HOW YOUR COMPENSATION COMPARES TO WHAT OTHER COMPANIES ARE PAYING

EDUCATION COSTS COMPANIES ARE TO ENGINEERS

2014 ENGINEERING SALARY SURVEY

AVERAGE SALARIES BY YEARS OF ENGINEERING EXPERIENCE 54%

27% HOW INTELLECTUALLY CHALLENGED YOU ARE AT WORK?

AVERAGE SALARIES BY JOB FUNCTION 32%

18% AVERAGE SALARIES BY INDUSTRY

THE 10 MOST PRESSING PROBLEMS AT WORK

ENGINEERING BY THE numbers

AVERAGE SALARIES BY LEVEL OF EDUCATION

AVERAGE SALARIES BY SIZE OF COMPANY

9% AVERAGE SALARIES BY AGE

SATISFACTION WITH YOUR CURRENT POSITION 36%

TOP 10 PERKS IN 2014

ENGINEERING SPECIALTIES IN HIGHEST DEMAND 37%

WAYS ENGINEERS ARE EARNING THEIR BONUSES IN 2014 42%

SIGNING BONUSES/ INCENTIVES FOR NEW ENGINEERING HIRES 14%

AVERAGE SALARIES BY ENGINEERING TITLE

THE FACTORS THAT INFLUENCE JOB SATISFACTION

microwaves&rf

Editorial

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Don't Trust that Tower

Current news headlines seem to scream weekly about hackers getting credit-card and other secure information from stores, banks, etc. Meanwhile, concerns are already being voiced about spying that can be done via the "Internet of Things" (IoT). It also is possible to steal user information and data usage from cellular phones. Beyond identity theft, these threats raise concerns about what such breaches can mean for our national security—especially when our wireless infrastructure is called into question.

In an article titled, "Rogue cell towers discovered in Washington, D.C." on CSO (www.csoonline.com), the author reports that engineers and customers of ESD America (makers of the ultra-secure CryptoPhone) had discovered more than a dozen rogue cell towers (also known as interceptors or IMSI catchers) around the U.S. this past summer. There is a good chance that this number is only a small representation of the total interceptors that exist. It also fails to take into account mobile base stations.

The article notes that these interceptors are only supposed to be used by law enforcement or the government. According to CSO, "That's because once a device connects to them, the interceptor's operator can perform a number of tasks, including eavesdrop on calls or text messages, or in some cases, push data (spyware for example) to the device." Due to the suspected large number of interceptors in the U.S., it is possible that other countries or entities could be spying on the U.S. as well.

Realizing the threat that could be posed by interceptors, the U.S. Congress has pressured the Federal Communications Commission (FCC) to tackle this topic. Reportedly, the FCC responded by creating a task force "to combat the illicit and unauthorized use of IMSI catchers." Truly, though, this is not much of a fix. The carriers need to step up to secure the spectrum they use. While the official parties wrangle over this topic and try to come up with mandatory solutions, individuals need to be aware. In particular, for those engineers working for defense contractors: If your employer trusts you with design, financial, or any other types of secrets, it is time to think about securing your cell phone with more than just a password. mw

JEAN-JACQUES DELISLE | Technical Editor

2014 RF ENGINEERING SALARY SURVEY ENGINEERING BY THE Numbers

With economies, industries, education, and technology constantly changing, engineering is quite an exciting profession. RF engineers lead some of today's most cutting-edge technology developments, increasing our knowledge and connection with our world and each other. *Microwaves & RF* recently polled our community to find out what really makes RF engineers tick, how they are compensated, and what they think of the industry surrounding us.

This is the first year that *Microwaves & RF* has performed a Salary & Opinion Survey, giving us a chance to share in the realities of a community that is one of the biggest contributors and least-known of modern technology movers.

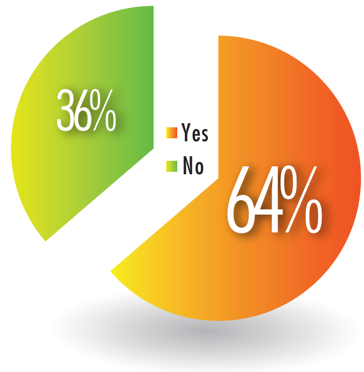
HOW SECURE IS AN RF ENGINEER?

In an economy where many have been concerned about layoffs, downsizing, restructuring, and pink-slip frenzy, it seems that the RF engineer stood relatively immune to such fluctuations. The vast majority—more than 86% of RF engineers—are employed with the same job title as the previous year. The main factors for switching job positions were promotion, reassignment, job-switching, and retirement. This makes sense, as the majority of RF engineers are working for full-time employers and have for some time.

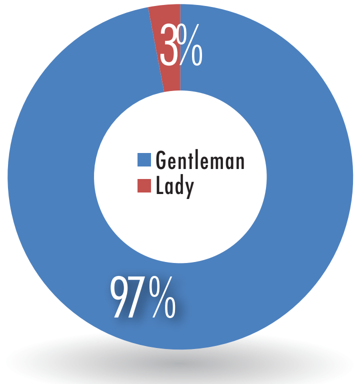
The average length of employment with the same employer is almost 13 years (though this figure may have been skewed by the large number of RF engineers who have been working for an employer longer than 20 years). Fully a quarter of all RF engineers reported a stay of such length with their present employers. But the data indicates that another quarter of RF engineers may have swapped jobs between 2009 and 2013.

All and all, RF engineers are paid very well compared to other, more traditional engineering disciplines. The average total compensation for an RF engineer is close to $112,000 a year, with over a quarter of RF engineers reporting six-figure salaries. Most RF engineers don't receive bonuses or additional compensation. Yet those who do appear to be very well compensated, with most reporting an additional $10,000 in income from either bonuses, stock options, or other sources.

DO RF ENGINEERS FEEL ADEQUATELY COMPENSATED?



GENTLEMAN OR LADY?



Additionally, the majority of RF engineers reported an increase in salary in 2014—an eighth with a greater than 10% increase. Over a third did report that their salary didn't receive an increase, but less than 10% reported a decrease in salary.

Most RF engineers also indicate that they are equally or better compensated than their peers, with only a third of RF engineers reporting that they may be compensated less. In addition, almost two-thirds of RF engineers feel adequately compensated, with a third feeling they may deserve more. These RF engineers don't appear to be greedy, though, as those who claimed they should be compensated more only requested about a 20% increase in compensation.

The RF engineers who are offered bonuses receive them based upon personal and company/division performance. Additional sources of income are derived from patent awards, project milestone completions, and company profit sharing.

An interesting note is that many RF engineers seem to feel the strain of changing health insurance laws. Many companies don't appear to be offering health benefits comparable to past years.

HOW DO RF ENGINEERS FEEL ABOUT JOBS?

Either way, RF engineers appear to be a rather satisfied bunch in terms of their employment. Almost 88% of all RF engineers report feeling at least satisfied where they work. It can be construed that the quarter of RF engineers who decided to change employers must have found a company or position with which they are happier. Close to two-thirds of RF engineers are also of the opinion that there is a reasonable potential for salary advancement compared to the past five years.

