SALARY & CAREER REPORT 2021

A compendium of articles from

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# SALARY & CAREER REPORT 2021

ENGINEERS AND DESIGNERS have faced major hurdles along with the rest of the world because of COVID-19 so it was no surprise that it had a significant impact on the results of our *Salary and Career Survey*. The articles in this ebook analyze the results targeting different aspects such as continuing education, job satisfaction and challenges that have arisen like remote work. We also examine how things have changed with respect to the supply chain and how it affects the design and development process.

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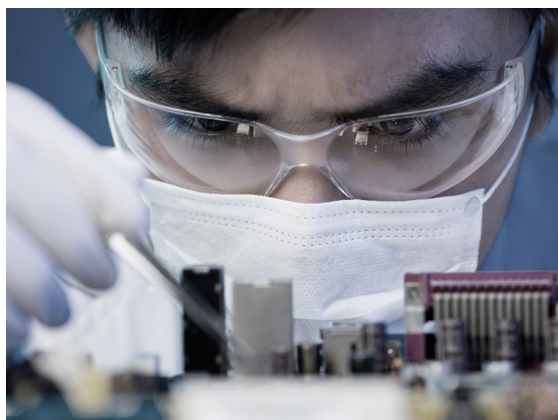
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CHAPTER 1:

Engineering is Still a Great Job

BILL WONG, Editor, *Electronic Design*

As revealed in our 2021 Salary Survey, science and engineering jobs continue to be fun and profitable.

was excited about engineering before I was in high school. I discovered programming then and you can tell I've been around for a while—my first exposure to software was programming in BASIC on a Teletype ASR 33 with punch paper tape. Georgia Institute of Technology was the starting point of being a real engineer with co-op sessions at Burroughs Corp. working with mini and mainframe design.

I've had a lot of jobs since then and backed into the editorial side of things because I had a knack for technical writing. I still dabble with hardware and software, but I've never lost the awe and excitement of engineering.

One thing that's always cropped up along the way was whether engineering was a worthwhile profession. I've always recommended it to those who were interested; I have three children who are all engineers, although none went into electric engineering or software like dear old dad or into mom's engineering field either.

I'm happy to say that most engineers and programmers want to stay in their jobs and would recommend them to others based on the results of our recent salary survey. The majority of engineers and programmers were satisfied with their current position, which is a good indication they chose the right profession (**Fig. 1**). Likewise, the survey results show that more than 90% recommend engineering as a career choice to others. Still, getting into a good engineering school will be a challenge with an acceptance rate on
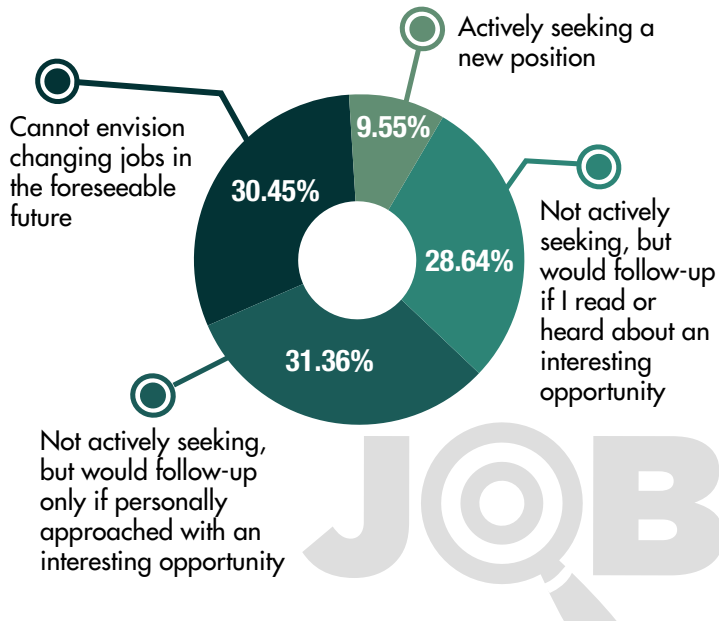
How satisfied are you in your current position?

- Extremely satisfied
- Very satisfied
- Satisfied
- Not very satisfied
- Not at all satisfied

1. Most respondents were satisfied or better with their current position.

What is your status regarding new employment?

- Actively seeking a new position — 9.55%
- Not actively seeking, but would follow-up if I read or heard about an interesting opportunity — 28.64%
- Not actively seeking, but would follow-up only if personally approached with an interesting opportunity — 31.36%
- Cannot envision changing jobs in the foreseeable future — 30.45%

2. Most engineers are not actively searching for a new job, but if the opportunity arises, one never knows.

the order of 8%.

Job satisfaction seems to match well with retention or it may be the sign of the times. Not a lot of engineers or developers are actively searching for a new position (**Fig. 2**). Still, a substantial portion are keeping their eyes open for opportunities that may arise.

The challenge for companies that want to retain their staff include keeping them happy. Likewise, trying to attract new employees has become more interesting since location sometimes isn't a factor, given the ability to work remotely. Even developers who need to work with hardware may not be limited by remote access.

For example, Green Hills Software's Embedded Board Farm allows developers to test software on actual hardware without having it on a nearby lab bench (**Fig. 3**). The boards are connected to power supplies, scopes, and logic analyzers that can be remotely controlled. Remote collaboration also is part of the mix these days, with access to shared debugging tools and video conferencing allowing people to work together from almost anywhere.
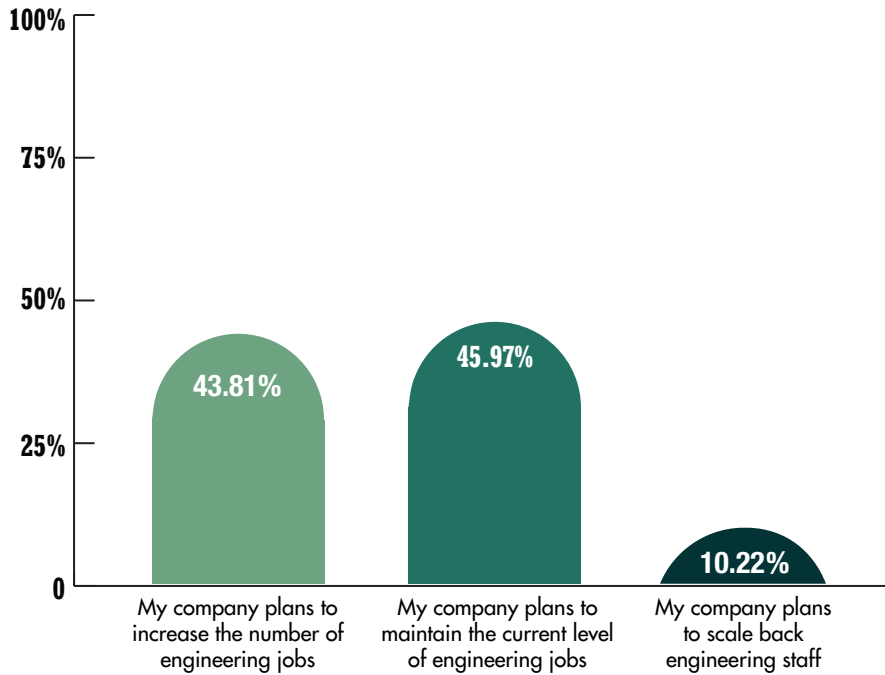
The outlook for engineers who want to stay put or move into new positions looks good, with most

3. Green Hills Software's Embedded Board Farm allows remote developers to test real hardware.

To the best of your knowledge, what is the engineering employment outlook at your company in the coming year?
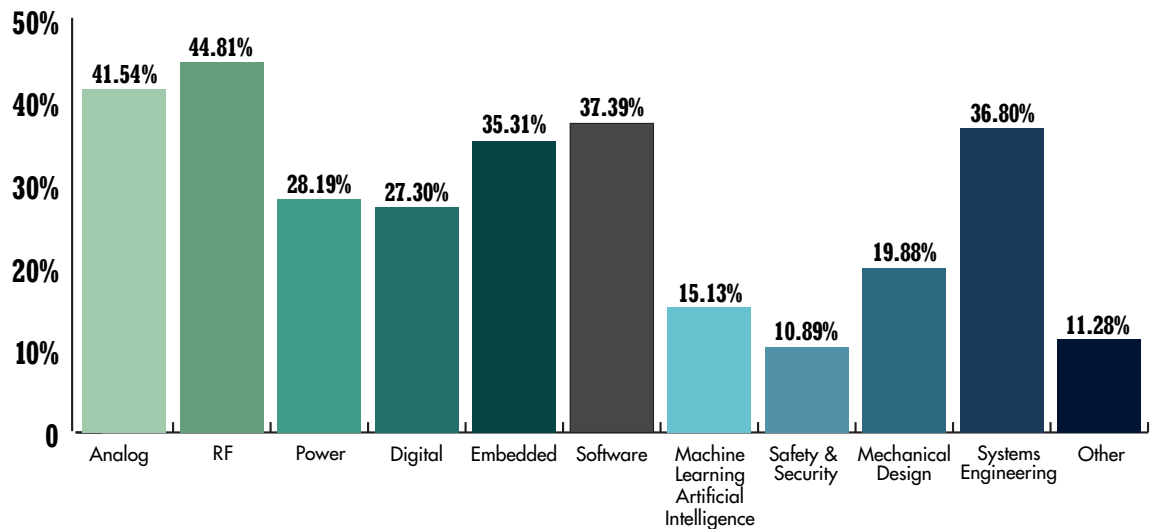

4. The outlook for engineers remains strong.

companies maintaining or increasing the number of engineers or developers on their staff (**Fig. 4**). The fact that over 40% are looking for new employees should make those hunting for a new position happy.

On the flip side, matching up the engineers and developers to fill needed positions can be a challenge of human resources as well as engineering managers. Our results based on feedback from both our electrical/electronic and machine design respondents (**Fig. 5**) was pretty similar. Systems engineers are in demand everywhere, with mechanical engineers high on the list as well. Electrical/electronic engineering responses put a higher priority on areas like analog and RF.

