

2013 ENGINEERING SALARY SURVEY

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Is There Really A Shortage Of Engineers?

One of the things we keep hearing again and again is the refrain about the dire shortage of engineers. I think this so-called shortage is a myth. Where are the statistics to back it up? Is there a real hiring crisis or not? The real answer is probably yes and no.

Yes, there is a shortage of some critical engineering talent in some sectors. Analog/linear and RF/microwave design engineers are good examples. Programming talent is also in high demand. Yet companies create their own shortages by so narrowly defining job openings that there is little hope of ever finding just the right mix of education and specific experience.


However, the answer may be no for other engineering categories (see “2013 Engineering Salary Survey: Pressure Up, Salaries Down,” p. 26). Are there huge numbers of engineers out of work? Maybe some, but they may be engineers who are dated in their knowledge and skills. Do we really need all those H-1B visas to attract foreign engineers and programmers?

This purported shortage is creating another crisis in education. The general opinion is that we are not educating enough science, technology, engineering, and math (STEM) students to fill all those open and future positions (see “What Should Colleges Be Teaching EEs?” at *electronicdesign.com*). As a result there is an enormous number of programs in high schools, community colleges, and universities to recruit students for STEM jobs. And the students are not responding. They generally hate the rigor and geekiness of engineering.

But what if we do start magically producing more STEM graduates? Fat chance that will happen, but if it does, will we be graduating students into a marketplace with few available jobs? That may be happening now given the continuing high unemployment rate. Who really knows?

Robert Charette, in his article “The STEM Crisis Is a Myth” in the September issue of *IEEE Spectrum*, says that there is no looming shortfall of STEM workers. He backs it up with some facts and figures. If this topic interests you, by all means take a look. I agree with his assessment, and you may too after reading it.

By my own barometer, there are some shortages in unique specialties of engineering, but not an overall shortage crisis. I do see a real shortage of skilled technology workers like manufacturing techs, machinists, repairmen, and installers. There are indeed jobs going unfilled simply because the youth of today just are not interested in such blue-collar jobs.

Our millennials (generation Y, ages roughly 15 to 29) are enamored of technology and are heavy users, but they have no interest in learning the math and science required to fill such jobs. Even the military rejects about 30% of applicants because of their poor math and science knowledge. How do we solve this problem? 

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It's almost ironic. We're living in a time when engineering has never been more important. From communications devices in the hands of most people on the planet to the intelligence that is being embedded into manufactured goods at an unprecedented scale, engineering solutions have never been in higher demand.

Yet market dynamics are seemingly conspiring to undermine the ability of many engineers to make a decent living. Many engineers find themselves unemployed. Those who are employed are seeing their compensation erode even as they put in long hours.

Many factors are contributing to this somber situation. Globalization is placing downward pressure on wages. Advances increasingly seem to deliver incremental outcomes, rather than transformative ones. And there just isn't enough oxygen in the economy to fuel the kind of recovery that would really heat up the engineering job market.

So this year when we surveyed the experiences and views of nearly 3000 U.S. engineering professionals, we had to take a look at some very sobering realities. We hope that the resulting insights will be of value to you, even if it's only to let you know that you are not alone in your struggles—and that these are indeed pressure-packed times for the engineering profession.



2013 ENGINEERING SALARY SURVEY: PRESSURE UP, SALARIES DOWN

EE UNEMPLOYMENT REMAINS HIGH

The unemployment rate for electrical and electronics engineers increased sharply in 2013. According to data from the U.S. Labor Department Bureau of Labor Statistics (BLS), engineering jobs in the first quarter of 2013 declined by 40,000 and the unemployment rate for engineers rose to 6.5%. The industry lost another 3000 jobs during the second quarter, although the unemployment rate dropped somewhat to 4.5% in Q2 for technical reasons.

By comparison, in both 2011 and 2012 the unemployment rate for EEs was just 3.4%. Last year there were 335,000 EEs counted in the workforce. At the midway point this year, the number was estimated at just 292,000.

The IEEE-USA sees the unemployment rate for engineers getting worse if the proposals to increase H-1B visas now making their way through Congress are successful. The organization has long opposed efforts to raise the H-1B cap.



AVERAGE SALARIES BY LEVEL OF EDUCATION	Base salary	Total compensation
Doctoral degree	\$115,824	\$127,144
Master's degree	\$104,755	\$113,550
Bachelor's plus graduate studies	\$98,654	\$107,488
Bachelor's degree	\$93,524	\$101,904
High school or less	\$89,143	\$96,260
Attended college	\$77,000	\$84,121
Associate's degree	\$71,287	\$77,290

Speaking before the House Judiciary Committee Subcommittee on Immigration and Border Security earlier this year, IEEE-USA representative Bruce Morrison testified in support of permanent employment-based visas for science, technology, engineering, and mathematics (STEM) professionals but criticized proposals to increase America's reliance on H-1B temporary visas.

"We hear all the time that this is a nation of immigrants," Morrison said. "No one has ever said this is a nation of guest workers."

ALL EYES ON VISAS

Now that Congress has returned from its summer break, House Republican leaders are expected to resume work on their plan for high-skill immigration as part of a broader immigration strategy in part as a response to the plan adopted by the Senate in May. Backers of the Senate plan insist it has the potential to both increase the number of available H-1B visas for foreigners working in specialty occupations and shift the visa system to a more merit-based structure favoring STEM workers.

According to the BLS, five years from now nearly all of the 30 fastest-growing occupations will require quantitative skills and technical STEM knowledge. Supporters of the bipartisan legislation—including Google, Microsoft, IBM, Facebook, and other major tech companies—insist businesses cannot find the skills they require in the domestic labor market and need access to a bigger, global pool of STEM workers. Their hope is that companies will be able to attract more of the world's bright minds in engineering and technology by permitting these workers to stay in the U.S.

But others argue that there are plenty of engineers already in the U.S. who can do the job and that H-1B workers don't come with special skills, just lower wages. "Companies complain about 'no workers available' but are laying off experienced workers and replacing them with H-1B and offshore workers," one engineer lamented in a response to our survey. "The people who are hiring are paying entry-level wages or are demanding 60-hour workweeks."

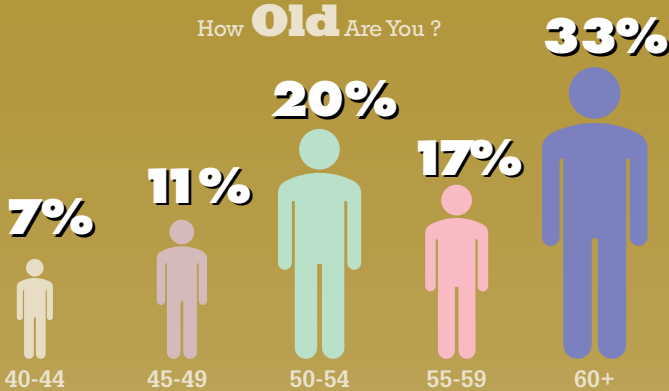
There appears to be broad support in both chambers of Congress for increasing H-1B visas for the technology industry and for making STEM green cards available to foreigners who graduate from U.S. universities. The Senate immigration bill would permit up to 180,000 H-1B visas and allow for unlim-

