Abt Associates Inc.

Engineers in the United States: An Overview of the Profession

Engineering Workforce Project Report # 2

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With a foreword by Robert Weatherall

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ABOUT THE ENGINEERING WORKFORCE PROJECT

The Engineering Workforce Project (EWP) is a multi-directorate program in the National Science Foundation (NSF) that describes and analyzes important dynamics of the U.S. engineering workforce. The project provides information on a range of topics related to engineering education, engineering degree graduates, and engineering occupations. Data come principally from the Scientists and Engineers Statistical Data System (SESTAT) in NSF's Division of Science Resources Statistics (see www.nsf.sestat.gov). Project findings are disseminated in NSF reports, journal articles, conference proceedings, and other presentations. This report concentrates on the profession of engineering, including the demographic characteristics and educational backgrounds of U.S. engineers. A complementary report about engineering graduates and other EWP reports and papers may be found at: www.abtassociates.com/Engineering_Workforce .

The Engineering Workforce Project has received major staff and funding support from the Directorate for Engineering and the Directorate for Social, Behavioral, and Economic Sciences. It has also received funds from the Directorate for Computer and Information Sciences and the Engineering Directorate for Education and Human Resources.

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The Engineering Workforce Project (EWP) evolved from the belief in the early 1990s that what was then a brand-new, highly detailed source of national science and engineering workforce data, the Scientists and Engineers Statistical Data System (SESTAT), provided great analytical potential to shed light on the full dimensions of the engineering workforce. In time, the Project's purpose became the empirical examination of a range of rich topics about the engineering workforce. The resulting reports, journal articles, presentations, etc. addressed specific portions of the engineering workforce to provide decisionmakers in academia, industry, and government with objective information not previously available.

Sustained encouragement and support for the Project's work during the 1990s came from the following individuals who saw the value of what EWP was trying to achieve and actively supported dissemination of results broadly:

Lawrence Burton, Program Director (on detail), Division of Computer and Network Systems, CISE

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Ongoing technical contributions were provided by Nimmi Kannankutty and Kelly Kang, Analyst and Senior Analyst, respectively, Division of Science Resources Statistics, SBE.

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Bhavya Lal, Director, Center for Science and Technology Policy Statistics

Kenneth Carlson, Mathematician

Susan Hills, Technical Editor (consultant)

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Susan Kemnitzer, Deputy Director for Education, Division of Engineering Education and Centers, ENG

Linda Hardy, Senior Analyst, Division of Science Resources Statistics, SBE, retired

Finally, the report was edited following review by Nita Congress. When it became possible to update the report with 1999 SESTAT data—the most recent data available until data collected in 2003 become available in 2005—staff at SRI International (EEC 02-19097) reviewed the narrative against the updated data in the text, graphics, and tables to ensure that the narrative remained consistent with the data.

Linda Parker
Project Coordinator
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FOREWORD

"There is, in the genius in the people of this country, a peculiar aptitude for mechanic improvements," wrote Alexander Hamilton in 1791 (Syrett and Cooke 1966). In his celebrated *Report on Manufactures*, he proposed that this aptitude be cultivated as an asset. Among the benefits he envisioned were the creation of new employment opportunities, increases in productivity, improvement in the terms of trade, a more diverse economy, and the ability of the country to support itself in time of war.

The extraordinary growth of the American economy over the last two centuries has amply confirmed his judgment. The wealth of the country can only be accounted for if technology is factored into the equation. A much-quoted estimate is that technical progress has been responsible for as much as 80 percent of the rise in personal incomes, capital investment for no more than 20.[1] Technical skill has been hailed as "human capital."

The creative individuals who transformed the American economy in the last century learned their skills mostly in the shop. They called themselves mechanics or "mechanicians" rather than engineers.[2] As late as the 1890s, the pioneers of the electrical power industry similarly called themselves "electricians" (McMahon 1984, p. 36). The title of "engineer," originally applied exclusively to the builders of such military and civilian structures as forts, bridges, canals, and railroads, was adopted haltingly in other technical fields.

Before the Morrill Act of 1862, which provided support for education "in agriculture and the mechanic arts," only six schools in the country offered degrees in engineering. In the next few decades, engineering schools proliferated. It was not until the first decades of this century, however, that a majority of engineers—which was now the commonly accepted term—had college degrees (Society for the Promotion of Engineering Education 1930, pp. 816 and 1021).

[1] Krugman (1994) quoting Robert M. Solow. Solow's original paper, "Technical Change and the Aggregate Production Function" (1957), is reprinted in Rosenberg (1971), pp. 344-62.

[2] Calvert (1967), passim; Blank and Stigler (1957), p. 4 ("The heroic age of the industrial revolution was presided over by the untutored entrepreneur, not the engineer or scientist").

Our Growing Engineering Workforce

Since 1900, the engineering workforce—including graduates in engineering (see table), graduates from other disciplines, and individuals without a college degree whose occupation is engineering—has mushroomed from less than 40,000 to close to 2 million. Between 1900 and 1930, it increased in size nearly sixfold. This workforce grew more slowly during the Depression but picked up speed again after World War II, more than doubling between 1950 and 1970. In the last 30 years it has continued to grow but at a more moderate rate, a little under 2 percent a year.

In 1900, engineers still formed a tiny group among the Nation's professional workers (scientists, engineers, lawyers, doctors, teachers, etc.)—scarcely more than 3 percent. By 1960, they accounted for over 12 percent. Today, with other and newer professions like computer science growing faster, engineers account for roughly 10 percent. Engineering has become an established profession, like law and medicine, against which other professions measure themselves (U.S. Bureau of the Census 1975 and 1997).

Foreword table

Bachelor's degrees awarded in engineering as a percentage of all bachelor's degrees: 1901-2000

Award Year	Number of Bachelor's Degrees in Engineering	Percent of All Bachelor's Degrees
1901-05	4,900	3.3
1906-10	7,500	4.3
1911-15	12,500	6.0
1916-20	20,100	9.3
1921-25	37,100	10.3
1926-30	38,800	7.0
1931-35	54,800	8.0
1936-40	62,600	7.6
1941-45	68,500	8.8
1946-50	159,600	11.3
1951-55	143,118	8.9
1956-60	168,791	9.5
1961-65	175,970	8.3
1966-70	196,055	6.0
1971-75	220,810	4.8
1976-80	239,677	5.1
1981-85	357,572	7.3
1986-90	353,051	6.9
1991-95	313,216	5.4
1996-2000	245,916	5.1

NOTE: From 1901-60, bachelor's degrees also include first professional degrees.

SOURCES: Data from 1901-55: Dael Wolfle, America's Resources of Specialized Talent *(New York: Harper, 1954), pp. 292-95, as quoted by David M. Blank and George J. Stigler,* The Demand and Supply of Scientific Personnel *(New York: National Bureau of Economic Research, 1957), p. 75; data from 1956 to 1965: National Center for Education Statistics,* Digest of Education Statistics *(Washington, DC, 1971); data from 1966 on: National Center for Education Statistics, Survey of Degrees and Other Formal Awards Conferred, and Completions Survey. Last group of years is a 4-year, rather than 5-year, period because no data are available for 1999.*

Surveying the Scientific and Engineering Workforce

An attempt to tally the Nation's workforce engaged in manufacturing was made as early as 1810. In 1820, the Census Office (as the Bureau of the Census was then called) set out to count the workforce in each of the main fields of economic activity—agriculture and commerce as well as manufacturing. But it was not until 1850 that it sought information on individuals' occupations.

The census-takers for the 1850 census counted 512 civil engineers, 11,626 engineers whom they did not classify further, and 16,004 mechanics. How many were engineers as we would now understand the term? There is no way of knowing. The Superintendent of the Census acknowledged in his report that his staff had difficulty classifying workers satisfactorily. He invited the reader to "judge for himself, and frame any other tables" if he preferred (Census Office 1853).

What Makes an Engineer an Engineer?

The same difficulty that faced the Superintendent of the Census in 1850 faces anyone counting engineers to this day. By what criteria should one judge whether someone is an engineer? His self-identification as such? Her job description and job title? Having an engineering degree? Having a degree in a related field? Indeed, does an engineer have to have a degree? Should someone still be counted an engineer if she has become a manager?

There is room for different views. An employer may be ready to accept job description as a sufficient measure. An academic is likely to want to see a degree. A policy analyst assessing the numbers of strictly technical practitioners may wish to exclude the engineer who has become a manager. Someone wishing to recommend engineering as a career may well want to include him. Clearly, differences in the criteria one uses will give different counts of the engineering workforce. They will be counts of somewhat different sets of people—though all may share, in some sense, Hamilton's "peculiar aptitude."

Until recently, the leading criterion used to identify the Nation's engineers and scientists has been employment as one, following the practice of the Census Bureau. In 1962, in a first effort to learn more about their education, degrees, work activities, and other characteristics, the National Science Foundation (NSF) joined forces with the Bureau to survey a representative sample drawn from the science and engineering workforce identified as such in the 1960 census (U.S. Bureau of the Census 1969). The two agencies conducted another survey in 1972 (following up on the 1970 census), asking similar questions and adding others (U.S. Bureau of the Census 1974).

Besides gathering much valuable information on a population that had previously been little studied, the surveys pointed up the opportunity for discrepancies in counts taken using different criteria. For example, only 70 percent of those the 1970 census had counted as engineers on the basis of their occupation declared in 1972 that they regarded themselves professionally as engineers. Eleven percent thought of themselves as administrators, managers, or business proprietors. Nine percent classified themselves as technicians or technologists—not a surprising statistic, given that one-third of the engineers surveyed held at most an associate's degree (U.S. Bureau of the Census 1974, p. 5, table 2.1, and p. 85, table 9).

The National Science Foundation decided that in future surveys it should not frame its definition of the science and engineering workforce solely on the basis of occupation but should also take into consideration education, degree level, and professional self-identification (U.S. Bureau of the Census 1974, pp. 113-14). It developed a carefully balanced, multidimensional definition for use in its next survey (conducted in 1974) and continued to use it in surveys based on the 1980 census (NSF 1976, pp. 18-19).

The new definition countered objections that one should not decide whether a person was an engineer or scientist simply on the basis of occupation. (Who was to say that employers were hiring qualified people? What of the amply qualified engineer who was currently doing something else?) It opened the door to other criticisms, however. A recurring complaint was that the new definition gave a count of the science and engineering workforce that did not tally with those generated by other agencies, notably the Bureau of the Census and the Department of Labor. Further, the definition's complexity made it difficult to determine where the problem lay, whether in the differences in definition or differences in sampling technique (NRC 1989, pp. 101-107). Perhaps worse, the

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resulting population was neither fish nor fowl: it was neither the whole population of those employed as engineers or scientists, nor the whole population of those trained in engineering or science, nor the whole population of those who considered engineering or science their profession. The definition could also be accused of bias. A college president whose highest degree was in engineering or science was counted regardless of whether he considered himself an engineer or scientist professionally. A graduate with the same credentials who was president of a company or head of a government agency was only counted if she identified engineering or science as her occupation or profession (not, as she very well might, management or administration).

Meanwhile, NSF had launched two other survey programs—one a biennial survey of Ph.D. graduates (and holders of equivalent degrees); the other a periodic survey of new entrants to the science and engineering workforce tracking bachelor's and master's recipients 1 to 2 years after graduation. In the 1980s, NSF merged the data from these surveys of graduates with the data from its census-based surveys to create an integrated data system covering the science and engineering workforce.

In 1986, NSF asked the National Research Council (NRC) to appoint a committee to review the component parts of this data system and to make recommendations on how the Foundation should use the 1990 census in its subsequent surveys. Besides making recommendations on system design, the committee urged the Foundation to abandon its multidimensional screen for deciding whether an engineer or scientist identified by the census should be counted as one (NRC 1989, pp. 101-107). Instead, NSF should permit inquirers "to apply their own definitions ... to suit their particular research and analysis purposes" (pp. 55-56). To this end it should collect and publish data on "the full range of people with academic training in science and engineering fields, not all of whom [may] have related work experience, and [on] the full range of people who are employed in science and engineering, not all of whom [may] have related training" (p. 153). In the latter case, however, it should no longer include engineers who were not college graduates. The committee urged this mostly for reasons of convenience. It was difficult to get a statistically representative sample of nondegreed engineers, and, in any case, their numbers were dropping: in 1985, less than 19 percent of engineers under the age of 40 had not completed 4 years of college (p. 34).

Querying a Unique Resource: The Scientists and Engineers Statistical Data System

NSF has incorporated these principles in the management of its Scientists and Engineers Statistical Data System (SESTAT). The system is set up to answer an inquirer's questions regardless of how he or she defines an engineer or scientist—whether by occupation, training, or some combination of the two. Analysis is based on returns from some 100,000 individuals responding to NSF surveys fielded in 1993 and from 87,000 responding to surveys fielded in 1999. The 1993 respondents represent about 11 million people who have science and engineering degrees or who work in science and engineering. The 1999 respondents represent about 13 million scientists and engineers. SESTAT is probably the world's most comprehensive database on a nation's technical talent.

SESTAT data are available both on compact disks and on the World Wide Web at http://sestat.nsf.gov, making it possible for users to "frame" their own tables in a way that the superintendent of the 1850 census could only dream of.

The report that follows is the second in a series that will examine SESTAT's extensive data on the Nation's engineers. The intent is to present in "hard copy" what can be learned from the database and to highlight key findings.

This second report of the Engineering Workforce Project focuses on the population of engineering graduates, looking at the degrees they hold in engineering and in other fields and at the variety of occupations—technical and non-technical—for which their education has prepared them.

Subsequent reports will examine the population of those occupied in engineering specifically, both those with and without engineering degrees; the work activities of engineers, including their authorship of papers and obtaining of patents; their membership in professional societies and continuing education; the participation of engineers in management; and the changing demographics of the profession over time.

Robert Weatherall
Ipswich, Massachusetts
December 1998
(updated with 1999 data)

EXECUTIVE SUMMARY

Engineering degree programs in the United States have always been more geared to practice in the private sector than have most science degree programs. At the end of the 20th century, engineering practice was challenged by a proliferation of occupations requiring technical education; by rapidly changing technological advances; and by a perennial—if not heightened—concern with the relationship between engineering degree programs and occupational outcomes.

This study illuminates the role of engineering education in ways not heretofore possible. It uses empirical data from a sample of 24,700 engineering graduates to provide information needed by people engaged in engineering education and engineering practice. These include employers who strive to build and retain highly qualified staffs, engineering school faculty who design course and program content, and both potential and actual engineering graduates as they weigh their educational choices and career options.

As of 1999,[1] approximately 2.8 million people in the United States had an engineering degree at the baccalaureate level or above. Some of these engineering graduates—about 1.3 million of them—

[1] NSF's collection of workforce data was done biennially in the 1990s, but after 1999 no data were collected again until 2003. The 2003 data will not be available for analytic purposes until calendar year 2005.

were employed as engineers. At the same time, nearly a million were applying their engineering knowledge and skills to solve problems in other technical areas or were engaged in a surprising variety of non-engineering careers. Many had chosen to acquire degrees in other fields, opening new career paths or expanding their abilities to contribute to the engineering specialties in which they were working. This study provides a close look at the available data on how engineering graduates have chosen to structure their formal education and how their formal education relates to their employment.

Degree Patterns of Engineering Graduates. The majority of engineering graduates (59%) hold only one degree, usually at the baccalaureate level. Though 80 percent of graduates with any engineering degree hold only engineering degrees, the others demonstrate a rich variety of degree combinations. Engineering graduates have combined engineering degrees with degrees in management, fine arts, the humanities, and the full range of scientific disciplines. Data suggest that in coming years, a higher proportion of engineering graduates at all ages will earn two or more degrees during the course of their lives.

Multiple Degrees and Degree Levels. Engineering graduates with multiple degrees display a wide variety of degree patterns. Those with two or more degrees did not necessarily acquire them in the same field, nor was an engineering degree necessarily the first acquired. Graduates also may not acquire their degrees at successively higher levels. People who attain the master's degree show particular flexibility in degree field mixing and are also more widely dispersed across the spectrum of engineering and non-engineering

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occupations. Master's level engineering graduates with any non-engineering degree become senior managers at higher rates than those with only engineering degrees. Engineering graduates whose most recent degree was at the master's level are divided almost evenly between people with only engineering degrees and people with degrees in other subjects.

Engineering and Business Degrees. A growing proportion of younger engineering graduates hold both engineering and business degrees. Of those engineering graduates who chose to combine engineering degrees with one or more degrees in a non-engineering field, the largest number—250,000, or 46 percent—combined engineering and business degrees. At the master's level, those who have engineering and business degrees are twice as likely as those who have only engineering degrees to become senior managers at some point in their careers.

Engineering and Science Degrees. Overall, engineering graduates demonstrate an apparent ease of movement between educational programs in scientific and engineering disciplines. This study found only a small difference in the proportions of engineering graduates, regardless of degree level, who move from engineering degrees to scientific degrees versus from scientific to engineering degrees. There is only a slight net "gain" from those moving from science to engineering degrees, and only at the baccalaureate and master's level; engineering graduates who obtain a Ph.D. and have a science degree are equally as likely to obtain the Ph.D. in science as in engineering. These patterns may indicate intentional combinations of science and engineering degree programs to prepare for occupations requiring multidisciplinary knowledge and skills.

Degree Patterns of Female Engineering Graduates. Some differences were apparent in the type and sequence of degrees acquired by male and female engineering graduates. Women have obtained degrees outside engineering slightly more frequently than men. They also differ in their choice of non-engineering degree fields: while most of men's non-engineering degrees are in business or management, women have more often paired engineering with science degrees. Further, they are more likely to be attracted to engineering degree fields that tend to have a significant science component such as biomedical/bioengineering, environmental engineering, and chemical engineering.

Engineering Graduates With Degrees and Occupations in Science. Nearly one-third of engineering graduates who complemented their engineering degree with one in another discipline earned a degree in a scientific field. On the other hand, only one-fifth (21%) of engineering graduates working as scientists hold a science degree. Engineering graduates working as scientists are commonly found in computer-related occupations.

Careers in Engineering and Other Occupations. The majority of engineering graduates (57%) are employed in some engineering specialty. However, the data strikingly show that they are progressively less likely to be employed in engineering positions as they mature. The tendency to acquire additional degrees during their 30s and 40s corresponds with a decrease in the proportion of engineering graduates who report their occupation as "engineer" during these years. Still, 70 percent of engineering graduates working in non-engineering occupations have earned no degrees other than engineering degrees.

Thus the findings of this study show that engineering graduates have a wide variety of occupational choices, both in the engineering specialties and in non-engineering occupations. While analysis of the educational histories of engineering graduates shows that most have obtained only the baccalaureate in engineering, younger cohorts have more often earned additional degrees than have their older colleagues. When individuals earn a degree beyond a single engineering baccalaureate, it is just about as often in engineering as in some other field. Of the latter, almost half of the degrees earned are in business.

Occupations of engineering graduates with one or more degrees, solely in engineering or combined with other fields, are often associated with multidisciplinary skills, especially those related to management. The mixing of science degrees with engineering degrees as a strategy in educational choice is shown in this study to result in considerable flexibility for both employees and employers who hire them. The next study of the Engineering Workforce Project will explore these themes further, focusing on the occupation of engineering, including practicing engineers who have no degree in engineering.

INTRODUCTION

In 1999, 1.7 million people in the United States were employed as engineers. That group of working engineers—regardless of educational background or other credentials—is the focus of this report.

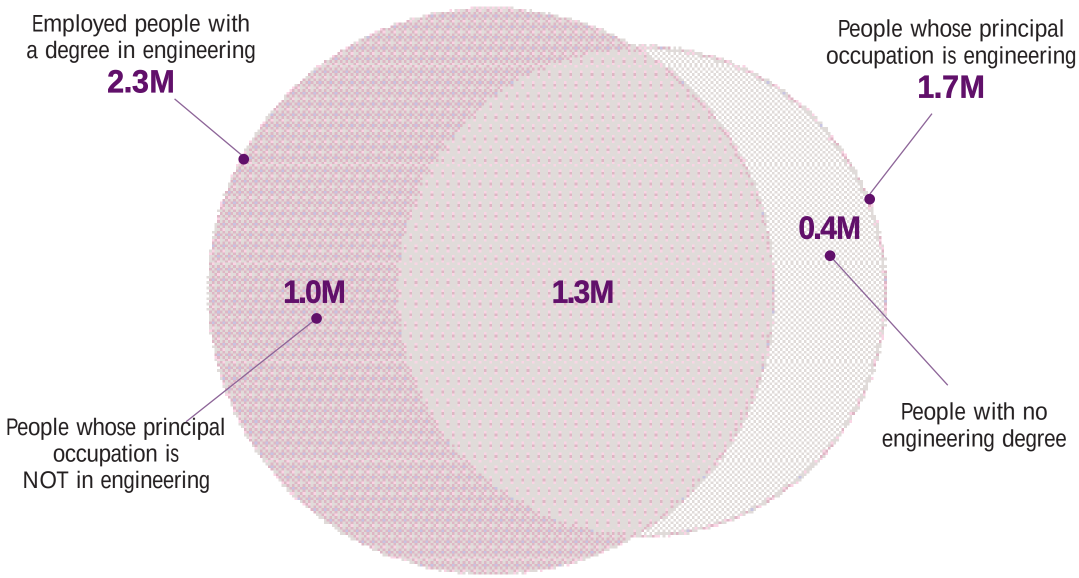
The first section of this report describes U.S. engineers as a group, drawing their demographic profile with survey data on gender, racial and ethnic groups, citizenship status, age, and whether or not they are native to the United States. The second section identifies sectors of the economy in which engineers are employed, highlighting distinctive employment patterns for different segments of the profession. The third section shows how engineers in these subgroups distribute themselves among the engineering occupations. The fourth section describes the educational backgrounds that engineers bring to their work and points out unique patterns in movement from engineering education fields to engineering occupational specialties. A summary of all data across engineering occupations appears in Appendix A.

Who Is an "Engineer?"

In this report, the term "engineer" refers only to practicing engineers, independent of educational background. Also included are computer software engineers, who in other NSF reports may be reported in computer science occupations. The term excludes engineering technologists and technicians, as well as the 1.5 million engineering degree recipients who were not practicing engineers or were not working in 1999. In addition, because of the nature of the survey instrument, high-level "technical" managers (i.e., mid- or senior-level managers who were engineering graduates) are excluded. Also excluded are approximately 13,000 people who were engineers in their second job but not in their principal occupation in 1999.

Of the 2.8 million people in the United States in 1999 who earned an engineering degree at the baccalaureate level or above, 2.3 million were working and 1.3 million were practicing engineers (Figure 1). In addition, 407,000 workers held engineering jobs without having earned an engineering degree. Engineers who were not engineering graduates

Figure 1
Employed engineering graduates and U.S. engineers: 1999



NOTE: Engineering graduates have a bachelor's or higher degree in engineering. A person whose principal occupation is engineer may or may not be an engineering graduate.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

(i.e., those who did not have at least a bachelor's degree in engineering) accounted for nearly one-fourth (23.5%) of all people who were employed as engineers in the United States in 1999.[1] (Their educational backgrounds are described further in Section 4.)

Terms Used Throughout This Study

Engineering graduate: An individual who had at least one degree in engineering at the baccalaureate, master's, or doctoral level; a few engineering graduates with "other professional" engineering degrees are also included, but no additional information about these degrees is available. All people to whom this study refers had a degree in some field at the baccalaureate or higher level.

Highest degree: The highest formal degree attained by the survey respondent. For the purposes of this analysis, the highest degree is usually the most recent degree. In a few instances, the highest degree was earned prior to the most recent degree (e.g., a master's degree preceded a baccalaureate).

Most recent degree: The last degree the survey respondent had attained as of the week of the study reference date (April 15, 1999). In almost all cases, the most recent degree is also the highest.

Occupation or principal occupation: The principal job held by the respondent during the week of April 15, 1999. Second jobs are not included in this study. All study respondents discussed in this report were employed in 1999.

[1] Because a large proportion of these engineers were computer software engineers—whose numbers grew considerably in the 1990s—and because the data used here include persons employed as engineers without any degree in science or engineering as of 1990, 1999 employment numbers may be underestimated. Only graduates with degrees in science or engineering from U.S. 4-year institutions have been added to the estimates since 1990. See Kannankutty and Wilkinson (1999).

Table 1 shows the engineering occupations included in this study and the number of engineers in each category. Engineering technologists/technicians and mid-level and senior managers are not included in the definition of "engineer" used in this study.

Table 1
U.S. engineers, by occupational specialty: 1999

TOTAL, ALL ENGINEERS	**1,708,700**
Aeronautical/aerospace engineers	67,400
Biomedical/bioengineers	13,100
Chemical engineers	79,900
Civil/architectural engineers	223,700
Computer hardware engineers	54,700
Computer software engineers	338,400
Electrical/electronics engineers	307,500
Environmental engineers	73,500
Industrial engineers	81,200
Materials/metallurgical engineers	35,300
Mechanical engineers	265,800
Mining/geological/petroleum engineers	22,300
Nuclear engineers	17,500
Postsecondary engineering teachers	31,400
Sales engineers	45,700
Other engineers	51,300

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

SECTION 1

WHO ARE AMERICA'S ENGINEERS?

SECTION 1

WHO ARE AMERICA'S ENGINEERS?

This section describes the practicing engineers in the United States in terms of their age, gender, racial and ethnic groups, and citizenship status in 1999.

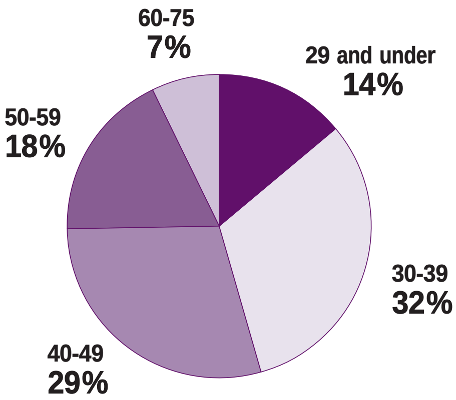
Age

Among engineers in the United States in 1999, 46 percent were 39 years old or younger, and 61 percent were between the ages of 30 and 49 (Figure 2). This age distribution is consistent with a strong tendency, noted in a previous study, of engineering graduates to leave the occupation of engineering—or, at least, to stop referring to themselves as engineers—as time passes. Only 66 percent of all persons under the age of 30 with an engineering degree worked as engineers in 1999; that percentage drops to under 44 percent for engineering graduates in their fifties (Burton and Parker 1999).