In answer to a question regarding the outlook of salary increases, a respondent stated, "Technology still needs engineers. Capable engineers are in demand and well-compensated. The key is to have expertise in the key areas of demand. Outside of that, I would have answered no."

Yet another shared, "It is all about adding value. Engineering today has great opportunities to add value as long as we think not only about the product, but the people building the product and using it."

Not all RF engineers have such a rosy opinion, as some claimed that government funding cuts and corporate stinginess were providing less opportunities for promising engineers. This contrasts significantly with many other respondents, who claim that they are not able to staff enough skilled engineers. Some concern was voiced, in regard to potential salary increases, surrounding the use of work visas, and the growing use of computer tools in the engineering environment.

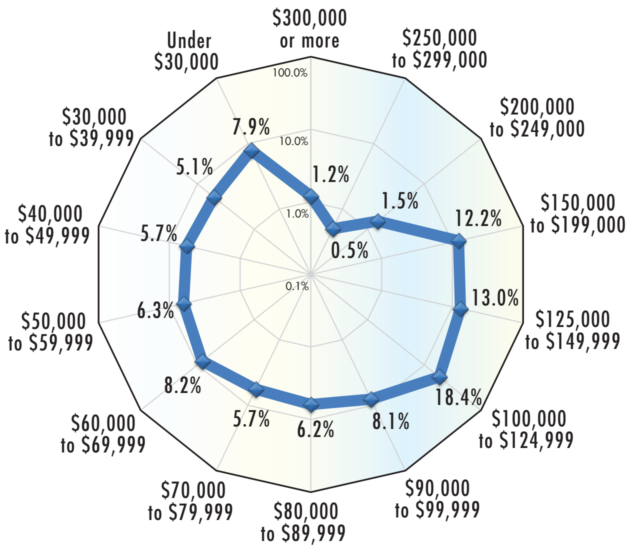
Regardless of any negative trends and views, just over two-thirds of RF engineers said they wouldn't even consider leaving the engineering profession. Those who shared that they may be interested in phasing out of engineering seemed to be looking for a change of pace, less stress, and more free time to explore other avenues of interest. Also, almost 90% of RF engineers would recommend engineering as a profession to the next generation. This being said, it appears that RF engineers are very passionate about engineering and are very willing to recommend the challenging work environment brought about by a career in engineering.

And challenging it is: More than 90% of RF engineers responded that they feel challenged in their positions. Over two-thirds of respondents said that the challenges associated with design represent one of the most important factors influencing job satisfaction. RF engineers seem to enjoy exploration and researching new technology solutions while working in a team environment. The biggest hold-ups in this process, which seem to add a lot of frustration, are shrinking project deadlines. RF engineers like to stay current and feel that such deadlines limit their ability to stay on the cutting edge.

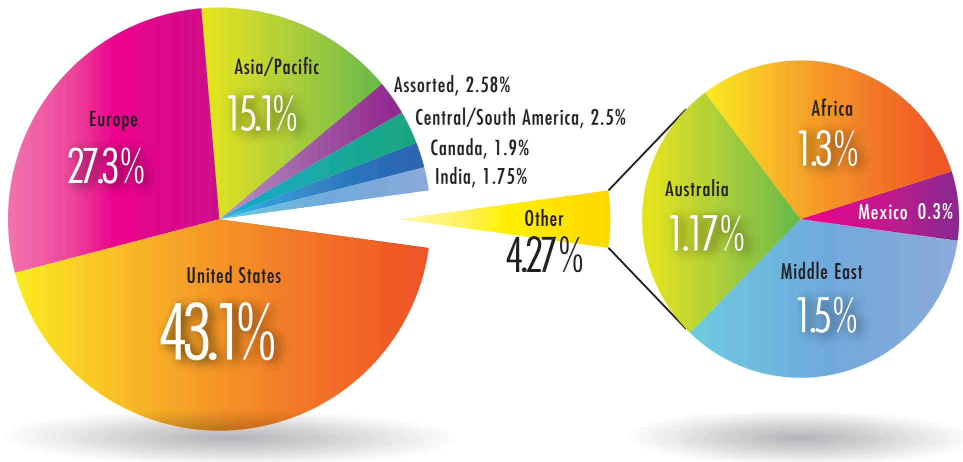
HOW IS YOUR COMPANY?

While many industries are cutting back and attempting to "go lean" with staffing, it seems that most RF engineers don't have to be too concerned with this trend. Only about an eighth

HOW MUCH ARE RF ENGINEERS MAKING? [%]



WHERE DO RF ENGINEERS COME FROM?



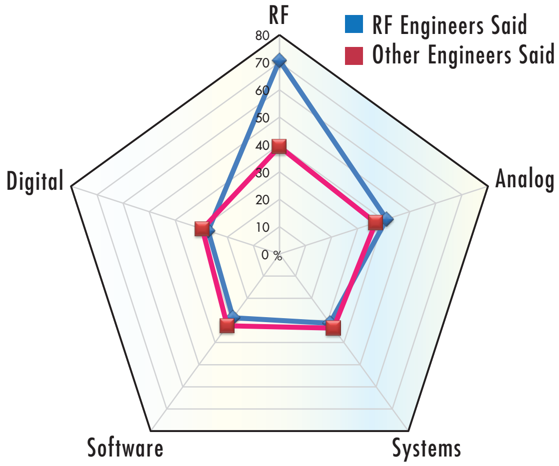
of RF engineers report that their companies are considering scaling back their engineering staff. Over half of RF engineers report that their companies will maintain their present staff, with almost a third indicating that their companies are looking to expand their engineering staffs.

From these responses, it seems that the majority of companies are having trouble finding qualified candidates for their engineering positions. Most RF engineers report that RF engineering is the engineering discipline with the highest demand. Given the audience surveyed, this opinion may at first seem rather biased.

Yet when compared to the Salary & Opinion Surveys of our sister brands, *Electronic Design* and *Machine Design*, it appears that most engineers actually agreed on this point. A few of the those commenting shared what is in the greatest demand: "microwave/electromagnetic engineers with experience," "microwave and millimeter-wave hardware design," and "electromagnetic interference, electromagnetic compliance, and RF interference engineers."

Interestingly enough, over two-thirds of RF engineers reported that their companies aren't focused on employee retention. This could just be a function of what the prior data indicated—that RF engineers are generally happy with their current employers and don't need extra incentive to stick around. Yet some respondents said, "With the difficulty in finding good, experienced help, it underlines the need to retain current experienced staff." Another respondent stated, "Although it should be, the company isn't doing anything different than last year. We have low turnover in our company. But we can't afford to lose anyone right now, so retention should be a hot topic."