The only surprise I noted was that machine learning/artificial intelligence (ML/AI) was on the low side. I suspect that's being driven by two factors. First, ML/AI is being used in specialized areas such as automotive applications and that industrial applications are just starting to ramp up investigation or deployment. It
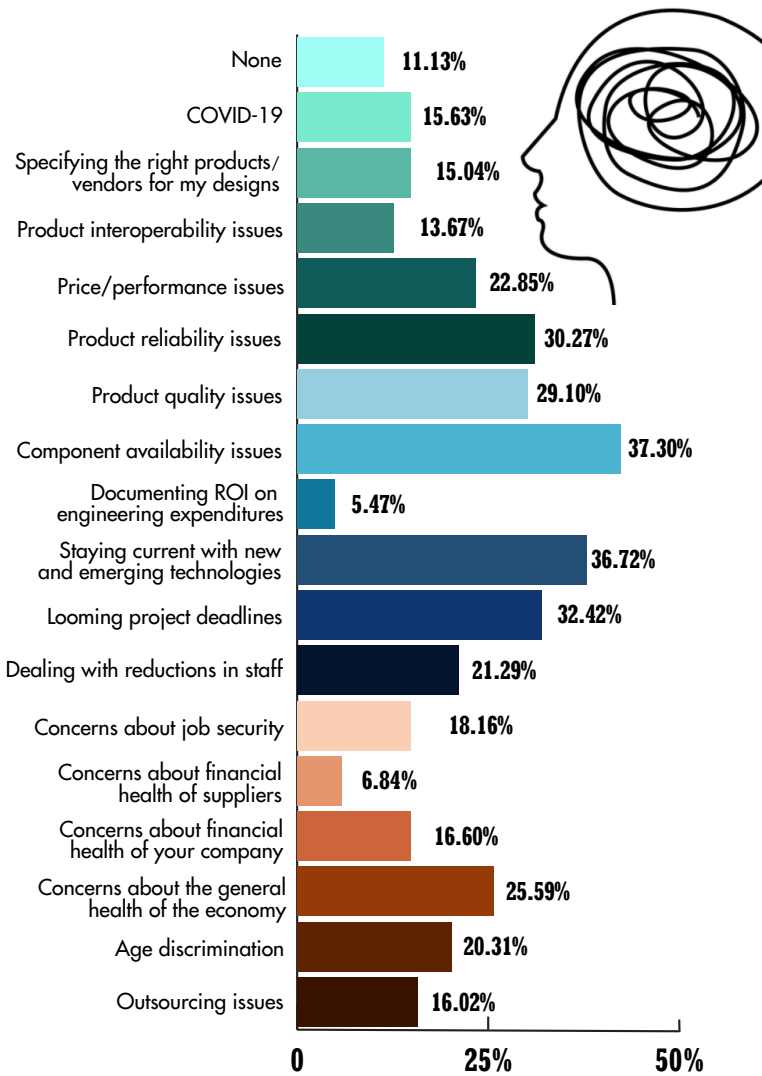
5. Engineers for these are specialties have become hard to find and hire.

For which engineering specialties are you have difficulty finding qualified candidates?

What are the professional issues that keep you up at night?

Issue	Percentage
None	11.13%
COVID-19	15.63%
Specifying the right products/vendors for my designs	15.04%
Product interoperability issues	13.67%
Price/performance issues	22.85%
Product reliability issues	30.27%
Product quality issues	29.10%
Component availability issues	37.30%
Documenting ROI on engineering expenditures	5.47%
Staying current with new and emerging technologies	36.72%
Looming project deadlines	32.42%
Dealing with reductions in staff	21.29%
Concerns about job security	18.16%
Concerns about financial health of suppliers	6.84%
Concerns about financial health of your company	16.60%
Concerns about the general health of the economy	25.59%
Age discrimination	20.31%
Outsourcing issues	16.02%

6. **What issues keep engineering and software developers up at night? Quite a few, with component availability rising to the top this year.**

also may mean that the solutions accessible to developers are being packaged in a way that allows their use without requiring lots of expertise. Of course, telling an engineer that they can't handle a job is like waving a red flag in front of a bull.

Besides, learning on the job is par for the course for engineers and programmers. But I leave that part of the story to other editors who are writing about our survey results.

It does lead me to the chart highlighting concerns that keep engineers up at night (**Fig. 6**). I had to contend with quite a few of those at the top end when managing a group of engineers and programmers, including deadlines and staying current with new and emerging technologies. ML/AI would fall in that category for many.

Product quality and availability rank high on the list. The survey was done before much of the major supply-chain issues arose, so these percentages may be increasing. We shall see how things fare in 2022. They weren't really an issue in 2020.

COVID-19 is in the list and one that will likely be with us for at least the near future. It has changed the landscape significantly for trade shows and working conditions, with remote attendance being the norm at this point whenever possible. Vaccinations are making it easier to work and meet in person, but the interest in continuing remote operations is high. As noted, it also can be a selling point for a job these days, with companies being more amendable to it versus just a couple years ago.

I help manage the local, annual Mercer Science and Engineering Fair and I like to let the students know that their interests can lead to fulfilling jobs in industry. Our survey results reinforce this view. I hope everyone's interest in science and engineering will be passed onto new and budding programmers, engineers, and developers so that they can enjoy the benefits and meet the challenges you encounter on a regular basis.

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CHAPTER 2:

Electrical Engineers See COVID Pain Turn into Salary, Bonus Gains

JAMES MORRA, Senior Staff Editor, *Electronic Design*

Our 2021 Salary Survey revealed that around 60% of engineers expect to see their compensation go up this year, a huge improvement compared to 2020.
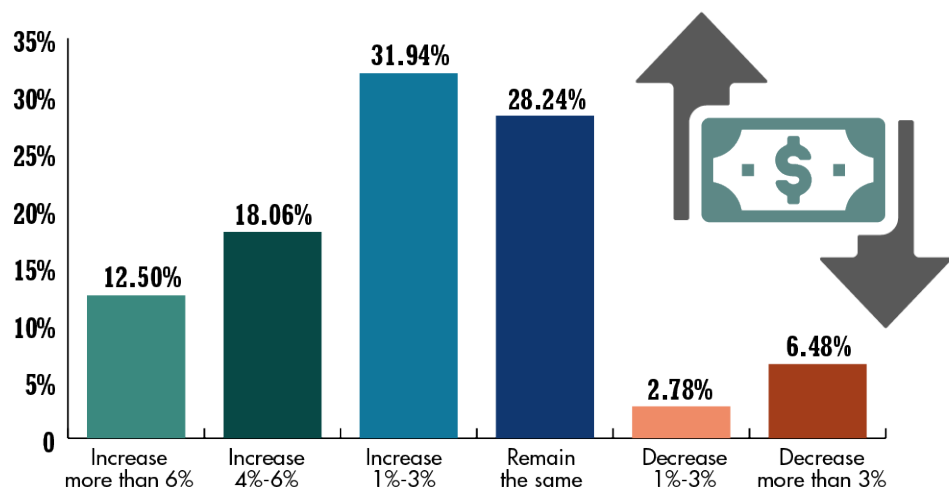
As the world collapsed under the strain of coronavirus last year, many companies delayed raises, canceled bonuses, and paused hiring for electrical engineers to reduce costs. Now they are starting to make up for all the belt-tightening.

Employers are raising salaries and boosting hiring for electrical engineers as the economy roars back from the worst of the pandemic, according to the results of the latest annual survey from *Electronic Design* and Endeavor Business Media›s Design Engineering Group. As employers grapple with a skills shortage, many are boosting bonuses or other perks to entice engineers from other jobs or hold on to the ones they have.

Last year, electrical engineers for the most part survived the worst of the pandemic. Many were able to work remotely without issue even though it has contributed to higher stress and burnout. But engineers did not get out completely unharmed. Many said employers delayed raises, reduced wages, paused hiring, and pushed bonuses to cut costs in the wake of the world collapsing under the strain of a devastating virus.
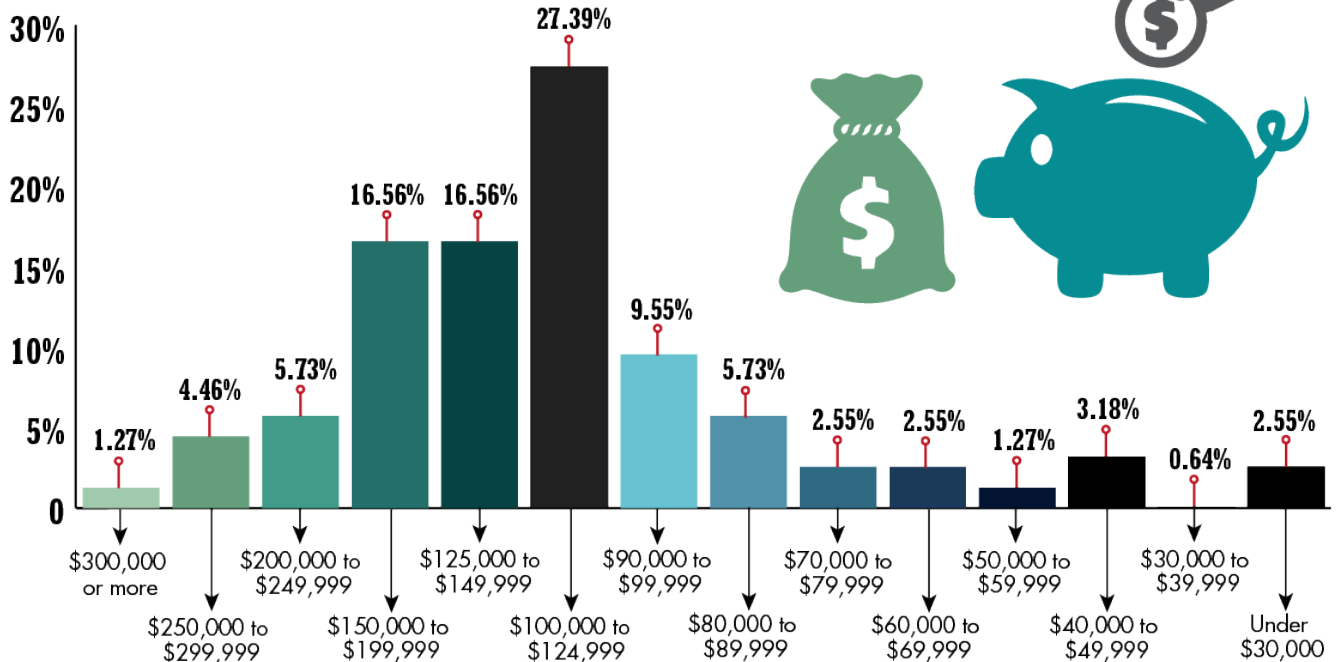
As large portions of the US get vaccinated, many firms have been in recovery mode. The economic boom promises to pay dividends for highly skilled workers like electrical engineers. According to a survey from *Electronic Design* and Endeavor Business Media's Design Engineering Group, around 60% of engineers said that they would see higher wages in 2021, up from about 42% of engineers who landed wage gains in 2020.

■ How will your total 2021 compensation (salary, bonuses, etc.) **compare to what you earned in 2020?**

Bar chart data:
- Increase more than 6%: 12.50%
- Increase 4%-6%: 18.06%
- Increase 1%-3%: 31.94%
- Remain the same: 28.24%
- Decrease 1%-3%: 2.78%
- Decrease more than 3%: 6.48%

What do you expect your total compensation to be in 2021? (BASE SALARY)

Bar chart data:
- $300,000 or more: 1.27%
- $250,000 to $299,999: 4.46%
- $200,000 to $249,999: 5.73%
- $150,000 to $199,999: 16.56%
- $125,000 to $149,999: 16.56%
- $100,000 to $124,999: 27.39%
- $90,000 to $99,999: 9.55%
- $80,000 to $89,999: 5.73%
- $70,000 to $79,999: 2.55%
- $60,000 to $69,999: 2.55%
- $50,000 to $59,999: 1.27%
- $40,000 to $49,999: 3.18%
- $30,000 to $39,999: 0.64%
- Under $30,000: 2.55%

More than 650 engineers responded to the survey, volunteering to share general details about their salaries, bonuses, and other sources of income with Electronic Design, Microwaves & RF, and Evaluation Engineering. Engineers said they have gained an edge this year as jobs are abundant, wages are rising, and companies are competing for scarce talent, even as the labor market has been upended by the pandemic.

While most of the respondents are struggling with the stresses of working remotely, they're also grappling with tightening deadlines, continuous education, and other issues that have lasted for years. Many are also dealing with issues related to component sourcing as the global chip shortage runs up lead times to more than a full year in some of the worst cases. But they remain as upbeat about the future pay prospects as ever.

Buoyed by demand for highly skilled electrical and electronics engineers, more than 70% said that they feel the potential for salary advancement in electronic engineering is as favorable today as it was pre-pandemic.

