STEM Employment Forecasts and Distributions Among Employment Sectors

ABSTRACT

Bureau of Labor Statistics projections of employment in 2014 suggest that apart from IT-related occupations, most other scientific, technological, engineering and mathematical (STEM) professions are expected to grow moderately, at rates similar to those for the entire U.S. labor force. Only three specific STEM occupations are expected to actually decline in employment, and all of those projected declines are quite small. This report includes estimated 2004 and projected 2014 employment data for over 100 STEM occupations or broad sets of occupations. The same data also support a look at how STEM professionals are distributed across major employment sectors in the economy. Resources are identified that will yield further details about who works where in STEM jobs.

This is the seventh report in a series on recent trends in the scientific and technical professions. All of these materials, including detailed data archives, are available on the World Wide Web at http://www.cpst.org.

Every two years, the Bureau of Labor Statistics at the U.S. Department of Labor prepares detailed 10-year employment projections. Details for STEM occupations in the latest set of these projections, released in 2005, show that information technology is expected to continue to be the leading growth sector within the science and technology specialties. Nine of the ten IT-related occupations in these federal data — one of these, ***computer and information systems managers,*** is grouped with management and executive positions rather than with the professions — are listed as "high growth rate" fields in Exhibit 1 at the right. The tenth IT occupation, ***computer programming,*** has been a lower-growth profession for years, as the production of computer code has become both increasingly automated itself and also increasingly likely to be handed off to offshore sources of labor.

Fast rates of growth are not the only way for occupations to stand out in projections like these. Larger specialties may have relatively low rates of growth but still generate impressive numbers of new jobs. For example, ***forensic science technology*** appears on the list of high growth rate occupations in Exhibit 1, while the field of ***architectural and civil drafting*** is included in the set of low-growth fields, despite the fact that it is expected to gain a larger number of new jobs, because forensic science is a relatively small occupation while architectural and civil drafting is a relatively large one. On measures of the sheer numbers of new jobs projected for the STEM professions, however, the IT occupations are also dominant: they are both fast growing *and* large (see Exhibit 2 on the next page). The broad group of all IT professions ("computer specialists") leads the list of the STEM occupations expected to generate the largest absolute numbers of new jobs during the next few years, and if the set of computer and information systems managers is added to the count, then IT people account for more than five percent of *all* the job growth projected by BLS for the USA between 2004 and 2014.

Exhibit 1: STEM Occupations With High or Low Rates of Growth, 2004-2014

Occupation	Change
High projected growth rates (20 percent or better):	
Forensic science technicians	*+36%*
Medical scientists & epidemiologists (summary)	*+34*
Hydrologists	*+32*
Biomedical engineers	*+31*
Computer specialists (summary)	*+31*
Network systems & data communications analysts	*+55*
Computer software engineers	*+46*
Network & computer systems administrators	*+38*
Database administrators	*+38*
Computer systems analysts	*+31*
Computer & information scientists, research	*+26*
Computer support specialists	*+23*
Computer specialists, all other	*+19*
Environmental engineers	*+30*
Computer & information systems managers	*+26*
Environmental engineering technicians	*+24*
Actuaries	*+23*
Life scientists (summary)	*+21*
Market and survey researchers (summary)	*+20*
Other life, physical, & social science technicians	*+20*
Low projected growth rates (five percent or less):	
Sociologists	*+5*
Statisticians	*+5*
Architectural and civil drafters	*+5*
Chemical technicians	*+4*
Historians	*+4*
Mathematical technicians	*+3*
Computer programmers	*+2*
Electrical and electronics drafters	*+1*
Petroleum engineers	*-0*
Mathematicians	*-1*
Mining & geological engineers, incl. mining safety	*-2*

Notes: total employment across all occupations in the U.S. is projected to grow 13%. Data for "summary" groups (where further details are available for occupations within those groups) are used here, with the exception of the large group of computer-related professions, where the details may be of special interest to readers of this report. Source statistics for the complete set of STEM occupations are provided in Exhibit 3.

A number of STEM occupations are projected to fall short of the overall anticipated U.S. employment growth rate of 13 percent over the ten year projection period. In no case, however, are any STEM professions projected to actually lose large numbers of jobs. Slight declines of less than 100 positions are projected for ***mining and geological engineers, petroleum engineers,*** and ***mathematicians,*** but on the whole, BLS expects general economic demand to at least remain stable for all the STEM occupations, even when they are examined at the very detailed levels used here, with data on nearly 100 specific professions.

All projections of future conditions are necessarily speculative, and BLS cannot anticipate developments like the dot-com/telecommunications bubble of the late 1990's. The uncertainties of the future do not diminish a need on the part of students, educational institutions, industry, policy advisors, and many other kinds of audiences for informed thinking about trends like these. In particular, the BLS employment projections are used to inform the biennial editions of the *U.S. Occupational Outlook Handbook,* the nation's principal guide for career guidance and a publication readily available in virtually every public library in the nation (note that it contains excellent descriptions of the occupations discussed in this report). BLS does not take these responsibilities lightly. Its projections allow for economic conditions, labor supplies, and many other factors. A good series of articles explaining the projections in more detail is available on the web at http://www.bls.gov/emp/; look for the papers by Saunders, Su, Toossi, Berman, and Hecker.

The STEM Workforce Data Project has not attempted to cover health care practitioners or related health occupations, but those fields account for the largest portion of all U.S. job growth over the projection period. One of the set of five articles noted above provides a concise summary of overall projected trends:

> Employment within [the broad professional and related occupations group] is projected to grow the fastest of all major groups and to add more jobs (6.0 million) than any other major group... Of the eight occupational subgroups within professional and related occupations, three — health care practitioner and technical occupations; education, training, and library occupations; and computer and mathematical science occupations — are expected to account for nearly 75 percent of the new [professional] jobs... Health care practitioner and technical occupations are projected to add nearly 1.8 million jobs and grow twice as fast as the average for all occupations... Education, training, and library occupations are projected to grow faster than the average for all occupations, adding more than 1.7 million jobs... Computer and mathematical science occupations are projected to add 967,000 jobs and grow the fastest among the eight professional subgroups.
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> — Daniel E. Hecker, "Occupational employment projections to 2014," *Monthly Labor Review* (Washington, D.C.: U.S. Department of Labor, November, 2005, pp. 70-101).

