

DOCUMENT RESUME

ED 032 400

VT 008 729

Tomorrow's Manpower Needs. Volume III, National Trends and Outlook: Occupational Employment. Bulletin No. 1606.

Bureau of Labor Statistics (Dept. of Labor), Washington, D.C.

Pub Date Feb 69

Note-54p.

Available from-Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (BLS Bulletin No. 1606, \$ .55)

EDRS Price MF-\$0.25 HC Not Available from EDRS.

Descriptors-Economic Factors, Employment Projections, \*Employment Qualifications, \*Employment Trends, Industrial Structure, \*Manpower Needs, \*Occupational Clusters, \*Occupational Information, Occupational Surveys, Technology

This publication is the third of four volumes of "Tomorrow's Manpower Needs," which are devoted to the subject of national, state, and area projections of manpower requirements. This volume presents information on the national employment trends and projected 1975 requirements for workers in nine major occupational groups and 40 selected occupations. The nine major occupational groups are (1) professional, technical, and kindred workers, (2) managers, officials, and proprietors, (3) clerical and kindred workers, (4) sales workers, (5) craftsman, foreman, and other skilled workers, (6) semi-skilled workers (operatives), (7) laborers, (8) service workers, and (9) farm workers. The occupational statements include a discussion of past employment trends, the economic and technological factors expected to influence occupational requirements through the mid 1970's, and ways workers become qualified for the occupation. Related publications are available as VT 008 727-VT 008 730. (CH)

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# **TOMORROW'S MANPOWER NEEDS**

National manpower projections and a guide  
to their use as a tool in developing State  
and area manpower projections

**VOLUME III.**  
**NATIONAL TRENDS AND OUTLOOK:**  
**OCCUPATIONAL EMPLOYMENT.**

**BULLETIN NO. 1606**

U.S. DEPARTMENT OF LABOR  
BUREAU OF LABOR STATISTICS

For sale by the Superintendent of Documents, U.S. Government Printing Office Washington, D.C., 20402 - Price 55 cents

## PREFACE

This is the third of four volumes of *Tomorrow's Manpower Needs*, a publication devoted to the subject of national, State, and area projections of manpower requirements. The full series of volumes is as follows:

- I Using National Manpower Data to  
Develop Area Manpower Projections
- II National Trends and Outlook: Industry  
Employment and Occupational Structure
- III National Trends and Outlook:  
Occupational Employment
- IV The National Industry-Occupational  
Matrix and Other Manpower Data

The objective of this publication is to help fill a gap in manpower information best described by President Johnson in his 1964 Manpower Report to Congress, "Projections of probable need in particular occupations are an essential guide for education, training, and other policies aimed at developing the right skills at the right time in the right place." Projections of occupational needs at the State and area levels are needed in planning education and training programs. To help meet this need, *Tomorrow's Manpower Needs* presents up-to-date national manpower projections and provides a guide to their use in developing State and area manpower projections. This publication will be used in conjunction with a companion publication, *Handbook for Projecting Manpower Requirements and Resources for States and Areas*, prepared by the Bureau of Employment Security, Manpower Administration, U.S. Department of Labor, which will provide detailed operating instructions for the specific use of State employment security agencies.

The assumptions underlying this publication are: (1) State and area manpower requirements estimates can be made more reliable if the analyses are made within the context of nationwide economic and technological developments. (2) Regional manpower analysts familiar with local markets, the movement of industry into an area, and other factors affecting local industry and occupational employment are best able to estimate manpower requirements at the local level. (3) Selection of an appropriate projection technique or mix of techniques should take into account the financial resources available to the regional manpower analysts, the technical sophistication of their staff, the volume of projections required, the purpose of the projections as they affect the need for accuracy and detail, and the availability of computer assistance.

The Bureau of Labor Statistics hopes that by providing a consistent and reasonably detailed national manpower framework and a guide to its use in making State and area manpower projections the well-informed local analyst will be aided in developing or improving local manpower projections.

This report was prepared in the Bureau of Labor Statistics' Office of Manpower and Employment Statistics. The study was performed by staff of the Bureau's Division of Manpower and Occupational Outlook. It was planned and supervised by Sol Swerdloff and Russell B. Flanders. Richard E. Dempsey, David P. Lafayette, James W. Longley, Neal H. Rosenthal, and Joe L. Russell prepared or supervised preparation of major parts of the study. Other staff members contributing to the research and writing were Liguori O'Donnell, Melvin Fountain, Gerard Smith, Michael Crowley, Lloyd David, Penny Friedman, Edward Ghearing, William Hahn, Jerry Kursban, Annie Lefkowitz, Dorothy Orr, Judson Parker, Irving Phillips, Joseph Rooney, Norman Root, John Sprague, Howard Stambler, and Annie Asensio.

The industry-occupational matrices for 1960 and 1975 were developed in the Division of Occupational Employment Statistics, under the direction of Harry Greenspan. The Office of Manpower Research of the Manpower Administration, U.S. Department of Labor, funded a large part of the development of the national industry-occupational matrix for 1975. The projections of the labor force were prepared by Sophia Cooper Travis, Chief, Division of Labor Force Studies and by Denis F. Johnston of that Division. The illustrative labor force projections by State presented in the appendix were reprinted from Special Labor Force Report No. 74, prepared by Denis F. Johnston and George F. Methee of that Division. Information on trends in output per man-hour was provided by the Office of Productivity, Technology, and Growth. Especially valuable was information on technological trends in major industries collected by that office under the direction of Edgar Weinberg. In the projections of employment by industry, extensive use was made of the work on estimates of industrial output and employment carried on by the Division of Economic Growth, as part of the Interagency Growth Study Project.

The Bureau wishes to acknowledge the encouragement received from the Coordinating Committee on Manpower Research (CCMR) of the U.S. Department of Labor, which recommended the development of this report. We also appreciate the assistance of many representatives of other Federal agencies, State government agencies, private research organizations, trade associations, labor unions, and colleges and universities.

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## INTRODUCTION

In a growing economy, the occupational composition of the work force, as well as the skills required in each occupation, change through the years. Present manpower needs, therefore, are an uncertain guide to future requirements. To plan education and training programs to meet tomorrow's manpower needs, projections are needed of these changing manpower requirements. Such projections can help also in the vocational guidance of young people. To the extent that education, training, and vocational guidance accurately reflect the changing character of manpower needs, imbalances between manpower requirements and labor supply can be reduced, the productivity of the economy and the earning power of workers enhanced, and structural unemployment minimized.

The manpower legislation passed in the early 1960's emphasized the need for projections of occupational requirements and supply information. The Area Redevelopment Act of 1961, the Manpower Development and Training Act of 1962, the Vocational Education Act of 1963, and the Higher Education Facilities Act of 1963 were concerned with the education and training needs of the Nation. Some of these acts specifically provided that occupational needs should be one of the factors on which education and training programs should be based. Other legislation, such as the Economic Opportunity Act of 1964, the Civil Rights Act of 1964, the Higher Education Act of 1965, and the Appalachian Regional Development Act of 1965, focused additional attention on the need for up-to-date information on future skill requirements.

*Tomorrow's Manpower Needs* is an attempt to provide a basis for developing manpower requirements information for States and areas through the use of national manpower information. The report presents the latest projections of national manpower requirements and provide a guide to their use in developing State and area manpower projections. The Bureau hopes that this information will be useful also in planning national programs of education and training, and in reviewing the extent to which State and local programs are meeting the Nation's manpower needs. Specifically, the publication provides information on the impact of national developments on industry and occupational manpower requirements. It presents the results of research on the growth and changing composition of the population and the labor force, the relative growth of industries, the effect of automation and other technological changes and economic factors on industry employment, the occupational structure of industries, patterns of working life, and techniques for appraising the supply of workers having various skills. This information is provided to serve as a background and tool for the appraisal of manpower requirements at the State and local level.

The bulletin reflects the continuing program of manpower research conducted by the Bureau of Labor Statistics. Consequently, the projections of industry and occupational employment requirements supersede those published in previous Bureau reports. In addition, some of the projection data never have been published before by the Bureau in the detail presented in this report. It is anticipated that *Tomorrow's Manpower Needs* will be revised every few years to reflect the latest information available as a result of the Bureau's continuing program of manpower research.

The Bureau of Employment Security currently is preparing a companion volume, *Handbook for Projecting Manpower Requirements and Resources for States and Areas*, which will explain in additional detail how analysts in State employment security agencies can use various methods and sources of data, including the national manpower information presented in this report, to develop State and area manpower estimates and projections.

This volume presents information on the national employment trends and projected 1975 requirements for workers in nine major occupation groups and 40 selected occupations. Volume IV, appendix E presents employment projections for a large number of additional occupations. The occupational statements include a discussion of past employment trends, the economic and technological factors expected to influence occupational requirements through the mid-1970's, and ways workers became qualified for the occupation.

The Bureau of Labor Statistics, as its resources permit, may be able to provide technical assistance, including clarification of the methods described in volume I of this bulletin, to organizations developing State and area manpower projections. Requests for such assistance should be made to the appropriate BLS Regional Office, located as follows:

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## CHANGING OCCUPATIONAL STRUCTURE

Significant changes can be expected to take place in the occupational structure of the Nation's labor force. One of the most significant since World War II has been the greater growth of white-collar and service worker employment, compared with that of manual workers. The professional and high-level managerial groups experienced especially rapid growth. Employment of white-collar workers rose nearly two-thirds between 1947 and 1966, from less than 20.2 million to more than 33.3 million. Employment of service workers also rose substantially, from 6.0 million to 9.7 million, an increase of 62 percent. At the same time, blue-collar employment increased much less rapidly, about 15 percent, from 23.6 million to 27.2 million, and farm workers actually declined more than one-half, from 8.1 million in 1947 to 3.9 million in 1966.

Many factors affect the occupational structure of the work force. One of the most important factors is the different rates of employment growth among industries, resulting from influences such as shifts in income distribution and changes in consumption patterns. Among the other factors are (a) growth in population and its changing age composition, which for example, has an effect on the need for teachers; (b) government policy, which determines such matters as the size of defense and space programs and expenditures for research and development; (c) institutional factors, such

<sup>1</sup> The projections of occupational requirements in 1975 were developed under the same assumptions as the industry projections presented in Volume II. As in the industry projections, they illustrate national trends. They are not meant to imply that all areas of the country will experience similar changes in employment requirements. In any one area, future occupational requirements depend on many factors, including the expected growth of industries that employ workers in the occupations under consideration and the occupational utilization patterns of these industries; these may differ from national trends. Other factors that must be considered in estimating an area's manpower needs include death and retirement losses, which also may differ from the national average, and inter-area mobility. (See ch. 5 for a discussion of how to estimate replacement needs.) In addition, the projections are not meant to represent actual employment levels in 1975. Actual employment reflects the interaction of demand and supply; no attempt was made to assess the future supply of workers and analyze this interaction in this study.

as union-management relationships and practices, and (d) supply-demand conditions, which may cause the substitution of workers in one occupation for more urgently needed workers in another, such as technicians for engineers. Another important factor that affects the occupational structure of the economy is technological change. Each industry's occupational pattern will continue to be heavily influenced by technological advances, such as the development of new products and processes and changes in the form of business enterprise.

Taking into account these diverse factors, the projections of occupational requirements developed for this report anticipate about a 28 percent increase in white-collar workers between 1966 and 1975.<sup>1</sup> (See table 1.) Among white-collar occupations, the most rapid advance in requirements will be for professional and technical workers, who may increase nearly twice as fast (39 percent) as the average for all workers (20 percent). Requirements for both clerical workers and sales workers also are expected to increase rapidly, about one-fourth, and the need for managers, officials, and proprietors should rise more than one-fifth. Requirements for blue-collar workers are expected to rise 10 percent between 1966 and 1975. Among blue-collar workers, the most rapid increase in requirements will be for craftsmen (18 percent), about the average increase for total employment. Requirements for operatives will increase more slowly (7 percent), and little change is expected in the demand for laborers. The need for service workers is expected to rise nearly one-third. On the other hand, a decline in requirements of about 14 percent is anticipated for farmers and farm workers.

As a result of these changes in occupational requirements, the Nation's occupational composition is likely to change significantly between 1966 and 1975. The major changes will be in the proportions that professional and technical and service workers represent of all workers—proportions that are expected to rise significantly. Conversely, the proportions of farmers and farm workers, operatives, and nonfarm laborers in the work force will decline. The remaining occupational groups—managers, sales workers, clerical workers, and craftsmen—are expected to represent the same proportions in 1975 as they did in 1966.

Employment by Major Occupational Group, 1966 and Projected 1975

Occupational Group	1966 employment		Projected 1975 requirements		Percent change, 1966-75
	Number (millions)	Percent	Number (millions)	Percent	
Total, 14 years and over-----	74.1	100.0	88.7	100.0	20
White-collar workers-----	33.3	45.0	42.6	48.1	28
Professional and technical-----	9.3	12.6	12.9	14.6	39
Managers, officials and proprie- tors-----	7.4	10.0	9.0	10.2	22
Clerical workers-----	11.8	16.0	14.8	16.7	25
Sales workers-----	4.8	6.4	5.9	6.7	24
Blue-collar workers-----	27.2	36.7	29.9	33.7	10
Craftsmen and foremen-----	9.6	13.0	11.4	12.8	18
Operatives-----	13.9	18.7	14.8	16.7	7
Nonfarm laborers-----	3.7	5.0	3.8	4.3	(1)
Service workers-----	9.7	13.1	12.7	14.4	31
Farmers and farm workers-----	3.9	5.2	3.4	3.8	-14

1/ Less than 5 percent.

Note: Projections assume a 3-percent level of unemployment in 1975. Because of rounding, the sum of individual items may not equal totals.

### Replacement Needs

In addition to anticipated manpower needs for occupational growth, many hundreds of thousands of workers will be required to replace those who are expected to withdraw from the labor force because of deaths, retirements, or for other reasons. Each year such losses are estimated at about 3 percent of all workers. The loss rate to a specific occupational group is influenced heavily by the age and sex distribution of its workers. For example, replacement needs for women workers are high because many young women leave the labor force each year to get married and rear families. Thus, the major occupational groups with the highest proportion of females—clerical and service workers—have the highest loss rates (3.5 percent to 4.5 percent annually); the major occupational groups with the lowest proportion of females—laborers and craftsmen—have the lowest loss rates (1.5 percent to 2.0 percent annually).

### Training

Workers in the United States acquire the education and training necessary to perform their jobs through a variety of methods. Of those holding white-collar jobs, professional, technical, and kindred workers generally acquire their occupational training in a 4-year college or university. Large numbers of professional and related

workers complete 2 years of post-secondary training in a junior college, technical institute, or specialized school. In some technical occupations such as engineering and science technicians, on-the-job training provided by employers has been the primary method of obtaining the needed training. Four-year college programs prepare large numbers of managerial workers for their jobs. However, many of these workers also qualify through experience in related sales or clerical jobs. Clerical workers, the largest of the white-collar occupational groups, generally complete high school business courses, or post-secondary training in business schools and in junior colleges. Sales workers who sell complex products such as scientific instruments or industrial machinery may acquire their training in a college or university, supplemented by specialized training given by their employers. Other sales workers who sell standardized merchandise in retail stores generally have little specialization; they usually learn their duties on the job in a short time.

Among blue-collar workers, craftsmen receive intensive training to qualify for their jobs—many of them through apprenticeship or other formal training programs given on the job, sometimes supplemented by related classroom instruction. Many craftsmen, however, acquire knowledge needed to perform their jobs through work experience by moving from one semiskilled job to another over a period of years. Semiskilled workers

(operatives) generally acquire their training on the job; this training may last from a few days to several weeks and generally is informal, with the supervisor providing necessary instruction. Laborers usually require no specialized training, other than brief instructions.

Service workers are a very diverse group and acquire their training in a variety of ways. The amount of training needed by these workers ranges from a college education, as for FBI agents, to short on-the-job training for elevator operators. Many service workers, such as barbers and cosmetologists, attend vocational school.

For the most part, farm workers learn their work on the job. Others take vocational training, such as that

available under federally assisted programs; and still others, including farm owners and managers, are graduates of college programs in agriculture.

Information on the methods through which workers are trained for their jobs must be viewed carefully in analyzing a particular area's manpower situation. Employers in the designated area may prefer workers trained in a manner that differs from the methods generally used in other parts of the country. Therefore, in developing training programs for given occupations or groups of related occupations, planners must consider all training methods already in effect for the occupations in the selected areas.

## PROFESSIONAL, TECHNICAL, AND KINDRED WORKERS

### *Current Employment*

About 9.3 million workers were employed in professional, technical, and kindred occupations in 1966. The largest groups of these workers were teachers (more than 2 million), professional health workers (about 2 million), scientists and engineers (about 1.4 million); and engineering and science technicians, including draftsmen, (about 900,000).

### *Training*

Professional and technical workers generally require extensive education and training. Professional workers usually acquire their specialized knowledge in a college or university; most of them need a bachelor's degree to enter their occupations. Others—including physicians, dentists, and architects—must complete more than 4 years of college to qualify for their professions. Technical workers, such as draftsmen and engineering and science technicians, may complete 2 years of post-secondary training in a junior college, technical institute, or specialized school.

Some professional and technical workers qualify for their jobs through on-the-job training, rather than formal schooling. The length of this training varies for different occupations. For example, many medical laboratory assistants complete several months of on-the-job training, whereas, many engineering technicians have had several years of on-the-job training and experience. The importance of industry training for engineering technicians is described in a Bureau of Labor Statistics study<sup>2</sup> which states that in recent years one-fourth of the new entrants to the technician group qualified through formal industry training and one-half qualified through informal on-the-job training or were upgraded from lesser skilled jobs.

Licenses or certificates are required for work in many professions that affect the health, safety, or welfare of the general public, such as medicine, dentistry, pharmacy, architecture, and teaching. Generally, the licensing requirements specify the completion of a recognized training program and the passing of an examination given by a State examining board.

### *Employment Trends and Outlook*

Employment of professional, technical, and kindred workers increased nearly 2½ between 1947 and 1966,

rising from about 3.8 million to 9.3 million. This increase was stimulated by a growing demand for goods and services resulting from population growth and rising business and personal incomes. Other factors underlying this employment growth included increasing government and private expenditures for research and development, highways, public buildings, medical care, education, and a great variety of other goods and services.

By 1975, manpower requirements for professional, technical, and kindred workers are expected to rise nearly 40 percent to 12.9 million. Manpower needs will increase in practically every professional and technical field including counseling, the natural sciences, engineering, programming, the health professions, the social sciences, social and welfare work, and teaching but the rate of increase is likely to differ among the occupations.

Teaching, the largest profession, is expected to grow moderately to meet the needs of a rising school-age population and an expected increase in school attendance. The demand for elementary and secondary school teachers is expected to increase more slowly than for college and university teachers.

In engineering and natural science occupations, employment requirements are expected to increase substantially by 1975. Increased requirements are anticipated to meet the general needs of our increasingly complex and technologically oriented economy and the Nation's expanding research and development programs. Employment requirements for scientists are expected to grow faster than those for engineers.

Employment requirements for technicians are expected to grow very rapidly from 1966-75. The increasing emphasis on improved utilization of workers such as scientists, engineers, physicians, and dentists and the need to relieve these workers of relatively routine tasks that can be performed by less highly trained persons will continue to be the major factors that underlie the increased requirements for technicians.