This Section Addresses the Following Questions:

- What are the demographic characteristics of the people employed as engineers?
- Are there distinctive patterns in engineering employment for population subgroups and engineering specialties?

Figure 2
U.S. engineers, by age: 1999



SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

In 1999, the median age of an engineer in the U.S. workforce was 41 (Table 2). The median age for specific engineering occupations varied. Biomedical/bioengineering engineers were the youngest, with a median age of 35; also among the youngest were computer software engineers, whose median age was 38, and computer hardware engineers and industrial engineers, whose median age was 39. Engineering teachers—an occupational group whose members require time to complete higher degrees—were the oldest group, with a median age of 45.

The youngest engineers were those employed by the military; their median age was 36. Engineers who were employed in 2-year colleges or were self-employed were the oldest, with median ages of 48 and 49, respectively.

Table 2
Median age of U.S. engineers, by selected characteristics: 1999

TOTAL, ALL ENGINEERS	**41**
Engineering occupation	
Other engineers	46
Postsecondary engineering teachers	45
Aeronautical/aerospace engineers	43
Nuclear engineers	43
Civil/architectural engineers	42
Electrical/electronics engineers	42
Mining/geological/petroleum engineers	42
Environmental engineers	41
Materials/metallurgical engineers	41
Sales engineers	41
Chemical engineers	40
Mechanical engineers	40
Computer hardware engineers	39
Industrial engineers	39
Computer software engineers	38
Biomedical/bioengineers	35
Employment sector	
Self-employed	49
2-year colleges	48
U.S. government	45
All other sectors	44
State and local government	43
Private, for-profit	40
4-year colleges/universities[1]	39
Military	36
Gender	
Male	41
Female	36
Race/ethnicity[2]	
White	41
Asian	40
Hispanic	38
Black	37
Native American	36
Engineering degree status	
Did not have an engineering degree	42
Has an engineering degree	40

[1]*Four-year colleges/universities includes medical schools and university-affiliated research institutes.*

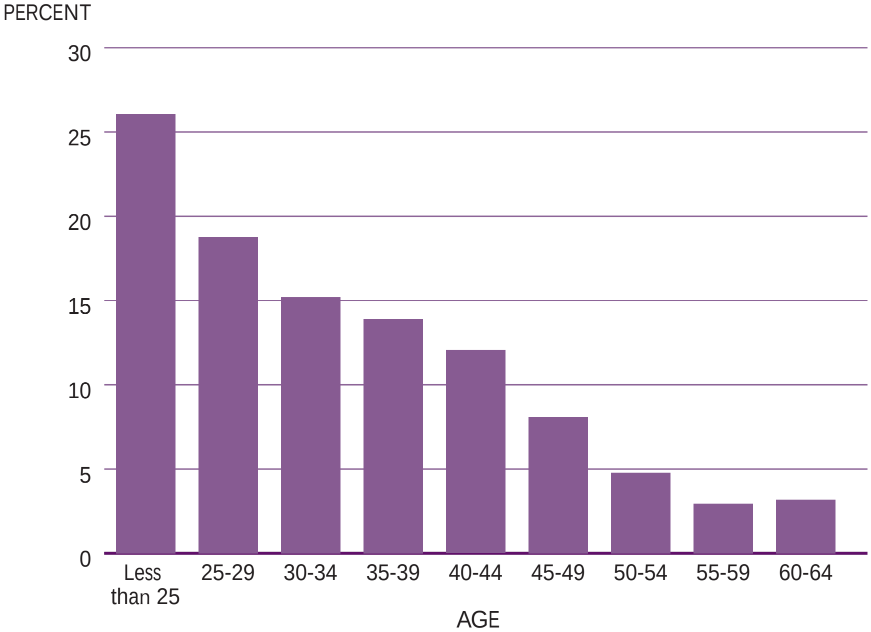
[2]*Race/ethnicity includes only U.S. citizens and permanent residents.*

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Gender

Female engineers in 1999 were younger than their male colleagues. The median age of women who were practicing engineers was 36, compared to 41 for men. The median age was 41 for all engineers (Table 2). Figure 3 shows that the younger the cohort, the greater the proportion of women. Women made up one-fourth of engineers under age 25 but less than one-twentieth in each age category over 49. Because women began to enter the profession in significant numbers only in recent decades,

Figure 3
Women as a percentage of all U.S. engineers, by age: 1999



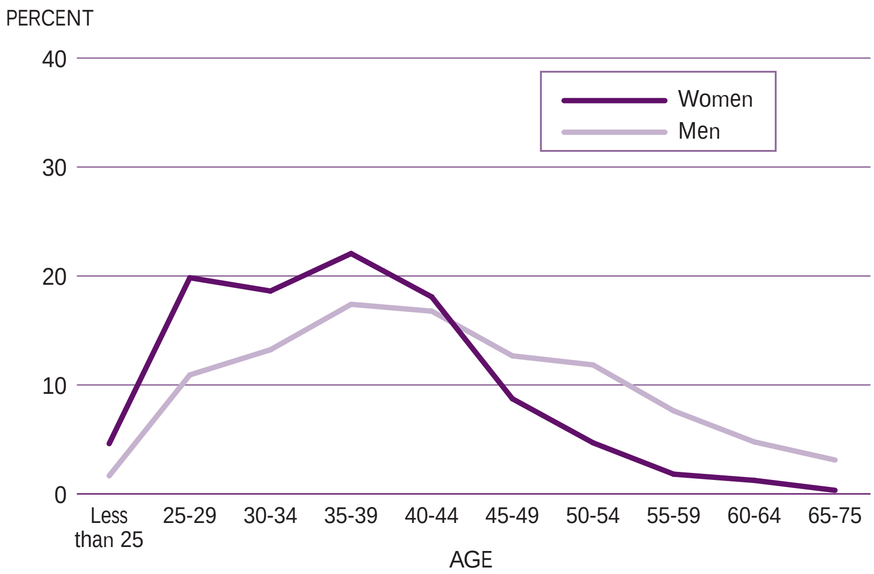
NOTE: Engineers over age 64 are omitted due to the small number of cases.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

the finding that they tended to be younger than their male engineer colleagues is logical.[2] The fact that they were more highly represented among younger engineers is also consistent with the increasing proportion of women who received bachelor's degrees in engineering in recent years.[3]

Figure 4 shows the percentage distributions of male and female engineers, foreshadowing a change in the future gender demographics of the profession if degree and employment trends in engineering are maintained.

Figure 4
Gender of U.S. engineers, by age: 1999



SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

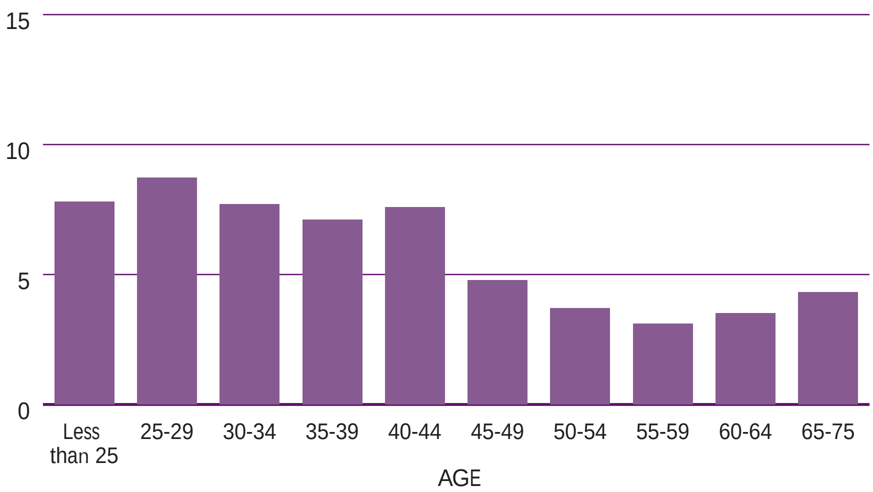
[2] Another analysis of the Engineering Workforce Project explored the salary differences between male and female engineers and found that they are explained almost entirely by years since the baccalaureate (Lal, Yoon, and Carlson 1999).

[3] Details of degree awards in science and engineering by gender appear in Hill and Johnson (2004).

Underrepresented Minorities

Blacks, American Indians/Alaska Natives, and Hispanics (of any race) were relatively rare among engineers. In 1999, these groups combined accounted for 23 percent of the U.S. population between the ages of 22 and 75,[4] but they were only 6 percent of practicing engineers (see Table 11). Even among engineer cohorts younger than 30, where these groups were found in the largest numbers, they represented only 9 percent of engineers (Figure 5).

Figure 5
Underrepresented minorities as a percentage of all U.S. engineers, by age: 1999



NOTE: Underrepresented minorities are Hispanics, blacks, and American Indians/Alaska Natives. Race/ethnicity includes only U.S. citizens and permanent residents.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

[4] Calculated from U.S. Census Bureau data at http://www.census.gov/population/estimates/nation/e90s/e9999rmp.txt.

Black engineers were younger than their white, Asian,[5] and Hispanic colleagues. The median age in 1999 was 41 for whites, 40 for Asians, 38 for Hispanics, and 37 for blacks (Table 2).

Immigrants[6]

Compared to the population as a whole, non-native-born workers were disproportionately well represented among engineers. As of April 1999, about 19 percent of U.S. engineers and 17 percent of all U.S. scientists and engineers were non-native born (Table 3). These percentages significantly

Table 3
U.S. scientists and engineers, by occupation and percentage non-native born: 1999

Occupation	Total (N)	Non-native born (%)
TOTAL, SCIENTISTS AND ENGINEERS	**3,541,000**	**17**
Chemical and physical scientists	298,000	16
Computer scientists	746,000	14
Life scientists	342,000	17
Mathematical scientists	83,000	17
Social scientists	363,000	10
Engineers	1,709,000	19

NOTE: Totals for engineers and computer scientists differ from totals in other NSF/SRS publications; here, computer software engineers are counted as engineers.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

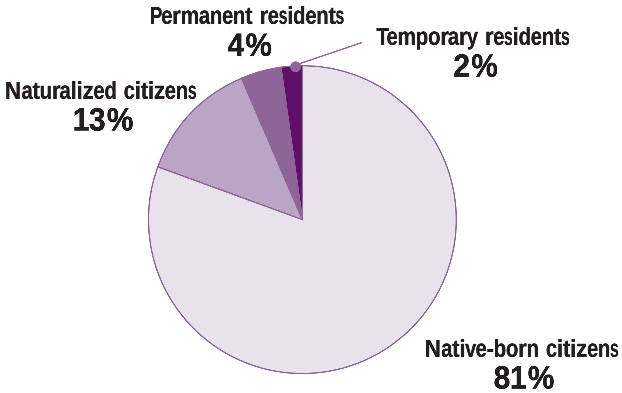
[5] The term Asian includes Pacific Islanders throughout this report.

[6] All engineers in this section are described only according to location of nativity; citizenship status is discussed further in the section Employment Sectors, by Gender, Race/Ethnicity, and Citizenship Status, page 39.

exceed the 11.9 percent of the employed population age 25 and older that was born abroad and was working in the United States in 1999.[7]

As Figure 6 shows, non-native-born engineers in the United States were much more likely to be naturalized U.S. citizens or to have held permanent visas rather than temporary visas. (Those who did have temporary visas

Figure 6
U.S. engineers, by citizenship status: 1999

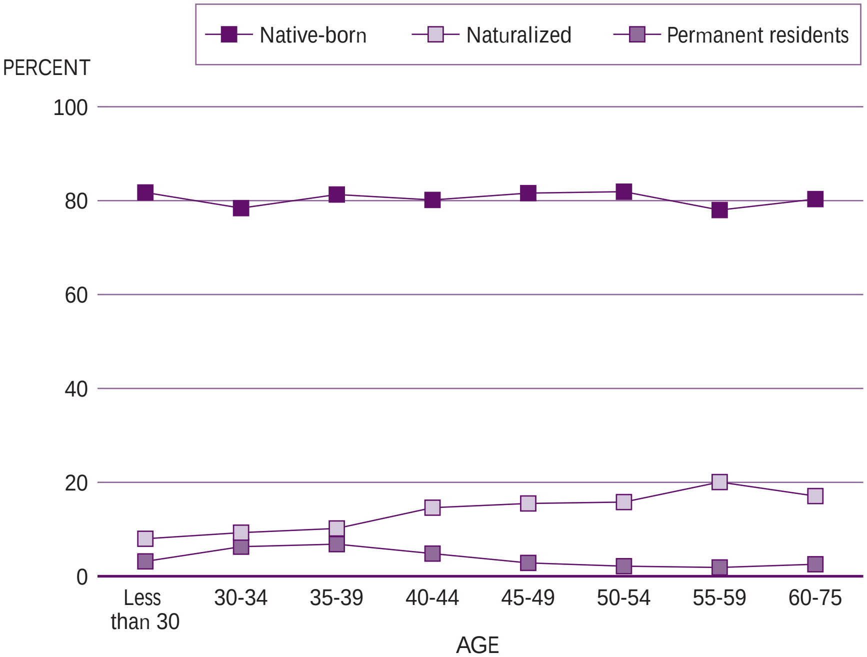


SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

[7] U.S. Bureau of the Census, March 1999 Current Population Survey. Data discussed throughout this section are also available in Burton and Wang (1999).

tended to be in the youngest age cohorts.) As age increases, beginning with those who were 30-34, the proportion of non-native-born engineers on permanent visas gradually decreases, and the proportion who were naturalized citizens rises steadily through the 55-59 cohort (Figure 7).

Figure 7
Citizenship status of U.S. engineers, by age: 1999



SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

These trends reflect decades of immigration from abroad into the population of U.S. engineers up through 1990.[8] As Table 4 shows, the ratio of native-born to non-native-born engineers in 1999 was the same—about four to one—across 10-year age groups. By contrast, increasingly large

Table 4
U.S. engineers, by native-born status, employment sector, age, and highest degree: 1999

Characteristic	Total (N)	Native born (%)	Non-native born (%)
TOTAL, ALL ENGINEERS[1]	**1,709,000**	**81**	**19**
Employment sector[2]			
4-year colleges/universities[3]	66,000	69	31
Government	193,000	80	20
Private, for-profit	1,339,000	81	19
Age			
Less than 30	238,000	82	18
30-39	543,000	80	20
40-49	498,000	81	19
50-59	307,000	80	20
60-75	123,000	80	20
Highest degree[4]			
Bachelor's	1,094,000	87	13
Master's	492,000	71	29
Doctorate	99,000	55	45

[1]*Includes computer software engineers, who are counted as computer scientists in other NSF/SRS publications.*

[2]*About 110,000 engineers worked in other sectors, including nonprofit organizations and self-employment.*

[3]*Includes medical schools and university-affiliated research institutes.*

[4]*The highest degrees of about 24,000 engineers do not fall into these categories.*

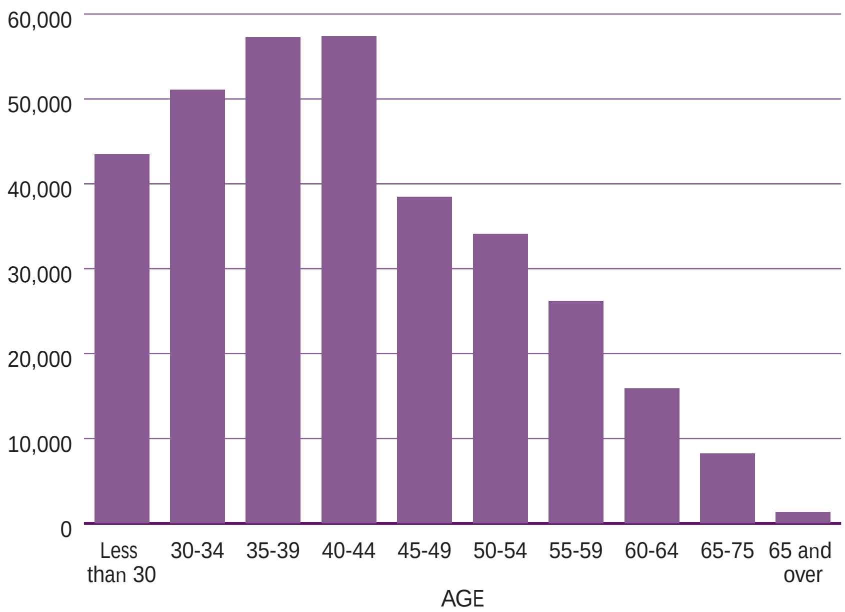
NOTE: Details may not add to totals due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

[8] As noted above, persons entering the United States to practice engineering and who did not receive a science or engineering degree in the United States since 1990 are not included in these estimates.

numbers of people born abroad who became engineers in the United States were in the younger age cohorts, which corresponds with the age pattern in the profession overall (Figure 8). In short, the 1999 data suggest that although the number of immigrant engineers in the United States increased over the years, the percentage of engineers supplied by this group changed hardly at all. (Non-native-born engineers were more common, however, among engineers with a doctorate; thus, they were also particularly well represented among engineers at 4-year colleges/universities.)[9]

Figure 8
Number of non-native-born U.S. engineers, by age: 1999



SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

[9] In this study, 4-year colleges/universities includes medical schools and university-affiliated research institutes.

Table 5 shows a sharp increase from older to younger cohorts in the percentage of non-native-born engineers who earned their highest degree in the United States. This pattern suggests that younger immigrant engineers may have taken a different route into U.S. engineering practice from their older non-native-born colleagues; more often, the younger immigrants came to the United States to obtain or finish their education and subsequently became practicing engineers. In the past, larger percentages of immigrants who became employed as engineers in the United States had finished their formal education abroad. Table 5 also shows that immigrant engineers whose highest degree was a master's or doctorate were more likely to have earned the degree at a U.S. college or university than were immigrant engineers whose highest degree was a bachelor's. Similarly, non-native-born engineers in academia were more likely than their colleagues in industry or government to have earned their highest degree in the United States.

Table 5
Non-native-born U.S. engineers who earned their highest degree in the United States, by age, employment sector, and level of highest degree: 1999

Characteristic	Non-native born (N)	Highest degree earned in U.S. (%)
TOTAL, NON-NATIVE-BORN U.S. ENGINEERS	**332,000**	**83**
Employment sector[1]		
4-year colleges/universities[2]	20,000	89
Government	38,000	75
Private, for-profit	254,000	84
Age		
Less than 30	43,000	100
30-39	108,000	95
40-49	96,000	80
50-59	60,000	66
60-75	24,000	52
Highest degree[3]		
Bachelor's	143,000	73
Master's	140,000	91
Doctorate	45,000	89

[1]*Roughly 19,700 were employed in other sectors.*

[2]*Includes medical schools and university-affiliated research institutes.*

[3]*About 3,600 highest degrees do not fall into these categories.*

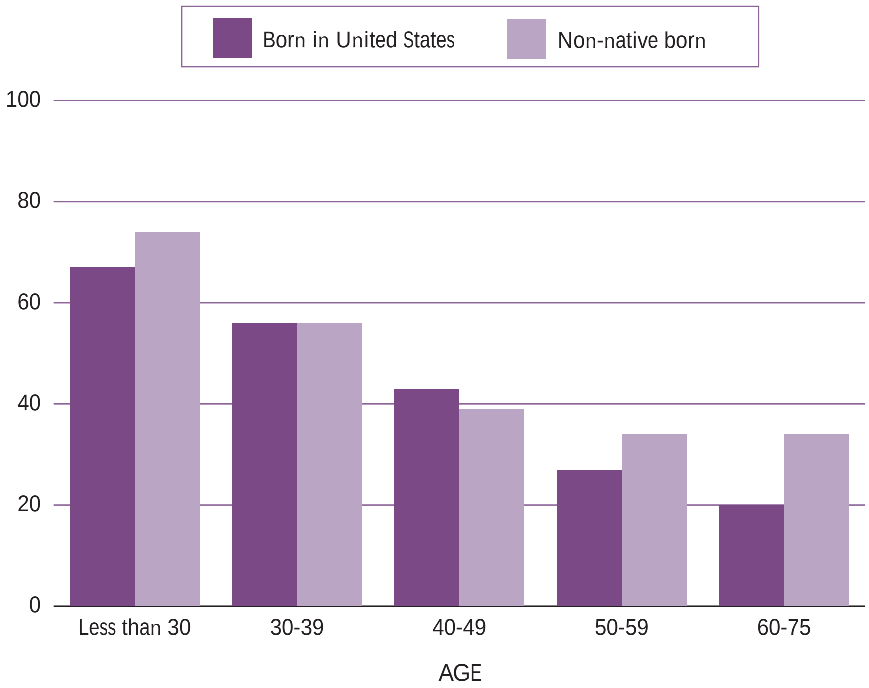
NOTE: Details may not add to totals due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Parental education has traditionally been used as one measure of an individual's socioeconomic background, and the relationship between parental levels of education and the careers of their children has been analyzed in studies of intergenerational mobility (Lipset 1964). Consistent with NSF data that suggest levels of education have increased throughout the U.S. population as well as abroad, the parents of younger engineers were far more likely to have obtained a college degree than those of older engineers (Figure 9). Among engineers age 50 and older, one-fourth of native-born engineers and about one-third of non-native-born engineers had at least one parent with a degree at the baccalaureate level or higher. Sharp increases in parental education—and thus in the socioeconomic status of the families from which U.S. engineers emerged—are evident among the "baby boomers" aged 30-49, especially those born in the United States. Native-born engineers in their thirties were twice as likely as engineers in their fifties to have at least one parent with a 4-year degree. In the youngest cohort, about two-thirds of practicing U.S. engineers had parents who had already attained the socioeconomic status conferred by a 4-year degree.

Figure 9

Percentage of U.S. engineers with at least one parent with a bachelor's degree or higher, by age and native-born status: 1999



SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

SECTION 2

WHERE DO ENGINEERS WORK?

SECTION 2

WHERE DO ENGINEERS WORK?

This section looks at where engineers were employed in the United States in 1999. It reports findings on the employment sectors of engineers by age, gender, citizenship, and race/ethnicity.

Employment Sectors and Engineering Occupations

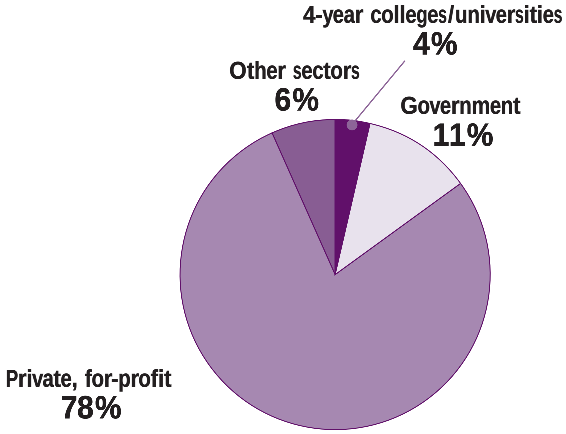
In 1999, by far the greatest number of engineers—more than 1.3 million people, accounting for 79 percent of all practicing engineers—worked in the private, for-profit sector.[10] The government sector employed nearly 200,000 of all engineers (11%); another 66,000 (4%) worked in 4-year colleges/universities (Figure 10).

This Section Addresses the Following Questions:

- In what employment sectors do engineers work?
- Are there distinctive patterns in engineering employment for subgroups?

[10] In this section "private, for-profit" excludes self-employment.

Figure 10
Employment sector of U.S. engineers, by selected engineering occupation: 1999



NOTE: Four-year colleges/universities includes medical schools and university-affiliated research institutes. Other sectors include nonprofit organizations and self-employment. Percents may not add to 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

As Table 6 and Figure 10 show, engineers working in each of the different engineering occupations were distributed among sectors in distinctive patterns. Engineers in most occupational specialties—including computer software engineers, computer hardware engineers, chemical engineers, electrical engineers, mechanical engineers, sales engineers, and industrial engineers—were overwhelmingly employed in private-sector jobs.[11] Over one-quarter of the biomedical/bioengineering engineers[12] worked in 4-year colleges/universities; this was the only engineering occupation other than postsecondary teaching in which more than 5 percent worked in academic settings. The government employed higher percentages of civil/architectural engineers (34%), environmental engineers (31%), nuclear engineers (30%), and aeronautical/aerospace engineers (19%) than the overall percentage of engineers employed in this sector (11%).

[11] Data on civil and architectural engineers have been collapsed into one category for this analysis.

[12] Data on bioengineers and biomedical engineers were not collected in separate categories.

Table 6
Distribution of U.S. engineers, by occupation and employment sector: 1999

Engineering occupation	4-year colleges/ universities[1] (%)	Government (%)	Private, for-profit (%)	Other sectors[2] (%)
TOTAL, ALL ENGINEERS	**4**	**11**	**78**	**6**
Aeronautical/aerospace engineers	4	19	73	5
Biomedical/bioengineers	27	4	58	11
Chemical engineers	2	4	90	4
Civil/architectural engineers	2	34	55	9
Computer hardware engineers	2	5	89	5
Computer software engineers	1	2	90	6
Electrical/electronics engineers	3	12	80	6
Environmental engineers	3	31	60	6
Industrial engineers	2	5	88	5
Materials/metallurgical engineers	4	6	84	7
Mechanical engineers	2	5	87	6
Mining/geological/petroleum engineers	1	3	84	12
Nuclear engineers	4	30	58	8
Postsecondary engineering teachers	90	0	0	10
Sales engineers	0	0	94	6
Other engineers	3	12	77	8

[1]*Four-year colleges/universities includes medical schools and university-affiliated research institutes.*

[2]*Other sectors includes nonprofit organizations and self-employment.*

NOTE: Percents may not add to 100 due to rounding.