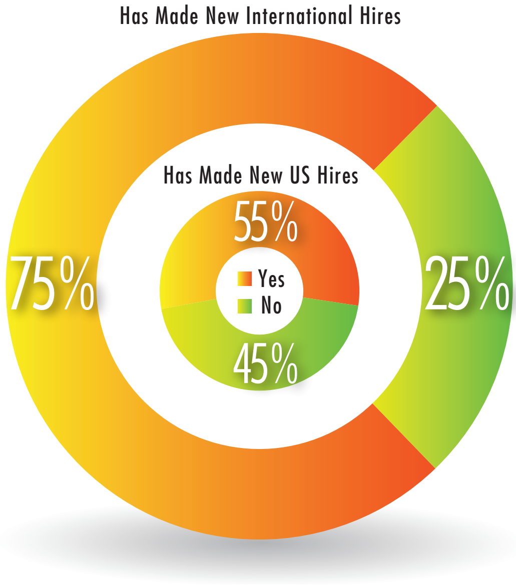
WHAT DISCIPLINE OF ENGINEERS IS IN THE GREATEST DEMAND?



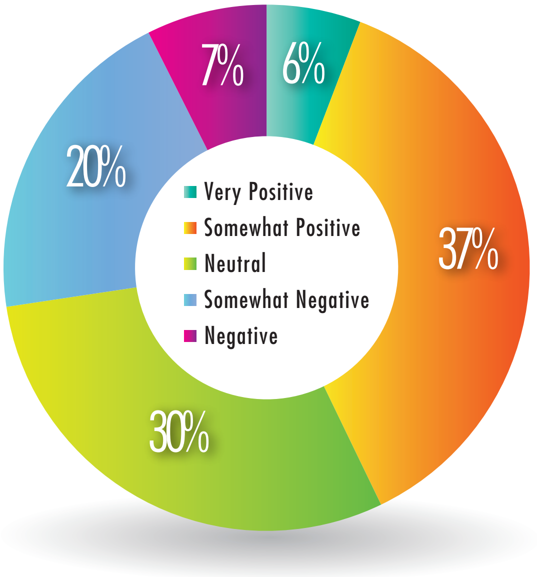
When asked about headhunting or recruitment specialists contacting our respondents with offers, over two-thirds of RF engineers claimed that they had no such contact. This also coincides with a full third of RF engineers sharing that they have no interest in changing jobs in the foreseeable future. Another third said that they would only consider new employment if they were personally approached with an opportunity that was much more interesting than their current situation. Only a tenth of the RF engineers claimed to be actively looking for other employment.

Regarding the industries and markets on which they focus, almost a quarter of RF engineers report working at a location where the dominant focus of the end product is communica-

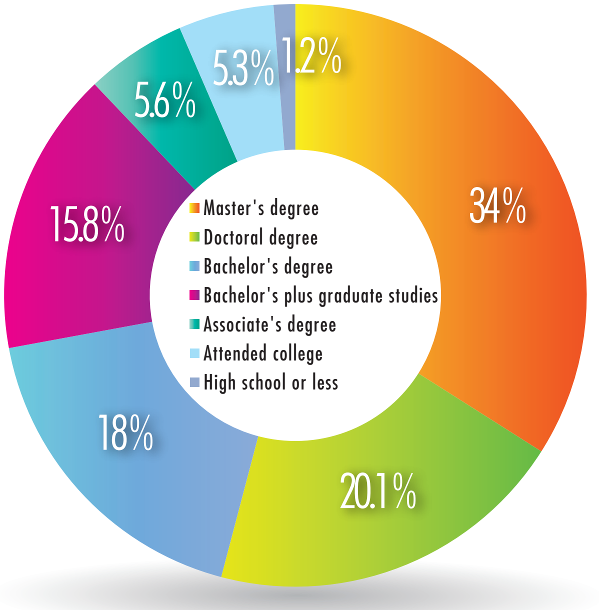
HOW COMPANIES WHO EMPLOY RF ENGINEERS ARE HIRING



HOW DO RF ENGINEERS SEE THE ECONOMY?



HOW EDUCATED ARE RF ENGINEERS?



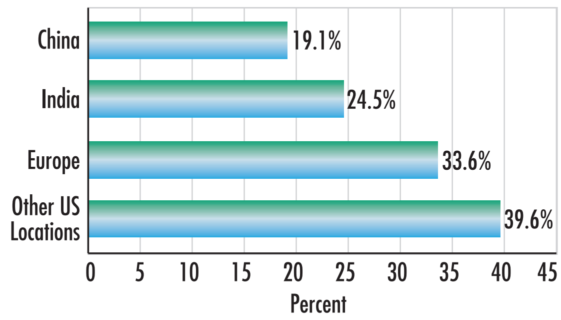
tions systems/equipment. In size, that focus is followed by R&D, government/military, avionics/marine/space, semiconductors/ICs, and test and measurement equipment. Another core group works at consultancy agencies or consults privately for the industries mentioned above.

WHAT CONCERNS AN RF ENGINEER?

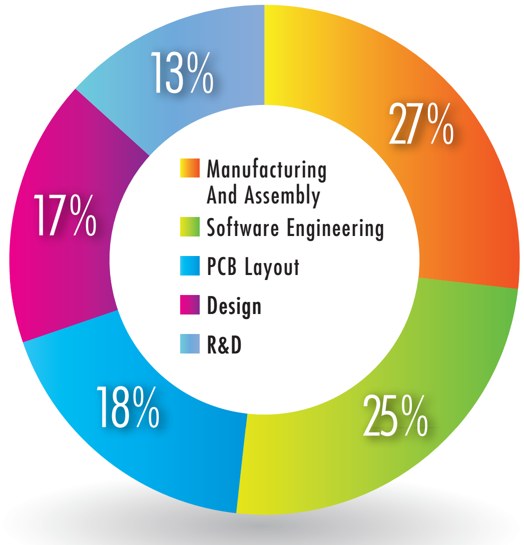
RF engineers are most concerned about looming project deadlines, product reliability issues, product quality issues, and price/performance issues. It makes sense that someone with an engineering mind would demand that every product should perform better, be more reliable, and be affordable—while simultaneously complaining about customers demanding that their latest product be produced better and at a faster schedule. That desire to push the boundary of excellence does seem to keep a few engineers awake. One respondent reported, “How can I get people to see a vision and embrace it such that we are always moving forward,” while another highlighted stress over “technical issues that I cannot yet resolve.”

Contrary to popular mythos, it appears that RF engineers actually prefer working with peers in teams. They value the recognition they receive from their peers significantly. Yet RF engineers don’t seem to appreciate that recognition as much as they enjoy compensation and the opportunity to design products that benefit society. For many, this may indicate that some stereotypes are true: Engineers are dreamers who are willing to put elbow grease behind their vision.

WHERE DOES YOUR COMPANY OUTSOURCE ENGINEERING WORK?

