Twenty Years of Scientific and Technical Employment

ABSTRACT

Time series data from the U.S. Bureau of Labor Statistics (BLS) for employment by occupation from 1983 through 2002 can be used to document substantial growth in the overall numbers of persons in the United States with scientific, technological, engineering and mathematical (STEM) jobs. A pause in this general trend of growth occurred during the business recession of the early 1990s, and declines in employment also affected many STEM occupations in 2002. Much of the growth was due to the recent boom in the computer and telecommunication industries. Other sectors of STEM employment did not do as well. The number of jobs in some occupations declined over the 20-year period, while growth in other occupations did not keep up with general increases in the overall size of the U.S. labor force.

This report presents this information. It also examines recent employment data for 2003. A separate data archive at www.cpst.org includes both the source statistics from BLS, and more detailed versions of the STEM tabulations presented here.

About the STEM Workforce Data Project

The STEM Workforce Data Project will identify and distribute reliable statistics on scientific, technological, engineering and mathematical workers in the United States. Like the similar IT Workforce Data Project (see www.cpst.org for those reports), the STEM project draws on the full range of statistical resources offered by U.S. federal agencies as well as other private sources of information, and it will issue reports and data in both print and electronic media.

This is a project of the Commission on Professionals in Science and Technology (CPST) in Washington, D.C., supported by a grant from the Alfred P. Sloan Foundation.

Queries about the STEM project are welcome. The principal investigators are Eleanor Babco, Executive Director, CPST (202-326-7080; ebabco@cpst.org), and Richard Ellis, of Ellis Research Services in Carlisle, Pennsylvania (717-218-9818; raellis@earthlink.net). Dr. B. Lindsay Lowell of the Center for the Study of International Migration at Georgetown University will work on foreign content in the U.S. STEM workforce. Other investigators are expected to participate in the project, and a review panel is being formed.

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The best source for a summary of recent employment trends for technical people in the United States — the scientific, technological, engineering, and mathematical ("STEM") workers whose services have been critical for the economic well-being of the nation — is a time series from the Bureau of Labor Statistics, maintained by the Office of Employment and Unemployment Statistics in the Division of Labor Force Statistics. This source uses data from the monthly Current Population Survey to assemble estimates of average annual employment from 1983 through 2002 for the entire civilian labor force, including details for men and women, several hundred occupations, and racial and ethnic minority groups (those details are available only in separate related datasets for the years when the minority statistics are available; for more information, see the sidebar on page two of this report).

We have used these data to construct a table of employment trends for STEM occupations during the last 20 years. The complete summary includes data on both non-academic and academic workers. With nearly 100 lines of information, that tabulation is not well-suited for reproduction in a brief printed report. However, it is available, along with the original data from BLS that were used to construct it, in an archive for the STEM Workforce Data Project in our web site at www.cpst.org. A condensed version of these data on STEM employment trends, suppressing most of the distinctions between academic and non-academic workers, will be found on pages four and five below.

Growth in STEM occupations as a whole. During the 20 years covered by these data, the entire U.S. labor force increased by a third at its peak in 2001, to 136 percent of its size at the start of the period. Growth was stronger in executive, managerial, administrative and professional specialty occupations, which rose to 180 percent of their starting size during the two decades. The STEM occupations kept pace with this general growth in jobs for professional people. If a relatively conservative definition of these occupations is used, ignoring social scientists and science and engineering technicians, STEM employment increased from about 3 million persons in 1983 to over 5.7 million in the peak year of 2000, or a growth rate of 190 percent. Adding social scientists to the definition of STEM occupations lowers this estimate of growth slightly; allowance for technicians lowers it more, to 173 percent or a rise from 4.4 to 7.6 million jobs.

A pause in the general trend of growth is evident during the business recession of the early 1990s, and STEM employment declined by more than 300,000 jobs between 2001 and 2002. Employment losses were especially large for computer specialists, engineers, and chemists.