Employment requirements in health service occupations also are expected to increase substantially. Among the factors underlying this expected increase are population growth and the increasing ability of persons to pay for health care, growing interest in preventive medicine, and an increase in medical research to prevent diseases.

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<sup>2</sup> *Technician Manpower: Requirements, Resources, and Training Needs* (BLS Bulletin 1512, June 1966).

In addition to manpower needs for occupational growth, many professional, technical, and kindred workers will be needed to replace those who transfer to other fields of work, or who die, retire, or otherwise

withdraw from the labor force. For example, each year, an estimated 2.5 to 3.0 percent of the workers in this occupational group withdraw from the labor force.

## Accountants<sup>3</sup>

### *Current Employment*

About 500,000 accountants were employed in 1966. About 80,000 of these workers were certified public accountants (C.P.A.'s).

More than half of all accountants do private accounting work for business and industrial firms. About one-third are engaged in public accounting as proprietors, partners, or employees of independent accounting firms. About 10 percent work for Federal, State, and local government agencies. A small number teach in colleges and universities.

### *Training*

Accountants acquire the training needed to perform their work in a variety of ways. A large number qualify by completing 4-year college degree programs and receiving a major in accounting or a closely related field. Many others acquire their accounting skills in 2- or 3-year programs in private accounting or private business schools. Some acquire their skills in junior college courses or through correspondence courses.

All States require that anyone practicing in the State as a C.P.A. hold a certificate issued by the State board of accountancy. Requirements for licensing and registration vary from one State to another. Almost half the States have laws that by 1970, will require C.P.A. candidates to be college graduates. All States use the C.P.A. examination provided by the American Institute of Certified Public Accountants. Nearly all States require at least 2 years of public accounting experience, or its equivalent, before the C.P.A. certificate is used.

### *Employment Trends and Outlook*

Employment of accountants increased from more than 300,000 in 1950 to about 500,000 in 1966. This increase resulted from a number of factors, including growth in the size and number of businesses; greater use

of accounting procedures in business management; increased complexity and changes in tax systems; and increased use of accounting services by small businesses.

Employment requirements for accountants are expected to rise about one-third between 1966 and 1975, from 500,000 to about 660,000 based, in part, upon a continuation of the factors operating in the past. In addition, several new developments are expected to stimulate the demand. For example, growth in the number and activities of nonprofit institutions—including charitable, health, and welfare organizations; pension and welfare funds; labor unions; educational institutions; churches; and clubs—may result in more financial reporting and the need for more accountants.

The computer is expected to have a major effect on the accounting profession in the future. The increasing use of automatic data processing systems is expected to reduce manual bookkeeping for preparing trial balances, financial statements, and simple tax returns. As a result, the need for junior accountants may be reduced substantially. On the other hand, computers provide vast quantities of accounting data that will require additional accountants to analyze. In larger companies, the computer is expected to bring about radical changes in information systems and decisionary processes. As the number of "total" information systems rise, additional highly trained accountants will be required to prepare, administer, and analyze the output of these systems.

In addition to the number of accountants that will be needed from 1966-75 to meet the growth in manpower requirements, many will be needed to replace those who retire, die, or otherwise withdraw from the labor force, or who transfer to other fields of work. For example, each year, withdrawals from the labor force alone are estimated to number between 2.0 to 2.5 percent of all accountants.

<sup>3</sup> (D.O.T. 160.188), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

## Chemists<sup>4</sup>

### *Current Employment*

Nearly 120,000 chemists were employed in 1966; chemists constituted the largest group of physical scientists.<sup>5</sup> This occupational classification includes five specialists: organic chemists, inorganic chemists, physical chemists, analytical chemists, and biochemists. About two-thirds of all chemists work for private industry. The major industrial employer of chemists, the chemicals manufacturing industry, employs more than two-fifths of the chemists in private industry. Relatively large numbers of chemists also are found in the industries manufacturing food, petroleum, paper, electrical equipment, and primary metal products. Significant numbers of chemists also are employed by distributors of chemical, pharmaceutical, food, and petroleum products, and by independent laboratories and research institutes providing consulting services. About one-fifth of all chemists are employed in colleges and universities. A smaller number of research chemists work for foundations and other nonprofit organizations. Others are employed by Federal Government agencies; small numbers work for State and local governments.

### *Training*

Most chemists acquire their basic professional training in college and university programs leading to the bachelor's degree in chemistry. Other chemists qualify for their jobs through other basic science or engineering programs. In addition, some technicians without degrees enter chemist jobs after acquiring the required knowledge through many years of work experience.

According to a follow-up study of the career patterns of new college graduates<sup>6</sup> about one-third of each year's college graduates who receive the bachelor's degree in chemistry enter chemistry jobs. Other graduates with the chemistry degree enter other science occupations or engineering, or take jobs in fields such as sales or management. However, some of those who enter other types of jobs eventually return to chemistry.

### *Employment Trends and Outlook*

Employment of chemists increased from more than 50,000 in 1950 to nearly 120,000 in 1966. One of the

major factors underlying this rapid increase was the sharp growth in demand for products of industries that employ large numbers of chemists, particularly the chemicals and allied products industry. Increased expenditures for research and development, in which nearly one-half of all chemists are engaged, was another major factor in the employment growth of chemists. In addition, scientific discoveries opened new employment areas for chemists in manufacturing products such as plastics, man-made fibers, rocket fuels, and pharmaceuticals.

Employment requirements for chemists are expected to rise by more than three-fifths between 1966 and 1975, from nearly 120,000 to about 195,000. An important reason for the anticipated increased demand for chemists will be growing expenditures for research and development. Such expenditures, which have increased rapidly in recent years, probably will continue to rise through the mid-1970's, although somewhat more slowly than in the past 10 years. Other important reasons for the expected rise in employment requirements for chemists include the expanding demand for the products of industries that are major employers of chemists, the greater complexity of chemical products and the processes required to produce them, and the increased demands of a growing population for improved products, such as better drugs.

In addition to those chemists needed over the 1966-75 period to meet rising employment requirements, many will be needed to replace those who transfer to other occupations or withdraw from the labor force because of death, retirement, or other reasons. Annual losses for these reasons are estimated at 3.0 to 4.0 percent of all chemists.

<sup>4</sup> (D.O.T. 022.081; .168, .181, and .281), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

<sup>5</sup> The employment estimate and projections of requirements for chemists presented here differ from those in Vol. IV, appendix H because of the inclusion here of college chemistry teachers. The occupation-industry matrix follows the Census classification in which college chemistry teachers are counted in the college teacher total.

<sup>6</sup> *Two Years After the College Degree. Work and Further Study Patterns*, National Science Foundation, NSF 63-26.

## Draftsmen<sup>7</sup>

### *Current Employment*

About 260,000 draftsmen were employed in 1966. The large majority—nearly 9 out of 10—are employed in private industry. The manufacturing industries that employ large numbers of draftsmen are the machinery, electrical equipment, fabricated metal products, and transportation equipment industries. Nonmanufacturing industries employing large numbers of draftsmen are engineering and architectural consulting firms, construction companies, and public utilities.

More than 25,000 draftsmen worked for Federal, State, and local governments in 1966. Of those employed by the Federal Government most work for the Departments of Army, Navy, and Air Force. Draftsmen employed by State and local governments work chiefly for highway and public works departments. A few thousand draftsmen are employed by colleges and universities and by nonprofit organizations.

### *Training*

Draftsmen acquire their training in a variety of ways. Many complete training programs in technical institutes, junior and community colleges, and vocational and technical high schools. Others acquire their training on the job, while they attend part-time schooling in colleges and universities or correspondence schools, or in 3- or 4-year apprenticeship programs.

### *Employment Trends and Outlook*

Rising from about 125,000 to about 260,000, employment of draftsmen more than doubled between

1950 and 1966. The rapid growth in demand for the products of the durable goods industries, which employ large numbers of draftsmen, was a major factor underlying this increase. Another contributing factor was the large increase in the number of complex products requiring extensive plans and exact drawings to be produced. In addition, the rapid growth in areas of work requiring large numbers of draftsmen—such as research and development, space exploration, and defense activities—contributed greatly to the increase in employment from 1950 to 1966.

Employment requirements for draftsmen are expected to increase about 45 percent between 1966 and 1975, and rise to about 375,000. However, this projected increase represents a significant reduction in the rate of increase over the past decade and a half. Among the factors underlying the projected growth are the continued expansion of industries employing large numbers of draftsmen, and the increasingly complex design problems of modern products and processes. Furthermore, as the number of scientists and engineers increases, more draftsmen will be needed as support personnel.

In addition to draftsmen needed to fill new positions from 1966-75, many will be required to replace those who transfer to other fields of work, or who die, retire, or otherwise leave the labor force. Annual replacements are estimated at 4.0 to 5.0 percent of all draftsmen.

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<sup>7</sup> (D.O.T. 001. through 019.), *Dictionary of Occupational Titles*. U.S. Department of Labor, 1966, 3d edition.

## Engineering and Science Technicians<sup>8</sup>

### *Current Employment*

Nearly 650,000 engineering and science technicians (excluding draftsmen and surveyors) were employed in 1966. Engineering technicians make up the largest field of specialization, and account for more than half of all technicians. Physical science technicians, about half of whom were chemical technicians, constituted more than one-fifth of the total. The next largest group was made up of life science technicians, who averaged about 10 percent of all technicians.

About three-fourths of all technicians were employed by private industry in 1966. The industries employing

the largest number of technicians were electrical equipment, chemicals, machinery, and aircraft and parts. The Federal Government employed more than 70,000 engineering and science technicians, mainly in the Department of Defense. State government agencies employed about 45,000, and local governments over 15,000. The rest were employed by colleges and universities, mostly in university-operated research institutes, and by nonprofit organizations

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<sup>8</sup> (D.O.T. .002 through .029). *Dictionary of Occupational Titles*. U.S. Department of Labor, 1966, 3d edition.

## Training

Training required for technician occupations may be obtained through many methods. In 1966, two-fifths of the new entrants into technician occupations acquired their training through many years of experience in technician related work and were upgraded to technician jobs.

Nearly one-fourth of all the new entrants into these occupations acquired their training in 2-year post-secondary school programs, and about the same number qualified for their jobs through employer training programs. About 1 of every 12 acquired their training in college or university science and engineering programs; more than two-fifths of these entrants had a degree. A relatively small number of all entrants completed training under the Manpower Development and Training Act of 1962, as amended, or in the Armed Forces.

## Employment Trends and Outlook

Employment of engineering and science technicians rose from about 450,00 in 1960 to nearly 650,000 in 1966. The rapid growth in demand for products of industries that employ large numbers of technicians was a major factor underlying this employment growth. Another factor that contributed to the employment growth of technicians was the great increase in expenditures in areas of work requiring large numbers of these workers, such as research and development, defense, and space exploration. The increasing complexity of industrial products and processes also created a demand for more technically trained personnel.

Employment requirements for technicians are expected to increase more than one-half between 1966 and 1975, and rise to more than one million. An important reason for the anticipated increase will be the continued expansion of industries employing large numbers of technicians. The services of technicians will be used more extensively in the future than in the past, as employers realize they can better utilize scientists and engineers by supplying additional support personnel. The anticipated growth in research and development expenditures is another important reason for the expected increase in demand for engineering and science technicians. Such expenditures are expected to continue to rise through the mid-1970's although less rapidly than in the past 10 years.

This report assumes that the level of defense expenditures in 1975 will not be significantly different from those in 1964, before the Viet Nam buildup. Therefore, rising levels of defense expenditures were not significant in projecting the large increase in requirements for engineering and science technicians. A major change in defense activity would affect requirements for technicians, since an estimated one-fourth are engaged in defense or related work.

In addition to the technicians needed to fill new positions for growing manpower requirements from 1966-75, many will be needed to replace those who transfer to other fields of work or who die, retire, or leave the labor force for other reasons. Approximately 4.0 to 4.5 percent of all engineering and science technicians must be replaced each year.

## Engineers<sup>9</sup>

### Current Employment

About 1 million engineers were employed in 1966. Engineering is the second largest profession and for men, it was the largest profession.<sup>10</sup> Three fields of specialization—electrical, mechanical, and civil engineering—each accounted for about 20 percent of all engineers. Smaller proportions were employed in industrial (11 percent), aeronautical (6 percent), and chemical (5 percent) engineering. The rest were employed in several other specialties, including sales, agricultural, ceramic, metallurgical, and mining engineering.

More than one-half of all engineers were employed in manufacturing in 1966. The manufacturing industries

employing the largest number of these workers were electrical machinery, aircraft and parts, machinery, ordnance, chemicals, and professional and scientific instruments. Almost 30 percent of all engineers were employed in private nonmanufacturing sectors of the

<sup>9</sup> (D.O.T. 002. through 015.), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition,

<sup>10</sup> The employment estimate and projection of requirements for engineers presented here differ slightly from those presented in Vol. IV, Appendix H because college teachers of engineering are included and metallurgists are excluded. In the occupation-industry matrix which follows the Census classification, college engineering teachers are counted as part of the college teacher total and metallurgists as part of the engineer total.

economy, primarily in the construction industry; engineering and architectural services; and electric, gas, and sanitary services industries. About 15 percent of all engineers were employed in Federal, State, and local government agencies other than educational institutions. More than half of these engineers worked for the Federal Government. Public and private educational institutions employed about 3.5 percent of all engineers.

### *Training*

An estimated 70 percent of all engineers employed in 1966 had an engineering degree. About 10 percent had a college degree in one of the natural sciences, and a very small proportion had a degree in a field other than science or engineering. The rest, nearly one-fifth, who did not have a degree, qualified after many years of experience in a related occupation such as engineering technician or draftsman. According to a follow up study of career patterns of new college graduates,<sup>11</sup> about 85 percent of each year's college graduates who receive the bachelor's degree in engineering enter engineering jobs. Other graduates enter natural science or sales occupations, or nontechnical work such as management. However, some of those who enter other types of jobs eventually return to engineering.

All 50 States and the District of Columbia have laws which license or register engineers whose work may affect life, health, or property. Generally, registration requirements include graduation from an accredited college, plus at least 4 years of experience in engineering work and the passing of a State examination. Examining boards may accept a longer period of experience as a substitute for a college degree.

### *Employment Trends and Outlook*

Rising from more than 400,000 to about 1 million, engineering was one of the fastest growing occupations between 1950 and 1966. A major factor in this increase

was the rapid growth of industries employing large numbers of engineers. The rapid growth of Federal expenditures for research and development and defense and defense-related activities resulted in large increases in employment, particularly in the aircraft and parts, electrical machinery, professional and scientific instruments, and ordnance industries. Many scientific discoveries developed new areas of work for engineers, including nuclear energy, space exploration, and computer technology.

Engineers are expected to number nearly 1.5 million in 1975 largely because of the anticipated growth of industries employing large numbers of engineers and increasing research and development activities. Expenditures for such activities are expected to rise through the mid-1970's, although the rate of growth will be less rapid than in the recent past. Engineers will continue to be in the forefront of technological change, and the growing automation of industry will require large numbers of engineers to plan, develop, and produce the equipment involved.

This report assumes that the level of defense expenditures in 1975 will not be significantly different from that in 1964. Therefore, rising levels of defense expenditures were not significant in projecting the large increase in requirements for engineers. A major change in defense activity would affect requirements for engineers, since an estimated one-fourth of all engineers are engaged in defense or related activities.

In addition to the number of engineers needed from 1966-75 to meet the growth in manpower requirements, many thousands will be needed to replace those who transfer to other fields of work, or who die, retire, or withdraw from the labor force for other reasons. Approximately 2.5 to 3.5 percent of all employed engineers must be replaced each year.

<sup>11</sup> *Two Years After the College Degree, Work and Further Study Patterns*, National Science Foundation, NSF 63-26.

## Registered Professional Nurses <sup>12</sup>

### *Current Employment*

Nursing is the largest profession in the health field. In 1966, more than 620,000 registered professional nurses were employed in the United States; about one-fourth worked part-time.

Approximately two-thirds of all nurses worked in hospitals and related institutions. About 10 percent were

private duty nurses who cared for patients in hospitals and private homes, and about 8 percent were office nurses. Public health nurses in government agencies, visiting nurse associations, and clinics made up approximately 6 percent; nurse educators in nursing schools

<sup>12</sup> (D.O.T. 075.118 through .378), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

accounted for 4 percent; and occupational health nurses in industry, about 3 percent.

### *Training*

Professional nurses acquire the training through three types of educational programs—diploma, baccalaureate degree, and associate degree. In 1966, about three-fourths of all graduates of these programs completed diploma programs, which are conducted by hospital and independent schools and usually require 3 years of training. About 15 percent completed bachelor's degree programs, some of which require 5 years of study. About 10 percent of all nursing program graduates were trained in associate degree programs in junior and community colleges.

The large majority—7 out of every 8—of all professional nurses employed in 1966 had a diploma or associate degree. More than 10 percent had a baccalaureate degree, and the rest had a master's or higher degree.

A license is required to practice professional nursing in all States and in the District of Columbia. To obtain a license, a nurse must graduate from a school approved by a State board of nursing and pass a State board examination. A nurse may be licensed in more than one State, either by examination or endorsement of a license issued by another State.

### *Employment Trends and Outlook*

Rising from 375,000 to more than 620,000, employment of nurses increased about two-thirds between 1950

and 1966. The major growth factors included increased demand for hospital and other medical and health services resulting from the expanding population; extension of medical insurance coverage; growing expenditures by industry and government for medical care, and rising standards of living.

Employment requirements for nurses are expected to rise about two-fifths between 1966 and 1975, to about 860,000. Among the factors that are expected to contribute to a continuing increase in demand for hospital and health services and, therefore, an increasing need for nurses are: a growing population; rising ability of families to pay for medical care, partly because of greater coverage of insurance programs, including Medicare; and expansion of medical services resulting from new medical techniques and drugs. An increasing number of nurses also will be needed to rehabilitate the mentally handicapped, particularly in community health centers being established under the provisions of the Mental Retardation Facilities and Community Health Centers Construction Act of 1963.

In addition to manpower requirements for employment growth through the mid-1970's, many nurses will be needed to replace those who transfer to other fields of work or who die, retire, or leave the labor for marriage or other family responsibilities or for other reasons. Each year the profession loses approximately 4.5 to 5.0 percent of its nurses. Many who become inactive because of home responsibilities, however, return to the profession in later years.

## Teachers<sup>13</sup>

### *Current Employment*

Teachers make up the largest group of professional workers. About 2.2 million full-time teachers were employed in the 1965-66 academic year. Approximately one-half of all teachers were employed in elementary schools, more than a third in a secondary school, and about 10 percent in colleges and universities.

Women teachers far outnumber men in kindergarden and elementary schools and hold slightly less than one-half of the teaching positions in secondary (junior and senior high) schools. However, only about one-fourth of all college and university teaching positions are filled by women.

### *Training*

All States require elementary and secondary school teachers in public schools to have a teaching certificate. In 1966, 46 States and the District of Columbia issued regular elementary school teaching certificates only to persons who have at least 4 years of approved college preparation. In every State, a bachelor's degree is needed for a secondary school teaching certificate. For both elementary and secondary school certificates, most

<sup>13</sup> (D.O.T. 090.168 and .228, 091.118 through .228, and 092.228), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

States also require at least the equivalent of one-half year of education courses.

