

Aviation Week
SPECIAL REPORT

A&D Leaders Work to Manage Multiple Generations;

Survey Responses Call for Rebranding of Industry

September 12, 2017

Carole Rickard Hedden
Executive Editorial Director
Aviation Week Executive Intelligence

Sponsored by



Executive Summary

Ask any aerospace and defense (A&D) industry chief executive what his/her primary concern is when looking at growth and success, and the response will be workforce: the 849,000 people who design, build, support and service the industry's systems and products. Keeping them engaged and fully contributing rests on the ability of these leaders to keep the industry sold to the current cadre but also the ability to attract and continuously develop new generations of employees.

While a complicated effort at any time, attempts to succeed in this leadership role are exacerbated by the realities of the heavily regulated A&D industry, with its mandated security clearances, contracting requirements that demand engineering expertise that is heavily skewed toward older (and more expensive) workers and—more recently—competition from outside.

Just as difficult is the fact that the industry is shedding workers by the thousands. In 2016, the industry reported losing slightly more than 48,000 workers through layoffs, attrition and retirements. And in the first half of 2017, more than 6,000 workers have been let go, including the elimination of entire levels of senior leaders. With a 2017 forecast to hire 27,000 people, there is a confusing web of requirements to add skills and competencies, shed jobs as programs move through their life cycles or needs change, and build in the bench strength needed as about 10% of the workforce will move to its own next stage in the life cycle. This may not mean full retirement but it does forecast a change in how, when and where employees will work as they age.

In preparing our 2011 study, an expert on A&D engineering hiring trends stated a reality for that time: “Engineers don’t let engineers go [to] finance/consulting.” Today that same statement would come closer to including a long list of other industries: “A&D engineers don’t let engineers go [to] automotive, banking, consulting, ride-hailing, smartphones, telecommunications/satellite providers or even online retail.

The 2017 Aviation Week Workforce Survey provided further clarity to several issues with which the industry has grappled during the past decade.

- Companies continue to improve management of a five-generation workforce.
 - Retirements remain lower than the national averages.
 - The leadership dip—the 40-50-year-old range—has smoothed out.
- Demographics remain a challenge.
 - Despite much discussion, hiring of young professionals continues to reflect current demographics with no significant increase in the number of under-represented minorities or women hired.
 - The percentage of women in executive leadership increased; the percentage of underrepresented minorities in executive leadership declined.
- Students and young professionals (YPs) continue to show commitment to the A&D industry.
 - Student level of interest remains high.
 - Benefits, including health care and education, remain differentiators.
- The list of critical skills companies say they want for hiring has become more nuanced.
 - It is no longer either/or; the industry needs legacy skills of aerospace, mechanical and electrical engineers, and now also seeks knowledge of cognitive computing, artificial intelligence and materials.
 - The decrease of pay in several areas does not reflect the competitive market for systems or software engineers; entry-level pay for aerospace engineers declined as well.
- The industry is investing at levels equal to prior years.
 - IRAD (independent research and development) remained at 5% on average.
 - More than 80% of companies invested in manufacturing automation and IT systems.

Recommendations

To formulate recommendations based on the 2017 Aviation Week Workforce Study, we turned to an advisory board of chief executive officers, engineering and human resources executives, workforce analytics professionals, the young professionals advisory board, and deans and faculty at leading U.S. universities. Among the data points most compelling to the group in making these recommendations were:

- Despite best efforts, the diversity of this industry has not changed significantly in the past four decades.
- Americans are remaining at work longer (19% of Americans in their 70s are working); 29.8 % of A&D workers are 55 years of age or older.
- 77% of today's A&D young professionals became interested in this industry as the result of an event/experience in Grades K-12; 71% of YPs report this is when their interest developed.
- The factors that attract students and YPs are the same ones that attracted today's veteran experts: technological challenge, opportunity, pay/benefits and relationships.
- What differentiates today's talent from that of prior generations?
 - Technology used to personally and professionally connect and remain connected.
 - Recognition that work/life balance is enabled by technology and thus presents an apparent and logical solution to the dilemma.
 - Student loan debt, while lower than in past years, remains significant and particularly for black and Hispanic students and YPs.
- Vocational education, reskilling and retraining initiatives, such as those to ease security clearance processes so employees can obtain work more quickly.
- Define and recommend on H-1B visa needs.
- Refine government contracting policies to support a greater age mix of engineering skills/experts.