This is the broader context for the findings on projections for STEM employment reported in this paper, which seem to be influencing the STEM workforce in other ways. For example, outside the IT specialties, relatively high rates of growth are also expected for health-related STEM occupations like ***medical scientists, biomedical engineers,*** and ***life scientists.***

Better levels of detail. The BLS projections use large surveys of employers carried out in collaboration with state employment agencies. Unlike older editions of these surveys, every round of data collection now covers all sectors of the economy. Data from Current Population Surveys are used to add in estimates for self-employed people and others who cannot be reached with employer surveys. The end result is a large database that supports results for many smaller occupational specialties that are not reported by other regular federal studies. Exhibit 3 on the next page reports estimated employment for 2004 and projected employment in 2014 for more than 100 STEM professions or groups of professions, and is far more detailed than any other list of scientific and tech-

Exhibit 2: STEM Occupations With High or Low Numbers of Added Jobs, 2004-2014

Occupation	Change
High absolute numbers of added jobs (24,000 or better):	
Computer specialists (summary)	*+956,711*
Computer software engineers	*+368,589*
Computer systems analysts	*+152,955*
Network systems & data communications analysts	*+126,190*
Computer support specialists	*+119,191*
Network & computer systems administrators	*+106,868*
Database administrators	*+39,899*
Computer specialists, all other	*+28,283*
Computer & information systems managers	*+72,622*
Engineering technicians, except drafters	*+62,868*
Life scientists (summary)	*+48,167*
Market and survey researchers (summary)	*+42,929*
Civil engineers	*+39,165*
Psychologists (summary)	*+33,380*
Industrial engineers	*+28,258*
Other life, physical, & social science technicians	*+27,450*
Engineers, all other	*+26,502*
Medical scientists & epidemiologists (summary)	*+25,941*
Mechanical engineers	*+25,127*
Engineering managers	*+24,757*
Low absolute numbers (999 or less):	
Statisticians	*+879*
Anthropologists and archeologists	*+836*
Economists	*+718*
Marine engineers and naval architects	*+575*
Mathematical scientists, all other	*+533*
Electrical and electronics drafters	*+460*
Agricultural engineers	*+408*
Political scientists	*+372*
Sociologists	*+210*
Historians	*+113*
Mathematical technicians	*+62*
Geographers	*+57*
Petroleum engineers	*-19*
Mathematicians	*-33*
Mining & geological engineers, incl. mining safety	*-78*

Notes: total employment across all occupations in the U.S. is projected to grow 13%. Data for "summary" groups (where further details are available for occupations within those groups) are used here, with the exception of the large group of computer-related professions, where the details may be of special interest to readers of this report. Source statistics for the complete set of STEM occupations are provided in Exhibit 3.

Exhibit 3: Estimated 2004 Employment and Projected 2014 Employment for STEM Occupations

	2004	2014
Total, all occupations	145,612,332	164,539,901
STEM executive/management occupations:		
Computer/information systems managers	280,294	352,916
Engineering managers	190,366	215,123
Natural sciences managers	42,175	47,928
STEM Professions:		
Computer/mathematical science	3,152,801	4,119,844
Computer specialists	3,045,836	4,002,547
Computer/info. scientists, research	22,385	28,123
Computer programmers	455,271	464,270
Computer software engineers	800,050	1,168,639
Computer support specialists	518,369	637,560
Computer systems analysts	486,545	639,500
Database administrators	104,382	144,281
Network/computer systems admin.	278,381	385,249
Network systems/data comm. analysts	231,271	357,461
Computer specialists, all other	149,181	177,464
Mathematical science occupations	106,965	117,297
Actuaries	17,547	21,610
Mathematicians	2,537	2,504
Operations research analysts	57,515	62,343
Statisticians	18,908	19,787
Mathematical scientists, all other	8,632	9,165
Mathematical technicians	1,825	1,887
Engineers (except sales engineers)	1,448,871	1,643,500
Aerospace engineers	75,584	81,833
Agricultural engineers	3,390	3,798
Biomedical engineers	9,695	12,673
Chemical engineers	30,649	33,899
Civil engineers	237,299	276,464
Computer hardware engineers	76,511	84,255
Electrical engineers	155,904	174,279
Electronics engineers, except computer	142,864	156,732
Environmental engineers	49,257	64,026
Health/safety engineers, except mining	26,520	30,081
Industrial engineers	176,702	204,960
Marine engineers/naval architects	6,788	7,363
Materials engineers	21,430	24,054
Mechanical engineers	225,857	250,984
Mining/geological engineers	5,187	5,109
Nuclear engineers	17,433	18,701
Petroleum engineers	16,237	16,218
Engineers, all other	171,567	198,069
Sales engineers	73,617	83,897
Surveyors/cartographers/photogrammetrists	66,533	77,047
Drafters/engineering/mapping technicians	850,906	933,406
Drafters	253,975	267,391
Architectural/civil drafters	110,128	115,238
Electrical/electronics drafters	37,709	38,169
Mechanical drafters	82,193	86,689
Drafters, all other	23,945	27,294
Engineering technicians, except drafters	531,978	594,846
Aerospace engineering technicians	9,502	10,311
Civil engineering technicians	93,549	106,747
Electrical/electronic engineering techs	181,636	199,366
Electro-mechanical technicians	19,141	20,995
Environmental engineering technicians	20,227	25,167
Industrial engineering technicians	68,993	76,216
Mechanical engineering technicians	47,734	53,612
Engineering technicians, all other	91,197	102,433
Surveying/mapping technicians	64,953	71,169