In 1966, more than one-fifth of all recipients of bachelor's degrees met the certificate requirements for high school teaching. Nearly 15 percent met the certificate requirements for elementary school teaching. However, all those who have teaching certificates do not enter teaching. In 1966, about 4 of every 5 who met the requirements for an elementary school teaching certificate entered elementary school teaching positions and about two-thirds of those who met the requirements for a high school teaching certificate entered high school teaching positions.

Of all new college teachers in the 1965-66 academic year, about 27 percent had a doctor's degree. About 60 percent had a master's degree and about 13 percent had a bachelor's degree.

### *Employment Trends and Outlook*

Employment of public and private school teachers combined increased from an estimated 1.4 million in the 1955-56 school year to about 2.2 million in 1965-66. This employment growth resulted primarily from a great increase in the school-age population. In addition, the proportion of young people of high school and college age attending school has increased in recent years. At the beginning of the 1965-66 school year, about 54 million people were enrolled in the Nation's schools and colleges, compared with about 38 million people in the 1955-56 school year.

Employment requirements for teachers are expected to rise more than one-fifth during 1966-75 and reach about 2.7 million in 1975-76 because of increases in the growth of the school-age population, increasing attendance rates, and improvement in the pupil-teacher ratios. At the elementary school level increasing require-

ments will result primarily from improvement in the pupil-teacher ratio. A slight decline of enrollments is expected because of declines in the school-age population and because attendance rates already are high.

Secondary school and college enrollments are expected to increase 30 percent and 65 percent respectively, partly because the school-age population at these levels is expected to increase. Attendance rates also should rise as part-time work becomes increasingly available to high-school and college students: as the financial ability of parents to pay for higher education increases; and as scholarships become more numerous for college and university students, in part due to funds provided by recent Federal legislation, including the Health Profession Educational Assistance Act of 1963 and the Higher Education Act 1965. Growth of facilities to accommodate the increasing number of students also will result from these acts as well as from the Elementary and Secondary Education Act of 1965 and the Amendments to these acts.

Technological developments will have little effect on employment requirements for teachers through the mid-1970's. Educational television and teaching machines are gaining in use, but they will have little influence on reducing the need for teachers. Such equipment probably will be used primarily to free teachers from routine tasks; to provide time for individual assistance to students; and to prepare improved lessons and teaching materials.

In addition, to manpower needs for occupational growth, many teachers will be needed to replace those who transfer to other occupations, die, retire, or leave the field for family responsibilities. Many teachers who become inactive because of family responsibilities, however, return to the profession in later years. Each year the profession has a estimated net loss of between 6.0 and 8.0 percent of all employed teachers.

## Medical Laboratory Assistants<sup>14</sup>

### *Current Employment*

Approximately 50,000 medical laboratory assistants were employed in 1966, about 80 percent of whom were women. Hospital laboratories employed the largest number of these workers—nearly three-fourths of the total. Medical laboratory assistants were also employed in public and private clinical laboratories, physicians' offices, public health agencies, and industrial and pharmaceutical laboratories.

Federal Government agencies employed about 3,000 medical laboratory assistants in 1966. Most of these

assistants worked in veterans' hospitals; the remainder were employed by the Armed Forces and the Public Health Service.

### *Training*

Medical laboratory assistants acquire their training in a variety of ways. Most learn their skills through training

<sup>14</sup> (D.O.T. 078.381), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

in a medical laboratory. Such training usually lasts about one year, but the length of time may vary, depending on the person's previous experience and his ability to master laboratory techniques.

An increasing number of medical laboratory assistants are acquiring their skills in academic programs offered by hospitals and by private schools. These programs last a year and include classroom instruction and practical training in the laboratory. Hospitals provide the greatest number of such programs, many of which were established in recent years under the Manpower Development and Training Act of 1962 and the Vocational Education Act of 1963. A few medical laboratory assistants acquire their training in 2-year programs offered by junior colleges.

#### *Employment Trends and Outlook*

The employment of medical laboratory assistants rose from about 20,000 in 1950 to approximately 50,000 in 1966. Among the factors underlying this rapid employment growth were an increase in the number of hospitals, growth of medical care insurance programs, an increasing population, and the development of new laboratory techniques and laboratory tests to diagnose and treat disease.

Employment requirements for medical laboratory assistants are expected to reach 100,000 in 1975, double the 1966 levels. The factors that contribute to this

anticipated continuing rapid growth include the country's expanding population, increasing ability of persons to pay for health care, partly because of the expansion of prepayment programs for hospitalization and medical care, including Medicare, expanding medical services resulting from new medical techniques and drugs, increasing reliance of physicians on laboratory tests to diagnose and treat disease, expanding medical research activities, and increasing use of assistants relative to other more highly trained laboratory workers.

Federal legislation is expected to be a major factor stimulating the demand for medical laboratory assistants, as well as for all other health workers. Examples of such legislation recently passed by Congress include Medicare and Medicaid in the Social Security Amendments of 1965; the Heart Disease, Cancer, and Stroke Amendments of 1965; and the Mental Retardation Facilities and Community Health Centers Construction Act of 1965 as amended.

In addition to the employment requirements for occupational growth, many assistants will be needed from 1966-75 to replace workers who transfer to other occupations, or who die, retire, or withdraw from the labor force for other reasons. Each year, withdrawals from the labor force alone (including women who leave the field for marriage or family responsibilities) are estimated to number between 4.0 and 5.0 percent of all medical laboratory assistants.

## MANAGERS, OFFICIALS, AND PROPRIETORS

### *Current Employment*

About 7.4 million managers, officials, and proprietors were employed in the United States in 1966; about two-fifths were self-employed. Women constituted about 15 percent of this occupational category.

Managers are employed in virtually all industries. Retail trade was the largest employing industry, and accounted for about one-third of all managers, officials, and proprietors in 1966. Other industries which had large numbers of managers were durable and nondurable goods manufacturing; wholesale trade; finance, insurance, and real estate; construction; and public administration.

### *Training*

Managers, officials, and proprietors acquire training for their jobs in a variety of ways. Large numbers of salaried managers have completed a bachelor's degree program in business administration and received a major in accounting, economics, or finance. Others have backgrounds in engineering, science, or liberal arts. Many managers who have less than a bachelor's degree qualified for their positions through experience in related work in sales and clerical jobs.

Many large organizations place beginners in management trainee programs that may last a year or more. Such programs often include job rotation and formal classroom instruction, and help prospective managers and officials become acquainted with the organization's activities and policies as well as with specific job functions.

### *Employment Trends and Outlook*

Employment of managers, officials, and proprietors increased from nearly 5.8 million to 7.4 million between 1947 and 1966. However, employment trends among the occupations that make up this broad occupational category varied sharply.

Employment of salaried managers and officials, including industrial traffic managers and purchasing agents, rose rapidly between 1957 and 1966 and grew from about 3 million to about 4.7 million. Major reasons for this increase were the continuing growth in the size of business and manufacturing establishments and the ever increasing complexity of a wide variety of business functions. Technological developments also contributed to the employment growth, and were reflected in the

increasing number of technical managers needed to plan research and development programs, make policy decisions concerning the installation and use of automated machinery, and supervise automatic data processing systems.

The number of proprietors, on the other hand, declined during 1957-66, from about 3.7 million to about 2.7 million largely because of the replacement of small grocery and general stores and hand laundries (often run as family businesses) by supermarkets and large chains. Also, many proprietors of relatively small firms incorporated their businesses and thereby became classified as "salaried managers" instead of "self-employed."

Employment requirements for managers, officials, and proprietors as a group are expected to rise more than one-fifth between 1966 and 1975, increasing from 7.4 million to 9.0 million. The major reasons for this anticipated growth include the expected continued increase in demand for goods and services resulting from a growing population and rising living standards, and the continued increase in the number and complexity of business establishments. As in the past, requirements for salaried managers and officials are likely to continue to increase rapidly because of the increasing dependence of business organizations and government agencies on trained management specialists.

The number of self-employed managers is expected to continue to decline from 1966-75. The trend toward formation of larger businesses is expected to continue to restrict the growth in the total number of firms. In addition, the replacement of small grocery and general stores and hand laundries by supermarkets and large chains is expected to continue. However, the greatest part of this shift from small proprietor-owned stores to larger businesses appears already to have taken place and, as a result, the decline in the number of proprietors is expected to be slower through the mid-1970's than over the past decade. This decline also will be limited by the expansion of such businesses as quick-service grocery stores, self-service laundries and drycleaning shops, hamburger and frozen custard drive-ins, dance studios, and slenderizing salons.

In addition to the number of managers required for employment growth from 1966-75, many will be needed to replace managers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons. For example, each year an estimated 2.5 to 3.0 percent of all managers, officials, and proprietors withdraw from the labor force.

## CLERICAL AND KINDRED WORKERS

### *Current Employment*

About 11.8 million clerical and kindred workers were employed in 1966; about 7 of every 10 were women. Clerical and kindred workers constitute the largest group of white-collar workers.

More than one-half of all clerical and kindred workers are employed in manufacturing, wholesale and retail trade, and public administration. Large numbers also are employed in insurance companies, finance and real estate firms, educational institutions, and professional service organizations.

### *Training*

Clerical workers acquire their training in a variety of ways. Large numbers complete business courses in high school. Some high school students train for clerical jobs in cooperative work-study programs, which enable them to acquire practical work experience under trained supervision. Many clerical workers prepare for their jobs through post-secondary training in business schools, junior colleges, or 4-year colleges. Some clerical workers are trained in programs operated under provisions of the Manpower Development and Training Act of 1962.

### *Employment Trends and Outlook*

Rising from 7.2 million to about 11.8 million, employment of clerical and kindred workers increased almost steadily between 1947 and 1966. This rapid increase reflected not only growth of the economy, but also growth in the size and complexity of modern business organizations and government. The rapid increase in the amount of communications conducted

through mail, telephone, and telegraph also brought about a need for more clerical workers.

Employment requirements for clerical and kindred workers are expected to reach 14.8 million by 1975, about one-fourth higher than the 1966 level. Many new positions will develop as industries employing large numbers of clerical workers continue to expand. The trend in retail stores toward transferring to clerical workers functions that were formerly performed by sales personnel also will tend to increase employment requirements for clerical workers. Furthermore, the expected continued increase in the size and complexity of modern business organization will help to increase the overall demand for clerical workers.

Technological developments limit the employment growth for clerical workers. For example, the use of electronic computers, bookkeeping machines, and other mechanical devices to process routine and repetitive work will require fewer clerks for jobs such as filing, sorting bank checks, making up payrolls, keeping track of inventories, and billing customers. On the other hand, the laborsaving innovations will be offset to some extent by growing requirements for machine operators.

Secretaries, receptionists, and other clerical workers whose duties require judgment and contact with the public will not be affected significantly by technological innovations.

In addition to manpower needs for occupational growth during 1966-75, thousands of clerical workers will be needed to replace workers who transfer to other occupations, or who die, retire, or withdraw from the labor force for other reasons. For example, each year between 3.5 and 4.5 percent of all clerical workers withdraw from the labor force because of family responsibilities or other reasons.

## Bookkeeping Workers <sup>15</sup>

### *Current Employment*

About 1.2 million workers were employed in bookkeeping jobs in 1966. Five of every six of these workers were women and most are general bookkeepers or accounting clerks. Bookkeeping machine operators probably number fewer than 75,000.

Bookkeeping workers are found in all industries. In 1966, about 25 percent were employed by retail establishments and almost 20 percent by manufacturing

firms. Banking and credit agencies employed more than 12 percent, and wholesale trade establishments, over 10 percent.

### *Training*

Bookkeepers often obtain preliminary training in high school courses, such as business arithmetic and

<sup>15</sup> (D.O.T. 210.368 through .588; 215.388 and .488; 216.388; and 219.388 and .488), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

bookkeeping, through post-high school business courses, or in junior colleges. Most bookkeeping workers, however, acquire their skills on the job. An increasing number of large companies offer on-the-job training for newly hired accounting clerks and machine operators. In some localities, employers cooperate in work-study programs operated by high schools and business schools in which students gain practical work experience. Some bookkeepers have received training through programs established under the Manpower Development and Training Act of 1962. In 1966, about 1,100 persons were enrolled in MDTA institutional programs for bookkeeping workers.

### *Employment Trends and Outlook*

Employment of bookkeeping workers increased from about 725,000 in 1950 to about 1.2 million in 1966, or by about two-thirds. This increase resulted primarily from expansion of economic activity and growth in the complexity of modern business.

Employment requirements for bookkeeping workers are expected to increase to nearly 1.4 million in 1975, about one-sixth above the 1966 level. The increasing use of laborsaving technological innovations, such as auto-

matic data-processing and other mechanized bookkeeping equipment, however, will limit the growth of workers performing the more routine bookkeeping tasks. More and more accounting and bookkeeping establishments will use electronic data processing machines. However, many companies probably will not have the capital nor the volume of work to automate their bookkeeping operations. Furthermore, some firms will continue to combine electronic data-processing equipment with conventional equipment. Even in companies that install electronic data processing equipment, bookkeepers who did routine clerical posting before the machines were installed are not expected to be displaced to any great extent. The bookkeeping demands of many firms will continue to grow and create an increasing need for workers to prepare the inputs for the new equipment and the additional reports made possible by using this equipment.

In addition to manpower needs for occupational growth, many bookkeeping workers will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons. Each year withdrawals from the labor force alone are estimated to be between 4.0 and 4.5 percent of all bookkeeping workers.

## Office Machine Operators <sup>16</sup>

### *Current Employment*

About 500,000 office machine operators (excluding typists) were employed in 1966 most of whom were women.

About one-third of all office machine operators work for manufacturing companies. Other large numbers work for banks and insurance companies, government agencies, wholesale and retail firms, and transportation and public utility companies. Some office machine operators are employed in "service centers," agencies that contract to handle tasks such as preparing monthly bills and mailing circulars.

### *Training*

Most office machine operators learn their skills mainly on the job. Although some receive high school or business school training in business arithmetic and the operation of office machines, additional on-the-job training is usually necessary. Also, some office machine operators have received training through programs operated under the Manpower Development and Training Act of 1962.

The amount of instruction and on-the-job experience needed by new workers depends chiefly on the type of machine or machines they operate. Only a few days may be required to train operators of some duplicating machines; a few weeks may be needed to train key-punch and calculating machine operators. Several weeks are required for operators of tabulating machines to learn how to set and adjust their equipment and to do simple wiring of plugboards. Operators of tabulating equipment often are trained at company expense in special schools established by equipment manufacturers.

Computer operators may acquire some of their training in high school, business school, or a school run by computer equipment manufacturers, and complete their training on the job. Auxiliary equipment operators generally learn their skills in a few weeks on the job. Console operators receive most of their training through formal classroom instruction, where they learn how to

<sup>16</sup> (D.O.T. 207.782 and .855; 207.782; 213.138-.885; 214.488; 216.488 and .588; 217.388; 219.388; 213.588; and 234.582 and .885), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

mount tapes, operate the console, and become sufficiently familiar with the equipment they are using to trace the reasons for mechanical failures. This training is supplemented by further instruction on the job.

### *Employment Trends and Outlook*

Employment of office machine operators increased from more than 140,000 in 1950 to about 500,000 in 1966 because of a tremendous increase in the paper work requirements of an expanding economy, and growth in the size and complexity of modern business. The expanding use of electronic computers resulted in a rapid increase in the employment of operators of computers and auxiliary equipment.

Employment requirements for office machine operators are expected to increase nearly two-fifths between 1966 and 1975, to approximately 700,000 workers. Underlying this projected increase is the expected continued growth of recordkeeping requirements in both the public and private sectors of the economy. Large employers of office machine operators such as manufacturing, insurance, and banking firms are expected to experience significant increases in paper-work volume, as their business continues to grow.

Although employment requirements for office machine operators as a whole will increase rapidly in the years ahead, technological developments are expected to limit growth in employment requirements for operators of certain types of office machines. The spread of

automated recordkeeping processes may displace some tabulating and billing machine operators, since electronic computers generally perform these functions more efficiently. In addition, as automatic reading devices become a common component of computer systems, requirements for keypunch operators to prepare material for use in computers may be affected adversely. Furthermore, advances in interoffice communications and electronic computer technology should enable many large private firms and government agencies to consolidate recordkeeping functions at a central location, and reduce requirements for office machine operators in many small branch offices. As more sophisticated computer systems are introduced in the future, the number of computer and auxiliary equipment operators needed for each machine may decline. However, the spread of computer service centers, along with the increased applications of computers to more varied functions, should result in a rapid increase in the employment of computer operating personnel.

The increasing use of "quick-copy" equipment and other new and improved office machines also is expected to stimulate the demand for office machine operators.

In addition to manpower needs for occupational growth, many office machine operators will be needed to replace workers who transfer to other occupations, or who die, retire, or withdraw from the labor force for other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to be between 3.5 and 4.0 percent of all office machine operators.

## **Stenographers, Secretaries, and Typists<sup>17</sup>**

### *Current Employment*

Stenographers, secretaries, and typists make up the largest group of clerical and kindred workers. About 3.1 million stenographers, secretaries, and typists were employed in 1966; more than 95 percent were women. Workers in this field are employed by public and private organizations of every size and type. Particularly large numbers work in professional and related services; manufacturing; finance, insurance, and real estate; and public administration.

### *Training*

Many secretaries, stenographers, and typists obtain their training in high school. In addition to typing and

secretarial-stenographic training, high schools may provide instruction in the operation of office machines, such as photocopiers, transcribing machines, and adding machines. Secretaries and stenographers also train for their jobs through post-secondary training in business schools or in junior colleges. Some post-secondary courses are limited to shorthand and typing and can be completed in a few months. In other courses, usually of longer duration, students also learn additional office skills, such as general business practices and office conduct. There also are courses of study that provide intensive training in stenographic reporting or legal, technical, or medical-dental secretarial work. Some

<sup>17</sup> (D.O.T. 201.268 and .368; 202.368 and .388; 203.138 through .588; and 209.388 through .588), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

public schools conduct cooperative work-study programs that enable students to acquire work experience under trained supervision.

Some secretaries and stenographers obtain their skills in bachelor's degree programs in secretarial studies offered in colleges and universities. Others train in programs established under the Manpower Development and Training Act of 1962. In 1966, about 8,700 persons were enrolled in MDTA institutional programs for secretaries, stenographers, and typists.

### *Employment Trends and Outlook*

Rising from nearly 1.6 million to about 3.1 million, employment of stenographers, secretaries, and typists increased nearly double between 1950 and 1966. Expansion of economic activity and growth in the complexity of modern business tended to increase the volume of paperwork and, thus, employment requirements for these workers.

Employment requirements for stenographers, secretaries, and typists are expected to increase more than one-fourth during 1966-75, and rise from 3.1 million in 1966 to approximately 3.9 million in 1975. This

projected increase in requirements will result from the continued expansion of general economic activity and, in particular, the continued rapid expansion of these industries employing large numbers of clerical personnel, such as finance, insurance, and real estate. Furthermore, as modern business organizations continue to grow in size and complexity, the volume of paperwork also will expand.

