

# Fact Sheet 2009



## SCIENTISTS AND ENGINEERS: VITAL STATISTICS

### Current Numbers, Recent Growth and Decline

- In 2008, 3,488,000 workers in professional and related occupations were employed in computer and mathematical occupations, while 2,746,000 were employed in engineering occupations and 1,209,000 in life and physical science occupations. Together they accounted for 26.4% of the professional labor force.<sup>1</sup>
- From 1997–2007 the total number of jobs in the U.S. increased by 12.7 %, while:\*
  - ▶ Aerospace engineers increased by 48%, and civil engineers by almost 54%.<sup>2</sup>
  - ▶ Mechanical engineers decreased by 16%.<sup>3</sup>
  - ▶ Among the natural sciences, the number of chemists and materials scientists decreased 18%, and agricultural scientists decreased by nearly 40%.<sup>4</sup>
  - ▶ The number of medical scientists increased by 97.4%.<sup>5</sup>
  - ▶ Survey and mapping technicians increased by 21%, and the number of drafters decreased by over 15%.<sup>6</sup>

### 2006–2016 Job Projections Reflect Offshoring of High-Tech and IT Jobs

The latest projections by the U.S. Department of Labor, Bureau of Labor Statistics (BLS) show that due to the increasing exodus of highly skilled jobs overseas, the vast majority of occupations expected to experience the largest job growth from 2006–2016 are low-wage service occupations.

- In the 2006–2016 projections, network systems and data communications analysts was predicted to be the fastest growing job in America. Computer software engineers are growing rapidly both in terms of speed and size.<sup>7</sup>
- BLS projected that from 2004–2014, 794,000 high-tech jobs would be generated by the six most rapidly growing occupations, an average annual increase of 79,400 jobs. Now BLS anticipates an average annual increase of only 64,500 high-tech jobs from the five high-tech occupations expected to grow most rapidly from 2006–2016.<sup>8</sup>
- Comparing the five most rapidly growing occupations from the 2004–2014 projection period with the 2006–2016 projections for those same high-tech occupations, some of which have less growth, and others have more:

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\* **Note:** Due to 2003 changes in BLS occupational classification reporting, comparative 1997–2007 figures are approximations calculated using BLS’ “Conversion factors for the Census occupational and industry classifications, Table 5: *Distribution of employment from the 1990 to the 2002 Census Occupational Classification by detailed occupation*” (<http://www.bls.gov.cps.cpsoccind.htm>).

- ▶ 4,000 more computer software engineers, applications;
  - ▶ 47,000 less computer software engineers, systems software;
  - ▶ 7,000 less computer systems analysts;
  - ▶ 14,000 more network systems and data communications analysts;
  - ▶ 10,000 less database administrators.
- In all, nearly 150,000 fewer high-tech jobs are anticipated in the 2006–2016 period—just 81% of the 794,000 high-tech jobs originally projected in 2004 to be created by the most rapidly growing tech occupations.<sup>9</sup>
  - BLS projections for 2006–2016 put no high-tech jobs among the top ten occupations expected to create the most new jobs, with only three in the top thirty.<sup>10</sup>
  - While high-tech job growth in the U.S. slows, analysis of imports from 2001 through 2005 shows that payments for foreign computer and information services may have nearly doubled in these five years, while those for imported research, development, and testing services may have nearly tripled.<sup>11</sup>

### **Other Employment Changes, 2006–2016**

- Increases in the life, physical, and mathematical science occupations in the 2006–2016 projections are similar to previous estimates. Life scientists are projected to increase by almost 12.8% and physical scientists by about 15.7%. Mathematical scientists are projected to increase by 13.2%. The largest percentage increases in these areas are expected in medical scientists (20.2%), epidemiologists (13.6%), biochemists and biophysicists (15.9%), and environmental scientists (24.2%).<sup>12</sup>
- Jobs in the engineering field in general are projected to increase by 10.6% between 2006 and 2016, slightly more than the 10.4% anticipated for the work force as a whole. The greatest increases are expected in biomedical engineering (21.1%) and environmental engineering (25.4%).<sup>13</sup>
- Engineering technicians, excluding drafters, are projected to increase by 6.7%; drafters are expected to increase by 6%.<sup>14</sup>
- Life, physical, and social science technicians are projected to increase by 11.8%. Biological technicians are expected to increase by 16%.<sup>15</sup>