Trends in specific occupations. The general trend of growth in STEM occupations during the 20 year period did not apply evenly to all these professions. Much of the increased employment during the period can be attributed to the boom during the late 1980s and 1990s in the information technology and telecommunications industries. Most other sectors of employment did not do as well. Exhibit 1 on the next page summarizes some of the more exceptional developments. As observers of this scene would expect, computer-related occupations led all others in growth. The small profession of miscellaneous “physical scientists n.e.c.” (“not elsewhere classified”) also did very well. This group included geographers, physical geographers, environmental scientists, and material scientists. Employment in some other STEM occupations increased more rapidly than in science and technology as a whole, including work for medical scientists, social scientists “n.e.c.” (philologists, linguists, and intelligence analysts), postsecondary physics teachers (although employment for non-academic physicists remained flat over the 20 year period), biological and life scientists and technicians, actuaries, psychologists, and electrical and electronic engineering technicians (the only engineering-related occupation that achieved better-than-average growth, compared to STEM as a whole).

Employment in some STEM occupations decreased during the 20 year period. The largest such group consisted of drafting technicians; BLS predicted this decline, which can be attributed to the introduction of computer-assisted drafting and design tools. Other occupations with losses of jobs included nuclear engineers, petroleum engineers, and surveyors and mapping scientists.

Using data from the Current Population Survey

The CPS is a joint project of the Bureau of Labor Statistics and the Bureau of the Census. It is a monthly survey of roughly 50,000 households and has been conducted for over half a century.

Each of the two sponsoring agencies maintains its own forms of access to CPS data. Linkages at http://www.bls.census.gov/cps/datamain.htm provide access to FTP directories of Census CPS files, the Census DataFerrett database engine (which requires users to download special software), and the BLS LabStat system, which provides simple time series for major occupational groups. A separate collection of data files, using annualized CPS statistics similar to those presented in this report, available in both text and Acrobat PDF formats, is maintained by BLS at ftp://ftp.bls.gov/pub/special.requests/lf/. These materials provide better details for work on STEM workforce trends, although they do not provide the level of detail that is in the tabulations presented in this report. Files at the BLS FTP web site also include information on women and minorities. The most current data are provided at the main web location given above; additional time series back to 1995 are provided in subdirectories.

In general, annual BLS statistics assembled from the monthly CPS surveys are best for tracking STEM employment over long periods of time. By merging the rolling samples of cases used to collect responses every month, larger databases are obtained, reducing error and improving the ability to produce good estimates for many of the smaller STEM occupations.

As this is written, the detailed BLS 1983-2002 time series for occupations used to generate this report was not available on government web sites. However, a copy of it is stored in the STEM Workforce Data Project archive at www.cpst.org.

Beginning with data for 2003, new complications must be resolved to continue these time series. Federal Standard Occupational Codes, which had not been thoroughly revised since 1980, have been updated. Conversion to these new systems has been underway for several years and has now been implemented for the CPS. Many STEM occupations have been redefined. No certain method yet exists to relate old and new versions of the data, but work is underway to address this problem. See the last section of this report for more comments.

These kinds of judgments require caution. Sampling errors can contribute to exceptional results in employment data for any particular occupation and year, especially for the smaller groups — which means that information in Exhibit 1, below, on “peak” and “trough” years should be taken more as guidance for closer examination of the detailed data than as final summations of trends (for example, some peaks or troughs were reached more than once). Occupations have been labeled as “growing” only when increases in employment significantly exceeded rates for all STEM occupations as a whole, and they are classified as “shrinking” only when time series data are unambiguous.

What's not included here. Decisions about which occupations should be included in STEM data are not always easy to make. The definition of scientific and technical occupations used for this report includes a group that is not treated by federal occupational codes as a scientific or technical profession: sales engineering (which can require serious technical skills to adapt technology to the particular situations of its users). We have also left out an occupation group, architects, that is classified along with engineers in the federal coding systems but which can also be grouped with other kinds of fine artists. For example, architects are included in the coverage of reports on employment and other economic trends issued from time to time by the National Endowment for the Arts (however, note that the STEM estimates do include architectural engineers, who are included in the miscellaneous set of “engineers n.e.c.”).