Technological developments are not expected to significantly limit growth in employment requirements for stenographers, secretaries, and typists as a group during the decade ahead. However, the increased use of duplicating machines, flexowriters, dictating machines, and other office equipment is expected to increase output per employee, particularly of workers who perform the more routine tasks.

In addition to manpower needs for occupational growth, many secretaries, stenographers, and typists will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, family, or other reasons. Each year, withdrawals from the labor force alone are estimated to be between 4.5 and 5.5 percent of all secretaries, stenographers, and typists.

## SALES WORKERS

### *Current Employment*

Approximately 4.8 million sales workers were employed in the United States in 1966. Most were employed in retail trade. About one-fourth worked part time or less than a 35-hour week. Women accounted for about two-fifths of all persons in the occupation group.

### *Training*

The methods of acquiring training for sales work—like the work itself—vary. Salesclerks who do little more than wait on people to sell standardized merchandise seldom have specialized training. They usually learn their duties on the job by working with experienced salesclerks. In some large stores, new workers may attend brief training courses.

Sales workers who sell complex products or services, such as computers or industrial machinery, sometimes receive from their employers specialized training that may last several months. Salesmen who must discuss technical aspects of a product often receive the required background through college programs in engineering or some other related field. Those dealing in specialized services and products may acquire the necessary technical knowledge by taking courses offered by colleges and universities or by manufacturers. Still others gain "know-how" through years of on-the-job experience, often supplemented by home study.

### *Employment Trends and Outlook*

Rising from about 3.4 million to about 4.8 million, employment of sales workers increased about two-fifths between 1947 and 1966. Increased sales of many new products, resulting from rapid population growth, new product development, business expansion, and rising income levels, was the major reason for increased employment of salesworkers.

Employment in some types of saleswork increased faster than in others. Among the large sales occupations that had particularly rapid growth are real estate salesman, insurance agent, manufacturers' salesman, and wholesale salesman. Some smaller sales occupations such as demonstrator, stock and bond salesman, and house-to-house salesman also increased rapidly. The number of retail salesworkers grew very little; this occupation, however, represents the largest category of sales workers.

Employment requirements for sales workers are expected to reach 5.9 million in 1975, nearly one-fourth above the 1966 level. The same factors that affected employment growth in the past are expected to continue to result in a growth of salesworker employment in the future. In addition, employment prospects in a variety of sales occupations will be enhanced by growth in particular types of business activity. For example, the expected increase in residential and commercial construction and urban renewal will increase the need for real estate agents, continued extension of laws such as workman's compensation and automobile liability insurance should boost the need for insurance salesmen, and continuation of the trend for stores in metropolitan areas to remain open longer should increase the need for retail salespersons. However, in recent years, the growth of retail salesworker employment in many trade establishments, such as variety stores, supermarkets, and department stores, has been limited by the increasing use of self-service and checkout counters. This trend is expected to continue, but at a slower rate than in recent years. In addition, an increasing variety of goods are expected to be merchandised through vending machines.

In addition to manpower needs for occupational growth, many sales workers will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, family, or other reasons from 1966-75. For example, each year, withdrawals from the labor force alone are estimated at between 2.5 and 3.0 percent of all sales workers.

### Retail Salesworkers<sup>18</sup>

#### *Current Employment*

The largest group of salesworkers, about 2.6 million, were employed in retail trade in 1966. Of this number, nearly three-fifths were women who predominated in

department, variety, apparel, and drug stores. Men outnumbered the women in automobile dealerships, and

<sup>18</sup>(D.O.T. 260, through 290.068, .118, .128, .158, .250, .258, .383, .858). *Dictionary of Occupational Titles*. U.S. Department of Labor, 1966, 3d edition.

in stores selling furniture, household appliances, hardware, farm equipment, shoes, and lumber.

The largest employers of retail salesworkers were general merchandise (including department and variety stores), food, and apparel stores, and motor vehicle and accessory dealers. Substantial numbers of salesworkers also were employed by lumber and building materials dealers, drug, shoe, appliance, furniture and home furnishings, and hardware and farm equipment stores.

### *Training*

Salesworkers employed by retail establishments are trained in a variety of ways. Newly hired sales personnel usually receive on-the-job instruction in sales and store methods. They learn about credit and other store policies and any special information that is required to sell a product. In a great many small stores, new employees receive their training on the job, and work under the close supervision of an experienced employee or the proprietor. In large stores, training programs are likely to be more formal, and beginners usually attend training sessions for a few days.

Some salesworkers receive specialized sales training in high schools that have distributive education programs. Such programs include courses in merchandising, principles of retailing, and retail selling. These schools also provide an opportunity for students to gain practical experience under trained supervision by working part time in local stores. The Federal Government sponsors training of retail salesworkers under the Manpower Development and Training Act of 1962. In 1966, about 2,400 persons were enrolled in MDTA institutional programs for retail salesworkers.

### *Employment Trends and Outlook*

Rising from about 2.4 million to nearly 2.9 million, employment of retail salesworkers increased about one fifth between 1950 and 1966. The major reason for this increase in employment was increased sales of many products, resulting from population growth, new product development, business expansion, and rising income levels.

Employment requirements for retail salesworkers are expected to reach 3.2 million in 1975, about one-fourth above the 1966 level. The projected increase in employment is based on anticipated increases in population and disposable personal income, which will result in a rising volume of sales. Also, the trend for stores in metropolitan and suburban areas to stay open longer will result in the need for additional salesworkers. However, the growth of retail salesworkers will be restricted as variety and department stores and large supermarkets continue to replace salesworkers with self-service and check-out counters. In addition, vending machines are expected to provide an increasing variety of goods once handled by salesworkers.

In addition to manpower needs for occupational growth, many retail salesworkers will be needed to replace those who transfer to other occupations, or who die, retire, or withdraw from the labor force for family or other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 3.0 to 3.5 percent of all retail salesworkers.

## Wholesale Salesmen<sup>19</sup>

### *Current Employment*

More than 700,000 wholesale salesworkers were employed in the United States in 1966, about 95 percent of whom were men.

The largest employers of wholesale salesmen are companies that sell food and food products. Other large employers are wholesalers of drugs, dry goods and apparel, motor vehicles and equipment, electrical appliances and other items for home use, and products such as ma-

chinery and building materials for use by industrial and business firms.

### *Training*

Most wholesale salesmen have completed formal education only through high school. However, many wholesale salesmen who sell technical and scientific products, such as heating and air-conditioning equipment, medical supplies, and electronic equipment, have completed specialized training in a junior college or 4-year college program.

<sup>19</sup> (D.O.T. 260. through 289.068, .118, .128, .151, .158, .250, .258, .383, .858), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

Wholesale salesmen usually begin work in a trainee job. Although the time spent in these initial jobs varies among companies, 2 years or longer are required to prepare for outside selling. Prospective salesmen often begin in the stockroom, where they become familiar with the items the wholesaler carries. They may transfer later to the pricing desk where they learn prices of articles and discount rates for goods sold in quantities. Next, they are likely to be "inside salesmen," and write orders that come from customers by telephone. After trainees have become familiar with the company's products, customers, and techniques of selling, they are assigned a territory of their own.

#### *Employment Trends and Outlook*

Employment of wholesale salesmen increased by nearly two-fifths between 1950 and 1966, from about 510,000 to more than 700,000. New product development, business expansion, and rising income levels were major factors underlying the increased employment of wholesale salesmen.

Employment requirements for wholesale salesmen are expected to reach nearly 900,000 in 1975, about one-

fourth higher than the 1966 level. The expected growth is based on a continued rising demand for goods and services, and a corresponding increase in the amount of business transacted by wholesale houses. In the next decade, wholesale salesmen will spend an increasing proportion of their time rendering special services to customers, this practice, in turn, will add to the need for sales personnel. As chain stores and other large business firms continue to centralize their purchasing activities, the value of the sales that wholesalers make to individual customers will become larger and competition for sales will be correspondingly greater. To meet this competition, wholesalers can be expected to place an increasing amount of emphasis on sales activities.

In addition to manpower needs for occupational growth, many wholesale salesmen will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons from 1966-75. For example, each year, withdrawals from the labor force alone are estimated to be between 2.0 and 2.5 percent of all wholesale salesmen.

### Manufacturers' Salesmen<sup>20</sup>

About 600,000 manufacturers' salesmen were employed in the United States in 1966. About three-fourths of all manufacturers' salesmen worked in non-durable goods manufacturing industries. The printing and publishing industry, the largest single employer of sales workers (reflecting the large number of newsboys employed), accounted for nearly two-fifths of all manufacturers' salesmen. The food and kindred products industry employed nearly one-fifth of these workers. Other durable and nondurable goods industries which have large numbers of manufacturers' salesmen were chemicals and allied products; fabricated metal products; electrical and other machinery; and apparel.

#### *Training*

Large numbers of manufacturers' salesmen are college graduates. Many of those who sell technical products and equipment, such as electrical equipment, heavy machinery, and some types of chemicals, have college training in engineering, chemistry, or other technical specialties. Many salesmen of nontechnical products are college graduates who have a degree in liberal arts or business administration. Also, many persons who have

little or no training beyond high school are employed as manufacturers' salesmen; such workers generally sell nontechnical products.

Beginning salesmen usually are given some company sponsored training before they start on the job. Formal training programs can last 2 years or more, especially in companies manufacturing complex, technical products. In some of these programs, trainees are rotated among jobs in several departments of the plant and office to learn all phases of production, sales, and distribution of the products. Some training programs include formal instruction in classes at the plant, sometimes followed by intensive on-the-job training in a branch office under the supervision of field sales managers.

#### *Employment Trends and Outlook*

Rising more than two-fifths from approximately 445,000 to about 600,000, the occupation of manufacturers' salesmen grew rapidly between 1950 and

<sup>20</sup> (D.O.T. 260. through 289.068, .118, .128, .151, .158, .250, .858), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

1966. Growth in population and income levels and the development of new products were major factors underlying this increase.

Employment requirements for manufacturers' salesmen are expected to increase to about 740,000 in 1975, because of further increases in population, income levels, and industrial production. Furthermore, continued development of new products and improvements in marketing techniques are expected to heighten competi-

tion among manufacturers, and cause them to place greater emphasis on their sales activities.

In addition to manufacturers' salesmen who will be required for occupational growth, many will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirements, or other reasons from 1966-75. For example, each year, withdrawals from the labor force alone are estimated to be between 2.0 and 2.5 percent of all manufacturers' salesmen.

## Insurance Agents and Brokers<sup>21</sup>

### *Current Employment*

About 400,000 insurance agents and brokers were employed in the United States in 1966, about 90 percent of whom were men. About half of all insurance agents and brokers specialized in life insurance; the other half sold property and casualty insurance.

### *Training*

Most insurance agents and brokers entering the field in recent years have had some college training. Many have taken courses in accounting, economics, finance, and business law as well as courses in insurance subjects. Others have completed a liberal arts curriculum.

Before they start selling, new agents usually receive training at insurance company home offices, or at the agency or brokerage firms where they will be working.

Some insurance companies sponsor classes in sales problems and insurance principles. This instruction may be given over several weeks or a few months. In other cases, training takes the form of working on the job under the direct supervision of experienced sales personnel.

Many agents and brokers have broadened their knowledge of the insurance business by enrolling in intermediate or advanced courses available at many colleges and universities, and by attending institutes, conferences, and seminars sponsored by insurance organizations. An insurance agent and broker can become designated as a Chartered Life Underwriter (CLU) or a Chartered Property Casualty Underwriter (CPCU) by passing a series of examinations.

All insurance agents and most brokers must obtain licenses in the States where they plan to sell insurance. In most States, licenses are issued only to applicants who pass written examinations covering insurance fundamentals and the State insurance laws.

### *Employment Trends and Outlook*

Employment of insurance agents and brokers increased nearly one-half between 1950 and 1966, from almost 275,000 to about 400,000. Factors contributing to employment growth during this period were a growing population; rising personal income; and longer life expectancy, which resulted in greater interest in life insurance to build adequate retirement funds. Also, expansion in industrial plant and equipment and increases in major consumer purchases such as homes and automobiles added to the need for property and liability agents and brokers.

Employment requirements for insurance agents and brokers are expected to reach about 450,000 in 1975, one-eighth higher than the 1966 level. This expected increase in employment will result mainly from a rapidly increasing volume of insurance business. As the population continues to grow more individuals will purchase life insurance as well as insurance to provide retirement income and funds for children's education. In the business world, more property and liability insurance will be required as new plants are built, new equipment is installed, and more goods are shipped. Furthermore, as the coverage of State workmen's compensation laws is broadened, more employers may need workmen's compensation insurance.

In addition to insurance agents and brokers who will be required for occupational growth, many will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons from 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 2.0 and 2.5 percent of all insurance agents and brokers.

<sup>21</sup> (D.O.T. 250.258), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

## CRAFTSMEN, FOREMEN, AND KINDRED WORKERS (SKILLED WORKERS)

### *Current Employment*

More than 9.6 million craftsmen, foremen, and kindred workers were employed in 1966. More than half of these workers were employed in two broad occupational groupings—construction craftsmen (29 percent) and mechanics and repairmen (25 percent). Approximately 850,000 were carpenters and about 785,000 were automotive mechanics. Other skilled occupations that had over 100,000 workers included painter; electrician; plumber and pipefitter; skilled machining worker; stationary engineer; excavating, grading, and road machinery operator; bricklayer; appliance serviceman; compositor and typesetter; tool and diemaker; and television and radio service technician. However, many skilled occupations, such as paperhanger, engraver, and electrotypist, had fewer than 20,000 workers each.

Although skilled workers were employed in almost every industry in 1966, more than three-fifths were employed in manufacturing and construction. Those manufacturing industries employing the largest numbers of skilled workers included the primary metals, fabricated metals, electrical machinery, machinery (except electrical), transportation equipment, food and kindred products, and printing and publishing. More than 90 percent of all craftsmen, foremen, and kindred workers worked for private employers or Federal, State, or local governments; the rest were self-employed. The occupations which have the largest number of self-employed workers included carpenter, automobile mechanic, painter, plumber and pipefitter, radio and television service technician, and brickmason.

### *Training*

Most craftsmen, foremen, and kindred workers complete extensive training to qualify for their jobs. Many skilled workers acquire the skills of their occupations through a formal apprenticeship program consisting of systematic on-the-job training, supplemented by formal classroom instruction. Apprenticeship programs generally last 4 years; however, they range from 3 to 6 years. Some skilled workers also learn the skills of their trade through formal training programs, other than apprenticeship, offered by employers. These programs generally provide systematic on-the-job training and may include supplementary classroom instruction.

Many workers acquire the knowledge to become skilled workers by moving from one semiskilled job to another over a period of years. In these cases, new workers begin on the simplest task under the direction of a foreman or an experienced worker and gradually progress to more difficult work. Others learn a skilled trade in vocational, trade, and technical schools. Some workers in semiskilled or unskilled jobs qualify for more skilled work by completing correspondence courses, manufacturers' training programs, or by taking vocational courses in the evening. In addition, workers being trained or retrained for skilled occupations make up one of the largest groups to receive training in programs operated under the Manpower Development and Training Act of 1962.

The Armed Forces are an important source of skilled workers. Training acquired in the Armed Forces often qualifies persons for skilled jobs in civilian life, such as automobile mechanic, electrician, or office machine repairman.

### *Employment Trends and Outlook*

Rising from almost 7.8 million to nearly 9.6 million, employment of craftsmen, foremen, and kindred workers increased nearly one-fourth between 1947 and 1966. Employment increased relatively rapidly in the early years from 1947-66, and reached 8.4 million in 1951; but during 1951-62 employment changed relatively little, and fluctuated between 8.3 million and 8.7 million. In 1963, however, employment increased sharply to 8.9 million and by 1966, it stood at nearly 9.6 million.

Employment trends between 1950 and 1966 varied sharply among the individual skilled occupations. For example, although construction activity increased during this period, employment of carpenters declined, primarily as a result of growing use of prefabricated building components and increasing efficiency of tools and equipment. Employment of bakers also fell slightly, chiefly as a result of increasing mechanization of bakery production processes and fewer establishments in the baking industry.

Many skilled occupations, on the other hand, increased in numbers between 1950 and 1966. For instance, increases in construction activity resulted in significant employment gains for cement and concrete finishers and terrazzo workers (67 percent); excavating,

grading and road machinery operators (137 percent), plumbers and pipefitters (17 percent), and electricians (23 percent). Significant employment gains also were recorded for tool and diemakers (30 percent), primarily because of a substantial expansion in metalworking activity resulting from increased demand for metal-consumer products such as automobiles, heating and air-conditioning equipment, and household appliances. Employment of mechanics and repairmen grew more rapidly than the skilled work force as a whole between 1950 and 1966. This disparity resulted from the need to maintain, repair, and install the growing volume of increasingly complex equipment used in factories, stores, offices, and homes. For example, employment of business machine servicemen more than doubled, and employment of television and radio service technicians and appliance servicemen each increased more than one-half.

Employment requirements for craftsmen, foremen, and kindred workers are expected to reach about 11.4 million in 1975, 18 percent above the 1966 level. Industrial growth and increasing business activity are the major factors expected to increase the need for skilled workers.

As in the past, rates of employment growth will differ among the skilled occupations. Employment of mechanics and repairmen is expected to continue to grow more rapidly than the skilled work force as a whole. Industry will need increasing numbers of craftsmen to repair and maintain the automatic conveyor systems, sensing and measuring devices, and other instruments and equipment that are becoming an integral part of modern industrial production processes. A growing

stock of household appliances also should increase the need for mechanics and repairmen.

Employment requirements for skilled workers in the building trades and in the major skilled machining occupations are expected to increase at slower rates than mechanics and repairmen, since technological developments are expected to partially offset the rising demand for construction and machining work. For example, as more building components such as wall panels, door frames, roof trusses, and precast concrete components are prepared offsite, requirements will be reduced for carpenters, cement masons, and structural metal workers. Similarly, the growing use of plastic materials, such as plastic pipes, polyfoam insulation, and plastic shells may reduce requirements for skilled workers such as plumbers, pipefitters, and brickmasons. Although employment requirements in the machinery occupations are expected to rise from 1966-75, the expanding use of numerically controlled machines is expected to restrict employment growth in these occupations. On the other hand, employment in the printing trades, one of the largest groups of skilled workers, is expected to show little or no change over the next decade because of laborsaving technological changes in printing methods.

In addition to manpower needs for the expected growth in employment requirements, many skilled workers will be needed to replace workers who transfer to other fields of work, or who die, retire, or withdraw from the labor force for other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number about 2.0 percent of all craftsmen, foremen, and kindred workers.

## Airplane Mechanics<sup>22</sup>

### *Current Employment*

Approximately 120,000 airplane mechanics were employed in the United States in 1966. Nearly 2 of every 5 were employed by certificated scheduled and nonscheduled airlines. About one-fourth worked for the military and other agencies of the Federal Government. The remaining mechanics were employed in general aviation, primarily by certificated repair stations.

### *Training*

Most airplane mechanics learn the skills of the trade by working as trainees or apprentices. Large airlines give

apprentices or trainees 3 or 4 years of combined instruction and work experience. Persons who have learned aircraft maintenance in the Armed Forces usually are given credit for this training towards the requirements of apprenticeship or other on-the-job training programs.

Other mechanics prepare for their trade by graduating from a Federal Aviation Agency approved mechanics' school. Most of these schools have an 18- to 24-month program. Several colleges and universities also offer 2-year programs that prepare students for the FAA mechanic examination.