Last year, many engineers said that their companies delayed raises, reduced wages, or canceled bonuses to slash costs in the aftermath of the world collapsing under the strain of a devastating virus. Others said that, due to the economic fallout from the pandemic, their raises and bonuses were far less significant than usual. But that is changing, with 60% saying a raise is in store in 2021, up from 42% last year, the survey concluded.

More than 58% said that their wages have not been affected directly by the economic crisis of the last year. Only a small percentage indicated they are losing out on raises or bonuses this year due to ongoing economic woes.

Many other factors affect wages, such as education, age, location, seniority, the status

of the labor market, whether your company does profit-sharing, and the economy where their company operates. But the results of the latest survey revealed a median base salary of $100,000 to $124,999 for electrical and electronic engineers, with 58% of respondents reporting a base salary in the range of $100,000 to $199,999.
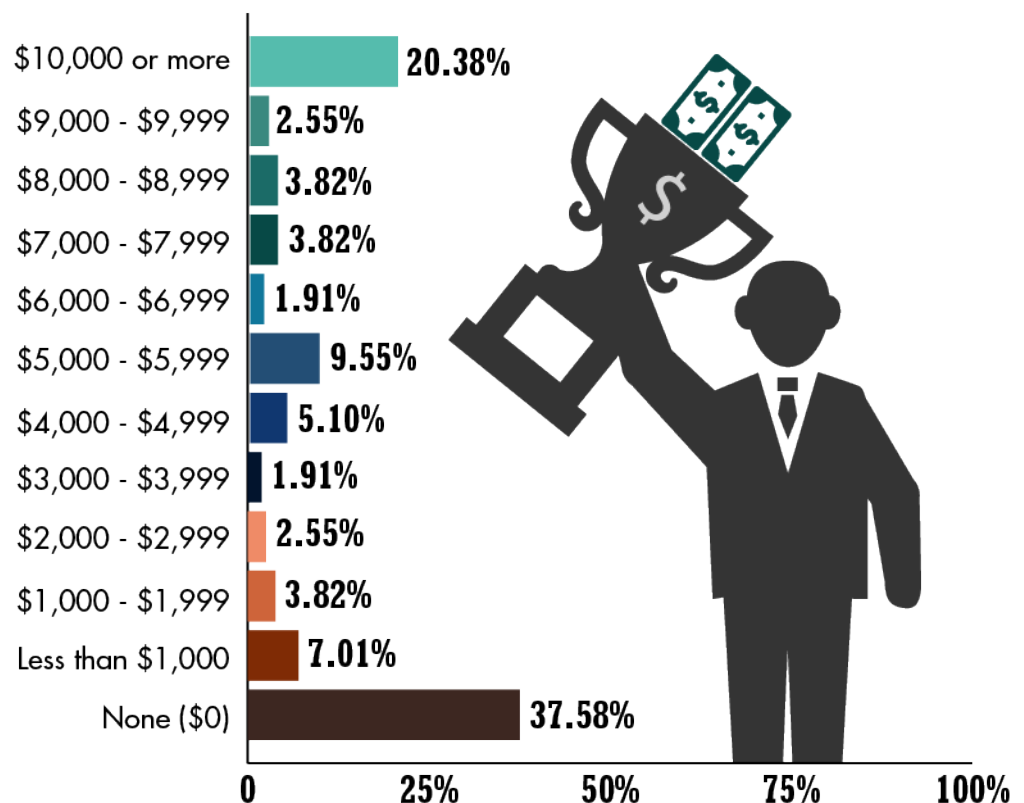
Many employers plan to pay out bonuses in 2021, supplementing salaries with a median bonus of $1,000 to $1,999. Over 34% of engineers are on pace to land more than $5,000 in bonus pay, according to the data.

At the top of the pay scale, engineers in management and executive roles not only have higher salaries, but they also receive thousands of dollars more in stocks and through employer-led share-matching programs. The rank-and-file engineers are largely left with bonuses and other standard perks. Only 30% of respondents said stocks are part of their pay package in 2020, and 12% plan to be rewarded with $10,000-plus in stocks.

Around 15% revealed their total compensation rose by more than 6% in 2021 compared to last year, roughly double the number last year, while around 30% of respondents said that they're seeing growth of 1% to 3% in compensation. According to the survey, another 16% are in store for raises of around 3% to 5%, signaling that companies are ramping up wage growth for engineers as the economy recovers from the worst of the virus.
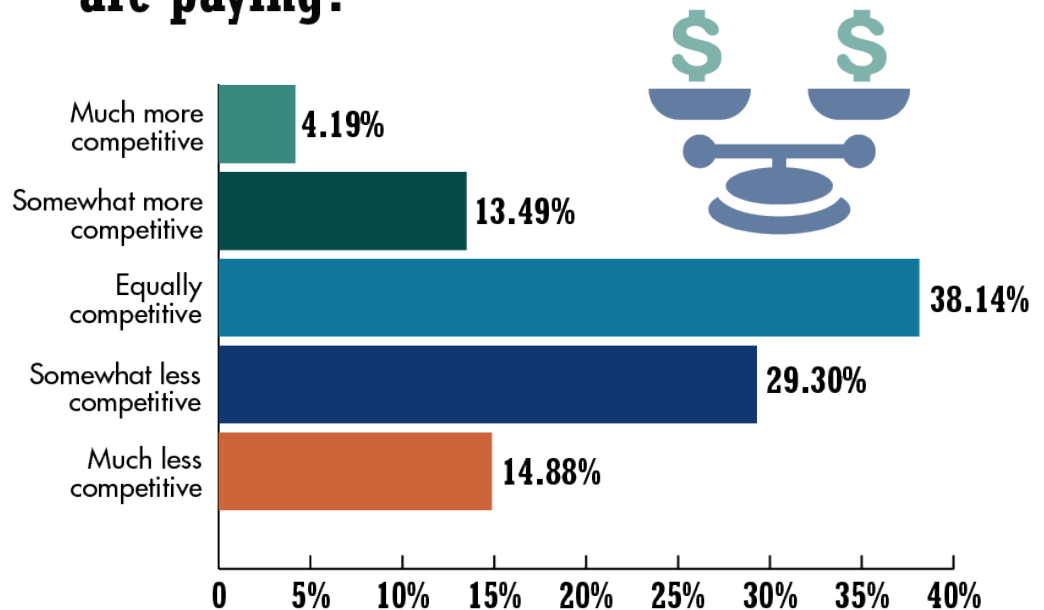
But at the same time, others felt that these salary gains are falling short given the grind of engineering jobs, struggling with very long hours, tight deadlines, and the challenges of being up-to-date on new technologies.

■ Bonuses

Bonus Range	Percentage
$10,000 or more	20.38%
$9,000 - $9,999	2.55%
$8,000 - $8,999	3.82%
$7,000 - $7,999	3.82%
$6,000 - $6,999	1.91%
$5,000 - $5,999	9.55%
$4,000 - $4,999	5.10%
$3,000 - $3,999	1.91%
$2,000 - $2,999	2.55%
$1,000 - $1,999	3.82%
Less than $1,000	7.01%
None ($0)	37.58%

Generally speaking, how do you think your compensation package compares with what other engineering employers are paying?

Response	Percentage
Much more competitive	4.19%
Somewhat more competitive	13.49%
Equally competitive	38.14%
Somewhat less competitive	29.30%
Much less competitive	14.88%

At the same time, around 30% said pay rates are largely remaining the same, whether because of economic pressures or other factors, such as older workers reaching the top of their pay range. That could result in a pay cut due to rising inflation in the US and globally. About 10% were victims of a pay cut—a big improvement from the 20% who last year said wages would contract due to delayed bonuses, pay cuts, or other measures.

More than 60% of engineers said their employer adequately compensates them for the work they do, and 36% feel that their compensation package is as competitive as what other firms are offering their engineers. Another 19% report they're probably better compensated than other workers in the same role, and among engineers who feel as though they should be making more money, many say they deserve a sizable raise.

While a preponderance of engineers feel as though they deserve more pay, about 90% said they recommend engineering as a career with a promising future and—all things considered—competitive pay to the younger generation.

Only 32% said they have debated whether to leave engineering for another career or hang up the soldering iron in retirement. They indicated feeling burned out by the unrelenting demands of the job and want to pursue another career. And more than 30% said they have considered leaving to make more money.

The results come as the pandemic has caused worker shortages—called the "Great Resignation" by many—in a range of sectors. As the pandemic clouds lift, the percentage of Americans leaving their employers for new jobs is at record levels. The wave of resignations marks a sharp turn from the early days of the crisis, when highly skilled workers

craved job security as the coronavirus spread, causing turmoil and uncertainty.

The COVID-19 crisis also remains unpredictable. The highly infectious Delta variant spread chiefly among the unvaccinated in recent months, causing hospitals to almost overflow in many states. New outbreaks and variants could prolong economic woes, while snarls in the global supply chain may also imperil the world's recovery and drive inflation.

While some sectors such as transportation are churning workers more than others, the number of those quitting helps explain why so many employers are struggling more than ever to fill hiring gaps. Around 43% said their employers are trying to increase the number of engineers on staff, while only 10% expect job cuts.

The difficulties in finding engineering hires predates the pandemic, and it could have to do with the types of jobs engineers are comfortable taking today than it does with a shortage of workers. Even so, high-end engineering skills continue to be coveted, with around 54% last year saying their companies were having trouble hiring engineers. This year? Around 67% said their employers are having the same problem.

But it is unclear whether the shortages are directly making employers more willing to increase pay to lure hard-to-fill positions or preventing them from reducing worker pay, freezing raises, or removing signing bonuses.

Many engineers are keeping the door open to changing jobs. A high percentage feel that moving to a management role or changing jobs are the only ways to guarantee wage growth in engineering. Around 10% are in the process of looking for a new position, while 33% responded that they're not actively looking but would follow up if contacted by a recruiter, and 28% would follow up if they even heard about a promising new opportunity.

But while 61% of respondents are willing to change jobs—a percentage largely unchanged from last year—around 29% are enjoying their current position and have no plans to start a new job in the foreseeable future.

