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The U.S. Science and Engineering Workforce: Recent, Current, and Projected Employment, Wages, and Unemployment

John F. Sargent Jr.
Specialist in Science and Technology Policy

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Summary

The adequacy of the U.S. science and engineering workforce has been an ongoing concern of Congress for more than 60 years. Scientists and engineers are widely believed to be essential to U.S. technological leadership, innovation, manufacturing, and services, and thus vital to U.S. economic strength, national defense, and other societal needs. Congress has enacted many programs to support the education and development of scientists and engineers. Congress has also undertaken broad efforts to improve science, technology, engineering, and math (STEM) skills to prepare a greater number of students to pursue science and engineering (S&E) degrees. Some policymakers have sought to increase the number of foreign scientists and engineers working in the United States through changes in visa and immigration policies.

Many policymakers, business leaders, academicians, S&E professional society analysts, economists, and others hold diverse views with respect to the adequacy of the S&E workforce and related policy issues. These issues include the question of the existence of a shortage of scientists and engineers in the United States, what the nature of such a shortage might be (e.g., too few people with S&E degrees, mismatched skills and needs), and whether the federal government should undertake policy interventions to address such a putative shortage or to allow market forces to work in this labor market. Among the key indicators used by labor economists to assess occupational labor shortages are employment growth, wage growth, and unemployment rates.

In 2011, there were 5.9 million scientists and engineers employed in the United States, accounting for 4.6% of total U.S. employment. Science and engineering employment was concentrated in two S&E occupational groups, computer occupations (56%) and engineers (25%), with the rest accounted for by S&E managers (9%), physical scientists (4%), life scientists (4%), and those in mathematical occupations (2%). From 2008 to 2011 S&E employment increased by 99,550, rising to 5.9 million, a compound annual growth rate (CAGR) of 0.6%, while overall U.S. employment contracted at 1.7% CAGR. Viewed only in aggregate, the overall increase in S&E employment masks the varied degrees of growth and decline in the detailed S&E occupations.

In 2011, the mean wage for all scientists and engineers was $85,700, while the mean wage for all other occupations was $43,300. Between 2008 and 2011, the mean wages of each S&E occupational group grew more slowly (1.5%-2.2% CAGR) than the mean wage for all occupations (2.3% CAGR).

Compared to the overall workforce, the S&E occupational groups had significantly lower unemployment rates for the 2008-2011 period. In general, though, the professional occupations (of which the S&E occupations are a part) historically have had lower unemployment rates than the workforce as a whole. In 2011, the overall S&E unemployment rate of 3.9% was higher than for other selected professional occupations, including lawyers (2.1%), physicians and surgeons (0.6%), dentists (0.7%), and registered nurses (2.0%).

The Bureau of Labor Statistics projects the number of science and engineering jobs (as defined in this report) will grow by 1.1 million between 2010 and 2020, a growth rate (1.7% CAGR) that is somewhat faster than that of the overall workforce (1.3%). In addition, BLS projects that a further 1.3 million scientists and engineers will be needed to replace those projected to exit S&E occupations. Growth in the S&E occupational groups is projected to range from 1.0%-2.0% CAGR. The number of scientists and engineers needed to meet growth and net replacement needs between 2010 and 2020 is 2.4 million, including 1.4 million in the computer occupations and 525,900 engineers.

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Overview

Many congressional policymakers have maintained an ongoing interest in the adequacy of the number of U.S. scientists and engineers required to address the needs of U.S. employers, to spur economic growth and job creation through innovation, to maintain U.S. global technological leadership and industrial competitiveness, and to help address important national and societal needs.

To help ensure an adequate S&E workforce, Congress has enacted and appropriated funds for a variety of federal programs. These programs intend to foster improved science, technology, engineering, and mathematics (STEM) skills among students; to incentivize students to pursue degrees in science and engineering (S&E) through tools such as fellowships, assistantships, and traineeships; and to provide graduate and post-graduate research experiences at U.S. colleges and universities through the financing of university-based research. The 113th Congress is considering legislation to create, reform, and provide funding for STEM education efforts, and may seek to reauthorize the America COMPETES Act of 2007 (P.L. 110-69) and the America COMPETES Reauthorization Act of 2010 (P.L. 111-358).[1] In addition, Congress is considering changes to immigration policies, among them the number and processes associated with F-1 visas, H-1B visas, L1 visas, and legal permanent residency (commonly referred to as "Green Cards"), to address U.S. S&E workforce needs.[2]

As Congress develops policies and programs and makes appropriations to help address the nation's needs for scientists and engineers, it may wish to consider past, current, and projected S&E workforce trends. In this regard, this report provides employment, wage, and unemployment information[3] for the computer occupations, mathematical occupations, engineers, life scientists, physical scientists, and S&E management occupations, in three sections:

- "Current Employment, Wages, and Unemployment" provides a statistical snapshot of the S&E workforce in 2011 (the latest year for which data are available) with respect to occupational employment, wage, and unemployment data.
- "Recent Trends in Employment, Wages, and Unemployment" provides a perspective on how S&E employment, wages, and unemployment have changed during the 2008-2011 period.
- "Employment Projections, 2010-2020" provides an analysis of the Bureau of Labor Statistics' occupational projections examining how the number employed in S&E occupations are expected to change during the 2010-2020 period, as well as how many openings will be created by workers exiting each occupation (replacement needs).

[1] For additional information about P.L. 110-69 and P.L. 111-358, see CRS Report R42430, *America COMPETES 2010 and the FY2013 Budget*, by Heather B. Gonzalez.

[2] For additional information, see CRS Report R42530, *Immigration of Foreign Nationals with Science, Technology, Engineering, and Mathematics (STEM) Degrees*, by Ruth Ellen Wasem.

[3] Among the key factors that labor economists examine for evidence of labor shortages are employment growth, wage growth, and unemployment rates relative to other occupations. See, for example, Carolyn M. Veneri, "Can Occupational Labor Shortages Be Identified Using Available Data?," *Monthly Labor Review*, March 1999, p. 18.

A final section, "Concluding Observations," provides various stakeholder perspectives that Congress may wish to consider as it seeks to ensure that the United States has an adequate S&E workforce to meet the demands of the 21st century.

Methodology

Occupational Taxonomy

Most experts agree that there is no authoritative definition of which occupations comprise the science and engineering (S&E) workforce. Rather, the selection of occupations included in any particular analysis of the S&E workforce may vary. Some analysts, policymakers, and organizations may refer to the group in different ways (e.g., the scientific and technical workforce, the STEM workforce) and include varying sets of occupations. In 2001, the Bureau of Labor Statistics (BLS), in defining the STEM occupations for a particular analysis, stated, "This is only one possible definition of STEM occupations; other definitions exist that may be better suited for other uses."[4]

The size of the S&E workforce varies substantially depending on which occupations are included in the definition. In its 2012 Science and Engineering Indicators report, the National Science Board (NSB) stated, "In the most recent estimates, the U.S. S&E workforce (defined by occupation) totaled between 4.8 million and 6.4 million people."[5] Previously, the NSB asserted that the S&E workforce could be as large as 21 million people if the definition included those with either an S&E degree or a degree in an S&E-related field such as health or technology.[6]

The policy debate about the adequacy of the U.S. S&E workforce has focused largely on the computer occupations, mathematical occupations, engineers, and physical scientists. For purposes of this report, these occupations, along with life scientists (a part of the natural sciences, with physics and chemistry) and S&E management occupations, are collectively referred to as the S&E workforce. Notably, this group does not include social scientists (e.g., economists, survey researchers, psychologists, sociologists, urban and regional planners, anthropologists, archeologists, geographers, historians, political scientists) or S&E-related technicians. As defined this way, the size of the S&E workforce in 2011 was approximately 5.9 million.

This report uses a modified version of the Standard Occupation Classification (SOC) system[7] to categorize scientists and engineers. The report taxonomy includes six S&E occupational groups, each composed of closely related detailed occupations:

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[4] For purposes of the BLS analysis, the authors defined the STEM occupation group as consisting of 97 occupations, including computer and math sciences, architecture and engineering, life and physical sciences, managerial and post-secondary teaching occupations associated with these functional areas, and two sales occupations that require scientific or technical education at the postsecondary level—sales engineers and wholesale and engineering manufacturing sales representatives of technical and scientific products. Ben Cover, John Jones, and Audrey Watson, "Science, Technology, Engineering, and Mathematics (STEM) Occupations: A Visual Essay," *Monthly Labor Review*, May 2011, p. 3.

[5] National Science Board, *Science and Engineering Indicators 2012*, January 2012, p. 3-10.

[6] National Science Board, *Science and Engineering Indicators 2008*, January 2008, p. 3-8.

[7] The Standard Occupational Classification system is a federal system that defines over 840 detailed occupations, and groups them into 461 broad occupations, 97 minor groups, and 23 major groups. Detailed occupations in the SOC with similar job duties, and in some cases skills, education, and/or training, are grouped together. The system is used by (continued...)

- **computer occupations—**including computer and information research scientists; computer systems analysts; computer programmers; software developers, applications; software developers, systems software; database administrators; network and computer systems administrators; computer support specialists; information security analysts, web developers, and computer network architects; and computer occupations, all other;

- **mathematical occupations—**actuaries; mathematicians; operations research analysts; statisticians; and mathematical science occupations, all other;

- **engineers—**including aerospace, agricultural, biomedical, chemical, civil, computer hardware, electrical, electronics (except computer), environmental, health and safety (except mining safety engineers and inspectors), industrial, materials, mechanical, mining and geological (including mining safety engineers), nuclear, and petroleum engineers; engineers, all other; and marine engineers and naval architects;

- **life scientists—**animal scientists, food scientists and technologists, soil and plant scientists, biochemists and biophysicists, microbiologists, zoologists and wildlife biologists, biological scientists, all other, conservation scientists, foresters, epidemiologists, medical scientists (except epidemiologists), and life scientists, all other.

- **physical scientists—**astronomers, physicists, atmospheric and space scientists, chemists, materials scientists, environmental scientists and specialists (including health), geoscientists (except hydrologists and geographers), hydrologists, and physical scientists, all other; and

- **S&E managers—**computer and information systems managers, architectural and engineering managers,[8] and natural sciences managers.

A description of the detailed occupations is provided in the **Appendix**.

Data Sources

This report relies on federal government employment, wage, and unemployment data from the following sources:

- The **Occupational Employment Statistics (OES)**,[9] a survey of non-farm establishments conducted by the Department of Labor's Bureau of Labor Statistics and state workforce agencies, is the source of employment and wage data for the 2008-2011 period. The survey provides employment and wage estimates annually for over 800 occupations. According to BLS, "employees" are all part-time and full-time workers who are paid a wage or salary. The survey

(...continued)

federal statistical agencies for the purpose of collecting, calculating, and disseminating data. First established in 1977, the SOC system has been revised periodically; the latest revision is the 2010 SOC.