AVERAGE SALARIES BY YEARS OF ENGINEERING EXPERIENCE	Base salary	Total compensation
30-34 years	\$108,953	\$117,574
25-29 years	\$102,362	\$111,076
40 years or more	\$100,411	\$109,625
20-24 years	\$99,872	\$108,461
35-39 years	\$98,779	\$107,696
15-19 years	\$94,935	\$104,080
10-14 years	\$78,845	\$87,677
Less than 1 year	\$77,464	\$82,653
5-9 years	\$72,949	\$80,592
1-4 years	\$58,106	\$63,516

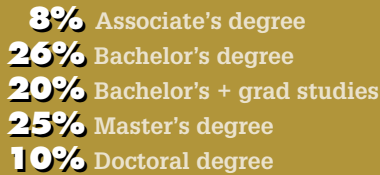
AVERAGE SALARIES BY SIZE OF COMPANY	Base salary	Total compensation
\$5 billion - \$9.9 billion	\$120,457	\$130,196
\$10 billion or more	\$115,705	\$127,151
\$500 million - \$999.9 million	\$114,434	\$123,689
\$1 billion - \$4.9 billion	\$108,381	\$118,549
\$100 million - \$499.9 million	\$105,899	\$114,596
\$25 million - \$49.9 million	\$103,863	\$111,851
\$50 million - \$99.9 million	\$99,860	\$108,002
\$5 million - \$9 million	\$98,756	\$107,568
\$10 million - \$24.9 million	\$91,975	\$99,935
Less than \$5 million	\$78,395	\$85,775

The Typical Engineer

How **Old** Are You ?



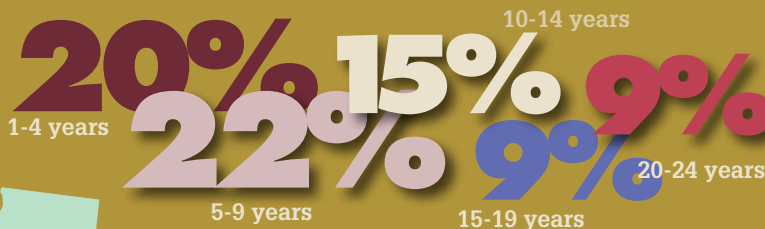
What Is Your Highest Level Of **Education** ?



How **Long** Have You Worked In Engineering?



How **Long** Have You Worked At Your Present Company?



What **State** Do You Work In?



ited green cards for U.S. STEM grads. The high-skill bill likely to be taken up in the House is the Skills Visa Act, which raises the H-1B cap to 155,000 from 65,000 and doubles the number of H-1B visas set aside for U.S. STEM grads to 40,000.

Lawmakers have chosen to advance the cause of skilled immigration at the same time as they grapple with more controversial immigration-related issues, so none of the visa reforms sought by the tech industry will be resolved unless the House and Senate can settle their differences over what to do about the more than 11 million undocumented aliens already in the U.S.

Still, the IEEE-USA believes it would be better to have an immigration policy based on "green cards, not guest workers" because those with green cards hold their own visa, as opposed to H-1B workers whose visa is held by the company. Numerous government studies have found that H-1B fraud and abuse is rampant. In fact, the IEEE-USA cited an analysis of government data that showed the top 10 users of H-1B visas last year were offshore outsourcers.

"This is another reason why our country should rely more on green cards for skilled workers, not H-1B visas," said IEEE-USA president Marc Apter. "Green card holders are free to start their own companies and create jobs in the United States. H-1B holders are not."

PERCEPTIONS OF H-1B HIRING

About one in five survey participants say they work at an organization that hires engineers with temporary H-1B visas. Nearly a third (32%) of those working at such firms say their company is looking to employ more H-1B workers in the coming year.

"They'll work for less, tolerate bad treatment, and then leave after a few years," complained one survey participant. "They'll then be followed by another younger H-1B holder who'll pull

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the bar even lower. Every H-1B visa holder means one more American engineer out of work. The 2012 graduates from engineering programs at most colleges are still looking for jobs. And less than a quarter of the grads in this region, which is home to four universities, are finding jobs in their field.”

Another wrote: “They have generally demonstrated their capability as competent engineers. However, they have often been hired as contractors on a per-project or per-task basis. While this type of limited employment is a boon for employers, it is anathema for anyone currently in or looking for full-time continuing employment.”

Interestingly, only 41% of those surveyed agree that hiring H-1B visa workers threatens opportunities for U.S. engineers. Fewer than 10% feel personally threatened by engineers with H-1B visas, although that number jumps to 17% for engineers who work at companies that hire H-1B visa workers.

“I believe my skills and expertise keep me in a secure position,” explained one engineer. “Specialized work requires specialized skills, and you cannot readily obtain my level of experience and talent.”

Other representative comments from survey participants included:

- “Many of the H-1B engineers I have worked with have looked to me for guidance and mentoring. These individuals have participated on our teams and contributed to our product improvements.”
- “They have book smarts, but often do not have other sensibilities that make them a better engineer, such as a cultural understanding of customer needs and understanding how to make things work in a large organization. In general, they are used in narrowly focused areas of research or development.”
- “American engineers still cannot be matched or beaten with respect to creativity, passion for product delivery, and their desire to make an impact on society with their hard work.”

The bottom line, however, seems to be that the very phenomenon of the H-1B worker has a deleterious impact on the psyche of the American engineer. As one put it: “The stress of always being told that some low-income H-1B is standing in line for your job, along with the lack of respect from the organization and the long work hours, sometimes makes you feel the job’s not worth it.”

WAGE STAGNATION

After three years of modest increases, engineering salaries have stalled. Base salaries and bonuses were off slightly in 2013, and employers were even more tightfisted with stock options (down 6%) and other sources of income (down 4%). All told, the average total income for engineers was \$105,028 in 2013—down \$1070, or 1% from 2012 levels.

“Engineering salaries in my company seem to have hit a ceiling,” lamented one respondent. “Significant income potential beyond this seems like it’s available only to managers, who are only modestly skilled.”

As wages stagnate, engineers appear to be throttling back a bit on the hours they’re willing to put into their jobs. Last year, engineers averaged a 53-hour workweek (41 hours in the office

AVERAGE SALARIES BY TYPE OF DESIGN WORK YOU DO	Base salary	Total compensation
ICs and semiconductors	\$127,690	\$142,531
Military products	\$121,584	\$129,689
Computer product design (supercomputers, mainframes, workstations, servers, PCs, notebooks/laptops, peripherals, boards, etc.)	\$117,117	\$128,135
Medical products	\$111,649	\$122,455
Software design/development/programming	\$110,782	\$119,365
Mobile equipment	\$110,778	\$119,153
Avionics, marine, or space	\$110,588	\$117,418
Materials handling equipment/services	\$98,750	\$111,550
Safety/security	\$101,661	\$111,191
Automotive products	\$99,803	\$107,162
Communications systems and equipment (local-area/wide-area networking products, wireless, cellular, RF and microwave, Bluetooth, etc.)	\$93,408	\$102,737
Test and measurement equipment	\$92,476	\$99,812
Consumer products	\$91,092	\$98,138
Industrial controls systems and equipment (including robotics)	\$89,365	\$97,968
Research & development	\$87,369	\$94,575
Components and subassemblies	\$86,845	\$93,755
Power design	\$84,523	\$92,189
Other (please specify)	\$82,682	\$91,079
Machine tool/automation	\$74,952	\$81,764
Packaging	\$65,200	\$76,875
Appliance	\$65,000	\$69,750
AVERAGE SALARIES BY JOB FUNCTION	Base salary	Total compensation
Executive/operating management	\$107,063	\$120,598
Engineering management	\$109,707	\$119,578
Design & development engineering	\$96,155	\$104,072
Other engineering	\$85,740	\$92,725
Other	\$82,066	\$90,590

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plus an additional 12 hours at home). This year, that number was closer to 49. Companies have cut the number of hours engineers spend moving between locations and on call this year, too.