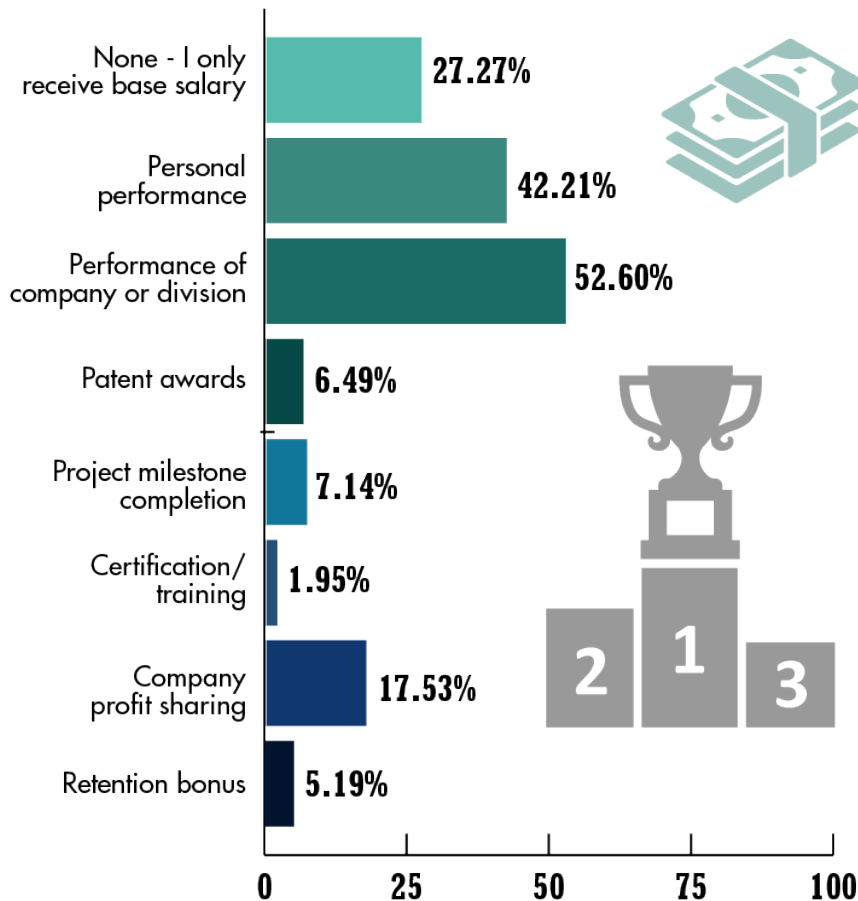## ■ Do you feel your company adequately compensates you for the work you do?
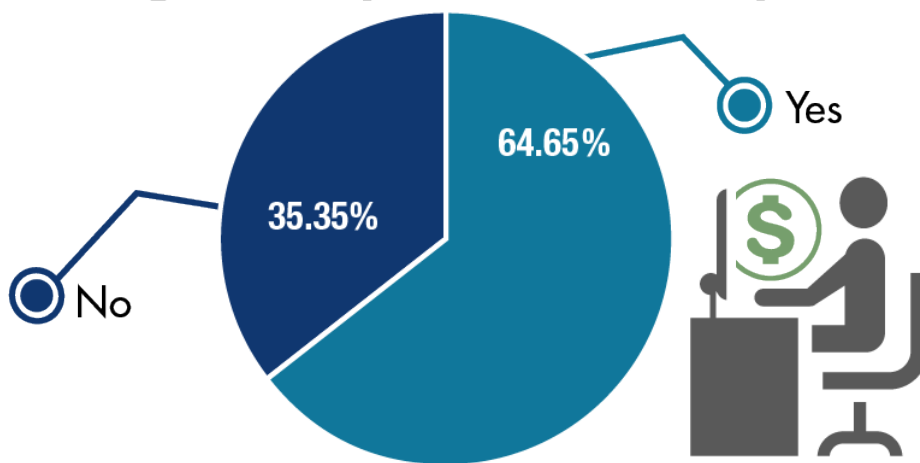
64.65% Yes
35.35% No

■ Do you believe that a career path in engineering and the potential for salary advancement is as promising today as it was five years ago?

27.66% No
72.34% Yes
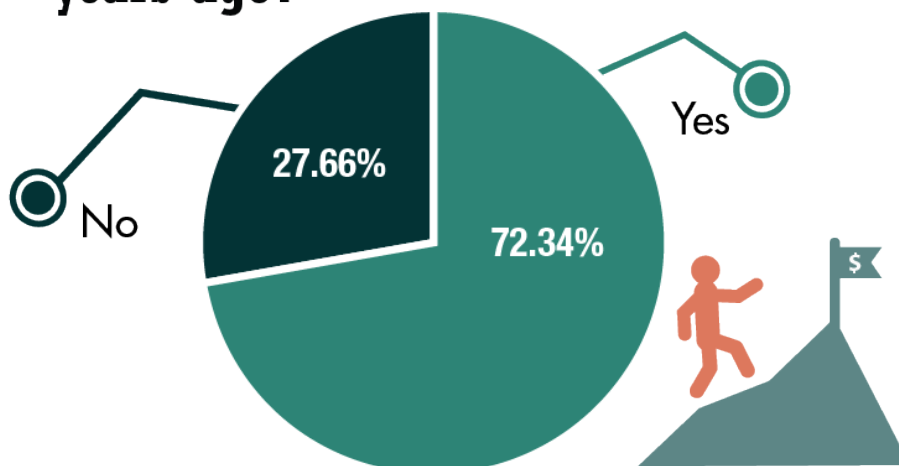
■ Of the bonuses and other direct cash payments over and above base salary that you receive, please specify the primary reason(s) for them?

Bar chart:

- None - I only receive base salary — 27.27%
- Personal performance — 42.21%
- Performance of company or division — 52.60%
- Patent awards — 6.49%
- Project milestone completion — 7.14%
- Certification/training — 1.95%
- Company profit sharing — 17.53%
- Retention bonus — 5.19%

(x-axis: 0, 25, 50, 75, 100)

The survey signals that while some engineers are walking out the door and others are eyeing open positions, many others are staying put, possibly in part due to the ongoing uncertainty around the virus and the stability of their current jobs. Only 7% of engineers changed jobs within the last year, and among them, around 13% were promoted to a new role with their current employer while 24% left to pursue a new position.

Another 15% of engineers who changed jobs said they landed at a new employer after losing a previous job.

Given the challenges of scouting and hiring highly skilled engineers, many companies are trying to hold onto their workers. Almost two-thirds of engineers replying to the survey said their companies are at least as focused on employee retention this year as they were last year. The worker shortage could give engineers extra bargaining power to get a raise or promotion, allowing them to avoid changing jobs.

Employees are adding value with various perks. Many are paying for continuing education, as the tightening market for engineering talent—at least in the U.S.—underscores the need to nurture new skills internally. While firms suspended travel last year, engineers say many are now willing to pay for travel to industry conferences again. Others reported that their firms restarted 401K match programs after pausing them last year.

Engineers have long complained about the feeling that employers look at them as interchangeable worker bees. But the current labor shortage could help bring about change—and possibly better pay in the process.

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CHAPTER 3:

How Working Remotely is Spawning a Design Revolution

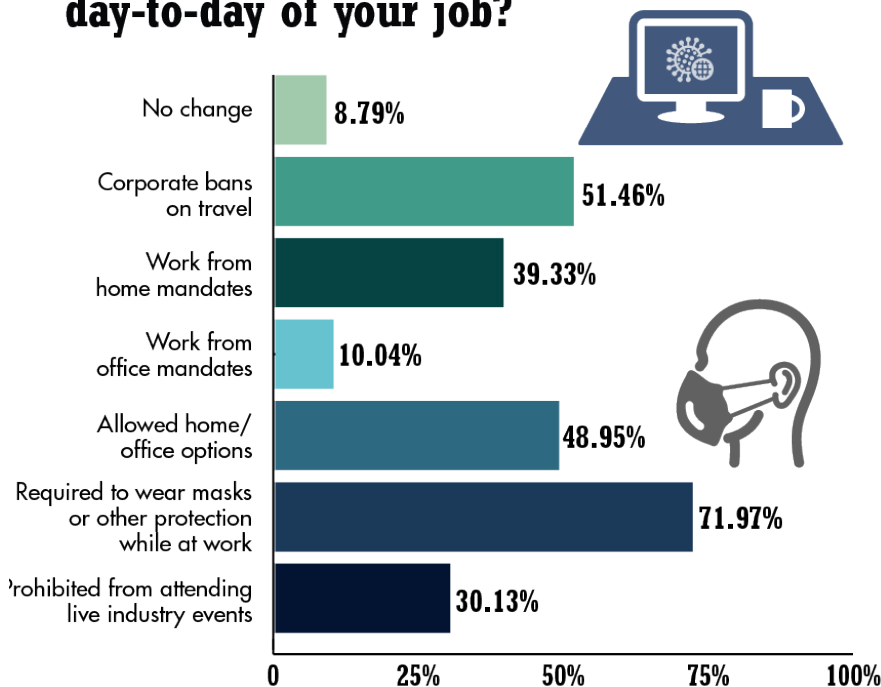ALIX PAULTRE, Editor-at-Large, *Electronic Design*

The forced isolation from COVID brought a perfect storm of need to foment a greater acceptance of advanced design and development tools.

The saying "every cloud has a silver lining" is very apt for the situation we've found ourselves in during this age of COVID-19. The forced isolation and need to separate has caused a great deal of hardship on every level and in every venue of society. However, the need to interact at both a social and business level forced us to investigate solutions such as telepresence and other collaborative tools to operate.

Holding meetings with people and sharing data with others online wasn't a new concept a couple of years ago—that movement was already on its way to more widespread adoption. Companies were using these tools to do business before COVID-19, but they were mostly multinationals with far-flung principals and high-end freelancers who needed to be everywhere.

The pandemic created a "perfect storm" of need that significantly increased adoption of remote tools, causing additional development in a fledgling industry. The latest collaborative tools are not only useful for telepresence, they're also fomenting a design revolution based on real-time design and manufacturing.

How has COVID-19 affected the day-to-day of your job?

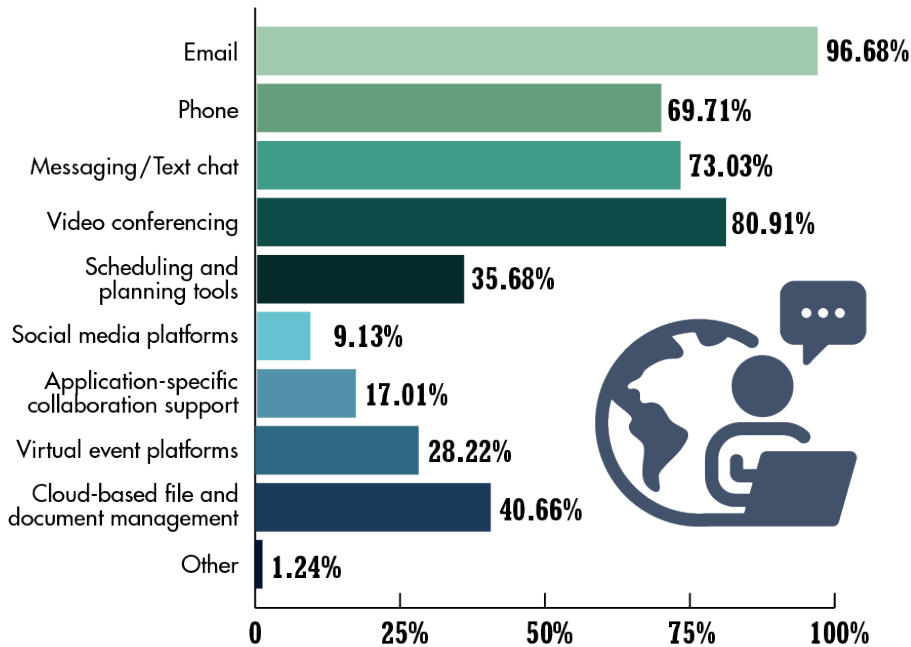| Category	Percentage
No change	8.79%
Corporate bans on travel	51.46%
Work from home mandates	39.33%
Work from office mandates	10.04%
Allowed home/office options	48.95%
Required to wear masks or other protection while at work	71.97%
Prohibited from attending live industry events	30.13%

Impacting Work

In our 2021 Salary Survey, we asked our engineering audience about how COVID-19 affected their day-to-day job (**fig.1**). The most prevalent business actions quoted included corporate bans on travel (46.93%), prohibitions on attending live industry events (29.96%), being allowed to work from a home office (50.72%), and even work-from-home mandates (34.84%). This pretty much forced everyone with the ability to create a home office to make one.

The tools required to perform work vary from company to company and industry to industry, but the common-need denominators include the ability to communicate with team members, schedule and manage event timelines, and share data and documents. These needs are often dealt with using separate

1. Team separation was among the biggest COVID-19 impacts on day-to-day work.

What collaboration tools are you using on a regular basis?