(continued in the following column)

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	2004	2014
Life/physical/social science occupations	1,315,697	1,531,618
Life scientists	231,723	279,890
Agricultural/food scientists	30,143	33,987
Animal scientists	2,657	3,000
Food scientists/technologists	10,556	11,710
Soil/plant Scientists	16,930	19,276
Biological scientists	77,099	90,235
Biochemists/biophysicists	16,124	19,514
Microbiologists	15,063	17,657
Zoologists/wildlife biologists	16,470	18,603
Biological scientists, all other	29,442	34,461
Conservation scientists/foresters	31,750	33,806
Conservation scientists	18,574	19,747
Foresters	13,176	14,059
Medical scientists	77,275	103,216
Epidemiologists	4,786	6,039
Other medical scientists	72,488	97,178
Life scientists, all other	15,457	18,646
Physical scientists	250,417	280,913
Astronomers/physicists	15,702	16,823
Astronomers	756	835
Physicists	14,946	15,987
Atmospheric/space scientists	7,410	8,636
Chemist/materials scientists	89,679	96,258
Chemists	82,127	88,100
Materials scientists	7,553	8,158
Environmental scientists/geoscientists	108,988	126,366
Environmental scientists/specialists	73,370	85,923
Geoscientists	27,580	29,866
Hydrologists	8,039	10,577
Physical scientists, all other	28,637	32,831
Social scientists/related occupations	491,663	579,799
Economists	12,724	13,442
Market/survey researchers	212,186	255,115
Market research analysts	189,872	227,015
Survey researchers	22,315	28,100
Psychologists	178,963	212,343
Clinical/counseling/school psych.	166,688	198,598
Industrial-organizational psych.	2,444	2,943
Psychologists, all other	9,830	10,802
Sociologists	4,507	4,717
Urban and regional planners	32,152	37,029
Misc. social scientists/related workers	51,131	57,152
Anthropologists and archeologists	4,918	5,754
Geographers	844	901
Historians	2,611	2,724
Political scientists	5,091	5,463
Social scientists/related, other	37,666	42,310
Life/physical/social science techs	341,894	391,017
Agricultural/food science techs	22,615	25,646
Biological technicians	64,400	75,475
Chemical technicians	62,346	65,113
Geological/petroleum technicians	10,927	11,637
Nuclear technicians	7,313	8,314
Social science research assistants	17,704	20,792
Other life/physical/social sci. techs	156,589	184,039
Environmental science technicians	30,934	35,967
Forensic science technicians	9,823	13,399
Forest/conservation technicians	32,611	34,778
Other life/physical/social sci. techs	83,222	99,895

Sources: the complete BLS 2004-2014 Industry-Occupation Matrix is available at the BLS ftp web site at ftp://ftp.bls.gov/pub/special.requests/ep/ind-occ.matrix/. Additional supporting materials, including documentation, are also stored at this location. Several formats are supported, including databases and spreadsheets.

nical job titles used previously in this series of reports on science and technology workforce trends. A quick scan of Exhibit 3 reveals data on such STEM professions as ***aerospace engineering technology, animal science, astronomy, electro-mechanical technology, epidemiology, geography, hydrology, industrial psychology,*** and ***mathematical technology,*** all smaller STEM specialties not treated individually in this series before.

The STEM occupation with the most striking level of employment growth between 2004 and 2014 is ***network systems and data communications analysts.*** This group includes the people who design and install computer networks, a field that is rapidly increasing in both importance and complexity. BLS anticipates a 55 percent gain in employment in this moderately large specialty during the ten year projection period. This is almost as great a rate of growth as that for the most rapidly expanding occupation of all in the 2014 BLS projections, the much larger field of home health aides, which is expected to grow to nearly a million workers by the end of the projected period. The second, third, and fourth most striking examples of growth in the STEM occupations are all other IT fields: ***computer software engineers,*** with a gain of 46 percent over the decade, and ***network and computer systems administrators*** and ***database administrators,*** each with growth rates of 38 percent over the projected period. Other STEM occupations with relatively strong rates of growth include ***environmental engineers*** and ***environmental engineering technicians, actuaries, market and survey researchers,*** and a residual set of ***other life, physical, and social science technicians.*** Other STEM professions that do not have high growth rates, but which are still expected to add at least 24,000 new jobs by 2014, include ***civil engineers, engineering managers, engineering technicians, industrial engineers, mechanical engineers,*** a residual set of ***other types of engineers,*** and ***psychologists.***

At the other end of the scale, both low rates of growth and low numbers of added jobs are reported for ***electrical and electronics drafters, historians, mathematicians*** and ***mathematical technicians, mining and geological engineers, petroleum engineers, sociologists,*** and ***statisticians,*** but in some of these cases, a weakness in the BLS database may also be at work. Some STEM specialties are staffed mostly by academics; the field of ***history*** is an example. In the employment forecasts, however, all postsecondary faculty are grouped together into a single occupational set, and no separation is possible between people in STEM fields and those in others, such as professors of arts or business disciplines. This leads to a degree of undercounting for the more heavily academic STEM professions, such as ***physics.***

Where STEM specialists work. The BLS projections include details for all of the feasible combinations of *two* dimensions of employment. Results are available not only for occupational categories but also for different kinds of employers — the "industry" side of the Bureau's biennial "industry-occupation matrices." These very large two-way tabulations add other analytic applications of these data, supporting the display of both the distribution of particular occupations across different kinds of employers, and the occupational makeup of particular employing industry groups. The industry or employer categories are nearly as detailed as are the occupational titles used for these surveys, and so the result is a level of what market researchers like to call "granularity" in the data that can only be illustrated in a brief report like this one.