Other occupations might be included in STEM data but have not been considered here, such as health professionals and secondary science and math teachers. The health occupations have been excluded because they are a very large group, and it seems reasonable for data on health-related employment to be treated separately (note, however, that our definition of STEM occupations does include medical scientists). Secondary science and math teachers cannot be included in the STEM employment statistics presented here, because to date we have not been able to locate comparable data that separates them from other kinds of secondary teachers, even though federal occupational coding systems do allow for those distinctions. Still other occupations might be counted in a broad approach to STEM employment, including people who use training in applied social science (such as social workers and counselors), industrial production managers, industrial designers, and technical writers.

Trends for women and minorities. This report does not include a detailed examination of trends over time in the numbers of women and minorities in

(text continues on page 6)

Exhibit 1
Selected occupations with growth or shrinkage, 1983-2002

(Numbers in thousands)

Occupation	Employment: 1983	Peak or trough	Peak/trough year(s)	Change at peak/trough	2002
GROWING EMPLOYMENT:					
Computer systems analysts and scientists	276	1,835	2001	665%	1,742
Physical scientists, n.e.c.	10	63	1999	630%	47
Medical scientists	27	101	2001	374%	89
Social scientists, n.e.c.	14	40	1998	286%	38
Postsecondary physics teachers	8	22	2000	275%	16
Biological technicians	52	131	2002	252%	131
Biological and life scientists, including biochemists	55	127	2001	231%	119
Actuaries	11	25	1998-99	227%	16
Psychologists	135	280	1994	207%	277
Electrical and electronic engineering technicians	260	486	2001	187%	433
SHRINKING EMPLOYMENT:					
Drafting occupations	273	219	2000	80%	247
Nuclear engineers	17	8	1992, 2002	47%	8
Petroleum engineers	33	15	1991	45%	18
Surveyors and mapping scientists	35	14	1998	40%	24

NOTE: some of the data used to construct this exhibit will be found only in the complete STEM time series, available at the archive for this project at www.cpst.org, and are not included in the condensed version reproduced here as Exhibit 2 on the following pages. “Growth” is relative to other STEM occupations, not to the labor force as a whole.

Exhibit 2

Employed persons in broad STEM occupations, 1983-2002

(Numbers in thousands. Components may not sum to exact value of aggregates due to rounding. See below for additional information)

