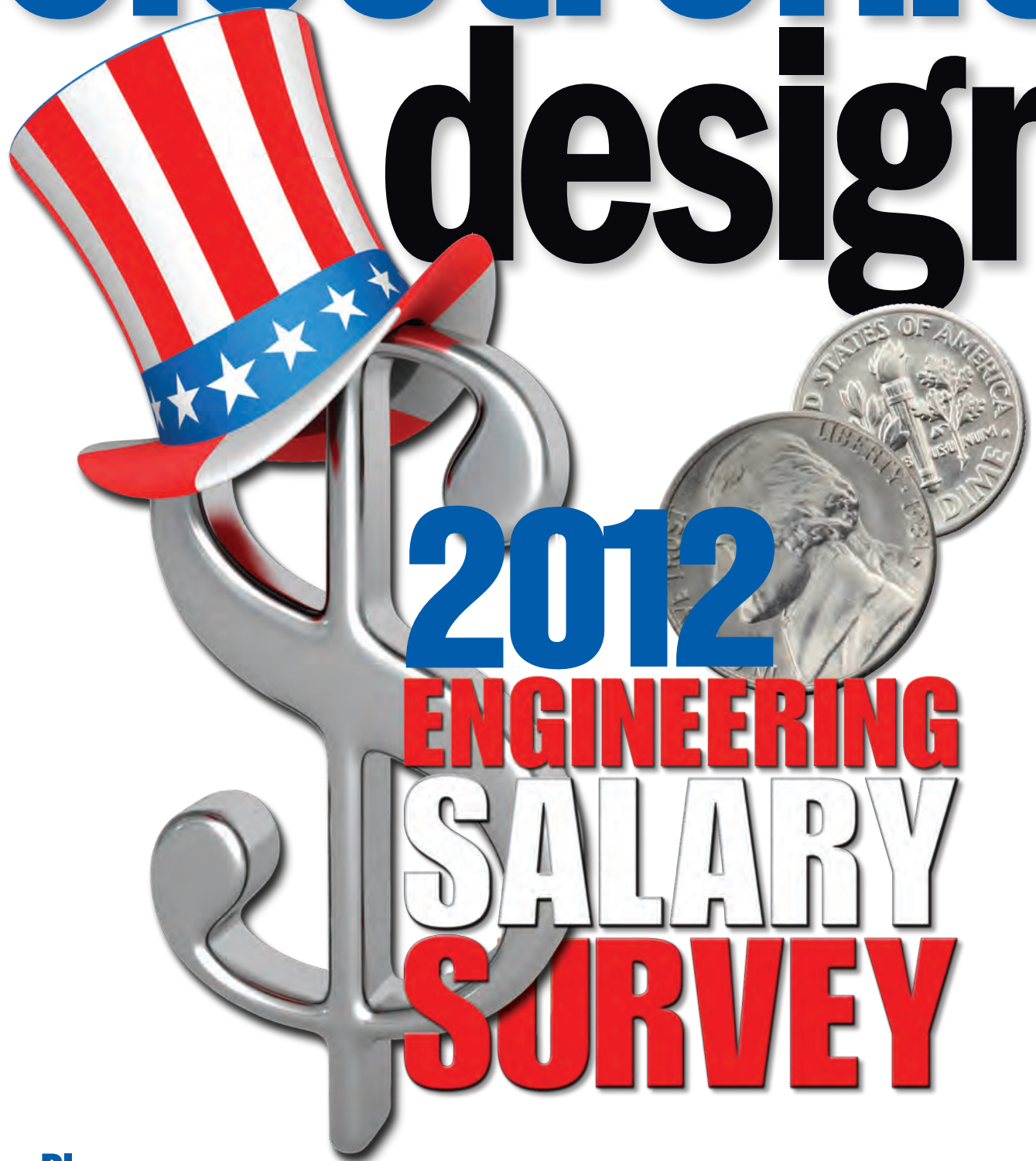


# electronic design



**Plus:**

**TOP 50 EMPLOYERS IN ELECTRONIC DESIGN**



# DEAR READER,

**TWO OF *ELECTRONIC DESIGN'S*** most popular articles of the year are our annual salary survey and our annual list of the top 50 employers in electronic design. For the salary survey, besides our standard questions we typically include a set of questions that are pertinent to what is happening during the current year. Since this is an election year, we decided to ask our readers what they thought about political issues affecting the profession.

We asked questions about H1-B visas, free trade, unemployment, government support for innovation, engineering education, outsourcing and other topics. Then we asked which candidate/party they thought would best address those questions if elected. In addition, we invited industry leaders to answer these questions as well. You won't want to miss reading about the issues and answers that our readers and industry leaders provided.

In the traditional part of our salary survey, we asked our readers our usual set of questions, which will give you insight into the financial aspects of the profession including salary, benefits and more. We slice and dice this data by presenting a bevy of charts to show how engineers are faring by region, engineering title, number of years in the profession, and so forth. And for the first time this year, we've added infographics to the mix to make the data more appealing to read and digest.

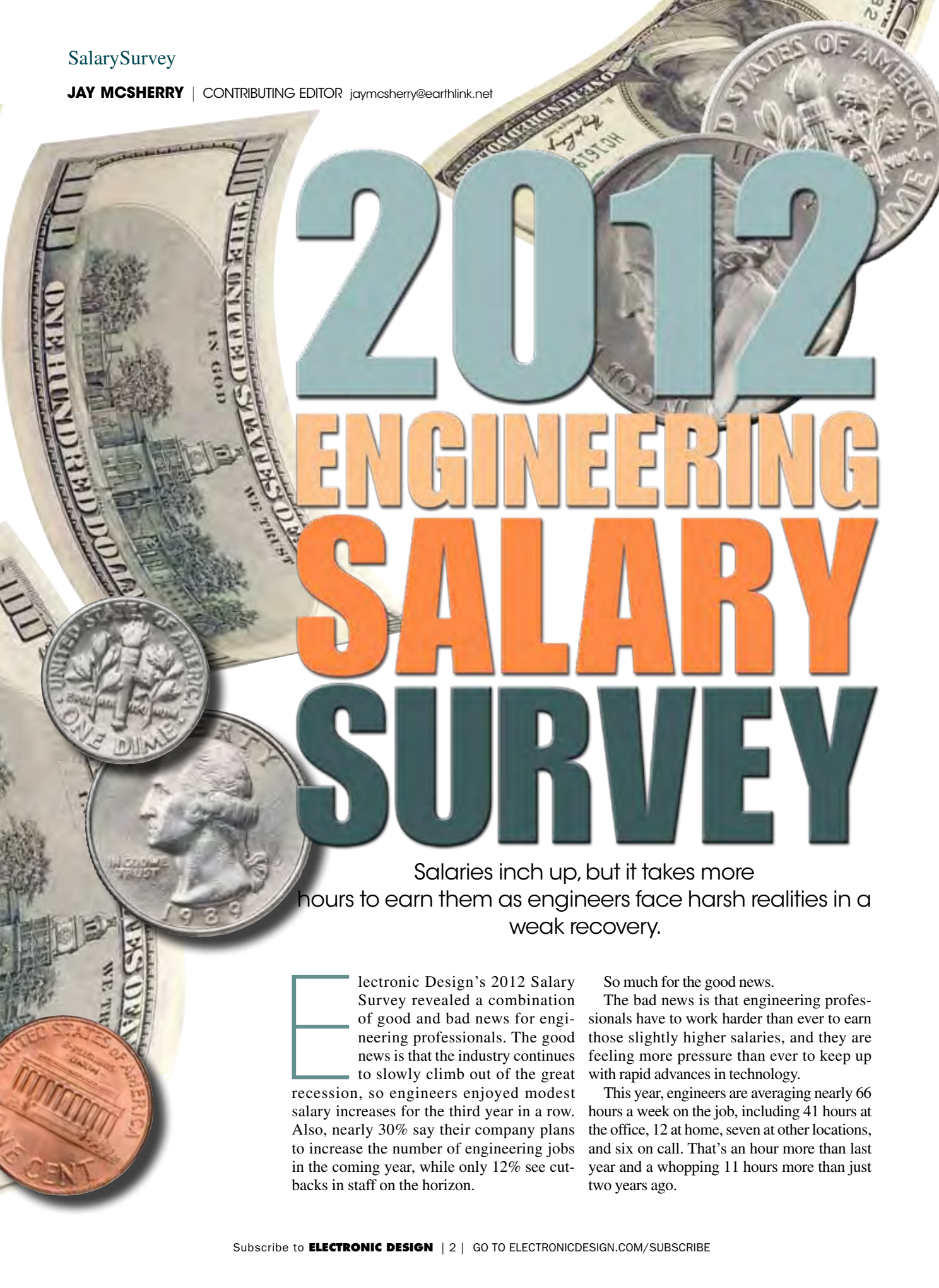
Beyond the salary survey, we've included our Top 50 Employers in Electronic Design, a very popular feature that we did earlier this year. The list includes both manufacturers of electronic end products and OEMs.

We're sure that you'll find these two features both interesting and informative.

Regards,

**Joe Desposito**





# 2012 ENGINEERING SALARY SURVEY

Salaries inch up, but it takes more hours to earn them as engineers face harsh realities in a weak recovery.

**E**lectronic Design's 2012 Salary Survey revealed a combination of good and bad news for engineering professionals. The good news is that the industry continues to slowly climb out of the great recession, so engineers enjoyed modest salary increases for the third year in a row. Also, nearly 30% say their company plans to increase the number of engineering jobs in the coming year, while only 12% see cutbacks in staff on the horizon.

So much for the good news.

The bad news is that engineering professionals have to work harder than ever to earn those slightly higher salaries, and they are feeling more pressure than ever to keep up with rapid advances in technology.

This year, engineers are averaging nearly 66 hours a week on the job, including 41 hours at the office, 12 at home, seven at other locations, and six on call. That's an hour more than last year and a whopping 11 hours more than just two years ago.

SALARIES		
Average Salaries By Engineering Title	Base Salary	Total Compensation
Software engineering manager	\$126,416.67	\$134,016.67
Technical director/director of engineering/R&D/engineering manager	\$115,698.41	\$128,183.01
Chief engineer/senior engineer/lead engineer/principal engineer	\$114,738.26	\$124,333.66
Vice president/VP of engineering	\$111,125.00	\$123,288.06
Applications/systems engineering manager	\$110,609.38	\$121,396.19
Group leader/project team leader/project manager	\$105,699.03	\$115,546.20
President/owner/CEO/other executive management	\$98,016.81	\$108,648.05
Department head/section head	\$97,068.97	\$106,617.74
Systems engineer/applications engineer	\$96,990.20	\$104,725.15
Software engineer	\$98,627.45	\$104,622.57
Manufacturing/production engineer	\$92,360.47	\$99,145.66
Design engineer/project engineer/R&D engineer	\$91,171.62	\$98,428.76
Other	\$89,892.27	\$97,954.75
Manufacturing/production manager	\$86,529.41	\$96,862.75
Quality control/evaluation/test manager	\$84,566.67	\$92,021.22
Test engineer	\$79,847.46	\$86,257.34
Consulting engineer/scientist	\$74,005.32	\$82,330.43
Member of technical staff	\$75,341.84	\$81,847.80

Average Salaries By Geographic Region	Base salary	Total compensation
Pacific	\$113,731.09	\$124,061.51
West South Central	\$105,051.59	\$114,863.04
New England	\$102,028.30	\$110,865.86
South Atlantic	\$99,208.09	\$108,806.46
Mid-Atlantic	\$97,002.55	\$104,372.98
Mountain	\$93,204.23	\$101,440.83
West North Central	\$91,821.43	\$100,041.53
East North Central	\$89,134.69	\$96,507.73
East South Central	\$86,541.67	\$96,194.89

“It has been extremely challenging just to maintain a reasonable life-work balance,” said one engineer. “There is so little time remaining to stay current with relevant engineering information.”