A greatly simplified industry-occupation matrix for STEM professionals in 2004 is presented in Exhibit 4 on pages 6 and 7. Only 31 employer categories are used, but this is sufficient to provide broad sectoral assignments for at least 80 percent of the STEM workforce, as well as some details for the larger industry groups. To keep the presentation intelligible, only numbers of cases are included in it, but many users may prefer to generate percentages or other more comparable summary statistics for selected portions of this tabulation. Such transformations of these data can be easily carried out by making use of the source spreadsheet used to create the exhibit, available at the STEM Workforce Data Project archive pages at http://www.cpst.org.

Examination of Exhibit 4 will immediately establish that scientific and technical professionals can be found in every broad employment market in the U.S. economy, including goods distribution sectors such as wholesale trade, retail trade, and transportation and warehousing. Like the occupational categories, these industrial classifications have been recently revised; the previous U.S. Standard Industrial Classification (SIC) system has been replaced with a new North American Industry Classification System (NAICS; for details, see http://www.census.gov/epcd/www/naics.html). Among many fundamental changes, a new broad "information" employer sector includes all types of print publishing, motion pictures, radio and television broadcasting, and electronic data systems including the internet. The consolidation of skilled specialty services in large conglomerates which operate multiple enterprises shows that substantial numbers of STEM professionals are now associated with employers that manage other companies. Another significant set of STEM workers is grouped in a broad class of organizations that provide administrative and/or support services, including one of the leading growth industries, employment service companies (see the sidebar on page 5). Temporary staffing agencies now supply the services of more than 100,000 STEM professionals. This last number is one of many statistics that do not appear in the simplified matrix in Exhibit 4, but which can be obtained by inspecting the much more detailed supporting files used to build this table, all available from BLS at the location cited in Exhibits 3 and 4.

Two extra employer categories are included in the exhibit to allow for self-employed STEM professionals — a sizable group — and for a residual set of all employment sectors not otherwise reported in the table.

Comments from BLS about the 2004-2014 Employment Projections

Announcements from the Bureau of Labor Statistics about the release of its 2004-2014 employment projections and the publication of the current (2006-2007) edition of the *Occupational Outlook Handbook* include useful information about influences on current employment trends. Job outlooks may be affected by many factors, including changes in the age structure and ethnic makeup of the labor force, new technology, trends in business practices, changes in supply and demand for different types of skills, and increased competition from abroad.

Employment growth in the 2004-2014 decade, the Bureau states, is "projected to be concentrated in the service-providing sector of the economy. Within the service-providing sector, two industry groups are expected to account for half of all wage and salary employment growth in the economy: education and health services; and professional and business services. In the goods-producing sector, employment is expected to grow in construction; employment is expected to decline both in natural resources and mining and in manufacturing. The decline in manufacturing will not be as severe as the 16 percent loss from 1994 to 2004... Nonetheless, employment in goods-producing industries is expected to decrease from 15 percent to 13 percent of total employment."

The BLS announcements take note of such facts as the following:

• "The 10 detailed industries with the largest wage and salary employment growth are in the service-providing sector. The leading growth industries are employment services, local government education, and offices of physicians.

• "Eight out of the 10 detailed industries with the largest wage and salary employment declines are in the manufacturing sector.

• "An associate or bachelor's degree is the most significant source of postsecondary education or training for 6 of the 10 fastest growing occupations.

• "The labor force will change in composition, as a result of changes in both the composition of the population and in the rates of labor force participation across demographic groups. The projected labor force growth will be affected by the aging of the baby-boom generation — persons born between 1946 and 1964. In 2014, baby-boomers will be ages 50 to 68 years, and this age group will grow significantly over the 2004-2014 period. The labor force will continue to age, with the number of workers in the 55-and-older group projected to grow by 49.1 percent, nearly five times the 10 percent growth projected for the overall labor force. Youths — those between the ages of 16 and 24 — will decline in numbers and lose share of the labor force, from 15.1 percent in 2004 to 13.7 percent in 2014. Prime-age workers — those between the ages of 25 and 54 — also will lose share of the labor force, from 69.3 percent in 2004 to 65.2 percent in 2014. The 55-and-older age group, on the other hand, is projected to gain share of the labor force, from 15.6 percent to 21.2 percent.

• "Over the 2004-14 projection period, the number of women in the labor force is projected to grow by 10.9 percent, faster than the 9.1 percent growth projected for men. As a result, women's share of the labor force is expected to increase from 46.4 percent in 2004 to 46.8 percent by 2014.

• "By 2014, the Hispanic labor force is expected to reach 25.8 million, due to faster population growth resulting from a younger population, higher fertility rates, and increased immigration levels. Despite relatively slow growth, whites will remain the largest group, composing 80.2 percent of the labor force. Blacks will constitute 12.0 percent of the labor force. Asians will continue to be the fastest growing race group, climbing to 5.1 percent of the labor force in 2014."

The Bureau also adds this cautionary comment:

"*Note on labor shortages in the context of long-term economic projections:* the measures upon which the employment projections and labor force projections are based are different. The former is a count of jobs and the latter a count of individuals. Users of these data should not assume that the difference between the projected increase in the labor force and the projected increase in employment implies a labor shortage or surplus. The BLS projections assume a labor market in equilibrium, i.e., one where labor supply meets labor demand except for some degree of frictional unemployment. For a discussion of the basic projection methodology, see 'A summary of BLS projections to 2014,' Norman C. Saunders, November 2005 *Monthly Labor Review.* For a discussion of labor shortages in the context of long-term projection models, see 'Employment projections to 2012: concepts and context,' Michael W. Horrigan, February 2004 *Monthly Labor Review*."

—"BLS Releases 2004-14 Employment Projections," USDL media release 05-2276, Dec. 7, 2005, available at ftp://ftp.bls.gov/pub/news.release/ecopro.txt, and "2006-07 editions of the Occupational Outlook Handbook and the Career Guide to Industries available on the internet, USDL media release 05-3251, Dec. 21, 2005, available at ftp://ftp.bls.gov/pub/news.release/ooh.txt.