[8] Occupational Employment Survey (OES) employment figures for the occupation group "architectural and engineering managers" are reported as a single number, thus the architectural managers are included in this group, though data on architect and other architectural-related occupations are not otherwise included in this report.

[9] Occupational Employment Survey, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes.

does not cover the self-employed, owners and partners in unincorporated firms, household workers, or unpaid family workers. For this report, the wage statistic used is the occupational "mean wage," an average wage calculated by summing the wages of all the employees in a given occupation and then dividing the total wages by the number of employees.

- The **Current Population Survey (CPS)**,[10] a monthly survey of households conducted for BLS by the Department of Commerce's Bureau of the Census, is the source of the unemployment data in this report. CPS data are also used to supplement OES data in BLS employment projections (discussed below).
- BLS's **Employment Projections**,[11] a biennial product of BLS, provides occupational employment and industry employment projection data for ten-year periods. The latest projections, covering the 2010-2020 period, were published in January 2012. According to BLS, for most industries, the OES survey provides data for the occupational staffing patterns—the distribution of wage and salary employment by occupation in each industry—and Current Employment Statistics (CES)[12] data provide information on total wage and salary employment in each non-farm industry. While OES data include only wage and salary, non-farm employment, the employment data in the projections also include agricultural industry employment and the self-employed (derived from CPS data) to arrive at 2010 employment levels for each occupation.[13]

Timeframe

The "Current Trends in Employment, Wages, and Unemployment" section provides information on changes in employment, wages, and unemployment for the period 2008 to 2011. The "Employment Projections, 2010-2020" section relies entirely on the most recent Bureau of Labor Statistics biennial employment projections for the 2010-2020 timeframe.

Methodological Limitations

A variety of factors may affect the comparability of OES data over time:

> Although the OES survey methodology is designed to create detailed cross-sectional employment and wage estimates for the U.S., States, metropolitan and nonmetropolitan areas, across industry and by industry, it is less useful for comparisons of two or more points in time. Challenges in using OES data as a time series include changes in the occupational, industrial, and geographical classification systems, changes in the way data are collected, changes in the survey reference period, and changes in mean wage estimation methodology, as well as permanent features of the methodology.[14]

[10] Current Population Survey, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/cps.

[11] Employment Projections, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/emp.

[12] The Current Employment Statistics survey provides industry employment data used by BLS in making its biennial ten-year projections. The CES survey does not collect occupational information.

[13] Telephone conversation with Michael Wolf, economist, Division of Occupational Outlook, Office of Occupational Statistics and Employment Projections, Bureau of Labor Statistics, Department of Labor, March 4, 2013.

[14] BLS website, Occupational Employment Statistics, Frequently Asked Questions, http://www.bls.gov/oes/ (continued...)

In its examination of current trends, CRS chose the 2008-2011 time period to enhance comparability of data across the period by reducing inconsistencies resulting from changes in the OES occupational classification system. The OES survey used the same occupational categories throughout the 2008-2011 period.

The Bureau of Labor Statistics makes a number of estimates in developing its employment projections. These estimates include "the future size and composition of the population, as well as on the trends in labor force participation rates of different age, gender, race, and ethnic groups, a total of 136 separate categories," "the rate of growth and demand composition of real GDP, the labor productivity growth rate, and the inflation rate," expectations regarding the federal budget surplus or deficit, historical staffing patterns, shifts in product mix, changes in technology and business practices, and retirement rates.[15] If these estimates do not accurately reflect future performance, occupational employment projections may be over- or underestimated. Other factors may affect occupational projections as well, including changes to immigration laws and patterns, trade laws and practices, regulatory regimes, and social and educational patterns; wars and disasters; revolutionary advances in technology; and shifts in consumer tastes. The BLS evaluates the accuracy of its projections regularly and publishes these evaluations in its *Monthly Labor Review*.[16]

(...continued)

oes_ques.htm.

[15] BLS website, Employment Projections, Projections Methodology, http://www.bls.gov/emp/ep_projections_methods.htm.

[16] For links to past evaluations of BLS projections, see http://www.bls.gov/emp/ep_pub_projections_eval.htm. For the latest evaluation, see "Evaluating the 1996–2006 employment projections," by Ian D. Wyatt, *Monthly Labor Review*, September 2010, http://www.bls.gov/opub/mlr/2010/09/art3full.pdf.

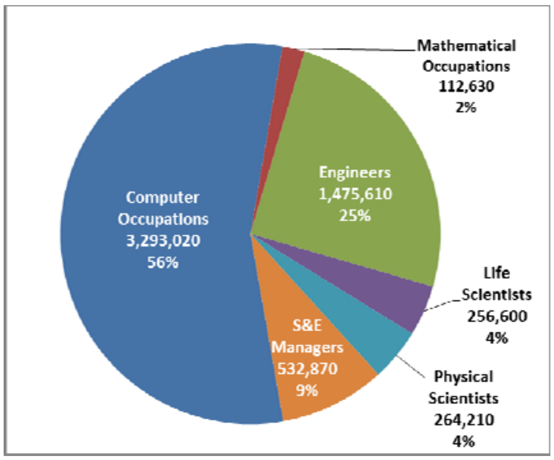
Selected S&E Occupational Data

Current Employment, Wages, and Unemployment

This section provides a snapshot of the S&E workforce in 2011, using employment, wages, and unemployment data.

Employment

Figure 1. Share of S&E Occupational Employment, 2011



Source: CRS analysis of Occupational Employment Survey data, May 2011, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes/tables.htm.

Notes: Chart does not include social scientists or S&E-related technicians.

In 2011, the latest year for which Occupational Employment Survey data are available, 5.9 million people were employed in the United States as scientists and engineers, accounting for 4.6% of total U.S. employment. Science and engineering employment was concentrated in two occupational groups—computer occupations and engineers—which together accounted for 81% of S&E jobs, with 56% and 25%, respectively. The remainder of S&E employment was accounted for by science and engineering managers (9%), physical scientists (4%), life scientists (4%), and mathematical occupations (2%). Employment totals and share of S&E occupational employment are presented in **Figure 1**.

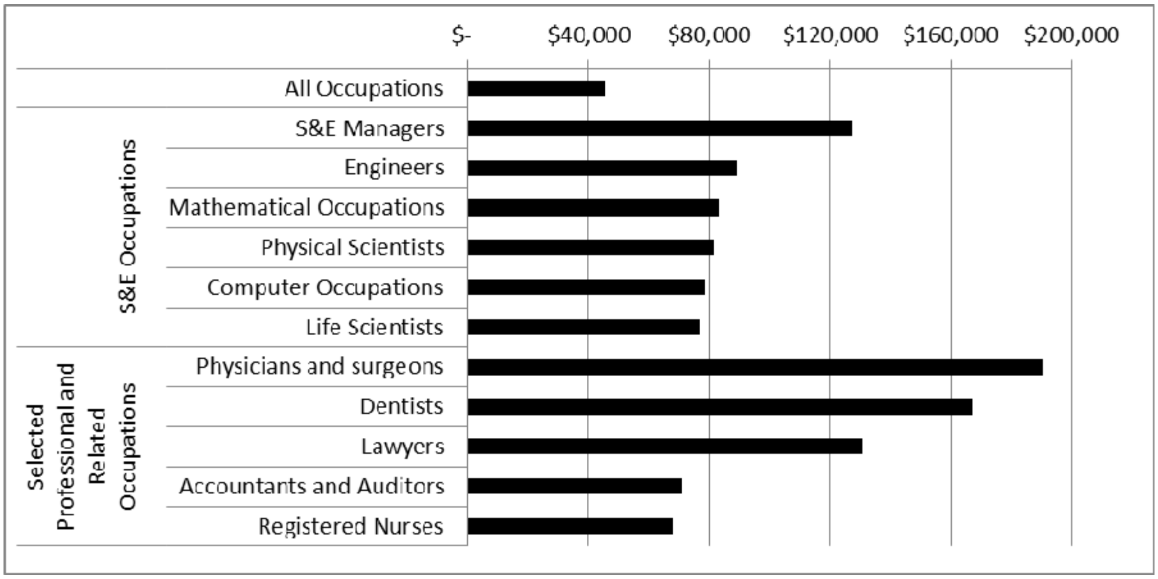
Table 4 provides 2011 employment data for each of the individual S&E occupations, organized by S&E group.

Wages

Scientists and engineers, in general, have mean wages that exceed the mean wage for all occupations in the United States. In 2011, the mean wage for all occupations—professional and non-professional—was $45,230. S&E managers had the highest mean wage of all S&E occupational groups at $127,200, followed by engineers, $89,000; mathematical occupations,

$81,400; computer occupations, $78,600; and life scientists, $76,800. Scientists and engineers earn less than some other professionals, such as physicians and surgeons ($190,100), dentists ($166,900), and lawyers ($130,900). (See **Figure 2**.)

Figure 2. Mean Wages of S&E Occupational Groups and Other Selected Professional Occupations, 2011



Source: CRS analysis of Occupational Employment Survey data, May 2011, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes/tables.htm.

Table 1 provides the 2011 mean wages for each of the individual S&E occupations, organized by S&E group.

Table 1. Mean Wages of S&E Occupations, 2011

Occupational Group	Mean Wage
Science and Engineering Managers	
Computer and Information Systems Managers	$125,660
Architectural and Engineering Managers	129,350
Natural Sciences Managers	128,230
Computer Occupations	
Computer and Information Research Scientists	$103,160
Computer Systems Analysts	82,320
Computer Programmers	76,010
Software Developers, Applications	92,080
Software Developers, Systems Software	100,420
Database Administrators	77,350
Network and Computer Systems Administrators	74,270

Occupational Group	Mean Wage
Computer Support Specialists	51,820
Information Security Analysts, Web Developers, and Computer Network Architects	81,670
Computer Occupations, All Other	80,500
Mathematical Occupations	
Actuaries	$103,000
Mathematicians	101,320
Operations Research Analysts	78,840
Statisticians	77,280
Mathematical Science Occupations, All Other	63,170
Engineers	
Aerospace Engineers	$103,870
Agricultural Engineers	78,400
Biomedical Engineers	88,360
Chemical Engineers	99,440
Civil Engineers	82,710
Computer Hardware Engineers	101,360
Electrical Engineers	89,200
Electronics Engineers, except Computer	94,670
Environmental Engineers	83,340
Health and Safety Engineers, except Mining Safety Engineers and Inspectors	78,540
Industrial Engineers	79,840
Marine Engineers and Naval Architects	91,730
Materials Engineers	86,790
Mechanical Engineers	83,550
Mining and Geological Engineers, Including Mining Safety Engineers	90,070
Nuclear Engineers	105,160
Petroleum Engineers	138,980
Engineers, All Other	92,260
Life Scientists	
Animal Scientists	$74,170
Food Scientists and Technologists	64,170
Soil and Plant Scientists	63,890
Biochemists and Biophysicists	87,640
Microbiologists	71,720
Zoologists and Wildlife Biologists	61,880

Occupational Group	Mean Wage
Biological Scientists, All Other	73,050
Conservation Scientists	62,290
Foresters	56,130
Epidemiologists	69,660
Medical Scientists, except Epidemiologists	87,640
Life Scientists, All Other	74,220
Physical Scientists	
Astronomers	$101,630
Physicists	112,090
Atmospheric and Space Scientists	90,860
Chemists	74,780
Materials Scientists	86,600
Environmental Scientists and Specialists, Including Health	68,810
Geoscientists, except Hydrologists and Geographers	97,700
Hydrologists	79,070
Physical Scientists, All Other	96,290

Source: CRS analysis of Occupational Employment Survey data, May 2011, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes/tables.htm.