Engineers are working so hard because their companies are very reticent to add staff when business growth is so slow and the global economy is still so full of uncertainty. So, instead of hir-

ing, they’re trying to get more productivity out of their existing employees. Also, mobile technology is making it easier than ever to stay connected anywhere, anytime.

As a result, engineers are putting in more extra hours working and following new developments in their chosen fields. To some extent, though, engineers have become victims of their own success. The more innovations they deliver, the more time they have to spend tracking those innovations.

“My biggest challenge is finding the time to devote to staying at the bleeding edge of technology,” noted one engineer who responded to the survey. “I spend at least five hours a week of my own time at home reading, studying, and trying to learn about new technologies.”

Other survey respondents voiced similar sentiments: “There’s just not enough time in the day to keep up with all of the advances. The explosion of information available on the Internet is just too extensive to keep up with,” one said.

For some, it’s about more than the job at hand. “I try to spend time examining topics that aren’t directly related to any work I’m doing now, but may be doing in the future,” explained one forward-thinking survey respondent. “But doing anything outside of current work-related development must be done on my own time at my own expense.”

Despite this loss of leisure hours, engineers are no less committed to making the most of whatever time off they have. More than half of the survey respondents said they participate in strenuous physical outdoor activities such as biking, hiking, or mountain climbing when they can finally get away from work.

Nearly half of the respondents like to spend their free time developing, modifying, or repairing electronic or mechanical hardware, including more than a third (36%) who enjoy tinkering with do-it-yourself electronic projects at home. About 30% also say they work on cars (including hybrids and electronics), and one in four develop software during their free time.

#### SMALL GAINS IN PAY

According to the survey, engineers across the United States report an average total compensation of \$106,097 in salary and bonuses this year, compared to \$104,370 last year. Most (52%) of the respondents saw their paychecks get bigger this year, while 37% received no increase in pay. Overall, raises averaged just 1.7%.

Virtually all of the increases in earnings in 2012 came in base salary. On average, bonuses were flat while other sources of income like stock options were lower than they were in 2011.

“There’s a big change in how the end-of-year bonus is being calculated,” explained one engineer. “Bonuses are normally based on the number of days worked, so you’d receive a bonus proportional to your salary. Now they’ve made the bonus flat across the company, effectively reducing the bonus for higher-paid engineers. I used to receive more than 15% of my earnings in bonuses. Now? Maybe 1%.”

The number of engineers reporting any income from profit sharing also dropped by about 12% this year. Furthermore, several respondents pointed out that their companies seem less concerned with retaining older workers and more concerned with attracting younger ones.

“New hires are paid more than when I started at a time when qualified engineers were more available. Yet there is no increase for me, with 11 years on the job,” complained one of our respondents. “The pay gap between experienced engineers and new hires is small and unfair. The policy here is to pay more for good candidates, rather than spending money to keep experienced engineers happy.”

Some saw other changes in compensation. “Cash increases in base salary have been flat for the past three years, but we are now receiving compensation in the form of stock grants,” said one engineer. “I suspect there will be salary increases in future years, but I suspect the restricted stock awards will continue as a common form of compensation, especially among highly compensated employees.”

On average, design and development engineers earned a base salary of \$97,045 this year and total compensation of \$105,265. Engineering managers saw their paychecks dip a bit in 2012, averaging \$114,318 in base salary and \$125,784 in total compensation. More than half (55%) of the corporate managers we surveyed work in small companies and startups (annual rev-

enues under \$5 million) and take home an average base salary of \$101,641 and total compensation of \$113,187.

The best-paid engineers this year were software engineering managers (earning total compensation of \$134,017) followed by technical directors and directors of engineering or R&D (\$128,183) and chief engineers (\$124,334).

#### MIXED SENTIMENTS

While engineering remains a high-paying profession compared to many other fields, engineers are evenly split over whether engineering offers the same opportunity for salary advancement as it did five years ago. Many of our respondents, however, remain enthusiastic.

“Engineers do more to improve the quality of life for our society than any other profession,” brimmed one engineer. “Yet, in this country we suffer from a scarcity of young people entering this field. For those who do, this is a tremendously valuable career path.”

Another respondent expressed confidence that current tough times won’t last forever. “The economic changes we have seen in the past five years have pushed off retirement for many including engineers,” he said. “This makes the current job market tough for the new grad. However, this will be temporary, as the Baby Boomer generation will be retiring en masse, leaving gaping holes in industry and in ‘tribal knowledge.’ In five years, we will see unprecedented demand for engineers.”

But to advance in the engineering profession, you have to avoid complacency at all costs. “Engineering is still necessary and science degrees still pay well, but you need to be willing to change jobs every three to five years to boost your salary and stay ahead,” said one engineer. “Working with the same employer for your lifetime will not allow a high salary and good growth.”

Another reader concurred: “Five years ago I was completing my formal education while working half-time for an engineering company. I fully expected to receive a full-time position with the same company and a commensurate pay increase for completing my degrees. Today, I am optimistic about the potential for salary advancement because of the job change that I made last year. My new employer has the resources to do what my former employer does not.”

Others were less bullish. “There seems to be a ‘glass ceiling’ in the design/development path at about 10 years of experience,” observed one engineer. “If you haven’t made it onto the management track by then, you’re probably at the end of the line. Unfortunately, it’s pretty difficult to get 10 years of experience at the same company, so the vast majority ends up at a dead end.”

But one engineer summed up the opportunity simply this way: “Engineering and design are entering the era of Warp Speed—if you possess the right DNA.”

Geography is key in determining engineers’ salaries. The Pacific region is still on top with total incomes averaging \$124,062, followed by the West South Central region (\$114,863). Next are the New England states (\$110,866) and the South Atlantic region (\$108,806).

Different market segments also vary significantly when it comes to compensation. Chip houses led the way in engineering pay again this year at \$132,654, followed by software houses (\$131,342), computer OEMs (\$122,550), government/military

Average Salaries By Gender	Base salary	Total compensation
Male	\$97,599.65	\$106,506.20
Female	\$81,020.83	\$89,406.54

Average Salaries By Job Function	Base salary	Total compensation
Engineering management	\$114,318.01	\$125,783.73
Executive/operating management	\$101,641.30	\$113,186.72
Design & development engineering	\$97,045.49	\$105,264.87
Other engineering	\$92,257.98	\$99,407.58
Other	\$77,928.14	\$87,075.56

Average Salaries By Industry	Base salary	Total compensation
ICs and semiconductors	\$119,714	\$132,654
Software	\$118,838	\$131,342
Computer systems/boards/peripherals/software	\$110,056	\$122,551
Government/military	\$109,937	\$116,676
Communications systems/equipment	\$102,077	\$110,576
Medical electronics	\$99,996	\$109,771
Avionics/marine/space	\$99,205	\$107,715
Test and measurement equipment	\$96,130	\$105,259
Automotive electronics	\$93,813	\$102,474
Consumer electronics	\$92,456	\$100,555
Industrial controls systems/equipment	\$91,826	\$99,968
Research & development	\$91,753	\$99,708
Other	\$88,642	\$97,165
Consultant	\$84,545	\$92,189
Contract design or manufacturing	\$82,403	\$90,679
Components and subassemblies	\$81,728	\$89,693



contractors (\$116,676), communications systems and equipment manufacturers (\$110,576), and medical electronics firms (\$109,771).

### PLUS ÇA CHANGE

No matter where engineers work, however, they have to remain aggressive about keeping up with emerging technologies. In fact, staying current with new and emerging technologies is the number one issue causing engineers to lose sleep this year, even more than concerns about the general health of the economy.

But doing so can be difficult during a weak recovery, since companies are apparently stingier than ever about compensating their employees for the costs of continuing education, including conferences, seminars, and trade shows. Only about half of the respondents said that their companies foot the bill for these activities, and only 44% of them can get money for college courses.

“While they sometimes will reimburse us for training, they are very reluctant to approve it,” said one engineer. “So if you really want to do it and it isn’t approved, then you are on your own to pay for it.”

In addition, only about a third of engineers say they get reimbursed for the engineering textbooks they purchase. Barely one in four gets repaid for certification programs and online training.

“It seems companies are shifting the burden of staying technically current to employees,” said one engineer. “Fortunately, there has been an increase in free online learning. For example, Stanford and MIT offer excellent courses.”

Naturally, since their companies are so reluctant to compensate them for continuing education, engineers are extensively using free information resources online. Nine out of 10 engineers say they download white papers, app notes, and data sheets from the Web, and nearly two-thirds watch online videos and read online blogs. Nearly a third exchange information with their peers on online communities and forums.

The most dramatic—and perhaps most disturbing—change in perspective revealed by this year’s survey concerned how engineers feel less valued by their employers. Last year, nearly 55% felt their company was more focused on employee retention compared to the previous year. This year, that number plunged to just 30%.

“We are graded against the offshore engineers who earn a great deal less, so our salaries look like a huge cost to the company,” declared one engineer. “As far as I can tell, no consideration is made for different living standards. Also, H1B visa people now are approximately 10% to 15% of the engineering workforce, further driving U.S. citizens away from engineering.”

### DISAPPEARING PERKS

That sense of being less valued isn’t helped by reductions in benefits. Nearly 53% of survey respondents say their companies provided them with 401(k) matching this year, but that’s down from 57% a year ago. And while just under 60% are getting company-paid health benefits this year, that’s also down from 63% in 2011.

“It is costing so much more for health insurance premiums, especially for highly compensated employees,” protested one engineer. “So much so that I received a \$4,000 raise last Sep-

Average Salaries By Type Of Design Work You Do	Base salary	Total compensation
ICs and semiconductors	\$123,855	\$136,955
Computer product design (supercomputers, mainframes, workstations, servers, PCs, notebooks/laptops, peripherals, boards, etc.)	\$111,799	\$124,271
Military products	\$116,394	\$124,050
Software design/development/programming	\$105,386	\$114,096
Communications systems and equipment (local-area/wide-area networking products, wireless, cellular, RF and microwave, Bluetooth, etc.)	\$103,727	\$113,032
Avionics, marine, or space	\$103,732	\$111,764
Consumer products	\$98,589	\$108,355
Medical products	\$96,088	\$105,998
Industrial controls systems and equipment (including robotics)	\$93,800	\$101,948
Test & measurement equipment	\$92,629	\$101,418
Automotive products	\$92,257	\$100,015
Power design	\$91,454	\$99,947
Research & development	\$91,624	\$99,703
Other	\$85,794	\$94,068
Safety/security	\$84,303	\$92,602
Packaging	\$83,800	\$89,050
Components & subassemblies	\$82,750	\$88,815
Appliances	\$81,400	\$88,150
Mobile equipment	\$73,333	\$83,686
Materials handling equipment/services	\$64,154	\$74,046
Machine tool/automation	\$66,769	\$73,144

Average Salaries By Age	Base salary	Total compensation
60 or older	\$95,545.71	\$104,471.11
55-59	\$104,012.03	\$113,636.95
50-54	\$104,568.07	\$114,122.20
45-49	\$99,133.57	\$107,156.42
40-44	\$90,680.00	\$98,840.19
35-39	\$92,682.29	\$102,167.34
30-34	\$87,780.49	\$95,988.49
25-29	\$63,956.52	\$70,061.53
Under 25	\$64,656.25	\$71,822.92

tember, and starting in January my actual paycheck was slightly smaller than before my raise—which supposedly had put me into the highest category for sharing benefit costs. The good raise was for exceptional performance. Kind of empty, huh?”