Also, 40% of engineers believe their compensation is competitive with what other employers are paying for similar work, while 43% feel it's less competitive. "The only way to gain pay increases today is by changing employers," one respondent opined. "Staying with the same employer will only get you cost-of-living salary increases."

On average, design & development engineers earned a base salary of \$96,155 this year and a total compensation of \$104,072. The engineering job titles that commanded the most money this year were software engineering managers (\$141,600), VPs of engineering (\$133,051), technical directors (\$127,475), group/team leaders (\$116,169), and chief/principal engineers (\$115,244).

Engineering managers, by the way, were not immune from the drop in income in 2013. On average, they earned \$109,707 in base salary and \$119,578 in total compensation—a nearly 5% dip in their paycheck.

STAYING POSITIVE

Surprisingly, despite current wage stagnation, engineers are more likely than they have been in a while to agree that engineering offers the same opportunity for salary advancement that it did five years ago. This may be in part because 2008 was five years ago—and there's a sense that the global economy hit rock bottom then. But it's also because market forces continue to shift. As one respondent observed: "A skills shortage combined with Boomers exiting the job market has made recruitment of skilled labor difficult."

But not everyone has a rosy outlook about the future. "The economy has been shrinking, manufacturing has moved overseas, and many engineering jobs have moved overseas," remarked one engineer. "Companies are looking for the cheapest talent, so experience and knowledge do not seem to command the value they once did. There is an idea, pervasive in today's culture, that anybody can do any job. Perhaps this is because there is so much information easily available at the touch of a keyboard."

Geographic location also plays a big role in determining what engineers make. As in the past, the Pacific region is still on top with total incomes averaging \$122,137, followed by the West South Central region (\$114,251) and the New England states (\$113,197).

The market segments also play a key role in compensation. Chip houses led the way in engineering pay again this year at \$139,852, followed by software houses (\$132,385), computer



AVERAGE SALARIES BY AGE	Base salary	Total compensation
50-54	\$103,437	\$112,353
55-59	\$103,806	\$111,974
45-49	\$98,002	\$107,926
60 or older	\$96,596	\$105,050
40-44	\$94,464	\$102,912
35-39	\$82,848	\$91,696
30-34	\$68,597	\$76,059
25-29	\$67,811	\$74,973
Under 25	\$53,083	\$58,377
AVERAGE SALARIES BY SIZE OF COMPANY	Base salary	Total compensation
\$5 billion - \$9.9 billion	\$120,457	\$130,196
\$10 billion or more	\$115,705	\$127,151
\$500 million - \$999.9 million	\$114,434	\$123,689
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\$5 million - \$9 million	\$98,756	\$107,568
\$10 million - \$24.9 million	\$91,975	\$99,935
Less than \$5 million	\$78,395	\$85,775
AVERAGE SALARIES BY GEOGRAPHIC REGION	Base salary	Total compensation
Pacific	\$112,057	\$122,137
West South Central	\$104,770	\$114,251
New England	\$104,547	\$113,197
South Atlantic	\$101,539	\$111,294
Mid-Atlantic	\$99,629	\$107,221
Mountain	\$97,585	\$106,178
East North Central	\$92,736	\$100,398
West North Central	\$92,586	\$99,255
East South Central	\$85,500	\$92,188

OEMs (\$121,972), government/military contractors (\$121,672), and medical electronics firms (\$120,055).

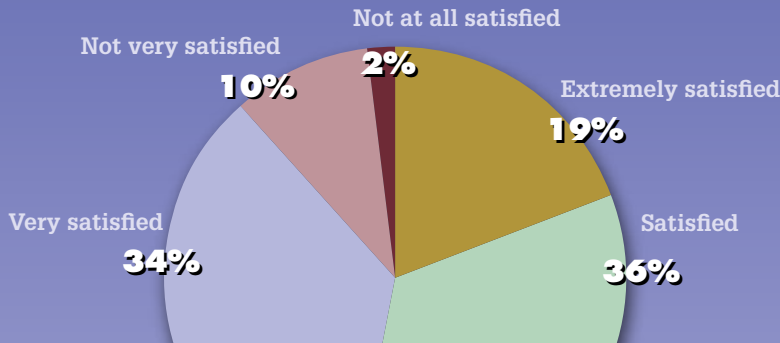
GOTTA LOVE IT

Despite pay and job issues, engineers remain high on the profession. Nearly 90% say they would recommend engineering to a young person looking to choose a career. "Despite the salary stagnation I have experienced, engineering is still a very interesting and fulfilling profession," wrote one engineer. "My own son just graduated from engineering school last year and is now working as an aerospace engineer. He's loving it!"

"I found it extremely rewarding and challenging," said another. "Owning a company, being its creative core, allows

Importance Of Job Satisfaction

How Satisfied Are You In Your Current Position?



Does Your Work **Challenge** You Intellectually?



Do You Ever Consider **Leaving** Engineering?



Why Would You Leave Engineering?



Would you recommend engineering as a career path?



me to continue to learn and grow. Not too many other fields offer that type of independence. I have hired local college engineering students to encourage them to continue in this path.”

Others are more sanguine. “There doesn’t seem to be much room for advancement, and not as many positions are available today as there once were,” said one engineer. “Salary expectations from new grads are over twice what is available.”

Still, on the upside, nearly nine in 10 respondents say they enjoy their jobs, and an equally high number find their jobs at least somewhat challenging. Typical comments included:

- “Challenges faced by engineers in their professional tasks are far more interesting and rewarding (once solved) than in any other field.”
- “It is still exciting and challenging. Most engineering-type personalities would be bored in any other field.”
- “The challenges to fix real-life problems really get you going. There’s great satisfaction that comes from solving issues and problems faced by folks in everyday life.”

About two-thirds of the engineers surveyed say they feel adequately compensated for the work they do. As one clearly contented survey participant put it: “Name another profession where your employer buys all the cool toys and then pays you to ‘play’ with them. It is a profession where you can learn something new every hour of every day.”

Not everyone is feeling the love, however. “Competition from less expensive foreign talent, and the tendency of professionals to retire later, make job openings a little more scarce,” said one disgruntled engineer. “Additionally, many companies seem to have decided to adhere to five-years-ago salary offers, seem less willing to help employees develop more skills, and won’t even discuss pay increases.”

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But just because engineers aren't thinking about going anywhere soon, it doesn't mean they couldn't be enticed if the right offer came along. "If given the option to take on more of a managerial or finance-style role within an engineering company, I would be interested," an industrial controls engineer declared. "Or if I could find an easier position in another capacity with the same pay, it would be tempting."

While only 7% of respondents say they're actively seeking a new position, one in four said they would follow up if they heard about an interesting opportunity somewhere else. Another third would listen to an offer if personally approached.

"There are literally hundreds of thousands of exciting, smart, useful products just waiting to be brought to creation out there with what is available today in off-the-shelf, economical, software and hardware," a respondent said. "And engineers are the folks that are going to make it happen."