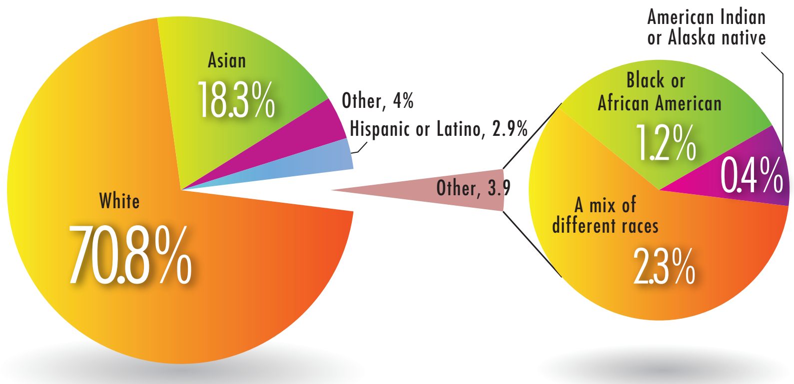


WHAT DOES YOUR COMPANY OUTSOURCE?



Given a list of the problems of funding, non-optimal components, and having to compromise designs approaches, the engineers polled said they are more impacted by the lack of qualified people to help get the job done. Another revelation is that RF engineers, though very opinionated, seem to care far less about the sociopolitical aspects of the workplace than they do about

RF ENGINEERS DIVERSITY FACTOR



getting the job done.

One of the biggest complaints seemed to be engineers having to respond to customer's needs, even though they didn't deem those needs worthwhile. For example, one respondent listed this as a chief point of concern: "the growing gap between customers' desires and their willingness to pay, combined with the fact that we are in an industry with relatively few large customers and many small vendors."

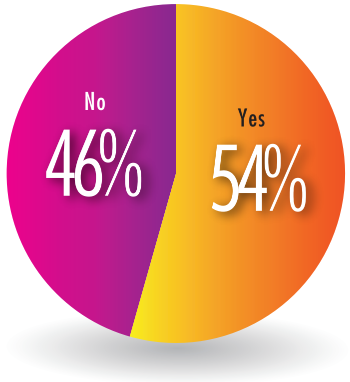
HOW ABOUT OUTSOURCING?

Many RF engineers voiced concerns about outsourcing. Over half of the RF engineers surveyed reported that their companies outsource to some degree. Unlike many industries, however, most of this outsourcing is directed toward other locations in the United States and Europe. Surprisingly enough, about a quarter of RF engineers shared that their companies outsourced work to India more than China. This may be due to the boom of IT firms available for contract in Indian markets.

According to our respondents, the two main reasons that their companies outsourced was due to a lack of in-house talent/specialty skill and to save money. The next reasons were to save time and better utilize existing engineering resources. These responses seem to indicate that a majority of the outsourcing work may take place in a field other than RF engineering—mainly software. To note, most RF engineers—nearly 90%—were confident that their companies were not looking to outsource in the future.

For the negative effects of outsourcing, RF engineers listed fewer engineering jobs being available, lower employee morale, new hires with reduced salaries, and less opportunity for advancement. When asked if they were personally concerned about their jobs being outsourced, however, over 75% of respondents shared that they had little to no concern. This could be another indicator that the jobs being outsourced are not specifically related to RF engineering.

IS YOUR COMPANY OUTSOURCING ENGINEERING WORK?



A LITTLE BIT ABOUT AN RF ENGINEER

Considering the RF engineers currently employed in the United States, which comprised half of our list (followed by Europe and Asia and then showing smatterings across the globe), a full quarter are working in California. They must be enjoying the weather. Surprisingly, New York State was the next-largest employer. Texas, New Jersey, Massachusetts, Maryland, and even Florida also provide significant home bases for many RF engineers.

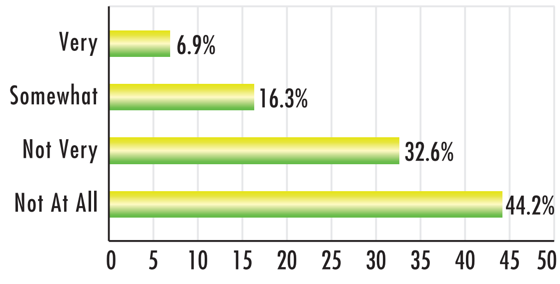
With Maryland, Massachusetts, and Pennsylvania all showing significant numbers of RF engineers, the Northeast coast is the area with the largest concentration of RF engineers. In smaller numbers, however, RF engineers are surprisingly spread out across the country. This could be the result of the majority of RF engineers working for companies that are worth less than $25 million. These smaller companies may be located in areas that are less likely to be the hubs of commerce.

In terms of schooling, RF engineers tend to be highly educated. Over half of RF engineers are equipped with either a Master's or a Doctoral degree. Another third have a Bachelor's degree and may even have had some additional graduate studies. The level of study achieved may be a factor of the lengthy stay many RF engineers have had at their companies, during which they benefited from continuing-education benefits and/or support.

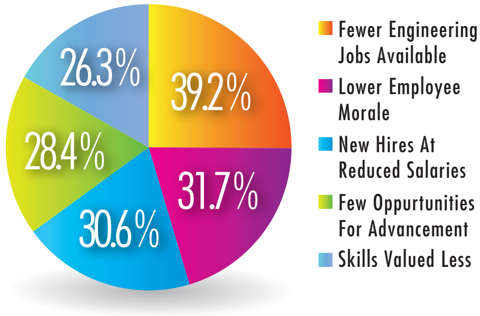
A FEW STARTLING NUMBERS

RF engineers are not likely to relocate anytime soon, as the average age of the engineer who responded to our survey is 51. With almost half of the respondents older than 55—and more than half of those engineers older than 60—this could be a sign of a troubling trend in our industry. There are likely to be many openings for skilled and experienced RF engineers in

ARE RF ENGINEERS WORRIED ABOUT OUTSOURCING AND JOB LOSS? [%]



HOW DO RF ENGINEERS FEEL ABOUT OUTSOURCING?



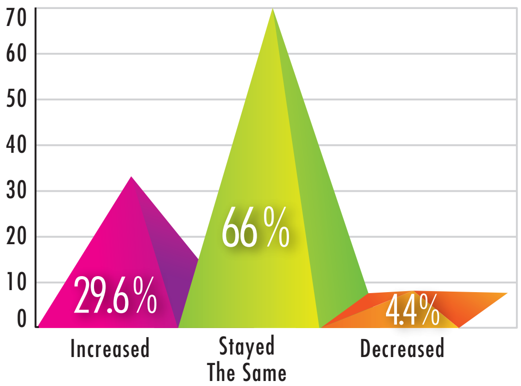
the next 5-10 years. In addition, most RF engineers identify as being white, which corresponds to the majority of RF engineers originating from the United States and Europe. The next largest ethnic demographic is Asian, with only a smattering of other ethnicities. The huge majority of our RF engineering respondents are also men, with women coming in at only 3%.

These demographics bring up some startling and significant truths. The diversity of RF engineers is currently very narrow. If this doesn't change, there will be fewer and fewer skilled engineers to take on the latest challenges. In our results, this gap was underscored by the total percentage of RF engineers who are younger than 30—less than 10%.