Another engineer commented: “Health insurance costs to employees have been increasing more than 10% every year for as long as I can remember. The company has been very fair and tried

to absorb the increase. 401(k) matching was cut out completely, but has been gradually added back based on the performance of the company. But it is still not at the same level as before 2008, and probably won't be anytime soon."

Other types of indirect cash rewards that fell off in 2012 include compensation for professional organization dues, tuition reimbursement, and stock purchase plans (now offered by just 14% of companies).

"The people who work for me need pay raises," stated one manager. "I came on board two years ago, and I'm fine. But these guys need to be recognized and persuaded into staying. I have really great developers and engineers under me."

While working engineers struggle with their companies' lukewarm attitudes toward employee retention, they also see those same companies struggling to find qualified candidates for open positions. Nearly half of those surveyed say their company is having difficulty finding and recruiting fresh talent, up slightly from last year.

"It's more difficult to hire for senior positions than for entry-level positions, so we are focusing more on ways to retain engineers, especially in the five- to 10-year experience range," noted one engineer.

The toughest positions to fill are in software (37%), followed by analog design (36%), systems engineering (34%), embedded design (29%), and power electronics (28%). "Once we are able to find capable workers, we want to keep them," said a respondent. "It helps to keep our reject rates down, thus driving the likelihood of profits."

But another engineer saw things another way: "Company management has realized that improvements in the market make it more attractive for us to consider positions with other companies, so they've made some adjustments to help prevent the loss of employees."

## THE OTHER REWARDS

Despite the tough job market, most engineers remain upbeat on the profession and the companies they work for. Barely 10% say they are actively seeking another position. And while 60% say they would be open to following up on an interesting offer if it presented itself, 30% can't envision themselves changing jobs anytime in the near future.

"The present situation at work, though not the greatest, will eventually change," insists one engineer. "Engineering is an ever-green field for conceptually clear people, and if you are young and hardworking, the sky can be the limit."

Even with its challenges, engineering continues to earn high grades with members of the profession as a way to do exciting things, work with smart people, and see ideas transformed into working realities. 87% say they would recommend engineering as a career path to a young person.

"Engineering remains a challenging, rewarding, and respected career," proclaimed one engineer. "I have never had a dull day at work. Even though I think the biggest benefits are not monetary, good engineers still have good opportunities for advancement and financial success."

"Engineering is one of the few careers where at an entry level, you can have a job that is challenging and different every day,"

Average Salaries By Size Of Company	Base salary	Total compensation
\$10 billion or more	\$114,152.63	\$124,364.05
\$5 billion to \$9.9 billion	\$119,482.95	\$130,185.99
\$1 billion to \$4.9 billion	\$108,520.74	\$118,936.83
\$500 million to \$999.9 million	\$114,064.89	\$123,082.67
\$100 million to \$499.9 million	\$105,169.19	\$113,683.28
\$50 million to \$99.9 million	\$101,012.20	\$107,083.76
\$25 million to \$49.9 million	\$91,945.95	\$99,991.37
\$10 million to \$24.9 million	\$95,175.98	\$102,995.55
\$5 million to \$9 million	\$89,192.81	\$97,921.07
Less than \$5 million	\$81,207.40	\$89,239.29

Average Salaries By Years Of Engineering Experience	Base salary	Total compensation
40 years or more	\$93,388	\$101,682
35-39 years	\$107,144	\$116,678
30-34 years	\$106,848	\$116,343
25-29 years	\$107,458	\$116,786
20-24 years	\$99,211	\$108,625
15-19 years	\$93,287	\$102,212
10-14 years	\$85,742	\$94,761
5-9 years	\$77,493	\$84,534
1-4 years	\$62,052	\$67,215
Less than 1 year	\$58,647	\$64,117

Average Salaries By Level Of Education	Base salary	Total compensation
Doctoral degree	\$115,536.36	\$126,195.60
Master's degree	\$106,155.06	\$115,339.09
Bachelor's plus graduate studies	\$95,687.68	\$104,566.78
Bachelor's degree	\$95,215.64	\$103,824.28
Attended college	\$77,317.88	\$86,565.32
Associate's degree	\$76,115.13	\$82,062.61
High school or less	\$74,725.00	\$83,609.62

said another. "Shuffle paper or do manual labor for a living, and your mind and soul will be dead in a year."

Of course, with engineering there is always the excitement of potentially making a quantum breakthrough in the field. And the diversity of opportunity, from design to manufacturing to field support, allows engineers to utilize their abilities and explore their interests in many different ways.

"I find it very fulfilling to work on problems affecting people's lives and helping to find solutions to those problems," said one engineer. "If we can help young people see that aspect of engineering, the ability to make a real difference in society, we'd have them beating down the doors to get in the engineering programs across the world."

Some engineers were more cautious in their enthusiasm during these tough economic times. "I see friends and colleagues that were laid off having to accept a lower salary than their previous job because employers don't see an advantage that 30 years of

experience can deliver compared to 15 to 20 years experience,” said one engineer.

“This is especially true with the new CM/ODM (contract manufacturer/original design manufacturer) model where the design is largely done outside the U.S. and where the engineering talent costs less. If you can stay employed at the same company, then you can see some salary increase, but usually at 2% to 4% per year,” the engineer continued.

But one engineer summed up the attitudes of many when he said: “Engineering is the art of finding and creating solutions to our daily life issues. Sometimes dauntingly difficult, sometimes exhilaratingly easy, it is an always enriching task and, as long as you dare to realize you’re always a newbie in some given area, a pleasant job. I have always been doing what I liked the most, so I enjoy it a lot. I learn a lot

as well, and I’m ready to keep learning in the years to come. That’s how anybody willing to have any engineering position should face it.”

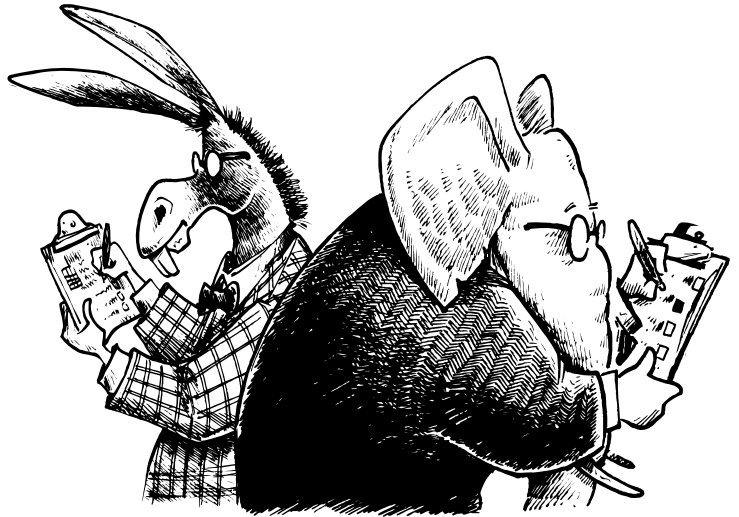
So perhaps the best news of all from this year’s survey is that most engineers (55%) still find themselves sufficiently challenged intellectually with the projects they work on, while only 10% claim they’re not. And, gripes aside, nearly two-thirds (63%) feel adequately compensated for the work they do.

The bottom line is that engineers are not immune from the effects of a weak global economy. However, they’re not likely to abandon their chosen profession anytime soon. Time will tell whether or not a stronger recovery ever winds up leading to improved compensation and benefits. But in an increasingly technology-centric world, engineers are probably in the right place at the right time. **ed**

## SpecialReport

**JAY MCSHERRY** | CONTRIBUTING EDITOR [jaymcsberry@earthlink.net](mailto:jaymcsberry@earthlink.net)

# ENGINEERS AMP UP POLITICAL DIFFERENCES



**E**ngineers are a cynical lot when it comes to politics. Regardless of their affiliation, they are overwhelmingly likely to believe neither party represents the interests of their professional community.

Roughly 20% of the respondents to the Electronic Design 2012 Salary Survey say they are Democrats, with one-third saying they are Republicans, and the rest classifying themselves as either other or independent. By comparison, research from Gallup puts the U.S. as a whole at 30% each for Democrats and Republicans, with the rest independent.

Just under 16% of those surveyed say Democrats would do well for the engineering community, and 28% give the nod to Republicans. But a little more than half have no faith in either party, with many saying both are more concerned with maintaining power than actually governing.

Our survey asked about a variety of political, social, and economic concerns. A look at responses based on self-reported political affiliation yields some expected differences, given each party’s agenda.



For instance, Republicans rate national security, government ethics, national debt, entitlement programs, taxes, inflation concerns, the value of the U.S. dollar, and immigration—although whether this was regarding work visas specific to the engineering community or a general concern was unclear—as much more significant concerns than did Democrats. Democrats feel energy policy, healthcare, the environment, and the inability of political parties to work together are more pressing issues than their GOP counterparts. Across the board, respondents rated the U.S.’s overall economic footing as the most important issue facing the country.

The professional issues that keep each group up at night vary as well. Democrats are more concerned about product reliability and product quality issues, looming project deadlines, age discrimination, and job security. They also were more likely to cite outsourcing issues as concerns than Republicans.

Republicans lose more sleep over specifying the right products and vendors for their designs, component availability, documenting return on investment on engineering expenditures, and the general health of the economy. But a higher percentage of Republican engineers say nothing keeps them up at night. And Republicans’ higher faith in their job security is reflected in a higher percentage of them saying their organizations are having difficulty finding qualified candidates for open engineering positions.

Despite these beliefs, engineers of both stripes are sticking with their party in the upcoming presidential election. Three-quarters of Republicans and Democrats alike anticipate voting for their party’s candidate in November. Not that there isn’t some hint of bipartisanship: Both cite similar disapproval levels,

#### WHAT POLITICAL PARTY DO YOU BELONG TO?

Republican	33.2%
Democratic	20.3%
Independent	36.5%
Other	10.0%

#### HOW WOULD YOU CHARACTERIZE YOUR SOCIAL POLITICS?

Conservative	34.8%
Moderate	44.7%
Liberal	20.5%

#### IN YOUR VIEW, WHICH POLITICAL PARTY BEST REPRESENTS THE INTERESTS OF THE ENGINEERING COMMUNITY?

Republican Party	28.0%
Democratic Party	15.6%
Other	4.1%
Neither	52.2%

#### DO YOU BELIEVE THAT IMPOSING TERM LIMITS ON MEMBERS OF CONGRESS WOULD HELP GET THINGS DONE IN WASHINGTON?

	Yes	No
All respondents	60.9%	39.1%
Republicans	68.2%	31.8%
Democrats	48.2%	51.8%
Independents	61.5%	38.5%

## CORPORATE PERSPECTIVE: BUSINESS AND EDUCATION MUST COLLABORATE TO INNOVATE

**In the photonics industry, we’ve** observed how recent generations of engineering graduates are as talented, and with more specialized training, than at any time in recent memory. That’s good news for our industry, which is robust and dynamic.

