** | The ability to time the adjustments of a movement or equipment control in anticipation of changes in the speed and/or direction of a continuously moving object or scene. |

**Reaction Time** — The ability to quickly respond (with the hand, finger, or foot) to one signal (sound, light, picture, etc.) when it appears.

**Response Orientation** — The ability to chose quickly and correctly between *two or more movements* in response to *two or more different signals* (lights, sounds, pictures, etc). It includes the *speed* with which the correct response is *started* with the hand, foot, or other body parts.

**Selective Attention** — The ability to concentrate and not be distracted while performing a task over a period of time.

**Sound Localization** — The ability to tell the direction from which a sound originated.

**Spatial Orientation** — The ability to know one's location in relation to the environment, or to know where other objects are in relation to one's self.

**Speech Clarity** — The ability to speak clearly to that it is understandable to a listener.

**Speech Recognition** — The ability to identify and understand the speech of another person.

**Speed of Limb Movement** — The ability to *quickly* move the arms or legs.

**Speed of Closure** — The ability to quickly make sense of information that seems to be without meaning or organization. It involves quickly combining and organizing different pieces of information into a meaningful pattern.

**Stamina** — The ability to exert one's self physically over long periods of time without getting winded or out of breath.

**Static Strength** — The ability to exert maximum muscle force to lift, push, pull, or carry objects.

**Time Sharing** — The ability to efficiently shift back and forth between two or more activities or sources of information (such as speech, sounds, touch, or other sources).

**Trunk Strength** — The ability to use one's abdominal and lower back muscles to support part of the body repeatedly or continuously over time without "giving out" or fatiguing.

**Visual Color Discrimination** — The ability to match or detect differences between colors, including shades of color and brightness.

**Visualization** — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.

**Wrist-Finger Speed** — The ability to make *fast, simple,* repeated *movements* of the *fingers, hands, and wrists.*

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| **Written Expression** | The ability to communicate information and ideas in writing so others will understand. |
| **Written Comprehension** | The ability to read and understand information and ideas presented in writing. |

# Appendix B:
## Related Sites on the Internet

### Information Technology Links

Association for Computer Educators in Texas
http://www.utdallas.edu/orgs/acet/

Association for Computing Machinery - Special Interest Group on Data Communications
http://www.acm.org/sigcomm/

Association of Information Technology Professionals
http://www.aitp.org/

- Austin Chapter http://www.sig.net/~aitp/
- Amarillo Chapter http://aitp-gs.arn.net/
- San Antonio Chapter http://www.sa-aitp.org/
- Student Chapters
  - Tarleton State University
    http://www.tarleton.edu/organizations/aitp/aitp.html
  - Texas A&M University
    http://cmis.tamu.edu/aitp/
  - Texas State Technical College - Sweetwater
    http://www.geocities.com/CollegePark/Campus/9406/
  - University of Texas at Arlington
    http://www.uta.edu/student_orgs/AITP/AITP.htm
  - West Texas A&M University
    http://www.amaonline.com/csa/

Broad Alliance for Multimedia Technology and Applications (BAMTA) Careers Page
http://www.careerexpo.com/pub/library/bamta.html

The CIO Institute
http://www.escal.com/cio_institute.htm

Glossary of Electronic Commerce Terms at the University of Scranton
http://www.ecrc.uofs.edu/glossary.html

Help Desk Institute - The Future of Software Support
http://www.helpdeskinst.com/news/brose.htm

The Information Technology Association of America (ITAA)
http://www.itaa.org/

The Information Technology Industry Council
http://www.itic.org/

Information Technology Training Association (ITTA)
http://www.itta.org/

Multimedia Professional Interest Committee of the Lone Star Chapter of the Society for Technical Communication
http://stc.org/region5/lsc/www/mpic/

National Institute of Standards and Technology Computer Security Resource Clearinghouse
http://csrc.nist.gov/

Online Dictionary of Computing Terms at Princeton University
http://wagner.princeton.edu/foldoc/contents.html

## Semiconductor and Electronics Manufacturing Links

Institute of Electrical and Electronics Engineers (IEEE) Employment Services Page
http://www.ieee.org/usab/DOCUMENTS/EMPLOYMENT/employment.menu.html