Fewer than a third say they would ever consider leaving the profession. "We are in a more technologically advanced age than ever before," said one. "The drive for renewable energy, greater efficiency, greater portability means there are many opportunities and not enough engineers to fill the roles."

Most of the engineers we heard from who have considered leaving the profession pointed to the frustrations and stress. Here is one example of the venting our survey elicited:

"Engineers get a bad deal in most companies. They are forced to work under unrealistic deadlines without sharing in rewards that management does. If you want to stay in engineering as a career, you turn down management roles, which caps your promotion, salary, and bonus potential. On the other hand, if you take on management responsibility, you quickly lose touch with your engineering skills. Bottom line is that most engineering organizations are horribly understaffed, which makes the job very high-stress. I've had enough of that. Eventually, I formed my own consulting company and for the first time in 15 years I am not stressed out all the time, yet get to work in technology and management as I choose."

KEEPING CURRENT

Most engineers still see their biggest challenge as remaining current with new and emerging technologies. Many find it nearly impossible to research and sift through all the information that's available while continuing to do the job at hand. "I cover a broad range of products for a wide range of applications and customers," said one engineer. "It can be easy to miss something when there are so many things to keep track of."

"I find myself trying to balance my own engineering interests against the engineering needs of my company," said another engineer. "Trying to filter out and focus on meaningful engineering developments... there's simply so much more going on."

In addition to reading technology journals like *Electronic*

Design, engineers rely on white papers (67%), webcasts (60%), seminars (58%), textbooks (48%), trade shows (45%), and vendor-sponsored education (44%) to keep up to date.

"I try not to follow the flavor-of-the-month for design trends—sticking to basic principles," said another engineer. "Also, the complexity of system-on-chip devices can lead to information overload when trying to master new devices."

Unfortunately, engineers are on their own for the most part when it comes to keeping their skills and knowledge current. Barely half are reimbursed by their company for conferences (57%) and seminars (56%), while only about a third are reimbursed for engineering textbooks. "There's no budget for engineering education," complained one respondent. "And vendor-sponsored education is usually more of a sales pitch than real education."

Some positive indicators did pop up in our survey. Only 11% of survey respondents foresee their company scaling back engineering staff in the coming year, and 28% expect their company to increase the number of engineering jobs.

Nearly half the engineers we surveyed say their company is having difficulty finding qualified candidates to fill their open

WAYS ENGINEERS ARE EARNING THEIR BONUSES TODAY	
Personal performance	49%
Performance of company or division	48%
Profit sharing	23%
Patent awards	12%
Project milestone completion	10%
Certification/training	5%
Retention bonus	4%
Other	12%
SIGNING BONUSES/INCENTIVES FOR NEW ENGINEERING HIRES	
My company has never offered them	65%
We used to offer them, but don't anymore	15%
We stopped offering them, but have started to again	3%
We've always offered them	17%
TOP 10 PERKS IN 2013	
Health benefits	56%
401(k) match	49%
Time off	39%
Further education/training	20%
Pension plan	18%
Professional organization dues	15%
Company phone	15%
Stock options	13%
Tuition reimbursement	12%
Stock purchase plan	12%

engineering positions. The jobs cited as the toughest to fill include analog designers, software engineers, systems engineers, and embedded systems designers. Perhaps it's not surprising then that nearly half the engineers we surveyed say a recruitment specialist or headhunter seeking engineering talent had approached them within the past year.

However, while engineers say their companies are struggling to find qualified candidates to fill open positions, an alarming 70% don't feel their company is as focused on employee retention this year as they were a year ago. "There is a constant apprehension that engineers are somehow expendable or that our work could be outsourced," said one engineer. "It seems like they don't care about retaining the knowledge gained through years of experience."

"With the overall financial crisis, retention is not a priority," said another. "Upper management relies on unemployment woes alone to keep sufficient staff. As a result, the best people end up going away."

Others noted that companies were beginning to wake up to the issue. "HR has been hearing the rumors of dissatisfaction and watched as the number of people leaving for other opportunities has increased," one engineer told us. "Now, after the fact, they are trying to stop the outgoing momentum."

WHITHER THE "RESHORING" BOOM?

One of the more interesting economic predictions in recent years has been that U.S. manufacturing is on the verge of a dramatic revival. As the theory goes, labor costs in China and other developing nations are on the rise. When you factor in the cost of international shipping and inventory, the cost advantages of manufacturing overseas are being diminished or even erased. Throw in the recent shale-gas boom here at home promising a new age of cheap natural gas and energy independence, and you've got a recipe for hundreds of thousands of new U.S. manufacturing jobs.

The debate over outsourcing and offshoring even took center stage in the 2012 Presidential race. As a result, there has been even greater focus on bringing manufacturing jobs back to America. Estimates suggest that many companies underestimate the real cost of offshoring by as much as 30% and fail to fully understand the risk to their supply chains.

"They still think that it's cheaper to manufacture overseas, while the real costs of doing so are ignored," railed one respondent to the survey.

Others believe outsourcing is baked into the political system. "There are just too many tax incentives for doing business overseas," said one engineer. "The U.S. tax system discourages domestic investment."



DOES YOUR COMPANY CURRENTLY HIRE ENGINEERS WITH H-1B WORK VISAS?

Yes	19%
No	51%
Don't know	30%

H-1B VISA APPROVALS—FIVE-YEAR TREND

YEAR	Approved
2008	98,014
2009	80,283
2010	69,266
2011	99,591
2012	134,780

Initial petition requests that were approved; does not include renewals. Source: U.S. Citizenship and Immigration Service

UNEMPLOYMENT RATE FOR EEs

YEAR	Approved
2009	6.4%
2010	5.4%
2011	3.4%
2012	3.4%
2013 Q1	6.5%
2013 Q2	4.5%

Source: U.S. Labor Department, Bureau of Labor Statistics

Another survey respondent put it this way: "A global company is positioned to take advantage of the best tax structures. In our industry, the medical device tax applies directly to a company's income, plus they get taxed on profit, which means there's double taxation. So I expect to see more offshore development, not less."

But while U.S. manufacturing has made a decent comeback in recent years, it appears that improvements in the sector—at least for now—are more the result of the overall bounce-back from the Great Recession than from any sort of long-term shift. Indeed, while U.S. exports—typically a reliable measure of manufacturing strength—have risen modestly since 2009, credit for the increase is generally given to a falling U.S. dollar, rather than a sustained structural improvement.

What's more, energy represents a relatively small cost factor for many companies, so the notion that America's newfound glut of cheap natural gas will lead to a long-term manufacturing renaissance has as many skeptics as believers.

This year, 43% of the engineers in our survey say their company currently manufactures products outside the U.S., and only 11% say for certain that their company plans to transition some of its manufacturing back into the U.S. "Salaries for offshore manufacturing are approximately 20% of what they are in the U.S., so I don't see significant manufacturing returning

WHO'S HIRING ENGINEERS WITH H-1B TEMPORARY VISAS	
BY COMPANY SIZE (REVENUE)	
\$1 billion or more	37%
\$500 million - \$999 million	27%
\$100 million - \$499 million	24%
\$50 million - \$99 million	19%
Less than \$50 million	10%
BY BUSINESS AND INDUSTRY	
ICs and semiconductors	64%
Automotive electronics	30%
Computer systems/equipment	26%
Software	24%
Test and measurement equipment	24%
Communications systems/equipment	22%
Components and sub-assemblies	20%
Consumer electronics	19%
Research and development	18%
Medical electronics	17%
Avionics/marine/space	15%
Industrial controls systems/equipment	13%
Government/military	9%

unless cost of energy makes shipping prohibitive," explained one respondent.