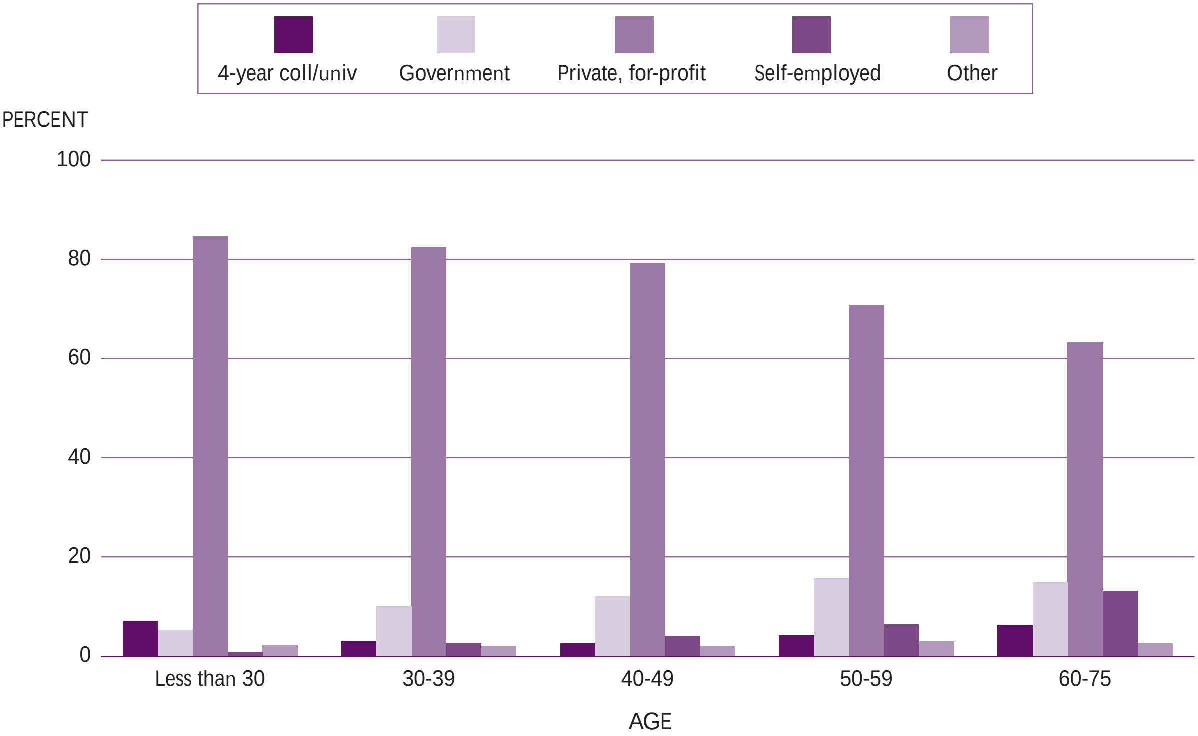
SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Employment Sectors, by Age

The median ages of engineers in 1999 varied depending on the sector in which they were employed. Engineers who were self-employed, for example, had a median age of 49, whereas engineers in the military had a median age of 36 (Table 2). For those in the private sector, the median age was 40; engineers who were employed in 2-year colleges had a median age of 48.

As Figure 11 shows, the percentage of engineers employed in the for-profit sector steadily decreased as engineers aged; in contrast, the proportion of self-employed engineers increased with each cohort and was the greatest among engineers ages 60-75.

Figure 11
Employment sector of U.S. engineers, by age: 1999



NOTE: Four-year colleges/universities includes medical schools and university-affiliated research institutes. Nonprofit organizations are omitted.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Among engineers who moved into self-employment between 1997 and 1999, however, more than twice as many were in the age 30-39 cohort as in the age 60-75 cohort (31% versus 13%; Table 7). Although there were far more engineers in the younger age groups overall than in the older cohorts, this finding is intriguing. The cause of this unexpectedly high rate of movement to self-employment among relatively young engineers is unclear; more research will be required to determine the reasons for these choices.

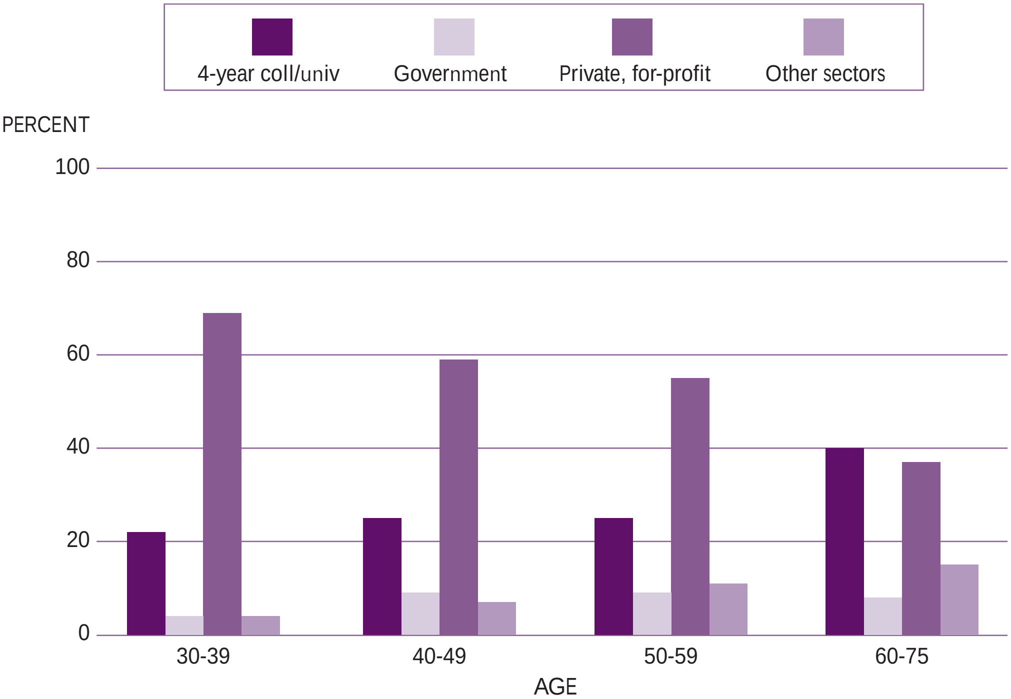
Table 7
U.S. engineers who became self-employed between 1997 and 1999, by age in 1997: 1999

TOTAL, RECENTLY SELF-EMPLOYED ENGINEERS	**21,000**
Age in 1997	(%)
Less than 30	6
30 - 39	31
40 - 49	30
50 - 59	20
60 - 75	13

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1997 and 1999.

In all age cohorts except the 60-75 cohort, engineers with doctorates—like engineers generally—were predominately employed in the for-profit sector. Indeed, for the age 30-39 cohort, 69 percent worked in the for-profit sector, and about 22 percent worked in 4-year colleges/universities. Of engineers in the 60-75 cohort, on the other hand, 40 percent worked in 4-year colleges/universities, and 37 percent in the for-profit sector (Figure 12).

Figure 12
Employment sector of U.S. engineers with doctorates, by age: 1999



NOTE: Four-year colleges/universities includes medical schools and university-affiliated research institutes. Other sectors includes nonprofit organizations and self-employed.

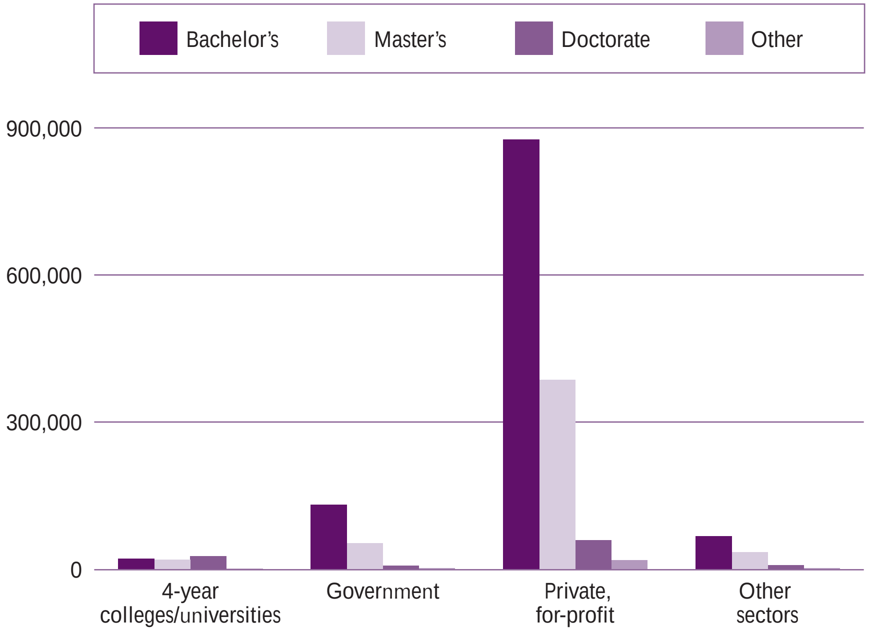
SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Employment Sectors, by Degree Background

Figures 13 and 14 and Table 8 show how engineers with different degree backgrounds were distributed among employment sectors in 1999. Regardless of the highest degree, most engineers worked in the private sector: 59 percent of engineers with doctorates and more than three-quarters of engineers with master's and bachelor's degrees worked in this sector. Four-year colleges/universities[13] employed roughly equal numbers of people with bachelor's, master's, and doctoral degrees; however, they employed a greater proportion of engineers with doctorates (26%), compared to those with master's (4%) or bachelor's (2%) degrees. For most government engineers, a bachelor's was the highest degree (68%), although more than 25 percent had master's degrees. Engineers with doctorates constituted the smallest group of government engineers, and engineers with doctorates were least likely to be employed in government compared to any other employment sector.

[13]In this study, "four-year colleges/universities" includes medical schools and university-affiliated research institutes.

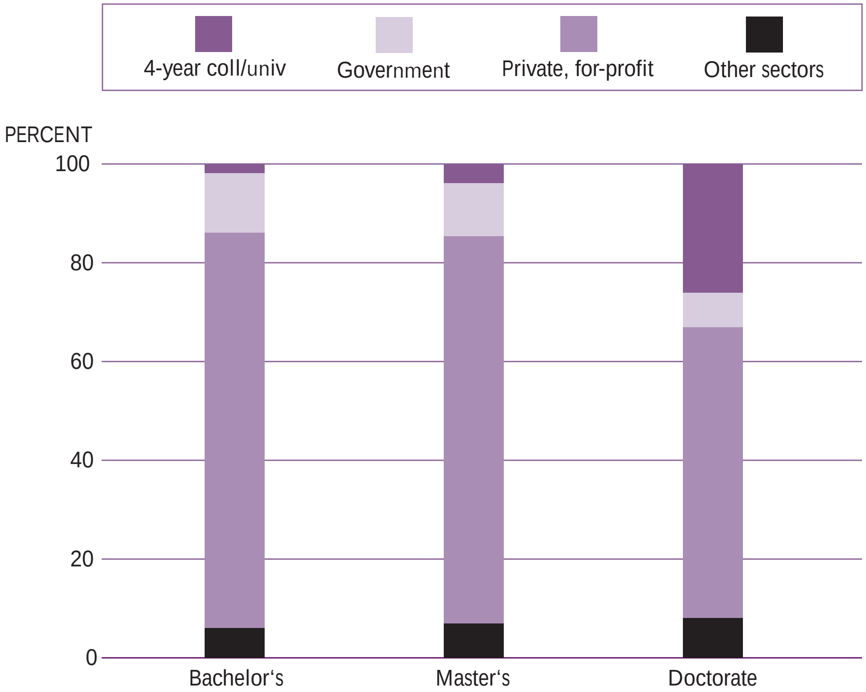
Figure 13
U.S. engineers, by employment sector and highest degree in any field: 1999



NOTE: A small number of engineers whose highest degree is a professional degree are omitted. Four-year colleges/universities includes medical schools and university-affiliated research institutes. Other sectors includes nonprofit organizations and self-employment.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Figure 14
U.S. engineers, by highest degree in any field and employment sector: 1999



NOTE: A small number of engineers whose last degree is a professional degree are omitted. Four-year colleges/universities includes medical schools and university-affiliated research institutes. Other sectors includes nonprofit organizations and self-employment.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Table 8
Employment sector of U.S. engineers, by highest degree in any field: 1999

		Highest degree in any field[1]								
		Bachelor's			Master's			Doctorate		
Employment sector	Total number	Number	Row (%)	Column (%)	Number	Row (%)	Column (%)	Number	Row (%)	Column (%)
TOTAL, ALL ENGINEERS	**1,706,000**	**1,094,300**	**64**	**100**	**491,600**	**29**	**100**	**99,300**	**6**	**100**
4-year colleges/universities[2]	66,100	20,900	32	2	19,300	29	4	25,900	39	26
Government	192,300	131,200	68	12	52,600	27	11	7,000	4	7
Private, for-profit	1,337,400	875,700	65	80	385,600	29	78	58,400	4	59
Other sectors[3]	110,100	66,500	60	6	34,100	31	7	8,000	7	8

[1]A small number of engineers whose highest degree was a professional degree are omitted.

[2]Four-year colleges/universities includes medical schools and university-affiliated research institutes.

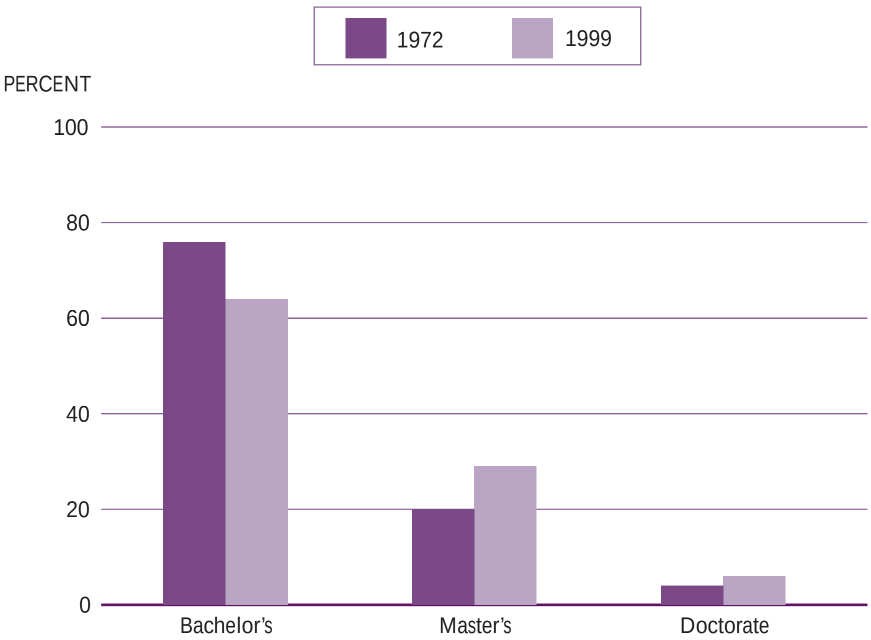
[3]Other sectors includes nonprofit organizations and self-employment.

NOTE: Details may not add to totals and percents may not add to 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Comparisons of 1999 data with data from 1972 (National Science Foundation 1975)[14] provide a 27-year picture of change in the profession. Figure 15 shows that between 1972 and 1999, overall education levels increased for engineers. As the percentage of those with only bachelor's degrees decreased, the percentage of those with master's degrees increased measurably (from 20% to 29%).

Figure 15
U.S. engineers, by highest degree in any field: 1972 and 1999



SOURCES: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999; The 1972 Scientist and Engineer Population Redefined, *NSF 75-313, Table B-1.*

[14]Similar analyses using 1965 data appear in Perruci, LeBold, and Howland, 1966.

Table 9 shows that the highest degree earned by engineers varied by engineering occupation. For more than three-fifths of all engineers (64%), the highest degree earned was the bachelor's. Mining/geological/petroleum engineers (79%), sales engineers (76%), industrial engineers (76%), and mechanical engineers (73%) were more likely than those in other engineering specialties to have only a bachelor's degree. Only 6 percent of all engineers

Table 9
Distribution of U.S. engineers, by occupation and level of highest degree: 1999

	Highest degree		
Engineering occupation	Bachelor's (%)	Master's (%)	Doctorate (%)
TOTAL, ALL ENGINEERS	**64**	**29**	**6**
Aeronautical/aerospace engineers	53	38	7
Biomedical/bioengineers	53	30	17
Chemical engineers	64	25	10
Civil/architectural engineers	71	25	2
Computer hardware engineers	62	32	4
Computer software engineers	58	35	5
Electrical/electronics engineers	64	30	5
Environmental engineers	58	35	5
Industrial engineers	76	21	1
Materials/metallurgical engineers	51	29	20
Mechanical engineers	73	23	3
Mining/geological/petroleum engineers	79	16	4
Nuclear engineers	52	36	9
Postsecondary engineering teachers	18	21	61
Sales engineers	76	22	1
Other engineers	61	32	6

NOTE: Percents may not add to 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

had a doctorate; however, more than three-fifths of the postsecondary engineering teachers (61%) held a Ph.D., as did a sizable number of materials/metallurgical engineers (20%) and biomedical/ bioengineering engineers (17%). Although 29 percent of all engineers had a master's as their highest degree, environmental and aeronautical/aerospace engineers were most likely (38%) to have this degree.

Employment Sectors, by Gender, Race/Ethnicity, and Citizenship Status[15]

Male and female engineers were distributed in virtually the same patterns across employment sectors in 1999 (Table 10). Table 11 shows that sectoral patterns for racial and ethnic minorities differed from those of the majority.

Table 10
U.S. engineers, by employment sector and gender: 1999

Employment sector	All	Female	Male
TOTAL, ALL ENGINEERS	**1,708,700**	**192,900**	**1,515,700**
	(%)	(%)	(%)
2-year colleges	0	s	0
4-year colleges/universities[1]	4	4	4
Military	1	s	1
Private, for-profit	80	81	79
Self-employed	4	2	5
State/local government	5	5	5
U.S. government	6	7	6
Other sectors[2]	0	s	0

s = Suppressed estimate due to small cell count.

[1]Four-year colleges/universities includes medical schools and university-affiliated research institutes.

[2]Other sectors includes nonprofit organizations.

NOTE: Details many not add to totals and percents may not total 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

[15]This section differs from the discussion of nativity earlier in this report as follows: Independent of country of nativity, the racial/ethnic categories here include U.S. citizens and permanent residents. The race or ethnicity of temporary residents is not analyzed here.

Table 11
U.S. engineers, by employment sector, race/ethnicity, and citizenship status: 1999

Employment sector	Total (N)	U.S. citizens and permanent residents: Asian (%)	Under-represented minorities (%)	White (%)	Temporary residents (%)
TOTAL, ALL ENGINEERS	**1,708,700**	**12**	**6**	**80**	**2**
2-year colleges	3,800	s	s	81	s
4-year colleges/universities[1]	66,100	14	6	71	9
Military	10,200	14	14	72	0
Private, for-profit	1,359,900	11	6	81	2
Self-employed	71,900	8	4	87	s
State/local government	91,600	16	11	73	s
U.S. government	101,400	12	8	80	s
Other sectors[2]	3,600	s	s	68	s

s = Suppressed estimate due to small cell count.

[1]*Four-year colleges/universities includes medical schools and university-affiliated research institutes.*

[2]*Other sectors includes nonprofit organizations.*

NOTE: Details many not add to totals and percents may not total 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

For example, only 6 percent of all engineers were underrepresented minorities, although a comparatively large proportion of underrepresented minority engineers was employed at all levels of government—federal (8%), state and local (11%), and the military (14%). White engineers predominated among those who were self-employed (87%), while their overall proportion among engineers was 80 percent.

A disproportionately large number of U.S. citizen and permanent resident Asian engineers were employed in 4-year colleges/universities. In contrast, although 80 percent of all engineers were white, only 71 percent of the engineers employed in these institutions were white.

Only 2 percent of all engineers were temporary residents,[16] but these individuals constituted 9 percent of engineers employed at 4-year colleges/universities. Many of these engineers may have been pursuing higher degrees or holding postdoctoral appointments.

[16]The race/ethnicity of temporary residents is not included in the analysis.

SECTION 3

ABOUT ENGINEERING OCCUPATIONS

SECTION 3

ABOUT ENGINEERING OCCUPATIONS

This section explores trends in employment in engineering occupations. After noting 27-year trends apparent in data from 1972 and 1999, the section continues by pointing out how engineering occupations differ with regard to the relative age of practitioners. It also considers distinctions in the way engineers were distributed by gender and by racial and ethnic group, as well as by citizenship characteristics, among the various occupations.

Overall Trends in Engineering Occupations

The size of the engineering profession doubled over the 27 years between 1972 and 1999 (Table 12). Although most engineering occupational specialties grew at about the same rate, the most striking change was the

This Section Addresses the Following Questions:

- In what engineering occupations are U.S. engineers employed?
- What trends are apparent over time?
- Are there distinctive patterns in engineering employment for subgroups?

sharp growth in computer-related engineering specialties. In 1999 nearly one-fourth (23%) of all engineers in the United States were employed in the two engineering occupations directly related to the development and application of information technologies—computer software and hardware engineering.

Table 12
Growth in U.S. engineering occupations: 1972 and 1999

	1972		1999	
Engineering occupation	Number	Percent	Number	Percent
TOTAL, ALL ENGINEERS	**731,800**	**100**	**1,708,700**	**100**
Aeronautical/aerospace engineers	33,500	5	67,400	4
Chemical engineers	44,100	6	79,900	5
Civil/architectural engineers	118,400	16	297,200	17
Computer hardware engineers	na	na	54,700	3
Computer software engineers	na	na	338,400	20
Electrical/electronics engineers	182,300	25	307,500	18
Industrial engineers	44,300	6	81,200	5
Materials/metallurgical engineers	20,400	3	35,300	2
Mechanical engineers	156,500	21	265,800	16
Mining/geological/petroleum engineers	12,800	2	22,300	1
Nuclear engineers	5,900	1	17,500	1
Other engineers	113,600	16	141,600	8

na = not applicable.

NOTE: In this table only and for purposes of comparison, environmental engineers have been included with civil/architectural engineers; and postsecondary engineering teachers, sales engineers, and biomedical/bioengineers have been included in "other engineers." The 1972 data include engineers with any education; the 1999 data are limited to engineers with at least a baccalaureate degree. Computer software engineers may have been counted as computer scientists in other NSF/SRS publications. Details may not add to totals and percents may not add to 100 due to rounding.

SOURCES: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999; The 1972 Scientists and Engineer Population Redefined, NSF 75-313.

Engineering Occupations, by Age

As Table 2 shows, median ages ranged from 35 to 46 for engineering occupations. (See Section 1 for further discussion of this topic.) Engineering occupations with rapidly growing or emerging degree programs—biomedical engineering/bioengineering and computer software and hardware engineering—had a significantly larger percentage of engineers who were age 39 or younger compared to the engineering profession as a whole (Table 13).

Table 13
U.S. engineers, by occupation and age: 1999

Engineering occupation	Age: Less than 30 (%)	30–39 (%)	40–49 (%)	50–59 (%)	60–75 (%)
TOTAL, ALL ENGINEERS	**14**	**32**	**29**	**18**	**7**
Aeronautical/aerospace engineers	8	27	31	23	11
Biomedical/bioengineers	28	36	22	12	2
Chemical engineers	18	29	28	18	7
Civil/architectural engineers	15	26	29	21	10
Computer hardware engineers	22	32	29	14	3
Computer software engineers	17	39	30	12	2
Electrical/electronics engineers	10	30	30	20	10
Environmental engineers	12	32	32	18	6
Industrial engineers	18	33	25	18	6
Materials/metallurgical engineers	14	28	30	19	10
Mechanical engineers	14	35	26	17	8
Mining/geological/petroleum engineers	12	21	50	12	5
Nuclear engineers	10	25	36	22	7
Postsecondary engineering teachers	14	22	25	21	18
Sales engineers	13	32	28	20	6
Other engineers	5	28	30	28	10

NOTE: Percents may not add to 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

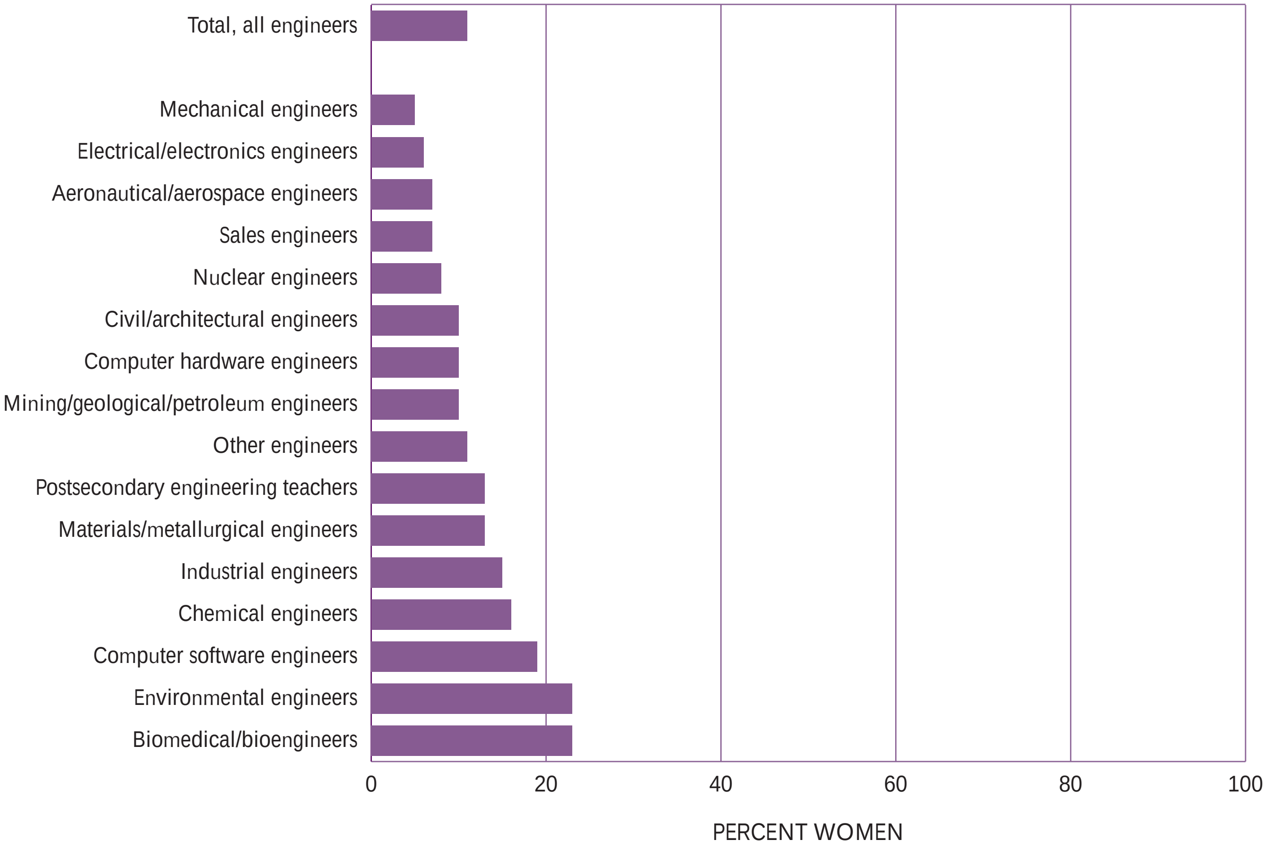
Engineering Occupations, by Gender, Race/Ethnicity, and Citizenship Status

Women made gains in employment across all engineering occupations, particularly those in which relatively high proportions had non-engineering degree backgrounds *(The Education and Employment of Engineering Graduates* 2004*).* Overall in 1999, 10 percent of engineers were female, but about one-fifth of all computer software engineers, environmental engineers, and biomedical engineers/bioengineers were women. Among engineering occupations with high proportions of engineering graduates, women were most likely to be in industrial engineering, materials/metallurgical engineering, and chemical engineering. The smallest proportions of women were employed in mechanical engineering, electrical/electronics engineering, aeronautical/aerospace engineering, and nuclear engineering (Figure 16).