3. Refocus diversity efforts to develop an inclusive work environment.
 - a. Establish a numeric goal.
 - b. Reevaluate affinity groups as a useful tool.
 - c. Use the problem-solvers upon whom we depend to develop alternatives.
4. Develop transition plans for veterans of the industry.
 - a. Share expertise programs.
 - b. Increase the availability of alternative work structures.

Methodology

Aviation Week launched the 2017 workforce study in January in association with the Aerospace Industries Association (AIA) and American Institute of Aeronautics and Astronautics. The study also is designed to address concerns and questions from other organizations including the U.S. Commerce, Defense and Labor departments; top-tier engineering schools; and economic development experts scattered across the country. It is our premise that the information gathered in 2017 and 2018 will be critical to the U.S. government's call for an updated review of the defense industrial base.

It is important to note that the base of employees considered in this study was 849,000 versus the much broader 2.4 million used in previous work by the AIA. The intent is to cover that portion of the industry that designs, builds and sustains systems and platforms and thus more closely mirrors the codes used by the Labor Department to define the industry.

This year's effort was designed on the basis of a composite of questions posed by each of these organizations. Working with our sponsor, PricewaterhouseCoopers (PwC), we developed five core study components:

1. Executive interviews to provide context to the study
2. A survey of a random sample of university engineering students
3. A random-sample survey of A&D YPs (all disciplines, under age 35)

Based on these facts, a workforce advisory group comprised of industry executives, university leaders and the Young Professionals Advisory Board developed recommendations:

1. Develop an industry-wide branding initiative.
 - a. Students, YPs, mid-career hires and experts are attracted to the industry on the basis of technological challenge and the work we do.
 - b. Include in any branding the breadth of skills/talents required: aerospace, mechanical and software plus new critical skills in learning machines, cognitive computing, artificial intelligence, cybersecurity and data science.
 - c. Benchmark best practices for on-campus recruiting and provide a list to study respondents.
 - d. Benchmark best practices for retaining top talent and provide a list to study respondents.
 - e. Develop specific initiatives around attracting high school students to advanced manufacturing opportunities.
2. Develop policy recommendations supportive of workforce requirements.
 - a. Low-rate student loans.

Sponsored By



4. Demographic and core data gathered from industry reflecting 65% of employees
5. Compensation data from industry reflecting 65% of employees

Our objective was to answer core questions around attracting, hiring and retaining employees; quantifying the degree to which industry is meeting the expectations of current and potential employees; and establishing a framework that all responding companies can use to gauge their data within the industry.

A New Generation Weighs In

Among the most prevalent myths regarding young people and work is that they are not interested in money and they do not want to work hard. Forget the myths—the Number One thing attracting students and YPs is the importance they place on technological challenge.

As to money and work, nothing is further from the truth, according to the data gathered in this year’s engineering student and young professionals surveys. Hard work is expected, but younger workers do want the latest technologies supporting them in their work and as an aid in providing flexibility.

And students and young professionals, facing a heavy weight of debt, expect to be paid well—compensation is the top factor considered during a job search and when determining whether to accept an offer. And ranking right up there with pay and benefits are “an ongoing challenge” and the “ability to feel valued in contributing to meeting company targets.”

What University Students are Telling A&D

Aviation Week polled a random sample of engineering students at 11 preferred suppliers of new college graduates to the industry. The good news is that 59% of those responding to the study are pursuing a career in A&D. The bad news is that they are incurring heavy debt to make that possible.

Interest in A&D careers was strongest among white engineering students and lower among black, Asian and female students—less than 50% of students in each of these groups planned to pursue A&D positions.

The Number One way these university students became interested in A&D—most often during elementary or middle school years—was by witnessing an event, experiment or demonstration of technology, followed by a classroom experience or extracurricular activity/club. The three factors currently influencing their choices are an interest in the industry, the tough technical problems to be tackled, and participation in high-profile projects while continuing to learn.

Those indicating no interest in an A&D career reported it was due to a lack of interest in aircraft, defense or space. But they also cited lower levels of bureaucracy in other industries, better alignment with personal values and preferred location/salary.