	1983	1984	1985	1986	1987	1988	1989
Larger aggregates, for comparisons:							
All employed persons, 16 years and over	100,834	105,005	107,150	109,597	112,440	114,968	117,342
All managerial and professional specialty occupations	23,592	24,858	25,851	26,554	27,742	29,190	30,398
All professional specialty occupations	12,820	13,286	13,630	13,911	14,426	14,974	15,550
STEM summaries:							
All occupations combined	4,401	4,599	4,828	5,029	5,004	5,266	5,444
All occupations except social scientists	4,058	4,240	4,470	4,647	4,605	4,844	4,999
All occupations except science and engineering technicians	3,377	3,539	3,713	3,884	3,904	4,120	4,290
All occupations except social scientists and technicians	3,034	3,180	3,355	3,502	3,505	3,698	3,845
STEM details:							
Natural scientists and science technicians	**637**	**631**	**670**	**669**	**670**	**684**	**696**
Natural scientists	435	431	459	461	466	468	479
Agricultural and forestry scientists and faculty	67	59	65	65	61	60	63
Biological and life scientists, including faculty	81	86	90	90	95	101	96
Chemists and chemistry faculty	116	114	129	139	132	138	134
Medical scientists, including faculty	40	41	47	43	54	47	59
Physicists, astronomers, and physics faculty	38	39	40	42	42	40	39
Other natural scientists and faculty	93	93	89	81	82	84	89
Science technicians	202	200	211	208	204	216	217
Biological technicians	52	55	54	55	59	55	59
Chemical technicians	82	72	88	78	73	81	74
Science technicians, n.e.c.	68	73	70	74	72	80	84
Mathematical and computer scientists (includes programmers)	**961**	**1,062**	**1,170**	**1,241**	**1,259**	**1,373**	**1,490**
Computer systems analysts, scientists, programmers, and faculty	731	829	908	950	985	1,071	1,149
Operations and systems researchers and analysts	142	140	164	195	197	210	239
Actuaries	11	14	13	15	12	10	16
Statisticians	25	29	30	28	24	28	25
Mathematical scientists, n.e.c.	9	8	6	8	5	5	7
Mathematical science faculty	43	42	50	45	36	49	54
Engineers, surveyors, and engineering technicians	**2,460**	**2,547**	**2,630**	**2,737**	**2,676**	**2,787**	**2,813**
Engineers and surveyors	1,638	1,687	1,726	1,800	1,780	1,857	1,876
Engineers	1,602	1,663	1,704	1,775	1,752	1,834	1,851
Aerospace engineers	80	80	95	93	104	115	112
Agricultural engineers	5	7	4	3	2	2	3
Chemical engineers	67	56	64	59	63	65	67
Civil engineers	211	223	221	233	210	218	249
Electrical and electronic engineers	450	491	544	550	545	573	571
Industrial engineers	210	192	178	203	221	221	199
Marine engineers and naval architects	13	20	17	13	13	16	16
Mechanical engineers	259	268	272	287	277	297	310
Metallurgical and materials engineers	27	24	19	27	25	22	24
Mining engineers	8	6	9	9	6	6	4
Nuclear engineers	17	17	12	10	16	13	10
Petroleum engineers	33	33	31	31	27	26	21
Engineers, n.e.c., including sales engineers (1992 onward)	192	211	217	229	221	230	238
Engineering faculty	30	36	21	26	21	29	28
Surveyors and mapping scientists	35	24	22	25	29	23	24
Engineering and related technologists and technicians	822	860	904	937	896	930	937
Drafting occupations	273	305	297	283	283	290	296
Electrical and electronic technicians	260	273	304	328	305	322	326
Industrial engineering technicians	9	9	6	6	3	5	4
Mechanical engineering technicians	15	12	14	10	10	11	13
Surveying and mapping technicians	44	60	64	80	81	78	70
Engineering technicians, n.e.c.	221	200	219	229	214	224	228
Social scientists and urban planners	**343**	**359**	**358**	**382**	**399**	**422**	**445**
Economists, including faculty	123	129	116	127	135	135	138
Psychologists, including faculty	151	158	169	180	189	216	228
Sociologists, including faculty	10	10	10	14	11	12	11
Other social scientists and faculty	60	63	63	61	64	59	68

Addititional notes: n.e.c. = not elsewhere classified. "Faculty" = postsecondary teachers. Source: adapted from "Employed persons by detailed occupation (3-digit census code) and sex, annual averages 1983-2002," a tabulation prepared from Current Population Survey data maintained by the U.S. Bureau of Labor Statistics. See text for further comments.

TIPS ON VIEWING THESE DATA: although the Adobe Acrobat reader will support viewing two adjacent pages of a report at the same time, the size and level of detail in this tabulation will make such an approach unsatisfactory for many users, especially those whose computer monitors use lower levels of resolution (such as 640 x 480 or even 800 x 600). We recommend that the report be printed out. Users who would like to manipulate these numbers can download them from the STEM Workforce Data Project archive at www.cpst.org.