<sup>22</sup> (D.O.T. 621.281), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

Airplane mechanics responsible for any repair or maintenance operation must be licensed by the FAA. At least 18 months' experience working with airframes or engines is required for an airframe or powerplant license, and at least 30 months experience working with both airframes and engines is required for a combined airframe and powerplant license. (However, this experience is not required of graduates of FAA approved mechanics' schools.) In addition to meeting these experience requirements, applicants must pass a written test and give a practical demonstration of their ability to do the work. Mechanics who perform only specific maintenance and repair operations for which their employers received FAA authorization must have still another type of FAA repairman license.

Mechanics who maintain and repair electronic communications equipment are required to have at least a Federal Communications Commission Second Class Radio Telephone Operator License.

### *Employment Trends and Outlook*

Employment of airplane mechanics more than doubled between 1950 and 1966, increasing from approximately 50,000 to an estimated 120,000. Employment of airplane mechanics working for the scheduled airlines, who make up the largest single group in this occupation, increased slightly faster than those employed by nonscheduled airlines, general aviation firms, and government, combined. The rapid growth in employment of airplane mechanics during the 1950's and early 1960's was chiefly the result of dramatic increases in civil flying activity and in the number of registered aircraft; between 1954 and 1966, the total number of eligible registered aircraft on record with the FAA increased from slightly more than 60,000 to almost 95,000, a rise of about two-thirds. In addition, super-

sonic military aircraft required more intensively trained mechanics.

Employment requirements for airplane mechanics are expected to reach about 140,000 by 1975, an increase of more than 15 percent over 1966. This projected increase will result primarily from the anticipated growth in civil flying activities, including a rapid rise in the number of operating aircraft. However, employment requirements for airplane mechanics are not expected to increase as fast as civil flying activities, due to technological improvements that will increase the efficiency of aircraft maintenance work and reduce the ratio of mechanics to operating aircraft.

A large percentage of the projected growth in civilian aircraft is expected to occur in general aviation aircraft, especially among business aircraft users and small commercial operators. The major stimulus for this increase, and the consequent need for mechanics to maintain general aviation aircraft, will result from the rising demand for fast, dependable, and flexible air transportation services.

The number of airplane mechanics required by the scheduled airlines is expected to continue increasing from 1966-75 because of a substantial rise in operating aircraft engaged in passenger and cargo traffic. An increase in requirements also is expected because of the need to service the growing array of complex navigational and control systems being incorporated into modern jet transports.

In addition to manpower needs for occupational growth, many mechanics will be required to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons during 1966-75. For example, each year withdrawals from the labor force alone are estimated to number between 1.0 and 1.5 percent of all airplane mechanics.

## **Automotive Mechanics<sup>23</sup>**

### *Current Employment*

About 785,000 automotive mechanics were employed in the United States in 1966. Included in the occupation classification are automobile mechanics, truck mechanics, bus mechanics, and body repairmen. About three-fourths of these workers are automobile mechanics.

Approximately two-fifths of all automotive mechanics are employed in independent automotive

repair shops. About one-fourth are employed in the service departments of new and used car and truck dealers. More than 1 of every 10 mechanics are employed by organizations that maintain and repair their own motor vehicles, such as trucking companies, automotive leasing companies, and government agencies. Gasoline service stations and department stores employ

<sup>23</sup> (D.O.T. 620.131 through .381, .782 and .885; 721.281; 807.381, and 825.281), *Dictionary of Occupational Titles*, U.S. Department of Labor 1966, 3d edition.

most of the rest to provide automotive repair services. The majority of automotive mechanics work in shops employing from 1 to 5 mechanics. Some of the largest repair shops, however, employ more than a hundred automotive mechanics.

### *Training*

Automotive mechanics acquire their training in a variety of ways. Most automotive mechanics learn the trade on the job. They usually start out as helpers, lubrication men, or gasoline station attendants, and gradually acquire knowledge and skills by working with experienced mechanics or supervisors. Although beginners usually are able to do simple repairs after a few months' experience, at least 3 to 4 years of on-the-job training and experience are required generally to become an all-round mechanic. In contrast, mechanics who specialize exclusively in the repair of items such as radiators, brakes, or front-ends generally learn their specialty in about 2 years of on-the-job training.

Many automotive mechanics obtain formal training either in high school; in trade or technical school; in the Armed Forces; through correspondence school courses; through apprenticeship programs; or through combinations of these types of training. A relatively small number of graduates of automotive mechanic programs in vocational high schools are selected each year to attend factory sponsored training programs for beginners. At the beginning of 1967, about 5,200 persons were enrolled in registered apprenticeship programs for "automobile mechanic," a classification that includes truck and bus mechanics. A small number of additional workers were in unregistered apprenticeship programs. Also, automotive mechanics make up one of the largest groups of workers to receive training under the Manpower Development and Training Act of 1962; in 1966, about 7,200 persons were enrolled in MDTA institutional programs for automotive mechanics.

Many dealers send experienced mechanics to factory training centers, for brief periods, to learn how to repair new car models, or to repair special parts such as automatic transmissions or air-conditioners. Manufacturers

also send representatives to local shops to conduct short training sessions for the shops' mechanics.

### *Employment Trends and Outlook*

Automotive mechanic employment increased from about 650,000 to 785,000 between 1950 and 1966, a rise of about 20 percent. The number of motor vehicles in use—the principal determinant of mechanic employment—increased almost 88 percent during the same period, rising from about 49 million to more than 92 million. The disparity between the rates of growth in employment and in the number of motor vehicles was largely the result of a decline in automotive mechanic requirements for vehicle maintenance. During 1950-66, the average age of motor vehicles in use dropped sharply and, reflected the availability of new vehicles following World War II and high scrappage rates for those produced before the war.

Employment requirements for automotive mechanics are expected to reach about 940,000 in 1975, about one-fifth above the 1966 employment level. The projected increase is based primarily on an anticipated expansion of more than one-fourth in the number of motor vehicles in use between 1966 and 1975. The need for mechanics also will increase because an increasing proportion of vehicles are expected to have air-conditioning, power steering, devices to reduce exhaust fumes, and other features that add to repair and maintenance needs. The effects of the increasing number of vehicles and their greater complexity will be offset partially by decreasing mechanic labor requirements for each vehicle resulting from factors such as growing mechanic and repair shop specialization; greater emphasis on replacement rather than repair of parts; and increasing use of laborsaving equipment, including dynamometers, engine analyzers, and power tools.

In addition to manpower requirements for occupational growth, many mechanics will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 1.0 and 1.5 percent of all automotive mechanics.

## Bakers<sup>24</sup>

### *Current Employment*

More than 100,000 bakers were employed in 1966. This occupation classification includes a wide variety of specialized occupations such as all-round bakers, batter mixers, bench hands, dough mixers, and ovenmen.

About 7 of every 10 bakers were employed in the bakery industry in 1966. Nearly one-fourth were employed in retail bakeries that produced their own baked goods, and the rest worked in establishments such as schools, hospitals, hotels, and restaurants.

### *Training*

Bakers usually acquire their training by working as helpers to skilled bakers. Helpers wash and grease pans, carry ingredients to mixing machines, push troughs of dough to the proofing room, and otherwise assist skilled bakers.

Some bakers learn the skills of the trade through formal apprenticeship programs. Apprenticeship programs last 3 or 4 years, and include on-the-job training in all baking operations and related classroom instructions.

Other workers acquire baking skills by taking courses in vocational schools or by learning some aspects of the trade in the Armed Forces. Although such training may not qualify a worker as a skilled baker, it may help him to become an apprentice and perhaps shorten his apprenticeship period. Some bakers receive training in programs operated under the Manpower Development and Training Act of 1962.

### *Employment Trends and Outlook*

Total employment of bakers decreased from about 120,000 to about 100,000 between 1950 and 1966.

Factors that contributed to the employment decrease included increasing mechanization of bakery production processes and fewer establishments in the baking industry. For example, between 1960 and 1966, the total number of industrial bakeries declined approximately 15 percent.

Employment requirements for skilled bakers are expected to decrease slightly to more than 95,000 from 1966-75. Increasing efficiency in production methods of industrial bakeries is expected to more than offset the growing demand for bakery products. The automation of dough mixing through the continuous mix process virtually eliminates manual operations and increases production capacity. In addition, the increasing use of mechanical devices that require a minimum of direct labor to produce such specialty products as French bread and club rolls will reduce employment requirements.

The growing use of freezing processes also is expected to reduce employment requirements for bakers. Freezing processes make possible the storage of dough and baked goods for future use; eliminate the need for bakers for second and third shifts; increase the distribution area for an establishment's bakery products; and contribute to decreases in the number of establishments necessary to serve an area.

Despite declining manpower needs for skilled bakers during 1966-75, many thousands of bakers will be needed to replace those who transfer to other fields of work, or who die, retire, or otherwise withdraw from the labor force. For example, each year, withdrawals from the labor force alone are estimated to number between 2.0 and 2.5 percent of all bakers.

<sup>24</sup> (D.O.T. 526.781, .782, .884, and .885), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

## Business Machine Servicemen<sup>25</sup>

### *Current Employment*

Approximately 80,000 business machine servicemen were employed in the United States in 1966. Included in the occupational classification are typewriter servicemen, adding machine servicemen, calculating machine servicemen, accounting-bookkeeping machine servicemen, data-processing equipment servicemen, dictating machine servicemen, duplicating and copying machine

servicemen, and servicemen of postage and mailing equipment.

About one-third of all business machine servicemen employed in 1966 were servicing and repairing typewriters, and approximately one-fifth serviced data-processing equipment. Other sizable proportions were

<sup>25</sup> (D.O.T. 633.281), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

employed to service and repair adding machines, calculators, cash registers, and duplicating and copying machines.

It is estimated that in 1966 the majority of business machine servicemen were employed in establishments that manufacture business machines. A large number were employed by independent retailers in repair shops that service business machines. The remaining servicemen worked in a variety of industries, in establishments that had enough machines in daily use to justify employing full-time servicemen.

### *Training*

Many business machine servicemen acquire their skills through a combination of on-the-job training, work experience, and instruction in manufacturers' training schools. Men hired as trainees in manufacturers' branch offices usually are sent to company schools for periods lasting from several weeks to several months, the time required depends upon the type of machines they will service. They then receive from 1 to 3 years of practical experience and on-the-job training. During this period, they may occasionally go back to factory schools for additional training.

Some business machine servicemen learn the trade by working with experienced servicemen in independent shops. Men in independent shops usually receive little formal training. The time required to become a skilled serviceman tends to be somewhat longer in independent shops than in manufacturers' branches, because of the greater variety of machines and the generally informal nature of the training.

The length of the training period of both manufacturers' branch offices and independent shops varies in relation to the complexity of the equipment. To service calculating machines, about 2 years of training and experience are required. Cash register repairmen learn their job in 2½ to 3½ years, the last 6 months of which usually are spent in a company school. Skilled accounting-bookkeeping machine repairmen generally must have at least 3 to 4 years of training and experience. During the first 1 to 2 years they service adding machines, calculators, or cash registers, since such experience is considered valuable background for servicing accounting-bookkeeping machines.

Courses in business machine maintenance and repair conducted by some State and city vocational schools and by private correspondence schools also are a means of learning the skills of the trade. Few business machine servicemen, however, learn in this manner. Some servicemen received training in programs operated under pro-

visions of the Manpower Development and Training Act of 1962.

### *Employment Trends and Outlook*

Estimated employment of business machine servicemen more than doubled during the post-World War II period and reached about 80,000 in 1966 due to increasing use of many types of office machines to do clerical work. Additional business machine servicemen were employed to maintain and service increasing numbers of office machines used for correspondence, recording and processing transactions, and duplicating and mailing information. In addition to greater numbers of machines, many technical changes in long-established types of business machines increased the need for servicemen. For example, electrically driven mechanical equipment, including electric typewriters and adding machines, rapidly is replacing nonelectrical mechanical machines. In recent years, the number of duplicating and copying machine servicemen and dictating machine servicemen has grown fastest, and calculating machine servicemen, slowest.

Employment requirements for business machine servicemen are expected to reach about 105,000 by 1975, an increase of about 30 percent over the 1966 level. This projected increase in employment requirements is based on the expected increase in the use of business machines, resulting in part from continued technological improvements in office equipment. The development of new types of business machines and improvements in present equipment are expected not only to increase the demand for skilled servicemen but also to affect changing skill requirements in existing jobs. Those occupations expected to grow fastest are typewriter serviceman, data-processing equipment serviceman, and duplicating and copying machine serviceman. Those occupations in which employment is expected to grow less rapidly are calculator serviceman, cash register serviceman, and serviceman of postage and mailing equipment.

In addition to manpower requirements for occupational growth, many servicemen will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons during 1966-75. However, because many of the workers in this occupation are relatively young, estimated annual withdrawals from the labor force will number less than 1.0 percent of all business machine servicemen.

*Current Employment*

About 850,000 carpenters were employed in the United States in 1966. Most carpenters work in the construction industry and are employed primarily by contractors and homebuilders at construction sites. Some carpenters alternate between wage employment with contractors and self-employment on small jobs. Some work for government agencies or nonconstruction firms that employ a separate work force for their own construction work. A large number of carpenters do maintenance work in factories, hotels, office buildings, and other large establishments. Others are employed in shipbuilding, mining, and the production of many kinds of display materials.

*Training*

Most training authorities, including the national joint labor-management apprenticeship committee for the carpentry trade, recommend the completion of a 4-year apprenticeship program as the best way to learn carpentry. In early 1967, about 23,000 individuals were registered in formal apprenticeship training programs.

A substantial number of carpenters acquire the skills of their trade informally by working as helpers or handymen; they observe and learn from experienced carpenters. Many of these men also take correspondence or trade school courses. Some carpenters receive their training through programs operated under provisions of the Manpower Development and Training Act of 1962. In 1966, about 1,000 workers were enrolled in MDTA institutional programs for carpenters.

*Employment Trends and Outlook*

Employment of carpenters declined from about 1 million to about 850,000 between 1950 and 1966; however, this occupation remained the largest among the skilled trades occupations. The decline can be attributed in part to the growing use of prefabricated building components and the increasing efficiency of tools and equipment, both of which increased the value of construction put in place by each worker. For example, walls and

partitions prepared off site can be lifted into place in one operation, sometimes by workers other than carpenters. Improved equipment and tools that have increased the efficiency of carpentry work include nails which have improved holding properties, so that fewer nails and less hammering are required, and power-driven tools such as stud drivers, screw drivers, sanders, saws, staplers, and nailing machines.

Employment requirements for carpenters are expected to reach approximately 900,000 in 1975 as a result of the large increase anticipated in construction activity. The factors that are expected to stimulate construction activity include large increases in population and in the number of households, high levels of personal and corporate income, rising expenditures for new industrial and commercial facilities, and increases in government expenditures for highways and schools. More carpenters also will be needed in the maintenance department of factories, commercial establishments, large residential projects, and government agencies.

Employment growth of carpenters will be limited by the increasing use of construction materials and techniques that further reduce the amount of carpentry work required in building construction. For example, steel framing, already used in many commercial buildings, may be used increasingly in houses. When houses are framed in steel, curtain wall panels can be quickly fastened in place. These wall panels may reduce the need for carpenters because they are available in nonwood materials such as glass, aluminum, and porcelain-coated steel, which can be installed by craftsmen other than carpenters. In addition, the growing use of plastics and strong adhesives is expected to reduce the time needed to put building components in place.

In addition to the carpenters required for employment growth through the mid-1970's, many thousands will be needed to replace those who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons. For example, each year, withdrawals from the labor force alone are estimated to number between 2.0 and 2.5 percent of all carpenters.

<sup>26</sup> (D.O.T. 860.281 through .781), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

## Cement and Concrete Finishers and Terrazzo Workers<sup>27</sup>

### *Current Employment*

Approximately 55,000 cement and concrete finishers and terrazzo workers were employed in the United States in 1966. Most of these workers were cement and concrete finishers; terrazzo workers constituted only a small proportion of the total.

Cement and concrete finishers work principally on large buildings, but many are employed on highway or other nonbuilding construction. They work directly for general contractors who are responsible for constructing entire projects such as highways, or large industrial, commercial, and residential buildings. They also work for concrete contractors who do only the concrete work on a large construction project, or who work on smaller projects such as sidewalks, driveways, and basement floors. A small number work for municipal public works departments, public utilities, and manufacturing firms that do their own construction work. Some cement finishers are self-employed and do small concrete jobs such as sidewalks and steps. Terrazzo workers are employed mainly in new building construction and in large urban areas. Substantial numbers of terrazzo workers are employed in Florida and California, where concrete flooring often is necessary because of insect damage to wood.

### *Training*

Most training authorities recommend a 3-year apprenticeship program as the best way to learn to become cement and concrete finishers. Nearly 2,000 individuals were registered as apprentices in these trades in early 1967.

A substantial number of cement and concrete finishers and terrazzo workers have acquired their skills by working for many years on construction jobs as helpers; they observed, assisted, and learned from skilled workers.

### *Employment Trends and Outlook*

Employment of cement and concrete finishers and terrazzo workers increased about two-thirds between 1950 and 1966. This rapid increase resulted primarily from an increase in construction activity and a growing use of concrete and concrete products.

Employment requirements for cement and concrete finishers and terrazzo workers are expected to reach approximately 75,000 in 1975, more than one-third above the 1966 level. The projected increase in employ-

ment requirements for cement and concrete workers is based on an anticipated rapid increase in construction activity, especially highway, industrial, and commercial construction; and a growing use of concrete and concrete products, especially prestressed concrete and lightweight concrete wall panels. Prestressed concrete makes possible the use of wide spans where column-free construction is desired. The use of concrete and concrete products has expanded to include thin shell dome roofs, ornamental grill-work, and slab and arch roofs in residential buildings, and girders, columns, piles, and beams for bridges.

Employment requirements for terrazzo workers also are expected to increase very rapidly through the mid-1970's, especially in Florida, Southern California, and other warm regions of the country where concrete flooring is often necessary. Employment growth will be further stimulated by the use of new materials such as epoxy and latex terrazzo, which are lighter and take less space than cement-based terrazzo and can be used on upper floors of multistoried buildings.

Although employment requirements for cement and concrete finishers are expected to increase rapidly through the mid-1970's, growth will be limited somewhat by the growing use of laborsaving innovations. Many concrete products are now precast away from the site, and these products generally do not require finishing. The efficiency of on-site masons also has increased through the use of new and improved construction methods, materials, and equipment. Concrete slabs for roofs and floors can be processed at ground level and raised into place with synchronized hydraulic jacks or cranes. Walls can be processed in the same manner and tilted into place. Worker efficiency also has been increased by the introduction in recent years of new machines, including powered concrete conveyors, portable powered screeds, electric concrete vibrators, hydraulic joint-forming machines, powered concrete cutting saws, and cement finishing machines.

In addition to manpower requirements for occupational growth, many cement and concrete finishers and terrazzo workers will be needed to replace those who transfer to other fields of work, or who retire, die, or otherwise withdraw from the labor force. For example, each year, withdrawals from the labor force alone are estimated to number between 1.5 and 2.0 percent of all cement and concrete finishers and terrazzo workers.