The most important considerations for the students when weighing job offers—in rank order—are work-life balance, pay and health care, and a strong retirement plan.

The survey also asked students what they think employers are looking for when they hire new graduates. They believe employers prefer graduates who have completed internships and cooperative assignments, who have project and leadership experience. Forty-seven percent of the respondents have been interns, while another 11% have worked in cooperative assignments.

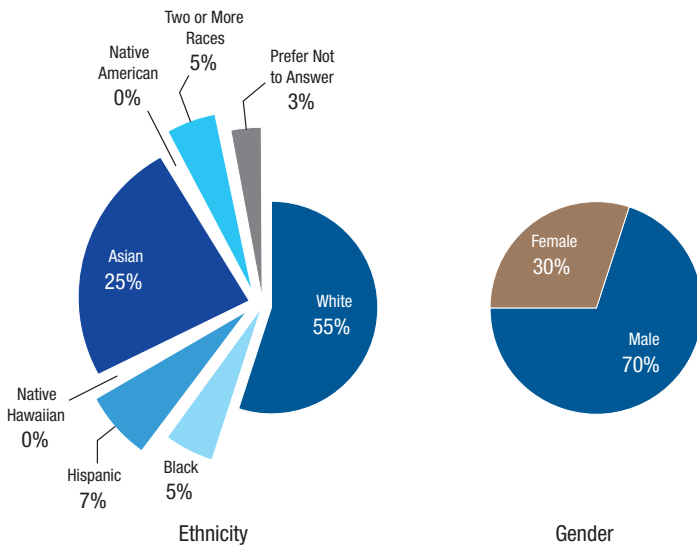
As in past years, about 40% of the students are using loans to pay for their education. The situation is most prevalent among black and Hispanic students whose loan usage is closer to 50%. It is interesting to note that the Trump administration is examining how to improve student loans, but the focus is not on alleviating cost. Rather, the focus is on developing more efficient business operations and streamlining to a single source of loan administration.

During the review of data with company executives, they lamented the student loan situation. One company noted that its ability to repay loans for students has unanticipated legal and tax implications. A second said that if a company establishes an education fund to which a student can apply for loans, funds then are depleted and not available for continued education/learning. A possible solution being considered is larger sign-on bonuses, which traditionally have carried a length of service or payback clause.

Sponsored By

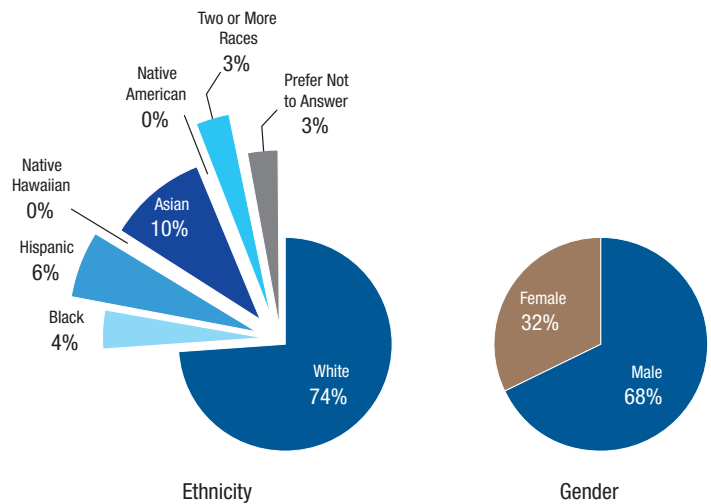


Figure 1: Student Respondent Demographics



Source: 2017 Aviation Week Workforce Study

Figure 2: Young Professional Respondent Demographic



Source: 2017 Aviation Week Workforce Study

Young Professionals Not So Very Different than Previous Generations

The response rate to the YP survey traditionally runs high, and 2017 was no exception with 34%. Of these YPs, who come from 14 different companies of every size and geographic location across the U.S., 77% said they would recommend the A&D industry to a friend. Another 72% believe A&D provides incentives and benefits comparable to other industries.

While that is the kind of feedback A&D executives would like to have, they also rely on the YPs for honest opinions about what could be done better. And the respondents provided that guidance clearly, led by the fact that 26% are looking for a new job outside their current company. Some 41% believe their company is managing the current high degree of change just “moderately well.”