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
118,793	117,718	118,492	120,259	123,060	124,900	126,708	129,558	131,463	133,488	136,891	136,933	136,485
30,602	30,934	31,085	32,231	33,847	35,318	36,497	37,686	38,937	40,467	41,337	42,271	42,482
15,800	16,030	16,363	16,893	17,536	18,132	18,752	19,245	19,883	20,883	21,368	21,765	21,921
5,615	5,646	5,568	5,738	6,082	6,147	6,346	6,705	6,979	7,256	7,614	7,620	7,262
5,178	5,176	5,102	5,255	5,564	5,614	5,824	6,173	6,447	6,701	7,057	7,081	6,730
4,382	4,450	4,400	4,599	4,900	4,991	5,182	5,458	5,724	5,990	6,331	6,300	5,991
3,945	3,980	3,934	4,116	4,372	4,458	4,660	4,926	5,192	5,435	5,774	5,761	5,459
722	**774**	**791**	**891**	**890**	**889**	**869**	**907**	**896**	**975**	**958**	**989**	**934**
479	531	549	627	624	613	624	620	611	682	685	694	643
53	58	62	70	80	68	65	72	68	76	83	67	81
99	132	128	149	152	145	148	133	139	150	149	162	149
139	142	143	158	163	159	162	158	148	155	177	186	147
57	58	77	97	75	73	97	96	100	117	103	116	109
43	42	37	38	41	47	39	39	40	48	47	42	42
89	99	101	114	113	121	113	121	117	135	125	120	115
243	243	242	264	266	276	245	287	285	293	273	295	291
69	65	80	86	89	96	79	106	108	106	109	127	131
85	89	77	74	77	84	78	85	75	79	71	69	64
89	89	84	104	100	96	87	96	102	108	93	99	96
1,541	**1,548**	**1,551**	**1,702**	**1,797**	**1,819**	**1,977**	**2,188**	**2,432**	**2,574**	**2,889**	**2,868**	**2,702**
1,227	1,249	1,263	1,372	1,483	1,511	1,674	1,883	2,108	2,231	2,562	2,536	2,372
213	201	192	235	222	217	209	201	212	241	228	233	238
20	18	16	15	15	17	16	21	25	25	22	21	16
24	22	25	26	27	21	22	27	33	25	25	28	28
7	6	5	5	6	7	6	8	7	7	6	7	5
51	50	45	49	44	46	51	47	48	45	47	42	43
2,915	**2,854**	**2,760**	**2,662**	**2,867**	**2,906**	**2,978**	**3,078**	**3,119**	**3,152**	**3,210**	**3,224**	**3,094**
1,925	1,901	1,834	1,787	1,951	2,026	2,059	2,118	2,149	2,179	2,200	2,199	2,114
1,897	1,879	1,817	1,767	1,928	2,006	2,039	2,103	2,135	2,163	2,182	2,175	2,090
110	102	88	82	75	78	80	87	86	79	77	86	90
4	3	2	2	3	3	2	2	6	4	2	0	3
70	81	71	58	56	80	95	92	69	82	85	75	77
235	224	217	220	240	231	243	248	296	287	292	296	267
587	566	530	533	556	611	601	652	629	639	738	740	677
204	200	204	201	245	250	257	258	262	260	246	258	235
12	13	12	12	13	14	14	14	17	21	8	9	12
316	311	304	296	341	330	350	352	335	340	345	341	301
24	26	25	28	34	25	27	32	38	30	32	26	23
6	7	6	6	7	6	6	8	6	6	2	3	6
11	11	8	10	11	14	12	10	9	10	12	11	8
19	15	20	18	28	23	20	23	24	21	21	17	18
272	291	302	272	287	304	297	291	316	341	291	288	347
29	29	30	29	30	35	34	34	43	44	30	23	25
27	22	15	20	23	20	21	15	14	15	18	24	24
990	953	926	875	916	880	919	960	970	973	1,010	1,025	980
285	266	256	246	239	229	233	222	228	235	219	225	247
357	352	332	299	316	334	361	391	431	437	472	486	433
5	6	4	4	5	4	5	8	7	1	6	9	9
21	17	14	13	18	17	17	20	21	18	18	18	17
75	68	73	73	68	62	73	76	71	67	79	68	65
246	244	247	241	270	234	230	243	212	215	216	219	209
437	**470**	**466**	**483**	**528**	**533**	**522**	**532**	**532**	**555**	**557**	**539**	**532**
133	137	143	140	129	167	168	156	159	164	161	155	136
224	250	242	259	296	287	267	281	263	297	297	289	298
11	11	12	15	16	13	14	13	14	11	16	12	10
68	72	69	69	86	66	73	82	96	83	83	84	88