One challenge we find in Florida is that the most talented graduates in the country often gravitate to more traditional technology centers in places such as the Silicon Valley, the Northeast, and the Research Triangle in North Carolina. Still, we have a strong university system in Florida, with excellent programs in lasers, opto-electronics, and photonics, along with institutions that are willing to partner with the technology business community.

In fact, our founders were products of Florida’s university system. The company is staffed at all levels by skilled technicians recruited from within the community and by graduates of Florida universities, including PhD-level scientists. About three-quarters of our engineering staff today attended Florida universities.

There are two areas we need to address with engineering education. First, the commercial sector should be doing all it can to encourage more participation in science, engineering, technology, and mathematics (STEM) education at the primary and secondary school level. Being able to work with educators and political leaders on STEM education will yield dividends down the road.

Second, we need to foster innovation and creativity in engineering at all levels, starting with how we engage our future colleagues in both their formative years and as they prepare to enter the workforce.

Our parent company recognizes the value of the commercial sector taking an active role in reaching out to the most talented engineering graduates. Our new graduate development program provides financial support as well as workplace experience in return for a commitment from the graduate to work on special projects that help advance innovation. We’re very excited to participate in this program.

There was a time in the not too distant past when kids would dream about becoming an astronaut. The prospect of traveling into space seemed so romantic and exciting back then. Now kids dream about inventing the next Facebook. That’s not quite the same, but it’s still exciting. Our goal with engineering education should be to foster all kinds of dreams.



KEVIN CHITTIM is president and CEO of Ocean Optics. Previously, he was the president and CEO of Labsphere Inc. He has a BA from Dartmouth College.

around 85%, for Congress's performance.

Overall, respondents award President Obama a gentleman's C: 53% give him this rank or below for his performance. As might be expected, this broke across party lines. While nearly 90% of Democrats rank him above that middle point, 84% of Republicans pegged him at or below it. Asked for reasons for their ranking, many cited the economy, although more than a few cited social issues and perceptions about his religion and background.

Do respondents have more faith in Mitt Romney, the GOP candidate? A little less than 40% believe he would have a significant positive effect on the economy, a sentiment reflected by 68% of Republicans and 12% of Democrats. Several cite tax and other business policies as likely being more advantageous under

a Romney administration. Many respondents cited his business experience and acumen, but more than a few said the U.S.'s economic concerns were too big for one man to handle.

#### DO YOU THINK A ROMNEY WIN WOULD HAVE A SIGNIFICANT POSITIVE IMPACT ON THE ECONOMY?

	Yes	No
All respondents	38.9%	61.1%
Republicans	67.9%	32.1%
Democrats	12.0%	88.0%
Independents	29.7%	70.3%

## CORPORATE PERSPECTIVE: SMART OUTSOURCING STRATEGIES CAN YIELD REWARDS

**Almost 30 years ago, an** EDA software support organization working for me at Texas Instruments hit a brick wall in terms of hiring. There were far too few skilled software and circuit design engineers who were willing to move to Dallas, Texas, to staff our most critical needs. Mohan Rao, the leader of the design automation group, was familiar with India and guided us to establish an operation in Bangalore there, despite the lack of infrastructure or any similar company operations.

Today, Bangalore is a center of engineering excellence challenged by rapid growth in demand for its engineers and its burgeoning infrastructure. Since then, I've learned some lessons from my experience in Bangalore and dozens of other engineering sites around the world.

- **If you need to establish an offshore development site, don't be influenced by labor costs.** The important factors are availability of skilled engineering graduates, proximity to the key customers and markets you must support, and infrastructure for communication and travel. Labor costs for critical talents will tend to equalize over time around the world.
- **It's always easiest to manage engineering organizations situated in a single location.** There is a real cost of dividing work up among groups around the world. Therefore, make sure that every site is a center of excellence in some major area of technology. To the extent that it's possible, assign complete projects to a single site. Twice in the last five years, I've been involved in moving major groups of engineers from India to locations in the U.S. and Europe because of the importance of consolidating expertise.
- **Most multi-national companies would like to outsource the routine engineering work that the home team doesn't want to do, while keeping the challenging excitement at home.** It doesn't work. The best engineers remain with a company because it provides challenges, intellectual growth, and the excitement of major successes. High turnover at an offshore site is worse than no offshore site at all. As a minimum, be sure there is at least one group on every site that is engaged in a leading-edge technology so the best engineers can aspire to become part of a world-class operation.
- **Go where others aren't.** If you choose offshore sites that are popular locations for your competitors, you can hire your initial employees from them and later watch other companies do the same to you. It's better to find a place where you can hire and train tal-

ented engineering graduates and hang onto them for periods long enough for major accomplishments.

- **Think about the U.S. and Europe as "offshore engineering sites."** If you can't hire enough good engineers locally, there are lots of growing centers with good educational resources. Dozens of San Francisco Bay Area electronics companies are establishing major facilities in Austin, Texas. North Carolina Research Triangle Park, Portland, Pittsburgh, San Diego, Seattle, Boston, to mention just a few, have growing centers of specialized technology expertise in the U.S. Both Western and Eastern Europe have dozens of centers of truly innovative engineers and universities. Most companies have found, however, that nurturing their own selection of universities is the best way to ensure a continuing supply of talented graduates. Sponsorship of research, equipment donations, internship programs, mentoring, and the development of special relationships with professors are all key parts of building an infrastructure that will sustain the need for talent.
- **The critical resource is innovation.** The lower the value added, the more easily it can be done by low-cost labor in other parts of the world. Some of the most innovative companies in the world, like Apple, have the predominant share of the resources highly concentrated in areas with high labor costs because they are producing ideas and innovation, rather than manufacturing products.
- **Communication and virtual meetings have made possible the effective use of distributed creative resources.** This trend will continue. And since customers will increasingly be distributed around the world, more and more product ideas and innovative solutions will require multicultural teams and geographically distributed support resources. A large share of major company employees will inevitably come from different cultures and live in different regions of the world. Innovation will increase as a result, and so will our international understanding of each other.



WALDEN C. RHINES, chair and CEO of Mentor Graphics, holds a BS in metallurgical engineering from the University of Michigan, a master of science degree and a PhD in materials science and engineering from Stanford University, and an MBA from Southern Methodist University.

## WHAT ARE THE MOST IMPORTANT ISSUES FACING THE U.S.?

All respondents	Republicans	Democrats	Independents
1. Overall economy	1. Overall economy	1. Overall economy	1. Overall economy
2. Inability of parties to work together and get things done	2. National debt	2. Inability of parties to work together and get things done	2. Inability of parties to work together and get things done
3. National debt	3. Government ethics	3. Education	3. National debt
4. Government ethics	4. Entitlement programs	4. Healthcare	4. Government ethics
5. Education	5. National security	5. Energy policy	5. Education
6. Energy policy	6. Taxes	6. The environment	6. Energy policy
7. Entitlement programs	7. Inability of parties to work together and get things done	7. Government ethics	7. Entitlement programs
8. Healthcare	8. Energy policy	8. Entitlement programs	8. Taxes
9. Taxes	9. Value of the U.S. dollar	9. National security	9. National security
10. National security	10. Education	10. Trade deficit	10. Trade deficit

## OUTSOURCING TAKES CENTER STAGE

While outsourcing has become a way of life in the engineering community, it has suddenly become a mainstream issue during this contentious election year. Democrats claim President Obama has a plan to bring jobs back to the U.S. by eliminating tax breaks for companies that outsource American jobs and by creating tax incentives for businesses bringing jobs back home.

Democrats also have created a cloud of uncertainty around Mitt Romney's success as a business leader by questioning whether or not Bain Capital or its subsidiaries were involved in outsourcing. The Romney campaign has countered with claims that the President is the "outsourcer-in-chief" because of his support of solar

and wind-energy companies that end up making their products outside the U.S.

Outsourcing is an issue that's all too familiar to engineers today, according to this year's survey, as a comfortable majority (60%) of OEMs continue to farm out work both domestically and overseas.

"We have a very symbiotic relationship with our outsourcing company," commented one engineer. "We work closely with them and they extend our capacity rather than replacing employees. Because of our relationship with the company, we can take on jobs we would otherwise lack the manpower to do."

With decades of experience in outsourcing now under their belts, companies seem to have a better sense of where they're

## CORPORATE PERSPECTIVE: STEM EDUCATION MUST TAKE ROOT FOR ECONOMIC SUCCESS

**American competitiveness is more important** today than ever before as estimates show the U.S. will have over 1.2 million unfilled science, technology, engineering, and mathematics (STEM) jobs by 2018. Yet today, only 19 out of 100 students who enter a STEM program actually graduate.

Thus, it will be critical for the next U.S. presidential administration to foster and support programs that cultivate the development of STEM skills early on and inspire private sector companies, educational entities, and non-government organizations (NGOs) to work together and ensure that students are prepared with the appropriate skills and experiences to tackle the world's toughest challenges and lead in the global marketplace.

The current U.S. administration has taken several steps to promote teacher development and STEM skill development among today's youth. Programs such as the Digital Promise, an initiative created by the President and Congress and supported through the Department of Education, aims to unlock the promise of breakthrough technologies to transform teaching and learning. In fact, the federal government has inspired several organizations, like AMD, Microsoft, ESA,

the Cooney Center, and E-Line Media, to band together to create programs like the National STEM Video Challenge that advance the STEM skill development of middle and high school students through video game design.

One of the most important powers of government is its ability to set a public agenda for the country and to convene key leaders to address critical issues. As we move toward the 2012 presidential elections, we ask the next administration to prioritize the education of American students in STEM fields and to use its power to communicate the urgency of ensuring that the U.S. workforce has STEM graduates required for our nation to remain globally competitive.



ALLYSON PEERMAN is president of the AMD Foundation and AMD's corporate vice president of public affairs, responsible for the company's government affairs, community affairs, and corporate responsibility efforts worldwide. She graduated with honors from the University of Texas with a degree in public relations.



willing to take the risk of handing over design, development, and manufacturing to others.

“Outsourcing essentially is cyclical,” remarked one engineer. “As we try to reduce costs by going offshore, the economics of dealing with different cultures/time zones eventually force you back to insourcing unless the entire piece being outsourced is self-contained. In general, that means that the company engineers get to focus higher up on the design cycle at architectural levels, and only things like manufacturing, test, production end up being viable for overseas outsourcing. As such, it’s a good thing for most design engineers.”

But outsourcing also has burned companies. “It’s mostly a waste of time,” complained one engineer. “Few of the outsourcing efforts I have been involved in were successful, and those that were did not reduce the local work load that much. And the support structure needed is huge.”

Another engineer concurred: “In most cases I have witnessed, outsourced development to other lower-cost countries has not saved much development money—and has often cost a lot of money in missed opportunities and remediation efforts.”