### **Offshoring and Guest Worker Policy Challenges the Entry-Level Workforce**

New data from the Current Population Survey (CPS) indicates that the long trend of strong U.S. demand for scientific and technical specialists ended after 2001 and had not resumed by 2006. Possible explanations for these changes are the increase of foreign workers on temporary visas in the United States and the offshoring of science and technology jobs.<sup>16</sup>

- The primary policy affecting professional employees, particularly those in science and technology fields, is the H-1B guest worker visa program. The H-1B visa program allows an employer to temporarily employ foreign workers in a specialty occupation.<sup>17</sup> Currently there is a cap on the number of H-1B visa holders set at 65,000 workers but it has been as high as

125,000 in the recent past.<sup>18</sup> The H-1B visa allows foreign workers to stay in the United States for a maximum of six years, although extensions and renewals of the visa are permitted.<sup>19</sup>

- The number of H-1B visa workers in the U.S. is larger than it appears. Cap exemptions for educational institutions, non-profits and other entities and an exemption for U.S.-educated foreign workers with advanced degrees allow 27,500 and 20,000, respectively, more foreign workers into the U.S. annually. In 2007 alone, 18,372 visas were approved for foreigners working in university and college education.<sup>20</sup> As a result of these exemptions and option for visa renewal, 230,000 foreign professionals get new or renewed guest worker visas and 125,000 existing visa holders renew annually.<sup>21</sup>
- The Department of Labor estimates that job openings in all the professional specialty occupations in the near future will average only 604,600 per year. Yet they reviewed and certified more than 960,000 H-1B applications between 2002 and 2005, nearly one-third of which were for computer and programming related industries.<sup>22</sup> In 2007 the Department of Labor approved 281,444 petitions of which 161,413 were visas for continuing employment and 119,805 were visas for initial employment. Of these approved applicants, 123,986 were in systems analysis and programming occupations, 11,290 were in computer-related occupations, 4,393 were in architecture and engineering occupations, and 3,877 were in civil engineering occupations.<sup>23</sup>
- The Center for Immigration Studies found that employers who used the Department of Labor's skill-based prevailing wage system classified most workers (56%) as being at the lowest skill level (Level I) as did most State Employment Security Agency (SESA) wage determinations (57%).<sup>24</sup>
- Despite the provision of the law stating that H-1B visa holders must be paid the prevailing wage, foreign guest workers make less than their American counterparts in the same occupations and locations. In 2005, the actual wages reported for H-1B workers were \$12,000 below the median wage for American workers in the same occupation and location. Eighty-four percent of H-1B workers made below the median U.S. wage and 51% were in the bottom 25<sup>th</sup> percentile of U.S. wages.<sup>25</sup>
- The H-1B visa program keeps IT wages from rising. According to a Congressional study conducted by the National Research Council, "**the current size of the H-1B workforce relative to the overall number of IT professionals is large enough to keep wages from rising** as fast as might be expected in a tight labor market."<sup>26</sup>
- Between 2005 and 2007, the median weekly earnings for computer systems analysts and scientists increased from \$1,091 to \$1,173 (in current dollars), which after adjusting for inflation represents an annual average increase of about 0.7%.<sup>27</sup> For computer operations and systems researchers and analysts the median wages decreased from \$1,252 to \$1,182 from 2005 to 2007, which after adjusting for inflation represents an annual average decrease of 6.2%.<sup>28</sup> While the current numbers increased overall during this period, the rate was unstable and fluctuated considerably. For computer programmers, the average weekly wage increased from \$1,086 in 2005 to \$1,232 in 2007, which after adjusting for inflation amounts to a change of 3.2% annually.<sup>29</sup>

### **Median Weekly Earnings Vary in 2007**

- Median weekly earnings for engineers ranged from a high of \$1,557 for aerospace engineers to a low of \$1,223 for industrial engineers in 2007.<sup>30</sup>
- For computer-related fields, median weekly earnings ranged from a high of \$1,455 for computer software engineers to a low of \$877 for computer support specialists. Among natural scientists, physical scientists other than chemists and environmental scientists earned a high of \$1,371, while biological scientists earned the low of \$1,004.<sup>31</sup>
- Among engineering and related technologists and technicians, surveying and mapping technicians earned the least, \$748, while engineering technicians other than drafters earned the most, \$902.<sup>32</sup>
- Women and minorities are more concentrated in the lower-paying technical occupations.<sup>33</sup>