(text continued from page 3)

science and technology, but it should be noted that BLS data will support such an analysis. The sidebar on page two of this report indicates where detailed information about these groups of people can be found. Overall, the most recent information, included in Exhibit 3 below and on the following page of this report, shows that women now hold about a quarter of all jobs in science and technology. Blacks account for about six percent of STEM employment; Hispanics account for about five percent. Asians, who are not underrepresented in these occupations, account for ten to 12 percent of STEM jobs, depending on how the sector has been defined. These levels of inclusion are substantially better than they were twenty years ago, but great variations in diversity are still present among the different STEM occupations. The next report in this series will look at these trends for minorities and women in more detail.

STEM employment in 2003. The sidebar cited above notes that definitions of many STEM occupations have changed, so

Exhibit 3 (page 1 of 2)

Employment in STEM occupations, 2003

(Numbers in thousands. Due to rounding, components may not sum to exact aggregates. Percent not employed based on total labor force (employed plus unemployed). Dashes: data not available. See text for discussion of changes in the occupational definitions used in Exhibit 2.)

STEM FIELDS	Number Employed	Percentages: Women	Blacks	Asians	Hispanics	Not Employed
Larger aggregates, for comparisons:						
Employed persons, 16 years & over	137,736	46.8	10.7	4.2	12.6	5.6
Managers & professionals	47,929	50.5	8.2	5.4	6.1	3.1
Professional occupations	27,995	56.4	9.1	6.3	6.2	3.2
STEM summaries:						
All occupations combined	7,528	26.1	6.3	10.7	5.3	4.7
All occupations except the social scientists	7,114	24.4	6.3	9.6	5.2	4.8
All occupations except technicians	6,495	25.9	5.9	11.5	4.8	4.5
All occupations except social scientists & technicians	6,081	23.9	5.9	12.0	4.7	4.7
STEM details:						
Life, physical, & social scientists & technicians	1,385	43.0	6.2	10.3	5.9	3.3
Life, physical, & social scientists	1,071	44.1	4.8	10.8	7.7	2.2
Natural science managers & scientists	657	37.4	4.1	14.3	4.4	1.9
Natural science managers	10	38.0	—	12.9	6.4	0.0
Life & physical scientists	647	37.4	4.2	14.4	4.3	2.0
Agricultural & food scientists	41	21.4	2.7	5.2	8.3	4.7
Astronomers & physicists	18	8.0	4.9	12.2	6.5	10.0
Atmospheric & space scientists	9	19.7	4.7	0.5	—	0.0
Biological scientists	112	46.1	5.1	13.3	2.3	1.8
Chemists & material scientists	140	36.4	5.9	19.8	6.4	0.7
Conservation scientists & foresters	29	12.7	—	2.4	3.1	0.0
Environmental scientists & geoscientists	85	29.8	3.1	1.0	3.2	3.4
Medical scientists	101	50.5	4.8	21.0	4.9	1.9
All other physical scientists	112	41.8	2.7	21.0	2.5	0.9
Social scientists	414	54.6	5.8	5.3	6.0	2.6
Economists	34	19.7	11.4	15.6	8.9	2.9
Market & survey researchers	124	56.6	7.7	7.0	5.5	6.1
Psychologists	185	65.8	4.0	2.3	5.9	0.5
Sociologists	4	45.8	20.8	12.0	—	0.0
Urban & regional planners	22	34.6	—	5.0	1.6	0.0
Miscellaneous social scientists	45	41.0	5.2	4.2	8.4	2.2
Life, physical, & social science technicians	315	39.4	11.4	8.6	9.2	6.8
Agricultural & food science technicians	28	39.8	17.8	0.4	14.8	3.4
Biological technicians	23	47.8	15.5	5.6	14.8	8.0
Chemical technicians	86	28.8	14.8	8.9	7.7	6.5
Geological & petroleum technicians	19	33.2	23.5	5.2	9.3	5.0
Nuclear technicians	3	38.0	—	—	—	0.0
Other life, physical, & social science technicians	156	44.7	6.2	11.0	8.3	7.7

(Details for STEM occupations continued on page 7)

that results from the Current Population Surveys for 2003 and beyond are not easily compared with the data from earlier years. Exhibit 3 illustrates this problem and also provides information on more recent trends in STEM employment. Like Exhibit 2, this is a condensed version of a larger tabulation that can be downloaded from our web-based data archive.