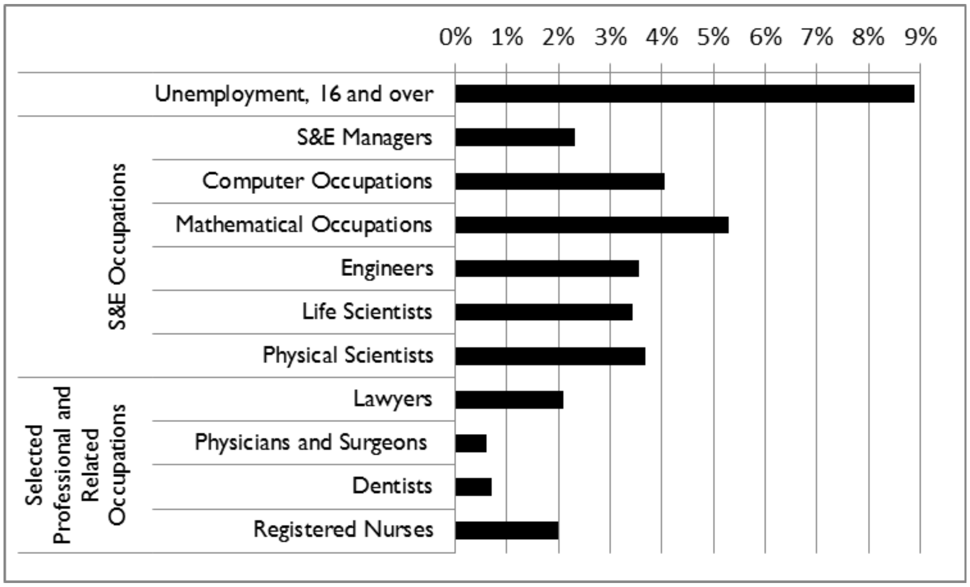
Unemployment

The 2011 unemployment rates for S&E occupational groups are shown in **Figure 3**, together with the unemployment rates of other selected professional and related occupations.[17] The unemployment rates for the S&E occupations overall (3.9%) and for each individual S&E occupational groups (which range from 2.3% to 5.3%) were lower than the overall unemployment rate for those 16 and over (8.9%), and generally lower than the unemployment rate for the professional and related occupations group (4.3%).[18] However, the unemployment rates for the S&E occupational groups were higher than the rates for some other professional occupations, including lawyers (2.1%), secondary school teachers (3.0%), physicians and surgeons (0.6%), dentists (0.7%), and registered nurses (2.0%).

[17] Science and engineering occupations are part of the larger category of "Professional and Related Occupations" used in the Current Population Survey.

[18] Mathematical occupations was the only S&E occupational group with a higher unemployment rate (5.3%) than the professional and related occupations group (4.3%).

Figure 3. Unemployment Rates for S&E Occupational Groups and Selected Professional and Related Occupations, 2011



Source: CRS analysis of unpublished 2011 data from the Current Population Survey, Bureau of Labor Statistics.

The unemployment rate for each detailed S&E occupation is provided in **Table 2**.[19] The unemployment rates for S&E occupations ranges from 1.2% for environmental scientists and geoscientists to 7.3% for computer support specialists.[20]

Table 2. Unemployment Rate for S&E Occupational Groups and Detailed S&E Occupations, 2011

Occupation	Unemployment Rate (Percentage)
Total, all occupations, 16 years and over	**8.9**
Science and Engineering Managers	**2.3**
Computer and information systems managers	2.9
Architectural and engineering managers	1.6
Natural sciences managers	n/a
Computer Occupations	**4.1**
Computer and information research scientists	n/a
Computer systems analysts	2.5
Information security analysts	n/a
Computer programmers	3.7
Software developers, applications and systems software	4.0
Web developers	4.7
Computer support specialists	7.3
Database administrators	1.3

[19] The occupational classification system used in the Current Population Survey is based on the 2010 Standard Occupational Classification System but differs somewhat from those used by in the Occupational Employment Survey.

[20] CPS does not publish unemployment rates for occupations with an employment base of less than 50,000.

Occupation	Unemployment Rate (Percentage)
Network and computer systems administrators	3.9
Computer network architects	0.4
Computer occupations, all other	4.7
Mathematical Occupations	**5.3**
Actuaries	n/a
Mathematicians	n/a
Operations research analysts	6.5
Statisticians	n/a
Miscellaneous mathematical science occupations	n/a
Engineers	**3.6**
Aerospace engineers	1.9
Agricultural engineers	n/a
Biomedical engineers	n/a
Chemical engineers	3.6
Civil engineers	4.8
Computer hardware engineers	2.3
Electrical and electronics engineers	3.4
Environmental engineers	n/a
Industrial engineers, including health and safety	5.5
Marine engineers and naval architects	n/a
Materials engineers	n/a
Mechanical engineers	2.4
Mining and geological engineers, including mining safety	n/a
Nuclear engineers	n/a
Petroleum engineers	n/a
Engineers, all other	2.9
Life Scientists	**3.4**
Agricultural and food scientists	n/a
Biological scientists	2.9
Conservation scientists and foresters	n/a
Medical scientists	3.4
Life scientists, all other	n/a
Physical Scientists	**3.7**
Astronomers and physicists	n/a
Atmospheric and space scientists	n/a
Chemists and materials scientists	6.1
Environmental scientists and geoscientists	1.2
Physical scientists, all other	4.0

Source: Current Population Survey, 2011, Bureau of Labor Statistics, U.S. Department of Labor.

Notes: Unemployment for occupations refers to the experienced unemployed (those with prior work experience), classified according to their last job. For occupations in which the total number of employed and unemployed totals less than 50,000 the unemployment rate is not shown; n/a indicate data are not available.

Recent Trends in Employment, Wages, and Unemployment

This section provides information on changes in employment, wages, and unemployment for the period 2008 to 2011.

Employment Trends

Aggregate S&E Employment

During the 2008-2011 period, aggregate S&E employment increased by 99,550 jobs, rising from 5.8 million to 5.9 million, a compound annual growth rate of 0.6%.[21] The growth in the S&E occupations ran counter to overall U.S. employment which contracted at 1.7% CAGR during this same period. Growth rates for the S&E occupational groups and detailed occupations are provided in the following sections.

Science and Engineering Occupational Groups

Table 3 provides employment data—2008 employment, 2011 employment, and changes in number employed and the compound annual growth rates during the 2008 to 2011 period—for each S&E occupational group. The fastest growth rate among S&E occupational groups during this period was in science and engineering managers which grew at 2.0% CAGR, while the largest increase in the number employed was in computer occupations which added 94,970 jobs. Among the S&E occupational groups, only engineers experienced a decline in employment, losing a total of 40,620 jobs during this period (-0.9% CAGR).

Table 3. Employment Change in S&E Occupational Groups, 2008-2011

Occupation	Employment, 2008	Employment, 2011	Employment Change, Number	Employment Change, Compound Annual Growth Rate
All occupations	135,185,230	128,278,550	-6,906,680	-1.7%
All S&E occupations	5,835,390	5,934,940	99,550	0.6%
S&E managers	502,180	532,870	30,690	2.0%
Computer occupations	3,198,050	3,293,020	94,970	1.0%
Mathematical occupations	109,130	112,630	3,500	1.1%
Engineers	1,516,230	1,475,610	-40,620	-0.9%
Life scientists	250,250	256,600	6,350	0.8%
Physical scientists	259,550	264,210	4,660	0.6%

Source: CRS analysis of Occupational Employment Survey data, 2008-2011, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes/tables.htm.

[21] A compound annual growth rate (CAGR) is a calculated growth rate which, if applied year after year to a beginning amount reaches a specified final amount.

Detailed S&E Occupations

Table 4 provides 2008-2011 employment data for each of the S&E occupations, organized by S&E group. The data indicate that there was substantial variation in the number of jobs gained and lost among the S&E occupations, as well as in their growth rates. With respect to the number employed, the occupation with the largest gain was computer support specialists which added 86,970 jobs, while the occupation experiencing the largest decrease was computer programmers which lost 74,130 jobs. The S&E occupation with the fastest growth rate was astronomers with a 17.6% CAGR (though the number of new jobs (800) was small compared to other S&E occupations), while the occupation with the fastest decline was mathematical science occupations, all other, which experienced a -42.4% CAGR.

Among the computer occupations, those with the fastest growth rates were information security analysts, web developers, and computer network architects (5.8% CAGR); computer support specialists (5.1% CAGR); and computer software developers, applications (3.0% CAGR). These occupations also accounted for the vast majority of the job growth in the computer occupations group. These gains offset losses in other computer occupations, including computer programmers (-74,130, -6.7% CAGR); computer occupations, all other (-14,150, -2.5% CAGR); and database administrators (-7,270, -2.1% CAGR).

Several engineering occupations increased employment during this period, including aerospace engineers (11,600, 5.4% CAGR), petroleum engineers (10,000, 13.9% CAGR), nuclear engineers (1,790, 3.5%), mechanical engineers (4,650, 0.7% CAGR), and biomedical engineers (1,370, 2.9% CAGR). Employment gains in these engineering occupations were offset by declines in twelve engineering occupations, including engineers, all other (-43,650, -9.5% CAGR); civil engineers (-7,230, -0.9% CAGR); electronics engineers (-3,620, -0.9% CAGR); industrial engineers (-3,090, -0.5%), and chemical engineers (-3,110, -3.5% CAGR).

Growth in the mathematical occupations was led by operations research analysts (4,170, 2.2% CAGR), statisticians (3,090, 4.8%), and actuaries (1,370, 2.4% CAGR). Mathematicians grew somewhat (210, 2.5% CAGR), while mathematical science occupations, all other declined (-5,340, -42.4% CAGR).

Among life scientists, the occupation biological scientists, all other, had the largest employment growth (3,260, 3.7% CAGR), while conservation scientists had the fastest growth rate (3,080, 6.1% CAGR). Employment declined in four life science occupations: medical scientists (-4,530, -1.5% CAGR); life scientists, all other (-2,010, -5.9% CAGR); foresters (-1,160, -4.0% CAGR); and animal scientists (-570, -7.4% CAGR).