Despite its spotty track record, most survey respondents believe that outsourcing makes fewer engineering jobs available and lowers employee morale. What’s more, nearly 40% of engineers think outsourcing drives down salaries for new engineering hires and limits opportunities for advancement for those already on board.

“Outsourcing is bad for our people and country because it reduces the number of good jobs, creates higher unemployment, can have a negative effect on salaries, creates a loss of engineering talent and a loss of control of projects—as well as a loss in

DO YOU APPROVE OR DISAPPROVE OF THE WAY CONGRESS IS HANDLING ITS JOB?			
	Approve	Disapprove	Unsure
Republicans	3.9%	85.1%	11.0%
Democrats	3.9%	84.3%	11.8%
Independents	2.4%	82.7%	14.9%

WHAT IS THE LIKELIHOOD OF YOU CROSSING PARTY LINES IN THE UPCOMING PRESIDENTIAL ELECTION?	
Very likely	7.7%
Somewhat likely	8.6%
Unlikely	61.4%
Don't know yet	22.3%

knowledge going forward as technology advances,” protested one engineer. “It also generates less tax income for our nation, which is already in significant trouble with a national debt of about 17 trillion dollars and counting.”

Surprisingly, despite the fact that most of the respondents believe that outsourcing results in fewer engineering jobs, most also deny that it has affected them personally. Three out of four say they aren’t concerned with the prospect of losing their job to outsourcing, while 12% maintain their skills are valued more than before—and 20% go as far as to claim that outsourcing gives them the opportunity to work on more innovative projects, since more routine tasks have been moved out of the organization.

“Outsourcing can be a double-edged sword,” noted one engineer. “If you are outsourcing mundane work, work that is not part of your core competency, that can give you the edge to compete globally. When you give away your secret sauce, you are mortgaging the future of the company and morphing it into merely a distributor of product.”

As wages in offshore hotspots like India and China continue to rise, some question whether the old ways of outsourcing may be coming to an end, and they wonder if outsourcing may be running its course as a cost arbitrage strategy. Only time will tell. **ed**

HOW WOULD YOU GRADE THE JOB PRESIDENT OBAMA HAS DONE IN HIS FIRST TERM?				
Grade	All respondents	Republicans	Democrats	Independents
A	12.5%	2.5%	27.0%	12.2%
B	28.2%	9.1%	52.6%	34.5%
C	21.9%	24.4%	17.2%	22.1%
D	15.6%	25.9%	2.4%	14.0%
F	21.8%	38.1%	0.8%	17.2%

HOW ROMNEY SUPPORTERS VIEW THE CANDIDATE

“He knows how to run a business. The government needs to be run like one.”

“We need fiscal responsibility to avoid an economic meltdown.”

“I think he would be more willing to work with congress (the way Reagan was able to).”

“Most companies are holding back money, which they will spend if Romney is President.”

“I don’t think he has an interest in making money off the government. He seems like he’s motivated by what he sees as right and just for those living now and not to make up for injustices of the past.”

“He’s a proven leader and has accomplished more already than many past presidents.”

“Business community would view the change as having the potential to stimulate growth.”

## HOW ROMNEY DETRACTORS VIEW THE CANDIDATE

---

“If Romney is elected you can see the gap between the 1% and the rest of us increasing.”

---

“More breaks for the super-rich, more jobs shifted overseas, and less help for the middle class.”

---

“He would not increase revenue, which is an absolute requirement for reducing the debt.”

---

“He will privatize industries that will eliminate jobs and increase corporate profits.”

---

“He has the same tired old solution that got us where we are today, which is less taxes and oversight at the expense of workers and the environment.”

---

“His economic theories are greed based, and he believes trickle down economics works. It doesn't.”

---

## HOW OBAMA SUPPORTERS VIEW HIM

---

“The fact that he achieved anything at all while facing total opposition from the Republicans in Congress is almost a miracle.”

---

“He has saved the auto industry and captured or killed more Al Qaeda terrorists than his predecessors. Also, he is a calm, intelligent man that does not make rash uninformed decisions. Only Congress seems to do nothing.”

---

“I appreciate his foreign policy decisions and his efforts to save entitlement programs.”

---

“He got Mitt Romney's health care reform in Massachusetts passed for the rest of the nation. He did this despite the fact that the Republicans abandoned their own health care plan because he was backing it.”

---

“He walked into a hot mess to clean up that was years in the making. It will take years to turn things around.”

---

“He has handled the economic crisis well and also managed the war well.”

---

## HOW OBAMA DETRACTORS VIEW HIM

---

“He has not helped for jobs or the economy. He is more concerned with snuggling up to unions and big government.”

---

“He has contributed to increased polarization of the Congress and the citizenry. This was not the change we needed.”

---

“He is unwilling to compromise. He has forced his ineffective policies into law without working in a bipartisan manner.”

---

“He has provided no leadership and his ideology will bankrupt us.”

---

## MAKING THE CASE FOR TERM LIMITS

---

“Seniority is different in positions of power than in positions like engineering—the former is self-destructive and tends to lose its original *raison d'être*.”

---

“Need new thinking in Congress.”

---

“Term limits, line item veto, equal application of laws, and campaign finance reform would all help to get things done. We need to remove the incentives to constantly campaign and to actually do something beneficial.”

---

“It might help flush out some serious obstructionists.”

---

“Politicians would be more likely to do what's right and not necessarily what's popular once they don't have to deal with re-election.”

---

“Politicians are like diapers—they work best when changed often.”

---

“There would be too many people in Washington with too little experience—the tribal knowledge is held by the elders that have been there a while.”

---

“If they can't get it done now, giving them less time won't help.”

---

“Representatives will still vote with their short-term hearts, not with long-term reasoning brains.”

---

“Electing qualified officials and keeping them is what's most important.”

---

“It seems like a remedy for the symptom rather than for the underlying issue.”

---

## ONLY ABOUT ONE IN FOUR ENGINEERS THINK REPUBLICANS BEST REPRESENT THE INTERESTS OF ENGINEERS...

---

"Republicans seem to want to bring manufacturing back to the U.S.—unlike the environmental terrorists who control the Democratic Party."

---

"Our company depends on DOD and NASA budgets for many programs, which Republicans tend to support."

---

"Lower taxes and less wasteful government spending will mean more money for private enterprise to invest and grow, resulting in more jobs for engineers."

---

"Republicans are typically conservative and proponents of defense, which typically drives the engineering community."

---

"Republican policies are better for the economy in general, and therefore better for engineers."

---

"Republicans provide the best combination of laissez-faire and responsibility available in a party that is actually electable."

---

"Republicans are the more capitalist party—engineering thrives in a capitalist society."

## ABOUT HALF THAT NUMBER THINK DEMOCRATS BEST REPRESENT THEIR INTERESTS...

---

"The Democrats seem more willing to invest in new technologies like those that can solve our energy problems."

---

"Democrats are for creating/maintaining U.S. jobs while Republicans support outsourcing."

---

"Democrats tend to see the social value of engineering and technology more than Republicans do."

---

"The Republican Party only supports major company owners, not workers or engineers."

---

"The Democrats have a clearer view of the benefits of technology and science on society."

---

"The Republicans don't want to spend money on new technology and want to go back to the environment we had in the 1960s."

---

"Federal funding for science and technology generally is higher under Democratic administrations."

---

"Democrats care more about job retention, health care, and renewable energy, which can lead to more jobs."

## ...BUT MOST ENGINEERS BELIEVE NEITHER PARTY HAS THEIR BACK.

---

"All politicians want to align themselves with innovation, science, and technology. Unfortunately, while it's quite popular to give lip service to these important endeavors, most political parties and politicians are most interested in serving their financial backers and other constituents. This means that their approach to supporting innovative science and technology is fragmented and piecemeal at best."

---

"Both parties claim they want increase in STEM, but I don't see much proof in support."

---

"Nobody is interested in small & medium business needs, where most of the engineering jobs are."

---

"Apparently most politicians are in it for themselves. Only rich constituents matter."

---

"Engineering is too low on the priority list."

---

"Prominent R&D policy is notably absent from both parties."

---

## THE ECONOMY'S BROKEN—WHAT'S YOUR SOLUTION?

During our survey, we gave you a chance to share your ideas for getting the economy moving again. Here are some of your responses.

---

"Reduce tariffs on raw materials. Stop rewarding greed in our banking & business systems. Provide incentives to small business. Completely overhaul the medical/pharmaceutical/insurance industry without the need for business to carry the brunt of costs."

---

"Tax corporations more and remove personal income tax or reduce it greatly. If more people suddenly received a 20% to 30% income increase by way of tax cancelling, people would have more money to spend on things they want or need or to eliminate debt or save more while raising their lifestyle in a hopefully positive and healthy way. If the income tax was removed, I could eliminate significant debt which is slowly being paid off in a single year and afford to both take better care of myself, afford better continuing education, and explore outside interests more easily."

---

"We need a radical change to our tax structure. Eliminate the IRS and change to a consumption based tax structure. That will



draw manufacturing back to the U.S. and restore U.S. jobs. An economy cannot survive on service jobs alone. There needs to be a mining and/or manufacturing base to support the rest.”

---

“Encourage innovation, allow dinosaur businesses to fail naturally (with no bailouts), fund higher education, boost national technical skills, penalize banks that are not lending, fund universal healthcare, encourage skilled immigration, and compete for the best and brightest students from other countries (i.e., reverse the brain drain).”

---

“Having people that have actually worked a day in their life be part of Congress and PACs, instead of the throngs of self-entitled people that come from families with large resource pools. The fact that the U.S. legal system has taken the average person out of being able to participate has handicapped the nation and increased the apathy of the average person.”

---

“Control access to the marketplace. If you want to sell goods here, you must pay fair taxes for the privilege. Corporate minimum tax rate, no matter what business they are in. End subsidies to oil, gas, and coal. End subsidies to agri-business and pharmaceutical companies. Government negotiated prescription drug prices on all drugs. Bust up big banks. Re-regulate banking and prevent them from creating unbacked securities (printing their own money with no backing except the tax payers and the Fed). Start prosecuting CEOs, Wall Street, and bankers for clear dereliction of fiscal duty, fraud, incompetence. Restoration of the values of ‘personal’ responsibility by holding the actual people accountable for acts and lack of acts.”

---

“Intelligent investment in America is first and foremost. The past four years have shown the flurry of bottom-up economics. It’s a big flash in the pan and dissipates in a single quarter. The same number of dollars at the top, funded to support key technology development, circulate far longer, generate more tax revenue, and produce a sustained effect that last far beyond the initial funding, perhaps even in perpetuity—if self-sustaining businesses are developed in the wake of development grants and business assistance.”

---

“Reinforce what makes the U.S. great by fostering more innovation, technology, and small businesses both for the short and long term. Education, tax, immigration (bring more in legally) policies are key. Also better integration and cooperation between private and public sectors, not fighting against each other.”

---

“Stop the bailout and let bad companies fail. Subsidizing failed companies stagnates the economy by permitting them to provide bad services and produces and prevents innovative companies from moving up. In 1925, there was a real estate bubble crash. Eighteen months later the economy **recovered** because the bad banks and other businesses were allowed to fail and be replaced with newer businesses that were able to meet the market’s demand.”