Many respondents say products are being specifically designed for offshore markets, globalization requires multiple locations worldwide, and companies are heavily invested in working with offshore contract manufacturers. "At this time, our primary markets are close to the outsourced locations where our products are being made, so shipping costs are lower than they would be shipping from the U.S.," said one engineer.

The chip sector poses a different set of challenges for bringing manufacturing back to U.S. shores. Taiwan, Japan, and South Korea are way ahead as the top consumers of semiconductor materials used to make microchips. According to an April report from the Semiconductor Industry Association, even China has now surpassed the U.S. in semiconductor manufacturing—and the number of plants for making microchips is expanding in China as it declines in the U.S. So, don't look for chip manufacturing to return to the U.S. anytime soon.

"We make highly specialized CMOS semiconductor products, and there are no affordable options in the U.S.," observed one respondent in the industry. Another survey respondent noted: "We are a fabless semiconductor company. New fabs that support our business just aren't being built in the U.S."

While it may be cheaper to make chips overseas, not everyone believes the cost of manufacturing should be the only consideration. "Semiconductor manufacturing is not workforce intensive, so it really should matter where the markets are,"

one respondent said. "Production should stay in the locations where products are consumed, including in the U.S. I see it as a fair practice to have it proportional to share of sales in each geographical area."

Companies that have transitioned some or all of their manufacturing back to the U.S. generally cite better control over quality and costs as the primary reason for the changeover. Some came to believe that certain sophisticated products are just better built in the U.S. Others discovered that offshoring introduced more problems, complications, and hidden costs than had been predicted. But many alluded to other hitches associated with offshoring, such as unanticipated transportation difficulties, language challenges, public relations concerns, stolen designs, supplier snags, public pressure, unstable political climates, and human rights issues.

"We do all our manufacturing in the U.S. now," said one engineer. "This was not a purposeful policy but happened because our Chinese manufacturers screwed up. For us, this turned out to be a really good move. What we now make in-house is far better and has enabled us to make a superior product that our customers love."

"We found it was important to have a balance of both domestic and offshore production capability to be responsive to customer needs and markets," said another. "Proximity to design and management allows for more efficiency and better cycle time when costs of manufacturing/assembly are reasonable."

"In general, the cost advantage of foreign work does not justify the costs and risks of using foreign work," a survey respondent explained. "We set up somebody to build a part and we've just created a resource for our existing domestic competitors—and may have even created a foreign company to compete with us. Frankly, we would rather purchase and own a foreign manufacturer."

Others cited improving conditions at home. "U.S. commercial real estate is now attractive and so the cost of doing business here makes better sense, both financially as well as for maintaining quality control," said one engineer.

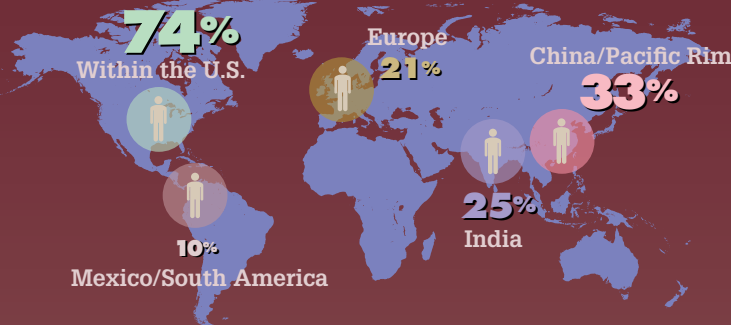
Some survey respondents saw the opportunity to grab government contracts. "There is a lot of discussion on developing domestic manufacturing to be able to bid for government projects," said an engineer involved in federal contracting. "That plus quality problems with products sourced from overseas are forcing us to reconsider our strategy."

A number of survey respondents also alluded to the intrinsic value of "Made in America" as a product attribute:

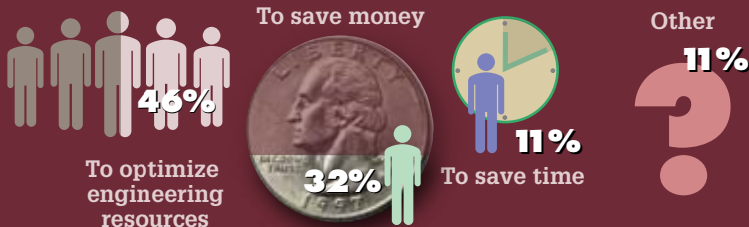
- "It is more attractive to consumers to know that the products they buy from us are manufactured here in the U.S."
- "Many customers participate in the Buy American Act, so we have begun assembling some products in the U.S. to meet our customer needs."

The Outsourcing Phenomenon

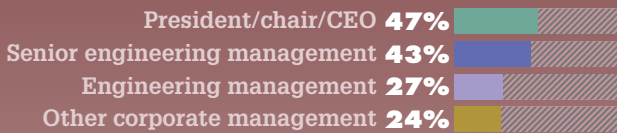
Where Work Is Being Outsourced



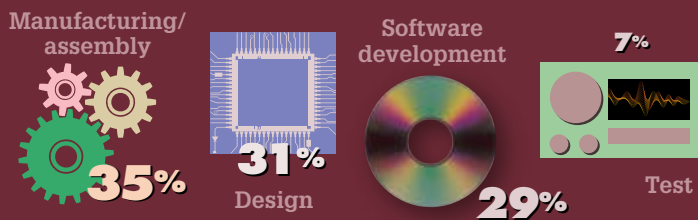
Reasons For Outsourcing



Who Decides To Outsource



Work Being Outsourced



Outsourcing's Impact On The Profession: Perceptions



- “Our customers are demanding that we have an American footprint with manufacturing in case of a disaster or political issue outside the U.S. We are setting up our first-ever manufacturing facility in the USA this year.”
- “I want to hire my neighbors—plain and simple.”

While there's little evidence to suggest a major shift in manufacturing back to the U.S., there are signs that the tide may indeed be turning. Motorola, for example, is building the Moto X smart phone in the U.S. with a combined bill of materials (BOM) and manufacturing cost in the same range as market-leading products made offshore. The total BOM of the Moto X amounts to \$214. When the \$12 manufacturing expense is added in, the cost to produce the Moto X increases to \$226.

At this cost level, the Moto X comes roughly in the middle of the combined BOM and manufacturing costs of the leading smart-phone models, Apple's iPhone 5 and Samsung's Galaxy S4. While the manufacturing expense of the Moto X is \$3.50 to \$4 more than these phones, the total cost to make Motorola's smart phone is only 9% more than the iPhone 5 and about 5% less than the Galaxy S4.

“With the Moto X, Motorola is reaping the public relations and customization upsides of producing a smart phone in the United States, while maintaining competitive hardware costs,” said Andrew Rassweiler, senior director, cost benchmarking services at IHS Inc., a global market information and analytics company. “In spite of its ‘Made in the USA’ label, overall costs are still competitive with similar smart phones.”

OFFSHORING: MANAGEMENT VS. LABOR?