The distinctive pattern of representation by women in engineering occupations is consistent with two notable avenues by which women enter engineering: acquisition of a science degree, followed by an engineering degree, or acquisition of a non-engineering degree, followed by entry into the practice of engineering without acquiring an engineering degree. All three of the engineering occupations in which women had especially strong representation in 1999 have close relationships to scientific disciplines. Although men also followed the same path into these occupations, they did so with less frequency.

Figure 16

Women as a percentage of U.S. engineers, by engineering occupation: 1999



SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

As a result of these dissimilar patterns, the distributions of men and women in engineering occupations differed (Table 14). One-third of female engineers were in computer software engineering, compared to 19 percent of men. Women were less likely to be mechanical engineers (8%) than were men (17%), and women and men were civil and architectural engineers in about the same proportions. Nine percent of female engineers were environmental engineers, compared to 4 percent of male engineers.

Table 14
Distribution of U.S. engineers, by gender and occupation: 1999

Engineering occupation	Number of female engineers	Percent of female engineers	Engineering occupation	Number of male engineers	Percent of male engineers
TOTAL, FEMALE ENGINEERS	**192,900**	**100**	**TOTAL, MALE ENGINEERS**	**1,515,700**	**100**
Computer software engineers	62,900	33	Electrical/electronics engineers	290,500	19
Civil/architectural engineers	22,500	12	Computer software engineers	275,500	18
Electrical/electronics engineers	17,000	9	Mechanical engineers	251,200	17
Environmental engineers	16,800	9	Civil/architectural engineers	201,200	13
Mechanical engineers	14,600	8	Industrial engineers	68,800	5
Chemical engineers	12,700	7	Chemical engineers	67,200	4
Industrial engineers	12,300	6	Aeronautical/aerospace engineers	62,800	4
Computer hardware engineers	5,600	3	Environmental engineers	56,700	4
Other engineers	5,400	3	Computer hardware engineers	49,200	3
Aeronautical/aerospace engineers	4,600	2	Other engineers	45,900	3
Materials/metallurgical engineers	4,500	2	Sales engineers	42,300	3
Postsecondary engineering teachers	3,900	2	Materials/metallurgical engineers	30,900	2
Sales engineers	3,400	2	Postsecondary engineering teachers	27,500	2
Biomedical/bioengineers	3,100	2	Mining/geological/petroleum engineers	20,000	1
Mining/geological/petroleum engineers	2,300	1	Nuclear engineers	16,200	1
Nuclear engineers	1,300	1	Biomedical/bioengineers	10,100	1

NOTE: Details may not add to totals and percents may not add to 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

As Table 15 shows, the distribution of racial and ethnic groups among engineering occupations holds few surprises. Asian engineers, who constituted 12 percent of the engineering workforce, were overrepresented in computer hardware engineering (21%), computer software engineering (17%), and postsecondary engineering teaching positions (14%). They were significantly underrepresented in sales engineering (4%) and nuclear engineering (3%)—occupations in which white engineers were overrepresented. Non-citizens on temporary visas (2% of engineers) were more often employed in teaching positions at 4-year colleges/universities (see Table 11), as well as in computer software and computer hardware engineering.

Table 15
Distribution of U.S. engineers, by occupation, race/ethnicity, and citizenship status: 1999

Engineering occupation	Total (N)	U.S. citizens and permanent residents: Asian (%)	Underrepresented minorities (%)	White (%)	Temporary residents (%)
TOTAL, ALL ENGINEERS	**1,708,700**	**12**	**6**	**80**	**2**
Aeronautical/aerospace engineers	67,400	11	4	84	1
Biomedical/bioengineers	13,100	12	5	82	s
Chemical engineers	79,900	12	7	79	2
Civil/architectural engineers	223,700	11	7	81	1
Computer hardware engineers	54,700	21	5	69	5
Computer software engineers	338,400	17	6	73	5
Electrical/electronics engineers	307,500	12	7	79	2
Environmental engineers	73,500	8	8	83	1
Industrial engineers	81,200	5	9	85	1
Materials/metallurgical engineers	35,300	10	4	83	3
Mechanical engineers	265,800	9	6	84	1
Mining/geological/petroleum engineers	22,300	4	6	89	s
Nuclear engineers	17,500	3	4	93	s
Postsecondary engineering teachers	31,400	14	7	73	6
Sales engineers	45,700	4	6	89	s
Other engineers	51,300	7	5	87	1

s = Suppressed estimate due to small cell count.

NOTE: Percents may not add to 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

SECTION 4

DEGREE BACKGROUNDS AND QUALIFICATIONS OF ENGINEERS

SECTION 4

DEGREE BACKGROUNDS AND QUALIFICATIONS OF ENGINEERS

Engineers bring a variety of educational backgrounds to their work. This section analyzes the correspondence between engineering degree attainment and employment in engineering occupations. For occupations in which educational and employment data are relevant, it focuses on the correspondence between education fields and engineering occupations, showing detailed degree histories of U.S. engineers with and without engineering degrees. Finally, it considers the licenses and certifications possessed by engineers working in different occupational specialties.

This Section Addresses the Following Questions:

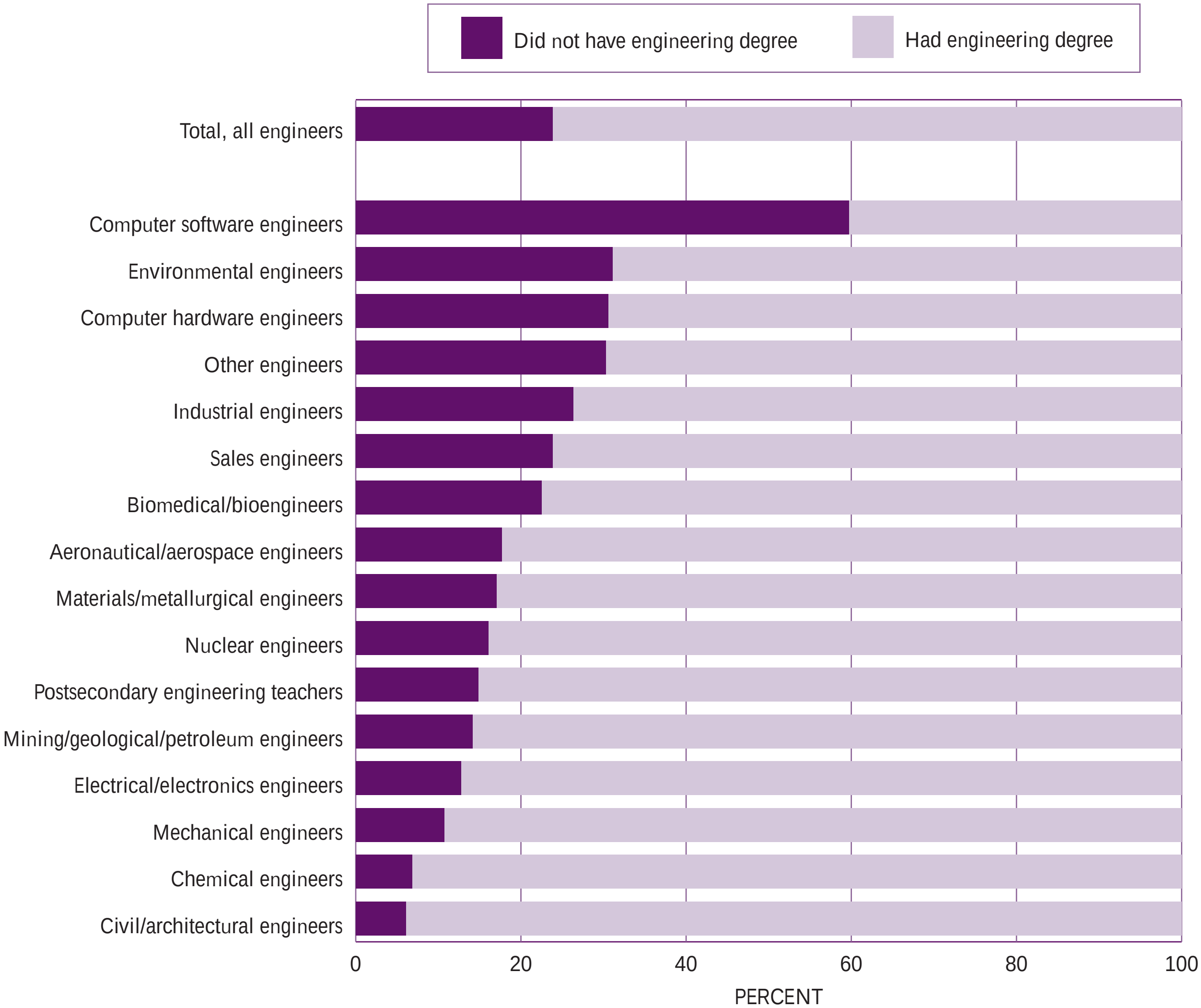
- What degree backgrounds do engineers bring to their jobs?
- What is the correspondence between engineering education fields and engineering occupations, and are there identifiable patterns of mobility among educational disciplines and engineering occupational specialties?
- What proportion of engineers in various engineering occupations is certified or licensed?

Engineers Without Degrees in Engineering

In 1999, approximately 407,000 engineers had one or more degrees at the baccalaureate level or higher but no degree in engineering. Engineers without engineering degrees accounted for one-quarter of all engineers; these engineers were distributed across engineering occupations in distinctive patterns that differed markedly from those of colleagues with one or more engineering degrees. Computer hardware and software engineering, environmental engineering, industrial engineering, and sales engineering had relatively high percentages of practitioners without engineering degrees. Although practitioners without engineering degrees were employed in all engineering occupations (Figure 17), their percentages were highest in engineering occupations with emerging or rapidly growing degree programs—including software engineering and environmental engineering. Practitioners without engineering degrees constituted 60 percent of all computer software engineers, their largest proportion in any occupation.

[17] Numbers throughout this section are estimates based on surveys of individuals; estimates based on employer data may differ considerably.

Figure 17
Engineering degree status of U.S. engineers, by engineering occupation: 1999



SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Overall, engineers without at least a bachelor's degree in engineering most frequently earned their most recent degree in computer science (23%), physics (8%), or electrical and electronics engineering technology (6%) (Table 16). These engineers also frequently held degrees in scientific fields related to their engineering employment; for example, environmental engineers without engineering degrees were most likely to have degrees in environmental science, chemistry, geology, or general biology.

Table 16
U.S. engineers who do not have at least a bachelor's degree in engineering, by selected occupation and field of most recent degree: 1999

Engineering occupation	Field of most recent degree	%
TOTAL, ALL ENGINEERS	Computer science	23
	Physics	8
	Electrical/electronics engineering technology	6
	General mathematics	5
	General computer and information sciences	5
	Business administration and management	4
	Mechanical engineering technology	4
	Chemistry, not biochemistry	4
	Applied mathematics	2
	General biology	2
	Geology	2
	All other degree fields	35
Computer software engineers	Computer science	43
	General computer and information sciences	9
	General mathematics	7
	Physics	4
	All other degree fields	37
Chemical engineers	Chemistry, not biochemistry	57
	Geology	13
	Other engineering-related technologies	9
	General biology	7
	All other degree fields	14
Environmental engineers	Environmental science	23
	Geology	12
	Chemistry, not biochemistry	11
	General biology	6
	Business administration and management	6
	Public health	5
	All other degree fields	37
Mechanical engineers	Mechanical engineering technology	50
	Industrial production technology	9
	Physics	6
	Business administration and management	6
	Electrical/electronics engineering technology	5
	Other performing arts	3
	All other degree fields	21
Electrical/electronics engineers	Electrical/electronics engineering technology	37
	Physics	21
	Business administration and management	7
	Computer science	6
	General mathematics	3
	All other degree fields	26

NOTE: Table shows the most frequently occurring fields of the most recent degrees.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Mature engineering occupations—such as electrical/electronics engineering, mechanical engineering, and civil/architectural engineering—primarily employed individuals with engineering degrees. Even in these mature engineering specialties, however, substantial numbers of engineers did not hold an engineering degree at any level.[18] As Figure 17 shows, 13 percent of electrical/electronics engineers, 11 percent of mechanical engineers, and 7 percent of chemical engineers had no engineering degree.

Reasons for Becoming an Engineer Without Obtaining an Engineering Degree

Engineers who did not have an engineering degree often had a related degree in a field of science. Eighty-five percent of engineers who did not have an engineering degree stated that their engineering job was closely or somewhat related to the field of their highest degree. The remaining 15 percent reported that their engineering occupations and highest degrees were not related. The most common reasons they cited for working in an occupation that was not related to their highest degree were pay and promotion opportunities (45%), changes in career or professional interests (25%), and unavailability of jobs in the field of their highest degree (13%). Often, a combination of reasons led them to select a particular engineering occupation (NSF/SRS, SESTAT 1999, unpublished tabulations).

[18] These engineers may have 4-year degrees in engineering technology, which the Engineering Workforce Project and other taxonomies of the National Science Foundation do not consider degrees in engineering.

Mobility Among Degree Fields and Engineering Occupations

As noted in a complementary study of the Engineering Workforce Project *(The Education and Employment of Engineering Graduates* 2004*)*, 70 percent of young engineering graduates became engineers but that percentage decreased across older age cohorts. Table 17 shows the percentages of engineering graduates by the field of their highest engineering degree and the proportions employed as engineers in 1999. It also shows, for those in engineering occupations, the correspondence between the field of the highest engineering degree and the graduate's engineering occupation. Table 17 makes clear that people with engineering degrees pursued a variety of occupations both inside and outside the engineering profession.

Of the engineering graduates listed in Table 17, half or fewer were employed in the occupational specialty that corresponds with the field of their highest degree. The highest percentage of people employed in the engineering occupation associated with their highest degree was in civil and architectural engineering (50%); 44 percent of engineering graduates whose highest degree was in mechanical engineering were mechanical engineers. Proportionately fewer individuals (21%) whose highest degree was in industrial engineering were employed in that occupation at the time of the study. Of all engineering graduates whose highest degrees were in the fields listed in Table 17, 11 to 27 percent were working in an engineering occupational specialty that was different from that of their highest engineering degree field. Furthermore, between 39 and 65 percent of engineering graduates whose highest degrees were in the fields listed were not employed as engineers.[19]

[19]Engineering Workforce Project report, *The Education and Employment of Engineering Graduates* (2004), presents details on all of the occupations of engineering graduates.

Table 17

Equivalence[1] of engineering education field with U.S. engineering occupation: 1999

Highest engineering degree field	Occupation in engineering: Total (%)	Occupation in engineering: Engineering specialty equivalent to highest engineering degree (%)	Occupation in engineering: Engineering specialty different from highest engineering degree (%)	Not in an engineering occupation (%)
Aeronautical/aerospace	46	26	20	54
Biomedical/bioengineering	44	23	21	56
Chemical	54	35	19	46
Civil/architectural	60	50	11	40
Electrical/electronics (including computer hardware)	61	40	21	39
Environmental	63	35	27	37
Industrial	35	21	14	65
Materials/metallurgical	53	34	19	47
Mechanical	61	44	17	39
Mining/geological/petroleum	55	38	17	45
Nuclear	58	42	16	42

[1]*Equivalence is defined as the same education field as the engineer's occupational specialty.*

NOTE: Computer hardware engineers, computer software engineers, postsecondary engineering teachers, sales engineers, and other engineers are omitted. For this table only, the engineering occupational specialties of electrical/electronics and computer hardware engineering have been combined. Unlike other tables in this report, this table is based on education, not occupation; thus, engineers who did not have an engineering degree are omitted here. Percent details may not total subtotals due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Table 18 shows similar data but from the opposite perspective—that is, the correspondence of the occupational specialty in engineering to the engineering degree fields, if any, for the same set of occupations. The difference between the first two columns of data (i.e., the first data column minus the second column) shows the percentage of engineers in the occupation who added a non-engineering degree after their last engineering degree. For example, 82 percent of aeronautical/aerospace engineers had an engineering degree in some engineering field, but that degree was the last[20] degree for only 71 percent; thus, 11 percent supplemented their engineering degree with at least one non-engineering degree. In addition, the table shows the percentage in the engineering occupation that had an engineering degree in a field corresponding to their occupation—where "corresponding" is defined as the same degree field specialty as the engineering occupational specialty. In 5 of the 11 engineering occupations shown, half or fewer of the engineers had earned an engineering degree corresponding to their occupation.

What engineering degrees had these engineers earned if not degrees corresponding to their occupations? Table 19 shows—to the extent the data allow—the detailed degree fields of these engineers.

[20]As noted earlier, the last and highest degrees were virtually always the same degree in these data.

Table 18

Equivalence[1] of U.S. engineering occupation with engineering education field: 1999

Engineering occupation	Percent with degree in any engineering field	Percent whose highest degree was in any engineering field	Percent with engineering degree field equivalent to engineering occupation
Aerospace/aeronautics engineer	82	71	39
Biomedical/bioengineer	77	69	33
Chemical engineer	93	85	86
Civil/architectural engineer	94	89	84
Electrical/electronics engineer	87	81	81
Environmental engineer	69	60	17
Industrial engineer	74	66	36
Materials/metallurgical engineer	83	80	64
Mechanical engineer	89	83	78
Mining/geological/petroleum engineer ..	86	83	52
Nuclear engineer	84	79	48

[1]*Equivalence is defined as the same education field as the engineer's occupational specialty.*

NOTE: Engineering occupational specialties of computer hardware, computer software, sales, postsecondary engineering teacher, and other are omitted.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Table 19
Selected U.S. engineering occupations, by degree field: 1999

Engineering occupation	Percent with engineering degree same as engineering occupation	Percent with engineering degree different from engineering occupation	Percent with no engineering degree
Aeronautical/ aerospace engineers	39%	43% Mechanical, electrical/electronics, civil and architectural, engineering science and physics, general engineering	18% Physics, industrial production technologies
Biomedical/bioengineers	33%	44% Mechanical, chemical engineering, electrical/electronics	23% s
Chemical engineers	86%	7% Mechanical, engineering science and physics, materials/metallurgical engineering	7% Chemistry
Civil/architectural engineers	84%	10% Environmental, mechanical, general, agricultural, engineering science and physics, and chemical engineering	6% Geology
Computer hardware engineers	61%	10% Mechanical, chemical engineering	31% Computer science, physics
Electrical/electronics engineers	81%	6% Engineering science and physics, mechanical, general, industrial, chemical, aeronautical/aerospace, materials/metallurgical engineering	13% Electrical/electronics technology, physics, computer science business, chemistry
Environmental engineers	17%	52% Chemical, civil and architectural, mechanical, agricultural, electrical/electronics engineering	31% Environmental science, geology, chemistry

Table 19 (continued)
Selected U.S. engineering occupations, by degree field: 1999

Engineering occupation	Percent with engineering degree same as engineering occupation	Percent with engineering degree different from engineering occupation	Percent with no engineering degree
Industrial engineers	36%	38% Mechanical, electrical/electronics, chemical, civil and architectural, materials, aeronautical/aerospace, general engineering	26% Industrial production technology, business, chemistry, physics
Materials/metallurgical engineers	64%	19% Chemical and mechanical engineering	17% Chemistry and physics
Mechanical engineers	78%	11% Aeronautical/aerospace, engineering science and physics, agricultural, chemical electrical/electronics, civil/architectural, general, industrial, marine, materials, nuclear, metallurgical engineering	11% Mechanical engineering technology, industrial production technology, physics
Mining/geological/petroleum engineers . .	52%	34% Mechanical, civil/architectural, chemical engineering	14% s
Nuclear engineers	48%	36% Mechanical engineering, chemical, electrical/electronics, civil, engineering science and physics	16% Physics

s = Suppressed due to small cell count.

[1]*Field of highest degree listed in descending order.*

NOTE: Engineering occupation specialties of computer software, sales, postsecondary teacher, and other are omitted. Listed education fields include only fields with 10 or more respondents. Engineers may have had other degrees not included in this table. Percents may not total 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

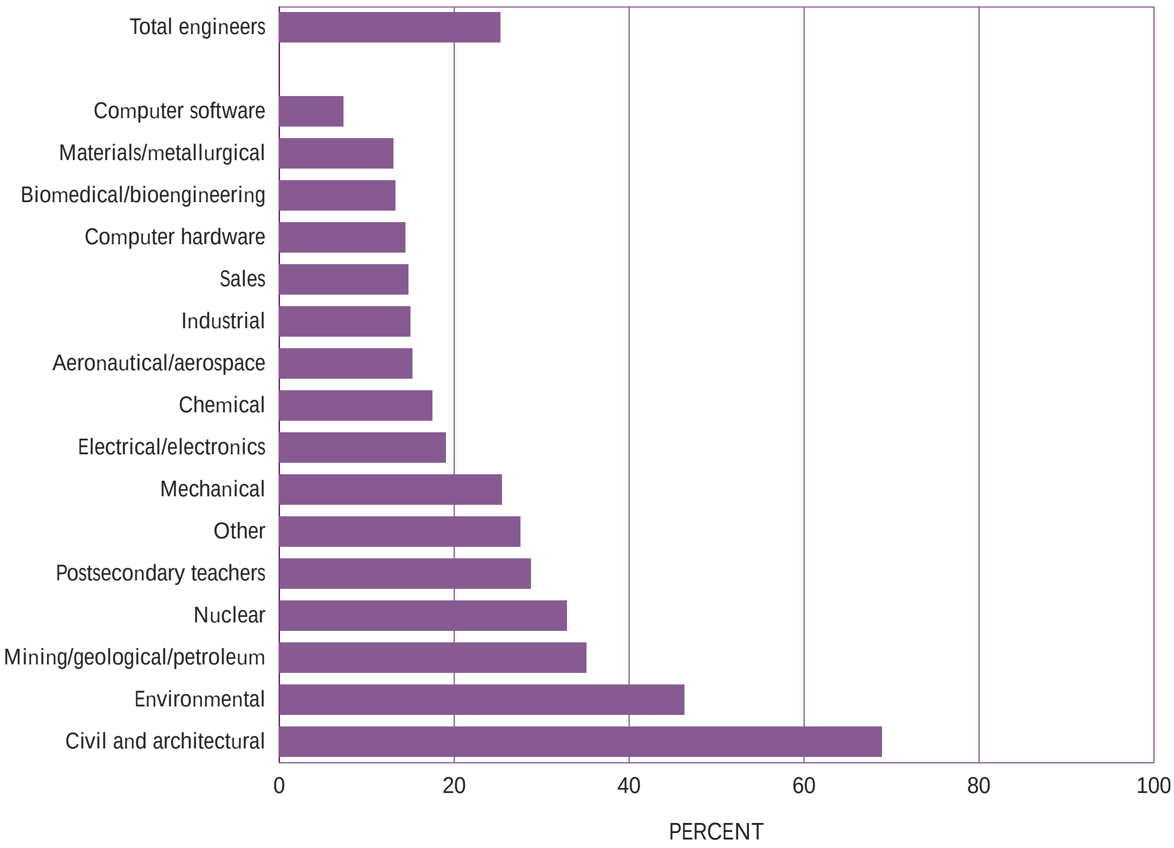
Licensing and Certification

Some engineers must show that they meet certain educational and other requirements; the proportion of engineers licensed or certified varies in part with the norms and requirements of specific engineering occupations.[21] Overall in 1997,[22] one-quarter of practicing engineers held licenses or certifications. Two-thirds of the civil and architectural engineers were licensed or certified (the highest percentage among engineering occupations), as were almost half of the environmental engineers (Figure 18). In two other engineering occupations—mining/geological/petroleum engineering and nuclear engineering—approximately one-third of the practitioners were licensed or certified. Two of these engineering occupations are closely concerned with matters that involve public safety and compliance with regulations. By contrast, only 7 percent of computer software engineers and 13 percent of biomedical/bioengineering and materials/metallurgical engineers held licenses or certifications (the two lowest percentages).

[21] The survey question asked, “As of the week of April 15, were you licensed or certified in your occupation?”

[22] Data on licensure and certification were not collected in 1999.

Figure 18
U.S. engineers, by engineering occupation and percentage with license or certification: 1997



SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1997.

BIBLIOGRAPHY

Burton, Lawrence, and Linda Parker. 1999. *Degrees and Occupations in Engineering: How Much Do They Diverge?* Issue Brief NSF 99-318. Arlington, VA: National Science Foundation.

Burton, Lawrence, and Jack Wang. 1999. *How Much Does the U.S. Rely on Immigrant Engineers?* Issue Brief NSF 99-327. Arlington, VA: National Science Foundation.

Ellis, R.A. 1997. "How Many Engineers?" *Engineers* 3, 4:9-11.

The Education and Employment of Engineering Graduates. 2004. Engineering Workforce Project Report 1. Cambridge, MA: Abt Associates, Inc.