In addition to the student loan information about students, the survey found 37% of YPs are currently paying down student debt and for 30%, the loans exceed \$40,000. Close to 7% owe more than \$100,000.

The good news is that 50% are satisfied with their current jobs, but another 42% believe there is no opportunity for them to grow in their current organizations. And 56% are looking to make a change in the near future. The factors that contribute to wanting to make the change reflect these points: the need for more challenge or to gain a leadership position, the need to improve their work environment, or a recommendation from a respected other person that it is time to make a move.

The survey asked respondents to reflect on what an ideal work scenario might look like, and the answers were familiar to the review panel—regardless of age:

- Work/life balance.
 - Paid time off/vacation days.
 - Flex time.
- Benefits and compensation.
 - My organization provides competitive vacation/holidays/sick leave.
 - My organization contributes to retirement funds.
 - My organization has a competitive compensation package.

Sponsored By



- Valued as an employee.
 - My organization supports work/life balance.
 - I am considered for new opportunities as they are made available/I contribute to my organization's success.

One area that remains relatively unresolved is how best to appeal to a diverse population. It is clear that, again, young people are not so very different than their predecessors. Ask any woman whether she wishes to have her success or coaching singled out as a female issue and she will quickly tell you it is a rich mix of people that best provides the coaching and expertise needed to learn the ropes and advance a career.

The Face of A&D: Demographics

During the formal review of this study's data, there was clear frustration about one area—demographics. The discussion is not ideological alone; the need for technically literate workers spans every industry sector and necessitates that more than just white men are hired, developed and promoted.

The good news: Companies are doing a fairly good job of managing five generations. The bad news: Those five generations look much like they did 30 years ago. In a diversity-awareness class taught at a Tier One supplier in 1987, workers were told that about 22% of employees were female, about 5% people were non-white.

A major change was made in how data were collected this year. Rather than look at statistics for underrepresented minorities, results of this year's study were broken out by ethnicity or two or more races (see table, right). This better aligns the process with how data are collected for government agencies.

One look at the table and the story is fairly clear. With the exception of women in senior leadership roles, nothing much has changed.

In the past year, the percentage of executives from all minorities dropped by 1%. While this could be the result of who actually responded to the survey, it is a data point to watch. Similarly, the percentage of engineering executives who are minorities (race or ethnicity) dropped to 8% this year from 10% in 2016.

Figure 3: The Face of A&D—Demographics

	2017	2016
Workforce Women	24%	21.9%
Blacks	5%	6.7%
Hispanics	6%	6.3%
All Minorities	21%	15.2%
Executive Payroll	1.3%	2%
Women	24%	20%
Blacks	3%	NA
Hispanics	2%	NA
All Minorities	11%	12%
Engineering Executives Women	16%	11%
Black	2%	NA
Hispanic	2%	NA
All Minorities	8%	10%

Source: 2017 Aviation Week Workforce Study

Within the general population, all minorities/races made up 21% of the workforce in 2017, up from 15.2% in 2016. However, 5% of the general population is black and 6% is Hispanic. Two or more races and Asian heritage categories did grow. Blacks hold 3.3% of engineering jobs, Hispanics 4.8%.

Today, 24% of the workforce is female, down from 26% in 2007. Within the engineering ranks, 15% of employees are women versus 12% in 2007—indicating some improvement. However, National Academies data indicates 19.3% of all engineering graduates in 2013 were women. Chemical, materials and industrial engineering have the highest percentages of women graduates. Clearly, work is needed to influence the pipeline coming into engineering programs and completing degrees.

And while A&D executives continue to lament the relatively low percentages of women in technology jobs, companies across the U.S. face the same situation. In an era of aggressive and outspoken commentary, the backlash to corporate drives to improve diversity has

Figure 4: Women in Senior Leadership

IndieGoGo	43%
eBay, Hewlett-Packard, Apple (tied)	28%
LinkedIn	25%
Aerospace and Defense	24%
Facebook, Yahoo (tied)	23%
Google, Intel, Twitter (tied)	21%
Pinterest	19%
Cisco	19%

Source: Fortune Magazine

made headlines. A Google employee asserted that women simply cannot handle stress as well as men, gaining him national headlines but also costing him his job.