---

~~“I’m a Keynesian and believe from empirical evidence that private~~ industry’s solutions to a crash such as this will only bring on a death spiral. The government needs to step in with a major stimulus to get money circulating again. Yes, it is deficit financing, but the subsequent recovery pays that back. The biggest problem here is that the previous regime used deficit financing during positive economic times—and is now trying desperately to pin it on the next guy.”

---

“We need major investment by business and government in STEM education, as well as support for projects involving structural, scientific, and technological commitments that create lasting and meaningful work for our society. Additionally, we all need to shift our focus a little from our obsessions with immediate gratification and wealth and direct it just a bit more towards long-term financial stability for ourselves and strategies that benefit the economic health for the entire country.”

---

“We need some certainty in the market. Pass the highway bill, pass some meaningful (without being mean spirited) immigration reform, and get past the idea that Obama passed healthcare reform and modify the sections of the healthcare reform that need mending.”

---

# TOP 50 EMPLOYERS IN ELECTRONIC DESIGN

Leading companies innovate to define their markets and succeed in the face of uncertain financial futures.

---

Even though it started out as a promising year, 2011 was thrown into uncertainty as the European sovereign debt crisis, first brought to light in late 2009, intensified in October and still troubles us today. The electronics industry felt these aftershocks as it tried to build on the growth it enjoyed in 2010.

Some companies in the industry fared better than others as evidenced by this year's edition of the Top 50 Employers in Electronic Design (*Table*

1). Just as we have with previous editions, we based our results on a formula using public financial data with bonus points awarded using the results of our annual *Electronic Design* Reader Profile Survey (see “*The Method Behind Our Mathematics*” at [electronicdesign.com](http://electronicdesign.com)).

#### WHERE THE JOBS ARE

According to the Kiplinger U.S. Business Economic Outlook, job creation will accelerate in the second half of 2012 at an average of 150,000 net new jobs a month, but not enough to improve on last year’s mediocre 1.8 million total, reflecting an economy that lost momentum in the spring and is struggling to regain it. That’s still too slow, however, to significantly lower the unemployment rate—8.2% in June and around 8% by year-end 2012.

Progress in halting the financial crisis in the Euro Zone would help ease the worries of corporate managers, who slowed hiring and investment earlier this year as Europe’s problems threatened to sap global economic growth. The somewhat more improved outlook in Europe won’t be enough to give employment gains the big boost necessary. Global growth that is slower than last year’s will continue to curb U.S. export gains and slow new hiring by manufacturers, who provided an outsized share of job creation in 2010 and 2011 after decades of steady job cutting.

Most of the employment gain is likely to come in “business and professional services,” which includes engineering. The recent pause in job creation has taken pressure off private employers to raise wages, and pay increases will get even smaller.

In the 12 months ending June 2012, average wages for all workers rose 2%, a little faster than consumer inflation, but wage increases are expected to go back to lagging inflation. This will make most of us feel worse off and hinder growth in consumer spending, which accounts for most economic growth.

Three years after the end of the Great Recession, the number of workers unemployed for more than 27 weeks is 5.4 million, or 42% of the jobless. Though down from 2011, that share is much higher than it ever was before 2009.

Companies will pick up their investment in facilities and new equipment in the second half of 2012, as job creation and economic growth recover from the first-half pause. Real growth of 8% is expected from July through December, after roughly 3% in the first half.

Companies took a breather early this year, following the 2011 expiration of a tax credit for new investment that boosted capital spending last year. Also, labor productivity will be flat or negative for the second year in a row so any increases will have to come through new capital investment.

The increase in capital investment won’t be anything special—around 6% for the year, slower than the 8% increase in 2011. Annual business investment will still end 2012 below the level reached before the Great Recession. At that rate, capital investment will play a smaller role in economic growth this year, after accounting for about 40% of growth in 2011.

For fiscal 2011, the pool of 99 companies that we analyzed collectively showed employee growth of 3%, sales growth of almost 10%, and pretax income growth of 8%. In fiscal 2010, the comparisons were 1.5%, almost 10%, and 83%. Companies continued to cautiously add staff and were able to collectively replicate the previous year’s sales growth, but were not able to replicate the pretax income gains, although roughly 80% of the sales increase flowed through at the pretax level.

In fiscal 2010, companies significantly improved pretax profit margins by 5 points and debt-to-equity ratios by 9 points. This is extremely hard to duplicate once a company has pared its expenses down to the bone. In fiscal 2011, pretax margins

**TABLE 1: TOP 50 EMPLOYERS IN ELECTRONIC DESIGN**

Company	Fiscal 2011 rank
APPLE INC.	1
QUALCOMM INC.	2
CATERPILLAR INC.	3
ROCKWELL AUTOMATION INC.	4
SANDISK CORP.	5
GENERAL ELECTRIC CO.	6
KLA-TENCOR CORP.	7
LINEAR TECHNOLOGY CORP.	7
MENTOR GRAPHICS CORP.	7
SYNOPSYS INC.	7
MOLEX INC.	11
DELL INC.	12
JOHNSON CONTROLS INC.	12
THE BOEING COMPANY	12
INTEL CORP.	15
MAXIM INTEGRATED PRODUCTS INC.	15
ANALOGIC CORP.	17
GOODRICH CORP.	17
CADENCE DESIGN SYSTEMS INC.	19
EMC CORP.	19
INTERNATIONAL GAME TECHNOLOGY	21
GENERAL MOTORS CO.	22
LSI CORP.	22
AGILENT TECHNOLOGIES INC.	24
TE CONNECTIVITY LTD.	25
3M COMPANY	26
MICROSOFT CORP.	26
NOVELLUS SYSTEMS INC.	26
LEAR CORP. (11-09 FROM BK)	29
ALTERA CORP.	30
BROADCOM CORP.	30
COMCAST CORP.	30
CYPRESS SEMICONDUCTOR CORP.	30
UNITED TECHNOLOGIES CORP.	30
INTERNATIONAL BUSINESS MACHINES CORP.	35
MOOG INC.	35
RAYTHEON CO.	35
EATON CORP.	38
HARMAN INTERNATIONAL INDUSTRIES INC.	38
NETAPP INC.	38
EMERSON ELECTRIC CO.	41
HONEYWELL INTERNATIONAL INC.	41
ROCKWELL COLLINS INC.	41
SPX CORP.	41
ATMEL CORP.	45
NATIONAL INSTRUMENTS CORP.	45
XEROX CORP.	45
ANALOG DEVICES INC.	48
HARRIS CORP.	48
WESTERN DIGITAL CORP.	48





1. With products like the iPad (a), iPhone (b), MacBook Air (c), and iPod Touch (d), Apple dominates the mobile consumer market.

were down slightly by 0.2 points and debt-to-equity ratios deteriorated by 3.5 points, not unexpected given the huge gains in these areas last year. Research and development continued to grow by almost 9% versus a 3% increase in 2010, a very positive development.

Employment and R&D investment continued to climb back up in fiscal 2011. Companies were able to replicate sales increases but found it difficult to replicate the pretax income and margin increases or the balance sheet improvements achieved last year (*Table 2*). It's always difficult when the base one is comparing to improves so much. Progress has been made in 2010 and 2011, but there is still much to be done.

Our percentage of companies reporting growth in key categories for fiscal 2011 showed a decline from the high levels achieved in fiscal 2010 as 79% reported increases in sales while 54% reported increases in profits (*Table 3*). In 2010, these percentages were 89% and 90% respectively. Again, one can see the difficulty companies are having with continuing to reduce expenses and maintain margins over multiple years—not an easy task.

In fiscal 2011, 68% reported increases in their employee count and 78% reported increased R&D investment. These numbers are very favorable versus the levels achieved in fiscal 2010 of 62% and 67% respectively (*Table 4*).

On the bright side, let's not forget how gloomy the situation was back in 2009 and that the Lehman Brothers demise occurred in fall 2008, which wasn't that long ago. Looking ahead, cautious investments in staff, capital, and R&D along with a laser focus on controlling expenses and managing the balance sheet will be vital for success, as the long-term economic rebound slowly continues.

#### APPLE REIGNS SUPREME AGAIN

It slipped to fifth place in 2010, but Apple Inc. reclaims the top spot in our list of the Top 50 Employers in Electronic Design, a title it has held multiple times before. The Cupertino company designs, manufactures, and markets mobile communication and media devices, personal computers, and portable digital music players. It also sells a variety of related software,

services, peripherals, networking solutions, and third-party digital content and applications.

Apple's products and services include the iPhone, iPad, Mac, iPod, Apple TV, a portfolio of consumer and professional software applications, the iOS and Mac OS X operating systems, iCloud, and a host of accessory, service, and support offerings. The company also sells and delivers digital content and applications through the iTunes Store, App Store SM, iBookstore SM, and Mac App Store.

Since its release, Apple's iPhone has spurred a revolution in cell phones and mobile computing. The company also continues to innovate its core Mac desktop and laptop computers, all of which feature its OS X operating system, including the iMac all-in-one desktop for the consumer and education markets, the MacBook Air ultra-portable laptop, and the high-end Mac Pro and MacBook Pro for consumers and professionals.

Apple scored a runaway hit with the iPod and iTunes online music store. Its iPad tablet computer has become another game-changer in the consumer market. Apple currently holds about 80% of the digital music player market and anywhere between 60% and 70% of the tablet market (*Fig. 1*).

#### COMPETITIVE LANDSCAPE

Apple's markets are highly competitive. Frequent product introductions and rapid technological advances have substan-

TABLE 2: INDUSTRY GAINS IN KEY AREAS

Category	Fiscal 2011 versus 2010	Fiscal 2010 versus 2009
Employee growth	3.0%	1.5%
Sales growth	9.7%	9.9%
Pretax income growth	8.0%	83.2%
Pretax margin improvement	-0.2 points	5.1 points
Debt-to-equity ratio improvement	-3.5 points	9.1 points
Research & development expense	8.9%	2.7%
<i>Electronic Design</i> Reader Profile Survey respondents	36.2%	-2.9%

tially increased the capabilities and use of mobile communication and media devices, PCs, and other electronic devices.

Competitors that sell mobile devices and PCs based on other operating systems have aggressively cut prices and lowered their product margins to gain or maintain market share. Apple is focused on expanding its market opportunities related to mobile communication and media devices. These industries are highly competitive and include several large, well-funded, and experienced participants.

Competition in these industries will continue to intensify as competitors attempt to imitate some of the features of Apple's products and applications within their own products and/or collaborate with each other to offer solutions that are more competitive than those they currently offer. These industries are characterized by aggressive pricing practices, frequent product introductions, evolving design approaches and technologies, rapid adoption of technological and product advancements by competitors, and price sensitivity on the part of consumers and businesses.

Apple's digital content services have faced significant competition from companies promoting their own digital music and content products and services, including those offering free peer-to-peer music and video services. However, Apple believes it offers superior innovation and integration of the entire solution including the hardware (iPhone, iPad, Mac, and iPod), software (iTunes), and distribution of digital content and applications (iTunes Store, App Store, iBookstore, and Mac App Store).

MARKET SEGMENTS

Apple's customers are primarily in the consumer, small & medium enterprises (SMB), and education, enterprise, and government markets. Direct and indirect distribution channels, such as its retail stores, online stores, and direct sales force, and third-party cellular network carriers, wholesalers, retailers, and value-added resellers are used to distribute its products. No single customer accounted for more than 10% of net sales in 2011 or 2010.