The International Society for Optical Engineering
http://www.spie.org/

The Optical Society of America - OpticsNet
http://www.osa.org

Optics for Kids
http://www.opticalres.com/kidoptx.html

SEMI Online
http://www.semi.org

SEMI/SEMATECH Home Page
https://www.sematech.org/semi-sematech/home.htm

Semiconductor Manufacturers Guide
http://www.circuitworld.com/subpage/semicond.htm

## Services Links

Jobs in Insurance sponsored by the Fisher College of Business, The Ohio State University
http://www.cob.ohio-state.edu/~fin/jobs/insur.htm

Legal Researcher Reference at Wilkins Legal Institute
http://www.witkin.com/research/research.htm

Medicaid Reform Glossary at the Texas Health and Human Services Commission
http://www.hhsc.texas.gov/glossary.html

Meeting Planner's Resources
http://www.tradegroup.com/TTGPAGES/PLANNERS.HTML

Meeting Planner's Resources Education Page
http://www.tradegroup.com/TTGPAGES/education.html

Society of Research Administrators (SRA) Home Page
http://web.fie.com/cws/sra/sra.htm

Successful Meetings Magazine
http://www.successmtgs.com/billcomm.htm

Successful Meetings Magazine Hot Links page
http://www.successmtgs.com/hotlink.htm

## Telecommunications Links

DBS DISH Satellite News and Information
http://www.dbsdish.com/

Electronic Technicians Association (ETA) - Fiber Optics
http://www.eta-sda.com/cfoi.htm

Electronics Technicians Association (ETA) - Telecommunications Electronics Tech
http://www.eta-sda.com/certification/tcm.htm

Electronics Technicians Association (ETA) - Wireless Communications Tech
http://www.eta-sda.com/certification/wcm.htm

Electronics Technicians Association (ETA) - Certified Satellite Installer
http://www.eta-sda.com/certification/csi-tvro.htm

The International Multimedia Teleconferencing Consortium (IMTC)
http://www.imtc.org/

IC2 Institute - The University of Texas at Austin
http://www.utexas.edu/depts/ic2/main.html

International Teleconferencing Association
http://www.itca.org/

Jobs in the Telecom Corridor
http://www.ejobs.com/TelecomCorridor/default.asp

Multimedia Telecommunications Association (MTA)
http://www.mmta.org/

Telecommunication Reports International, Inc.
http://www.tr.com/

Telecommunications Industry Association
http://www.tiaonline.org/

Texas Association of Telecommunications Officers and Advisors
http://www.tatoa.org/

Wireless Communication Terms at Texas Instruments
http://www.ti.com/sc/docs/wireless/cellterm.htm

## Transportation Links

The American Congress on Surveying and Mapping
http://www.landsurveyor.com/acsm/

Aviation Career Information from the FAA
http://www.tc.faa.gov/ZDV/careers.html

Dictionary of Abbreviations and Acronyms in Geographic Information Systems, Cartography, and Remote Sensing from the University of California at Berkeley
http://www.lib.berkeley.edu/EART/abbrev.html

Electronics Technicians Association - Avionics Technician
http://www.eta-sda.com/certification/avionics.htm

Gateway to GIS Resources (GIS Links Page at the Bureau of the Census)
http://www.census.gov/geo/www/gis_gateway.html

GIS Jobs Clearinghouse sponsored by the University of Minnesota
http://www.gis.umn.edu/rsgisinfo/jobs.html

Geography Employment Resources sponsored by the University of South Carolina
http://www.cla.sc.edu/geog/geogdocs/otherdocs/job.html

GPS Frequently Asked Questions (FAQ) from the U.S. Bureau of the Census
http://www.census.gov/geo/www/faq-index.html

Global Positioning Overview
http://wwwhost.cc.utexas.edu/ftp/pub/grg/gcraft/notes/gps/gps.html

GPS World Magazine
http://www.gpsworld.com/

Glossary of Aviation Acronyms and Abbreviations at NASA
http://olias.arc.nasa.gov/AFO_Acronyms_.html