Exhibit 4: STEM Occupations and Sectors of Employment, 2004

EMPLOYMENT SECTORS

	Total employment, all workers	Mining, including oil/gas extraction	Utilities	Construction	MANUFACTURING SECTORS									Whole-sale trade
					All manufac-turing	Paper manufac-turing	Chemical manufac-turing	Plastic/rubber products	Fabricated metal products	Machinery manufac-turing	Computer/electronic products	Electrical equipment/applicances	Transportation equipment manufacturing	
ALL OCCUPATIONS COMBINED:	145,612,332	523,200	570,100	6,964,500	14,329,600	499,100	887,100	806,600	1,497,600	1,141,500	1,326,200	446,900	1,763,500	5,654,900
STEM-related executives/managers:														
Computer/information systems managers	280,294	292	1,791	675	29,947	404	3,953	1,129	1,884	2,925	9,448	1,124	2,348	15,950
Engineering managers	190,366	1,926	3,947	5,941	78,330	978	3,869	2,457	5,346	10,177	28,086	3,104	15,522	4,249
Natural sciences managers	42,175	350	174	—	6,998	—	5,733	—	—	—	331	—	—	733
STEM Professions:														
Computer/mathematical scientists	3,152,801	6,096	19,235	9,034	279,682	3,329	19,299	4,132	9,494	18,445	143,727	6,063	40,199	155,089
Computer specialists	3,045,836	6,024	18,015	8,951	272,511	3,246	17,867	4,090	9,088	18,163	141,523	5,949	38,159	153,281
Computer/information scientists	22,385	—	—	—	1,919	—	—	—	136	140	1,388	—	—	538
Computer programmers	455,271	979	2,083	1,234	29,138	791	2,062	827	2,123	3,032	9,418	712	3,510	30,435
Computer software engineers	800,050	754	3,614	1,102	114,107	216	2,049	454	1,175	6,857	83,310	1,488	14,187	30,677
Computer support specialists	518,369	1,101	1,877	2,370	36,889	496	2,846	725	1,167	3,020	16,721	794	3,688	30,976
Computer systems analysts	486,545	1,458	4,886	1,082	37,832	692	5,634	612	1,215	2,229	12,647	1,323	8,826	23,899
Database administrators	104,382	354	601	378	8,042	—	1,068	179	599	577	2,910	230	954	2,733
Network/computer systems admin.	278,381	305	1,923	1,982	21,323	486	1,788	790	2,011	1,176	6,444	675	2,402	13,750
Network systems/data comm. analysts	231,271	417	2,264	591	11,264	—	1,046	248	331	690	4,952	525	1,464	6,859
Computer specialists, all other	149,181	628	756	212	11,998	342	1,299	243	330	443	3,733	180	3,065	13,415
Mathematical science occupations	106,965	—	1,219	—	7,171	—	1,432	406	406	282	2,204	—	2,040	1,808
Actuaries	17,547	—	—	—	—	—	—	—	—	—	—	—	—	—
Mathematicians	2,537	—	—	—	158	—	—	—	—	—	—	—	—	—
Operations research analysts	57,515	—	1,181	—	4,639	—	362	—	137	175	1,844	—	1,608	1,544
Statisticians	18,908	—	—	—	1,398	—	917	—	269	—	—	—	—	134
Mathematical scientists, all other	8,632	—	—	—	594	—	—	—	—	—	—	—	350	125
Mathematical technicians	1,825	—	—	—	315	—	—	—	—	—	173	—	—	—
Engineers (less sales, techs, etc.)	1,448,871	19,133	30,466	36,628	554,682	7,323	29,381	15,358	31,897	63,046	186,329	22,074	145,887	38,633
Aerospace engineers	75,584	—	—	—	51,628	—	—	—	159	429	5,834	—	45,108	261
Agricultural engineers	3,390	—	—	—	728	—	—	—	—	125	—	—	—	170
Biomedical engineers	9,695	—	—	—	3,731	—	1,571	—	—	—	623	—	—	108
Chemical engineers	30,649	547	233	—	15,752	460	8,493	901	192	454	1,711	161	586	767
Civil engineers	237,299	429	2,287	19,565	3,314	—	430	—	833	210	517	—	427	445
Computer hardware engineers	76,511	128	405	171	34,756	430	—	—	110	648	33,030	225	411	4,195
Electrical engineers	155,904	293	10,973	3,334	61,300	881	881	522	821	8,446	36,647	6,087	5,042	5,945
Electronics engineers, except computer	142,864	188	573	1,203	42,116	217	217	—	350	1,562	35,130	2,859	1,270	8,255
Environmental engineers	49,257	741	651	275	4,200	337	893	125	215	176	561	—	590	273
Health/safety engineers, except mining	26,520	317	528	3,579	7,054	293	2,495	262	368	350	760	185	1,114	463
Industrial engineers	176,702	1,515	1,696	1,233	127,763	2,722	6,997	6,806	12,086	13,861	26,656	5,168	31,520	5,204
Marine engineers/naval architects	6,788	849	—	—	680	—	—	—	—	—	—	—	590	—
Materials engineers	21,430	250	203	—	14,066	337	679	661	1,220	1,440	3,059	596	2,737	483
Mechanical engineers	225,857	716	1,411	4,050	122,147	1,832	2,902	4,699	13,168	30,187	22,591	5,294	30,125	8,006
Mining/geological engineers	5,187	2,587	—	—	239	—	179	—	—	—	—	—	—	—
Nuclear engineers	17,433	—	6,522	—	1,211	—	1,115	—	—	—	—	—	—	—
Petroleum engineers	16,237	9,207	634	—	511	—	—	—	—	—	—	—	—	291
Engineers, all other	171,567	1,360	4,283	3,070	63,487	775	2,472	1,232	2,210	5,107	19,205	1,225	26,333	3,725
Engineering-related occupations:														
Sales engineers	73,617	177	—	1,912	20,009	—	436	452	1,565	6,293	7,465	1,506	1,313	26,013
Surveyors/cartographers/photogrammetrists	66,533	549	726	3,700	122	—	—	—	—	—	—	—	—	184
Drafters/engineering/mapping technicians	850,906	3,882	17,750	24,239	260,937	2,196	10,222	5,294	20,486	37,174	91,781	12,854	52,394	27,086
Drafters	253,975	457	3,424	16,863	67,632	368	981	960	13,528	16,833	10,575	4,072	11,874	4,873
Engineering technicians, except drafters	531,978	2,737	12,172	6,522	193,028	1,822	9,203	4,330	6,907	20,326	81,188	8,750	40,513	22,084
Surveying/mapping technicians	64,953	688	2,154	855	277	—	—	—	—	—	—	—	—	129
Life/physical/social science occupations	1,315,697	15,945	9,512	2,764	155,770	1,815	91,770	2,125	2,520	3,162	18,011	1,638	4,907	26,986
Life scientists	231,723	—	537	—	28,836	187	21,037	—	—	—	1,286	—	—	4,486
Agricultural/food scientists	30,143	—	—	—	4,096	—	133	—	—	—	—	—	—	1,760
Biological scientists	77,099	—	—	—	10,095	—	8,929	—	—	—	563	—	—	376
Conservation scientists/foresters	31,750	—	176	—	1,532	160	—	—	—	—	—	—	—	443
Medical scientists	77,275	—	—	—	10,812	—	10,252	—	—	—	269	—	—	1,561
Life scientists, all other	15,457	—	288	—	2,300	—	1,723	—	—	—	454	—	—	345
Physical scientists	250,417	7,427	1,799	482	43,755	691	31,153	792	664	588	3,253	213	1,429	3,093
Astronomers/physicists	15,702	—	336	—	1,177	—	417	—	—	—	575	—	—	—
Atmospheric/space scientists	7,410	—	—	—	122	—	—	—	—	—	—	—	—	—
Chemists/materials scientists	89,679	266	577	123	38,706	531	29,277	769	551	388	1,898	120	762	2,649
Environmental scientists/geoscientists	108,988	7,027	763	359	2,087	116	1,231	—	—	—	—	—	225	186
Physical scientists, all other	28,637	—	108	—	1,664	—	225	—	—	—	600	—	418	235
Social scientists/related occupations	491,663	288	1,528	1,966	24,882	168	3,414	479	617	1,792	10,150	1,246	1,766	15,165
Economists	12,724	—	116	—	—	—	—	—	—	—	—	—	—	—
Market/survey researchers	212,186	175	1,320	1,897	23,344	168	3,328	476	610	1,787	8,848	1,246	1,748	12,922
Psychologists	178,963	—	—	—	291	—	—	—	—	—	194	—	—	—
Sociologists	4,507	—	—	—	—	—	—	—	—	—	—	—	—	—
Urban/regional planners	32,152	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. social scientists/related workers	51,131	—	—	—	1,148	—	—	—	—	—	1,094	—	—	2,157
Life/physical/social science technicians	341,894	8,207	5,649	304	58,296	768	36,166	839	1,223	755	3,322	178	1,673	4,242