The physical sciences occupations with the largest growth were environmental scientists and specialists (2,970, 1.2% CAGR); physical scientists, all other (2,890, 4.0% CAGR); physicists (1,410, 3.1% CAGR); and geoscientists (1,230, 1.3%). Employment in three physical sciences occupations declined: chemists (-3,040, -1.2% CAGR), material scientists (-1,750, 6.5% CAGR), and hydrologists (-630, -2.8% CAGR).

Employment grew in each of the S&E managers occupations. The largest growth was in computer and information systems managers (24,010, 2.8%). Natural science managers had the fastest growth rate (4,450, 3.3%). Architectural and engineering managers grew by 2,230, with a growth rate of 0.4%.

Table 4. Employment in Detailed S&E Occupations, 2008-2011

Occupational Group	Employment, 2008	Employment, 2011	Employment Change, Number	Employment Change, Compound Annual Growth Rate
Science and Engineering Managers				
Computer and Information Systems Managers	276,820	300,830	24,010	2.80%
Architectural and Engineering Managers	182,300	184,530	2,230	0.40%
Natural Sciences Managers	43,060	47,510	4,450	3.30%
Computer Occupations				
Computer and Information Research Scientists	26,610	25,160	-1,450	-1.90%
Computer Systems Analysts	489,890	487,740	-2,150	-0.10%
Computer Programmers	394,230	320,100	-74,130	-6.70%
Software Developers, Applications	494,160	539,880	45,720	3.00%
Software Developers, Systems Software	381,830	387,050	5,220	0.50%
Database Administrators	115,770	108,500	-7,270	-2.10%
Network and Computer Systems Administrators	327,850	341,800	13,950	1.40%
Computer Support Specialists	545,520	632,490	86,970	5.10%
Information Security Analysts, Web Developers, and Computer Network Architects	230,410	272,670	42,260	5.80%
Computer Occupations, All Other	191,780	177,630	-14,150	-2.50%
Mathematical Occupations				
Actuaries	18,220	19,590	1,370	2.40%
Mathematicians	2,770	2,980	210	2.50%
Operations Research Analysts	60,860	65,030	4,170	2.20%
Statisticians	20,680	23,770	3,090	4.80%
Mathematical Science Occupations, All Other	6,600	1,260	-5,340	-42.40%
Engineers				
Aerospace Engineers	67,800	79,400	11,600	5.40%
Agricultural Engineers	2,640	2,650	10	0.10%
Biomedical Engineers	15,220	16,590	1,370	2.90%
Chemical Engineers	30,970	27,860	-3,110	-3.50%
Civil Engineers	261,360	254,130	-7,230	-0.90%
Computer Hardware Engineers	73,370	71,990	-1,380	-0.60%
Electrical Engineers	154,670	154,250	-420	-0.10%
Electronics Engineers, except Computer	139,930	136,310	-3,620	-0.90%
Environmental Engineers	52,590	50,350	-2,240	-1.40%
Health and Safety Engineers, except Mining Safety Engineers and Inspectors	25,190	23,170	-2,020	-2.70%

Industrial Engineers	214,580	211,490	-3,090	-0.50%
Marine Engineers and Naval Architects	6,480	5,470	-1,010	-5.50%
Materials Engineers	24,160	22,160	-2,000	-2.80%
Mechanical Engineers	233,610	238,260	4,650	0.70%
Mining and Geological Engineers, incl. Mining Safety Engineers	6,900	6,630	-270	-1.30%
Nuclear Engineers	16,640	18,430	1,790	3.50%
Petroleum Engineers	20,880	30,880	10,000	13.90%
Engineers, All Other	169,240	125,590	-43,650	-9.50%
Life Scientists				
Animal Scientists	2,760	2,190	-570	-7.40%
Food Scientists and Technologists	10,510	12,040	1,530	4.60%
Soil and Plant Scientists	10,790	11,860	1,070	3.20%
Biochemists and Biophysicists	22,230	25,160	2,930	4.20%
Microbiologists	15,750	17,660	1,910	3.90%
Zoologists and Wildlife Biologists	17,780	18,380	600	1.10%
Biological Scientists, All Other	28,290	31,550	3,260	3.70%
Conservation Scientists	15,830	18,910	3,080	6.10%
Foresters	10,160	9,000	-1,160	-4.00%
Epidemiologists	4,370	4,610	240	1.80%
Medical Scientists, except Epidemiologists	99,750	95,220	-4,530	-1.50%
Life Scientists, All Other	12,030	10,020	-2,010	-5.90%
Physical Scientists				
Astronomers	1,280	2,080	800	17.60%
Physicists	14,810	16,220	1,410	3.10%
Atmospheric and Space Scientists	8,860	9,640	780	2.90%
Chemists	83,080	80,040	-3,040	-1.20%
Materials Scientists	9,650	7,900	-1,750	-6.50%
Environmental Scientists and Specialists, including Health	80,120	83,090	2,970	1.20%
Geoscientists, except Hydrologists and Geographers	31,260	32,490	1,230	1.30%
Hydrologists	7,590	6,960	-630	-2.80%
Physical Scientists, All Other	22,900	25,790	2,890	4.00%

Source: CRS analysis of Occupational Employment Survey data, 2008-2011, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes/tables.htm.

Table 5 shows the 10 S&E occupations with the largest employment growth. The top five occupations are computer occupations, followed by aerospace engineers and petroleum engineers.

Table 5. S&E Occupations with the Largest Employment Growth, 2008-2011

Rank	S&E Occupation	Employment Growth
1	Computer Support Specialists	86,970
2	Software Developers, Applications	45,720
3	Information Security Analysts, Web Developers, and Computer Network Architects	42,260
4	Computer and Information Systems Managers	24,010
5	Network and Computer Systems Administrators	13,950
6	Aerospace Engineers	11,600
7	Petroleum Engineers	10,000
8	Software Developers, Systems Software	5,220
9	Mechanical Engineers	4,650
10	Natural Sciences Managers	4,450

Source: CRS analysis of Occupational Employment Survey data, 2008-2011, BLS, U.S. Department of Labor.

Table 6 shows the 10 S&E occupations with the largest employment losses. The occupation with the greatest employment loss is computer programmers. Some have speculated that some of the losses in computer programmers may be due to reclassification of these positions as other computer occupations (e.g., software developers).

Table 6. S&E Occupations with the Largest Employment Losses, 2008-2011

Rank	S&E Occupation	Employment Growth
1	Computer Programmers	-74,130
2	Engineers, All Other	-43,650
3	Computer Occupations, All Other	-14,150
4	Database Administrators	-7,270
5	Civil Engineers	-7,230
6	Mathematical Science Occupations, All Other	-5,340
7	Medical Scientists, except Epidemiologists	-4,530
8	Electronics Engineers, except Computer	-3,620
9	Chemical Engineers	-3,110
10	Industrial Engineers	-3,090

Source: CRS analysis of Occupational Employment Survey data, 2008-2011, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes/tables.htm.

Table 7 shows the 10 S&E occupations with the fastest growth rates. The occupation with the fastest growth rate was astronomers, though the growth in the number of jobs (800) was small compared to some S&E occupations. In contrast, petroleum engineers, the second fastest growing S&E occupation, was also the seventh ranked occupation in terms of job growth (10,000).

Table 7. S&E Occupations with the Fastest Growth Rates, 2008-2011

Rank	S&E Occupation	Employment Growth rate
1	Astronomers	17.60%
2	Petroleum Engineers	13.90%
3	Conservation Scientists	6.10%
4	Information Security Analysts, Web Developers, and Computer Network Architects	5.80%
5	Aerospace Engineers	5.40%
6	Computer Support Specialists	5.10%
7	Statisticians	4.80%
8	Food Scientists and Technologists	4.60%
9	Biochemists and Biophysicists	4.20%
10	Physical Scientists, All Other	4.00%

Source: CRS analysis of Occupational Employment Survey data, 2008-2011, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes/tables.htm.

Table 8 shows the 10 S&E occupations with the slowest growth rates. This group includes at least one occupation from each of the engineering, physical sciences, life sciences, mathematics, and computer occupational groups.

Table 8. S&E Occupations with the Slowest Growth Rates, 2008-2011

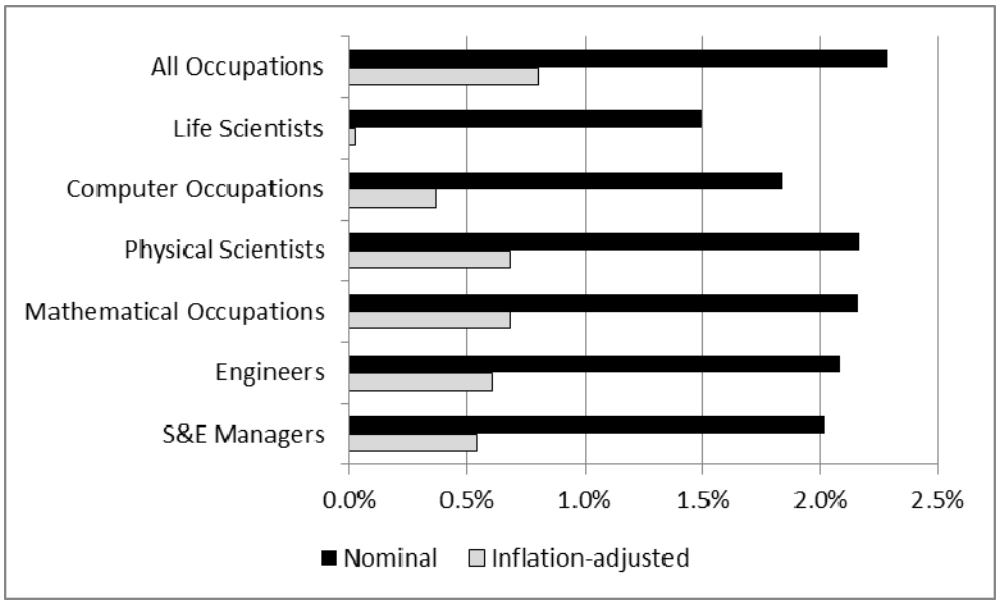
Rank	S&E Occupation	Employment Growth Rate
1	Mathematical Science Occupations, All Other	-42.40%
2	Engineers, All Other	-9.50%
3	Animal Scientists	-7.40%
4	Computer Programmers	-6.70%
5	Materials Scientists	-6.50%
6	Life Scientists, All Other	-5.90%
7	Marine Engineers and Naval Architects	-5.50%
8	Foresters	-4.00%
9	Chemical Engineers	-3.50%
10	Materials Engineers	-2.80%

Source: CRS analysis of Occupational Employment Survey data, 2008-2011, Bureau of Labor Statistics, U.S. Department of Labor, http://www.bls.gov/oes/tables.htm.