Introduction to GPS Applications
http://www.redsword.com/gps/

The Institute of Navigation
http://www.ion.inter.net/welcome.html

Remote Sensing and GIS Information from the Univeristy ofMinnesota
http://www.gis.umn.edu/rsgisinfo/rsgis.html

## Environmental Links

Air and Waste Management Association
http://www.awma.org/

Exploring Environmental Careers sponsored by the University of Manitoba
http://www.umanitoba.ca/student/counselling/spotlights/enviro.html

The Environmental Careers Organization
http://www.eco.org/

Noise Pollution Clearing House
http://www.nonoise.org/

Outdoor and Environmental Careers sponsored by Princeton University
http://www.princeton.edu/~oa/careeroe.html

Safety and Health Internet Sites sponsored by the Occupational Safety and Health Administration
http://www.osha.gov/safelinks.html

Tellus Institute - Resource and Environmental Strategies
http://www.tellus.org/

Texas Association for Environmental Education
http://www-tenet.cc.utexas.edu/Pub/stat/taee.html

Texas Natural Resource Conservation Committee
http://www.tnrcc.texas.gov/

## Career Related Links

Advancing Women
http://www.advancingwomen.com/

Career Magazine
http://www.careermag.com/

CyberCafe's Index to Direct Job Information on the Internet
http://bashful.cybercafe.cfw.com/jobinfo.htm

Emerging Technologies Research Group
http://etrg.findsvp.com/etrginfo/etrgintr.html

JobSmart Career Guides
http://jobsmart.org/tools/career/spec-car.htm

National Council for Occupational Education (NCOE)
http://www.umt.edu/ncoe/

National Occupational Information Coordinating Committee
http://www.noicc.gov/

TechCareers Annual Salary Surveys
http://www.techweb.com/careers/careerdocs/salary.html

Texas Skill Standards Research and Communications Project
http://www.coe.tamu.edu/~ehrd/skills/sshomepg.htm

Texas State Occupational Information Coordinating Committee
http://www.soicc.capnet.state.tx.us

## Employment Links

America's Job Bank (Nationwide Job Listings )
http://www.ajb.dni.us/

Army Civilian Personnel Online
http://www.cpol.army.mil/

Austin 360 Classifieds
http://www.austin360.com/classifi/adtop.htm

Career Monthly Interactive
http://career.321media.com/321/start

FedWorld U.S. Government Jobs Search Engine
http://www.fedworld.gov/jobs/jobsearch.html

Governor's Job Bank (Job Listings with the State of Texas)
http://www.twc.state.tx.us/jobs/gvjb/gvjb.html

Job Listings in the Telecom Corridor
http://www.ejobs.com/TelecomCorridor/default.asp

The Monster Board (Nationwide Job Listings)
http://www.monster.com/

Office of Personnel Management ((OPM) Guide to Federal Jobs
http://www.usajobs.opm.gov/

Online Career Center
http://www.occ.com/

Texas Workforce Commission Job Express (Private Industry Job Listings )
http://www.twc.state.tx.us/jobs/jobx/express.html

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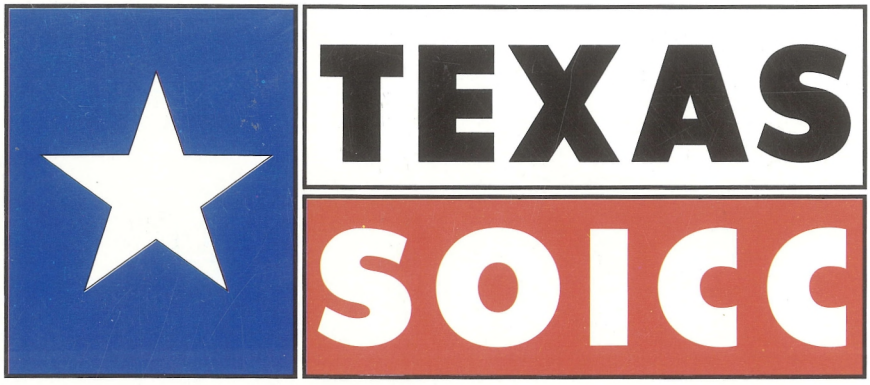


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