### **Location Matters**

In 2005, high-tech opportunities differed by state, and more rural states had fewer jobs:

- ▶ Maryland, Massachusetts, Virginia, Colorado and Washington had the highest proportion of science and engineering jobs (6.8% to 8.4% of the workforce).
- ▶ The median earnings of workers in these states ranged from \$38,871 to \$45,659.
- ▶ Arkansas, Wyoming, Kentucky, Mississippi, and South Dakota have the lowest rates, from 2.4% to 3.3%.
- ▶ Median earnings in the states with low numbers of high-tech workers ranged from \$29,467 to \$33,203.<sup>34</sup>

### **Educational Requirements and the Declining Number of IT Students**

The increase in offshoring of junior IT jobs (from entry level programmers to end-user support) means that there are less job opportunities for recent graduates and fewer incentives for students to major in computer science or related fields.<sup>35</sup>

About two-thirds of the IT workforce has a bachelor's degree or higher. The fields of study are:

- ▶ 46% in IT and Computer Engineering,
- ▶ 26% in Math and Science,
- ▶ 14% in Other Engineering,
- ▶ 6% in Business,
- ▶ 8% in Other.<sup>36</sup>

The 2004–2005 Taulbee Survey reports that enrollment in computer science and engineering degree programs has dropped since its peak in 2002–2003.<sup>37</sup>

The number of undergraduate IT majors has declined by 23% in 2003–2004, 10% in 2004–2005, and 21% in 2005–2006.<sup>38</sup>

Researchers believe the fall off in recent enrollment is significant but not justified in terms of job prospects. Instead, they see an over-focus on computer science and software engineering degrees as a source of IT workers, since less than a third of the workforce have these degrees.<sup>39</sup>

Highly qualified U.S. students are citing uncertainty in the future of domestic science and engineering resulting from an increasing H-1B workforce and increased outsourcing as a motivating factor in causing them to pursue other career opportunities.<sup>40</sup>

### **Women's Situation**

Women's participation in science, engineering, and technical occupations increased from 1995–2007, although women are still underrepresented in many fields, particularly in mathematical and computer science and engineering.

- Women are well-represented in medical and biological sciences, where they were 45.5% and 42%, respectively, of the scientists in 2007. However, they accounted for less than 25.6% of environmental and geoscientists in 2007.<sup>41</sup>
- In 2007, women comprised 14.6% of the engineering workforce. A study by the Commission on Professionals in Science and Technology found that this is only a small increase since 1983. The largest proportion of women was in industrial engineering, where women were 37.9% of the field. On the low end, only 7.8% of mechanical engineers were women.<sup>42</sup>
- Nearly 22.2% of engineering technicians were women in 2007, along with 36.8% of chemical technicians.<sup>43</sup>
- In 2005–06 women earned 17.8% of bachelor's degrees, 23.5% of master's degrees, and 20.2% of doctorates in engineering and engineering technologies. They also earned 41.7% of bachelor's degrees, 39.7% of master's degrees, and 30% of doctorates in physical sciences and science technologies.<sup>44</sup> In 2005–06 as in 2001, women earned the majority of bachelor's and master's degrees in biological/life sciences.<sup>45</sup>
- Women increased their presence in natural sciences, particularly in medical science where they now account for nearly half of total employment. The only other comparable area is biological technicians.<sup>46</sup>
- In computer science, the percentage for women in these jobs was lower in 2002 than in 1983. Yet, the overall growth in this field was so strong that the absolute numbers of women in the field rose through the year 2000 and then started to decline.<sup>47</sup>
- In almost every field, men's weekly median earnings were approximately 20% higher than women's.<sup>48</sup>

### **Blacks and Hispanics: Underrepresented and Underpaid**

Blacks and Hispanics are severely underrepresented in science and engineering:

- ▶ In 2007, Blacks were 11% of the labor force, but only 5.4% of environmental scientists, 8.8% of computer scientists, and 5.3% of engineering occupations.<sup>49</sup>