Wage Trends

Between 2008 and 2011, mean wages for each S&E occupational group grew at slower compound annual growth rates than the overall mean wage growth rate for all occupations, and only somewhat faster than inflation. **Figure 4** illustrates the nominal and inflation-adjusted compound annual growth rates for each S&E occupational group, as well as for all occupations. The nominal growth rate of mean wages for all occupations during this period was 2.3%, while the fastest growth rate in the S&E occupational groups was for physical scientists (2.2%) and mathematical occupations (2.2%), followed by engineers (2.1%), S&E managers (2.0%), computer occupations (1.8%), and life scientists (1.5%). Life scientists experienced nearly no real (inflation-adjusted) growth in mean wages between 2008 and 2011, while the other S&E occupational categories grew by less than 1% in inflation-adjusted terms, below the overall growth rate for all occupations.

Figure 4. Nominal and Inflation-adjusted Compound Annual Growth Rates of Mean Wages in S&E Occupational Groups, 2008-2011

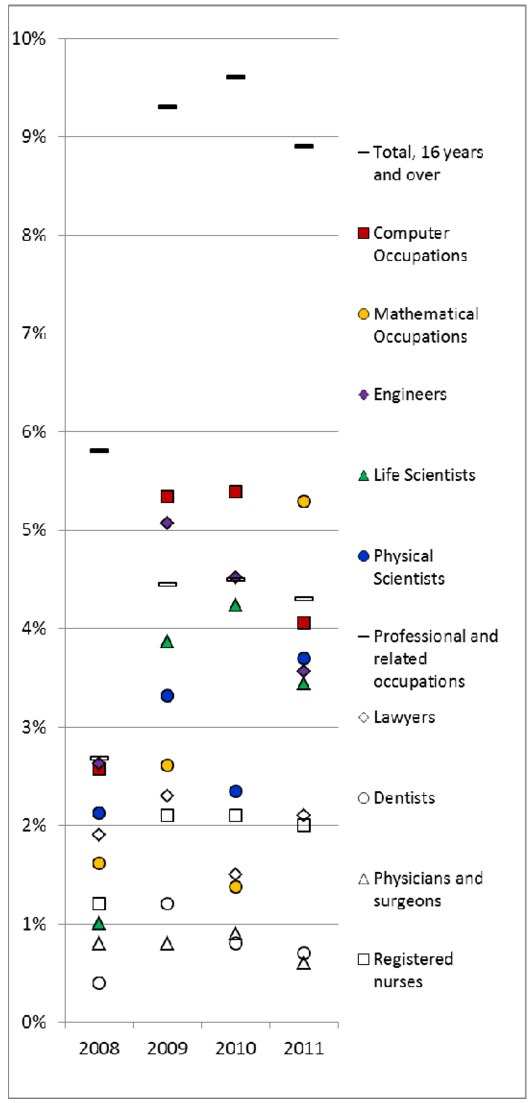


Source: CRS analysis of Occupational Employment Survey data, 2008-2011, http://www.bls.gov/oes/tables.htm, using Bureau of Labor Statistics Consumer Price Index Inflation Calculator, http://data.bls.gov/cgi-bin/cpicalc.pl.

Unemployment Trends

Figure 5 illustrates unemployment rates for the S&E occupational groups, as well as all for all workers (16 years and over) and selected professional and related occupations (e.g., lawyers, dentists, physicians and surgeons, registered nurses) for the years 2008-2011. This figure provides a perspective on how the unemployment rates of S&E occupational groups compare to the overall unemployment rate and other selected professional and related occupations, as well as how these rates changed during this period.

Figure 5. Unemployment Rates for S&E Occupational Groups, the Overall Workforce, and Other Selected Professional and Related Occupations, 2008-2011



Source: CRS analysis of unpublished 2011data from the Current Population Survey, BLS.

Compared to the overall workforce, S&E occupational groups had significantly lower unemployment rates for the 2008-2011 period. In general, though, the professional occupations (of which the S&E occupations are a part) historically have had a lower unemployment rate than the workforce as a whole.[22] As shown in **Figure 5**, the S&E occupational groups generally had unemployment rates that were comparable or higher than the rates for selected professional occupations during the 2008-2011 period. Also, the unemployment rates for the S&E occupational groups grew more than did the unemployment rates for the other selected professional occupations included in **Figure 5** (e.g., lawyers, dentists, physicians and surgeons, registered nurses). Consequently, the separation between the unemployment rates of the S&E occupational groups and the other selected professional occupations grew during this period. In 2008, the unemployment rates for each S&E occupational group and each selected professional occupation were below 3%. In 2011, the unemployment rates for each of the selected professional occupations remained below 3% while the unemployment rates for each of the S&E occupational groups were above 3%.

[22] For example, between 2000 and 2011, the unemployment rate for the overall workforce (age 16 years and over) was generally twice as high as that of professional and related occupations. In 2000, the unemployment rate for the overall workforce was 4.0%, while the unemployment rate for professional and related occupations was 1.9%; in 2011, the rates were 8.9% and 4.3%, respectively.

Employment Projections, 2010-2020

This section provides an analysis of the Bureau of Labor Statistics occupational employment projections data for the 2010-2020 period.

Scientists and Engineers in Aggregate

An analysis of Bureau of Labor Statistics employment projections indicates that the science and engineering workforce will grow by 1.1 million (18.0%) jobs between 2010 and 2020, a CAGR of 1.7%. This growth rate is somewhat higher than the growth rate projected for all occupations (1.3%) during this period.[23]

In addition to the job openings created by growth in the number of jobs in S&E occupations, BLS projects that an additional 1.3 million scientists and engineers will be needed to replace those who are expected to exit the S&E occupations during this period due to retirement, death, career change, etc. (i.e., net replacements). BLS projects a total of 2.4 million job openings in S&E occupations due to growth and net replacements during this period.

Science and Engineering Occupational Groups

Projection data for science and engineering occupational groups is provided in **Table 9**, which includes the following data for each group: 2010 actual employment, 2020 projected employment, the change in the number of jobs between 2010 and 2020, the total percentage increase in the number of jobs, the compound annual growth rate in the number of jobs, and the total job openings due to growth and net replacements.

Among the S&E occupational groups, computer occupations are projected to see the fastest employment growth (2.0% CAGR), the largest increase in the number employed (758,900), and the largest number of job openings (1,336,400). Computer occupations, which accounted for 57.5% of all S&E jobs in 2010, are projected to account for 68.5% of the total growth in S&E occupations between 2010 and 2020. (See **Figure 6**.) As a result, the share of all S&E jobs accounted for by computer occupations is projected to rise from 55.6% in 2010 to 57.5% in 2020.

Life scientists is the only other S&E occupational group projected to account for a greater share (5.3%) of total S&E job growth than its share of total 2010 S&E employment (4.6%). As a result, life scientists' share of S&E employment is projected to increase slightly to 4.7% in 2020. The mathematical occupations group is projected to account for 1.8% of S&E job growth during this period, approximately the same as its 1.9% share of S&E occupational employment in 2010.

The occupational groups that are projected to have growth slower than their share of total 2010 S&E employment are:

- **engineers**—projected to account for 14.5% of total S&E job growth during the 2010-2020 period, below its 24.6% share of S&E employment in 2010, thus reducing its projected share of 2020 S&E employment to 23.1%;

[23] CRS analysis of BLS 2010-2020 employment projections, http://www.bls.gov/emp.

- **physical scientists**—projected to account for 3.2% of total S&E job growth during the 2010-2020 period, below its 4.6% share of S&E employment in 2010, thus reducing its projected share of 2020 S&E employment to 4.4%; and
- **S&E managers**—projected to account for 6.8% of total S&E job growth during the 2010-2020 period, below its 8.7% share of S&E employment in 2010, thus reducing its projected share of 2020 S&E employment to 8.4%.

Table 9. 2010-2020 Employment Projections for S&E Occupational Groups

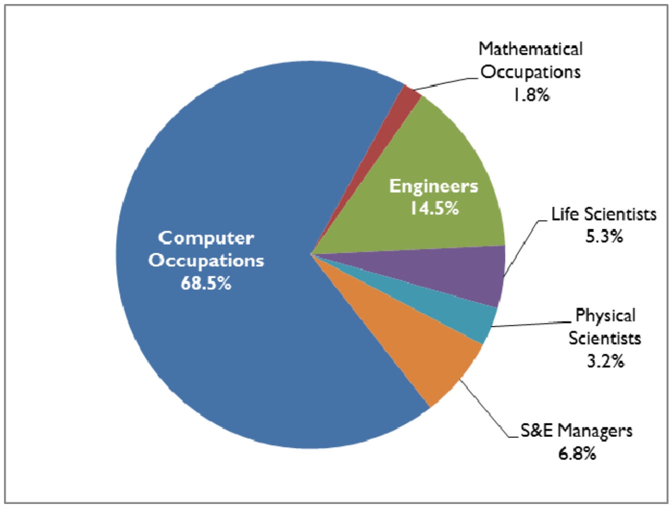
Numbers in thousands, except percent and CAGR

	Employment		Change, 2010-2020			Job Openings Due to Growth and Net Replacements
Occupations	**2010**	**2020**	**Number**	**%**	**CAGR**	
Computer Occupations	3,425.9	4,184.6	758.9	22.1	2.0	1,366.4
Mathematical Occupations	116.9	136.4	19.5	16.7	1.6	71.6
Engineers	1,519.0	1,679.6	160.3	10.6	1.0	525.9
Life Scientists	286.0	344.3	58.2	20.4	1.9	106.1
Physical Scientists	282.0	317.6	35.7	12.6	1.2	121.8
S&E Managers	534.0	608.8	74.8	14.0	1.3	186.0
S&E Occupations, Total	**6,163.8**	**7,271.3**	**1,107.4**	**18.0**	**1.7**	**2,377.8**
Other Selected Occupations						
Lawyers	728.2	801.8	73.6	10.1	1.0	212
Dentists	155.7	187.9	32.2	20.7	1.9	78.4
Physicians and Surgeons	691.0	859.3	168.3	24.4	2.2	305.1
Registered Nurses	2,737.4	3,449.3	711.9	26.0	2.3	1,207.4
Post-Secondary Teachers	1,756.0	2061.7	305.7	17.4	1.6	586.1
Total, All Occupations	**143,068.2**	**163,537.1**	**20,468.9**	**14.3**	**1.3**	**54,787.4**

Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

Notes: Numbers for S&E occupational groups may not add due to rounding of component occupations.