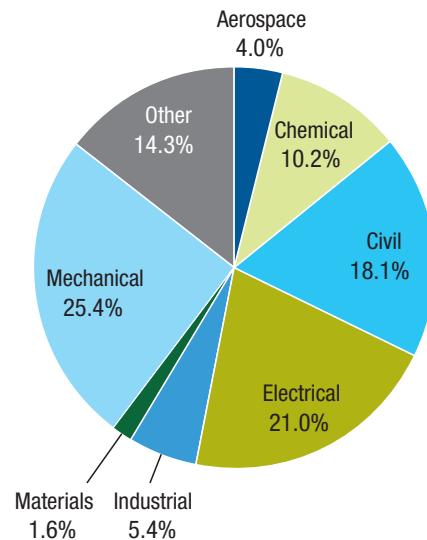
It is a careful line that company leaders must walk, whether while discussing recruiting a more diverse workforce or how promotions will be handled, with A&D leaders voicing agreement that the focus has to be on the benefits of diverse thought and respect for individuals.

In December 2016, 27 companies—Bank of America, Coca-Cola and DuPont among them—pledged to reach parity between women and men in their ranks by 2030. And no one has missed the point of General Electric’s Millie Dresselhaus advertisements—while they are marked by the notion of a woman gaining celebrity due to engineering acumen, the ads also make public GE’s pledge to add 20,000 women to technology jobs by 2020.

The question, then, is not whether A&D is off the mark compared to other industries but rather what to do about it?

The good news is A&D tends to act upon how it measures. This year’s study found that 24% of executives are women, up from 19% in 2014. And the number of women in engineering executive positions also has improved: 16% in 2017, versus 11% in 2014.

Figure 5: Engineering B.S. Graduates by Discipline, 2016



Source: 2017 National Science Foundation

Comparing the A&D figures with those of successful high-tech companies—those that most often earn the envy of A&D leaders—found that this is quite similar to the situation faced by the likes of Google, Amazon, Apple and Facebook.

Complicating the situation, of course, is that America’s colleges and universities are having the same issues. Of first note was the portion of engineers among total baccalaureate graduates.

As indicated, the greatest portions of these graduates are in mechanical and electrical engineering. Of the 87,812 students earning B.S. degrees in 2013, 4% were aerospace engineers, 21% electrical engineers and 25% mechanical engineers. Other engineers—computer and systems among them—make up just 10% of the graduates.

More interesting is the demographics of these graduates. The percentage of blacks, in particular, is not growing at the rate seen

Sponsored By



Figure 6: A&D’s Engineering Demographics, 2017

	Women	Hispanic	Native American/ Native Alaskan	Asian	Black	Native Hawaiian/ Pacific Islander	Two or More Races	Other/ Unknown Race/ Ethnicity
Engineering Overall	19.3%	9.0%	4.0%	11.3%	4.0%	2.0%	1.6%	3.9%
Aerospace	13.7%	8.3%	<1%	11.1%	2.6%	<1%	2.1%	3.1%
Chemical	29.7%	7.2%	<1%	12.6%	4.0%	<1%	1.2%	3.3%
Civil	23.0%	11.3%	<1%	8.5%	3.4%	<1%	1.6%	4.0%
Electrical	11.2%	9.7%	<1%	15.1%	6.2%	<1%	1.0%	4.1%
Industrial	26.8%	11.4%	<1%	8.8%	4.9%	<1%	1.0%	3.0%
Materials	29.7%	5.6%	<1%	14.0%	2.3%	<1%	1.8%	2.6%
Mechanical	12.0%	8.8%	<1%	8.4%	3.1%	<1%	1.6%	4.1%
Other	29.2%	6.3%	<1%	14.5%	3.2%	<1%	2.0%	4.2%

Source: 2017 Aviation Week Workforce Study

among Hispanic engineering graduates, and the percentage of women engineering graduates is 19%—lower than the percentage of women engineers hired in 2016.

The issue, then, is not only attracting and recruiting a diverse population to meet future requirements, but also to build a more diverse pipeline. And it is clear this is not an ideological discussion—to fill jobs successfully requires more people than a white male population can sustain.