Outsourcing has been a way of life for decades in the electronics industry. But the conflict over this practice is getting more intense as engineering profession-

AVERAGE SALARIES BY ENGINEERING TITLE	Base Salary	Total Compensation
Software engineering manager	\$127,000	\$141,600
Vice president/VP of engineering	\$120,170	\$133,051
Technical director/director of engineering/R&D/engineering manager	\$117,254	\$127,475
Group leader/project team leader/project manager	\$108,267	\$116,169
Chief engineer/senior engineer/lead engineer/principal engineer	\$107,298	\$115,244
President/owner/CEO/other executive management	\$98,304	\$109,653
Applications/systems engineering manager	\$96,931	\$109,283
Department head/section head	\$98,807	\$108,968
Software engineer	\$100,302	\$108,667
Systems engineer/applications engineer	\$96,040	\$104,422
Manufacturing/production manager	\$88,364	\$96,964
Design engineer/project engineer/R&D engineer	\$89,898	\$96,615
Other (please specify)	\$85,585	\$93,649
Manufacturing/production engineer	\$86,097	\$92,897
Consulting engineer/scientist	\$82,948	\$89,455
Member of technical staff	\$80,091	\$87,069
Test engineer	\$77,670	\$85,082
QC/evaluation/test manager	\$70,818	\$75,318

als feel increasingly threatened by management practices—while managers are under more pressure than ever to wrest every possible point of profit out of their lines of business.

According to this year’s survey, most engineers (52%) say their company outsources engineering work—a number that has held pretty steady over the last several years. Also, 58% say the work is being outsourced to other locations in the U.S. The biggest offshore locations for outsourcing are China and the Pacific Rim (33%), India (25%), and Europe (20%).

“As much as I hate it, most big companies are outsourcing work to low-cost countries,” commented one respondent. “I can’t blame my company for doing the same.”

The reasons cited most for outsourcing include the need to use engineering resources better (46%) and the desire to save money (32%) and time (11%). Other reasons mentioned include the need to leverage capabilities or expertise that weren’t available in-house, the needs to deliver on short-term projects, and the desire to avoid adding to the full-time staff.

The types of design work being outsourced most are manufacturing and assembly (35%), design work (31%), and software development (29%). “We have had a very hard time finding avail-

able qualified FPGA designers in the U.S. (especially in our area), but there is a wealth of very talented FPGA designers in Pakistan,” said one manager. “We have not laid off anyone due to outsourcing. Instead, we have used it to augment our existing capacity.”

One in four of the engineers we surveyed expressed some concern about losing their job to outsourcing. “Outsourcing has always happened at some level and it is needed, but it seems that many companies think that if some of it is good, then more of it will be better,” said one engineer. “It reduces the value of engineering to a commodity. It drains the in-house intelligence by not replacing highly skilled engineers.”

On the other hand, 36% of this year’s respondents said they were not terribly concerned with the threat of losing their job to outsourcing, and 42% expressed no concerns at all. “My view is that outsourcing should be welcomed,” said one such respondent. “It is cynical to have a free market for the sale of products we design and not for the engineering of them. Outsourcing forces the good engineers to become even better.”

Outsourcing remains one of the most divisive issues in engineering, with strong feelings on both sides of the argument. For many, outsourcing is today’s reality and engineers simply need to find ways to deal with it. “It is the world we live in,” said one engineer. “In general, unions have driven employment costs so high that companies will save money in any category possible in order to survive and prosper, and engineering is just one of those categories.”

Indeed, many respondents believe that outsourcing, if it’s directed well with appropriately set expectations, has its place.

AVERAGE SALARIES BY INDUSTRY	Base salary	Total compensation
ICs and semiconductors	\$125,458	\$139,852
Software	\$122,568	\$132,385
Computer systems/boards/peripherals/software	\$110,473	\$121,972
Government/military	\$114,173	\$121,676
Medical electronics	\$109,651	\$120,055
Avionics/marine/space	\$102,320	\$108,458
Automotive electronics	\$99,975	\$107,297
Communications systems/equipment	\$93,341	\$103,659
Consumer electronics	\$94,197	\$102,289
Test and measurement equipment	\$94,991	\$101,946
Other (please specify)	\$91,665	\$100,586
Components and subassemblies	\$91,613	\$99,519
Industrial controls systems/equipment	\$87,330	\$95,659
Research & development	\$87,516	\$95,063
Contract design or manufacturing	\$80,267	\$86,341
Consultant	\$72,789	\$79,571

“It allows a company to accelerate their strengths while allowing an outside company to handle the less critical functions,” said one engineer. “Engineers can then focus on being creative, finding new ways to improve a product design or utilize an all-new design. This has a direct benefit to the company as we are then seen as the go-to people for new ideas and new concepts.”

“Within my department, it would be hard to staff all the engineers required for everything we do,” admitted another. “Outsourcing is necessary to stay competitive and keep overhead down and profits up.”

“Outsourcing has its pluses and minuses. It’s clear that outsourcing is being used more to reduce the cost of operations than to compensate for the purported lack of availability of engineers. For instance, unless the laws of economics have been repealed, a shortage of engineers should result in an increase in wages,” one respondent said.

“Additionally, engineers would be receiving more opportunities to get their skills updated by their employers. Instead, wages are mostly stagnant and employers say that older engineers do not have the required skills, so they are ‘forced’ to look for engineers with the required skills—who just happen to work for lower costs—and do not bother to support the retraining of their existing engineers,” the respondent continued.



TOP 10 PROFESSIONAL ISSUES THAT KEEP YOU UP AT NIGHT

1. Staying current with new and emerging technologies
2. Looming project deadlines
3. Product reliability issues
4. Concerns about the general health of the economy
5. Product quality issues
6. Price/performance issues
7. Concerns about job security*
8. Concerns about financial health of your company
9. Specifying the right products/vendor for my designs*
10. Age discrimination

** New this year to the Top 10*

Many engineers believe outsourcing hurts company morale. “Relying on outsourcing to complete multiple projects in their entirety can diminish the morale of full-time employees who desire to work on those projects,” said one respondent. “Outsourcing can also lead to reduced product quality when the outsourced engineering team does not follow the same quality metrics of the company hiring them.”

Some blamed poor management as the reason why companies are forced to outsource. “Outsourcing is a strategy used to cover up poor management decisions in the past, something that is a quick fix in the short term, but a looming disaster in the future,” said one engineer. “Employees observing this will be less concerned about the well-being of the company they work for. This lowers morale and the quality of their workmanship—even in management and office work, never mind technical staff.”

“This is something large corporations do to cut costs, but they get what they pay for,” said another engineer. “Foreign engineers are often just as competent, but some things get lost in translation. Engineering jobs could see declines similar to those in manufacturing due to outsourcing. Certainly salaries have been lowered to stay competitive with countries like India. But the small company I work for can’t afford the hassle and time of outsourcing my job functions.”

Many respondents see outsourcing as overrated in terms of cost savings and underrated relative to risk. “Outsourcing has not been as successful as advertised,” said one engineer. “Innovation is more important than the cost of engineering. I have not seen that outsourcing fosters innovation. The effect of outsourcing at the company I contract to has been a loss of loyalty. Some of the best engineers have left for other opportunities as a result of it.”

Other naysayers pointed to the fact that in-house staffs were being forced to clean up the work that had been done by outsourced workers.