Email — 96.68%
Phone — 69.71%
Messaging/Text chat — 73.03%
Video conferencing — 80.91%
Scheduling and planning tools — 35.68%
Social media platforms — 9.13%
Application-specific collaboration support — 17.01%
Virtual event platforms — 28.22%
Cloud-based file and document management — 40.66%
Other — 1.24%

(axis: 0 25% 50% 75% 100%)

2. People desire the highest level of interactivity possible in interpersonal communications.

software-based solutions, but a growing number of all-in-one collaboration suites are emerging.

This multifaceted need is driving even more functionality into currently available solutions. The collaborative-tool marketplace is a relatively new one, and like many software-based industries, far from mature. Many people now routinely perform a significant number of tasks using collaborative tools—a number that will grow in both number and depth as the tools continue to mature.

When we asked our engineering audience about the collaboration tools they currently use (**fig.2**), email led the list at 96.22%, beating out the telephone (74.59%) and texting (69.37%). Video conferencing has become a primary tool for both social interaction and business, coming in at number two with 79.82% of our respondents using it. This underscores the desire for the highest level of interactivity possible in interpersonal communications.

The next island of responses involved tools used to conduct business. The need to schedule and plan, to share files and documents, and to meet other people in a common industry is important for a business to operate. Tools for cloud-based file and document management (35.32%) narrowly edged scheduling and planning tools (35.32%), followed closely by virtual-event platforms (30.81%). This shows that many functions traditionally done face-to-face are being done virtually, successfully.

Cascading Benefits

Once people begin using a new tool, they also find new places and ways to use it as a solution for the needs around them. Most tools, regardless of type, offer peripheral benefits. Some of these are very apparent to the user and often are the primary purpose the solution was obtained. However, sometimes it takes a while for a tool's full benefits to be appreciated.

For example, a design and development company may start using a collaborative planning tool to integrate the actions of a separated team, finding significant additional benefit in peripheral functionality. This could be something like the ability to create a bill of materials automatically, without the need of an additional engineer to monitor the process. That either reduces headcount or frees up a needed engineer for another aspect of product development.

This aspect directly addresses the shortage of engineers available to work on any given project, as one engineer can fill many boots with cloud-based development tools. In the survey, the most desired were RF (44.81%) and analog (41.54%) engineers. Sharing engineering resources isn't just a software solution, because many of the latest benchtop hardware tools such as oscilloscopes can now be operated remotely. This enables an engineer to troubleshoot hardware from the other side of the globe, if there's someone at the place of need who can place the probes for them.

Another significant benefit that comes from migrating your development process online is the ability to perform real-time design-while-build. Your team can utilize the same collaborative development tools they used to create a product, redesigning it on-the-fly to address manufacturing issues, functionality upgrades, or custom orders. The ability to react immediately to initiatives in a proactive manner can be a major force multiplier in a highly competitive marketplace.

Designing the Future

Not surprisingly, this growth in the market for collaborative tools of all kinds—societal and commercial—and the infrastructures needed for them is reflected in the design projects of our audience. When we asked them what best describes your current design project, 14.81% replied with communications systems and equipment, such as local-area/wide-area networking products, wireless, cellular, RF and microwave, Bluetooth, etc.

Another big area of interest was in industrial control systems and equipment (including robotics) at 9.88%, reflecting the impact of smart systems on manufacturing (Industry 4.0). This area of industry will eventually meld with the aforementioned collaborative development tools, further enabling real-time manufacturing oversight and management, and on-the-fly redesign and custom work.

This also is reflected in the answers to our question about the technologies having a major impact on their designs. Almost half of the responses (40.83%) said it was test equipment, which makes sense in light of the need to test, validate, and optimize these advanced interlaced technologies. Wireless networking came in second at 35.93%, followed by sensor integration at 32.12%, with power management a very important concern at 30.67%. It reflects the growth in the cloud-enabled IoT, the devices, and the infrastructure.

Looking Forward

The impact of COVID-19 may have accelerated the adoption of collaborative design tools, but the functionality they provide, and the cascading benefits offered, would have made the transition to their use inevitable. The latest generation of hardware and software solutions for engineering design and development is only beginning to mature, and the best in many ways is yet to come as these tools more deeply integrate into the engineering community.

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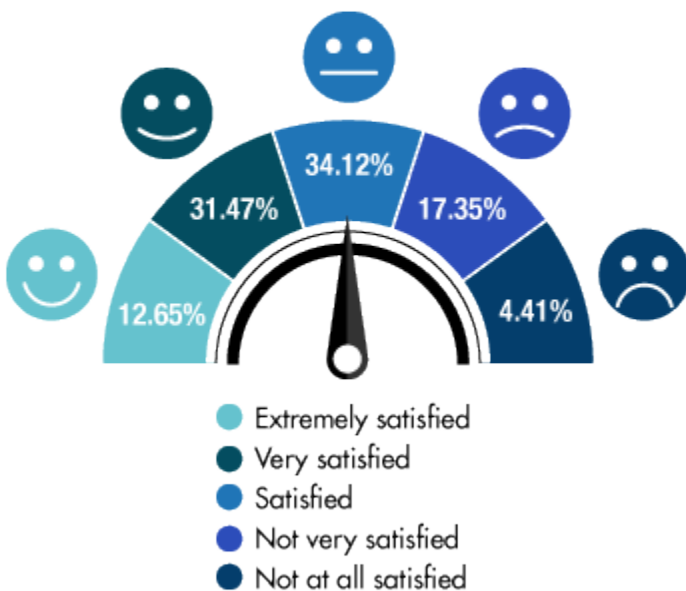
CHAPTER 4:

Facing the Future

BOB VAVRA, Editor, *Machine Design*

Experience and technology are key factors in Salary & Career Survey optimism.
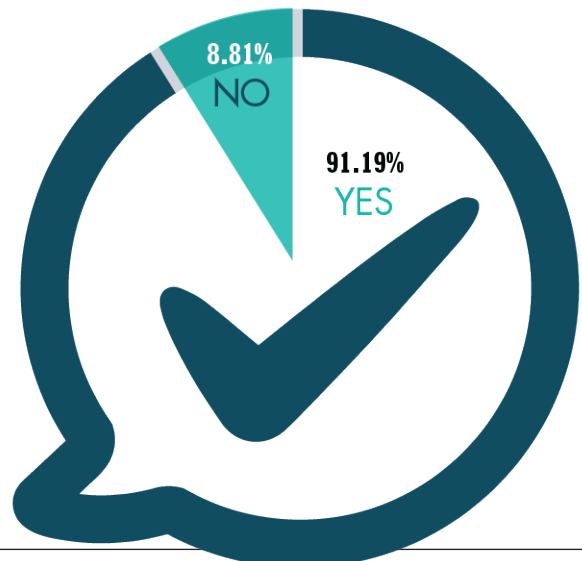
The future of engineering in particular and manufacturing in general has reached a crossroads. Impacted by global economic challenges, supply chain disruptions and worker shortages, manufacturing also has faced an explosion of technology that has replaced or augmented some jobs with robotics and automation.

Yet engineers who participated in the 2021 *Machine Design Salary & Career Survey* were generally optimistic about their profession's short-term benefits and longer-term future. As one respondent put it, "Engineering is not for everyone, but for someone with strong

■ **How satisfied are you in your current position?**

34.12%
31.47%
17.35%
12.65%
4.41%

- Extremely satisfied
- Very satisfied
- Satisfied
- Not very satisfied
- Not at all satisfied

■ **Would you recommend engineering as a career path to a young person looking to choose a profession?**

8.81%
NO

91.19%
YES

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Do you believe there is an engineer shortage?


68.69% YES

31.31% NO
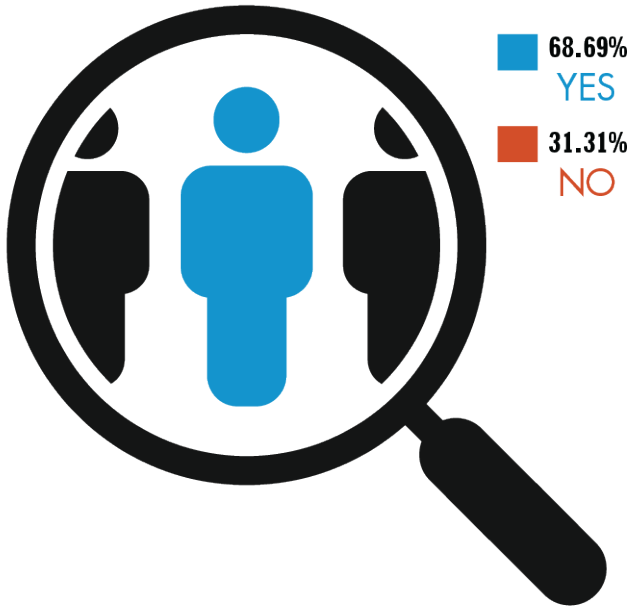
technical interests it can be very rewarding. With all the available jobs, a young candidate can "test the waters" in a couple different fields before settling on a long-term path."

Another took a more pragmatic approach to the opportunities available in engineering. "[It's a] great field that is constantly growing. If you want to travel with your job, you can. If you want to stay home with almost no travel, you can," he wrote. "There are lots of opportunities to either develop new tech or adapt the new tech to current problems or issues. And with the shortage of labor, engineers are always needed to help automate things to make better use of the few employees that choose to still go to work."

The engineers who responded to this year's survey come from a variety of disciplines. The majority of this group either are design or project engineer, have project management responsibilities or head up research and development. About 7% of respondents are in executive management.

Regardless of job title, the last two years have been enormously challenging for everyone. Yet engineers remain positive about their profession and its value to themselves, and to society as a whole. Regardless of their field, level of experience or compensation, engineers surveyed are satisfied with their present profession and optimistic about its future.

How has COVID-19 continued to impact hiring and budgeting at your company?
(Choose all that apply)
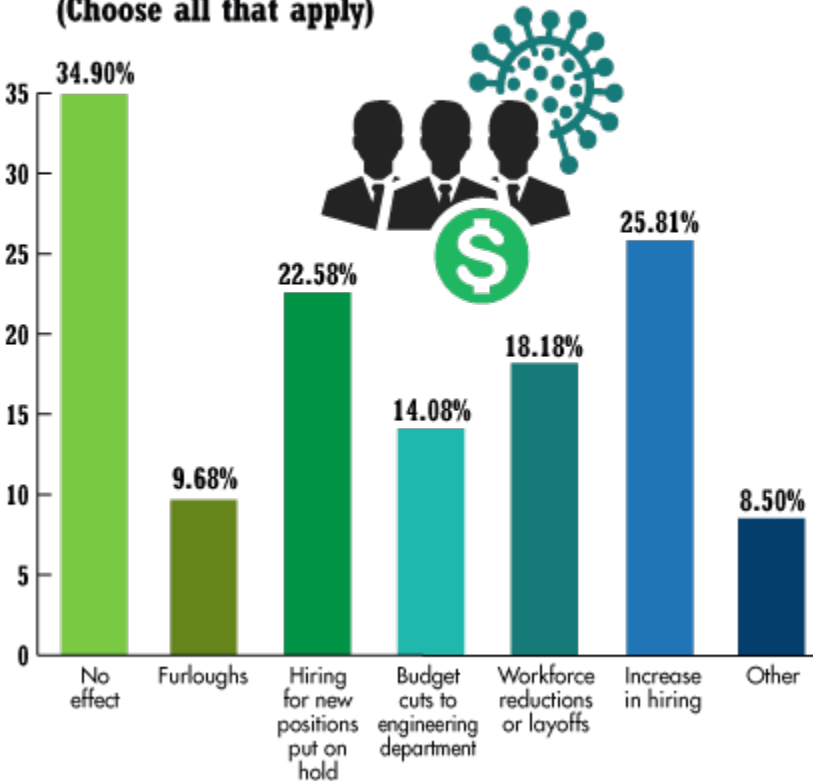
The Impact of COVID

12% of the group have changed jobs in the last year, and while 27.5% of those changes were promotions, and 15% were due to COVID layoffs or other job reductions, 32.5% left to pursue other opportunities. About two-thirds of respondents said their company is as focused on employee retention as it was a year ago.