<sup>27</sup> (D.O.T. 844.884; 852.884 and 861.781), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

## Compositors and Typesetters<sup>28</sup>

### *Current Employment*

About 170,000 compositors and typesetters were employed in the United States in 1966. They represented the largest printing craft occupation—nearly half of all printing trades craftsmen. Nearly 9 out of 10 of these workers are males. More than four-fifths of all compositors and typesetters worked in the printing, publishing, and allied industries in 1966. Others were employed in the paper and allied products industry; in wholesale and retail trade; in finance, insurance, and real estate; and in government.

### *Training*

An estimated 60 percent of all compositors and typesetters acquired their skills through apprenticeship programs. Others worked for several years as helpers to experienced compositors and typesetters, particularly in small shops and in small communities.

A typical apprenticeship program includes receiving instruction in elementary hand composition, page makeup, lockup (preparation of the composition for printing or for duplicate platemaking); taking trial or galley proofs of the composition; and reading proof. After basic training as a hand compositor, the apprentice receives intensive training in one or more specialized fields, such as the operation of typesetting machines—including phototypesetters, cold type composition machines, and teletypesetters—as well as specialized work in composition for both letterpress and offset printing.

<sup>28</sup> (D.O.T. 973.318), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

### *Employment Trends and Outlook*

Employment of compositors and typesetters was about the same in 1966 as in 1950, despite an approximate two-thirds increase in the production of printed materials. Employment growth was limited by increasing technological innovations in typesetting equipment and by changes in printing processes that make it possible to set more type without an increase in the number of craftsmen. For example, over the past decade, there was increasing use of tape-operated typesetting equipment that sets type much faster than a typesetter can manually operate a typesetting machine. Pasting up photo-composed materials on a layout sheet is a simpler and faster operation for a compositor than assembling metal type and photoengravings and fitting them in place in a metal frame.

Employment requirements for compositors and typesetters are expected to decline to about 155,000 by 1975, despite anticipated significant increases in the production of printed materials. The projected decrease in employment is based on anticipated expansion in the use of the laborsaving technological innovations, as well as the application of electronic computers to the typesetting process. However, despite the anticipated employment decline, a few thousand job openings for compositors and typesetters are expected annually because of the need to replace workers who retire, die, or withdraw from the labor force for other reasons, or who transfer to other occupations. For example, each year, withdrawals from the labor force alone are estimated to number between 2.0 and 2.5 percent of all compositors and typesetters.

## Electricians<sup>29</sup>

### *Current Employment*

About 400,000 electricians were employed in the United States in 1966. More than 40 percent of all electricians worked in the construction industry, primarily for electrical contractors. Substantial numbers of electricians were self-employed; others worked for government agencies or business establishments that do their own electrical construction work. Many electricians also

were employed in manufacturing establishments and in the public utilities industries.

### *Training*

Most training authorities recommend the completion of a 4-year apprenticeship program as the best way to learn the skills of the trade. In early 1967, more than 25,000 persons were enrolled in formal apprenticeship programs for this trade. All apprenticeship programs are conducted under written agreements between the apprentice and the local joint union-management

<sup>29</sup> (D.O.T. 821.381; 824.281; 829.281 and .381), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

apprenticeship committee, which supervises the training. The committee determines the need for apprentices in the locality, establishes minimum training apprenticeship standards, and schedules a diversified rotating work program. This program is designed to give the apprentice all-round training by having him work for several electrical contractors who engage in particular types of work.

Many electricians have learned the trade through years of informal on the job training. Working as helpers, they observed and learned from experienced craftsmen. Some of these persons have gained knowledge by taking trade school or correspondence courses, or through special training while in the Armed Forces.

Because improperly installed electrical work is hazardous, most cities require electricians to be licensed. To obtain a license, electricians must pass an examination that requires a thorough knowledge of the craft, and of State and local building codes.

### *Employment Trends and Outlook*

Estimated employment of electricians rose from about 325,000 to 400,000 between 1950 and 1966, an increase of nearly one-fourth. In recent years, however, employment growth has slowed because of the increasing use of labor-saving technological innovations.

Employment requirements for electricians are expected to reach about 450,000 in 1975. This increase is based on the anticipated rapid expansion in construction activity, and results primarily from rising popula-

tion, increasing family formations, and increasing personal and corporate income. Increased requirements for electrical outlets, switches, and wiring in homes are expected in order to accommodate the expanding use of appliances and air-conditioning systems. In addition, more extensive wiring systems will be needed to install electronic data processing equipment and electrical control devices being used increasingly in commerce and industry. The number of "all electric" homes, outdoor radiant heating, and ice and snow-melting systems also is expected to increase.

Technological developments, however, are expected to continue to limit growth in employment requirements for electricians. A major development that increases output for each worker is the prefabrication of electrical equipment. For example, preassembled and prewired ceiling units that the electrician connects to the power source eliminate the need to wire the complete system and to install individual fixtures. Also, improved tools, such as multiple spindle drills, cordless electric drills, and saws, as well as "kits" of splicing materials have reduced the time needed by electricians to do field installation of cable splices.

In addition to manpower needs for occupational growth, many electricians will be required to replace workers who transfer to other types of work, or who die, retire, or withdraw from the labor force for other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 1.5 and 2.0 percent of all electricians.

## Excavating, Grading, and Road Machinery Operators<sup>30</sup>

### *Current Employment*

Nearly 270,000 excavating, grading, and road machinery operators were employed in the United States in 1966. About three-fourths of these workers were employed in the construction industry primarily by contractors engaged in highway, dam, airport, and other large-scale engineering projects. Others were employed by utility companies, manufacturers, and other business firms that do their own construction, as well as by State and local public works and highway departments.

### *Training*

Most training authorities recommend completion of a 3-year apprenticeship program as the best way to acquire

the skills needed to be excavating, grading, or road machinery operators. In 1966, only a small number of individuals were enrolled in apprenticeship training programs for these occupations.

Many excavating, grading, and road machinery operators acquire their training on the job. Such individuals generally enter the occupation through jobs as oilers (assistants) or as helpers to heavy equipment repairmen; gain a knowledge of the machinery; and learn to keep it in good working order and to make repairs. Oilers and helpers must perform their work well and demonstrate initiative before they are given instruction in operating

<sup>30</sup> (D.O.T. 850.782 through .887; 851.883 and .887; 852.883; 853.782 and .882; 859.782; 859.883), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

the equipment. Acquiring the skills of the trade on the job usually takes much longer than acquiring them through a formal apprenticeship.

### *Employment Trends and Outlook*

Rising from about 114,000 to about 270,000, employment of excavating, grading, and road machinery operators more than doubled between 1950 and 1966. This rapid increase was spurred by increases in construction activity especially highway construction. In response to demand for better methods to facilitate construction activity, many new types of excavating, grading, and road machinery were introduced during this period.

Manpower requirements for operators of this equipment are expected to increase to approximately 335,000 by 1975, nearly one-fourth above the 1966 level. This projected increase is based on an anticipated continued increase in the use of construction machinery, primarily in highway construction. The need to maintain and repair the Nation's expanding systems of highways also will increase requirements for these machinery workers. In addition, the requirements for machinery operators will be stimulated by the continuing trend toward greater use of construction machinery in nearly all other types of construction activity.

Technological developments are expected to limit the growth in employment requirements in the occupation. The size, speed, mobility, and durability of equipment

are being increased. For example, earth moving equipment now moves many times the amount of materials that could be moved a few years ago, and scrapers can excavate and carry from 50 to 150 cubic yards of dirt in one load. In addition to improvements in conventional equipment, many types of machines developed in recent years are expected to gain widespread use in the future. One example is the slip-form paver that spreads, vibrates, forms, and finishes concrete paving in one continuous operation. The slip-form paver replaces at least four other machines formerly used in concrete paving.

New and improved construction machines are expected to decrease unit labor costs for skilled operators. However, the development of special-purpose machines to perform jobs for which machines are not now available, especially those designed specifically for use on smaller construction projects, is expected to stimulate employment requirements for these workers, and increase the requirements for heavy equipment mechanics to keep the expanding number of machines in good working order.

In addition to manpower needs for occupational growth, many excavating, grading, and road machinery operators will be required to replace workers who transfer to other occupations, or who die, retire, or otherwise withdraw from the labor force during 1966-75. For example, each year, withdrawals from the labor force alone are expected to number between 1.0 and 1.5 percent of all excavating, grading, and road machinery operators.

## Skilled Machining Workers<sup>31</sup>

### *Current Employment*

Approximately 500,000 skilled machining workers were employed in the United States in 1966. More than four-fifths of these workers were employed in manufacturing industries. Establishments producing machinery (except electrical) employed the largest proportion of machinists—almost one-third. Many machinists were employed in establishments producing transportation equipment, fabricated metal parts, electrical machinery, and primary metals. Other industries employing large numbers of these workers were the railroad, chemical, food processing, and textile industries.

### *Training*

According to most training authorities, apprenticeship is the preferable way to learn the machinist trade. A

typical apprentice program lasts 4 years and consists of approximately 8,000 hours of shop training and about 570 hours of classroom related instruction. Shop training includes learning the operation of various types of machine tools. The apprentice also is taught chipping, filing, handtapping, dowel fitting, riveting, and other hand operations. In the classroom, the apprentice studies blueprint reading, mechanical drawing, shop mathematics, and shop practices.

A substantial number of skilled machining workers learned their skills through years of varied experience in machining jobs. Several companies have training programs that qualify some of their employees as machinists in fewer than 4 years.

<sup>31</sup> (D.O.T. 600. through 607.886, 609.280 through .782 and 609.885), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1956, 3d edition.

## *Employment Trends and Outlook*

Employment of skilled machining workers remained unchanged at about 500,000 between 1950 and 1966, despite a substantial expansion in machining activity. Employment growth of skilled machining workers, however, was restricted by the introduction of technological developments such as increased power and speed of conventional machine tools and, in recent years, numerically controlled machine tools.

Employment requirements for skilled machining workers are expected to change very little between 1966 and 1975, as numerically controlled machine tools and other laborsaving technological innovations will offset the continued expansion of metal working activities. Population expansion and increasing personal disposable income are expected to result in a rapid increase in

purchases of consumer goods produced in metal-working industries, such as automobiles, heating and air-conditioning units, and home appliances. Growing business and consumer demand should result in higher expenditures for new industrial plant capacity and stimulate orders for industrial machinery, construction machinery, machine tools, materials handling equipment, engines, instruments, and other products manufactured in metal-working industries.

Although employment requirements are not expected to increase between 1966 and 1975, many machinists will be needed to replace those who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons. For example, each year withdrawals from the labor force alone are estimated at between 2.0 and 2.5 percent of the total number of machinists.

## **Plumbers and Pipefitters<sup>32</sup>**

### *Current Employment*

About 350,000 plumbers and pipefitters were employed in the United States in 1966. Although plumbing and pipefitting sometimes are considered to be a single trade, journeymen in this field can specialize in either of these crafts.

Most plumbers and pipefitters are employed by plumbing contractors in new building construction, mainly at the construction site. A substantial proportion are self-employed or work for plumbing contractors doing repair, alteration, or modernizing work. Some install and maintain pipe systems for government agencies and public utilities, and others work on the construction of ships and aircraft. Some do maintenance work in industrial and commercial establishments. Pipefitters, in particular, are employed as maintenance personnel in the petroleum, chemical, and food-processing industries where the industrial operations include the processing of fluids through pipes.

### *Training*

Most training authorities, including the national joint labor-management apprenticeship committee for the plumbing and pipefitting industry, recommend a formal 5-year apprenticeship for plumbers and pipefitters as the best way to learn all aspects of the trade. In early 1967, more than 25,000 individuals were registered in formal apprenticeship programs. Most of the apprentice training

programs are conducted under written agreements between the apprentices and local joint apprenticeship committees, composed of union and management representatives who supervise the training. The apprenticeship committee determines the need for apprentices in the locality, establishes minimum apprenticeship standards of training and, if necessary, schedules a rotating work program. This program is designed to give the apprentice diversified training by having him work for several plumbing or pipefitting contractors. A large number of plumbers and pipefitters acquired their skills informally by working for several years with craftsmen and receiving instruction from them. Many of these workers gained some of their knowledge of the trade by taking trade or correspondence school courses. Some plumbers and pipefitters received training in programs operated under provisions of the Manpower Development and Training Act of 1962.

### *Employment Trends and Outlook*

Employment of plumbers and pipefitters increased one-sixth between 1950 and 1966, from about 300,000 to about 350,000. Most of this increase can be attributed to growth in new construction activities.

Employment requirements for plumbers and pipefitters are expected to reach about 425,000 in 1975, about one-fifth above the 1966 level. The projected

<sup>32</sup> (D.O.T. 862.381), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

increase in employment requirements is based primarily on an anticipated rapid increase in construction activity resulting from rising population, increasing family formations, and growing personal and corporate income. In addition, plumbing and heating work is expected to become more important in many types of construction. For example, the trend toward more bathrooms for each dwelling unit is likely to continue. The installation of large appliances such as washing machines, dishwashers, and water-disposal units will become more widespread. Also, an increase in the number of automatic heating systems is anticipated.

The demand for installation workers also will rise because pipework is becoming important in many industries. For instance, the chemical and petroleum industries, which use extensive pipework in their processing activities, are continuing to expand their facilities. In addition, more maintenance and repair work for plumbers and pipefitters should result from the growing number of industrial activities associated with atomic energy, and the increased use of industrial refrigeration and air conditioning.

Employment growth, however, will be limited somewhat because of labor-saving technological innovations. A major development increasing the efficiency of plumbing and pipefitting work is the prefabrication of pipefitting components. For example, prefabricated plumbing assemblies such as plumbing "trees" are available from manufacturers. Such a system can be installed as one unit, thereby reducing the amount of on-site plumbing. Plastic plumbing, which is being used increasingly for a wide variety of plumbing operations, increases the number of installations for each plumber and pipefitter because it is light in weight and easily handled by one individual.

In addition to manpower requirements for occupational growth, many plumbers and pipefitters will be needed each year to replace workers who transfer to other fields of work, or who withdraw from the labor force because of death, retirement, or other reasons. For example, each year, withdrawals from the labor force alone are estimated to number between 1.5 and 2.0 percent of all plumbers and pipefitters.

## Stationary Engineers <sup>33</sup>

### *Current Employment*

About 260,000 stationary engineers were employed in the United States in 1966. Almost one-half were employed in manufacturing industries, mainly in establishments producing electrical machinery, fabricated metals, food and kindred products, petroleum and coal products, and machinery (except electrical). Gas and electric utility firms, mines, and Federal, State, and local governments also employed large numbers of stationary engineers.

### *Training*

Stationary engineers acquire their skills either through formal apprenticeship or informal on-the-job training. An apprentice training program customarily lasts 4 years and includes on-the-job training, related classroom instruction, and home study. Through on-the-job training, the apprentice learns to operate, maintain, and repair stationary equipment, and to use a variety of hand and machine tools. Classroom work includes instruction in technical subjects such as practical chemistry; elementary physics, blueprint reading; applied electricity; and the theory of refrigeration, air conditioning, ventilation, and heating.

Persons who become stationary engineers without going through a formal apprenticeship program generally do so only after many years of experience as assistants to licensed stationary engineers in such occupations as boiler, refrigeration, or turbine operator. This practical experience usually is supplemented by technical or other school training, or home study.

Eight States and more than 50 large and medium-size cities have licensing requirements for stationary engineers. Stationary engineer licenses, which are issued for several classes of work, specify the steam pressure or horsepower of the equipment the engineer may operate. Although requirements for obtaining a license differ from place to place, the following are typical: (1) The applicant must be over 21 years of age; (2) he must have resided in the State or locality in which the examination is given for a specified period of time; and (3) he must demonstrate that he meets the experience requirements for the class of license requested. A license is issued to applicants who meet these requirements and pass an examination, which may be written, oral, or a combination of both.

<sup>33</sup> (D.O.T. 950.782), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

## *Employment Trends and Outlook*

Rising from about 215,000 to 260,000, employment of stationary engineers increased about one-fifth between 1950 and 1966. This increase reflected the growing use of large stationary boilers, refrigeration and air conditioning equipment, turbines, diesel and natural gas engines, pumps, compressors, and other equipment operated and maintained by these workers.

Employment requirements for stationary engineers are expected to reach 280,000 by 1975, more than 5 percent above the 1966 level. The projected increase in employment requirements will result primarily from expansion of industrial, commercial, and governmental facilities requiring the type of equipment these workers

operate and maintain. In addition, the continued growth of pipeline transportation and saline water conversion also is expected to result in a need for more stationary engineers. However, the growing application of technological developments, such as larger equipment, centralized control panels, and automatic control systems, is expected to limit the growth in employment requirements for stationary engineers.

In addition to manpower requirements for occupational growth, many stationary engineers will be needed to replace workers who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 2.0 and 2.5 percent of all stationary engineers.

## Television and Radio Service Technicians<sup>34</sup>

### *Current Employment*

About 120,000 television and radio service technicians were employed in the United States in 1966. Three-fourths of these workers, including the one-third who were self-employed, worked in independent service shops or in retail stores that sell and service television receivers, radios, and other electronic equipment. Most of the rest were employed in a number of different industries, such as electrical machinery manufacturing, wholesale trade, and government; however, less than 10 percent of these service technicians were employed in any one industry.

### *Training*

Television and radio service technicians may acquire their electronics training in a variety of ways, including technical or vocational school programs, home study (correspondence school) courses, or military service training. In addition, on-the-job experience must be obtained; this experience may consist of helping qualified television and radio service technicians. From 2 to 3 years of combined electronics training and on-the-job experience generally are required to become a qualified service technician.

A few persons without previous electronics training may be hired as helpers or apprentices if they show aptitude for the work, or, like the amateur ("ham") radio operator, have a hobby in electronics.

Some radio and television service technicians receive training through programs operated under provisions of

the Manpower Development and Training Act of 1962. In 1966, about 800 workers were enrolled in MDTA institutional training programs for television and radio service technicians. These programs generally last from about 6 months to 1 year.

Several States and cities require television and radio service technicians to be licensed. To obtain a license, applicants must pass an examination to show their skill in the use of testing equipment and their knowledge of electronic circuits and components.

### *Employment Trends and Outlook*

Employment of television and radio service technicians increased from about 75,000 to approximately 120,000 between 1950 and 1966. This increase was mainly the result of the tremendous growth in the Nation's stock of television, radios, and other consumer electronic products. The growing use of home electronic products resulted from rising levels of consumer income and the introduction of new and improved products. The number of households which have television sets, for example, increased from less than a half million in 1947 to about 54 million in 1966.

Employment requirements for television and radio service technicians are expected to reach about 140,000 in 1975, one-sixth above the 1966 level. The projected increase in requirements for these workers is based on an

<sup>34</sup> (D.O.T. 720.281), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

anticipated continued rapid increase in the number of consumer electronic products during 1966-75. The number of households which have two or more television receivers is expected to increase significantly because of the growing demand for color and light-weight, portable television receivers. Demand also is expected to continue to increase for other consumer electronic products such as stereophonic radios and phonographs, AM-FM radios, and portable transistor radios. Relatively new consumer products, such as home video-tape recorders, also should stimulate the need for additional service technicians. In addition, there should be a growing demand for nonentertainment electronic products such as closed-circuit television to monitor production processes in manufacturing plants and to bring educational programs into classrooms. However,

employment requirements for television and radio service technicians are not expected to increase as rapidly as the stock of consumer electronics products because technological improvements, such as replacing tubes with transistors, using printed circuit boards instead of handwired chassis, and substituting solid-state amplifiers for amplifiers using vacuum tubes, will tend to reduce the amount of service the equipment requires.