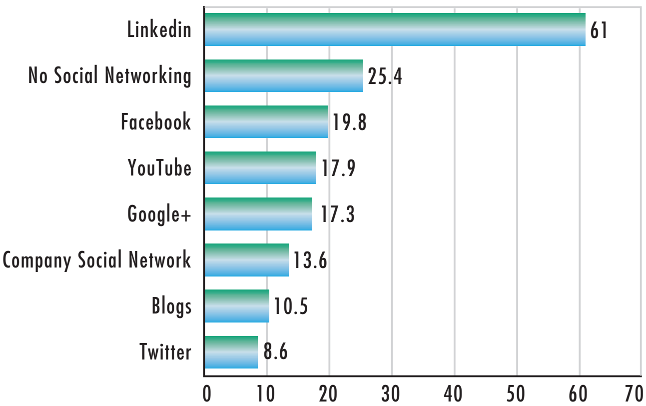
If RF engineering firms don't jump on the bandwagon by encouraging STEM education in ethnically diverse and mixed-gender environments, there may be fewer young people and students who would even consider a career in RF engineering. Meanwhile, the projections for the advancement of connectivity through communications and the wireless world are predicted to skyrocket in the next 10 to 15 years.

To fill the coming void, companies who employ RF engineers

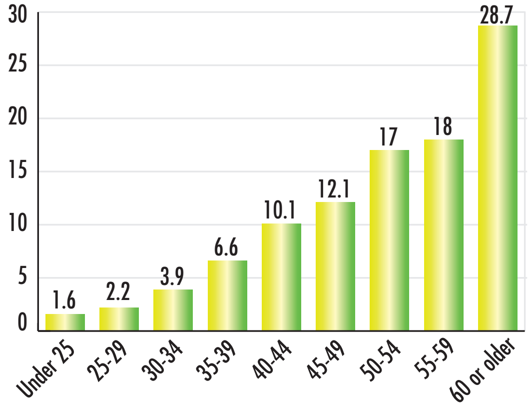
ARE RF ENGINEERS USING MORE OR LESS SOCIAL MEDIA? [%]



WHAT SOCIAL MEDIA SITES ARE RF ENGINEERS USING? [%]



RF ENGINEERS: AN AGING POPULATION [%]



may need to bring on less skilled engineers with an interest in RF. They can then leverage the more experienced, and even retiring engineers, to coach and mentor them to a higher level of technical achievement. This method may be counterintuitive for many organizations to employ. But as the resource of available RF engineers shrinks, so will the industry's options.

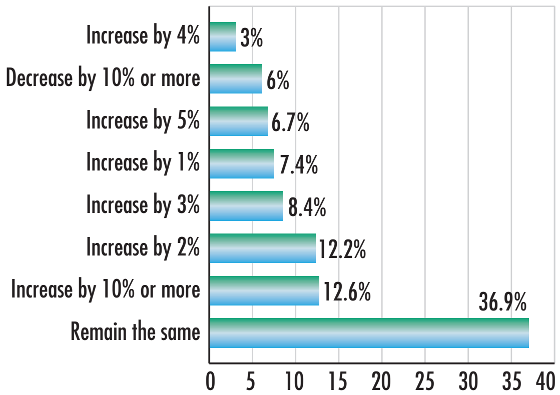
STUDENTS AND NEW HIRES

Most RF engineers seem to feel that recent graduates and students aren't adequately educated to be a productive member of the workforce. Almost half feel that these new recruits need as much as a year or more to be able to do their jobs independently upon being hired. These results coincide with RF engineers reporting that their companies appear to be hiring more engineers who were not born or raised in the United States.

The majority of RF engineers (over 70%) share the opinion that education abroad is poorer at preparing a new hire for real-world job duties. Although some of these new hires may have had some education in the United States, the majority seem to be educated abroad.

For instance, one respondent claims, "Most engineers from

ARE RF ENGINEERS MAKING MORE OR LESS THAN LAST YEAR? [%]



abroad seem to have less practical experience." Another comments, "Engineers from abroad are very heavy on theory/textbook, but have little practical knowledge." Of course, such statements may not be reflective of where the engineer was raised, as much as where they were educated. Another respondent, "Engineers we hired with either U.S. or foreign undergraduate degrees both seemed smart and competent—though they both had U.S. graduate degrees."

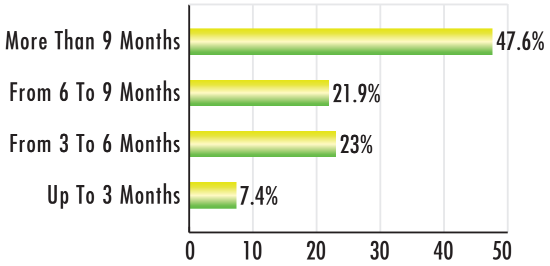
Most RF engineers seem to feel that US universities are focusing on the right material; they are just not enabling the students to have enough hands-on experience. In addition, almost three-quarters of RF engineers feel that internships, or cooperative education, should be mandatory for engineering education. When RF engineers work for companies that have developed a relationship with a local college or university, they believe the organization can more effectively hire new graduates with the skill sets they are seeking.

Unfortunately, less than half of RF engineering companies seem to be fostering any STEM education whatsoever. This situation may need to be change rapidly, as less and less U.S. engineers are coming from these companies' local communities.

CONTINUING EDUCATION

Consistent with many other technology fields, RF engineers mostly continue their education from engineering/technology publications. Seminars, webcasts, and white papers are also highly popular. Engineering textbooks, trade shows/conferences, and engineering association meetings also rank on the list of favorites. It's not surprising that the most accessible educational tools are the most popular, as many RF engineers confided that they are having more and more difficulty keeping current due to time constraints.

HOW MUCH MORE TRAINING DO RECENT GRADUATES NEED? [%]

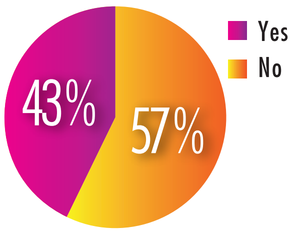


RETIREMENT

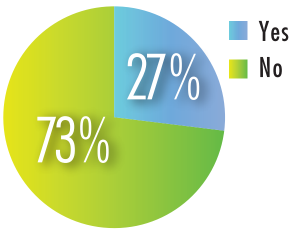
According to almost 70% of RF engineers, their companies are funding part of their retirement. The majority of this funding is in the form of a 401(k) or similar plan. Unlike many other industries, over 40% of RF engineers are also looking forward to a pension. A quarter of them enjoy either stock options or employee stock ownership.

Of course, much of this retirement assistance depends on the continuing health of these engineers' current/former employers. Given the impending lack of RF engineering knowledge, it may behoove RF engineers and their employers to enhance the drive for STEM education with youth. Otherwise, many RF companies may lack the employee base upon which they may continue to grow into the very bright future for this field. mw

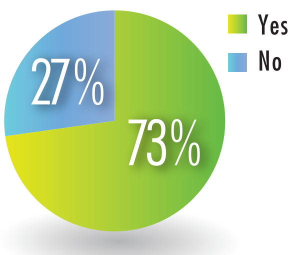
IS UNIVERSITY EDUCATION PRACTICAL ENOUGH?