36% don't work from home at all, while 31% work from home due to COVID restrictions and another 8% will remain working from home after COVID, compared with just under 8% that worked from home before COVID.

The COVID impact has been widespread:
- 40% of respondents faced a corporate ban on travel
- 28.5% had a work-from-home mandate, compared with just 8.7% with a work-from-office mandate
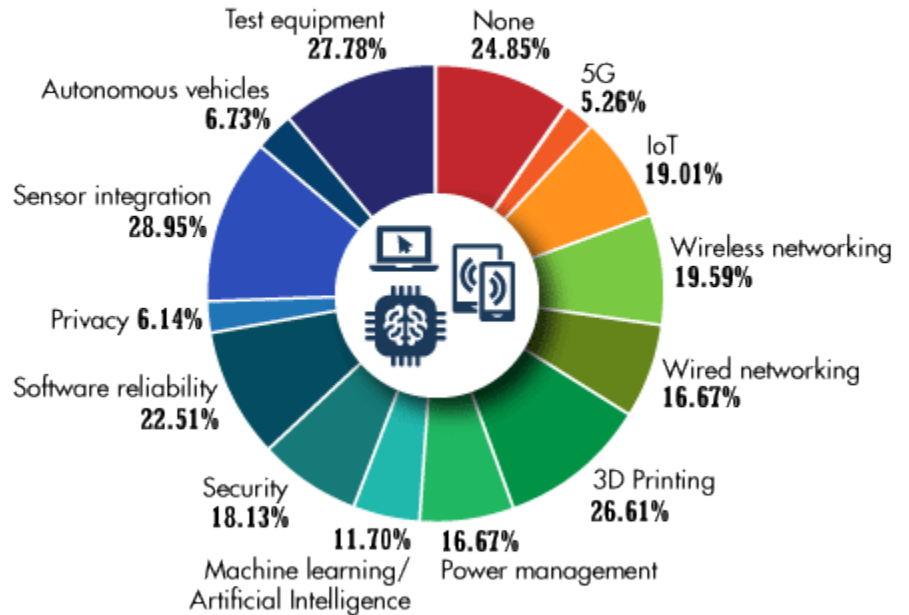- 67.2% were required to wear masks while at work.

The pandemic also had an impact on hiring and job retention—in both directions. There were job cuts for 18% of respondents, 9.6% experienced

Is your organization having difficulty finding qualified candidates for open engineering positions?

70.93% YES   **29.07%** NO

Which of these technologies have a major impact on your designs? (Choose all that apply)

Test equipment 27.78%
None 24.85%
5G 5.26%
IoT 19.01%
Wireless networking 19.59%
Wired networking 16.67%
3D Printing 26.61%
Power management 16.67%
Machine learning/Artificial Intelligence 11.70%
Security 18.13%
Software reliability 22.51%
Privacy 6.14%
Sensor integration 28.95%
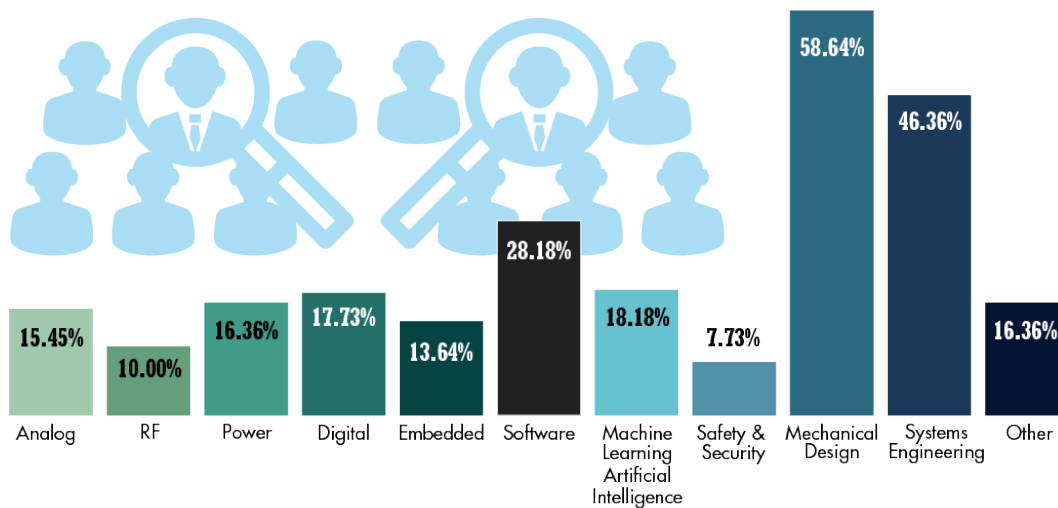Autonomous vehicles 6.73%

furloughs and 14% saw cuts in engineering department budgets. And while 22.5% saw a freeze on new manufacturing hires, 26% saw an increase in hiring. In 2022, 43% of respondents said their company was looking to increase hiring, while 50.5% said staffing would remain at current levels.

The use of online tools also increase—while email, phone and messaging were all primary tools, 82% used video conferencing, 41.3% employed scheduling and planning tools, 38.4% used cloud-based document management and another 15% used an industry-specific collaboration tool. While 30% attending conferences through virtual event platforms.

In looking at compensation, the majority of respondents (53%) said there was no change in compensation, with 14.5% reporting a freeze on raises and 11% noting that bonuses were cancelled. Overall, 18.9% reported a salary increase and 5.8% said there was a salary decrease.

The Role of Technology

Technology played a major role in helping manufacturers stay connected in the throes of

For which engineering specialties are you having difficulty finding qualified candidates?

Analog 15.45%
RF 10.00%
Power 16.36%
Digital 17.73%
Embedded 13.64%
Software 28.18%
Machine Learning Artificial Intelligence 18.18%
Safety & Security 7.73%
Mechanical Design 58.64%
Systems Engineering 46.36%
Other 16.36%

Approximately how long have you worked in engineering?

14.08%

12.32%

14.08%

9.68%

8.50%

11.44%

10.26%

9.68%

7.04%

2.93%

- Less than 1 year
- 1-4 years
- 5-9 years
- 10-14 years
- 15-19 years
- 20-24 years
- 25-29 years
- 30-34 years
- 35-39 years
- 40 years or more

the pandemic, but widespread use of technology on the plant floor remains a future project. While technologies such as the Internet of Things (IoT) is used in 18.9% of facilities, 19.5% employ wireless technology and 18% use some form of security, a full one-quarter of respondents use none of the technology advances of the last decade. One encouraging sign: 26.5% of respondents mentioned 3D printing, the largest single area cited in the survey.

Technology advancements are being embraced in some areas of the profession. "If you can find the right company and right attitude of employer, engineering can be an amazing career path simply due to the huge variety of possibilities, and now the speed of innovation is greater than ever," one respondent wrote.
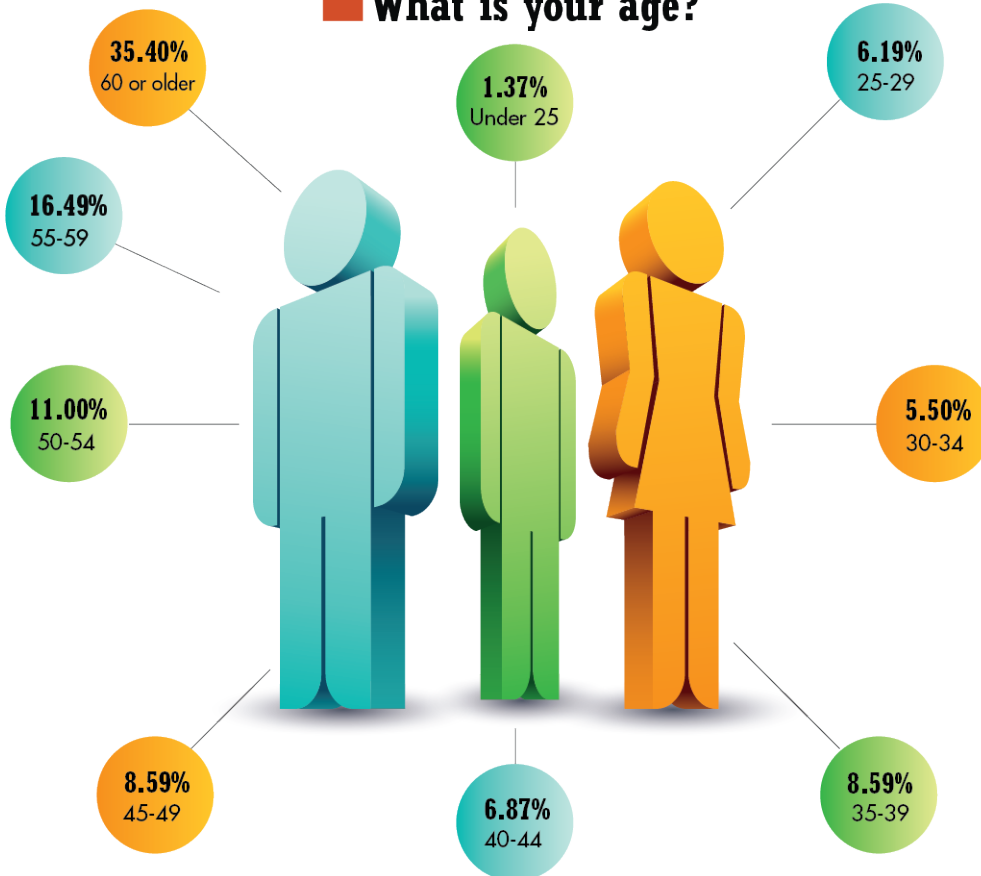
Present Experience, Future Opportunities

The *Machine Design* audience is experienced—62% of respondents have been in engineering at least 20 years, and 28% have been in the field more than 35 years. There are 62% of respondents over the age of 50, and 35.7% are above the age of 60. They also

are well-educated, with 84% having earned at least a bachelor's degree, and 23.7% earning a master's degree. They also remain bullish on the industry—almost three-quarters of respondents say the future for engineering is as promising as it was five years ago, and 90% recommend engineering as a career path for a young person.

What is your age?