Apple believes sales of its innovative and differentiated products are enhanced by knowledgeable salespersons that can convey the value of the hardware and software integration and demonstrate the unique solutions that are available on its products. The company further believes that providing direct contact with its targeted customers is an effective way to demonstrate the advantages of its products over those of its competitors and providing a high-quality sales and after-sales support experience is critical to attracting new and retaining existing customers.

Apple continues to expand and improve its distribution capabilities by expanding the number of its own retail stores worldwide to ensure a high-quality buying experience for its products in which service and education are emphasized. Also, it has invested in programs to enhance reseller sales by placing high-quality Apple fixtures, merchandising, and other resources within selected third-party reseller locations. Through the Apple Premium Reseller Program, certain third-party resellers focus on the Apple platform by providing a high level of integration and support services, as well as product expertise.

COMPETITORS

Apple's rivals include Microsoft, Google, Nokia, Dell, Samsung, Sony, LG, Toshiba, Real Networks, Amazon, Cisco, and other traditional PC and phone manufacturers.

When it comes to providing a complete solution for the consumer, Apple's dominant market position as a digital content manager makes it very difficult for other companies to compete head-on.

Other than Apple's, there is no Web or cloud-based OS and user interface (UI) that presents a simple approach to managing a user's digital assets, managed by a single password, tied to multiple purchasing options, allowing for both localized and online apps, and usable across any device that can access the Internet through a browser.

According to *PC Magazine*, the main competition may not come from the traditional PC and phone makers but instead from content companies such as Amazon, Google, Real Networks, and Sony. Not only do Apple's OS, UI, and Apps simplify digital content management, they provide direct content to the user in terms of music, movies, and applications for dedicated mobile devices such as the iPhone, the iPod touch, and the iPad.

Amazon clearly has become competition with its content commerce model, which delivers digital music, movies, TV shows, and books to end users. Its cloud-based approach has made it easy for customers to access and even manage some of that digital content around a simple UI. But it has a long way to go before it can deliver a localized approach to managing and accessing this content beyond standard PCs and basic mobile devices and across a broad range of products like Apple can.

Real Networks may also be a competitor to watch with respect to content. However, it has not created anything like Apple has in terms of an easy, commerce-based solution to access, manage, distribute, and play back digital content. Meanwhile, Sony has movies, music, e-books, and console and mobile games. Yet it has been unable to create a user environment to manage its own content across multiple products like the PS3, PS Vita, digital music players, and phones.

Google does have a Web-based UI with its Chrome browser that can manage a single user's digital content. Android, Google's OS and apps for smart phones, is quickly evolving into a product that could challenge the iPhone. If content providers make themselves available to both Android and iOS, Google could turn out to be Apple's biggest competition.

TABLE 3: PERCENTAGE OF COMPANIES THAT SAW GROWTH IN KEY AREAS		
Category	Fiscal 2011 versus 2010	Fiscal 2010 versus 2009
Sales growth	79%	89%
Pretax income	54%	90%
Employee growth	68%	62%
Research & development	78%	67%

**TABLE 4: MOST IMPROVED COMPANIES, FISCAL 2010-2011**

Category	Rise in the ranks
MENTOR GRAPHICS CORP.	80
MOLEX INC.	68
KLA-TENCOR CORP.	67
JOHNSON CONTROLS INC.	65
ANALOGIC CORP.	56

**BY THE NUMBERS**

Apple's success continues in 2012 as its first quarter sales grew by 59% fueled by 132% growth in the iPad segment, 85% growth in the iPhone segment, and 32% growth in the music segment. U.S. and European sales were up 41% and 46% respectively. Japan grew by 91%, and Asia-Pacific grew by 114%. While Apple's biggest markets remain the Americas and Europe at 35% and 26% of net sales respectively, Asia-Pacific has grown to represent 21% of sales and is growing the most rapidly.

From a product standpoint, the iPhone is still Apple's number-one profit center. Every iPhone model has been successful. The second most profitable segment is the iPad, already surpassing Apple laptop sales in the first quarter by 88%. The iPad currently is and will be the fastest growing product segment, as it is fairly new and will continue to cannibalize PC sales.

According to Canalsys, for the first time ever, shipments of smart phones have exceeded those of PCs, a category that includes tablet computers, or "pads" as Canalsys calls them, by 73.1 million units. In the first quarter of 2008, Apple sold 2.3 million iPhones. In the last quarter of 2011, it sold 37 million, breaking the record for the largest number of smart phones shipped worldwide in one quarter by a single vendor. The previous holder of the record, Nokia, shipped 28.3 million devices in the final quarter of 2010.

According to ComScore March 2012 data, in the U.S., Apple has gained market share in the smart-phone market as a result of two factors: Apple's release of the iPhone 4 and its broadened distribution to Verizon and Sprint, instead of just selling iPhones through AT&T. Apple should get another revenue boost once the iPhone 5 is released, which is expected around the fourth quarter of 2012.

Interestingly, according to Business Insider, the global smart phone movement may still be in its early phases. There are only around 835 million people using a smart phone, versus around 5.6 billion feature phone users. Globally, there are still fewer than 1 billion smart phone users estimated for 2012, while the forecast for 2016 is around 1.5 billion, so there is still a very large market to sell iPhones to.

Since the U.S. is leading in terms of conversion to smart phones—46% of cell

phone users in the U.S. have a smart phone, against 41% with feature phones—new smart phone sales will have to be directed at the rest of the world, and Apple will have to release a new iPhone every year or so to keep U.S. customers upgrading to the newer versions. Cheaper, smaller-featured versions of the iPhone may have to be implemented in certain global markets to reach as many potential customers as possible, as the feature phone conversion cycle is just getting started.

Gartner Inc. reports that for the first quarter of 2012, Android leads the pack with 56% of the smart-phone market with Apple at 23%. Symbian at 8.6% and Blackberry at 6.9% both continue to decline. Microsoft is negligible at 1.9%.

The fastest growing market is for tablets, with current global sales around 150 million units a year, forecasted to grow to around 400 million units sold annually by 2015 according to Business Insider. There is no real competition to the iPad at this point. Apple continues to solidify customer loyalty as both the iPhone 4S and the latest iPad blew away the launch performance of previous iterations with respect to units per day.

**WHITHER A 7-IN. IPAD MINI?**

The iPad's most serious competitors have been the Amazon Kindle Fire and the Barnes & Noble Nook. The Google Nexus 7 is just launching, and Microsoft's Surface has not launched yet. According to a February IHS estimate, Amazon sold about 3.9 million Kindle Fires in 2011. Barnes & Noble disclosed a \$220 million income from the Nook in the last fiscal quarter of 2011, although it's hard to obtain unit sales figures.

Smart-phone use continues to rise, so although sales of the Fire and Nook are not significant compared to those of the iPad, the market has demonstrated that smart-phone users are willing to purchase 7-in. tablets. Many consumers largely use tablets for content consumption, not creation, which means less interaction and fewer difficulties at the 7-in. size than Steve Jobs foresaw in 2010.

Even with the recently introduced Google Nexus 7, there is no real competitor to the iPad. The Nexus 7 looks like mainly a response to the Kindle Fire and the upcoming Kindle Fire 2, both of which use a version of Android customized to Amazon's commerce platform. The Nexus 7, Kindle Fire, and Nook

**TABLE 5: TOP 10 OEM EMPLOYERS**

Company	Fiscal 2011 OEM rank	Fiscal 2011 overall rank	Category
QUALCOMM INC.	1	2	Communications
ROCKWELL AUTOMATION INC.	2	4	Industrial controls
MENTOR GRAPHICS CORP.	3	7	EDA
SYNOPSYS INC.	3	7	EDA
LINEAR TECHNOLOGY CORP.	3	7	Components & subassemblies
MOLEX INC.	6	11	Industrial controls
MAXIM INTEGRATED PRODUCTS INC.	7	15	Components & subassemblies
INTEL CORP.	7	15	Components & subassemblies
ANALOGIC CORP.	9	17	Industrial controls
CADENCE DESIGN SYSTEMS INC.	10	19	EDA



are all undercutting Apple but at the expense of very slight margins at best. Their entry level models all sell for \$199. The hope is to make money on content sales.

Given Apple's track record of success, it could launch a 7-in. iPad, for \$299, right behind the iPad 2 at \$399 and the new iPad at \$499. Would consumers jump at a 7-in. iPad for just \$100 more? Upon releasing the second version of the device, the "new" 7-in. iPad could take over the \$299 price with the "original" 7-in. iPad reduced to \$199.

While this doesn't immediately compete with the Nook and the Fire on price, a 7-in. iPad would be "just \$100 more," instead of "twice as expensive." This could make the jump to an iPad easier for consumers. The 7-in. iPad would become price competitive when Apple releases its second version.

At \$299, it should be priced high enough for Apple to turn a profit, and the size of Apple's app store may be enough to disrupt the competition. Also, if Apple uses a 4:3 aspect ratio, its tablet would be 40% larger than most other 7-in. tablets.

The rumor persists that Apple may announce some sort of 7-in. tablet by October. Even though it risks cannibalizing the larger iPad, Apple would rather see the iPads dominate the market instead of leaving open an avenue for Android to take away market share. Having something you can hold in one hand seems to matter to some people and may matter in emerging markets, where they are growing significantly.

The smaller-screen iPad would be highly portable—more portable than the 9.7-in. iPad and with more functionality than the iPhone. Users may prefer the portability of a smaller-screen iPad, especially those who use the iPhone for a lot of work.

However, watching a movie or gaming would be better on a larger-screen iPad with the high-resolution Retina display. A smaller-screen tablet may be better for reading e-books or using custom applications designed for the display size, but it could also be stressful on the eyes in some cases, like when playing games or watching a high-definition movie.

A smaller-screen iPad would be attractive to students and also fit well in schools and universities. In 2012, Apple started offering iBooks 2, a tablet application that brings multimedia textbooks to students. Decisions about which tablet to buy will also be tied to mobile broadband contracts with carriers, as it remains to be seen if Apple will be able to sell both iPads to users who have 3G or 4G subscriptions, which are usually tied to specific devices. However, many users are happy with Wi-Fi only devices.

Things should get interesting by October. The Nexus 7 and Microsoft's Surface would have great pressure to succeed, as they have already risked alienating their hardware partners by producing their own tablet. Whether it's an iPad 7-in. Mini or the next-generation 7-in. iPod Touch, look for Apple to grab control of the nascent 7-in. tablet segment. Once Apple achieves 50% market share in a segment, it is very difficult for any competitor to make significant inroads.