“I don’t have a negative opinion of outsourcing in general, but I have not had a positive experience with the results it has

THE 10 MOST PRESSING PROBLEMS AT WORK

1	Insufficient people resources to get the job done
2	Finding the optimal components for my designs
3	Insufficient funding for my design projects
4	Time-to-market pressures
5	Having to compromise my design approaches
6	Inability to adequately test product designs
7	Shrinking product life cycles
8	Competitive market pressures
9	Lack of design management direction
10	Politics at work

THE FACTORS THAT INFLUENCE JOB SATISFACTION

1	The challenges that accompany the design of new products
2	Researching potential design solutions
3	Opportunity to design products that can benefit society
4	The compensation you receive for the work you do
5	The recognition you get from others for the work you do
6	Working in team situations with peers
7	Working independently of others
8	The pressures associated with solving design problems

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produced at my company,” said another engineer. “The turnover rate of outsourced employees is tremendous and this leads to very few ‘senior’ engineers. A lot of the U.S. engineers’ time is wasted trying to sort through design and documentation errors that came from the outsourced team.”

Many survey respondents pointed to the challenges that are associated with trying to manage outsourced talent. “Engineering isn’t like math or data crunching where there is only one answer,” said one engineer. “To effectively manage a design, the designer and all supporting staff needs to be where the project is. Further, in my experience, outsourced work requires micro-managing to ensure that standards are being maintained. I am not in favor of outsourcing. By sending creativity elsewhere we

risk losing our ability to be competitive. In effect, we are training our future competitors.”

Others expressed similar fears that outsourcing could have the effect of creating competitors in other countries. “I believe it is dangerously wrong to outsource engineering,” said one engineer. “It grows competitors outside the country and undermines the future of engineering and science in the U.S.”

Some believe that outsourcing more often than not results in poorer product quality.

“There are times when it makes sense, but most companies are only doing it to save money and aren’t looking at the quality of the product they are getting,” said one engineer. “Often they end up spending more money in support issues than they saved in the design process.”

While many engineers object to the offshoring of engineering jobs, outsourcing work to U.S. contractors bothers them less. “Outsourcing within the U.S. is fine. That’s a form of independent professional engineering,” said one engineer. “Outsourcing outside of the U.S. hurts the American economy and serves to depress wages and opportunities for engineers here at home. It would be interesting to see how international ‘insourcing’ of engineering work could be achieved by firms outside the U.S.”

“Outsourcing within the local area is best, keeping it within the USA is next best, and I am totally opposed to outsourcing outside the USA,” said another engineer.

MORE PROS AND CONS

Many engineers suggested that a certain amount of outsourcing was okay as long as it freed them up to be more creative and make the best use of their time. “I think there’s an appropriate use for outsourcing, particularly if you need to keep your core technology people focused on where they can add the most value,” said one engineer.

“We have to outsource on occasion for some tasks and all the time for other tasks,” noted one engineer. “Ideally, we’d have all of the resources in-house so we wouldn’t have to outsource, but given the ebb and flow of the projects/dollars we win from our customers, it could be difficult to sustain a higher headcount. But we’re growing our group so business is good now.”

Still others suggested that there were certain situations where it has its place and can be used wisely to benefit the company. “Outsourcing can simply be smarter engineering,” said one respondent. “Most technical resources are not needed on a full-time basis, so this makes good business sense and allows the insourcing company staff the opportunity to remain challenged with a diversity of tasks rather than react to a short-term goal and then coast until the next short-term task.”

“It depends how it is done,” said another. “We outsource so that we don’t have to hire and then lay off six months down the road. It’s to ensure that our staff is doing interesting things while providing the best job security that we can. If it’s done

HOW YOU CONTINUE TO STAY SMART	
Engineering/technology publications	74%
White papers	67%
Webcasts	60%
Seminars	58%
Engineering textbooks	48%
Trade shows/conferences	45%
Vendor-sponsored education	44%
E-books	33%
Association-sponsored meetings	28%
In-house educational programs	21%
User group meetings/meet-ups	21%
Online discussion forums	19%
Online college courses	18%
In-classroom college courses	11%
Social media platforms used for business	
LinkedIn	52%
YouTube	17%
Facebook	16%
Google+	12%
Company’s own social media sites	11%
Blogs	9%
Twitter	6%
Other	4%
None of these	35%
Mobile devices used for business	
Android-based smart phones	29%
iPhones	21%
iPads	12%
Android-based tablet	9%
BlackBerry	8%
Other tablet/reader	6%
None of these	36%

for the bottom line without regard to staffing, I'm not in favor of it."

Even companies that don't outsource have the potential to feel its effects. "It is not affecting my company directly because we do not outsource, but it is affecting our industry indirectly as more and more companies outside the U.S. are coming online that can produce products in competition to ours at lower manufacturing and regulatory costs," said one engineer. "This is compounded by the extensive intellectual property theft occurring that allows those who have not invested in their own research and development to unfairly compete against companies (and countries) that do."

Many of the engineers we surveyed suggested that outsourcing restricts opportunities for younger engineers. "I am not worried for my generation," said one. "However, I believe the impact on the current or recent graduates is more significant. They are competing with a much larger pool of engineers who are willing to work for lower wages."

"Outsourcing is moving many entry-level engineering positions out of the companies and making it difficult to train the next generation of senior engineers," said another.

"It's bad for the profession and future engineers," one engineer noted. "With the lack of good jobs and increased competition for those jobs that are available it's easy to see why students don't want to put forth the effort for any STEM job, especially engineering. Within 100 miles of where I work, hundreds of engineering jobs have disappeared within the past year. I'd put the unemployment/underemployment rate among engineers in the area at around 30% or higher. I know several people who have just given up on jobs in their area and have taken jobs selling insurance, cars, or even working in retail because of the lack of opportunity for engineers beyond the entry level."

Many expressed a real concern over the potential loss of intellectual property as one of the more dangerous side effects of outsourcing. "Outsourcing looks good on paper," said one engineer. "In operation it is inefficient and provides lower-quality design work. In the end, it is often self-defeating as foreign competitors are not above theft of IP and business."

"Using sources around the world theoretically allows 24-7 project progress and often at a lower total cost," said another.

"However, it can increase the risk of technical IP loss and lower motivation of local employees. It also requires a system adept at transferring 'tribal knowledge' quickly and thoroughly."

"Companies are giving their entire intellectual property away for free—a dumb idea for short-term return," said another engineer. "Driven by MBA types looking at spreadsheets, the analogy I see is cutting down the peach trees after the harvest and selling them as firewood to avoid the cost of pruning, spraying fungicides, fertilizer. Pretty stupid."

"It's simple economics," another engineer noted. "In the long run, companies will figure out what they should outsource and what they should not. It's scary to see core technology shared with Chinese contractors, and our engineers are not happy with it in general."

But many could see the benefits of outsourcing to running their small businesses. "It is an essential part of business for a small company," said one engineer. "Without outsourcing it would be impossible for us to handle workload peaks efficiently and effectively."

"For a small company like ours, hiring someone or the capital expenditure involved is not feasible in the short term," said another engineer. "Once volume increases, or a new product is launched successfully, then bringing some outsourced processes and jobs in-house becomes more of an option. For my company, outsourcing allows us to grow. For the engineering profession, it allows small firms that specialize in a specific task (software programming, testing, etc.) to build a service for many companies. As long as 'cost' is not the only determining factor, outsourcing (not necessarily international) can be a very good thing."

Many expressed the belief that outsourcing should be considered only as a last resort. "Where there is the ability to promote internal staff, this should be done," one engineer explained. "Where outsourcing is used to fill positions, companies lose the good will of their employees. I can't see how this is good for business in the long term. Too often I see outsourcing used as an easy solution when it is, in fact, the most expensive path to take."