35.40%
60 or older

1.37%
Under 25

6.19%
25-29

16.49%
55-59

11.00%
50-54

5.50%
30-34

8.59%
45-49

6.87%
40-44

8.59%
35-39

That recommendation carries with it the reality of a shortage of engineers, particularly with so many engineers nearing retirement age. The current disconnect between unemployed workers and job openings is especially chronic in manufacturing and engineering, and 68% of respondents said they believe there is a shortage of engineers, while 70.5% said their company is having difficulty finding engineers for open positions. Positions for systems engineers (46.6%) and mechanical design

Which one of the following best describes your highest level of education?
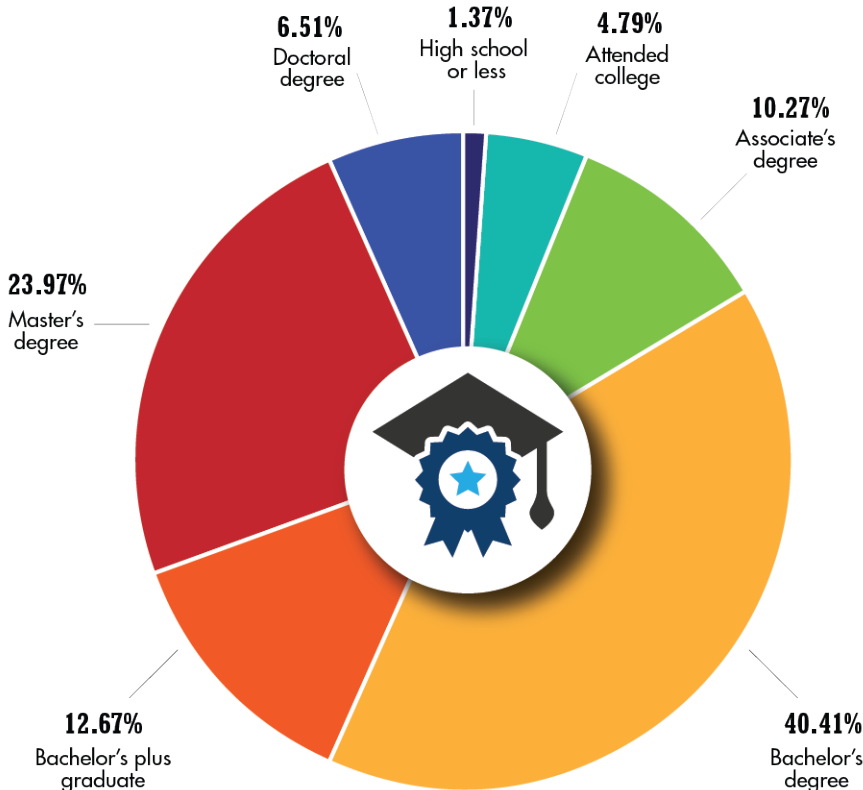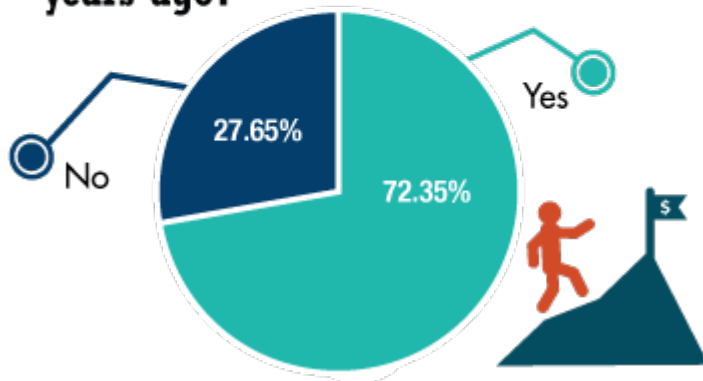

6.51% Doctoral degree

1.37% High school or less

4.79% Attended college

10.27% Associate's degree

23.97% Master's degree

40.41% Bachelor's degree

12.67% Bachelor's plus graduate studies

Do you believe that a career path in engineering and the potential for salary advancement is as promising today as it was five years ago?

No — 27.65%

Yes — 72.35%

(58.4%) are in particularly short supply.

"The baby boomer generation is due to start retiring en masse," noted one respondent. "Without a steady supply of new, young engineers to replace the retirees, the profession will face an employment crisis."

One area that does challenge the current engineering base is their workload. Of those who would consider leaving the profession, 37% said there was no further room for advancement, while 42% cited stress and 37.7% said burnout as contributing factors. Still, 50% said they'd leave just to try something different, 40% would leave to do something more fulfilling and 39.2% would consider a change to make more money.

While COVID was cited by about 15% of respondents as contributing to their stress, other business-related areas garnered far more attention. Issues such as product deadlines, the availability of components, product quality and reliability and price and performance were far greater issues for engineers.
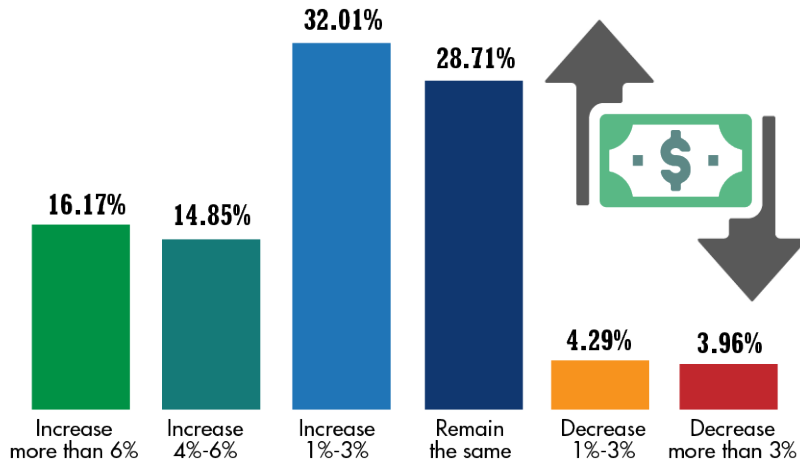
Salary and Satisfaction

The issue of job satisfaction did have a dollar sign attached to it—more than 80% said their pay was an important, if not critical consideration. The job challenges—areas such as finding the best designs, seeing those designs reach their potential, the collaborative nature of design and the recognition of their work by company management and customers all were significant factors in job satisfaction— all garnered significant support as well, and the opportunity to design products that can benefit society held almost the same level of importance as salary to the respondents. As one respondent put it, "Engineering allows a person to grow personally and professionally while being challenged to make a difference to society in general."

Their views on future employment appear to be evenly divided. While 11.5% are actively seeking new employment, 28.4% said they had no immediate plans to change jobs. The group in the middle also was evenly split—31.2%
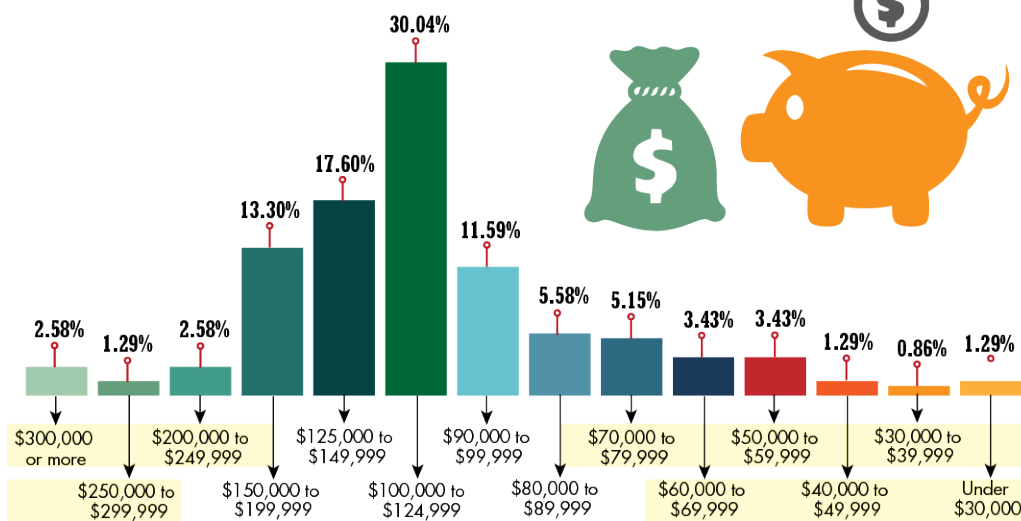
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How will your total 2021 compensation (salary, bonuses, etc.) compare to what you earned in 2020?

- Increase more than 6% — 16.17%
- Increase 4%-6% — 14.85%
- Increase 1%-3% — 32.01%
- Remain the same — 28.71%
- Decrease 1%-3% — 4.29%
- Decrease more than 3% — 3.96%

would respond to an interesting opportunity they heard about, while another 28.7% would respondent if recruited for such an opportunity.

The compensation levels tend to reflect the level of experience of the *Machine Design* audience respondents. While there are outliers at both ends of the salary spectrum, the general salary compensation range is between $70,000 and $200,000 a year. The largest percentage range was between $100,000 and $125,000, with 29.7% reporting salaries in that range. There were 31% reporting salaries in the range from $125,000 to $200,000 and 22.3% between $70,000 and $100,000. Their satisfaction with that compensation is also relatively high—59% rate it as at least competitive with others in the profession, and 61.3% consider themselves adequately compensated.

What do you expect your total compensation to be in 2021? (Base Salary)

- $300,000 or more — 2.58%
- $250,000 to $299,999 — 1.29%
- $200,000 to $249,999 — 2.58%
- $150,000 to $199,999 — 13.30%
- $125,000 to $149,999 — 17.60%
- $100,000 to $124,999 — 30.04%
- $90,000 to $99,999 — 11.59%
- $80,000 to $89,999 — 5.58%
- $70,000 to $79,999 — 5.15%
- $60,000 to $69,999 — 3.43%
- $50,000 to $59,999 — 3.43%
- $40,000 to $49,999 — 1.29%
- $30,000 to $39,999 — 0.86%
- Under $30,000 — 1.29%

Other compensation and benefits areas included:

- Stock or stock options—76.7% reported no such benefit
- Bonuses, while 26.5% reported no bonus plan, 34.5% reported a bonus program of at least $5,000—and 18% reported a bonus plan above $10,000. The bonuses are primarily based on personal performance and the performance of the company or division.

Respondents are expecting their compensation to increase in 2022—31.8% see an increase of at least 4%, and 63% see some sort of increase for the year. Just 8.5% are projecting a salary decrease.

But while compensation is a measuring stick for job satisfaction, it is not what drives many of the *Salary & Career Survey* respondents. "I compare engineering to art," one engineer wrote. "I get to create masterpieces that solve a problem or provide a service. I have designed and built machines and process for many years. It is the act of creation, just like art. At the end of the day, one can look back and say, 'I did that'."

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CHAPTER 5:

2021 Salary & Career Report: Continuing Education

DAVID MALINIAK, Editor, *Microwaves & RF*

What's the current state of continuing engineering education? Our 2021 Annual Salary and Career Report survey provides a snapshot and hints at some trends.

"Every project involves so many different technologies that it's hard to keep up," says a respondent to our 2021 Salary & Career Report Survey. In a nutshell, that's the overriding sentiment among engineers when it comes to continuing their engineering educations. In our survey, we asked you to update us on your current level of education and how you prefer to learn about new technologies and skills. Does your employer encourage continuing education by footing the bill, and if so, in what modes? And how does the coronavirus pandemic figure into the picture? In this article, we'll look at these topics with facts, figures, and anecdotal responses.

Education Levels Staying on Par

First, let's look at where you stand with your respective highest levels of education and see how that compares with the 2020 survey responses. The leading response was a master's degree (near 35% vs. 32% in 2020), followed by a bachelor's degree (25% vs. 27%). Nearly 16% claim a bachelor's degree plus some amount of graduate studies. The number of respondents holding a doctoral degree has held steady at 12%. So, these survey results suggest that overall, the levels of education among you are holding steady year-on-year compared to 2020.