Source: U.S. Bureau of Labor Statistics. All specific occupational tabulations used to build this exhibit are included in the file "occ_xls.zip," available at the Bureau's internet "ftp" site at ftp://ftp.bls.gov/pub/special.requests/ep/ind-occ.matrix/. Other useful files and documentation are also available at this location. See the text of this report for additional information. We apologize for the small print, but it is needed to display the more than 2,000 cells in even this greatly abbreviated version of the industry-occupation matrix, so that any part of these distributions can be inspected at a glance.

Retail trade	Transportation and warehousing	Information	Finance and insurance	PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES					Management of companies/ enterprises	Administrative/ Support Services	Health svces/social assistance	GOVERNMENT			Self employed, primary job	All Other Employers
				All prof./ scientific/ tech svces	Architectural/ engineering services	Computer design/ related	Mgmt/science/ technical consulting	Scientific R&D services				Federal	State	Local		
15,034,500	4,250,000	3,138,300	5,965,602	6,761,900	1,260,800	1,147,400	779,000	547,600	1,718,000	7,933,800	14,187,200	2,727,500	4,985,403	13,905,503	10,430,918	26,531,406
6,160	4,097	33,854	36,781	61,761	5,086	35,603	6,213	5,538	21,264	10,305	9,203	7,919	11,596	10,406	2,539	15,754
543	1,208	6,042	372	52,197	35,727	5,617	2,868	7,682	8,417	2,251	662	13,634	3,014	5,291	967	1,375
—	138	210	—	11,010	2,056	123	1,512	7,116	1,051	221	628	13,592	4,502	985	—	1,583
59,683	24,736	419,324	311,564	891,982	59,166	612,059	76,911	71,067	165,076	126,693	63,061	79,668	148,841	124,194	105,635	163,208
59,370	23,951	410,995	286,268	868,787	57,033	606,791	68,475	65,991	156,294	124,042	61,277	69,504	140,628	122,041	104,796	159,101
—	—	3,021	260	12,691	510	7,771	666	3,504	486	409	—	584	576	—	976	925
11,154	4,819	52,530	44,183	146,239	4,940	112,146	9,176	6,035	21,937	26,349	5,560	6,161	19,939	11,313	19,265	21,953
8,257	3,713	149,460	54,044	299,845	21,170	219,788	22,697	27,655	31,278	20,101	6,645	21,640	14,752	8,718	18,132	13,211
18,791	4,622	61,209	44,525	118,493	6,476	82,972	9,000	4,540	25,119	33,027	17,993	7,251	28,155	43,061	2,328	40,582
5,064	2,971	47,185	70,201	127,766	12,166	87,003	12,636	5,865	29,796	13,770	11,520	13,194	35,847	20,044	19,673	20,357
2,440	1,233	13,290	14,275	23,124	1,817	13,513	2,538	2,122	7,598	4,540	3,161	3,408	4,107	5,503	407	9,188
7,080	2,975	37,871	28,947	65,759	5,656	39,726	4,923	3,916	15,720	9,542	8,671	7,927	13,066	20,006	1,909	19,625
3,741	1,700	32,847	19,349	45,337	2,773	28,502	5,383	3,314	12,205	7,884	4,175	5,275	9,237	7,832	34,056	26,238
2,796	1,916	13,583	10,484	29,534	1,046	15,368	1,456	9,039	12,154	8,420	3,510	4,064	14,949	5,469	8,050	7,243
313	785	8,328	25,295	23,195	2,133	5,268	8,436	5,076	8,781	2,651	1,784	10,165	8,213	2,152	839	4,266
—	—	—	10,856	3,676	—	—	—	—	1,654	347	—	208	373	119	—	314
—	—	125	—	602	—	—	211	310	—	—	—	1,214	246	—	—	192
164	749	7,554	10,623	12,810	1,724	4,962	3,090	2,166	3,065	2,067	870	4,593	3,830	1,169	—	2,657
147	—	421	1,905	3,870	149	—	413	2,242	344	153	742	3,856	3,065	771	808	1,294
—	—	—	1,530	1,857	125	—	1,270	—	3,678	—	—	212	309	—	—	327
—	—	—	293	381	—	—	—	179	—	—	—	—	390	—	—	446
2,364	11,701	49,654	5,840	378,089	257,084	28,479	26,430	62,968	36,234	33,943	3,388	90,628	58,299	45,272	33,678	20,239
—	1,309	—	—	10,891	5,405	1,095	—	4,159	804	842	—	8,337	183	—	—	1,329
—	—	—	—	845	456	—	—	—	324	—	—	395	247	519	—	162