Comparison of Exhibits 2 and 3 shows how changes in federal Standard Occupation Codes (the "SOC") have affected classifications of STEM positions. In a major revision, social scientists have been moved into a broad "life, physical, and social scientists" category. Within the groups for natural scientists, many occupational titles have been revised. In some cases, these revisions are just improvements in nomenclature, but in other cases, changes in occupational titles are signals of significant shifts in the ways that people with STEM jobs are classified and counted. For example, the previous SOC coding system grouped both environmental scientists and material scientists with "other physical scientists n.e.c.," while

Exhibit 3 (page 2 of 2)

Employment in STEM occupations, 2003

(Numbers in thousands. Due to rounding, components may not sum to exact aggregates. Percent not employed based on total labor force (employed plus unemployed). Dashes: data not available. See text for discussion of changes in the occupational definitions used in Exhibit 2.)

STEM FIELDS	Number Employed	Percentages: Women	Blacks	Asians	Hispanics	Not Employed
STEM details, continued from page 6:						
Computer & mathematical scientists	3,469	29.0	7.7	12.4	5.3	5.4
Computer systems managers & scientists	3,327	28.4	7.6	12.4	5.4	5.6
Computer systems managers	347	30.5	4.4	8.3	3.8	4.9
Computer scientists	2,980	28.1	8.0	12.9	5.6	5.7
Computer scientists & systems analysts	722	30.4	9.7	10.8	5.4	5.1
Computer software engineers	758	24.4	6.1	22.7	4.8	5.3
Computer programmers	563	28.1	7.1	11.5	5.1	6.5
Computer support specialists	330	37.4	11.7	5.9	6.8	5.4
Database administrators	72	40.1	5.3	11.7	3.9	6.5
Network & systems administrators	176	21.7	8.1	5.9	9.2	5.4
Network & data communications analysts	359	23.6	7.3	9.0	5.7	6.5
Mathematical occupations	143	42.7	8.4	11.2	4.2	1.4
Actuaries	22	20.2	1.0	17.0	—	0.0
Mathematicians	3	27.6	18.3	8.1	—	0.0
Operations research analysts	95	50.6	7.8	11.0	5.8	2.1
Statisticians	22	35.4	16.8	9.9	1.2	0.0
Miscellaneous mathematical scientists	1	—	—	—	—	0.0
Engineers & engineering technicians	2,674	13.4	4.5	7.5	4.5	4.4
Engineering managers & engineers	1,956	10.4	3.2	10.4	7.1	4.2
Engineering managers	77	10.4	1.3	9.1	0.2	3.8
Engineers	1,879	10.4	3.3	10.4	4.0	4.2
Aerospace engineers	82	11.0	0.8	9.5	4.2	4.7
Agricultural engineers	3	4.0	—	—	—	0.0
Biomedical engineers	8	15.5	—	0.9	12.5	0.0
Chemical engineers	75	14.9	3.1	8.9	4.5	1.3
Civil engineers	278	8.7	4.6	11.7	5.3	2.8
Computer hardware engineers	99	10.4	5.8	18.9	1.9	6.6
Electrical & electronic engineers	363	7.1	4.4	13.6	2.4	6.2
Environmental engineers	47	20.6	3.1	9.4	—	0.0
Industrial engineers, including health & safety	180	19.2	3.6	8.9	4.3	5.3
Marine engineers & naval architects	14	9.2	—	—	1.9	0.0
Materials engineers	38	10.8	1.9	6.6	5.3	2.6
Mechanical engineers	285	5.5	2.2	8.3	3.7	3.4
Mining & geological engineers	8	27.0	—	—	25.5	0.0
Nuclear engineers	9	—	—	4.0	—	0.0
Petroleum engineers	16	7.2	—	3.0	—	0.0
Surveyors, cartographers, & photogrammetrists	41	13.3	3.5	3.2	1.7	2.4
Other engineers	332	12.5	2.7	9.3	6.1	4.9
Engineering technologists & technicians	718	21.3	8.1	4.0	7.8	5.2
Drafters	224	21.7	5.6	3.7	8.6	5.1
Surveying & mapping technicians	75	16.9	2.0	0.9	2.3	5.1
All other engineering technicians	419	21.8	10.3	4.9	8.4	5.2