Finn, Michael G. 2001. *Stay Rates of Foreign Doctorate Recipients from U.S. Universities, 1999.* Oak Ridge, TN: Analysis and Evaluation Programs, Science and Engineering Education Division, Oak Ridge Institute for Science and Education, Oak Ridge Associated Universities.

Hill, Susan T., and Jean M. Johnson. 2004. *Science and Engineering Degrees 1966-2001.* NSF 04-311. Arlington, VA: National Science Foundation.

Kannankutty, Nirmala, and R. Keith Wilkinson. 1999. *SESTAT: A Tool for Studying Scientists and Engineers in the United States.* NSF 99-337. Arlington, VA: National Science Foundation.

Lal, Bhavya, Sam Yoon, and Ken Carlson. 1999. *How Large Is the Gap in Salaries of Male and Female Engineers?* Issue Brief 99-352. Arlington, VA: National Science Foundation.

Lipset, Seymour Martin. 1964. *Social Mobility in Industrial Society.* Berkeley: University of California Press, 189-199.

National Research Council, Committee on National Statistics, Commission on Behavioral and Social Sciences and Education. 1989. *Surveying the Nation's Scientists and Engineers,* edited by Constance F. Citro and Graham Kalton. Washington, DC: National Academy Press.

National Science Foundation. 1975. *The 1972 Scientist and Engineer Population Redefined.* NSF 75-313. Washington, DC: National Science Foundation.

Perrucci, Robert, William K. LeBold, and Warren E. Howland. 1966. "The Engineer in Industry and Government." *Journal of Engineering Education,* March: 237-259.

APPENDIX A

SUMMARY TABLE

Table A (1 of 2)
Distribution of engineering occupations in the United States, by selected characteristics: 1999

			Highest degree level[1]				Employment sector			
Engineering occupation	Total (N)	Had engineering degree (%)	Bachelor's (%)	Master's (%)	Doctorate (%)	Had license/ certification[2] (%)	4-year colleges/ universities[3] (%)	Government (any) (%)	Private, for-profit (%)	Other[4] (%)
TOTAL, ALL ENGINEERS	**1,708,700**	**76**	**64**	**29**	**6**	**25**	**4**	**11**	**78**	**6**
Aeronautical/aerospace engineers	67,400	82	53	38	7	15	4	19	73	5
Biomedical/bioengineers	13,100	77	53	30	17	13	27	4	58	11
Chemical engineers	79,900	93	64	25	10	18	2	4	90	4
Civil/architectural engineers	223,700	94	71	25	2	69	2	34	55	9
Computer hardware engineers	54,700	69	62	32	4	14	2	5	89	5
Computer software engineers	338,400	40	58	35	5	7	1	2	90	6
Electrical/electronics engineers	307,500	87	64	30	5	19	3	12	80	6
Environmental engineers	73,500	69	58	35	5	46	3	31	60	6
Industrial engineers	81,200	74	76	21	1	15	2	5	88	5
Materials/metallurgical engineers	35,300	83	51	29	20	13	4	6	84	7
Mechanical engineers	265,800	89	73	23	3	25	2	5	87	6
Mining/geological/ petroleum engineers	22,300	86	79	16	4	35	1	3	84	12
Nuclear engineers	17,500	84	52	36	9	33	4	30	58	8
Postsecondary engineering teachers	31,400	85	18	21	61	29	90	0	0	10
Sales engineers	45,700	76	76	22	1	15	0	0	94	6
Other engineers	51,300	70	61	32	6	28	3	12	77	8

Table A (2 of 2)

Distribution of engineering occupations in the United States, by selected characteristics: 1999

	Gender		U.S. citizens and permanent residents				Age				
Engineering occupation	Male (%)	Female (%)	Asian (%)	Under-represented minorities[5] (%)	White (%)	Temporary residents (%)	Less than 30 (%)	30-39 (%)	40-49 (%)	50-59 (%)	60-75 (%)
TOTAL, ALL ENGINEERS	**89**	**11**	**12**	**6**	**80**	**2**	**14**	**32**	**29**	**18**	**7**
Aeronautical/aerospace engineers	93	7	11	4	84	1	8	27	31	23	11
Biomedical/bioengineers	77	23	12	5	82	s	28	36	22	12	2
Chemical engineers	84	16	12	7	79	2	18	29	28	18	7
Civil/architectural engineers	90	10	11	7	81	1	15	26	29	21	10
Computer hardware engineers	90	10	21	5	69	5	22	32	29	14	3
Computer software engineers	81	19	17	6	73	5	17	39	30	12	2
Electrical/electronics engineers	94	6	12	7	79	2	10	30	30	20	10
Environmental engineers	77	23	8	8	83	1	12	32	32	18	6
Industrial engineers	85	15	5	9	85	1	18	33	25	18	6
Materials/metallurgical engineers	87	13	10	4	83	3	14	28	30	19	10
Mechanical engineers	95	5	9	6	84	1	14	35	26	17	8
Mining/geological/ petroleum engineers	90	10	4	6	89	s	12	21	50	12	5
Nuclear engineers	92	8	3	4	93	s	10	25	36	22	7
Postsecondary engineering teachers	87	13	14	7	73	6	14	22	25	21	18
Sales engineers	93	7	4	6	89	s	13	32	28	20	6
Other engineers	89	11	7	5	87	1	5	28	30	28	10

s = Suppressed estimate due to small cell count.

[1] *"Other" degrees, consisting primarily of professional degrees, are excluded.*

[2] *Licensure and certification percentages are from 1997.*

[3] *Includes medical schools and university-affiliated research institutes.*

[4] *Includes nonprofit organizations and self-employment.*

[5] *Underrepresented minorities are Hispanics, blacks, and American Indians/Alaskan Natives.*

NOTE: All respondents have a baccalaureate or higher degree in some field. Percents may not add to 100 due to rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

APPENDIX B

TECHNICAL NOTES

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TECHNICAL NOTES

General Information

All publications prepared for the Engineering Workforce Project (EWP) are based on data contained in NSF's Scientists and Engineers Statistical Data System (SESTAT), which is a comprehensive and integrated system of information about the employment, educational, and demographic characteristics of scientists and engineers in the United States. SESTAT is intended for both policy analysis and general research, having features for both the casual and more intensive data user.

SESTAT currently contains data from three NSF-sponsored demographic surveys, which provide compatible data that have been merged into a single integrated data system. This integration gives SESTAT its analytical power and makes it unique around the world. This report relies on the 1999 survey responses. More recent SESTAT data will be available in approximately 2005, at which point the data collected in 2003 will have been integrated and added to SESTAT.

SESTAT Data System

In the 1990s, NSF's Division of Science Resources Studies (SRS) redesigned its data system covering scientists and engineers. Termed SESTAT, the new data system integrates data from the Survey of Doctorate Recipients, the National Survey of College Graduates, and the National Survey of Recent College Graduates. The integration of the SESTAT surveys requires complementary sample populations and reference periods; matching survey questions, procedures, and field definitions; and weighting adjustments for any overlapping populations. SESTAT's analytical power comes from this data integration.

The surveys provide data on individual respondents' educational background, occupation, employment, and demographic characteristics. They currently have a combined sample size of about 87,200, representing a population of about 13 million scientists and engineers. SESTAT defines scientists and engineers as those who either received a college degree (bachelor's level or higher) in a science or engineering field or who worked as a scientist or engineer in 1993. Each of the three surveys in the SESTAT data system collects new data every 2 years. The data reported in this publication were collected in 1999.

SESTAT has as its target population residents of the United States with a baccalaureate degree or higher who, as of the study reference period, were noninstitutionalized, age 75 or less, and either educated or working as a scientist or engineer. A baccalaureate or higher degree is a bachelor's, master's, doctorate, or professional degree. To meet the scientist or engineer requirement, the U.S. resident had to (1) have at least one baccalaureate or higher degree in a science or engineering field, or (2) have a baccalaureate or higher degree in a non-science or -engineering field but worked in a science or engineering occupation as of April 15, 1993. For the 1999 SESTAT surveys, the reference period was the week of April 15, 1999.

Some elements of SESTAT's desired target population were not included within the target populations of any of the three SESTAT component surveys. Bachelor's- and master's-level science- and engineering-educated personnel missing from the survey frames are predominately:

- residents whose bachelor's and/or master's degrees in science and engineering were received prior to April 1990 or from a foreign institution, who resided outside the United States on April 1, 1990, but not with the U.S. armed forces stationed abroad; or
- residents with no baccalaureate or higher degree in any field as of April 1, 1990, who were awarded a degree in science and engineering after June 1998 by a U.S. institution or after April 1990 by a foreign institution.

Persons with at least a bachelor's degree who are working in science and engineering jobs, but have no degree in a science or engineering field, are underrepresented in the SESTAT database after 1993 because the surveys do not capture new people entering these occupations who were not educated in science and engineering fields in this decade.

Doctorate-level science- and engineering-trained personnel missing from the survey frames are predominately:

- residents with doctorates in science and engineering received after June 1998 or from a foreign institution, with no baccalaureate or higher degree in any field as of April 1, 1990, and no bachelor's or master's degree in science and engineering received from a U.S. institution between April 1, 1990, and June 1998; or
- residents with doctorates in science and engineering received after June 1998 or from a foreign institution but with no bachelor's or master's science and engineering degree received from a U.S. institution between April 1, 1990, and June 1998, who resided outside the United States on April 1, 1990, but not with the U.S. armed forces stationed abroad.

SESTAT classifies the following broad categories as science and engineering occupations: computer and mathematical scientists, life and related scientists, physical and related scientists, social and related scientists, and engineers. Postsecondary teachers are included within each of these groups.

The following are considered non-science and -engineering occupations: top- and mid-level managers; teachers, except science and engineering postsecondary teachers; technicians/technologists, including computer programmers; and people in health and related occupations, social services and related occupations, and sales and marketing occupations. Other non-science and -engineering occupations include artists, broadcasters, editors, entertainers, public relations specialists, writers, clerical and administrative support personnel, farmers, foresters, fishers, lawyers, judges, librarians, archivists, curators, actuaries, food service personnel, historians (except science and technology), architects, construction tradespeople, mechanics and repairers, and those involved in precision/production occupations, operators (for example, machine set-up, machine operators and tenders, fabricators, assemblers) and related occupations, transportation/material moving occupations and protective and other service occupations. Information on SESTAT can be found on the Web at http://sestat.nsf.gov.

SESTAT Component Surveys

National Survey of College Graduates (NSCG). The National Survey of College Graduates (NSCG) is designed to provide data on the number and characteristics of individuals with training and/or employment in science and engineering in the United States. This survey is designed to complement the other surveys of scientists and engineers conducted by SRS in order to provide a comprehensive picture of the number and characteristics of individuals with training and/or employment in S&E in the United States. More information about this survey is available at http://www.nsf.gov/sbe/srs/nscg/start.htm.

National Survey of Recent College Graduates (NSRCG). The National Survey of Recent College Graduates (NSRCG) provides information about individuals who recently obtained bachelor's or master's degrees in a science or engineering field. This group is of special interest to many decisionmakers, because it represents individuals who have recently made the transition from school to the workplace. Details regarding the sample selection and collection of data are available at http://www.nsf.gov/sbe/srs/snsrcg/rcgmeth.htm.

Survey of Doctoral Recipients (SDR). The Survey of Doctorate Recipients (SDR) is designed to provide demographic and career history information about individuals with doctoral degrees. The results of this survey are vital for educational planners within the Federal Government and in academia. The results are also used by employers in all sectors (education, industry, and the government) to understand and predict trends in employment opportunities and salaries in S&E fields for doctorate holders and to evaluate the effectiveness of equal opportunity efforts. Additional information about this instrument's design, sampling, and data collection are available at http://www.nsf.gov/sbe/srs/ssdr/sdrmeth.htm.

Sampling Errors

Sampling errors occur when estimates are derived from a sample rather than from the entire population. The sample used for any particular survey is only one of a large number of possible samples of the same size and design that could have been selected. Even if the same questionnaire and instructions were used, the estimates from each sample would differ from the others. This difference, termed sampling error, occurs by chance, and its variability is measured by the standard error associated with a particular estimate.

The standard error of a sample survey estimate measures the precision with which an estimate from one sample approximates the true population value, and thus can be used to construct a confidence interval for a survey parameter to assess the accuracy of the estimate. Standard errors for the numbers in the tables are provided where available. The following formula can be used for estimating the standard error of totals:

$$SE(\hat{Y}) = [\beta_0 \hat{Y}^2 + \beta_1]^{1/2}$$

Approximate standard errors for percentages can be calculated from the following formula:

$$SE(P) = [\beta_1 / \hat{Y} (P(100\text{-}P))]^{1/2}$$

Where SE(P) is the predicted standard error for the percentage, $\hat{Y}$ is the estimated number of persons in the base of the percentage, and β_1 is the regression coefficient. A 95 percent confidence interval for an estimate can be calculated by multiplying 1.96 by the standard error of the estimate, and adding and subtracting the resulting amount from the estimate. Additional information about sampling error in SESTAT is available at http://srsstats.sbe.nsf.gov/docs/stderr00.html.

Standard error table 1
U.S. engineers, by occupational specialty: 1999

Engineering Occupation	Estimated total	Standard error	95% confidence interval	
			Lower	Upper
TOTAL, ALL ENGINEERS	**1,708,700**	**19,602.05**	**1,670,279.97**	**1,747,120.0**
Aeronautical/aerospace engineers	67,400	3,597.77	60,348.37	74,451.6
Biomedical/bioengineers	13,100	1,581.64	9,999.98	16,200.0
Chemical engineers	79,900	3,919.76	72,217.27	87,582.7
Civil/architectural engineers	223,700	6,607.59	210,749.13	236,650.8
Computer hardware engineers	54,700	3,238.99	48,351.57	61,048.4
Computer software engineers	338,400	8,174.52	322,377.93	354,422.0
Electrical/electronics engineers	307,500	7,780.17	292,250.86	322,749.1
Environmental engineers	73,500	3,758.25	66,133.84	80,866.1
Industrial engineers	81,200	3,951.79	73,454.50	88,945.5
Materials/metallurgical engineers	35,300	2,599.35	30,205.28	40,394.7
Mechanical engineers	265,800	7,218.09	251,652.55	279,947.4
Mining/geological/petroleum engineers	22,300	2,064.59	18,253.40	26,346.6
Nuclear engineers	17,500	1,828.49	13,916.17	21,083.8
Postsecondary engineering teachers	31,400	2,451.05	26,595.93	36,204.0
Sales engineers	45,700	2,959.17	39,900.02	51,499.9
Other engineers	51,300	3,136.16	45,153.13	57,446.8

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 2 (1 of 2)

Median age of U.S. engineers, by selected characteristics: 1999

Selected Characteristic	Estimated age	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
TOTAL, ALL ENGINEERS	**41**	**1,708,700**	**0.5196**	**0.0127**	**39.98**	**42.02**
Engineering occupation						
Other engineers	46	51,300	3.0387	0.0661	40.04	51.96
Postsecondary engineering teachers	45	31,400	3.8770	0.0862	37.40	52.60
Aeronautical/aerospace engineers	43	67,400	2.6334	0.0612	37.84	48.16
Nuclear engineers	43	17,500	5.1681	0.1202	32.87	53.13
Civil/architectural engineers	42	223,700	1.4411	0.0343	39.18	44.82
Electrical/electronics engineers	42	307,500	1.2291	0.0293	39.59	44.41
Mining/geological/petroleum engineers	42	22,300	4.5642	0.1087	33.05	50.95
Environmental engineers	41	73,500	2.5052	0.0611	36.09	45.91
Materials/metallurgical engineers	41	35,300	3.6150	0.0882	33.91	48.09
Sales engineers	41	45,700	3.1771	0.0775	34.77	47.23
Chemical engineers	40	89,900	2.2563	0.0564	35.58	44.42
Mechanical engineers	40	265,800	1.3122	0.0328	37.43	42.57
Computer hardware engineers	39	54,700	2.8799	0.0738	33.36	44.64
Industrial engineers	39	81,200	2.3637	0.0606	34.37	43.63
Computer software engineers	38	338,400	1.1522	0.0303	35.74	40.26
Biomedical/bioengineers	35	13,100	5.7548	0.1644	23.72	46.28
Employment sector						
Self-employed	49	71,900	2.5745	0.0525	43.95	54.05
2-year colleges	48	3,800	11.1919	0.2332	26.06	69.94
U.S. government	45	101,400	2.1575	0.0479	40.77	49.23
All other sectors	44	3,600	11.4247	0.2597	21.6	1 66.39
State and local government	43	91,600	2.2589	0.0525	38.57	47.43
Private, for-profit	40	1,359,900	0.5801	0.0145	38.86	41.14
4-year colleges/universities	39	66,100	2.6198	0.0672	33.87	44.13
Military	36	10,200	6.5632	0.1823	23.14	48.86

Standard error table 2 (2 of 2)

Median age of U.S. engineers, by selected characteristics: 1999

Selected Characteristic	Estimated age	Number	Standard error	Coefficient of variation	95% confidence interval Lower	95% confidence interval Upper
Gender						
Male	41	1,515,700	0.5610	0.0137	39.90	42.10
Female	36	192,900	1.3656	0.0379	33.32	38.68
Race/ethnicity						
White	41	1,365,604	0.5776	0.0141	39.87	42.13
Asian	40	196,813	1.2245	0.0306	37.60	42.40
Hispanic	38	57,682	2.2411	0.0590	33.61	42.39
Black	37	45,124	2.5204	0.0681	32.06	41.94
Native American	36	4,928	7.5823	0.2106	21.14	50.86
Engineering degree status						
Did not have an engineering degree	42	407,379	1.0679	0.0254	39.91	44.09
Has an engineering degree	40	1301305	0.5930	0.0148	38.84	41.16

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 3

U.S. scientists and engineers, by occupation and percentage non-native born: 1999

Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
TOTAL, SCIENTISTS AND ENGINEERS	**17**	**3,541,000**	**0.3502**	**0.0206**	**16.31**	**17.69**
Chemical and physical scientists	16	298,000	0.8093	0.0506	14.41	17.59
Computer scientists	14	746,000	0.5988	0.0428	12.83	15.17
Life scientists	17	342,000	0.8192	0.0482	15.39	18.61
Mathematical scientists	17	83,000	1.9434	0.1143	13.19	20.81
Social scientists	10	363,000	0.6858	0.0686	8.66	11.34
Engineers	19	1,709,000	0.4144	0.0218	18.19	19.81

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 4

U.S. engineers, by native-born status, employment sector, age, and highest degree: 1999

Characteristic	Estimated percent native born	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
TOTAL ALL ENGINEERS	**81**	**1,709,000**	**0.4144**	**0.0051**	**80.19**	**81.81**
Employment sector						
4-year colleges/universities	69	66,000	2.4860	0.0360	64.13	73.87
Government	80	193,000	1.2573	0.0157	77.54	82.46
Private, for-profit	81	1,339,000	0.4682	0.0058	80.08	81.92
Age						
Less than 30	82	238,000	1.0875	0.0133	79.87	84.13
30-39	80	543,000	0.7496	0.0094	78.53	81.47
40-49	81	498,000	0.7677	0.0095	79.50	82.50
50-59	80	307,000	0.9969	0.0125	78.05	81.95
60-75	80	123,000	1.5750	0.0197	76.91	83.09
Highest degree						
Bachelor's	87	1,094,000	0.4440	0.0051	86.13	87.87
Master's	71	492,000	0.8933	0.0126	69.25	72.75
Doctorate	55	99,000	2.1835	0.0397	50.72	59.28

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 5

Non-native-born U.S. engineers, who earned their highest degree in the United States, by age, employment sector, and level of highest degree: 1999

Characteristic	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
TOTAL, NON-NATIVE-BORN U.S. ENGINEERS	**83**	**332,000**	**0.7229**	**0.0087**	**81.58**	**84.42**
Employment sector						
4-year colleges/universities	89	20,000	2.4534	0.0276	84.19	93.81
Government	75	38,000	2.4632	0.0328	70.17	79.83
Private, for-profit	84	254,000	0.8066	0.0096	82.42	85.58
Age						
Less than 30	100	43,000	na	na	na	na
30-39	95	108,000	0.7354	0.0077	93.56	96.44
40-49	80	96,000	1.4316	0.0179	77.19	82.81
50-59	66	60,000	2.1445	0.0325	61.80	70.20
60-75	52	24,000	3.5761	0.0688	44.99	59.01
Highest degree						
Bachelor's	73	143,000	1.3019	0.0178	70.45	75.55
Master's	91	140,000	0.8481	0.0093	89.34	92.66
Doctorate	89	45,000	1.6356	0.0184	85.79	92.21

na = not applicable.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 6 (1 of 2)

Distribution of U.S. engineers, by occupation and employment sector: 1999

Engineering Occupation and Employment Sector	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
4-year colleges/universities, total	**4**	**1,708,700**	**0.2070**	**0.0518**	**3.59**	**4.41**
Aeronautical/aerospace engineers	4	67,400	1.0423	0.2606	1.96	6.04
Biomedical/bioengineers	27	13,100	5.3565	0.1984	16.50	37.50
Chemical engineers	2	79,900	0.6840	0.3420	0.66	3.34
Civil/architectural engineers	2	223,700	0.4088	0.2044	1.20	2.80
Computer hardware engineers	2	54,700	0.8266	0.4133	0.38	3.62
Computer software engineers	1	338,400	0.2362	0.2362	0.54	1.46
Electrical/electronics engineers	3	307,500	0.4248	0.1416	2.17	3.83
Environmental engineers	3	73,500	0.8689	0.2896	1.30	4.70
Industrial engineers	2	81,200	0.6785	0.3392	0.67	3.33
Materials/metallurgical engineers	4	35,300	1.4403	0.3601	1.18	6.82
Mechanical engineers	2	265,800	0.3750	0.1875	1.27	2.73
Mining/geological/petroleum engineers	1	22,300	0.9201	0.9201	-0.80	2.80
Nuclear engineers	4	17,500	2.0456	0.5114	-0.01	8.01
Postsecondary engineering teachers	90	31,400	2.3379	0.0260	85.42	94.58
Sales engineers	0	45,700	na	na	na	na
Other engineers	3	51,300	1.0401	0.3467	0.96	5.04
Government, total	**11**	**1,708,700**	**0.3305**	**0.0300**	**10.35**	**11.65**
Aeronautical/aerospace engineers	19	67,400	2.0867	0.1098	14.91	23.09
Biomedical/bioengineers	4	13,100	2.3643	0.5911	-0.63	8.63
Chemical engineers	4	79,900	0.9573	0.2393	2.12	5.88
Civil/architectural engineers	34	223,700	1.3831	0.0407	31.29	36.71
Computer hardware engineers	5	54,700	1.2868	0.2574	2.48	7.52
Computer software engineers	2	338,400	0.3323	0.1662	1.35	2.65
Electrical/electronics engineers	12	307,500	0.8093	0.0674	10.41	13.59
Environmental engineers	31	73,500	2.3558	0.0760	26.38	35.62
Industrial engineers	5	81,200	1.0562	0.2112	2.93	7.07
Materials/metallurgical engineers	6	35,300	1.7455	0.2909	2.58	9.42
Mechanical engineers	5	265,800	0.5838	0.1168	3.86	6.14
Mining/geological/petroleum engineers	3	22,300	1.5775	0.5258	-0.09	6.09
Nuclear engineers	30	17,500	4.7837	0.1595	20.62	39.38
Postsecondary engineering teachers	0	31,400	na	na	na	na
Sales engineers	0	45,700	na	na	na	na
Other engineers	12	51,300	1.9813	0.1651	8.12	15.88

Standard error table 6 (2 of 2)
Distribution of U.S. engineers, by occupation and employment sector: 1999

Engineering Occupation and Employment Sector	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Private, for-profit, total	**78**	**1,708,700**	**0.4376**	**0.0056**	**77.14**	**78.86**
Aeronautical/aerospace engineers	73	67,400	2.3615	0.0323	68.37	77.63
Biomedical/bioengineers	58	13,100	5.9549	0.1027	46.33	69.67
Chemical engineers	90	79,900	1.4656	0.0163	87.13	92.87
Civil/architectural engineers	55	223,700	1.4525	0.0264	52.15	57.85
Computer hardware engineers	89	54,700	1.8474	0.0208	85.38	92.62
Computer software engineers	90	338,400	0.7122	0.0079	88.60	91.40
Electrical/electronics engineers	80	307,500	0.9961	0.0125	78.05	81.95
Environmental engineers	60	73,500	2.4954	0.0416	55.11	64.89
Industrial engineers	88	81,200	1.5748	0.0179	84.91	91.09
Materials/metallurgical engineers	84	35,300	2.6946	0.0321	78.72	89.28
Mechanical engineers	87	265,800	0.9008	0.0104	85.23	88.77
Mining/geological/petroleum engineers	84	22,300	3.3902	0.0404	77.36	90.64
Nuclear engineers	58	17,500	5.1522	0.0888	47.90	68.10
Postsecondary engineering teachers	0	31,400	na	na	na	na
Sales engineers	94	45,700	1.5341	0.0163	90.99	97.01
Other engineers	77	51,300	2.5658	0.0333	71.97	82.03
Other sectors, total	**6**	**1,708,700**	**0.2509**	**0.0418**	**5.51**	**6.49**
Aeronautical/aerospace engineers	5	67,400	1.1593	0.2319	2.73	7.27
Biomedical/bioengineers	11	13,100	3.7751	0.3432	3.60	18.40
Chemical engineers	4	79,900	0.9573	0.2393	2.12	5.88
Civil/architectural engineers	9	223,700	0.8356	0.0928	7.36	10.64
Computer hardware engineers	5	54,700	1.2868	0.2574	2.48	7.52
Computer software engineers	6	338,400	0.5638	0.0940	4.90	7.10
Electrical/electronics engineers	6	307,500	0.5914	0.0986	4.84	7.16
Environmental engineers	6	73,500	1.2097	0.2016	3.63	8.37
Industrial engineers	5	81,200	1.0562	0.2112	2.93	7.07
Materials/metallurgical engineers	7	35,300	1.8753	0.2679	3.32	10.68
Mechanical engineers	6	265,800	0.6361	0.1060	4.75	7.25
Mining/geological/petroleum engineers	12	22,300	3.0051	0.2504	6.11	17.89
Nuclear engineers	8	17,500	2.8320	0.3540	2.45	13.55
Postsecondary engineering teachers	10	31,400	2.3379	0.2338	5.42	14.58
Sales engineers	6	45,700	1.5341	0.2557	2.99	9.01
Other engineers	8	51,300	1.6541	0.2068	4.76	11.24

na = not applicable.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 7

U.S. Engineers who became self-employed between 1997 and 1999, by age in 1997: 1999