In addition to manpower requirements for occupational growth, many service technicians will be needed to replace workers who transfer to other occupations, or who die, retire, or otherwise withdraw from the labor force during 1966-75. For example, each year, withdrawals from the labor force alone are expected to number between 1.0 and 1.5 percent of all television and radio service technicians.

## Bricklayers<sup>35</sup>

### *Current Employment*

About 170,000 bricklayers were employed in the United States in 1966. The great majority, nearly 90 percent, are employed in the construction industry. The remaining bricklayers work for industries, such as those producing glass or steel, where furnaces and kilns require special fire brick and refractory brick linings. For example, in a steel mill, the bricklayer uses refractory bricks to line converters, cupolas, and ladles that hold molten metal.

### *Training*

Bricklayers acquire their training in a variety of ways. Approximately half of the bricklayers learn the trade through informal on-the-job training. Some start as helpers or hod carriers, and gradually acquire knowledge and skills by working with and observing experienced bricklayers. Although beginners are able to do some of the simpler phases of the work after a few months experience, several years of on-the-job training and experience generally are required to become a skilled bricklayer.

Employment requirements for bricklayers are expected to increase from 170,000 to approximately 200,000 between 1966 and 1975. Much of the expected growth will result from the anticipated large increase in construction activity. The factors that will stimulate construction activity include anticipated increases in population and in the number of households; a

continuing shift of families from cities to suburbs; increasing government expenditures for schools; and a growing demand for alteration and modernization work on existing structures. The demand for bricklayers also will be stimulated by such factors as the increasing use of structural clay tile for fire-resistant partitions; glass blocks for exterior walls; and ornamental brickwork for structures, such as exterior screen walls and lobbies and foyers. In addition, the use of brick and masonry load-bearing walls is growing, particularly in apartment buildings. On the other hand, growth in employment requirements will be limited to some extent by the construction techniques described previously, and by recent developments that have increased the efficiency of bricklaying such as high-strength mortars that can be applied with caulking guns or compressor-powered extruders.

In addition to manpower needs for occupational growth, many bricklayers will be required to replace workers who transfer to other fields of work, or who withdraw from the labor force because of death, retirement, or other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 1.5 and 2.0 percent of all bricklayers.

About half of the bricklayers obtain formal training, including apprenticeship. In early 1967, nearly 9,500

<sup>35</sup> (D.O.T. 861.131, .381, .781, and .884), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

apprentices were in registered apprentice training programs. In some areas formal apprentice training for bricklayers includes brief preliminary instruction at a vocational school or some other type of prejob instruction. This experience is designed to give the apprentice a basic knowledge in the handling of tools and materials to prepare him for the start of his on-the-job training. Some bricklayers receive training in programs operated under provisions of the Manpower Development and Training Act of 1962. In 1966, about 500 workers were enrolled in MDTA institutional training programs for bricklayers.

### *Employment Trends and Outlook*

Employment of bricklayers remained relatively stable between 1950 and 1966, at approximately 170,000. Employment growth in this craft was limited by the increasing use of construction techniques that reduce the amount of brickwork for each structure. For example, the use of steel framework and reinforced concrete in structures eliminates load-bearing exterior brick walls. Also, the use of metal and glass wall panels in buildings results in less masonry work.

### **Appliance Servicemen<sup>36</sup>**

Approximately 195,000 appliance servicemen were employed in the United States in 1966. Included in the occupational classification are servicemen who repair appliances ranging from toasters and food mixers, which are relatively uncomplicated, to refrigerators and washing machines, which may have complex control systems.

More than half of all appliance servicemen in 1966 owned or were employed by independent repair shops and firms that specialize in servicing coin-operated washing and dry cleaning machines. About one-fourth were employed by retail establishments, including department stores. The rest were employed by appliance manufacturers and wholesale distributors who operated service centers, and by gas and electric utility companies.

#### *Training*

Most appliance servicemen acquire their skills through on-the-job training and work experience. In addition to practical experience on the job, trainees frequently receive classroom instruction given by appliance manufacturers and local distributors. Many trainees take correspondence school courses in basic electricity or attend technical schools to increase their skills in appliance repair. From 6 to 12 months are required for a trainee to become a qualified gas appliance serviceman. Electrical appliance servicemen usually need up to 3 years on-the-job experience to become fully qualified. Many experienced servicemen attend training classes (often on company time) and study service manuals to become familiar with new appliances and the best ways to repair them.

#### *Employment Trends and Outlook*

Rising from approximately 125,000 to about 195,000, employment of appliance servicemen increased

nearly three-fifths between 1950 and 1966. This increase resulted from the introduction of many new types of electric household appliances, such as knife sharpeners, can openers, and portable hair dryers, and the more extensive use of some household appliances, such as freezers, dishwashers, and automatic coffee makers. The estimated number of all household appliances in use more than doubled between 1950 and 1966.

Employment requirements for appliance servicemen are expected to increase to about 250,000 in 1975. The projected increase in employment requirements is based on an anticipated rapid increase in the number of household appliances in use and result from rising population, increasing family formations, and increasing personal disposable income. The demand for appliances also will be stimulated by the introduction of new appliances, some of which may be cordless like many automatic tooth brushes now in use, and by the improved styling and design of appliances to make them attractive and easy to operate. In addition, more widespread use is expected of such appliances as waste disposers, home clothes dryers, and coin-operated drycleaning machines.

Employment of appliance servicemen is not expected to increase as rapidly as the number of appliances that will be in use. Although the automatic operation of some types of appliances has tended to make them more complicated, manufacturers are designing appliances with more durable components and appliances that can be taken apart and repaired more easily. In addition, employers are increasing the efficiency of servicemen through more widespread and more effective training.

In addition to manpower requirements for occupational growth, many servicemen will be needed to

<sup>36</sup> (D.O.T. 187.168; 637.281; 723.381 and .884; and 827.131 and .281), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

replace workers who transfer to other occupations, or who die, retire, or withdraw from the labor force for other reasons during 1966-75. For example, each year,

withdrawals from the labor force alone are estimated to number between 1.5 and 2.0 percent of all appliance servicemen.

## Tool- and Die-Makers<sup>37</sup>

### *Current Employment*

Approximately 150,000 tool- and die-makers were employed in 1966—nearly all in manufacturing industries. Establishments producing machinery (except electrical) employed the largest proportion of these workers (almost one-third). Large numbers also were employed in establishments producing transportation equipment, fabricated metal parts, electrical machinery, and primary metals.

### *Training*

These workers learn the trade in one of two ways—either through formal apprenticeship or equivalent on-the-job training. A tool and die apprenticeship ordinarily lasts 4 to 5 years. Most of the time is devoted to on-the-job shop training, but there also is some classroom training in shop mathematics, shop theory, mechanical drawing, tool designing, and blueprint reading. Many workers who qualify for the more difficult tool and die work complete several years of experience after their apprenticeship. Some workers complete separate apprenticeship programs for both toolmaking and die-making.

Many learn the trade on the job without completing a formal apprenticeship. After acquiring years of experience as machine tool operators or as machinists, plus vocational or correspondence school training, these men have developed into all-round craftsmen who can skillfully perform almost any metal machining operation, including tool and die making.

### *Employment Trends and Outlook*

Employment of tool- and die-makers increased nearly one-third between 1950 and 1966, from 115,000 to about 150,000. This increase was the result of a substantial expansion in machining activity.

Employment requirements for tool- and die-makers are expected to increase to about 165,000 in 1975. The

projected increase is based on anticipated expansion in the machinery, electrical equipment, and other metalworking industries. Population expansion and increasing personal disposable income are expected to result in a large increase in the demand for metal consumer products such as automobiles, heating and air-conditioning equipment, and household appliances. Expanding business and consumer demand should result in higher expenditures for new industrial plant capacity, and stimulate orders for products manufactured in the metalworking industries such as industrial machinery, machine tools, materials handling equipment, engines, and instruments. In addition, expanding construction activity is expected to stimulate the demand for construction machinery.

Growth in employment requirements for tool- and die-makers is expected to be limited somewhat by the increasing use of labor-saving technological innovations such as numerically controlled machines. Numerically controlled machining operations require fewer and less complex special tools, jigs, and fixtures made by tool- and die-makers. In addition, numerically controlled machines can replace many of the conventional machines now used in manufacturing tools, jigs, and fixtures; thus, output for each tool- and die-maker will be increased. However, tool- and die-makers employed in metalworking repair shops and research and development laboratories are less likely to be affected by the use of numerically controlled machines than workers in other types of establishments.

In addition to manpower needs for occupational growth, many tool- and die-makers will be required to replace workers who transfer to other occupations, or withdraw from the labor force because of death, retirement, or other reasons during 1966-75. For example, it is estimated that, each year, withdrawals from the labor force alone will number between 1.5 and 2.0 percent of all tool- and die-makers.

<sup>37</sup> (D.O.T. 601.280, .380, and .381), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

## SEMISKILLED WORKERS (OPERATIVES)

### *Current Employment*

About 13.9 million workers were employed in semi-skilled (operative) jobs in 1966. An estimated 6 of every 10 of these workers were employed in manufacturing. About 40 percent of the operatives in manufacturing were employed in the following occupational categories: assemblers; checkers, examiners, and inspectors; drivers and deliverymen; filers, grinders, and polishers; packers and wrappers; sewers and stitchers; welders and flame cutters; and production painters. Each of these occupational categories had more than 100,000 workers, and four of them—assemblers; checkers, examiners, and inspectors; sewers and stitchers; and drivers and deliverymen—had more than 500,000 workers each. Many operative jobs are peculiar to particular industries; for example, almost all sewers and stitchers were employed in the apparel industry. On the other hand, some occupations, such as truck and tractor drivers, were distributed throughout all industries.

In 1966, about 4.1 million women were employed in semiskilled jobs. The proportion of women employed in different industries varies. Women accounted for 8 out of 10 operatives in the apparel industry. Large numbers of women also were employed in semiskilled occupations in the textile and food processing industries. On the other hand, plants that produce iron and steel and petroleum products employ relatively few women in operative jobs.

### *Training*

Semiskilled workers generally learn their jobs by completing brief periods of training on the job. The repetitive and routine tasks performed by these workers can be learned quickly and mastered in a few weeks. Even those jobs that require a higher degree of skill, such as truckdriver, can be learned in a few months. In general, new workers are told exactly what to do and their work is supervised closely.

### *Employment Trends and Outlook*

Rising from about 12.3 million to 13.9 million, employment of semiskilled workers increased about 13 percent between 1947 and 1966. Employment fluctuated

between 11.8 million and 12.8 million in the decade following World War II but, in 1958, the number dropped to 11.4 million and remained between 11 million and 12 million for the next 3 years. Since 1961, however, there have been significant increases in employment of semiskilled workers, primarily because of the increase in manufacturing employment.

Employment trends among the individual semiskilled occupations have varied since World War II, and have reflected the different rates of growth of the industries in which the workers were employed. However, employment trends also reflected the differing impact of technological innovations on occupations. For example, the rapid decline in employment of spinners and weavers reflected not only the relatively small increase in the demand for textile mill products, but also the increased mechanization of spinning and weaving processes.

Employment requirements for semiskilled workers are expected to reach about 14.8 million in 1975, 7 percent above the 1966 level, despite continued technological advances that will reduce employment requirements for some types of semiskilled occupations. Increases in production generated by a rising population and rapid economic growth, as well as an increasing trend in motor truck transportation of freight, are expected to be the main factors contributing to increased employment requirements.

Employment trends among the various occupations are expected to differ through the mid-1970's. Technological innovations are expected to have the greatest impact on employment requirements for semiskilled workers in manufacturing. For example, the use of numerically controlled machines for boring, drilling, lathing, and milling of metal parts should limit the increase of employment requirements for machine tool operators. On the other hand, employment requirements for truck drivers are expected to rise rapidly, as the volume of freight carried in trucks continues to increase.

In addition to manpower requirements for occupational growth, many semiskilled workers will be needed to replace those who transfer to other occupations, or who withdraw from the labor force because of death, retirement, or other reasons over 1966-75. It is estimated that, each year, withdrawals from the labor force alone number between 2.0 and 2.5 percent of all semiskilled workers.

## Machine Tool Operators<sup>38</sup>

### *Current Employment*

About 500,000 machine tool operators were employed in 1966 the largest machining occupation in the metal working trades. Within this occupation classification are lathe operators, milling machine operators, boring machine operators, and drill press operators.

About 9 of every 10 machine tool operators were employed in four industry groups machinery, except electrical; transportation equipment; electrical machinery; and fabricated metal products.

### *Training*

Although some companies provide formal training to acquaint new employees with the details of machine tool operation and machinery practice, most machine tool operators acquire their skills on the job. They begin by observing a skilled operator, and learn how to use measuring instruments and to make elementary computations needed in shop work. After these skills are acquired, they operate the machine tool, read blueprints, and plan the sequence of machinery work. To become a semiskilled machine tool operator generally requires a few months experience. Another 1½ to 2 years of on-the-job training and experience usually are required to become a skilled machine operator.

### *Employment Trends and Outlook*

Employment of machine tool operators increased from about 450,000 to 500,000 between 1954 and

<sup>38</sup> (D.O.T. 600.280; 601.280; 602.280 through .885; 603.280 through .885; 604.280 through .885; and 606.280 through .885), *Dictionary of Occupational Titles*. U.S. Department of Labor, 1966, 3d edition.

1966, or by about 11 percent. This increase in employment resulted primarily from the expansion of metal-working activity in the machinery, fabricated metals, and electrical equipment industries. Employment of machine tool operators, however, rose much less rapidly than output in these industries as a result of increased use of automatic transfer equipment, and improvements in the power, speed, and specialization of conventional tools. Numerically controlled machine tools were introduced during this period; further increases in output resulted for each machine tool operator.

Employment requirements for machine tool operators are expected to remain about the same between 1966 and 1975 as laborsaving technological innovations, such as the greater use of numerically controlled machine tools and automatic transfer equipment, about offset the anticipated expansion in metal-working activities. The substantial rise in population, in the number of households, and in disposable income is expected to increase the demand for metal consumer products such as automobiles, heating and air-conditioning equipment, and household appliances. In addition, expanding business requirements for industrial plant capacity should stimulate the demand for machinery, machine tools, engines, materials handling equipment, instruments, and other machine products. Also, expanding construction activity is expected to increase the demand for construction machinery.

Although employment requirements are not expected to increase from 1966-75, many machine tool operators will be needed to fill openings resulting from the transfer of operators to other occupations, or from deaths, retirements, and other withdrawals from the labor force. For example, each year, withdrawals from the labor force alone are estimated at about 1.5 to 2.0 percent of all machine tool operators.

## Welders and Oxygen and Arc Cutters<sup>39</sup>

### *Current Employment*

About 460,000 welders and oxygen and arc cutters were employed in the United States in 1966. Included in the occupational classification are arc welders, arc cutters, gas welders, combination welders, oxygen cutters, and resistance welders.

About 350,000 welders and oxygen and arc cutters were employed in manufacturing industries in 1966.

Large numbers were employed in the fabricated metal products, primary metals, machinery, and transportation equipment manufacturing industries. Of the approximately 110,000 welders and oxygen and arc cutters employed in nonmanufacturing industries, about two-thirds were employed in construction firms and estab-

<sup>39</sup> (D.O.T. 810. through 819.887), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

ishments performing miscellaneous repair services. The rest were distributed widely among other nonmanufacturing industries.

### *Training*

Welders and oxygen and arc cutters acquire their training in a variety of ways. Most of them learn their trade on the job. Generally, several years of training are required to become a skilled manual arc and gas welder; however, manual jobs that are performed by resistance welding machine operators and oxygen and arc cutters usually are learned in a few weeks on the job.

Some manual welders acquire their training in formal apprenticeship programs offered by a few large companies. Also, the U.S. Department of the Navy, at several of its installations, conducts 4-year welding apprenticeship programs for its civilian employees. In addition, some welders receive training through programs operated under provisions of the Manpower Development and Training Act of 1962; in 1966, more than 8,300 persons were enrolled in MDTA institutional programs for welders.

Welders may be required to pass an examination before being assigned to work where the strength of the weld is a highly critical factor. The test may be given by an employer, a municipal agency, a private agency designated by local government inspection authorities, or a Naval facility. Certification tests also are given to welders on some construction jobs, or to those who may be engaged in the fabrication or repair of steam or other pressure vessels where critical safety factors are involved. In addition to certification, some localities require welders to obtain a license before they can do certain types of outside construction work.

New developments in some manufacturing industries are increasing the skill requirements of welders, particularly in fields such as atomic energy or aerospace where high standards of reliability require more precise work.

### *Employment Trends and Outlook*

Rising from about 250,000 to about 460,000, employment of welders and oxygen and arc cutters increased nearly 85 percent between 1950 and 1966. This employment growth resulted from the increasing use of the welding process in the metalworking industries, as well as the general expansion of these industries during this period.

Employment requirements for welders and oxygen and arc cutters are expected to increase to about 575,000 by 1975. The projected increase is based on the favorable long-run outlook for metalworking industries and the continuing wider use of the welding process. Many more manual welders will be needed for maintenance and repair work. In addition, the number of manual welders engaged in production work is expected to increase in plants manufacturing structural-metal products such as metal doors, boilers, and storage tanks. The construction industry also will need an increasing number of welders as the use of steel structures expands.

Employment of resistance welders is expected to rise because of the increasing use of the machine resistance-welding process in activities such as the manufacture of motor vehicles; aircraft and missiles; and light, streamlined railroad cars; however, the use of faster and highly automated welding machines will tend to limit growth in these occupations. Employment requirements for oxygen and arc cutters also are expected to rise primarily as a result of the general expansion of metalworking activities; however, the increased use of oxygen-and-arc-cutting machinery will tend to limit the growth of this occupation.

In addition to manpower needs for occupational growth, many welders and oxygen and arc cutters will be needed to replace workers who transfer to other occupations, or who die, retire, or leave the labor force for other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 1.0 and 1.5 percent of all welders and oxygen and arc cutters.

### *Over-the-Road Truckdrivers<sup>40</sup>*

#### *Current Employment*

About 620,000 over-the-road truckdrivers were employed in the United States in 1966. Over-the-road drivers are employed by private and for-hire carriers.

Private carriers are companies, such as chain food stores or manufacturing plants, which transport their own

<sup>40</sup> (D.O.T. 903.883; 904.883; 905.883), *Dictionary of Occupational Titles*. U.S. Department of Labor, 1966, 3d edition.

goods. For-hire carriers are either common carriers (trucking companies serving the general public) or contract carriers (trucking firms hauling goods under contract for certain companies).

### *Training*

Most over-the-road truckdrivers acquire their training on the job. Long haul driving is considered a senior driving job and most over-the-road truckdrivers have had previous experience in local trucking. Beginners usually enter this occupation by first driving small, light trucks; after gaining experience, they get jobs driving the larger and more complicated trucks. Some also begin as helpers to local truckdrivers. They assist in loading and unloading trucks, and occasionally doing some relief driving. Others obtain experience by working for an inter-state bus company.