#### MENTOR'S MIGHTY LEAP

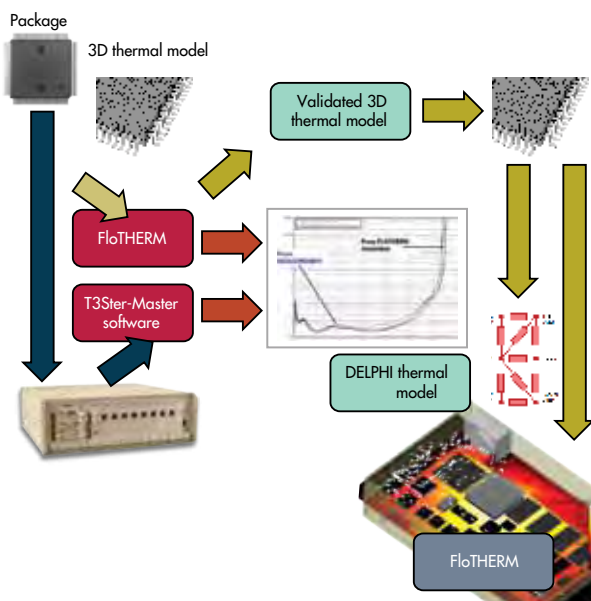
Mentor Graphics is this year's Cinderella story, rising from number 87 in the 2010 list to seventh place in 2011 (*Table 4*). Molex Inc. similarly rose from 79 on last year's list to eleventh in 2011 (*see "Molex Makes A Move" with the online version of this report at [electronicdesign.com](http://electronicdesign.com)*).

Incorporated in 1981, Mentor is a manufacturer of electronic connectors based in Wilsonville, Ore. But it's more widely known as a leading global developer of EDA software and systems used to design, simulate, and test electronic components such as ICs, wire harness systems, and printed-circuit boards (PCBs).

Products include PADS (PCB design), Nucleus (operating system), and Calibre (IC design). Its software is used to design components for such products as computers and wireless handsets. Clients come from the aerospace, IT, and telecommunications industries, among other fields. Mentor Graphics gets more than half of its revenues from Europe and the Asia-Pacific region, particularly Japan.

Product markets are characterized by price competition, rapid technological advances in application software, and new market entrants. The EDA industry tends to be labor intensive rather than capital intensive. This means that the number of actual and potential competitors is significant.

Mentor's two principal competitors, Cadence Design Systems and Synopsys Inc., are large companies with extensive capital and marketing resources (*Table 5*). Mentor also competes with small companies with little capital but innovative ideas. The main competitive market factors are breadth and quality of application software, product integration, the ability to respond to technological change, quality of a company's sales force, price, size of the installed base, level of customer support, and professional services.



2. Earlier this year, Mentor Graphics delivered the industry's first integrated component-to-system thermal characterization and analysis methodology. Computational fluid dynamics (CFD) models of IC packages can be compared to T3Ster measurements. Once validated, those CFD models are used to generate DELPHI compact models for FloTHERM and system-level thermal analysis.

## MARKET SEGMENTS

Revenues are segregated into five categories of similar products and services: scalable verification, IC design to silicon, integrated system design, new and emerging products, and services and “other.” Each category includes both product and support revenues.

- **Scalable verification:** The Mentor Graphics Scalable Verification tools allow engineers to verify that their complex IC designs function as intended. Functional errors are a leading cause of design revisions that slow down an electronic system’s time-to-market and reduce its profitability.
- **IC design to silicon:** Shrinking geometries and increasing design size in the nanometer era have enabled ever increasing functionality on a single IC. Today’s most advanced ICs are being produced in a 28-nm process with early test tape-outs occurring for 20-nm ICs. The Calibre tool family, which is a standard for most of the world’s largest integrated device manufacturers and foundries, addresses these challenges. The Olympus-SoC place-and-route product targets customers designing ICs using geometries of 65 nm and below. It addresses IC design challenges such as manufacturing variability, design size and complexity, and low power requirements. Also, the Tessent suite of integrated silicon test products is used to test a design’s logic and memories after manufacturing to ensure that a manufactured IC is functioning correctly.
- **Integrated System Design:** PCB-FPGA Systems Design software products support the PCB design process from schematic entry, where the electronic circuit is defined by engineers, through physical layout of the PCB, to providing digital output data for manufacturing, assembly, and test.
- **New and emerging products:** The Integrated Electrical Systems Division provides specialized software for design, analysis, manufacture, and data management of complex wire harness systems used by the automotive, aerospace, and other industries. A variety of software tools targeting the automotive market that focus on the functional design of the electronic components of cars also is offered.

Additional offerings include a suite of products for companies developing embedded software for products such as smart phones, automotive and aviation infotainment systems, and consumer electronics. These would be real-time operating systems, Linux and Android products and services, middleware, and associated development and debugging tools.

## THE KEYS TO SUCCESS

Mentor Graphics was our most improved company for fiscal 2011, rising in the ranks by 80 positions to the seventh slot. For the first time in its history, Mentor crossed over the \$1 billion revenue line, with bookings growing at 20%, revenue at 11%, and earnings per share almost tripling.

Mentor’s strengths are both in IC design and system design. In ICs, the top 50 companies make up over 85% of the total research and development spending in the entire market. The systems market is more fragmented, comprising many smaller

companies, and is harder to reach. Mentor’s channel strategy gives it an advantage in reaching those customers over the competition.

Large corporate account penetration is emphasized in military and aerospace, communications, computer, consumer electronics, semiconductor, networking, multimedia, and transportation. Products are licensed worldwide through a direct sales force, distributors, and sales representatives.

Due to product complexity, the selling cycle can be six months or longer. During the selling cycle, account managers, application engineers, and technical specialists make technical presentations and product demonstrations to the customer. Products also may be loaned to customers for short-term on-site evaluation. Its strong customer support structure includes Mentor Graphics Education Services and Mentor Consulting.

Two trends benefiting Mentor should continue into the future. First, in the traditional EDA space, the movement to 28-nm and 20-nm process nodes has created accelerated demand for advanced verification and manufacturing software. Second, Mentor’s previous investments in new and adjacent systems markets and channels to EDA are now delivering rapid growth.

As the move to 28 nm, 20 nm, and below continues, top semiconductor firms are looking for new technologies to help them stay ahead in the verification game. As integrated circuit sizes reach into billions of transistors, verifying the larger and more complex chips presents growing and significant challenges.

Traditional improvements in simulation verification depended on ever higher computer processor speeds, which have not recently kept pace. Emulation technology, which can run many times faster than a simulator, has become increasingly necessary to properly verify complex integrated circuits and systems. Bookings from the emulation side of the business are also growing rapidly.

In addition to functional verification being driven by the move to 28-nm and 20-nm process nodes, these advanced process nodes also present many manufacturing challenges that produced more than 25% growth in Mentor’s IC design to silicon business. Both the increasing prototyping work with respect to the 14-nm process node and the continuing adoption of 28 nm and 20 nm should ensure healthy growth for Mentor’s EDA market.

The company’s transportation segment also is delivering rapid growth with bookings for its wire harness software delivering at twice the rate of overall company growth. As a leader in this emerging market, Mentor does business with the top six global wire harness manufacturers, three of the top six global truck manufacturers, and four of the top six Chinese auto manufacturers. A wire harness is an assembly of cables or wires that transmits signals or electrical power.

The embedded software segment is also providing rapid growth as chip design and systems companies increase their need to provide development, compilation, and debugging environments for their customers. Another rapidly growing part of the systems segment has been thermal analysis of electronic systems, with quickly growing areas like the charac-

terization of LED-based systems and the thermal analysis of electronic packages.

Clearly the semiconductor industry transition to the 28-nm family of technologies, which broadly includes 32 nm and 20 nm, is a huge change fueling growth opportunities. According to IC Insights, the largest six of the 35 major semiconductor manufacturers (Samsung, Intel, TSMC, Hynix, UMC, Rohm) will increase capital spending by \$5.2 billion or 15% in 2012. These six companies make up 64% of total worldwide spending, with Samsung the largest closely followed by Intel.

The 28-nm node is emerging as the sweet spot for select, leading-edge products, due to cost and its low-power attributes. Foundries could very well prolong their efforts at 28 nm before migrating to the more expensive and difficult 20-nm node. Much of the 28-nm demand involves chips for smart phones, tablets, and notebooks. 28-nm foundry capacity will be tight throughout 2012, and possibly into 2013, due to low yields, lack of installed capacity, and underestimated demand.

According to Global IC Trading Group, Taiwan Semiconductor Manufacturing Co. (TSMC) plans to produce 10,000 more wafer starts per month (wspm) at 28 nm than expected. Samsung Electronics is converting two NAND flash lines—one in Korea and another in Austin, Texas—into 28-nm foundry capacity. Global Foundries and United Microelectronics Corp. (UMC) are also expanding their 28-nm capacities.

At 28 nm, total capacity of some 65,000 wspm is expected in 2012, according to Barclays Capital. When capacity is fully reached in 2013, foundries are projected to have a total capacity of 300,000 wspm, according to Barclays. In comparison, total foundry capacity has ranged from 200,000 to 250,000 wspm per node in previous generations, meaning that 28 nm could become the largest node in history in terms of volumes.

As yields and throughput mature at 28 nm, this major wave of capital investment will provide plentiful foundry capacity at lower cost, stimulating a major wave of design activity. Cost-effective, high-yield 28-nm foundry capacity will not only drive increasing numbers of new designs, it will also force redesigns of mature products to take advantage of the cost-reduction opportunity. The impact on overall spending on EDA for the industry, which typically increases in line with semiconductor R&D spending delayed by one year, should be very positive.

Mentor has received some unique benefits from the 28-nm transition. First, the dramatic increase in physical verification and resolution enhancement complexity already drove 25% in growth in its design for silicon segment last year, and even with a lack of major contract renewals in the first quarter this year, it drove 30% growth into design for silicon bookings this quarter.

Second, industry consolidation of place and route has accelerated adoption of Mentor's Olympus place and route at several of its largest customers. Place and route is a stage in IC design comprising two steps. Placement involves deciding where to place all electronic components, circuitry, and logic elements in a generally limited amount of space. This is followed by routing, which decides the exact design of all the wires needed to connect the placed components.

But the largest impact has been in emulation adoption. Emulation is seeing a major acceleration in growth. The 28-nm transition means full-chip verification through simulation is no longer possible for leading-edge large chips. Emulation technology used to be a requirement for a limited number of applications like graphics chips. But today, it's a verification necessity for a large share of the biggest chips and has changed a lot since it was a tool for specialists.

This quarter, Mentor announced the Veloce2 generation of accelerated verification products, which more than doubles the capacity to greater than 1 billion gates, doubles the speed, and reduces the power per gate by 40%, all compared to the company's still very competitive first-generation Veloce1 family. While traditional in-circuit emulation is well supported on Veloce2, the trend of leading-edge customers is for the acceleration of test benches or co-modeling, virtualizing the stimulus rather than plug-in hardware and software debugs for dozens of simultaneous users.

These changes mean emulation could be set up similar to a typical IT server farm with users remotely accessing the portion of the emulator capacity they need. And, the cost per cycle of emulation is more than two orders of magnitude lower than simulation on a traditional server farm. Bookings for this newly announced Veloce2 generation have already exceeded half of the total lifetime sales of the Veloce1 generation.

Emulation is so promising because a large and increasing share of the usage is systems companies. They use it to debug multichip systems and to develop and verify embedded software. The emulation business benefits from more than just the 28-nm transition. It benefits from the growing complexity of system design and the increasing need for embedded software development verification.

The combination of new applications of EDA and system design, the rapid growth of emulation, and the large design transition to 28 nm provided the record backlog at the beginning of 2012 that helped Mentor achieve record first-quarter revenue. Based upon publicly reported numbers, Mentor's current growth would put it on track to achieve the number-one market share position this year in the rapidly growing emulation market. **ED**