Age in 1997	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Less than 30	6	21,000	2.2631	0.3772	1.56	10.44
30-39	31	21,000	4.4073	0.1422	22.36	39.64
40-49	30	21,000	4.3669	0.1456	21.44	38.56
50-59	20	21,000	3.8118	0.1906	12.53	27.47
60-75	13	21,000	3.2048	0.2465	6.72	19.28

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 8-1

Employment sector of U.S engineers, by highest degree in any field, column percent: 1999

Highest Degree and Employment Sector	Estimated (column) percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Bachelor's						
4-year colleges/universities	2	1,094,300	0.1848	0.0924	1.64	2.36
Government	12	1,094,300	0.4290	0.0357	11.16	12.84
Private, for-profit	80	1,094,300	0.5280	0.0066	78.97	81.03
Other sectors	6	1,094,300	0.3135	0.0523	5.39	6.61
Master's						
4-year colleges/universities	4	491,600	0.3860	0.0965	3.24	4.76
Government	11	491,600	0.6163	0.0560	9.79	12.21
Private, for-profit	78	491,600	0.8159	0.0105	76.40	79.60
Other sectors	7	491,600	0.5025	0.0718	6.02	7.98
Doctorate						
4-year colleges/universities	26	99,300	1.9222	0.0739	22.23	29.77
Government	7	99,300	1.1181	0.1597	4.81	9.19
Private, for-profit	59	99,300	2.1553	0.0365	54.78	63.22
Other sectors	8	99,300	1.1889	0.1486	5.67	10.33

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 8-2

Employment sector of U.S engineers, by highest degree in any field, row percent: 1999

Employment Sector and Highest Degree	Estimated (row) percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Total						
Bachelor's	64	1,706,000	0.5075	0.0079	63.01	64.99
Master's	29	1,706,000	0.4797	0.0165	28.06	29.94
Doctorate	6	1,706,000	0.2511	0.0418	5.51	6.49
4-year colleges/universities						
Bachelor's	32	66,100	2.5055	0.0783	27.09	36.91
Master's	29	66,100	2.4373	0.0840	24.22	33.78
Doctorate	39	66,100	2.6198	0.0672	33.87	44.13
Government						
Bachelor's	68	192,300	1.4690	0.0216	65.12	70.88
Master's	27	192,300	1.3981	0.0518	24.26	29.74
Doctorate	4	192,300	0.6171	0.1543	2.79	5.21
Private, for-profit						
Bachelor's	65	1,337,400	0.5696	0.0088	63.88	66.12
Master's	29	1,337,400	0.5418	0.0187	27.94	30.06
Doctorate	4	1,337,400	0.2340	0.0585	3.54	4.46
Other sectors						
Bachelor's	60	110,100	2.0389	0.0340	56.00	64.00
Master's	31	110,100	1.9248	0.0621	27.23	34.77
Doctorate	7	110,100	1.0619	0.1517	4.92	9.08

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 9 (1 of 2)
Distribution of U.S. engineers, by occupation and level of highest degree: 1999

Engineering Occupation and Highest Degree	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Total, bachelor's degrees	**64**	**1,708,700**	**0.5071**	**0.0079**	**63.01**	**64.99**
Aeronautical/aerospace engineers	53	67,400	2.6548	0.0501	47.80	58.20
Biomedical/bioengineers	53	13,100	6.0218	0.1136	41.20	64.80
Chemical engineers	64	79,900	2.3450	0.0366	59.40	68.60
Civil/architectural engineers	71	223,700	1.3249	0.0187	68.40	73.60
Computer hardware engineers	62	54,700	2.8659	0.0462	56.38	67.62
Computer software engineers	58	338,400	1.1716	0.0202	55.70	60.30
Electrical/electronics engineers	64	307,500	1.1953	0.0187	61.66	66.34
Environmental engineers	58	73,500	2.5140	0.0433	53.07	62.93
Industrial engineers	76	81,200	2.0697	0.0272	71.94	80.06
Materials/metallurgical engineers	51	35,300	3.6743	0.0720	43.80	58.20
Mechanical engineers	73	265,800	1.1892	0.0163	70.67	75.33
Mining/geological/petroleum engineers	79	22,300	3.7666	0.0477	71.62	86.38
Nuclear engineers	52	17,500	5.2153	0.1003	41.78	62.22
Postsecondary engineering teachers	18	31,400	2.9940	0.1663	12.13	23.87
Sales engineers	76	45,700	2.7589	0.0363	70.59	81.41
Other engineers	61	51,300	2.9738	0.0488	55.17	66.83
Total, master's degrees	**29**	**1,708,700**	**0.4794**	**0.0165**	**28.06**	**29.94**
Aeronautical/aerospace engineers	38	67,400	2.5819	0.0679	32.94	43.06
Biomedical/bioengineers	30	13,100	5.5290	0.1843	19.16	40.84
Chemical engineers	25	79,900	2.1154	0.0846	20.85	29.15
Civil/architectural engineers	25	223,700	1.2643	0.0506	22.52	27.48
Computer hardware engineers	32	54,700	2.7543	0.0861	26.60	37.40
Computer software engineers	35	338,400	1.1323	0.0324	32.78	37.22
Electrical/electronics engineers	30	307,500	1.1412	0.0380	27.76	32.24
Environmental engineers	35	73,500	2.4295	0.0694	30.24	39.76
Industrial engineers	21	81,200	1.9739	0.0940	17.13	24.87
Materials/metallurgical engineers	29	35,300	3.3351	0.1150	22.46	35.54
Mechanical engineers	23	265,800	1.1272	0.0490	20.79	25.21
Mining/geological/petroleum engineers	16	22,300	3.3902	0.2119	9.36	22.64
Nuclear engineers	36	17,500	5.0107	0.1392	26.18	45.82
Postsecondary engineering teachers	21	31,400	3.1742	0.1512	14.78	27.22
Sales engineers	22	45,700	2.6759	0.1216	16.76	27.24
Other engineers	32	51,300	2.8441	0.0889	26.43	37.57

Standard error table 9 (2 of 2)
Distribution of U.S. engineers, by occupation and level of highest degree: 1999

Engineering Occupation and Highest Degree	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Total, doctorate	**6**	**1,708,700**	**0.2509**	**0.0418**	**5.51**	**6.49**
Aeronautical/aerospace engineers	7	67,400	1.3572	0.1939	4.34	9.66
Biomedical/bioengineers	17	13,100	4.5321	0.2666	8.12	25.88
Chemical engineers	10	79,900	1.4656	0.1466	7.13	12.87
Civil/architectural engineers	2	223,700	0.4088	0.2044	1.20	2.80
Computer hardware engineers	4	54,700	1.1570	0.2893	1.73	6.27
Computer software engineers	5	338,400	0.5174	0.1035	3.99	6.01
Electrical/electronics engineers	5	307,500	0.5427	0.1085	3.94	6.06
Environmental engineers	5	73,500	1.1101	0.2220	2.82	7.18
Industrial engineers	1	81,200	0.4822	0.4822	0.05	1.95
Materials/metallurgical engineers	20	35,300	2.9400	0.1470	14.24	25.76
Mechanical engineers	3	265,800	0.4569	0.1523	2.10	3.90
Mining/geological/petroleum engineers	4	22,300	1.8121	0.4530	0.45	7.55
Nuclear engineers	9	17,500	2.9874	0.3319	3.14	14.86
Postsecondary engineering teachers	61	31,400	3.8011	0.0623	53.55	68.45
Sales engineers	1	45,700	0.6427	0.6427	-0.26	2.26
Other engineers	6	51,300	1.4480	0.2413	3.16	8.84

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 10

U.S. engineers, by employment sector and gender: 1999

Sector	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Total, all engineers	**100**	**1,708,700**	**0.0000**	**0.0000**	**100.00**	**100.00**
2-year colleges	0	1,708,700	na	na	na	na
4-year colleges/universities	4	1,708,700	0.2070	0.0518	3.59	4.41
Military	1	1,708,700	0.1051	0.1051	0.79	1.21
Private, for-profit	80	1,708,700	0.4226	0.0053	79.17	80.83
Self-employed	4	1,708,700	0.2070	0.0518	3.59	4.41
State/local government	5	1,708,700	0.2302	0.0460	4.55	5.45
U.S. government	6	1,708,700	0.2509	0.0418	5.51	6.49
Other sectors	0	1,708,700	na	na	na	na
Total, female engineers	**100**	**192,900**	**0.0000**	**0.0000**	**100.00**	**100.00**
2-year colleges	s	192,900	na	na	na	na
4-year colleges/universities	4	192,900	0.5575	0.1394	2.91	5.09
Military	s	192,900	na	na	na	na
Private, for-profit	81	192,900	1.1161	0.0138	78.81	83.19
Self-employed	2	192,900	0.3983	0.1991	1.22	2.78
State/local government	5	192,900	0.6200	0.1240	3.78	6.22
U.S. government	7	192,900	0.7259	0.1037	5.58	8.42
Other sectors	s	192,900	na	na	na	na
Total, male engineers	**100**	**1,515,700**	**0.0000**	**0.0000**	**100.00**	**100.00**
2-year colleges	0	1,515,700	na	na	na	na
4-year colleges/universities	4	1,515,700	0.2235	0.0559	3.56	4.44
Military	1	1,515,700	0.1135	0.1135	0.78	1.22
Private, for-profit	79	1,515,700	0.4646	0.0059	78.09	79.91
Self-employed	5	1,515,700	0.2486	0.0497	4.51	5.49
State/local government	5	1,515,700	0.2486	0.0497	4.51	5.49
U.S. government	6	1,515,700	0.2709	0.0451	5.47	6.53
Other sectors	0	1,515,700	na	na	na	na

s = Suppressed estimate due to small cell count.

na = not applicable.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 11 (1 of 2)

U.S. engineers, by employment sector, race/ethnicity, and citizenship status: 1999

Sector, citizenship status, and race/ethnicity	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Total						
U.S. citizens and permanent residents						
Asian	12	1,708,700	0.2757	0.0230	11.46	12.54
Underrepresented minorities	6	1,708,700	0.2015	0.0336	5.61	6.39
White	80	1,708,700	0.4200	0.0052	79.18	80.82
Temporary residents	2	1,708,700	0.1188	0.0594	1.77	2.23
2-year colleges						
U.S. citizens and permanent residents						
Asian	s	3,800	na	na	na	na
Underrepresented minorities	s	3,800	na	na	na	na
White	81	3,800	8.7344	0.1078	63.88	98.12
Temporary residents	s	3,800	na	na	na	na
4-year colleges/universities						
U.S. citizens and permanent residents						
Asian	14	66,100	1.4966	0.1069	11.07	16.93
Underrepresented minorities	6	66,100	1.0243	0.1707	3.99	8.01
White	71	66,100	2.4223	0.0341	66.25	75.75
Temporary residents	9	66,100	1.2343	0.1371	6.58	11.42
Military						
U.S. citizens and permanent residents						
Asian	14	10,200	3.8098	0.2721	6.53	21.47
Underrepresented minorities	14	10,200	3.8098	0.2721	6.53	21.47
White	72	10,200	6.1017	0.0847	60.04	83.96
Temporary residents	0	10,200	na	na	na	na
Private, for-profit						
U.S. citizens and permanent residents						
Asian	11	1,359,900	0.2975	0.0270	10.42	11.58
Underrepresented minorities	6	1,359,900	0.2258	0.0376	5.56	6.44
White	81	1,359,900	0.4617	0.0057	80.10	81.90
Temporary residents	2	1,359,900	0.1331	0.0666	1.74	2.26

Standard error table 11 (2 of 2)

U.S. engineers, by employment sector, race/ethnicity, and citizenship status: 1999

Sector, citizenship status, and race/ethnicity	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Self-employed						
U.S. citizens and permanent residents						
Asian	8	71,900	1.1219	0.1402	5.80	10.20
Underrepresented minorities	4	71,900	0.8104	0.2026	2.41	5.59
White	87	71,900	1.7214	0.0198	83.63	90.37
Temporary residents	s	71,900	na	na	na	na
State/local government						
U.S. citizens and permanent residents						
Asian	16	91,600	1.3432	0.0840	13.37	18.63
Underrepresented minorities	11	91,600	1.1464	0.1042	8.75	13.25
White	73	91,600	2.0133	0.0276	69.05	76.95
Temporary residents	s	91,600	na	na	na	na
U.S. government						
U.S. citizens and permanent residents						
Asian	12	101,400	1.1316	0.0943	9.78	14.22
Underrepresented minorities	8	101,400	0.9447	0.1181	6.15	9.85
White	80	101,400	1.7240	0.0216	76.62	83.38
Temporary residents	s	101,400	na	na	na	na
Other sectors						
U.S. citizens and permanent residents						
Asian	s	3,600	na	na	na	na
Underrepresented minorities	s	3,600	na	na	na	na
White	68	3,600	10.6705	0.1569	47.09	88.91
Temporary residents	s	3,600	na	na	na	na

s = Suppressed estimate due to small cell count.

na = not applicable.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 12-1
Changes in U.S. engineering occupations, estimated total: 1972 and 1999

ENGINEERING OCCUPATION	Estimated total	Standard error	95% confidence interval	
			Lower	Upper
TOTAL, ALL ENGINEERS	**1,708,700**	**19,602.05**	**1,670,279.97**	**1,747,120.03**
Aeronautical/aerospace engineers	67,400	3,597.77	60,348.37	74,451.63
Chemical engineers	79,900	3,919.76	72,217.27	87,582.73
Civil/architectural engineers	297,200	7,644.76	282,216.28	312,183.72
Computer hardware engineers	54,700	3,238.99	48,351.57	61,048.43
Computer software engineers	338,400	8,174.52	322,377.93	354,422.07
Electrical/electronics engineers	307,500	7,780.17	292,250.86	322,749.14
Industrial engineers	81,200	3,951.79	73,454.50	88,945.50
Materials/metallurgical engineers	35,300	2,599.35	30,205.28	40,394.72
Mechanical engineers	265,800	7,218.09	251,652.55	279,947.45
Mining/geological/petroleum engineers	22,300	2,064.59	18,253.40	26,346.60
Nuclear engineers	17,500	1,828.49	13,916.17	21,083.83
Other engineers	141,600	5,234.88	131,339.63	151,860.37

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 12-2

Changes in U.S. engineering occupations, estimated percent: 1972 and 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
TOTAL, ALL ENGINEERS	**100**	**1,708,700**	**0.0000**	**0.0000**	**100.00**	**100.00**
Aeronautical/aerospace engineers	4	1,708,700	0.2070	0.0518	3.59	4.41
Chemical engineers	5	1,708,700	0.2302	0.0460	4.55	5.45
Civil/architectural engineers	17	1,708,700	0.3968	0.0233	16.22	17.78
Computer hardware engineers	3	1,708,700	0.1802	0.0601	2.65	3.35
Computer software engineers	20	1,708,700	0.4226	0.0211	19.17	20.83
Electrical/electronics engineers	18	1,708,700	0.4059	0.0225	17.20	18.80
Industrial engineers	5	1,708,700	0.2302	0.0460	4.55	5.45
Materials/metallurgical engineers	2	1,708,700	0.1479	0.0740	1.71	2.29
Mechanical engineers	16	1,708,700	0.3873	0.0242	15.24	16.76
Mining/geological/petroleum engineers	1	1,708,700	0.1051	0.1051	0.79	1.21
Nuclear engineers	1	1,708,700	0.1051	0.1051	0.79	1.21
Other engineers	8	1,708,700	0.2866	0.0358	7.44	8.56

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 13 (1 of 3)

Distribution of U.S. engineers, by occupation and age: 1999

Engineering Occupation and Age	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Less than 30	**14**	**1,708,700**	**0.3666**	**0.0262**	**13.28**	**14.72**
Aeronautical/aerospace engineers	8	67,400	1.4431	0.1804	5.17	10.83
Biomedical/bioengineers	28	13,100	5.4173	0.1935	17.38	38.62
Chemical engineers	18	79,900	1.8769	0.1043	14.32	21.68
Civil/architectural engineers	15	223,700	1.0425	0.0695	12.96	17.04
Computer hardware engineers	22	54,700	2.4459	0.1112	17.21	26.79
Computer software engineers	17	338,400	0.8917	0.0525	15.25	18.75
Electrical/electronics engineers	10	307,500	0.7471	0.0747	8.54	11.46
Environmental engineers	12	73,500	1.6552	0.1379	8.76	15.24
Industrial engineers	18	81,200	1.8618	0.1034	14.35	21.65
Materials/metallurgical engineers	14	35,300	2.5504	0.1822	9.00	19.00
Mechanical engineers	14	265,800	0.9294	0.0664	12.18	15.82
Mining/geological/petroleum engineers	12	22,300	3.0051	0.2504	6.11	17.89
Nuclear engineers	10	17,500	3.1317	0.3132	3.86	16.14
Postsecondary engineering teachers	14	31,400	2.7041	0.1931	8.70	19.30
Sales engineers	13	45,700	2.1724	0.1671	8.74	17.26
Other engineers	5	51,300	1.3288	0.2658	2.40	7.60
30 through 39	**32**	**1,708,700**	**0.4928**	**0.0154**	**31.03**	**32.97**
Aeronautical/aerospace engineers	27	67,400	2.3615	0.0875	22.37	31.63
Biomedical/bioengineers	36	13,100	5.7914	0.1609	24.65	47.35
Chemical engineers	29	79,900	2.2168	0.0764	24.66	33.34
Civil/architectural engineers	26	223,700	1.2807	0.0493	23.49	28.51
Computer hardware engineers	32	54,700	2.7543	0.0861	26.60	37.40
Computer software engineers	39	338,400	1.1579	0.0297	36.73	41.27
Electrical/electronics engineers	30	307,500	1.1412	0.0380	27.76	32.24
Environmental engineers	32	73,500	2.3761	0.0743	27.34	36.66
Industrial engineers	33	81,200	2.2787	0.0691	28.53	37.47
Materials/metallurgical engineers	28	35,300	3.3001	0.1179	21.53	34.47
Mechanical engineers	35	265,800	1.2776	0.0365	32.50	37.50
Mining/geological/petroleum engineers	21	22,300	3.7666	0.1794	13.62	28.38
Nuclear engineers	25	17,500	4.5202	0.1808	16.14	33.86
Postsecondary engineering teachers	22	31,400	3.2283	0.1467	15.67	28.33
Sales engineers	32	45,700	3.0133	0.0942	26.09	37.91
Other engineers	28	51,300	2.7375	0.0978	22.63	33.37

Standard error table 13 (2 of 3)

Distribution of U.S. engineers, by occupation and age: 1999

Engineering Occupation and Age	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
40 through 49	**29**	**1,708,700**	**0.4794**	**0.0165**	**28.06**	**29.94**
Aeronautical/aerospace engineers	31	67,400	2.4601	0.0794	26.18	35.82
Biomedical/bioengineers	22	13,100	4.9980	0.2272	12.20	31.80
Chemical engineers	28	79,900	2.1935	0.0783	23.70	32.30
Civil/architectural engineers	29	223,700	1.3249	0.0457	26.40	31.60
Computer hardware engineers	29	54,700	2.6792	0.0924	23.75	34.25
Computer software engineers	30	338,400	1.0878	0.0363	27.87	32.13
Electrical/electronics engineers	30	307,500	1.1412	0.0380	27.76	32.24
Environmental engineers	32	73,500	2.3761	0.0743	27.34	36.66
Industrial engineers	25	81,200	2.0984	0.0839	20.89	29.11
Materials/metallurgical engineers	30	35,300	3.3682	0.1123	23.40	36.60
Mechanical engineers	26	265,800	1.1749	0.0452	23.70	28.30
Mining/geological/petroleum engineers	50	22,300	4.6237	0.0925	40.94	59.06
Nuclear engineers	36	17,500	5.0107	0.1392	26.18	45.82
Postsecondary engineering teachers	25	31,400	3.3745	0.1350	18.39	31.61
Sales engineers	28	45,700	2.9004	0.1036	22.32	33.68
Other engineers	30	51,300	2.7940	0.0931	24.52	35.48
50 through 59	**18**	**1,708,700**	**0.4059**	**0.0225**	**17.20**	**18.80**
Aeronautical/aerospace engineers	23	67,400	2.2385	0.0973	18.61	27.39
Biomedical/bioengineers	12	13,100	3.9208	0.3267	4.32	19.68
Chemical engineers	18	79,900	1.8769	0.1043	14.32	21.68
Civil/architectural engineers	21	223,700	1.1892	0.0566	18.67	23.33
Computer hardware engineers	14	54,700	2.0488	0.1463	9.98	18.02
Computer software engineers	12	338,400	0.7714	0.0643	10.49	13.51
Electrical/electronics engineers	20	307,500	0.9961	0.0498	18.05	21.95
Environmental engineers	18	73,500	1.9569	0.1087	14.16	21.84
Industrial engineers	18	81,200	1.8618	0.1034	14.35	21.65
Materials/metallurgical engineers	19	35,300	2.8834	0.1518	13.35	24.65
Mechanical engineers	17	265,800	1.0061	0.0592	15.03	18.97
Mining/geological/petroleum engineers	12	22,300	3.0051	0.2504	6.11	17.89
Nuclear engineers	22	17,500	4.3243	0.1966	13.52	30.48
Postsecondary engineering teachers	21	31,400	3.1742	0.1512	14.78	27.22
Sales engineers	20	45,700	2.5839	0.1292	14.94	25.06
Other engineers	28	51,300	2.7375	0.0978	22.63	33.37

Standard error table 13 (3 of 3)

Distribution of U.S. engineers, by occupation and age: 1999

Engineering Occupation and Age	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
60 through 75	**7**	**1,708,700**	**0.2695**	**0.0385**	**6.47**	**7.53**
Aeronautical/aerospace engineers	11	67,400	1.6643	0.1513	7.74	14.26
Biomedical/bioengineers	2	13,100	1.6891	0.8446	-1.31	5.31
Chemical engineers	7	79,900	1.2465	0.1781	4.56	9.44
Civil/architectural engineers	10	223,700	0.8759	0.0876	8.28	11.72
Computer hardware engineers	3	54,700	1.0072	0.3357	1.03	4.97
Computer software engineers	2	338,400	0.3323	0.1662	1.35	2.65
Electrical/electronics engineers	10	307,500	0.7471	0.0747	8.54	11.46
Environmental engineers	6	73,500	1.2097	0.2016	3.63	8.37
Industrial engineers	6	81,200	1.1509	0.1918	3.74	8.26
Materials/metallurgical engineers	10	35,300	2.2050	0.2205	5.68	14.32
Mechanical engineers	8	265,800	0.7267	0.0908	6.58	9.42
Mining/geological/petroleum engineers	5	22,300	2.0154	0.4031	1.05	8.95
Nuclear engineers	7	17,500	2.6635	0.3805	1.78	12.22
Postsecondary engineering teachers	18	31,400	2.9940	0.1663	12.13	23.87
Sales engineers	6	45,700	1.5341	0.2557	2.99	9.01
Other engineers	10	51,300	1.8291	0.1829	6.41	13.59

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 14

Distribution of U.S. engineers, by gender and occupation: 1999

Engineering Occupation and Gender	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Total, female engineers						
Computer software engineers	33	192,900	1.3377	0.0405	30.38	35.62
Civil/architectural engineers	12	192,900	0.9245	0.0770	10.19	13.81
Electrical/electronics engineers	9	192,900	0.8142	0.0905	7.40	10.60
Environmental engineers	9	192,900	0.8142	0.0905	7.40	10.60
Mechanical engineers	8	192,900	0.7718	0.0965	6.49	9.51
Chemical engineers	7	192,900	0.7259	0.1037	5.58	8.42
Industrial engineers	6	192,900	0.6756	0.1126	4.68	7.32
Computer hardware engineers	3	192,900	0.4853	0.1618	2.05	3.95
Other engineers	3	192,900	0.4853	0.1618	2.05	3.95
Aeronautical/aerospace engineers	2	192,900	0.3983	0.1991	1.22	2.78
Materials/metallurgical engineers	2	192,900	0.3983	0.1991	1.22	2.78
Postsecondary engineering teachers	2	192,900	0.3983	0.1991	1.22	2.78
Sales engineers	2	192,900	0.3983	0.1991	1.22	2.78
Biomedical/bioengineers	2	192,900	0.3983	0.1991	1.22	2.78
Mining/geological/petroleum engineers	1	192,900	0.2831	0.2831	0.45	1.55
Nuclear engineers	1	192,900	0.2831	0.2831	0.45	1.55
Total, male engineers						
Electrical/electronics engineers	19	1,515,700	0.4474	0.0235	18.12	19.88
Computer software engineers	18	1,515,700	0.4382	0.0243	17.14	18.86
Mechanical engineers	17	1,515,700	0.4284	0.0252	16.16	17.84
Civil/architectural engineers	13	1,515,700	0.3836	0.0295	12.25	13.75
Industrial engineers	5	1,515,700	0.2486	0.0497	4.51	5.49
Chemical engineers	4	1,515,700	0.2235	0.0559	3.56	4.44
Aeronautical/aerospace engineers	4	1,515,700	0.2235	0.0559	3.56	4.44
Environmental engineers	4	1,515,700	0.2235	0.0559	3.56	4.44
Computer hardware engineers	3	1,515,700	0.1946	0.0649	2.62	3.38
Other engineers	3	1,515,700	0.1946	0.0649	2.62	3.38
Sales engineers	3	1,515,700	0.1946	0.0649	2.62	3.38
Materials/metallurgical engineers	2	1,515,700	0.1597	0.0798	1.69	2.31
Postsecondary engineering teachers	2	1,515,700	0.1597	0.0798	1.69	2.31
Mining/geological/petroleum engineers	1	1,515,700	0.1135	0.1135	0.78	1.22
Nuclear engineers	1	1,515,700	0.1135	0.1135	0.78	1.22
Biomedical/bioengineers	1	1,515,700	0.1135	0.1135	0.78	1.22

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 15 (1 of 2)

Distribution of U.S. engineers, by occupation, race/ethnicity, and citizenship status: 1999