Figure 6. Share of Total Projected S&E Occupational Job Growth, 2010-2020, by S&E Occupational Group

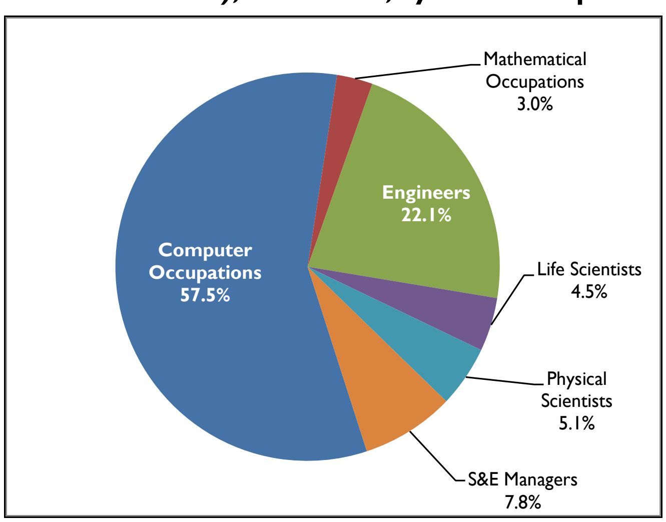


Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

Notes: Numbers are rounded and may not add to 100%.

For some S&E occupational groups, the number of openings resulting from growth in the number employed is comparable to the number of openings resulting from those exiting the occupations (net replacements). For example, BLS projects an increase of 758,900 jobs in the computer occupations between 2010 and 2020. During the same period, BLS projects that there will be 607,500 job openings in computer occupations due to net replacement needs. For other S&E occupational groups, net replacement needs greatly exceed the number of projected new jobs in the occupation. For example, BLS projects 365,600 job openings due to net replacement needs in the engineering occupations between 2010 and 2020, and job growth of 160,300. **Figure 7** illustrates the composition of total projected S&E job openings (due to growth and net replacements) by S&E occupational group.

Figure 7. Share of Total Projected S&E Occupational Job Openings (Job Growth plus Net Replacement Needs), 2010-2020, by S&E Occupational Group



Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

Detailed Science and Engineering Occupations

The Bureau of Labor Statistics' projected job growth and projected total job openings (job growth plus net replacements) for the S&E occupations vary substantially during the 2010-2020 projection period. Tables 12-17 show the top ten S&E occupations in terms of job growth, job losses, and job openings.

Table 10 shows the ten S&E occupations with the highest projected growth in jobs. Seven of the 10 S&E occupations on this list are in the computer occupations. One of the remaining three occupations is computer and information systems managers. The only non-IT occupations in the top ten are civil engineers and medical scientists.

Table 10. S&E Occupations with the Highest Projected Growth in Jobs and Other Selected Occupations, 2010-2020

Rank	S&E Occupation	Projected Average Annual Job Growth[a]
1	Software Developers, Applications	14,380
2	Software Developers, Systems Software	12,720
3	Computer Systems Analysts	12,040
4	Computer Support Specialists	11,000
5	Network and Computer Systems Administrators	9,660
6	Information Security Analysts, Web Developers, and Computer Network Architects	6,570
7	Computer and Information Systems Managers	5,580
8	Civil Engineers	5,110
9	Computer Programmers	4,370
10	Medical Scientists, except Epidemiologists	3,640
Other Selected Occupations with High Projected Growth		
	Registered Nurses	71,190
	Retail Salespersons	70,680
	Home Health Aides	70,630
	Personal Care Aides	60,700
	Office Clerks, General	48,950

Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

a. The numbers in this column are derived by dividing the net job creation during the 2010-2020 projection period for each occupation by 10 to get the average annual number of net new jobs created.

Table 11 shows the ten S&E occupations with the smallest projected growth in jobs. The list includes occupations from physical and life sciences, mathematics, and engineering occupations. The number of new jobs projected to be created in these ten occupations total an average of less than 600 per year.

Table 11. S&E Occupations with the Smallest Projected Growth in Jobs, 2010-2020

Rank	S&E Occupation	Projected Average Annual Job Growth[a]
1	Agricultural Engineers	20
2	Astronomers	20
3	Mathematical Science Occupations, All Other	30
4	Animal Scientists	40
5	Mathematicians	50
6	Foresters	50
7	Mining and Geological Engineers, incl. Mining Safety Engineers	60
8	Materials Scientists	90
9	Marine Engineers and Naval Architects	100
10	Atmospheric and Space Scientists	100

Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

a. The numbers in this column are derived by dividing the net job creation during the 2010-2020 projection period for each occupation by 10 to get the average annual number of net new jobs created.

Table 12 shows the 10 S&E occupations with the fastest projected job growth. Biomedical engineers (4.9% CAGR) and medical scientists (3.2% CAGR) are the fastest growing S&E occupations. The remaining occupations on the list range from 2.0%-2.8% CAGR, faster than the overall projected job growth rate for all occupations (1.3% CAGR). The list includes five computer occupations.

Table 12. S&E Occupations with the Fastest Projected Job Growth, 2010-2020

Rank	S&E Occupation	Projected Job Growth Rate (CAGR)	Projected Average Annual Job Growth[a]
1	Biomedical Engineers	4.9%	970
2	Medical Scientists, except Epidemiologists	3.2%	3,640
3	Software Developers, Systems Software	2.8%	12,720
4	Biochemists and Biophysicists	2.7%	770
5	Database Administrators	2.7%	3,390
6	Network and Computer Systems Administrators	2.5%	9,660
7	Software Developers, Applications	2.5%	14,380
8	Actuaries	2.4%	580
9	Epidemiologists	2.0%	120
10	Computer Systems Analysts	2.0%	12,040

Rank	S&E Occupation	Projected Job Growth Rate (CAGR)	Projected Average Annual Job Growth[a]
Other Occupations with the Fastest Projected Growth			
	Personal Care Aides	5.5%	60,700
	Home Health Aides	5.4%	70,630
	Helpers, Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters	4.9%	1,760
	Helpers, Carpenters	4.5%	2,590
	Veterinary technologists and technicians	4.3%	4,170
All Occupations		1.3%	2,046,890

Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

a. The numbers in this column are derived by dividing the net job creation during the 2010-2020 projection period for each occupation by 10 to get the average annual number of net new jobs created.

Table 13 shows the 10 S&E occupations with the slowest projected job growth, ranging between 0.4%-0.6% CAGR, well below the overall projected job growth rate of 1.3% CAGR. The list includes five engineering occupations.

Table 13. S&E Occupations with the Slowest Projected Job Growth, 2010-2020

Rank	S&E Occupation	Projected Job Growth Rate (CAGR)	Projected Average Annual Job Growth[a]
1	Chemists	0.4%	320
2	Foresters	0.4%	50
3	Aerospace Engineers	0.5%	400
4	Electronics Engineers, except Computer	0.5%	680
5	Conservation Scientists	0.5%	120
6	Computer Occupations, All Other	0.6%	1,230
7	Chemical Engineers	0.6%	180
8	Biological Scientists, All Other	0.6%	220
9	Industrial Engineers	0.6%	1,310
10	Engineers, All Other	0.6%	1,030

Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

a. The numbers in this column are derived by dividing the net job creation during the 2010-2020 projection period for each occupation by 10 to get the average annual number of net new jobs created.

Table 14 shows the 10 S&E occupations with the most projected job openings (jobs growth plus net replacements). This category shows where the most job opportunities are projected to be. The top seven occupations are computer occupations, with computer and information systems managers in the ninth spot. The other two occupations on the list are engineering occupations, civil engineering and mechanical engineering.

Table 14. S&E Occupations with the Most Projected Job Openings, 2010-2020

Rank	S&E Occupation	Projected Average Annual Job Growth[a]
1	Computer Support Specialists	26,950
2	Computer Systems Analysts	22,250
3	Software Developers, Applications	19,790
4	Software Developers, Systems Software	16,800
5	Network and Computer Systems Administrators	15,530
6	Computer Programmers	12,800
7	Information Security Analysts, Web Developers, and	11,030
8	Civil Engineers	10,440
9	Computer and Information Systems Managers	10,280
10	Mechanical Engineers	9,960

Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

a. The numbers in this column are derived by dividing the net job creation during the 2010-2020 projection period for each occupation by 10 to get the average annual number of net new jobs created.

Table 15 shows the 10 S&E occupations with the fewest projected job openings. This list includes occupations from the life sciences, engineering, physical sciences, and mathematics occupations.

Table 15. S&E Occupations with the Fewest Projected Job Openings, 2010-2020

Rank	S&E Occupation	Projected Average Annual Job Growth[a]
1	Agricultural Engineers	80
2	Astronomers	90
3	Epidemiologists	150
4	Miscellaneous Mathematical Science Occupations	170
5	Animal Scientists	180
6	Foresters	190
7	Mining and Geological Engineers, incl. Mining Safety Engineers	200
8	Life Scientists, All Other	210
9	Atmospheric and Space Scientists	210
10	Marine Engineers and Naval Architects	230

Source: CRS analysis of Employment Projections, 2010-2020, Bureau of Labor Statistics, U.S. Department of Labor.

Concluding Observations

The adequacy of the U.S. science and engineering workforce has been an ongoing concern of Congress for more than 60 years. Scientists and engineers are widely believed to be essential to U.S. technological leadership, innovation, manufacturing, and services, and thus vital to U.S. economic strength, national defense, and other societal needs. Congress has enacted many programs to support the education and development of scientists and engineers. Congress has also undertaken broad efforts improve science, technology, engineering, and math (STEM) skills to prepare a greater number of students to pursue science and engineering (S&E) degrees. Some policymakers have sought to increase the number of foreign scientists and engineers working in the United States through changes in visa and immigration policies.

Scientists and engineers are widely believed to be essential to U.S. technological leadership, innovation, manufacturing, and services, and thus vital to U.S. economic strength, national defense, and other societal needs (e.g., treating and preventing diseases, ensuring access to affordable energy, protecting and restoring the environment). However, there are varying perspectives with respect to the question of the existence of a shortage of scientists and engineers in the United States, what the nature of such a shortage might be (e.g., too few people with S&E degrees, a mismatch of worker skills and employer needs), and whether the federal government should undertake policy interventions to address a putative shortage or allow market forces to work in this labor market.