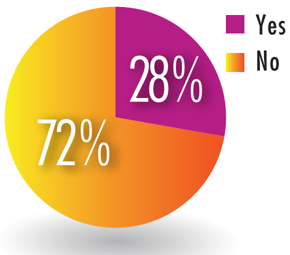
ARE STUDENTS GETTING ENOUGH HANDS-ON EXPERIENCE?



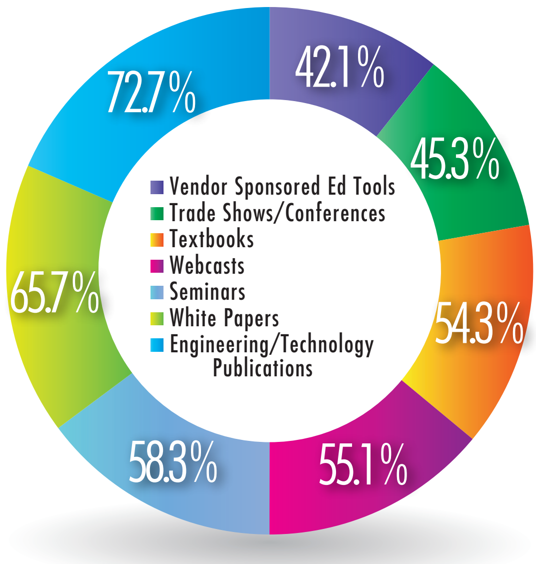
SHOULD INTERNSHIPS BE MANDATORY?



IS DOMESTIC OR ABROAD BETTER FOR ENGINEERING EDUCATION?



HOW DO RF ENGINEERS LIKE TO EDUCATE?



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THE GENDER DIVIDE

Women remain underrepresented in engineering—and the situation isn't improving

Like past surveys, relatively few female voices were heard in this year's Salary & Opinion Survey. Only about 3% of our 3000 responses came from women. So, to get a better understanding of some of the issues facing women in the field, *Electronic Design* teamed up with IEEE Women In Engineering—the professional association's wing dedicated to promoting women engineers and scientists—on research that paralleled our annual salary survey.

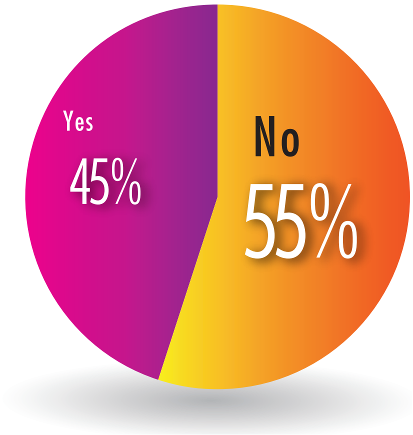
For this project, we solicited responses from nearly 400 women involved in design engineering, engineering management, and executive management at OEMs. These women shared their insights on general industry subjects as well as issues specific to women in engineering.

Engineering, of course, remains a male-dominated profession. The Congressional Joint Economic Committee recently reported that only about 14% of the engineers currently working in the U.S. are female. While that's a significant improvement from the early 1980s—when women made up a mere 6% of the engineering workforce—it still indicates that a serious gender divide exists in the field.

What's more, the profession's gender disparity may be getting worse, not better. According to the U.S. Census Bureau, the percentage of women holding STEM jobs is on the decline—mainly because their share of computer occupations dropped to 27% after reaching a high of 34% in 1990. "We have seen an increase in women employed in STEM occupations, but they are still underrepresented in engineering and computer occupations that make up more than 80% of STEM employment," said Liana Christin Landivar, a sociologist in the Census Bureau's Industry and Occupation Statistics Branch.

Women make up 51% of the U.S. population and 47% of the workforce, so it's clear that some issue or issues are preventing their proportionate representation in one of the working world's more lucrative professions.

ARE WOMEN IN ENGINEERING AFFORDED THE SAME OPPORTUNITIES FOR CAREER ADVANCEMENT IN **MANAGEMENT** POSITIONS AS MEN?



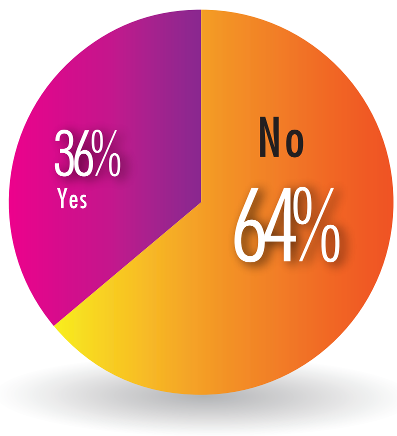
Because the number of women participating in our main Salary Survey was so small, it probably does not offer a statistically significant insight into the compensation disparities between men and women. That said, for the sample on hand, income between the sexes differed by about 10% ($106,869 in total compensation for men vs. $97,357 for women).

However, this disparity isn't based on a direct comparison of women and men holding the same positions or in the same situations. For example, the sample of women who participated in the Electronic Design survey were, on average, much younger (45 years of age vs. 53 for the men) and had nine fewer years of engineering experience than the men we heard from (18 years for women vs. 27 years for men).

On the other hand, when we looked at the 400 participants in the separate survey of women conducted with IEEE, we found that they had much higher levels of education than the average participant in our main survey. For example, 42% hold a master's degree (compared to just 30% in our main survey)—while 23% have a doctorate (compared to 9% in our main survey).

So rather than focus on issues related to compensation, we decided to use data from both surveys to compare how men and women engineers differ in their views about the profession generally and their jobs specifically. We also asked women to open up about their experiences working in a male-dominated occupation, as well as offer advice to young women who might consider entering the field.

ARE WOMEN IN ENGINEERING AFFORDED THE SAME OPPORTUNITIES FOR CAREER ADVANCEMENT IN **ENGINEERING** POSITIONS AS MEN?



DOES IT START IN SCHOOL?

The minority status of women in engineering becomes evident to them while still in school. On average, women estimate there were 13.5% fewer woman engineering students on graduation day than when they first entered college. While some suggested that the rigors of an engineering education were partly to blame for the drop-off, others cited the paucity of mentors for women among the faculty and staff as a major contributing factor.

"The lack of mentorship—especially from women faculty members—was clearly one reason for the dropouts," commented one survey participant. "The support of women faculty toward women students is non-existent. There are not many women faculty members at universities to begin with, and the majority of them are not supportive to students at all. They do not put their weight in at the admission committee when it comes to admitting more women students to the engineering programs. As a matter of fact, most male and women faculty members do not care about gender bias and gender equality issues at all."

"Harassment of female students was rampant," reflected another woman engineer. "It is much improved now. Also, in my college years, it was still an accepted practice for women to take care of the home and children in addition to any studies or outside work. The pressures of all of the responsibilities overwhelmed some."