the new SOC groups material scientists with chemists and places the environmental scientists with geoscientists.

Some of the differences between the data in Exhibit 2 and those in Exhibit 3 are simply consequences of the ways that large statistical organizations must operate. The Bureau of Labor Statistics has to deal with the entire economy, not just STEM-related employment, and there are no current requirements at BLS for formal publication of the annualized time series data used to prepare the STEM statistics presented in this report. Instead, these kinds of source materials may be developed by BLS staff as useful internal tools or for articles in publications such as the *Monthly Labor Review.* Accordingly, these kinds of special tabulations reflect the needs, judgments, and approaches of individual analysts, and should not be expected to always conform to a particular format, especially for details such as very specific occupational titles. These factors help to explain why source statistics from BLS for the 1983-2002 time series do not include details for science, engineering, and computer systems managers, but those details are available in the data for 2003. Similarly, the statistics for 2003 do not include breakdowns of the departmental affiliations of post-secondary teachers, but the time series for 1983-2002 does provide that information. One result of this second type of inconsistency is that our 2003 STEM employment estimates do not cover historians or political scientists, because most of those people are academics.

The revised 2003 SOC adds new occupational titles for database administrators, network administrators and data communication analysts, and several kinds of scientific technicians. Computer programmers are now treated as computing professionals, not as technicians. Documentation for the new SOC also specifies a title for social science research assistants, but the BLS data which we have been able to obtain for 2003 do not include details for this group.

Some difficulties with federal occupational coding systems existed in the past and have not been addressed in the recent revisions of the SOC, notably the combination of biochemists and biophysicists into a single group of workers classed under the biological and life sciences. Many biochemists are trained by departments of chemistry, and that profession would like to be able to keep track of those people, but under both the old and new occupational classification systems, this is not easily done. A rough adjustment is possible by using data for the combined group of biochemists and biophysicists, since a large majority of these people comes from the chemistry side. A more conclusive adjustment might be feasible, using the Census DataFerrett system to produce explicit counts of biochemists from Current Population Survey microdata, but this approach requires detailed knowledge of CPS weighting schemes and is not a project easily undertaken by inexperienced analysts.

The new BLS data might seem to suggest that the number of STEM workers has returned to the levels reached in 2001, but this is not the case. First, the statistics include 434,000 science, computer system, and engineering managers who were not counted at all in the data for 1983-2002. Second, the estimated numbers of other computer specialists, apart from the systems managers, have increased by 608,000 workers — but this rise is due to better classification of the existing jobs, not new employment. For example, we have noted that new occupational codes include several kinds of computer jobs that were not defined at all in the past; those workers had to have been counted elsewhere. Where? In electrical and computer hardware engineering and engineering technology, to name some of the likely culprits. 2003 employment in these occupations is 477,000 persons *lower* than it was in 2002. More definitive analysis will become feasible soon, when BLS completes a current project that will generate detailed data on how the new SOC has changed assignments of occupational titles. When those results become available, we expect that still other people who are now counted as computer specialists will turn out to have been classed in the past in such non-STEM occupations as other kinds of specialized managerial and administrative positions.

Future activities of the STEM Workforce Data Project

This report suggests some next steps for this project, including more detailed treatment of trends for women and minorities, and closer looks at the effects of the new occupational codes. Other kinds of work are planned, dealing with such topics as foreign involvement in U.S. STEM activity; supplies of new talent; and policy implications of STEM workforce trends.