No Shortage of Educational Options

No matter what your level of formal education, you must stay abreast of technological developments and trends as you progress in your engineering careers. So, we asked, "What are some of the ways in which you continue your engineering education?"

Repeating last year's survey, this year's leading category is engineering/technology publications, on which nearly 72% of respondents rely for keeping up with technology.
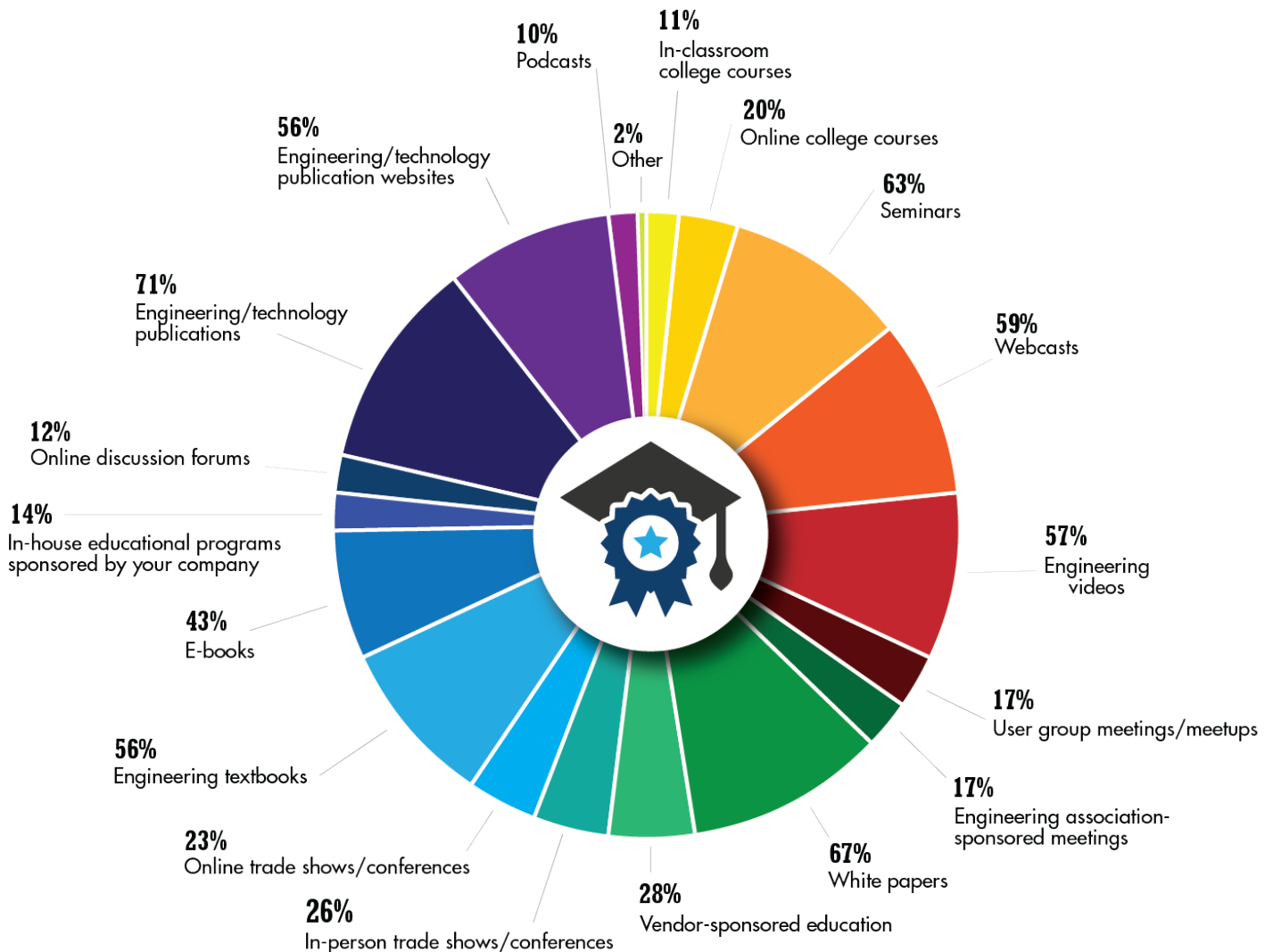
Close to 66% turn to whitepapers, and about 61% favor engineering videos and publication websites. Webcasts and seminars close out the top tier at about 60%. Vendors to the OEM electronics industry have always done a great job at cranking out videos, whitepapers, and webcasts to educate engineers on their latest and greatest innovations. All of those mediums are free to consume, and webcasts can usually be viewed on demand if you've missed the live events.

The in-person modes of continuing education—things like in-classroom college courses, seminars, user-group meetings, and meetups—are a mixed bag compared with last year's results. College courses are down from 11% to about 9%, but seminars inched up a bit, as did user-group meetings and engineering association-sponsored meetings. One might have expected to see a more general upturn for in-person educational opportunities as the COVID-19 pandemic wanes somewhat.

Online learning also brought mixed results compared with 2020's results. You've been reading more e-books (close to 48% vs. 45% in 2020) and visiting online engineering discussion forums more frequently (19% vs. 17%), but participating less in online college

■ What are some of the ways you continue your engineering education?

- 10% Podcasts
- 11% In-classroom college courses
- 2% Other
- 20% Online college courses
- 56% Engineering/technology publication websites
- 63% Seminars
- 71% Engineering/technology publications
- 59% Webcasts
- 12% Online discussion forums
- 57% Engineering videos
- 14% In-house educational programs sponsored by your company
- 43% E-books
- 17% User group meetings/meetups
- 17% Engineering association-sponsored meetings
- 56% Engineering textbooks
- 67% White papers
- 23% Online trade shows/conferences
- 28% Vendor-sponsored education
- 26% In-person trade shows/conferences

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courses (23% vs. 29%). Again, with the pandemic easing its grip on North America, it's a bit surprising that online learning hasn't fallen more out of favor. Don't you want to get out of the house and/or office a little more?

The Great Educational Limiter: Time

In keeping with the puzzling reticence to embrace in-person learning, respondents' written responses to challenges with taking in relevant engineering information mention COVID much less frequently than last year. It's not fear of disease that's preventing folks from venturing out into the world. Rather, as is typically the case in each year's Salary & Career Report, it's lack of time that holds them back.

"Finding time to devote to self-directed learning is nearly impossible," said one respondent, while another chimed in with "I have no time outside of other duties to complete in-depth studies." But at least one of you scoffs at such excuses: "It should never be a case of trying to find time—MAKE TIME."
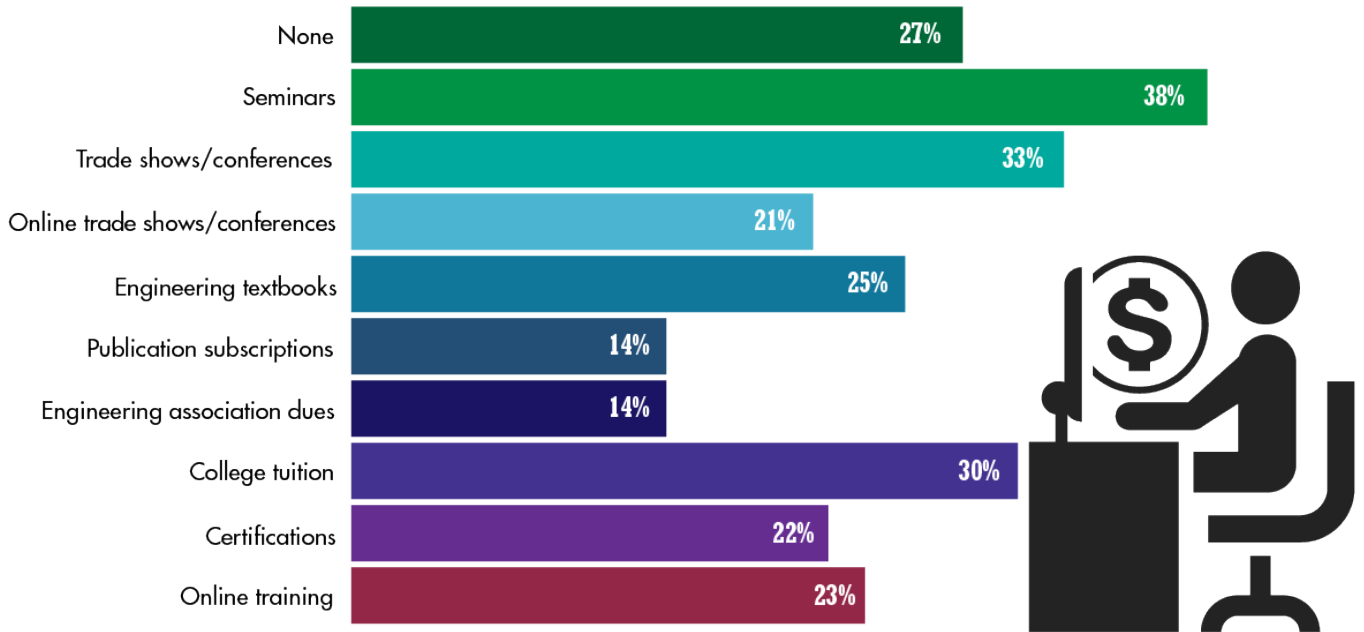
In addition, work-life imbalance is an ever-present issue for engineers, and not everyone wants to take home training materials or extracurricular reading. "The problem is trying to balance home life and education, as work does not allow time for research and learning," offered one respondent. Indeed, many respondents would rather do it on company time, but it's just not possible, citing workloads and their employers' expectations of them.

Another oft-cited roadblock is the sheer volume of material to be sifted through and prioritized. "The problem is discerning what is important in the enormous set of news that comes at us every day," said one respondent. Meanwhile, another laments that "there are too many avenues to get information from." Still others cite the combination of the pace of change in the industry and the number of topics to keep abreast of.

To be sure, there's no shortage of information to be had. Some respondents mentioned

For which of these forms of education does your company reimburse costs to engineers? (Select all that apply)

Category	Percentage
None	27%
Seminars	38%
Trade shows/conferences	33%
Online trade shows/conferences	21%
Engineering textbooks	25%
Publication subscriptions	14%
Engineering association dues	14%
College tuition	30%
Certifications	22%
Online training	23%

the need to vet information, both in terms of accuracy and its relevance to current projects.

Flagging Support from Employers

Finally, we asked whether your employer invests in its engineering staff through reimbursement for the cost of continuing education. Sadly, almost across the board, the trend here is downward when compared with last year's survey results, and in some cases the drop-off is precipitous.

For example, whereas 48% reported last year that employers offset the cost of attending trade shows and conferences, the number is down to just 37% in 2021. Help with online trade shows and conferences is down to 19% vs. 23% in 2020. Seminar reimbursements dropped to 36% from 41%. Reimbursement for engineering textbooks fell from 30% to 26%, while those for publication subscriptions slipped from 22% to 19%. And, this year, about 26.5% of respondents say their employers don't reimburse for continuing education costs at all, up from 24% in 2020.

Meanwhile, a couple of bright spots emerged in this regard. When it comes to college tuition, 32% are getting help from employers this year vs. 29% last year. Reimbursements for certifications have stayed on par at 27%. Finally, almost 19% say employers are reimbursing for engineering-association dues, up from 17% in 2020.

Without a doubt, staying abreast of technology trends and project-relevant information is a daunting task. Here's hoping you're able to maintain and expand your knowledge base sufficiently in 2022 to keep you at the top of your game.

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