- ▶ Blacks held 8.3% of engineering technician positions in 2007; they were also poorly represented among chemical technicians, where they constituted 7.4% of this (relatively lower-paying) occupation.<sup>50</sup>
- ▶ Participation in science and engineering occupations is even lower for persons of Hispanic origin. Hispanics were 14% of the labor force in 2007, but only 0.3% of environmental scientists, 5.6% of computer scientists, and 6.4% of engineers.<sup>51</sup>
- ▶ Hispanics were more equally represented in technician and technologist occupations, at 14.5% of chemical technicians, and over 11.2% of engineering technicians in 2007.<sup>52</sup>
- ▶ In nearly every science and engineering occupation, white men's median weekly earnings were higher in 2007 than those of Black men and women, Hispanic men and women, and white women.<sup>53</sup>
- ▶ Among math and computer scientists, white men earned 10.2% more than Black men, almost 13.2% more than Hispanic men, 16.2% more than white women, 26.2% more than Black women, and 39.4% more than Hispanic women.<sup>54</sup>
- ▶ Among scientists and engineers, Blacks and Hispanics were more likely than whites to be unemployed in 2002. Among technicians and technologists, Blacks were more likely to be unemployed than either whites or Hispanics.<sup>55</sup>

### **Union Membership**

- Union membership fluctuated between 1995 and 2007 within these occupations, increasing slightly among scientists and declining slightly among engineers and technicians.<sup>56</sup>
- In 2007, the highest union membership rate in the sciences was among conservation scientists and foresters (13.3%); in engineering, among environmental engineers (15%); and among engineering technicians (16.5%) and aerospace technicians (11%).<sup>57</sup>
- Among those technologists and technicians for which data is available (engineering technicians other than drafters), unionized workers earned an average of \$25.23 an hour, compared to an average hourly wage of \$21.99 for non-unionized workers. This amounts to a wage premium of over 14% for those belonging to unions.<sup>58</sup>
- In some cases, scientists and engineers who are non-union earn more than those who are union members. This is because a far greater proportion of scientists and engineers in government and academia are organized than in the higher-paying private industry, where most scientists and engineers work.<sup>59</sup>

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<sup>1</sup> U.S. Department of Labor, Bureau of Labor Statistics, <http://www.bls.gov/cps/home.htm#annual>, Table 11.

<sup>2</sup> U.S. Department of Labor, Bureau of Labor Statistics, *Ibid*; *Employment and Earnings*, Volume 40, No. 1, Table 11.

<sup>3</sup> *Ibid*.

<sup>4</sup> *Ibid*.

<sup>5</sup> *Ibid*.

<sup>6</sup> *Ibid*.

<sup>7</sup> Hecker, Daniel, "Occupational Employment Projections to 2010", U.S. Department of Labor, *Monthly Labor Review*, November 2001; "Occupational Employment Projections to 2012", U.S. Department of Labor, *Monthly*

*Labor Review*, February 2004; “Occupational Employment Projections to 2014”, U.S. Department of Labor, Monthly Labor Review, November 2005.

<sup>8</sup> *Ibid.*

<sup>9</sup> *Ibid.*

<sup>10</sup> *Ibid.*

<sup>11</sup> Ellis, R.A. “Is U.S. Science and technology adrift?”, STEM Workforce Data Project: Report No. 8, Commission on Professionals in Science and Technology, 2007.

<sup>12</sup> *Ibid.*

<sup>13</sup> *Ibid.*

<sup>14</sup> *Ibid.*

<sup>15</sup> *Ibid.*

<sup>16</sup> *Ibid.*

<sup>17</sup> “H-1B Specialty (Professional) Workers”, Employment and Training Administration, Department of Labor, 2007.

<sup>18</sup> U.S. Government Accountability Office, Report to Congressional Requesters, “H-1B Visa Program: Labor Could Improve Its Oversight and Increase Information Sharing with Homeland Security”, June 2006.

<sup>19</sup> “H-1B Specialty (Professional) Workers”, Employment and Training Administration, Department of Labor, 2007.

<sup>20</sup> “H-1B Petitions Approved by Detailed Occupation of Beneficiary and Type of Petition (Number): Fiscal Year 2006 and 2007”, *USCIS*.

<sup>21</sup> U.S. Government Accountability Office, Report to Congressional Requesters, “H-1B Visa Program: Labor Could Improve Its Oversight and Increase Information Sharing with Homeland Security”, June 2006.