Despite the relatively high average salaries in engineering, fewer than a third (29%) of the women surveyed believe women engineers fare better than those in other professions when it comes to achieving equal pay for equal work. About 47% say the opportunities are roughly the same, while one in four say the chances of receiving compensation on par with men is worse in the engineering field than other professions.

"I think that at certain levels, an engineer is an engineer, and the salary will be the same between men and women," said one survey respondent. "However, I think that the opportunities for advancement for women are lower, which then causes lower salaries."

This was a common complaint among women: "I get the sense that women in engineering are paid the same as men in the same role, but that women tend to end up in roles that are paid less on average, like QA or tech support."

INTERVIEW With Nita Patel

IEEE Women In Engineering Committee Chair
nita.patel@ieee.org

Why have so few women taken up engineering as a career?

I think there's a component of awareness and stereotypes involved. Awareness in that many people don't know what an engineer does or what it means to be an engineer. There are stereotypes and misconceptions about engineering. Also, there are stereotypes about the capabilities required. I think there's a stereotype and bias that implies that girls are not capable of pursuing a STEM field. Yes, STEM can be hard, but so are many other fields of study and women are successful in them (*e.g.*, doctors and lawyers).

In your view, what are some of the aspects of engineering that make it a particularly good career path for women?

I think it's a great career choice because there is an incredible amount of flexibility and many opportunities. An engineering/technical background provides many opportunities in terms of type of industry (defense, medical, commercial, space...), type of career (full-time, part-time, independent, team-based...), and level of contribution (individual, team lead, executive...). The analytical and logical skills that you learn through a STEM degree can be applied to many different industries. Also, most engineering careers are project-based, so there is great flexibility in the hours you can set.

What are the biggest challenges women in engineering face?

I think people are aware of and control overt biases. There are still some subtle biases floating around. The perception that engineering is a man's field is still prevalent, so this can be discouraging and prolongs the bias.

Given some of these challenges, would you recommend engineering as a career path for women?

Absolutely, I do not think the challenges are overwhelming. I think the career is very rewarding. Women have a lot to contribute in this field.

What career advice do you have for women currently working in engineering?

Challenge yourself and ask for larger leadership roles. I think it's important to get more women into higher-visibility management roles. I also think women should keep learning. Technology is ever-changing, so we must work to remain technically current and think about expanding our horizons by continually developing professional skills.

What advice do you have for women students who are considering the profession?

Go for it. You will find the technology exciting and the skills you learn will help you throughout your life. ■

"Women in general ask for less, so men are used to giving them less," opined another. "When in that early discussion with recruiters, women usually do not know what their male peers receive as offers. I used to be shocked to discover that my male coworkers who weren't as smart or productive as I was made more. Now I'm used to it, and I see how they receive more mentoring and guidance from their managers, who are almost all men."

Some women cited work/home balance issues as the reason for the disparity. "Many of the women that I have worked with have had children and, as a result, spend less time at work and require more time off to take care of their children," said one respondent. "I believe this affects their salary. At one company I worked for, a manager even said to me that if he were hiring, he would not select a women because most of them require extra time off to take care of children. This is a man who had a stay-at-home wife and children. Unfortunately, even if a woman does not have children, she would be viewed the same as women with children and have less opportunity to move up."

"At my previous job, I was making 20-25% less than my male counterparts with the same title," one engineer related. "I performed better, accomplished more, but was paid less—and was expected not to complain."

Despite these issues, about half of the women surveyed say they are either extremely happy or very happy in their current positions—closely matching the results for men. Digging deeper, 63% of female engineers say they feel sufficiently challenged intellectually with the projects they work on, compared to just 56% of men.

But, despite that satisfaction, 42% of women engineers say they've considered ditching the profession altogether to pursue something else, compared to just over a third of the men we heard from. In fact, 15% of women say they're already looking for a new job, compared to only 9% of the men surveyed.

One reason may be that most women (55%) don't believe they have the same opportunities for career advancement in engineering positions as men. "Women tend to promote themselves less than men, even though they are just as capable," noted one women engineer. "In my experience, the engineers who are the most vocal about their accomplishments are advanced to higher levels than those who quietly do brilliant work."

"It's an unconscious bias," claimed another survey participant. "Women do not brag about their achievements or come forward with clear ambition for management positions. Plus, many men don't believe it's possible to have both a family and a management career."

Another woman engineer put it this way: "There is a constant assumption that women engineers must face on a daily basis: that they're not engineers ('You're the admin, right?') or that they're not really engineers ('You're just the tester, right?'). Their voices are not heard in meetings, they're not acknowledged in leadership reviews, and they're discouraged from working on projects that could advance their careers. These micro-aggressions accumulate into reduced career outlook."

"We are not recognized for what we do," summarized another. "Peers, supervisors, and managers get the credit. What we do is forgotten or downplayed. Also, opportunities to be seen are given to male engineers by male engineers first."

The women we surveyed indicated that things get even worse for them if they do get into management. Nearly two-thirds (64%) of the female engineering managers we surveyed say they aren't afforded the same career advancement opportunities as men. "We are considered emotional and not able to make the tough decisions that men do," claimed one woman in a management position. "Women are still seen as emotional and needy, so they're not considered for some critical positions at companies," another agreed. "I've been told by management those exact words in previous jobs."

HOW DO WOMEN IN ENGINEERING FARE VS. WOMEN IN OTHER PROFESSIONS WHEN IT COMES TO EQUAL PAY FOR EQUAL WORK?

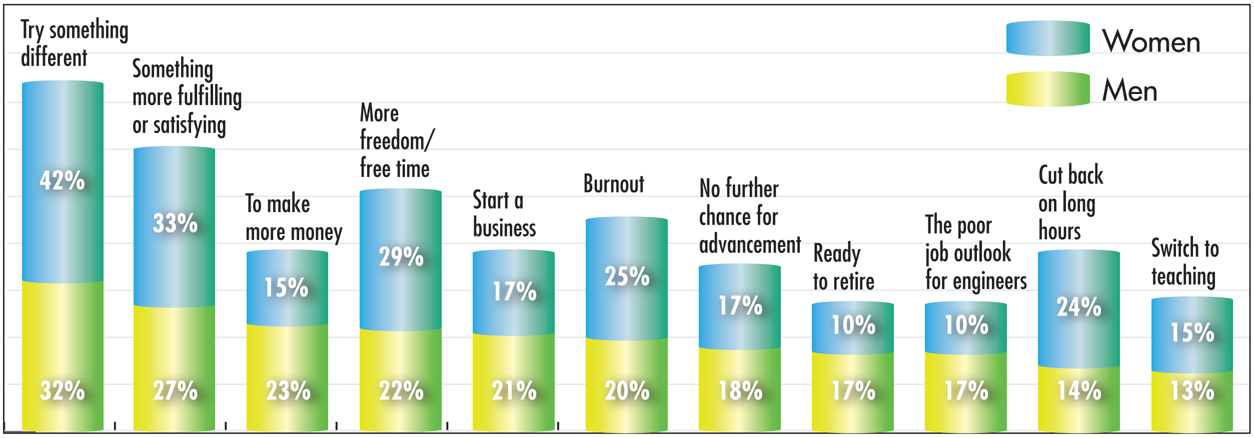
A smaller number of women described somewhat different experiences. "I think women who treat themselves like people rather than women advance the same as men," said one survey participant. "I've never seen myself as 'the woman in the room,' just 'a person in the room,' and I share my ideas and thoughts accordingly—and I have accelerated quickly at my company."