Engineering Occupation, Citizenship Status, and Race/Ethnicity	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
U.S. citizens and permanent residents						
Asian	**12**	**1,708,700**	**0.2757**	**0.0230**	**11.46**	**12.54**
Aeronautical/aerospace engineers	11	67,400	1.3365	0.1215	8.38	13.62
Biomedical/bioengineers	12	13,100	3.1484	0.2624	5.83	18.17
Chemical engineers	12	79,900	1.2748	0.1062	9.50	14.50
Civil/architectural engineers	11	223,700	0.7336	0.0667	9.56	12.44
Computer hardware engineers	21	54,700	1.9312	0.0920	17.21	24.79
Computer software engineers	17	338,400	0.7160	0.0421	15.60	18.40
Electrical/electronics engineers	12	307,500	0.6498	0.0542	10.73	13.27
Environmental engineers	8	73,500	1.1097	0.1387	5.83	10.17
Industrial engineers	5	81,200	0.8481	0.1696	3.34	6.66
Materials/metallurgical engineers	10	35,300	1.7706	0.1771	6.53	13.47
Mechanical engineers	9	265,800	0.6155	0.0684	7.79	10.21
Mining/geological/petroleum engineers	4	22,300	1.4551	0.3638	1.15	6.85
Nuclear engineers	3	17,500	1.4300	0.4767	0.20	5.80
Postsecondary engineering teachers	14	31,400	2.1714	0.1551	9.74	18.26
Sales engineers	4	45,700	1.0165	0.2541	2.01	5.99
Other engineers	7	51,300	1.2492	0.1785	4.55	9.45
Underrepresented minorities	**6**	**1,708,700**	**0.2015**	**0.0336**	**5.61**	**6.39**
Aeronautical/aerospace engineers	4	67,400	0.8370	0.2093	2.36	5.64
Biomedical/bioengineers	5	13,100	2.1116	0.4223	0.86	9.14
Chemical engineers	7	79,900	1.0009	0.1430	5.04	8.96
Civil/architectural engineers	7	223,700	0.5982	0.0855	5.83	8.17
Computer hardware engineers	5	54,700	1.0334	0.2067	2.97	7.03
Computer software engineers	6	338,400	0.4527	0.0755	5.11	6.89
Electrical/electronics engineers	7	307,500	0.5102	0.0729	6.00	8.00
Environmental engineers	8	73,500	1.1097	0.1387	5.83	10.17
Industrial engineers	9	81,200	1.1137	0.1237	6.82	11.18
Materials/metallurgical engineers	4	35,300	1.1566	0.2891	1.73	6.27
Mechanical engineers	6	265,800	0.5108	0.0851	5.00	7.00
Mining/geological/petroleum engineers	6	22,300	1.7635	0.2939	2.54	9.46
Nuclear engineers	4	17,500	1.6426	0.4107	0.78	7.22
Postsecondary engineering teachers	7	31,400	1.5967	0.2281	3.87	10.13
Sales engineers	6	45,700	1.2319	0.2053	3.59	8.41
Other engineers	5	51,300	1.0670	0.2134	2.91	7.09

Standard error table 15 (2 of 2)

Distribution of U.S. engineers, by occupation, race/ethnicity, and citizenship status: 1999

Engineering occupation, citizenship status, and race/ethnicity	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
White	**80**	**1,708,700**	**0.4200**	**0.0052**	**79.18**	**80.82**
Aeronautical/aerospace engineers	84	67,400	1.9381	0.0231	80.20	87.80
Biomedical/bioengineers	82	13,100	4.6070	0.0562	72.97	91.03
Chemical engineers	79	79,900	1.9777	0.0250	75.12	82.88
Civil/architectural engineers	81	223,700	1.1384	0.0141	78.77	83.23
Computer hardware engineers	69	54,700	2.7140	0.0393	63.68	74.32
Computer software engineers	73	338,400	1.0475	0.0143	70.95	75.05
Electrical/electronics engineers	79	307,500	1.0081	0.0128	77.02	80.98
Environmental engineers	83	73,500	1.9016	0.0229	79.27	86.73
Industrial engineers	85	81,200	1.7198	0.0202	81.63	88.37
Materials/metallurgical engineers	83	35,300	2.7440	0.0331	77.62	88.38
Mechanical engineers	84	265,800	0.9760	0.0116	82.09	85.91
Mining/geological/petroleum engineers	89	22,300	2.8757	0.0323	83.36	94.64
Nuclear engineers	93	17,500	2.6471	0.0285	87.81	98.19
Postsecondary engineering teachers	73	31,400	3.4386	0.0471	66.26	79.74
Sales engineers	89	45,700	2.0088	0.0226	85.06	92.94
Other engineers	87	51,300	2.0379	0.0234	83.01	90.99
Temporary residents	**2**	**1,708,700**	**0.1188**	**0.0594**	**1.77**	**2.23**
Aeronautical/aerospace engineers	1	67,400	0.4250	0.4250	0.17	1.83
Biomedical/bioengineers	s	13,100	na	na	na	na
Chemical engineers	2	79,900	0.5492	0.2746	0.92	3.08
Civil/architectural engineers	1	223,700	0.2333	0.2333	0.54	1.46
Computer hardware engineers	5	54,700	1.0334	0.2067	2.97	7.03
Computer software engineers	5	338,400	0.4155	0.0831	4.19	5.81
Electrical/electronics engineers	2	307,500	0.2800	0.1400	1.45	2.55
Environmental engineers	1	73,500	0.4070	0.4070	0.20	1.80
Industrial engineers	1	81,200	0.3872	0.3872	0.24	1.76
Materials/metallurgical engineers	3	35,300	1.0068	0.3356	1.03	4.97
Mechanical engineers	1	265,800	0.2140	0.2140	0.58	1.42
Mining/geological/petroleum engineers	s	22,300	na	na	na	na
Nuclear engineers	s	17,500	na	na	na	na
Postsecondary engineering teachers	6	31,400	1.4862	0.2477	3.09	8.91
Sales engineers	s	45,700	na	na	na	na
Other engineers	1	51,300	0.4871	0.4871	0.05	1.95

s = Suppressed estimate due to small cell count.

na = not applicable.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 16 (1 of 2)

U.S. engineers who did not have at least a bachelor's degree in engineering, by selected occupation and field of most recent degree: 1999

Engineering Occupation and Field of Most Recent Degree	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
All engineers, total						
Computer science	23	407,400	0.9105	0.0396	21.22	24.78
Physics	8	407,400	0.5870	0.0734	6.85	9.15
Electrical/electronics engineering technology	6	407,400	0.5138	0.0856	4.99	7.01
General mathematics	5	407,400	0.4715	0.0943	4.08	5.92
General computer and information sciences	5	407,400	0.4715	0.0943	4.08	5.92
Business administration and management	4	407,400	0.4240	0.1060	3.17	4.83
Mechanical engineering techology	4	407,400	0.4240	0.1060	3.17	4.83
Chemistry, not biochemistry	4	407,400	0.4240	0.1060	3.17	4.83
Applied mathematics	2	407,400	0.3029	0.1514	1.41	2.59
General biology	2	407,400	0.3029	0.1514	1.41	2.59
Geology	2	407,400	0.3029	0.1514	1.41	2.59
All other degree fields	35	407,400	1.0319	0.0295	32.98	37.02
Computer software engineers						
Computer science	43	202,000	1.5211	0.0354	40.02	45.98
General computer and information sciences	9	202,000	0.8793	0.0977	7.28	10.72
General mathematics	7	202,000	0.7840	0.1120	5.46	8.54
Physics	4	202,000	0.6021	0.1505	2.82	5.18
All other degree fields	37	202,000	1.4834	0.0401	34.09	39.91
Chemical engineers						
Chemistry, not biochemistry	57	5,400	9.3036	0.1632	38.77	75.23
Geology	13	5,400	6.3199	0.4861	0.61	25.39
Other engineering-related technologies	9	5,400	5.3780	0.5976	-1.54	19.54
General biology	7	5,400	4.7948	0.6850	-2.40	16.40
All other degree fields	14	5,400	6.5206	0.4658	1.22	26.78

Standard error table 16 (2 of 2)

U.S. engineers who did not have at least a bachelor's degree in engineering, by selected occupation and field of most recent degree: 1999

Engineering Occupation and Field of Most Recent Degree	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	95% confidence interval Upper
Environmental engineers						
Environmental science	23	22,800	3.8487	0.1673	15.46	30.54
Geology	12	22,800	2.9719	0.2477	6.18	17.82
Chemistry, not biochemistry	11	22,800	2.8615	0.2601	5.39	16.61
General biology	6	22,800	2.1719	0.3620	1.74	10.26
Business administration and management	6	22,800	2.1719	0.3620	1.74	10.26
Public health	5	22,800	1.9932	0.3986	1.09	8.91
All other degree fields	37	22,800	4.4155	0.1193	28.35	45.65
Mechanical engineers						
Mechanical engineering technology	50	28,500	4.0900	0.0818	41.98	58.02
Industrial production technology	9	28,500	2.3410	0.2601	4.41	13.59
Physics	6	28,500	1.9426	0.3238	2.19	9.81
Business administration and management	6	28,500	1.9426	0.3238	2.19	9.81
Electrical/electronics engineering technology	5	28,500	1.7828	0.3566	1.51	8.49
Other performing arts	3	28,500	1.3954	0.4651	0.27	5.73
All other degree fields	21	28,500	3.3318	0.1587	14.47	27.53
Electrical/electronics engineers						
Electrical/electronics engineering technology	37	39,100	3.3718	0.0911	30.39	43.61
Physics	21	39,100	2.8445	0.1355	15.42	26.58
Business administration and management	7	39,100	1.7819	0.2546	3.51	10.49
Computer science	6	39,100	1.6585	0.2764	2.75	9.25
General mathematics	3	39,100	1.1913	0.3971	0.66	5.34
All other degree fields	26	39,100	3.0633	0.1178	20.00	32.00

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 17 (1 of 3)

Equivalence of engineering education field with U.S. engineering occupation: 1999

Highest Engineering Degree Field and Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	95% confidence interval Upper
Aeronautical/aerospace						
Total, in an engineering occupation	46	92,800	2.1564	0.0469	41.77	50.23
Engineering specialty was equivalent to highest engineering degree	26	92,800	1.8978	0.0730	22.28	29.72
Engineering specialty was different from highest engineering degree	20	92,800	1.7307	0.0865	16.61	23.39
Not in an engineering occupation	54	92,800	2.1564	0.0399	49.77	58.23
Biomedical/bioengineering						
Total, in an engineering occupation	44	17,900	4.8901	0.1111	34.42	53.58
Engineering specialty was equivalent to highest engineering degree	23	17,900	4.1458	0.1803	14.87	31.13
Engineering specialty was different from highest engineering degree	21	17,900	4.0126	0.1911	13.14	28.86
Not in an engineering occupation	56	17,900	4.8901	0.0873	46.42	65.58
Chemical						
Total, in an engineering occupation	54	188,800	1.5118	0.0280	51.04	56.96
Engineering specialty was equivalent to highest engineering degree	35	188,800	1.4468	0.0413	32.16	37.84
Engineering specialty was different from highest engineering degree	19	188,800	1.1900	0.0626	16.67	21.33
Not in an engineering occupation	46	188,800	1.5118	0.0329	43.04	48.96
Civil/architectural						
Total, in an engineering occupation	60	371,400	1.0595	0.0177	57.92	62.08
Engineering specialty was equivalent to highest engineering degree	50	371,400	1.0814	0.0216	47.88	52.12
Engineering specialty was different from highest engineering degree	11	371,400	0.6767	0.0615	9.67	12.33
Not in an engineering occupation	40	371,400	1.0595	0.0265	37.92	42.08

Standard error table 17 (2 of 3)

Equivalence of engineering education field with U.S. engineering occupation: 1999

Highest Engineering Degree Field and Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Electrical/electronics						
Total, in an engineering occupation	61	701,200	0.7677	0.0126	59.50	62.50
Engineering specialty was equivalent to highest engineering degree	40	701,200	0.7711	0.0193	38.49	41.51
Engineering specialty was different from highest engineering degree	21	701,200	0.6411	0.0305	19.74	22.26
Not in an engineering occupation	39	701,200	0.7677	0.0197	37.50	40.50
Environmental						
Total, in an engineering occupation	63	34,700	3.4161	0.0542	56.30	69.70
Engineering specialty was equivalent to highest engineering degree	35	34,700	3.3748	0.0964	28.39	41.61
Engineering specialty was different from highest engineering degree	27	34,700	3.1413	0.1163	20.84	33.16
Not in an engineering occupation	37	34,700	3.4161	0.0923	30.30	43.70
Industrial						
Total, in an engineering occupation	35	138,800	1.6874	0.0482	31.69	38.31
Engineering specialty was equivalent to highest engineering degree	21	138,800	1.4410	0.0686	18.18	23.82
Engineering specialty was different from highest engineering degree	14	138,800	1.2276	0.0877	11.59	16.41
Not in an engineering occupation	65	138,800	1.6874	0.0260	61.69	68.31
Materials/metallurgical						
Total, in an engineering occupation	53	63,800	2.6044	0.0491	47.90	58.10
Engineering specialty was equivalent to highest engineering degree	34	63,800	2.4719	0.0727	29.16	38.84
Engineering specialty was different from highest engineering degree	19	63,800	2.0471	0.1077	14.99	23.01
Not in an engineering occupation	47	63,800	2.6044	0.0554	41.90	52.10

Standard error table 17 (3 of 3)

Equivalence of engineering education field with U.S. engineering occupation: 1999

Highest Engineering Degree Field and Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	95% confidence interval Upper
Mechanical						
Total, in an engineering occupation	61	454,100	0.9540	0.0156	59.13	62.87
Engineering specialty was equivalent to highest engineering degree	44	454,100	0.9709	0.0221	42.10	45.90
Engineering specialty was different from highest engineering degree	17	454,100	0.7347	0.0432	15.56	18.44
Not in an engineering occupation	39	454,100	0.9540	0.0245	37.13	40.87
Mining/geological/petroleum						
Total, in an engineering occupation	55	30,400	3.7608	0.0684	47.63	62.37
Engineering specialty was equivalent to highest engineering degree	38	30,400	3.6693	0.0966	30.81	45.19
Engineering specialty was different from highest engineering degree	17	30,400	2.8396	0.1670	11.43	22.57
Not in an engineering occupation	45	30,400	3.7608	0.0836	37.63	52.37
Nuclear						
Total, in an engineering occupation	58	18,900	4.7319	0.0816	48.73	67.27
Engineering specialty was equivalent to highest engineering degree	42	18,900	4.7319	0.1127	32.73	51.27
Engineering specialty was different from highest engineering degree	16	18,900	3.5148	0.2197	9.11	22.89
Not in an engineering occupation	42	18,900	4.7319	0.1127	32.73	51.27

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 18 (1 of 2)

Equivalence of U.S. engineering occupation with engineering education field: 1999

Occupation and Engineering Degree Field	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Aeronautical/aerospace engineer						
Degree in any engineering field	82	67,400	2.0436	0.0249	77.99	86.01
Highest degree was in any engineering field	71	67,400	2.4136	0.0340	66.27	75.73
Engineering degree field equivalent to engineering occupation	39	67,400	2.5944	0.0665	33.91	44.09
Biomedical/bioengineer						
Degree in any engineering field	77	13,100	5.0775	0.0659	67.05	86.95
Highest degree was in any engineering field	69	13,100	5.5801	0.0809	58.06	79.94
Engineering degree field equivalent to engineering occupation	33	13,100	5.6733	0.1719	21.88	44.12
Chemical engineer						
Degree in any engineering field	93	79,900	1.2465	0.0134	90.56	95.44
Highest degree was in any engineering field	85	79,900	1.7444	0.0205	81.58	88.42
Engineering degree field equivalent to engineering occupation	86	79,900	1.6952	0.0197	82.68	89.32
Civil/architectural engineer						
Degree in any engineering field	94	223,700	0.6934	0.0074	92.64	95.36
Highest degree was in any engineering field	89	223,700	0.9136	0.0103	87.21	90.79
Engineering degree field equivalent to engineering occupation	84	223,700	1.0704	0.0127	81.90	86.10
Electrical/electronics engineer						
Degree in any engineering field	87	307,500	0.8375	0.0096	85.36	88.64
Highest degree was in any engineering field	81	307,500	0.9769	0.0121	79.09	82.91
Engineering degree field equivalent to engineering occupation	81	307,500	0.9769	0.0121	79.09	82.91
Environmental engineer						
Degree in any engineering field	69	73,500	2.3558	0.0341	64.38	73.62
Highest degree was in any engineering field	60	73,500	2.4954	0.0416	55.11	64.89
Engineering degree field equivalent to engineering occupation	17	73,500	1.9133	0.1125	13.25	20.75

Standard error table 18 (2 of 2)

Equivalence of U.S. engineering occupation with engineering education field: 1999

Occupation and engineering degree field	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Industrial engineer						
Degree in any engineering field	74	81,200	2.1257	0.0287	69.83	78.17
Highest degree was in any engineering field	66	81,200	2.2957	0.0348	61.50	70.50
Engineering degree field equivalent to engineering occupation	36	81,200	2.326	1 0.0646	31.44	40.56
Materials/metallurgical engineer						
Degree in any engineering field	83	35,300	2.7609	0.0333	77.59	88.41
Highest degree was in any engineering field	80	35,300	2.9400	0.0367	74.24	85.76
Engineering degree field equivalent to engineering occupation	64	35,300	3.5280	0.0551	57.09	70.91
Mechanical engineer						
Degree in any engineering field	89	265,800	0.8381	0.0094	87.36	90.64
Highest degree was in any engineering field	83	265,800	1.0061	0.0121	81.03	84.97
Engineering degree field equivalent to engineering occupation	78	265,800	1.1096	0.0142	75.83	80.17
Mining/geological/petroleum engineer						
Degree in any engineering field	86	22,300	3.2087	0.0373	79.71	92.29
Highest degree was in any engineering field	83	22,300	3.4736	0.0419	76.19	89.81
Engineering degree field equivalent to engineering occupation	52	22,300	4.6200	0.0888	42.94	61.06
Nuclear engineer						
Degree in any engineering field	84	17,500	3.8270	0.0456	76.50	91.50
Highest degree was in any engineering field	79	17,500	4.2519	0.0538	70.67	87.33
Engineering degree field equivalent to engineering occupation	48	17,500	5.2153	0.1087	37.78	58.22

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table 19 (1 of 2)

Selected U.S. engineering occupations, by degree field background: 1999

Engineering Occupation and Educational Background	Estimated percent	Total Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Aeronautical/aerospace engineers						
Engineering degree same as engineering occupation	39	67,400	2.5944	0.0665	33.91	44.09
Engineering degree different from engineering occupation	43	67,400	2.6334	0.0612	37.84	48.16
No engineering degree	18	67,400	2.0436	0.1135	13.99	22.01
Biomedical/bioengineers						
Engineering degree same as engineering occupation	33	13,100	5.6733	0.1719	21.88	44.12
Engineering degree different from engineering occupation	44	13,100	5.9891	0.1361	32.26	55.74
No engineering degree	23	13,100	5.0775	0.2208	13.05	32.95
Chemical engineers						
Engineering degree same as engineering occupation	86	79,900	1.6952	0.0197	82.68	89.32
Engineering degree different from engineering occupation	7	79,900	1.2465	0.1781	4.56	9.44
No engineering degree	7	79,900	1.2465	0.1781	4.56	9.44
Civil/architectural engineers						
Engineering degree same as engineering occupation	84	223,700	1.0704	0.0127	81.90	86.10
Engineering degree different from engineering occupation	10	223,700	0.8759	0.0876	8.28	11.72
No engineering degree	6	223,700	0.6934	0.1156	4.64	7.36
Computer hardware engineers						
Engineering degree same as engineering occupation	61	54,700	2.8799	0.0472	55.36	66.64
Engineering degree different from engineering occupation	10	54,700	1.7713	0.1771	6.53	13.47
No engineering degree	31	54,700	2.7308	0.0881	25.65	36.35
Electrical/electronics engineers						
Engineering degree same as engineering occupation	81	307,500	0.9769	0.0121	79.09	82.91
Engineering degree different from engineering occupation	6	307,500	0.5914	0.0986	4.84	7.16
No engineering degree	13	307,500	0.8375	0.0644	11.36	14.64

Standard error table 19 (2 of 2)
Selected U.S. engineering occupations, by degree field background: 1999

Engineering Occupation and Educational Background	Estimated percent	Total Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Environmental engineers						
Engineering degree same as engineering occupation	17	73,500	1.9133	0.1125	13.25	20.75
Engineering degree different from engineering occupation	52	73,500	2.5448	0.0489	47.01	56.99
No engineering degree	31	73,500	2.3558	0.0760	26.38	35.62
Industrial engineers						
Engineering degree same as engineering occupation	36	81,200	2.3261	0.0646	31.44	40.56
Engineering degree different from engineering occupation	38	81,200	2.3523	0.0619	33.39	42.61
No engineering degree	26	81,200	2.1257	0.0818	21.83	30.17
Materials/metallurgical engineers						
Engineering degree same as engineering occupation	64	35,300	3.5280	0.0551	57.09	70.91
Engineering degree different from engineering occupation	19	35,300	2.8834	0.1518	13.35	24.65
No engineering degree	17	35,300	2.7609	0.1624	11.59	22.41
Mechanical engineers						
Engineering degree same as engineering occupation	78	265,800	1.1096	0.0142	75.83	80.17
Engineering degree different from engineering occupation	11	265,800	0.8381	0.0762	9.36	12.64
No engineering degree	11	265,800	0.8381	0.0762	9.36	12.64
Mining/geological/petroleum engineers						
Engineering degree same as engineering occupation	52	22,300	4.6200	0.0888	42.94	61.06
Engineering degree different from engineering occupation	34	22,300	4.3806	0.1288	25.41	42.59
No engineering degree	14	22,300	3.2087	0.2292	7.71	20.29
Nuclear engineers						
Engineering degree same as engineering occupation	48	17,500	5.2153	0.1087	37.78	58.22
Engineering degree different from engineering occupation	36	17,500	5.0107	0.1392	26.18	45.82
No engineering degree	16	17,500	3.8270	0.2392	8.50	23.50

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table A-1 (Appendix A)

Distribution of engineering occupations in the United States, by having an engineering degree: 1999

Engineering Occupation	Percent	Estimated total	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Total, all employees	**76**	**1,708,700**	**0.45**	**0.01**	**75.12**	**76.88**
Aeronautical/aerospace engineers	82	67,400	2.04	0.02	77.99	86.01
Biomedical/bioengineers	77	13,100	5.08	0.07	67.05	86.95
Chemical engineers	93	79,900	1.25	0.01	90.56	95.44
Civil/architectural engineers	94	223,700	0.69	0.01	92.64	95.36
Computer hardware engineers	69	54,700	2.73	0.04	63.65	74.35
Computer software engineers	40	338,400	1.16	0.03	37.72	42.28
Electrical/electronics engineers	87	307,500	0.84	0.01	85.36	88.64
Environmental engineers	69	73,500	2.36	0.03	64.38	73.62
Industrial engineers	74	81,200	2.13	0.03	69.83	78.17
Materials/metallurgical engineers	83	35,300	2.76	0.03	77.59	88.41
Mechanical engineers	89	265,800	0.84	0.01	87.36	90.64
Mining/geological/petroleum engineers	86	22,300	3.21	0.04	79.71	92.29
Nuclear engineers	84	17,500	3.83	0.05	76.50	91.50
Postsecondary engineering teachers	85	31,400	2.78	0.03	79.55	90.45
Sales engineers	76	45,700	2.76	0.04	70.59	81.41
Other engineers	70	51,300	2.79	0.04	64.52	75.48

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table A-2 (1 of 2) (Appendix A)

Distribution of engineering occupations in the United States, by highest degree level: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Total, bachelor's degrees	**64**	**1,708,700**	**0.5071**	**0.0079**	**63.01**	**64.99**
Aeronautical/aerospace engineers	53	67,400	2.6548	0.0501	47.80	58.20
Biomedical/bioengineers	53	13,100	6.0218	0.1136	41.20	64.80
Chemical engineers	64	79,900	2.3450	0.0366	59.40	68.60
Civil/architectural engineers	71	223,700	1.3249	0.0187	68.40	73.60
Computer hardware engineers	62	54,700	2.8659	0.0462	56.38	67.62
Computer software engineers	58	338,400	1.1716	0.0202	55.70	60.30
Electrical/electronics engineers	64	307,500	1.1953	0.0187	61.66	66.34
Environmental engineers	58	73,500	2.5140	0.0433	53.07	62.93
Industrial engineers	76	81,200	2.0697	0.0272	71.94	80.0
Materials/metallurgical engineers	51	35,300	3.6743	0.0720	43.80	58.20
Mechanical engineers	73	265,800	1.1892	0.0163	70.67	75.33
Mining/geological/petroleum engineers	79	22,300	3.7666	0.0477	71.62	86.38
Nuclear engineers	52	17,500	5.2153	0.1003	41.78	62.22
Postsecondary engineering teachers	18	31,400	2.9940	0.1663	12.13	23.87
Sales engineers	76	45,700	2.7589	0.0363	70.59	81.41
Other engineers	61	51,300	2.9738	0.0488	55.17	66.83
Total, master's degrees	**29**	**1,708,700**	**0.4794**	**0.0165**	**28.06**	**29.94**
Aeronautical/aerospace engineers	38	67,400	2.5819	0.0679	32.94	43.06
Biomedical/bioengineers	30	13,100	5.5290	0.1843	19.16	40.84
Chemical engineers	25	79,900	2.1154	0.0846	20.85	29.15
Civil/architectural engineers	25	223,700	1.2643	0.0506	22.52	27.48
Computer hardware engineers	32	54,700	2.7543	0.0861	26.60	37.40
Computer software engineers	35	338,400	1.1323	0.0324	32.78	37.22
Electrical/electronics engineers	30	307,500	1.1412	0.0380	27.76	32.24
Environmental engineers	35	73,500	2.4295	0.0694	30.24	39.76
Industrial engineers	21	81,200	1.9739	0.0940	17.13	24.87
Materials/metallurgical engineers	29	35,300	3.3351	0.1150	22.46	35.54
Mechanical engineers	23	265,800	1.1272	0.0490	20.79	25.21
Mining/geological/petroleum engineers	16	22,300	3.3902	0.2119	9.36	22.64
Nuclear engineers	36	17,500	5.0107	0.1392	26.18	45.82
Postsecondary engineering teachers	21	31,400	3.1742	0.1512	14.78	27.22
Sales engineers	22	45,700	2.6759	0.1216	16.76	27.24
Other engineers	32	51,300	2.8441	0.0889	26.43	37.57