Many policymakers, business leaders, academicians, S&E professional society analysts, economists, and others hold diverse views with respect to the adequacy of the S&E workforce and related policy issues. Here are some general characterizations of those views:

- **There is a shortage.** There is a shortage (or a looming shortage) of scientists and engineers (or, alternatively, an inadequate supply of workers with degrees in science and engineering fields), potentially resulting in the loss of U.S. scientific, engineering, technological, and industrial leadership and consequent effects on areas such as economic growth, job creation, standard of living, and national security.[24]
- **There is not a shortage.** Assertions of a broad shortage of scientists and engineers are not supported by the data when considering indicators such as employment growth, wage growth, and unemployment rates.[25]

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[24] See, for example, National Research Council, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, 2007, http://www.nap.edu/catalog.php?record_id=11463; U.S. Department of Energy, *Secretary Chu, Intel President Discuss Need for More U.S. Engineers*, September 1, 2011, http://energy.gov/articles/secretary-chu-intel-president-discuss-need-more-us-engineers; Shirley Ann Jackson, President, Rensselaer Polytechnic Institute, *The Quite Crisis: Falling Short in Producing American Scientific and Technical Talent,* Building Engineering and Science Talent (BEST), 2002; and Vinton G. Cerf, "How to Fire Up U.S. Innovation," *Wall Street Journal*, April 12, 2011, http://online.wsj.com/article/SB10001424052748704461304576216911954533514.html; and Rodney C. Atkins, Senior Vice President, Systems and Technology Group, IBM, "America Desperately Needs More STEM Students. Here's How to Get Them," *Forbes*, July 9, 2012, http://www.forbes.com/sites/forbesleadershipforum/2012/07/09/america-desperately-needs-more-stem-students-heres-how-to-get-them.

[25] See, for example, testimony of Ralph Gomory, President, Alfred P. Sloan Foundation, before the U.S. Congress, House Committee on Science and Technology, *The Globalization of R&D and Innovation, Part I*, 110th Cong., June 12, 2007 (Washington: GPO, 2008); testimony of Michael Teitelbaum, Vice President, Alfred P. Sloan Foundation and Harold Salzman, Senior Research Associate, The Urban Institute, before the U.S. Congress, House Committee on (continued...)

- **More scientists and engineers are needed regardless of the existence of a shortage.** Regardless of whether demand currently exceeds supply, increasing the number of U.S. scientists and engineers will increase U.S. innovation, economic performance, and job creation. Even if there is not a shortage of scientists and engineers, jobs in many occupations require a higher level of STEM knowledge than ever before.[26] Students who earn S&E degrees gain thinking skills, problem-solving skills, and STEM knowledge that will enable them to be successful not only in S&E occupations, but also in S&E-related careers or to apply their S&E knowledge and skills in non-S&E fields.[27] Historically, federal policies, programs, and investments have contributed to the development of the United States' scientific and engineering workforce.
- **Government interventions in the S&E labor market to address perceived shortages may introduce inefficiencies.** Federal government efforts to increase the number of scientists and engineers by incentivizing the pursuit of degrees in S&E disciplines and/or increasing immigration quotas may result in less efficient operation of the S&E labor market (e.g., too many students educated in S&E for the number of jobs available; lower salaries for graduates who find S&E jobs).[28]
- **Workforce projections are unreliable for predicting shortages.** Long-term projections for S&E occupations are unreliable.[29] Relying on such projections could possibly result in the preparation of too many or too few students with S&E degrees or in mismatches between the students' education and market needs. Among the difficulties in making long term projections are unexpected changes in: the mix of industrial output or employment due to technological or market changes; the use of substitution (e.g., capital for labor) resulting from changes in factor prices; retirement behavior; the availability of foreign labor sources; labor market demographics; and government policies.[30]

(...continued)

Science and Technology, *The Globalization of R&D and Innovation, Part IV*, 110th Cong., November 6, 2007 (Washington: GPO, 2008); Robert J. Samuelson, "Sputnik Scare, Updated" *Washington Post*, August 26, 2005, p. A27, http://www.washingtonpost.com/wp-dyn/content/article/2005/05/25/AR2005052501812.html; and Michael Teitelbaum, "The U.S. Science and Engineering Workforce: An Unconventional Portrait," *Pan-Organizational Summit on the U.S. Science and Engineering Workforce*, Government-Industry-University Research Roundtable, National Research Council, 2003, pp. 1-7, http://www.nap.edu/catalog.php?record_id=10727.

[26] See, for example, U.S. Congress Joint Economic Committee, Chairman's Staff, *STEM Education: Preparing for the Jobs of the Future*, April 2012, http://www.jec.senate.gov/public/index.cfm?a=Files.Serve&File_id=6aaa7e1f-9586-47be-82e7-326f47658320.

[27] See, for example, Vern Ehlers, before the U.S. Congress, House Committee on Science and Technology, *The Globalization of R&D and Innovation, Part IV*, 110th Cong., November 6, 2007 (Washington: GPO, 2008).

[28] See, for example, Leonard Lynn, Case Western Reserve University, and Hal Salzman, Rutgers University, "Dynamics of Engineering Labor Markets: Petroleum Engineering and Responsive Supply," presentation at "U.S. Engineering in the Global Economy," sponsored by the Alfred P. Sloan Foundation, Cambridge, MA, September 26, 2011, http://policy.rutgers.edu/faculty/salzman/dynamics.pdf.

[29] See, for example, Office of Technology Assessment, *Demographic Trends and the Scientific and Engineering Workforce*, OTA-TM-SET-35, December 1985, http://www.princeton.edu/~ota/disk2/1985/8507/8507.PDF.

[30] See, for example, Richard B. Freeman, *Is a Great Labor Shortage Coming? Replacement Demand in the Global Economy*, National Bureau of Economic Research, Working Paper 12541, Cambridge, MA, September 2006, http://www.nber.org/papers/w12541.

- **There may be shortages in certain industries, occupations, or fields.** Shortages may exist in some S&E occupations or for certain employers, for example in new and emerging S&E fields (e.g., nanotechnology), cyclical industries (e.g., aerospace); in fields where foreign scientists and engineers may not be employed due to export control laws; and for employers otherwise limited, in general or for specific purposes, to using only U.S. citizens.
    - **The labor market will resolve such needs.** If markets are allowed to operate freely (i.e., without government interventions), any short-term "shortages" will be resolved as wages equilibrate demand and supply, labor supply increases (i.e., as more students earn S&E degrees) in response to market signals, or through substitution of alternative inputs.[31]
    - **The potential adverse consequences of even discrete shortages require government interventions.** These shortages should be met with federal efforts to increase supply or the United States may face the loss of technological leadership in new and emerging fields, lower economic performance, and diminished national security.[32]
- **Industry assertions of shortages are driven by a desire to reduce costs, increase current knowledge.** Industry assertions of S&E shortages are driven primarily by a desire to lower their labor costs through increased supply and by providing a continuous stream of young, lower-cost recent college graduates (i.e., through education and training and by increases in immigrant visas) who can be hired to replace older, higher-cost workers with less current knowledge.[33]
- **The real issue is a skills mismatch, not a shortage of people.** The difficulty employers have in meeting their S&E workforce needs (in particular their information technology workforce needs) results primarily from a mismatch between the specific skills—or combinations of knowledge, skills, and experience—needed by employers and those held by S&E workers.[34]
- **Expanding immigration can help address the shortage.** Immigration policies directed at increasing the number of foreign scientists and engineers in the United States puts the creativity of the world's best and brightest to work for the U.S. economy and prevents the loss of U.S.-educated foreign nationals with S&E degrees (i.e., returning to their countries of origin, working in countries other than the United States).[35]

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[31] See, for example, Richard B. Freeman, *Does Globalization of the Scientific/Engineering Workforce Threaten U.S. Economic Leadership?*, National Bureau of Economic Research, Working Paper 11457, Cambridge, MA, June 2005, http://www.nber.org/papers/w11457.pdf.

[32] See, for example, National Research Council, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, 2007.

[33] See, for example, various writings of Norm Matloff, Professor of Computer Science, University of California at Davis, http://heather.cs.ucdavis.edu/matloff.html.

[34] See, for example, Tom Kucharvy, *Solutions to STEM Skills Mismatch*, Beyond IT, February 25, 2012, http://beyond-it-inc.com/GKEblog/solutions-to-stem-skills-mismatch.html; and "Statistic of the Month: Investigating the Skills Mismatch," Center on International Education Benchmarking, July 31, 2012, http://www.ncee.org/2012/07/statistic-of-the-month-investigating-the-skills-mismatch.

[35] See, for example, Vivek Wadhwa, Anna Lee Saxenian, Richard Freeman, and Alex Salever, *Losing the World's Best and Brightest: America's New Immigrant Entrepreneurs*, Ewing Marion Kauffman Foundation, March 2009, (continued...)

- **Expanding immigration will dampen the market signals that would otherwise drive more U.S. students into science and engineering.** Visa and immigration policies directed at increasing the number of foreign scientists and engineers in the United States may, by increasing the overall supply of scientists and engineers, depress wages, increase unemployment, and reduce career opportunities for U.S. scientists and engineers; discourage American students from pursuing S&E degrees and careers; and cloud labor market signals (e.g., wage increases, lower unemployment) to students considering pursing S&E degrees and careers.[36]
- **U.S. students lag those of other nations in STEM knowledge; federal efforts to improve STEM education are needed.** U.S. students lag foreign students in STEM knowledge possibly resulting in fewer and/or less-talented U.S. scientists and engineers, lower economic growth, and reduced economic competitiveness.[37] Federal policies and programs can help to build a stronger K-12 STEM education system.
- **International assessments do not reflect the adequacy of U.S. student STEM knowledge.** Standardized tests used to compare the STEM knowledge of U.S. K-12 students to those of other nations does not appropriately reflect the STEM knowledge of U.S. students, the adequacy of their preparation to pursue S&E degrees and occupations, or their future capabilities as scientists and engineers.[38]

These disparate perspectives contribute to a variety of opinions on the role(s) the federal government should play in fostering the development of the S&E workforce including the merits of federal policies focused on:

- increasing the number of students pursuing S&E degrees;

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http://www.kauffman.org/uploadedFiles/ResearchAndPolicy/Losing_the_World%27s_Best_and_Brightest.pdf; The White House, "Fact Sheet: Fixing Our Broken Immigration System So Everyone Plays by the Rules," press release, January 29, 2013, http://www.whitehouse.gov/the-press-office/2013/01/29/fact-sheet-fixing-our-broken-immigration-system-so-everyone-plays-rules; and Robert D. Atkinson, *Eight Ideas for Improving the America COMPETES Act*, Information Technology and Innovation Foundation, March 2010, http://www.itif.org/files/2010-america-competes.pdf.

[36] See, for example, Ross Eisenbrey, Vice President, Economic Policy Institute, "Op-Ed: America's Genius Glut," *New York Times*, February 7, 2013; Remarks of Brian Keane, Founder and CEO, Ameritas Technologies, and Neeraj Gupta, Founder and CEO, Systems in Motion, at Senate briefing on "Understanding the Impact of the H-1B Program: On the Economy, Employers and Workers," March 14, 2013, http://www.epi.org/files/2013/Keane_H-1B_briefing_14_March_2013.pdf; and Stan Sorscher, Labor Representative, Society of Professional Engineering Employees in Aerospace, *Flooding the STEM Labor Market*, March 3, 2013, http://www.ifpte.org/downloads/issues/2013-3-3%20Flooding%20the%20STEM%20labor%20market.pdf.