Ironically, however, this same survey participant also said that her compensation was only in the "21st percentile," while the male engineers who come to her for guidance are in the "90th percentile"—and was thus strongly inclined to leave her job. "It's very demoralizing, and it's too bad for the company that they haven't fixed it."

"Women in engineering have had to contend with men from the start," wrote another woman. "Be it in classrooms or on the job. You learn to live in their world and it helps when it comes to things like putting yourself out there for a raise or promotion."

Some are more philosophical: "As in anything with life, if

NEARLY 1 IN 4 WOMEN HAVE CONSIDERED LEAVING THE ENGINEERING PROFESSION TO SPEND MORE TIME WITH FAMILY. OTHER REASONS ENGINEERS HAVE FOR LEAVING THE PROFESSION INCLUDE:



DESPITE RECENT HEALTHCARE REFORM, THE PERCENTAGE OF ENGINEERS THAT RECEIVE HEALTHCARE BENEFITS FROM THEIR COMPANY CONTINUES TO DROP				
2010	2011	2012	2013	2014
57%	63%	61%	56%	54%

you are a go-getter and want to advance in your career you will, but if you are timid and don't afford yourself appropriate connections you will not get the same opportunities."

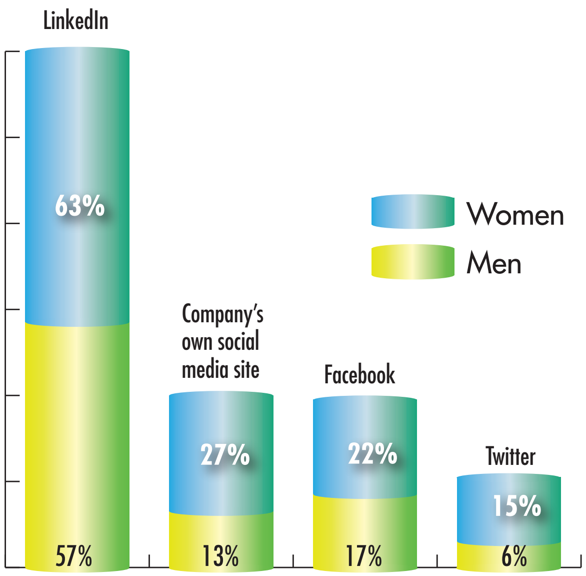
One reason women have very different experiences is that their companies maintain very different policies when it comes to gender issues. "In my division at IBM, there are an unusually high percentage of managers and engineers who are women compared to other corporations with which I've interacted," wrote one respondent. "IBM has made a concerted effort to advance women in technical roles. Also many of the women in our organization are the best in the world in their fields."

Some companies are making special efforts to address gender disparities, which may account for one interesting statistic from our research: 67% of them told us they'd been contacted by a headhunter or recruitment specialist within the past year, while only 54% of men could make that claim.

"I've always been lucky enough to encounter men who are more than thrilled at finding a woman engineer who can do as good, if not better, a job than her male counterparts," chimed in another. "These men typically afford women the same opportunities for advancement."

And, while it's important not to make unfounded generalizations about behavior and gender, it does appear that women do approach their jobs differently than men. Women,

WOMEN ENGINEERS ARE MORE ACTIVE USERS OF SOCIAL MEDIA FOR BUSINESS



for example, use social media more extensively for their work than men. This gives some credence to the belief that women tend to be more collaborative than their male counterparts.

ADVICE TO THE NEXT GENERATION

Despite the challenges women engineers face, 93% still say they would recommend engineering as a career path to young girls and boys alike. "Engineering has been a satisfying and personally rewarding career for me," said one. "I do believe that women often have obstacles that men don't as engineers, but if they are willing to negotiate those obstacles, it can be a fulfilling career."

"Engineering is an exciting field where you can make a difference," said another respondent. "There are opportunities for both men and women, but I would caution women that they need to be willing to work hard and be prepared to promote their own accomplishments if they want to be noticed and recognized for their skills."

"It is a good career, challenging, and pays well," said another. "Women do well in engineering, but the glass ceiling is low. This still is a field dominated by men, and it is difficult to fit in."

Some respondents suggested that the bigger issue for young people was a general understanding of what the engineering profession was all about. "It's something that I believe more people would enjoy if they had had exposure to it at an early age," observed one engineer. "The U.S. education system does not prepare high school students for careers. Exposure to engineering is minimal to nonexistent before college and that's unfortunate."

Some women suggested that they would only recommend engineering to young boys. "When I meet someone new and shake their hand, there is zero chance that their first comment won't be about my gender," complained one women engineer. "After ten years in the field, it is as sexist as when I first started. I'm tired of having to fight to be seen as an engineer. I wouldn't recommend this field to young women because I think they can get further in other fields that don't have the perception obstacle. Why fight if you can go somewhere better?"

Others shared similar sentiments: "I believe the only women who will continue in engineering with the current work environment are those who desperately love the work itself," one female respondent opined. "Why deal with others minimizing your accomplishments and with constant, blatant discrimination when you can work in a profession where women are more welcome? Why go through difficult engineering courses and social hostility to get paid what someone without an undergraduate education gets paid? Medicine has a large pay gap for women, but women are more socially accepted. My friends that switched to become doctors found it an easier thing, purely because of social reasons. It isn't supposed to be an easy career track, but compared to engineering it was easier for them. Life is short and love of work is not always enough to override all of the pitfalls of being a woman in engineering. But I'm still in it because I love the work."

Young girls need extra reassurance and role models, according to some women. "Young women need more encouragement than men to go into a field that's already dominated by men," said one respondent. "I'm happy to mentor the men who have made that choice already, but young women need to see that there's a place for them here, too."

Others homed in on what they saw as a special opportunity for women. "There are not enough women in the field, and a social stigma exists for girls to pursue math and science in school," said one engineer. "Girls are often not expected to do well in math and science, and a lot of them seem to subsequently believe that they should not even try. I think women should want to succeed for themselves despite pushback or stereotypes."

These comments and others highlight the fact that, even in 2014, the engineering field still suffers from issues that have plagued it for decades. Our research may even serve as a cautionary note to men in the profession who are unaware of attitudes and behaviors that unfairly undermine the ability of women to succeed in the field, despite their technical competence.

The study also shows the importance of groups like IEEE Women In Engineering, which can shed light on gender issues in the profession and take a position of advocacy for women. Future studies may show some progress in a profession that—perhaps even more than most others—could theoretically recognize and reward empirically evident technical abilities without any regard whatsoever for gender. ed