Some were downright philosophical on the subject of outsourcing. "I don't see outsourcing as the evil that most do," said one respondent. "I have worked at high levels in large global companies, and while we expanded greatly in Asia, we also had lots of experienced positions in the U.S. and Europe. In addition, there were always positions that were occupied by 'deadwood' and could be removed without impact. So from my perspective the overall pressures to outsource just made companies stronger by making better decisions on staffing levels and being more critical of retaining the highest talent and not accepting mediocrity."

"Further, I feel that for a sustainable global economy, there has to be a path to raise up a billion or so people out of poverty," this engineer continued. "That may mean some adjustments for those of us accustomed to excess. I have worked side by side with

TOP RETIREMENT PLANS OFFERED BY OEMS	
401(k) match	56%
Pension programs	23%
Profit sharing	9%
Stock options	3%
% OF OEM COMPANIES THAT FUND RETIREMENT PLANS	
Yes	70%
No	30%


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engineers in China, for example, and they are very intelligent, very hardworking, very eager, yet are living a quality of life much below that in the west. Yet those engineers are the lucky ones. There is so much more poverty. So if a balance of design here, design there plus balance on manufacturing is what it takes to do net good, I'm not concerned that we are harming U.S. jobs. In the long run this will all be for everyone's benefit."

SUMMARY

Engineers have to keep their expectations in check when it comes to their earning power. Also, the U.S. engineering

market faces significant uncertainty as the economics of globalization and the vagaries of domestic policy remain turbulent.

Yet engineering itself is sure to remain a central activity of American and international commerce for the foreseeable future. Ultimately, engineers become engineers because that's who they are. So while they may have to suffer the slings and arrows of some outrageous fortune today, they can take solace in the fact that they are also playing a unique role in building the world's tomorrow. 

THE 2003 SALARY SURVEY: TEN YEARS AFTER

WHAT A DIFFERENCE a decade makes. Back in 2003 when we first started tracking engineering salaries and gathering opinions about work- and industry-related issues, a gallon of gas cost just \$1.83. The Lord Of The Rings: The Return Of The King edged out Finding Nemo as the top-grossing film at the box office. 2003 may also be remembered as the year Madonna locked lips with Britney Spears at the MTV Video Music Awards—and for the media frenzy that followed.

But 2003 was also a big year in technology. It was the year MySpace first hit the scene and quickly became one of the most

popular social networking sites on the Web. By 2006, 100 million accounts had been created on the site. In April 2003, Apple opened the iTunes Music Store, revolutionizing the music industry one song at a time.

The Human Genome Project was completed in 2003. Although it began in 1990, critics claimed it would take

AVERAGE SALARIES BY GEOGRAPHIC REGION		
Region	2003	2013
PACIFIC (Alaska, Washington, Oregon, California, Hawaii)	\$96,374	\$122,137
WEST SOUTH CENTRAL (Arkansas, Louisiana, Oklahoma, Texas)	\$84,563	\$114,251
NEW ENGLAND (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)	\$94,037	\$113,197
SOUTH ATLANTIC (District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida)	\$83,044	\$111,294
MID-ATLANTIC (New York, New Jersey, Pennsylvania, Delaware, Maryland)	\$86,690	\$107,221
MOUNTAIN (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada)	\$87,870	\$106,178
EAST NORTH CENTRAL (Ohio, Indiana, Illinois, Michigan, Wisconsin)	\$77,208	\$100,398
WEST NORTH CENTRAL (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas)	\$73,870	\$99,255
EAST SOUTH CENTRAL (Kentucky, Tennessee, Alabama, Mississippi)	\$71,167	\$92,188

ENGINEERING SALARY TRENDS 92003-2013)		
Average Salaries By Industry		
Industry	2003	2013
ICs and semiconductors	\$106,377	\$139,852
Computer systems/boards/peripherals/software	\$101,146	\$121,972
Government/military	\$84,200	\$121,672
Medical electronics	\$85,213	\$120,055
Avionics/marine/space	\$85,551	\$108,458
Automotive electronics	\$79,954	\$107,297
Communications systems/equipment	\$90,840	\$103,659
Consumer electronics	\$79,973	\$102,289
Test and measurement equipment	\$79,475	\$101,946
Components and subassemblies	\$86,117	\$99,519
Industrial controls systems/equipment	\$78,036	\$95,659
Contract manufacturer	\$66,304	\$86,341
AVERAGE SALARIES BY JOB FUNCTION		
Function	2003	2013
Executive/operating management	\$105,652	\$120,598
Engineering management	\$104,417	\$119,578
Design & development engineering	\$82,313	\$104,072

AVERAGE SALARIES BY JOB TITLE		
	2003	2013
VP /VP of engineering	\$110,474	\$133,051
Technical director/director of engineering/R&D/engineering manager	\$106,057	\$127,475
Group leader/project team leader/project manager	\$92,386	\$116,169
Chief engineer/senior engineer/lead engineer/principal engineer	\$92,395	\$115,244
President/business owner	\$101,465	\$109,653
Applications/systems engineering manager	\$104,226	\$109,283
Department head/section head	\$98,980	\$108,968
Systems engineer/applications engineer	\$81,468	\$104,422
Manufacturing/production manager	\$84,844	\$96,964
Design engineer/project engineer/R&D engineer	\$74,264	\$96,615
Manufacturing/production engineer	\$64,015	\$92,897
Consulting engineer/scientist	\$84,395	\$89,455
MTS	\$94,615	\$87,069
Test engineer	\$64,208	\$85,082
QC/evaluation/test manager	\$70,259	\$75,318

AVERAGE SALARIES BY EDUCATION		
	2003	2013
Attended college	\$72,969	\$84,121
Associates degree	\$63,456	\$77,290
Bachelors degree	\$79,379	\$101,904
Bachelors plus graduate studies	\$91,208	\$107,488
Masters degree	\$95,456	\$113,550
Doctoral degree	\$104,517	\$127,144

thousands of years to finish. The project has since brought enormous benefits to the world of science and medicine and is transforming the ways we diagnose, treat, and prevent a number of diseases.

It was also a milestone year for space exploration. In June, a robot named Spirit was launched to Mars to analyze samples of the red planet's geologic composition. On July 10, astronomers discovered the oldest and most distant planet to date: a huge,

gaseous sphere that is 13 billion years old and 5600 light years away—changing theories about when planets formed and when life could have evolved.

In September, the Hubble Space Telescope began Hubble Ultra Deep Field, probing a small region of space that looked back approximately 13 billion years—between 400 million and 800 million years after the Big Bang—to search for galaxies that existed at that time.

In October, China successfully launched its manned Shenzhou 5 spacecraft into orbit, becoming only the third country in the world to independently put humans into space.

The year also marked the end of some pretty big aeronautic achievements. The space probe Galileo, one of NASA's most successful projects, completed its mission with a fiery dive into Jupiter's atmosphere. NASA made contact with the space probe Pioneer 10, one of the most distant manmade objects to ever leave Earth, for the very last time. The Air France Concorde also made its final flight in 2003.

Tragically, 2003 was also the year the Space Shuttle Columbia disintegrated during reentry at the conclusion of the STS-107 mission, killing all seven astronauts onboard—a stark reminder that even the best engineering can't completely eliminate risk.

The following charts show how engineering compensation has trended since we first started tracking the data a decade ago. ■