—	—	—	—	2,247	345	—	—	1,810	136	—	1,458	309	422	186	—	1,098
—	319	—	—	9,954	4,983	158	697	4,081	739	390	—	1,176	284	138	—	350
—	767	1,153	—	115,050	109,048	—	4,157	1,302	2,360	2,026	133	9,848	36,156	29,565	11,723	2,478
381	360	8,011	491	18,026	2,342	11,511	—	2,581	1,857	1,099	112	4,030	1,197	168	109	1,015
490	650	5,721	—	43,360	30,533	3,479	2,668	6,435	3,835	3,138	224	3,963	2,020	3,369	3,270	4,019
465	417	27,873	619	26,152	12,338	3,785	2,064	7,828	4,499	2,420	—	20,525	1,225	412	2,861	3,061
—	187	—	—	24,771	14,223	101	7,371	2,826	631	2,620	—	4,500	5,883	3,777	157	591
—	701	—	2,581	2,945	1,437	—	841	592	622	728	228	2,922	1,683	1,613	147	409
230	1,259	2,929	209	21,345	8,628	3,030	1,920	7,283	6,798	2,937	245	1,273	218	444	654	750
—	925	—	—	3,190	2,342	—	—	234	—	—	—	824	116	—	—	204
—	—	—	—	3,359	1,600	—	—	1,670	700	218	—	1,241	493	—	—	417
193	708	389	237	55,784	40,945	1,376	2,436	10,373	4,900	5,792	130	10,504	1,951	1,046	5,314	2,579
—	—	—	—	1,486	1,002	—	359	124	—	—	—	222	360	—	—	293
—	—	—	—	5,029	1,719	—	223	2,890	343	1,574	—	2,252	—	152	—	350
—	431	—	198	2,497	2,083	—	278	105	374	439	—	287	—	—	1,147	221
350	3,571	3,340	1,366	31,161	17,656	3,207	1,536	8,420	7,194	9,599	737	18,021	5,694	3,680	8,296	2,633
3,100	310	7,241	817	9,438	1,491	5,852	1,322	447	1,430	813	—	—	—	—	547	1,810
—	—	233	—	47,687	45,576	676	739	138	328	367	—	1,352	2,621	5,677	1,535	1,452
3,120	5,284	24,204	591	281,241	241,197	9,803	6,904	20,499	12,978	37,238	1,349	38,890	44,389	38,824	15,822	13,082
953	420	2,534	156	119,335	45,413	1,813	1,976	1,430	3,327	10,262	120	197	3,496	3,473	11,381	5,072
2,147	4,769	21,288	371	118,082	86,594	7,427	4,401	18,868	9,419	25,706	1,211	37,050	38,975	27,331	1,722	7,364
—	—	382	—	43,823	42,155	563	526	200	232	1,269	—	1,643	1,918	8,020	2,719	844
4,792	4,182	23,270	29,098	275,745	67,153	9,610	52,457	118,013	28,214	27,378	71,997	154,507	174,124	111,539	103,965	95,909
340	308	—	157	44,802	3,396	—	4,818	36,242	2,598	2,114	14,789	40,053	47,976	8,183	14,539	22,005
193	221	—	—	3,751	582	—	1,022	2,109	662	280	—	2,843	3,838	710	9,898	1,891
—	—	—	—	17,259	1,699	—	1,549	13,939	294	725	2,271	24,067	15,439	1,389	1,143	4,041
—	—	—	—	880	245	—	461	145	286	120	—	10,930	6,699	3,531	2,937	4,216
—	—	—	131	20,705	640	—	1,611	18,274	1,314	457	11,197	2,213	15,365	2,184	395	10,941
—	—	—	—	2,207	231	—	174	1,775	—	532	1,265	—	6,635	369	166	1,350
143	344	796	234	82,799	31,594	1,009	19,407	29,633	5,228	5,025	2,382	31,499	39,222	13,484	5,053	7,652
—	—	—	—	5,894	367	—	206	5,251	—	359	971	4,012	1,723	—	—	1,230
—	—	547	—	2,761	153	—	451	1,215	125	—	—	2,890	570	—	—	395
113	—	—	—	25,235	10,361	181	1,146	13,477	3,597	2,488	639	6,152	4,956	2,273	—	5,502
—	139	147	175	39,177	18,792	198	16,698	3,328	813	1,846	597	10,984	26,622	10,846	4,188	3,032
—	—	—	—	9,732	1,921	—	—	6,362	649	270	159	7,461	5,352	239	865	1,903
4,005	2,296	21,893	28,360	74,983	8,151	8,193	17,979	15,229	15,888	6,920	44,506	29,602	29,833	70,911	82,758	35,879
—	109	—	652	2,907	100	—	1,314	1,341	322	154	—	4,311	2,195	848	—	1,110
3,795	2,138	20,734	27,467	55,212	3,599	7,769	13,866	5,106	14,587	6,396	4,432	1,599	3,198	1,364	15,891	15,715
—	—	—	—	1,902	—	—	356	1,416	585	222	38,261	3,826	11,626	43,594	63,166	15,490
—	—	—	—	1,952	—	—	110	1,806	—	—	164	—	1,024	314	602	451
—	—	—	—	4,687	3,917	—	670	—	—	—	—	554	2,995	23,118	—	798
209	—	1,067	151	8,323	471	392	1,663	5,460	300	128	1,625	19,270	8,795	1,673	3,099	3,186
304	1,235	517	347	73,160	24,012	311	10,252	36,909	4,500	13,319	10,320	53,353	57,092	18,962	1,615	30,472