<sup>22</sup> *Ibid.*

<sup>23</sup> “H-1B Petitions Approved by Detailed Occupation of Beneficiary and Type of Petition (Number): Fiscal Year 2006 and 2007”, *USCIS*.

<sup>24</sup> Miano, John. “Low Salaries for Low Skills: Wages and Salaries for H-1B Computer Workers”, Center for Immigration Studies, 2007.

<sup>25</sup> *Ibid.*

<sup>26</sup> National Research Council, *Building a Workforce for the Information Economy*, 2001.

<sup>27</sup> U.S. Department of Labor, Bureau of Labor Statistics, *Current Population Survey*, 2006.

U.S. Department of Labor, Bureau of Labor Statistics, *Current Population Survey*, 2007.

<sup>28</sup> *Ibid.*

<sup>29</sup> *Ibid.*

<sup>30</sup> U.S. Department of Labor, Bureau of Labor Statistics, <http://www.bls.gov/cps/home.htm#annual>, Table 11; Volume 40, No. 1, Table 11.

<sup>31</sup> *Ibid.*

<sup>32</sup> *Ibid.*

<sup>33</sup> *Ibid.*

<sup>34</sup> Population Reference Bureau, Population Data Sheet, 2007.

<sup>35</sup> Babin, Ron and Kenneth A. Grant. “Factors Impacting the Supply and Demand of IT Workers in Canada and the USA”, School of Information Technology Management, Faculty of Business, Ryerson University, Toronto, ON, EDSIG, 2006.

<sup>36</sup> *Ibid.*

<sup>37</sup> *Ibid.*

<sup>38</sup> *Ibid.*

<sup>39</sup> *Ibid.*

<sup>40</sup> Salzman, Harold. “Globalization of R&D and Innovation: Implications for U.S. STEM Workforce and Policy”, Statement submitted to the Subcommittee on Technology and Innovation, November 6, 2007.

<sup>41</sup> U.S. Department of Labor, Bureau of Labor Statistics, <http://www.bls.gov/cps/home.htm#annual>, Table 39.

<sup>42</sup> *Ibid.*

<sup>43</sup> *Ibid.*

<sup>44</sup> Digest of Education Statistics: 2007, Table 265, Bachelor’s, Master’s, and Doctoral degrees conferred by degree granting institutions by sex of student and field of study: 2005–06.

[http://nces.ed.gov/programs/digest/d07/tables/dt07\\_265.asp?referrer=list](http://nces.ed.gov/programs/digest/d07/tables/dt07_265.asp?referrer=list)

<sup>45</sup> *Ibid.*

<sup>46</sup> Commission on Professionals in Science and Technology, [http://www.cpst.org/STEM\\_Report.cfm](http://www.cpst.org/STEM_Report.cfm), “Employment of Women in Science and Technology”.

<sup>47</sup> *Ibid.*

<sup>48</sup> *Ibid.*

<sup>49</sup> Employment and Earnings, <http://www.bls.gov/cps/home.htm#annual>, Table 11.

<sup>50</sup> *Ibid.*

<sup>51</sup> *Ibid.*

<sup>52</sup> *Ibid.*

<sup>53</sup> U.S. Department of Labor, Bureau of Labor Statistics, Table A-2 (unpublished).

<sup>54</sup> *Ibid.*

<sup>55</sup> Scientists and Engineers Statistical Data System (SESTAT), op. cit.

<sup>56</sup> BNA Plus, Union Membership and Earnings: Compilations from the Current Population Survey, 2007 edition.

<sup>57</sup> *Ibid.*

<sup>58</sup> *Ibid.*

<sup>59</sup> *Ibid.*

*The Department for Professional Employees, AFL-CIO (DPE) comprises 24 AFL-CIO unions representing over four million people working in professional, technical and administrative support occupations. DPE-affiliated unions represent: teachers, college professors, and school administrators; library workers; nurses, doctors, and other health care professionals; engineers, scientists, and IT workers; journalists and writers, broadcast technicians, and communications specialists; performing and visual artists; professional athletes; professional firefighters; psychologists, social workers and many others. DPE was chartered by the AFL-CIO in 1977 in recognition of the rapidly-growing professional and technical occupations.*

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