[37] U.S. Department of Education, "Secretary Arne Duncan's Remarks at OECD's Release of the Program for International Student Assessment (PISA) 2009 Results," press release, December 7, 2010, http://www.ed.gov/news/speeches/secretary-arne-duncans-remarks-oecds-release-program-international-student-assessment; Paul E. Peterson, Ludger Woessmann, Eric A. Hanushek, and Carlos X. Lastra-Anadon, *Globally Challenged: Are U.S. Students Ready to Compete*, Harvard Kennedy School, Harvard University, PEPG Report No. 11-03, August 2011, http://www.hks.harvard.edu/pepg/PDF/Papers/PEPG11-03_GloballyChallenged.pdf; and Brandon Wright, "What do International Tests Really Show About U.S. Student Performance," Thomas B. Fordham Institute, January 24, 2013, http://www.edexcellence.net/commentary/education-gadfly-weekly/2013/january-24/what-do-international-tests-really-show-about-us-performance.html.

[38] Martin Carnoy and Richard Rothstein, *What Do International Tests Really Show About U.S. Student Performance*, Economic Policy Institute, January 15, 2013, http://www.epi.org/publication/us-student-performance-testing.

- increasing the number of foreign scientists and engineers admitted to the United States;
- increasing the number and share of underrepresented minorities and women in science and engineering;
- improving K-12 STEM education; and
- improving career information and counseling for high school students.

As Congress considers approaches to bolstering U.S. competitiveness and scientific, engineering, technological, and industrial leadership, it may wish to consider these perspectives and opinions.

Appendix. S&E Occupational Descriptions and Entry-Level Education Requirements

Occupation	Description	Entry-level Education
Computer Occupations		
Computer and Information Research Scientists	Computer and information research scientists invent and design new technology and find new uses for existing technology. They study and solve complex problems in computing for business, science, medicine, and other uses.	Doctoral or professional degree
Computer Programmers	Computer programmers write code to create software programs. They turn the program designs created by software developers and engineers into instructions that a computer can follow.	Bachelor's degree
Computer Support Specialists	Computer support specialists provide help and advice to people and organizations using computer software or equipment. Some, called technical support specialists, support information technology (IT) employees within their organization. Others, called help-desk technicians, assist non-IT users who are having computer problems.	Some college, no degree
Computer Systems Analysts	Computer systems analysts study an organization's current computer systems and procedures and make recommendations to management to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both.	Bachelor's degree
Database Administrators	Database administrators use software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.	Bachelor's degree
Information Security Analysts, Web Developers, and Computer Network Architects	Information security analysts, web developers, and computer network architects all use information technology (IT) to advance their organization's goals. Security analysts ensure a firm's information stays safe from cyberattacks. Web developers create websites to help firms have a public face. Computer network architects create the internal networks all workers within organizations use.	Bachelor's degree
Network and Computer Systems Administrators	Network and computer systems administrators are responsible for the day-to-day operation of an organization's computer networks. They organize, install, and support an organization's computer systems, including local area networks (LANs), wide area networks (WANs), network segments, intranets, and other data communication systems.	Bachelor's degree
Software Developers	Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or other device. Others develop the underlying systems that run the devices or control networks.	Bachelor's degree
Mathematical Occupations		
Actuaries	Actuaries analyze the financial costs of risk and uncertainty. They use mathematics, statistics, and financial theory to assess the risk that an event will occur and to help businesses and clients develop policies that minimize the cost of that risk.	Bachelor's degree
Mathematicians	Mathematicians use high-level mathematics and technology to develop new mathematical principles, understand relationships between existing principles, and solve real-world problems.	Master's degree
Operations Research Analysts	Operations research analysts use advanced methods of analysis to help organizations solve problems and make better decisions.	Bachelor's degree
Statisticians	Statisticians use mathematical techniques to analyze and interpret data and draw conclusions.	Master's degree

Occupation	Description	Entry-level Education
Engineers		
Aerospace Engineers	Aerospace engineers design aircraft, spacecraft, satellites, and missiles. In addition, they test prototypes to make sure that they function according to design.	Bachelor's degree
Agricultural Engineers	Agricultural engineers—also known as biological and agricultural engineers—work on a variety of activities. These activities range from aquaculture (raising food, such as fish, that thrive in water) to land farming to forestry; from developing biofuels to improving conservation; from planning animal environments to finding better ways to process food.	Bachelor's degree
Biomedical Engineers	Biomedical engineers analyze and design solutions to problems in biology and medicine, with the goal of improving the quality and effectiveness of patient care.	Bachelor's degree
Chemical Engineers	Chemical engineers apply the principles of chemistry, biology, and physics to solve problems. These problems involve the production or use of chemicals, fuel, drugs, food, and many other products. They design processes and equipment for large-scale safe and sustainable manufacturing, plan and test methods of manufacturing products and treating byproducts, and supervise production.	Bachelor's degree
Civil Engineers	Civil engineers design and supervise large construction projects, including roads, buildings, airports, tunnels, dams, bridges, and systems for water supply and sewage treatment.	Bachelor's degree
Computer Hardware Engineers	Computer hardware engineers research, design, develop, and test computer equipment such as chips, circuit boards, or routers. By solving complex problems in computer hardware, these engineers create rapid advances in computer technology.	Bachelor's degree
Electrical and Electronics Engineers	Electrical engineers design, develop, test, and supervise the manufacturing of electrical equipment such as electric motors, radar and navigation systems, communications systems, and power generation equipment. Electronics engineers design and develop electronic equipment, such as broadcast and communications systems—from portable music players to global positioning systems (GPS).	Bachelor's degree
Environmental Engineers	Environmental engineers use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. They are involved in efforts to improve recycling, waste disposal, public health, and control of water and air pollution.	Bachelor's degree
Health and Safety Engineers	Health and safety engineers develop procedures and design systems to keep people from getting sick or injured and to keep property from being damaged. They combine knowledge of health or safety and of systems engineering to make sure that chemicals, machinery, software, furniture, and other products are not going to cause harm to people or buildings.	Bachelor's degree
Industrial Engineers	Industrial engineers find ways to eliminate wastefulness in production processes. They devise efficient ways to use workers, machines, materials, information, and energy to make a product or provide a service.	Bachelor's degree
Marine Engineers and Naval Architects	Marine engineers and naval architects design, build, and maintain ships from aircraft carriers to submarines, from sailboats to tankers. Marine engineers work on the mechanical systems, such as propulsion and steering. Naval architects work on the basic design, including the form and stability of hulls.	Bachelor's degree
Materials Engineers	Materials engineers develop, process, and test materials used to create a range of products, from computer chips and aircraft wings to golf clubs and snow skis. They also help select materials and develop new ways to use materials.	Bachelor's degree
Mechanical Engineers	Mechanical engineering is one of the broadest engineering disciplines. Mechanical engineers design, develop, build, and test mechanical devices, including tools, engines, and machines.	Bachelor's degree

Occupation	Description	Entry-level Education
Mining and Geological Engineers	Mining and geological engineers design mines for the safe and efficient removal of minerals, such as coal and metals, for manufacturing and utilities.	Bachelor's degree
Nuclear Engineers	Nuclear engineers research and develop the processes, instruments, and systems used to get benefits from nuclear energy and radiation. Many of these engineers find industrial and medical uses for radioactive materials—for example, in equipment used in medical diagnosis and treatment.	Bachelor's degree
Petroleum Engineers	Petroleum engineers design and develop methods for extracting oil and gas from deposits below the earth's surface. Petroleum engineers also find new ways to extract oil and gas from older wells.	Bachelor's degree
Life Scientists		
Agricultural and Food Scientists	Agricultural and food scientists work to ensure agricultural productivity and food safety.	Agricultural and food scientists: at least a bachelor's degree. Food scientists and soil and plant scientists: typically a bachelor's degree. Most animal scientists earn a Ph.D.
Biochemists and Biophysicists	Biochemists and biophysicists study the chemical and physical principles of living things and of biological processes such as cell development, growth, and heredity.	Doctoral or professional degree
Microbiologists	Microbiologists study the growth, development, and other characteristics of microscopic organisms such as bacteria, algae, and fungi.	Bachelor's degree
Zoologists and Wildlife Biologists	Zoologists and wildlife biologists study the characteristics and habitats of animals and wildlife.	Bachelor's degree
Conservation Scientists and Foresters	Conservation scientists and foresters manage overall land quality of forests, parks, rangelands, and other natural resources.	Bachelor's degree
Epidemiologists	Epidemiologists investigate the causes of disease and other public health problems to prevent them from spreading or from happening again. They report their findings to public policy officials and to the general public.	Master's degree
Medical Scientists	Medical scientists conduct research aimed at improving overall human health. They often use clinical trials and other investigative methods to reach their findings.	Doctoral or professional degree
Physical Scientists		
Physicists and Astronomers	Physicists and astronomers study the fundamental nature of the universe, ranging from the vastness of space to the smallest of subatomic particles. They develop new technologies, methods, and theories based on the results of their research that deepen our understanding of how things work and contribute to innovative, real-world applications.	Doctoral or professional degree

Occupation	Description	Entry-level Education
Atmospheric Scientists, Including Meteorologists	Atmospheric scientists study weather, climate, and other aspects of the atmosphere. They develop reports and forecasts from their analysis of weather and climate data.	Bachelor's degree
Chemists and Materials Scientists	Chemists and materials scientists study the structures, compositions, reactions, and other properties of substances. They use their knowledge to develop new and improved products, processes, and materials.	Bachelor's degree
Environmental Scientists and Specialists	Environmental scientists and specialists use their knowledge of the natural sciences to protect the environment. They identify problems and find solutions that minimize hazards to the health of the environment and the population.	Bachelor's degree
Geoscientists	Geoscientists study the physical aspects of the Earth, such as its composition, structure, and processes, to learn about its past, present, and future.	Bachelor's degree
Hydrologists	Hydrologists study water and the water cycle. They use their expertise to solve problems in the areas of water quality or availability.	Master's degree
S&E Managers		
Architectural and Engineering Managers	Architectural and engineering managers plan, coordinate, and direct activities in architecture and engineering, including research and development in these fields.	Bachelor's degree
Computer and Information Systems Managers	Computer and information systems managers, often called information technology managers (IT managers or IT project managers), plan, coordinate, and direct computer-related activities in an organization. They help determine the information technology goals of an organization and are responsible for implementing the appropriate computer systems to meet those goals.	Bachelor's degree
Natural Sciences Managers	Natural sciences managers supervise the work of scientists, including chemists, physicists, and biologists. They direct research and development projects and coordinate activities such as testing, quality control, and production.	Bachelor's degree

Source: *Occupational Outlook Handbook*, Bureau of Labor Statistics, Department of Labor, http://www.bls.gov/ooh/management/home.htm.

Author Contact Information

John F. Sargent Jr.
Specialist in Science and Technology Policy
jsargent@crs.loc.gov, 7-9147