An example of the kind of details which are available for these data is provided by the pharmaceutical industry, one of the key employment sectors for such STEM professionals as chemists. The archives noted above include a detailed spreadsheet for all occupational employment in NAICS code group number 325400, pharmaceutical and medicine manufacturing. This one file shows that in 2004, this single set of employers accounted for 2,485 computer and information systems managers; 1,267 engineering managers; and 4,639 natural science managers, easily the largest number of that last group of STEM specialists in any detailed manufacturing category and a striking reversal of the distribution of scientific and technical managers found in the workforce as a whole. The pharmaceutical sector is not all that large in total employment (291,000). But it employs nearly twice the share of IT specialists, at 4.5 percent of this total, than does the typical employer in the economy as a whole; it accounts for nearly 65 percent of the statisticians employed by *all* manufacturers; it employs all types of engineers and technicians, and is a leading employer of biomedical engineers and life scientists as well as chemists.

STEM employment in many other industry sectors can be examined in detail by using these archived resources. For example, Exhibit 4 shows the transportation equipment manufacturing sector only as a single general group, but details are available for seven types of motor vehicle, aerospace, rail, and shipbuilding employers. Within the mining group, oil and gas extraction, several types of mining, and mining support industries can be examined. The utilities group includes separate details for electrical power generation, natural gas distribution, and water and sewer systems. Similar kinds of additional data are available for most of the employment sectors included in Exhibit 4.

A further possibility, not pursued in detail in this report, is the comparison of shifts between 2004 and 2014 in the distribution of STEM employment among these various industry sectors. The sidebar on page 5 does take note of the three types of employers with the highest rates of anticipated growth: employment services, local government education, and offices of physicians. As noted above, the first of these three sectors is a significant employer of STEM specialists. The third, physicians' offices, is not an employer of STEM workers. The remaining high-growth employer group, local government education, is relevant for the STEM workforce but not a direct part of it. Science and math education at every level is a major policy concern in the United States, and many persons with STEM undergraduate degrees go on to become teachers of science and math, but data on elementary and secondary teachers are not available by teaching specialties, and so it has not been possible to include these workers in statistics on the STEM workforce. Nevertheless, the several private and public education employer sectors are projected to add more than two million jobs between 2004 and 2014, and many of these positions will be filled by people with STEM degrees. The employer groups for education include an educational services set for private schools and separate educational subsets for state and local governments. Data for the public institutions are taken from the Current Population Surveys, which helps explain why the BLS projections do not include information on post-secondary teachers employed by federal degree-granting schools such as the service academies (e.g., West Point) as well as other accredited institutions like the Naval Postgraduate School at Monterey, California and the Uniformed Services University of the Health Sciences in Bethesda, Maryland. We are indebted to Jay M. Berman of BLS, who points out that the CPS samples are not large enough to support estimates of the numbers of faculty in these federal schools. His paper, "Industry Output and Employment Projections to 2014" *(Monthly Labor Review,* November, 2005, pp. 45-68) includes more information on the use of NAICS codes in the 2004-2014 projections.

About the STEM Workforce Data Project

The purpose of the STEM Workforce Data Project is to identify and distribute reliable statistics on scientific, technological, engineering and mathematical workers in the United States. Like the similar IT Workforce Data Project (see http://www.cpst.org for those reports), the STEM project uses the full range of statistical resources offered by U.S federal agencies as well as other private sources of information. Our reports have drawn upon previously unused data, maintained by the Bureau of Labor Statistics, from Current Population Surveys, but other sources of information are also being examined and applied.

This is a project of the Commission on Professionals in Science and Technology (CPST) in Washington, D.C., supported by grants from the Alfred P. Sloan Foundation. Queries about the project are welcome. The principal investigators are Eleanor Babco, who recently retired as CPST's executive director (202-326-7080; babco@cpst.org), and Richard Ellis of Ellis Research Services in Carlisle, PA (717-218-9818; raellis@earthlink.net). Nathan Bell, CPST's associate director, is the project's manager (nbell@cpst.org). Dr. B. Lindsay Lowell of the Center for the Study of International Migration at Georgetown University is contributing expertise on foreign content in the U.S. STEM workforce. Dr. Ronil Hira of the Rochester Institute of Technology will comment on the policy implications of STEM workforce trends. Robert K. Weatherall, the retired past director of the Office of Career Services at MIT, is participating in the project as a reviewer of draft reports, as is CPST's new executive director, Dr. Lisa Frehill (lfrehill@cpst.org).

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