Standard error table A-2 (2 of 2) (Appendix A)

Distribution of engineering occupations in the United States, by highest degree level: 1999

Engineeering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interv	
					Lower	Upp
Total, doctorate	6	1,708,700	0.2509	0.0418	5.51	6.4
Aeronautical/aerospace engineers	7	67,400	1.3572	0.1939	4.34	9.6
Biomedical/bioengineers	17	13,100	4.5321	0.2666	8.12	25.8
Chemical engineers	10	79,900	1.4656	0.1466	7.13	12.8
Civil/architectural engineers	2	223,700	0.4088	0.2044	1.20	2.8
Computer hardware engineers	4	54,700	1.1570	0.2893	1.73	6.2
Computer software engineers	5	338,400	0.5174	0.1035	3.99	6.0
Electrical/electronics engineers	5	307,500	0.5427	0.1085	3.94	6.0
Environmental engineers	5	73,500	1.1101	0.2220	2.82	7.1
Industrial engineers	1	81,200	0.4822	0.4822	0.05	1.9
Materials/metallurgical engineers	20	35,300	2.9400	0.1470	14.24	25.7
Mechanical engineers	3	265,800	0.4569	0.1523	2.10	3.9
Mining/geological/petroleum engineers	4	22,300	1.8121	0.4530	0.45	7.5
Nuclear engineers	9	17,500	2.9874	0.3319	3.14	14.8
Postsecondary engineering teachers	61	31,400	3.8011	0.0623	53.55	68.4
Sales engineers	1	45,700	0.6427	0.6427	-0.26	2.2
Other engineers	6	51,300	1.4480	0.2413	3.16	8.8

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table A-3 (Appendix A)

Distribution of engineering occupations in the United States, by license or certification: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
License or certification, total	**25**	**1,708,700**	**0.4574**	**0.0183**	**24.10**	**25.90**
Aeronautical/aerospace engineers	15	67,400	1.8993	0.1266	11.28	18.72
Biomedical/bioengineers	13	13,100	4.0576	0.3121	5.05	20.95
Chemical engineers	18	79,900	1.8769	0.1043	14.32	21.68
Civil/architectural engineers	69	223,700	1.3504	0.0196	66.35	71.65
Computer hardware engineers	14	54,700	2.0488	0.1463	9.98	18.02
Computer software engineers	7	338,400	0.6057	0.0865	5.81	8.19
Electrical/electronics engineers	19	307,500	0.9769	0.0514	17.09	20.91
Environmental engineers	46	73,500	2.5387	0.0552	41.02	50.98
Industrial engineers	15	81,200	1.7304	0.1154	11.61	18.39
Materials/metallurgical engineers	13	35,300	2.4718	0.1901	8.16	17.84
Mechanical engineers	25	265,800	1.1598	0.0464	22.73	27.27
Mining/geological/petroleum engineers	35	22,300	4.4108	0.1260	26.35	43.65
Nuclear engineers	33	17,500	4.9085	0.1487	23.38	42.62
Postsecondary engineering teachers	29	31,400	3.5362	0.1219	22.07	35.93
Sales engineers	15	45,700	2.3066	0.1538	10.48	19.52
Other engineers	28	51,300	2.7375	0.0978	22.63	33.37

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table A-4 (1 of 2) (Appendix A)

Distribution of engineering occupations in the United States, by employment sector: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
4-year colleges/universities, total	**4**	**1,708,700**	**0.2070**	**0.0518**	**3.59**	**4.41**
Aeronautical/aerospace engineers	4	67,400	1.0423	0.2606	1.96	6.04
Biomedical/bioengineers	27	13,100	5.3565	0.1984	16.50	37.50
Chemical engineers	2	79,900	0.6840	0.3420	0.66	3.34
Civil/architectural engineers	2	223,700	0.4088	0.2044	1.20	2.80
Computer hardware engineers	2	54,700	0.8266	0.4133	0.38	3.62
Computer software engineers	1	338,400	0.2362	0.2362	0.54	1.46
Electrical/electronics engineers	3	307,500	0.4248	0.1416	2.17	3.83
Environmental engineers	3	73,500	0.8689	0.2896	1.30	4.70
Industrial engineers	2	81,200	0.6785	0.3392	0.67	3.33
Materials/metallurgical engineers	4	35,300	1.4403	0.3601	1.18	6.82
Mechanical engineers	2	265,800	0.3750	0.1875	1.27	2.73
Mining/geological/petroleum engineers	1	22,300	0.9201	0.9201	-0.80	2.80
Nuclear engineers	4	17,500	2.0456	0.5114	-0.01	8.01
Postsecondary engineering teachers	90	31,400	2.3379	0.0260	85.42	94.58
Sales engineers	0	45,700	na	na	na	na
Other engineers	3	51,300	1.0401	0.3467	0.96	5.04
Government, total	**11**	**1,708,700 0**	**.3305**	**0.0300**	**10.35**	**11.65**
Aeronautical/aerospace engineers	19	67,400	2.0867	0.1098	14.91	23.09
Biomedical/bioengineers	4	13,100	2.3643	0.5911	-0.63	8.63
Chemical engineers	4	79,900	0.9573	0.2393	2.12	5.88
Civil/architectural engineers	34	223,700	1.3831	0.0407	31.29	36.71
Computer hardware engineers	5	54,700	1.2868	0.2574	2.48	7.52
Computer software engineers	2	338,400	0.3323	0.1662	1.35	2.65
Electrical/electronics engineers	12	307,500	0.8093	0.0674	10.41	13.59
Environmental engineers	31	73,500	2.3558	0.0760	26.38	35.62
Industrial engineers	5	81,200	1.0562	0.2112	2.93	7.07
Materials/metallurgical engineers	6	35,300	1.7455	0.2909	2.58	9.42
Mechanical engineers	5	265,800	0.5838	0.1168	3.86	6.14
Mining/geological/petroleum engineers	3	22,300	1.5775	0.5258	-0.09	6.09
Nuclear engineers	30	17,500	4.7837	0.1595	20.62	39.38
Postsecondary engineering teachers	0	31,400	na	na	na	na
Sales engineers	0	45,700	na	na	na	na
Other engineers	12	51,300	1.9813	0.1651	8.12	15.88

Standard error table A-4 (2 of 2) (Appendix A)

Distribution of engineering occupations in the United States, by employment sector: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
Private, for-profit, total	**78**	**1,708,700**	**0.4376**	**0.0056**	**77.14**	**78.86**
Aeronautical/aerospace engineers	73	67,400	2.3615	0.0323	68.37	77.63
Biomedical/bioengineers	58	13,100	5.9549	0.1027	46.33	69.67
Chemical engineers	90	79,900	1.4656	0.0163	87.13	92.87
Civil/architectural engineers	55	223,700	1.4525	0.0264	52.15	57.85
Computer hardware engineers	89	54,700	1.8474	0.0208	85.38	92.62
Computer software engineers	90	338,400	0.7122	0.0079	88.60	91.40
Electrical/electronics engineers	80	307,500	0.9961	0.0125	78.05	81.95
Environmental engineers	60	73,500	2.4954	0.0416	55.11	64.89
Industrial engineers	88	81,200	1.5748	0.0179	84.91	91.09
Materials/metallurgical engineers	84	35,300	2.6946	0.0321	78.72	89.28
Mechanical engineers	87	265,800	0.9008	0.0104	85.23	88.77
Mining/geological/petroleum engineers	84	22,300	3.3902	0.0404	77.36	90.64
Nuclear engineers	58	17,500	5.1522	0.0888	47.90	68.10
Postsecondary engineering teachers	0	31,400	na	na	na	na
Sales engineers	94	45,700	1.5341	0.0163	90.99	97.01
Other engineers	77	51,300	2.5658	0.0333	71.97	82.03
Other, total	**6**	**1,708,700**	**0.2509**	**0.0418**	**5.51**	**6.49**
Aeronautical/aerospace engineers	5	67,400	1.1593	0.2319	2.73	7.27
Biomedical/bioengineers	11	13,100	3.7751	0.3432	3.60	18.40
Chemical engineers	4	79,900	0.9573	0.2393	2.12	5.88
Civil/architectural engineers	9	223,700	0.8356	0.0928	7.36	10.64
Computer hardware engineers	5	54,700	1.2868	0.2574	2.48	7.52
Computer software engineers	6	338,400	0.5638	0.0940	4.90	7.10
Electrical/electronics engineers	6	307,500	0.5914	0.0986	4.84	7.16
Environmental engineers	6	73,500	1.2097	0.2016	3.63	8.37
Industrial engineers	5	81,200	1.0562	0.2112	2.93	7.07
Materials/metallurgical engineers	7	35,300	1.8753	0.2679	3.32	10.68
Mechanical engineers	6	265,800	0.6361	0.1060	4.75	7.25
Mining/geological/petroleum engineers	12	22,300	3.0051	0.2504	6.11	17.89
Nuclear engineers	8	17,500	2.8320	0.3540	2.45	13.55
Postsecondary engineering teachers	10	31,400	2.3379	0.2338	5.42	14.58
Sales engineers	6	45,700	1.5341	0.2557	2.99	9.01
Other engineers	8	51,300	1.6541	0.2068	4.76	11.24

na = not applicable.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table A-5 (Appendix A)

Distribution of engineering occupations in the United States, by gender: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Male, total	**89**	**1,708,700**	**0.3361**	**0.0038**	**88.34**	**89.66**
Aeronautical/aerospace engineers	93	67,400	1.3800	0.0148	90.30	95.70
Biomedical/bioengineers	77	13,100	5.1630	0.0671	66.88	87.12
Chemical engineers	84	79,900	1.8212	0.0217	80.43	87.57
Civil/architectural engineers	90	223,700	0.8907	0.0099	88.25	91.75
Computer hardware engineers	90	54,700	1.8012	0.0200	86.47	93.53
Computer software engineers	81	338,400	0.9470	0.0117	79.14	82.86
Electrical/electronics engineers	94	307,500	0.6014	0.0064	92.82	95.18
Environmental engineers	77	73,500	2.1797	0.0283	72.73	81.27
Industrial engineers	85	81,200	1.7596	0.0207	81.55	88.45
Materials/metallurgical engineers	87	35,300	2.5134	0.0289	82.07	91.93
Mechanical engineers	95	265,800	0.5936	0.0062	93.84	96.16
Mining/geological/petroleum engineers	90	22,300	2.8209	0.0313	84.47	95.53
Nuclear engineers	92	17,500	2.8797	0.0313	86.36	97.64
Postsecondary engineering teachers	87	31,400	2.6650	0.0306	81.78	92.22
Sales engineers	93	45,700	1.6759	0.0180	89.72	96.28
Other engineers	89	51,300	1.9398	0.0218	85.20	92.80
Female, total	**11**	**1,708,700**	**0.2991**	**0.0272**	**10.41**	**11.59**
Aeronautical/aerospace engineers	7	67,400	1.2280	0.1754	4.59	9.41
Biomedical/bioengineers	23	13,100	4.5943	0.1998	14.00	32.00
Chemical engineers	16	79,900	1.6206	0.1013	12.82	19.18
Civil/architectural engineers	10	223,700	0.7926	0.0793	8.45	11.55
Computer hardware engineers	10	54,700	1.6028	0.1603	6.86	13.14
Computer software engineers	19	338,400	0.8426	0.0443	17.35	20.65
Electrical/electronics engineers	6	307,500	0.5351	0.0892	4.95	7.05
Environmental engineers	23	73,500	1.9396	0.0843	19.20	26.80
Industrial engineers	15	81,200	1.5657	0.1044	11.93	18.07
Materials/metallurgical engineers	13	35,300	2.2366	0.1720	8.62	17.38
Mechanical engineers	5	265,800	0.5282	0.1056	3.96	6.04
Mining/geological/petroleum engineers	10	22,300	2.5102	0.2510	5.08	14.92
Nuclear engineers	8	17,500	2.5625	0.3203	2.98	13.02
Postsecondary engineering teachers	13	31,400	2.3714	0.1824	8.35	17.65
Sales engineers	7	45,700	1.4913	0.2130	4.08	9.92
Other engineers	11	51,300	1.7261	0.1569	7.62	14.38

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table A-6 (1 of 2) (Appendix A)

Distribution of engineering occupations in the United States, by citizenship status and race/ethnicity: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
U.S. citizens and permanent residents						
Asian, total	**12**	**1,708,700**	**0.2757**	**0.0230**	**11.46**	**12.54**
Aeronautical/aerospace engineers	11	67,400	1.3365	0.1215	8.38	13.62
Biomedical/bioengineers	12	13,100	3.1484	0.2624	5.83	18.17
Chemical engineers	12	79,900	1.2748	0.1062	9.50	14.50
Civil/architectural engineers	11	223,700	0.7336	0.0667	9.56	12.44
Computer hardware engineers	21	54,700	1.9312	0.0920	17.21	24.79
Computer software engineers	17	338,400	0.7160	0.0421	15.60	18.40
Electrical/electronics engineers	12	307,500	0.6498	0.0542	10.73	13.27
Environmental engineers	8	73,500	1.1097	0.1387	5.83	10.17
Industrial engineers	5	81,200	0.8481	0.1696	3.34	6.66
Materials/metallurgical engineers	10	35,300	1.7706	0.1771	6.53	13.47
Mechanical engineers	9	265,800	0.6155	0.0684	7.79	10.21
Mining/geological/petroleum engineers	4	22,300	1.4551	0.3638	1.15	6.85
Nuclear engineers	3	17,500	1.4300	0.4767	0.20	5.80
Postsecondary engineering teachers	14	31,400	2.1714	0.1551	9.74	18.26
Sales engineers	4	45,700	1.0165	0.2541	2.01	5.99
Other engineers	7	51,300	1.2492	0.1785	4.55	9.45
Underrepresented minorities, total	**6**	**1,708,700**	**0.2015**	**0.0336**	**5.61**	**6.39**
Aeronautical/aerospace engineers	4	67,400	0.8370	0.2093	2.36	5.64
Biomedical/bioengineers	5	13,100	2.1116	0.4223	0.86	9.14
Chemical engineers	7	79,900	1.0009	0.1430	5.04	8.96
Civil/architectural engineers	7	223,700	0.5982	0.0855	5.83	8.17
Computer hardware engineers	5	54,700	1.0334	0.2067	2.97	7.03
Computer software engineers	6	338,400	0.4527	0.0755	5.11	6.89
Electrical/electronics engineers	7	307,500	0.5102	0.0729	6.00	8.00
Environmental engineers	8	73,500	1.1097	0.1387	5.83	10.17
Industrial engineers	9	81,200	1.1137	0.1237	6.82	11.18
Materials/metallurgical engineers	4	35,300	1.1566	0.2891	1.73	6.27
Mechanical engineers	6	265,800	0.5108	0.0851	5.00	7.00
Mining/geological/petroleum engineers	6	22,300	1.7635	0.2939	2.54	9.46
Nuclear engineers	4	17,500	1.6426	0.4107	0.78	7.22
Postsecondary engineering teachers	7	31,400	1.5967	0.2281	3.87	10.13
Sales engineers	6	45,700	1.2319	0.2053	3.59	8.41
Other engineers	5	51,300	1.0670	0.2134	2.91	7.09

Standard error table A-6 (2 of 2) (Appendix A)

Distribution of engineering occupations in the United States, by citizenship status and race/ethnicity: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
White, total	**80**	**1,708,700**	**0.4200**	**0.0052**	**79.18**	**80.82**
Aeronautical/aerospace engineers	84	67,400	1.9381	0.0231	80.20	87.80
Biomedical/bioengineers	82	13,100	4.6070	0.0562	72.97	91.03
Chemical engineers	79	79,900	1.9777	0.0250	75.12	82.88
Civil/architectural engineers	81	223,700	1.1384	0.0141	78.77	83.23
Computer hardware engineers	69	54,700	2.7140	0.0393	63.68	74.32
Computer software engineers	73	338,400	1.0475	0.0143	70.95	75.05
Electrical/electronics engineers	79	307,500	1.0081	0.0128	77.02	80.98
Environmental engineers	83	73,500	1.9016	0.0229	79.27	86.73
Industrial engineers	85	81,200	1.7198	0.0202	81.63	88.37
Materials/metallurgical engineers	83	35,300	2.7440	0.0331	77.62	88.38
Mechanical engineers	84	265,800	0.9760	0.0116	82.09	85.91
Mining/geological/petroleum engineers	89	22,300	2.8757	0.0323	83.36	94.64
Nuclear engineers	93	17,500	2.6471	0.0285	87.81	98.19
Postsecondary engineering teachers	73	31,400	3.4386	0.0471	66.26	79.74
Sales engineers	89	45,700	2.0088	0.0226	85.06	92.94
Other engineers	87	51,300	2.0379	0.0234	83.01	90.99
Temporary residents, total	**2**	**1,708,700**	**0.1188**	**0.0594**	**1.77**	**2.23**
Aeronautical/aerospace engineers	1	67,400	0.4250	0.4250	0.17	1.83
Biomedical/bioengineers	s	13,100	na	na	na	na
Chemical engineers	2	79,900	0.5492	0.2746	0.92	3.08
Civil/architectural engineers	1	223,700	0.2333	0.2333	0.54	1.46
Computer hardware engineers	5	54,700	1.0334	0.2067	2.97	7.03
Computer software engineers	5	338,400	0.4155	0.0831	4.19	5.81
Electrical/electronics engineers	2	307,500	0.2800	0.1400	1.45	2.55
Environmental engineers	1	73,500	0.4070	0.4070	0.20	1.80
Industrial engineers	1	81,200	0.3872	0.3872	0.24	1.76
Materials/metallurgical engineers	3	35,300	1.0068	0.3356	1.03	4.97
Mechanical engineers	1	265,800	0.2140	0.2140	0.58	1.42
Mining/geological/petroleum engineers	s	22,300	na	na	na	na
Nuclear engineers	s	17,500	na	na	na	na
Postsecondary engineering teachers	6	31,400	1.4862	0.2477	3.09	8.91
Sales engineers	s	45,700	na	na	na	na
Other engineers	1	51,300	0.4871	0.4871	0.05	1.95

s = Suppressed estimate due to small cell count.

na = not applicable.

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.

Standard error table A-7 (1 of 3) (Appendix A)

Distribution of engineering occupations in the United States, by age: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval Lower	Upper
Less than 30	**14**	**1,708,700**	**0.3666**	**0.0262**	**13.28**	**14.72**
Aeronautical/aerospace engineers	8	67,400	1.4431	0.1804	5.17	10.83
Biomedical/bioengineers	28	13,100	5.4173	0.1935	17.38	38.62
Chemical engineers	18	79,900	1.8769	0.1043	14.32	21.68
Civil/architectural engineers	15	223,700	1.0425	0.0695	12.96	17.04
Computer hardware engineers	22	54,700	2.4459	0.1112	17.21	26.79
Computer software engineers	17	338,400	0.8917	0.0525	15.25	18.75
Electrical/electronics engineers	10	307,500	0.7471	0.0747	8.54	11.46
Environmental engineers	12	73,500	1.6552	0.1379	8.76	15.24
Industrial engineers	18	81,200	1.8618	0.1034	14.35	21.65
Materials/metallurgical engineers	14	35,300	2.5504	0.1822	9.00	19.00
Mechanical engineers	14	265,800	0.9294	0.0664	12.18	15.82
Mining/geological/petroleum engineers	12	22,300	3.0051	0.2504	6.11	17.89
Nuclear engineers	10	17,500	3.1317	0.3132	3.86	16.14
Postsecondary engineering teachers	14	31,400	2.7041	0.1931	8.70	19.30
Sales engineers	13	45,700	2.1724	0.1671	8.74	17.26
Other engineers	5	51,300	1.3288	0.2658	2.40	7.60
30 through 39	**32**	**1,708,700**	**0.4928**	**0.0154**	**31.03**	**32.97**
Aeronautical/aerospace engineers	27	67,400	2.3615	0.0875	22.37	31.63
Biomedical/bioengineers	36	13,100	5.7914	0.1609	24.65	47.35
Chemical engineers	29	79,900	2.2168	0.0764	24.66	33.34
Civil/architectural engineers	26	223,700	1.2807	0.0493	23.49	28.51
Computer hardware engineers	32	54,700	2.7543	0.0861	26.60	37.40
Computer software engineers	39	338,400	1.1579	0.0297	36.73	41.27
Electrical/electronics engineers	30	307,500	1.1412	0.0380	27.76	32.24
Environmental engineers	32	73,500	2.3761	0.0743	27.34	36.66
Industrial engineers	33	81,200	2.2787	0.0691	28.53	37.47
Materials/metallurgical engineers	28	35,300	3.3001	0.1179	21.53	34.47
Mechanical engineers	35	265,800	1.2776	0.0365	32.50	37.50
Mining/geological/petroleum engineers	21	22,300	3.7666	0.1794	13.62	28.38
Nuclear engineers	25	17,500	4.5202	0.1808	16.14	33.86
Postsecondary engineering teachers	22	31,400	3.2283	0.1467	15.67	28.33
Sales engineers	32	45,700	3.0133	0.0942	26.09	37.91
Other engineers	28	51,300	2.7375	0.0978	22.63	33.37

Standard error table A-7 (2 of 3) (Appendix A)

Distribution of engineering occupations in the United States, by age: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
40 through 49	**29**	**1,708,700**	**0.4794**	**0.0165**	**28.06**	**29.94**
Aeronautical/aerospace engineers	31	67,400	2.4601	0.0794	26.18	35.82
Biomedical/bioengineers	22	13,100	4.9980	0.2272	12.20	31.80
Chemical engineers	28	79,900	2.1935	0.0783	23.70	32.30
Civil/architectural engineers	29	223,700	1.3249	0.0457	26.40	31.60
Computer hardware engineers	29	54,700	2.6792	0.0924	23.75	34.25
Computer software engineers	30	338,400	1.0878	0.0363	27.87	32.13
Electrical/electronics engineers	30	307,500	1.1412	0.0380	27.76	32.24
Environmental engineers	32	73,500	2.3761	0.0743	27.34	36.66
Industrial engineers	25	81,200	2.0984	0.0839	20.89	29.11
Materials/metallurgical engineers	30	35,300	3.3682	0.1123	23.40	36.60
Mechanical engineers	26	265,800	1.1749	0.0452	23.70	28.30
Mining/geological/petroleum engineers	50	22,300	4.6237	0.0925	40.94	59.06
Nuclear engineers	36	17,500	5.0107	0.1392	26.18	45.82
Postsecondary engineering teachers	25	31,400	3.3745	0.1350	18.39	31.61
Sales engineers	28	45,700	2.9004	0.1036	22.32	33.68
Other engineers	30	51,300	2.7940	0.0931	24.52	35.48
50 through 59	**18**	**1,708,700**	**0.4059**	**0.0225**	**17.20**	**18.80**
Aeronautical/aerospace engineers	23	67,400	2.2385	0.0973	18.61	27.39
Biomedical/bioengineers	12	13,100	3.9208	0.3267	4.32	19.68
Chemical engineers	18	79,900	1.8769	0.1043	14.32	21.68
Civil/architectural engineers	21	223,700	1.1892	0.0566	18.67	23.33
Computer hardware engineers	14	54,700	2.0488	0.1463	9.98	18.02
Computer software engineers	12	338,400	0.7714	0.0643	10.49	13.51
Electrical/electronics engineers	20	307,500	0.9961	0.0498	18.05	21.95
Environmental engineers	18	73,500	1.9569	0.1087	14.16	21.84
Industrial engineers	18	81,200	1.8618	0.1034	14.35	21.65
Materials/metallurgical engineers	19	35,300	2.8834	0.1518	13.35	24.65
Mechanical engineers	17	265,800	1.0061	0.0592	15.03	18.97
Mining/geological/petroleum engineers	12	22,300	3.0051	0.2504	6.11	17.89
Nuclear engineers	22	17,500	4.3243	0.1966	13.52	30.48
Postsecondary engineering teachers	21	31,400	3.1742	0.1512	14.78	27.22
Sales engineers	20	45,700	2.5839	0.1292	14.94	25.06
Other engineers	28	51,300	2.7375	0.0978	22.63	33.37

Standard error table A-7 (3 of 3) (Appendix A)

Distribution of engineering occupations in the United States, by age: 1999

Engineering Occupation	Estimated percent	Number	Standard error	Coefficient of variation	95% confidence interval	
					Lower	Upper
60 through 75	**7**	**1,708,700**	**0.2695**	**0.0385**	**6.47**	**7.53**
Aeronautical/aerospace engineers	11	67,400	1.6643	0.1513	7.74	14.26
Biomedical/bioengineers	2	13,100	1.6891	0.8446	-1.31	5.31
Chemical engineers	7	79,900	1.2465	0.1781	4.56	9.44
Civil/architectural engineers	10	223,700	0.8759	0.0876	8.28	11.72
Computer hardware engineers	3	54,700	1.0072	0.3357	1.03	4.97
Computer software engineers	2	338,400	0.3323	0.1662	1.35	2.65
Electrical/electronics engineers	10	307,500	0.7471	0.0747	8.54	11.46
Environmental engineers	6	73,500	1.2097	0.2016	3.63	8.37
Industrial engineers	6	81,200	1.1509	0.1918	3.74	8.26
Materials/metallurgical engineers	10	35,300	2.2050	0.2205	5.68	14.32
Mechanical engineers	8	265,800	0.7267	0.0908	6.58	9.42
Mining/geological/petroleum engineers	5	22,300	2.0154	0.4031	1.05	8.95
Nuclear engineers	7	17,500	2.6635	0.3805	1.78	12.22
Postsecondary engineering teachers	18	31,400	2.9940	0.1663	12.13	23.87
Sales engineers	6	45,700	1.5341	0.2557	2.99	9.01
Other engineers	10	51,300	1.8291	0.1829	6.41	13.59

SOURCE: National Science Foundation/Division of Science Resources Statistics, SESTAT (Scientists and Engineers Statistical Data System), 1999.