Regulations of the Interstate Commerce Commission establish minimum qualifications for over-the-road drivers. Drivers must be at least 21 years of age, able-bodied, have good hearing, and vision of at least 20/40 with or without glasses. They must read and speak English, have at least 1 year's driving experience (which may include driving private automobiles), and a good driving record. Most States require truckdrivers to have a chauffeur's license, which is a commercial driving permit obtained from State Motor Vehicle Departments.

Applicants for over-the-road truckdrivers are required to pass a physical examination. Many firms also give written traffic and driving knowledge tests. Some employers give tests to measure sharpness and field of vision, reaction time, ability to judge speed, and emotional stability. The applicant is expected to demonstrate his ability to handle a vehicle of the type and size he will operate in regular service under a variety of driving conditions. A few States require such a test before licensing a driver to operate a tractor-trailer combination.

### *Employment Trends and Outlook*

Employment of over-the-road truckdrivers increased from 555,000 to about 620,000 between 1960 and

1966. This increase in employment is attributed to the growing amount of intercity freight carried by trucks and results from high levels of business activity, the geographic dispersion of factories and warehouses, and the location of new businesses in areas where rail facilities are nonexistent or extremely limited. Improvements on trailer design also have contributed to more over-the-road trucking and make possible the long distance shipping of certain kinds of freight such as frozen foods and livestock.

Employment requirements for over-the-road truckdrivers are expected to reach approximately 1 million in 1975, about three-fifths above the 1966 level. Substantial growth in the volume of intercity freight is expected to result from continued increases in commercial and industrial activity and continued decentralization of industry. Furthermore, the demand for trucking services may increase as a result of new trucking methods that reduce handling and shipping time and, therefore, reduce freight costs for small loads. One example is the increasing use of "double bottoms" two trailers hitched in tandem to a tractor. When two trailers are used, they can be unhitched at the truck terminal and promptly delivered to customers. This plan eliminates the need to unpack a larger trailer, separate the contents, and repack on local delivery trucks.

Some recent freight transportation innovations will limit the anticipated increase in trucking business and over-the-road driver employment. For example, the movement of highway trailer on railroad flat cars, ocean vessels, and aircraft saves the cost of driver, fuel, and tractor.

In addition to manpower requirements for occupational growth, many over-the-road truckdrivers will be needed during 1966-75 to replace workers who transfer to other occupations, or who die, retire, or withdraw from the labor force for other reasons. For example, each year, withdrawals from the labor force alone are estimated to number between 1.5 and 2.0 percent of all over-the-road truckdrivers.

## LABORERS<sup>41</sup>

### *Current Employment*

Nearly 3.7 million laborers were employed in 1966, 30 percent of whom were employed in manufacturing establishments. About one-fifth of all laborers worked in the construction industry. Large numbers also were employed in wholesale and retail and in transportation work.

### *Training*

A great amount of the work performed by laborers requires little special training because it involves only simple tasks, such as handling and moving materials. To do such work, brief instruction combined with a few hours of on-the-job training is sufficient. However, since work processes are becoming more and more mechanized, many laborers need longer periods of on-the-job experience and instruction to operate various types of power-operated equipment and to learn new techniques.

### *Employment Trends and Outlook*

Employment of laborers increased from 3.5 million in 1947 to nearly 4 million in 1951. Between 1951 and 1961, employment decreased to below 3.5 million and then rose to 3.7 million in 1966. From 1947-66, growth

in employment of laborers was limited by the increasing use of mechanized equipment to replace manual labor in operations such as loading and unloading, digging, hoisting, and woodchopping.

Employment requirements for laborers are expected to change very little between 1966 and 1975, in spite of the rapid rise anticipated in manufacturing and construction activity. Increasing demand for laborers is expected to be about offset by the continuing substitution of mechanical equipment for manual labor. For example, power-driven equipment such as forklift trucks, derricks, cranes, hoists, and conveyor belts will take over more and more materials handling work in factories, at freight terminals, and in warehouses. Other power-driven machines will do excavating, ditch digging, and similar work. In addition, integrated systems of processing and materials handling equipment, a more advanced step in automation, will be installed in an increasing number of plants in the years ahead.

Although employment requirements for laborers are not expected to increase from 1966-75, many laborers will be needed to replace those who transfer to other occupations, or who die, retire, or withdraw from the labor force for other reasons. For example, each year, withdrawals from the labor force alone are estimated to number between 1.5 and 2.0 percent of all laborers.

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<sup>41</sup> Except farm and mine laborers.

## SERVICE WORKERS

### *Current Employment*

Nearly 9.7 million service workers were employed in the United States in 1966. Service workers include a wide range of diverse occupations such as elevator operator, policeman, fireman, cleaning woman, golf caddy, theater usher, barber, and laundress. Nearly one-fourth of all service workers were employed in private households and performed homemaking tasks such as cleaning, dishwashing, laundering, and preparing and serving meals. Women account for about 97 of every 100 private household workers.

About three-fifths of the more than 7 million service workers employed outside private homes in 1966 worked for one of the various service industries. These workers included thousands of nurse aids and other attendants in hospitals; cooks and kitchen workers in hospitals and schools; maids and porters in hotels, and barbers and beauty operators. In trade, most service workers were cooks, kitchen workers, fountain and counter workers, or waiters and waitresses in restaurants, drugstores, and other retail establishments where food is served. In government, many service workers were employed as firefighters, policemen, and other law enforcement officers.

### *Training*

Service workers acquire their training in a variety of ways because of the many different occupations that make up the group. Many occupations, including general maid, waiter, waitress, elevator operator, and hotel bellman, do not require formal education; workers in these occupations generally receive only short-term on-the-job instruction. Other service workers such as barbers and beauty operators acquire their training in vocational schools. Some service occupations, such as FBI agent, require college or university training. Policemen and firemen receive intensive on-the-job training and classroom instruction. Nurse aids receive on-the-job training that may last from a few weeks to a few months and generally includes some formal training. Some are trained in vocational schools.

### *Employment Trends and Outlook*

Employment of service workers increased nearly one-half between 1950 and 1966 and rose from about

6.5 million to nearly 9.7 million. The major factors underlying the growth in employment of service workers during this period were a rising population, expanding business activity, increasing leisure time, and increasing disposable personal income.

Employment requirements for service workers are expected to reach about 12.7 million in 1975, about 30 percent above the 1966 level. The occupations within the service group, however, will grow at different rates—some growing rapidly, others moderately, and a few actually declining.

The greatest growth in manpower requirements is expected to be for policemen and other protective service workers; nurse aids, orderlies, and attendants; beauty operators; cooks, waiters, and others who prepare and serve meals outside private homes; and janitors, caretakers, and building cleaners. Some of the main factors that are expected to increase requirements for these occupations are the rising demand for hospital and other medical care resulting from increases in population and the ability to pay for health care; the greater need for protective services as urbanization continues and cities become more crowded; and the more frequent use of restaurants, beauty parlors, and other services as income levels rise and as more wives take jobs outside the home.

The nature of the service occupations, especially the necessity for person-to-person contact, limits the application of laborsaving technological innovations. Overall, the number of jobs eliminated by laborsaving technological innovations, such as automatic drycleaning machines, automatic elevators, and computer controlled traffic signals, is expected to be small compared with the number of new jobs created as the demand for service workers expands.

In addition to manpower requirements for occupational growth, many service workers will be needed to replace workers who transfer to other occupations, or who die, retire, or withdraw from the labor force for other reasons during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 3.5 and 4.0 percent of all service workers.

## Municipal Policemen<sup>42</sup>

### *Current Employment*

Nearly 195,000 policemen and policewomen were employed by city and town police departments in 1966. Policewomen constituted less than 5 percent of the total, and worked mainly in large cities.

### *Training*

Municipal policemen usually learn their jobs in training programs offered by the police department. In large city police departments, extensive training may extend over several weeks or a few months. The training generally included classroom instruction on State laws and local ordinances and in the procedure to be followed in accident investigation, patrol, traffic control, and other police work. Recruits learn how to use a gun, defend themselves from attack, administer first aid, and deal with other emergencies. In many small communities, instruction usually is given informally as recruits work with experienced officers.

Some municipal policemen and policewomen obtain their training in colleges and universities. More than 100 colleges and universities offer programs in law enforcement. Most cities require municipal policemen to complete high school; however, some cities accept men who have not graduated from high school, particularly if they have worked in a field related to law enforcement, such as military police training.

### *Employment Trends and Outlook*

Municipal police employment increased about one-half between 1950 and 1966, from about 130,000 to nearly 195,000. The major factor contributing to this employment growth was increasing population, particularly urban population; greater protective service needs resulted.

Employment requirements for municipal policemen are expected to reach almost 250,000 in 1975, more than one-fourth above the 1966 level based primarily on expected further increases in population. Officers who have specialized training will be needed as engineering techniques are applied to traffic planning and control and social work techniques are used to prevent crime. On the other hand, relatively fewer officers will be required for routine assignments such as directing traffic because automatic signal lights will be used to control traffic at busy intersections.

In addition to manpower needs for occupational growth during 1966-75, many more municipal policemen will be required to replace workers who transfer to other occupations, or who leave the labor force because of death, retirement, or other reasons. For example, each year, the number leaving the labor force alone is estimated to be about 1.5 percent of all municipal policemen.

<sup>42</sup> (D.O.T. 375.118 through .868), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

## Private Household Workers<sup>43</sup>

### *Current Employment*

About 2.3 million private household workers were employed in 1966, nearly all of whom were women. Included in the occupation classification are general maids, mother's helpers, personal maids, nursemaids, infants' nurses, babysitters, home housekeepers, working housekeepers, cooks, laundresses, companions, governesses, handymen, caretakers, housemen, valets, butlers, and chauffeurs.

### *Training*

For most private household workers there are no formal training requirements. Those who do housework may acquire their skills while helping with the house-

work in their own homes. Some persons acquire such skills by working for about a year as an assistant to an experienced domestic worker or housewife. A few acquire skills beyond the level ordinarily reached in the home through the completion of home economics courses offered in high schools, vocational schools, and junior colleges, or in training courses sponsored by Federal agencies, State employment service offices, and local welfare departments. Some private household workers have received training through programs established under the Manpower Development and Training Act of 1962.

<sup>43</sup> (D.O.T. 301.887; 302.887; 303.138 and .878; 304.887; 305.281; 306.878; 307.878; 308.878; and 309.138 through .978), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

Some private household workers such as handymen, chauffeurs, and cooks acquire training through experience in related work. For example, some gardeners have acquired their skills by working for landscaping firms. In contrast to most other private household occupations, governesses generally need experience and a broad educational background in the arts to teach young children.

### *Employment Trends and Outlook*

Employment of private household workers increased more than one-fifth between 1950 and 1966, from approximately 1.9 million to about 2.3 million. The need for the services of these workers has risen because of the growing population, increasing number of households, and increasing number of housewives working

outside of the home. Rising family incomes also contributed to the increase in employment of private household workers.

Employment requirements for private household workers are expected to reach about 2.7 million in 1975, one-eighth above the 1966 level. The same factors that stimulated employment growth of these workers between 1950 and 1966 are expected to continue to boost demand for them through the mid-1970's.

In addition to manpower requirements for occupational growth, many thousands of private household workers will be needed to replace workers who transfer to other occupations, or withdraw from the labor force because of death, retirement, or other reasons during 1966-75. For example, each year withdrawals from the labor force alone are estimated to number between 5.0 and 6.0 percent of all household workers.

## Cooks and Chefs<sup>44</sup>

### *Current Employment*

About 650,000 chefs and cooks were employed in the United States in 1966. Included in this occupation classification are pastry cooks, fry cooks, roast cooks, vegetable cooks, and short order cooks.

More than one-half of all cooks and chefs are employed in restaurants. About one-third are employed in public and private schools, hotels, and hospitals. The rest work in a variety of establishments such as railroad dining cars, ocean liners, private clubs, manufacturing plants, and government agencies.

### *Training*

Most cooks, especially those who work in small eating places, acquire their skills on the job while employed as kitchen helpers. Others receive training through apprenticeship programs conducted by some large hotels and restaurants for their new employees.

Some cooks and chefs are trained in specialized courses in restaurant cooking offered in vocational high schools. Other courses, open in some cases only to high school graduates, range from a few months to 2 years or more in length. They are given under the auspices of restaurant associations, hotel management groups, and trade unions, and in technical schools and colleges. Also, the Federal Government, under provisions of the Manpower Development and Training Act of 1962, sponsored training programs for cooks; in 1966, about 3,100

persons were enrolled in MDTA institutional programs for these workers.

Although the curriculums vary among the different training programs, usually a major part of each student's time is spent in learning professional food preparation through actual practice in well-equipped kitchens. The student receives instruction in baking, broiling, and other methods of preparing food, and in the use and care of kitchen equipment. Instructions also may be given in selecting and storing food, determining the size of individual portions, planning menus, buying food supplies in quantity, hotel and restaurant sanitation, and the public health aspects of food handling.

### *Employment Trends and Outlook*

Rising from 435,000 to about 650,000, employment of cooks and chefs increased nearly one-half between 1950 and 1966. This substantial increase reflects the expansion in serving meals away from the home. Population growth, higher income levels, increased travel, and larger numbers of housewives employed outside of the home have stimulated the increase.

Employment requirements for chefs and cooks are expected to rise to about 860,000 in 1975, nearly one-third above the 1966 level. This projected increase is based on the continued expansion of the business of

<sup>44</sup> (D.O.T. 313.131 through .887; 314.381 through .878; and 315.131 through .381), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

serving meals away from home. Population growth and the relatively rapid increases in the size of groups customarily eating meals away from home young people entering jobs for the first time, women taking employment outside of their homes, and students attending schools and colleges—are among the factors expected to increase requirements for cooks and chefs. Greater requirements for these workers also are expected in hospitals and other institutions where an increase is foreseen in the number of patients, attendants, and others who regularly eat meals prepared on the premises.

In addition, rising income levels are increasing travel for business and pleasure and are expected to result in larger numbers of people who patronize eating places.

In addition to manpower requirements for occupational growth, many cooks and chefs will be needed to replace workers who transfer to other occupations, or who die, retire, or otherwise leave the labor force during 1966-75. For example, each year, withdrawals from the labor force alone are estimated to number between 3.5 and 4.0 percent of all cooks and chefs.

## Waiters and Waitresses<sup>45</sup>

### *Current Employment*

About 950,000 waiters and waitresses were employed in the United States in 1966, about 88 percent of whom were waitresses.

Approximately four-fifths of all waiters and waitresses are employed in restaurants, drug stores, and other retail establishments that serve food to the general public. The rest are employed in hotels and other lodging places, in both private and public educational institutions, and in entertainment and recreational service establishments.

### *Training*

Practically all waiters and waitresses learn their skills on the job. Some of this training may be obtained by working as busgirls or busboys. Some large restaurants and hotels, particularly chain organizations, and some restaurant associations have formal training programs for waiters and waitresses. In addition, the Federal Government sponsors programs to train these workers under the Manpower Development and Training Act of 1962. In 1966, about 300 persons were enrolled in MDTA institutional training programs for waiters and waitresses.

<sup>45</sup> (D.O.T. 311.138 through .878), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.

### *Employment Trends and Outlook*

Employment of waiters and waitresses increased 45 percent between 1950 and 1966, from 658,000 to about 950,000. This increase stemmed from a great expansion in serving meals away from home. The factors responsible for expanding restaurant services included a growing population; rising income levels; increasing travel, both for business and pleasure; and increasing numbers of housewives employed outside of the home.

Employment requirements for waiters and waitresses are expected to reach more than 1.2 million by 1975, about one-fourth above the 1966 level. The factors that stimulated employment of waiters and waitresses between 1950 and 1966 are expected to continue to influence the demand for them through the mid-1970's. However, the increasing use of labor-saving devices, such as vending machines that dispense prepared foods, will limit the growth in requirements for waiters and waitresses.

In addition to manpower requirements for occupational growth during 1966-75, many waiters and waitresses will be needed to replace workers who transfer to other occupations, or who die, retire, or withdraw from the labor force for family or other reasons. For example, each year, withdrawals from the labor force alone are estimated to number between 4.0 and 4.5 percent of all waiters and waitresses.

## Farm Workers<sup>46</sup>

### *Current Employment*

About 3.9 million farm workers—including farmers, farm managers, laborers, and foremen—were employed in the United States in 1966. Over half of all farm workers were farmers and farm managers.

### *Training*

Many farm workers obtain their skills by living on a farm. Many farmers also take vocational training available under federally assisted programs. Such training is offered in full-time programs supervised by teachers who are agriculture college graduates; in short courses for young farmers offered during the day on subjects such as farm planning, farm layout, farm structure, plant breeding, and pest control; and in adult evening classes (or day classes in off seasons) that provide instruction in areas such as conservation and crop and livestock production. Organized groups such as the Future Farmers of America and the 4-H Clubs also train young farm people.

### *Employment Trends and Outlook*

Employment requirements for farm workers decreased 52 percent from about 8.1 million in 1947 to approximately 3.9 million in 1966. Farmers and farm managers declined faster than the group as a whole, from nearly 5 million in 1947 to 2.1 million in 1966, a 60 percent decrease. Farm laborers and foremen declined more than two-fifths, from 3.1 million workers in 1947 to 1.8 million in 1966. The decline in farm workers occurred despite a substantial increase in farm output over the same period. The major factors that caused the decline in employment requirements for farm workers were the increased size and efficiency of farms, and the mechanization of many farm operations. In 1947, one farm worker produced enough food and fiber for himself and 14 others; in 1966, he produced enough for himself and 31 others.

Employment requirements for farm workers are expected to decrease from 4.3 million to about 3.4

million between 1966 and 1975, in part because of continued improvements in farm technology. For example, improved fertilizers, seeds, and feed will permit farmers to increase production without corresponding increased employment. Improved mechanical harvesters for vegetables and fruits will decrease the need for seasonal or other hired labor. Innovations in livestock and poultry feeding and improved milking systems will allow more efficient handling of a greater volume of production. The expected development of automatic packing, inspection, and sorting systems for fruits, vegetables, and other farm products also will reduce employment requirements for farm workers.

Employment requirements for farm workers also are expected to decline because of the continued trend toward larger and more efficient farms. Farmers and farm managers are expected to continue to be most affected by the decline in the number of small farms, and requirements for these workers are expected to continue to decline faster than for farm laborers and foremen.

Output of farm products is expected to continue to increase in the years ahead. However, unlike other segments of the economy, farm output is not expected to be stimulated by significant increases in per capita consumption of its products. Increases in domestic farm production will result primarily from the increased demand as the population grows.

Despite declining manpower requirements for farm workers during 1966-75, many thousands of farm workers will be needed to replace those who transfer to other occupations, or withdraw from the labor force because of death, retirement, or other reasons. For example, each year, withdrawals from the labor force alone are estimated to number between 2.0 and 3.0 percent of all farm workers.

<sup>46</sup> (D.O.T. 406.887; 409. through 409.885; 411. through 419.137; 421. through 421.887; 423. through 423.999; 424. through 424.886; 429.131; 429.885; and 429.887), *Dictionary of Occupational Titles*, U.S. Department of Labor, 1966, 3d edition.