The demographics differ by size of company, and to some extent its location. The percentage of women by head-count size does not vary significantly until companies with fewer than 10,000 employees are examined. In terms of race, the data are more differentiated with Hispanic employees higher within companies with head counts of 1,000-9,999. Smaller companies tend to have the lowest percentages and more commonly reflect the demographics of their local populations.

The Age Factor: Distribution and Retirements

Since 2004, A&D leaders have cautioned that the rate of retirements is a strategic barrier for growth and meeting the nation’s defense and security needs. And while the rates of retirement growth have been reported in startling headlines (40% in next four years), better than 10% of the industry’s population could retire in any year. In 2007, 2% did retire; in 2017, the rate was basically the same at 1.8%.

Figure 7: A&D’s Engineering Demographics by Size of Company

	Aggregate	50,000-Plus Employees	10,000-49,999 Employees	1,000-9,999 Employees	Fewer Than 1,000 Employees
Total Head Count Represented by This Study	529,790	355,739	140,127	32,563	1,360
Total Organizations Responding to Elements	33	4	10	10	5
Demographics					
Women	24%	24.5%	22.2%	21.8%	21.1%
Blacks	5%	5%	6.7%	5.6%	3.3%
Hispanics	6%	5.5%	6.1%	8.2%	3.8%
All Minorities	21%	20.9%	20.8%	22.9%	12%
Executive Payroll	1.3%	1.4%	1.2%	0.8%	2.3%
Women	24%	23.8%	22.2%	12.6%	16.1%
Blacks	3%	3.1%	3.4%	0%	Insufficient Data
Hispanics	2%	2.5%	2.1%	1.6%	Insufficient Data
All Minorities	11%	8.3%	10.3%	2.8%	Insufficient Data
Engineering Executives-Women	16%	15.9%	15.9%	0%	Insufficient Data
Blacks	2%	1.7%	0%	0%	Insufficient Data
Hispanics	2%	1.6%	3.4%	0%	Insufficient Data
All Minorities	8%	3.2%	5.7%	0%	Insufficient Data

Source: 2017 Aviation Week Workforce Study

Average age = 46 years
22.3% under age 35
29.8% over age 55

In looking back at the 2007 data, one critical issue was that there was a dangerous gap in developing leadership: a downward slide in the 40-50-year age group created by layoffs in prior years. The graphic back then looked alarmingly like a double-humped camel.

In the ensuing years, companies have done a relatively good job of smoothing the age curve of the industry. However, as the use of workforce data analytics has increased, companies have set more razor-sharp targets—in 2017 the companies plan to hire 28% of new hires off university campuses. This in turn will improve the balance between workers under age 35 with those over age 55.

Among the pain points for the industry is the “single point of failure”—the expert in composite layup or a particular tool or RF design who works in a smaller company upon whom a major platform relies. The age distribution by company size then comes into play.

Figure 8: Age Distribution by Head Count Category

	Aggregate	50,000-Plus Employees	10,000-49,999 Employees	1,000-9,999 Employees	Fewer Than 1,000 Employees	
Total Number of Employees	495,053	495,053	337,545	130,953	25,237	1,318
Employees Under 30	61,239	12.3%	12.9%	11.1%	10.8%	24%
Employees 31-40	98,500	19.9%	19.9%	20.1%	19.2%	23.4%
Employees 41-50	101,147	20.4%	19.6%	22.3%	21.9%	21.5%
Employees 51-60	175,450	35.4%	36.3%	33.6%	34.7%	22.6%
Employees 61-70	55,793	11%	10.8%	12.3%	13%	8.1%
Employees Over 70	2,925	1%	0.6%	0.6%	0.5%	0.4%

Source: 2017 Aviation Week Workforce Study

Figure 9: Retirement as Percent of Total Head Count

	2017	2016	2015
Overall	1.8%	2.6%	1.7%
Engineering	1.4%	2%	1.3%
Program Management	1.8%	3.2%	NA
Manufacturing Salaried	1.9%	0.7%	NA
Manufacturing Hourly	3.6%	3.2%	NA

Source: 2017 Aviation Week Workforce Study

As indicated previously, the rate of retirements remains a point of discussion, whether it is based on data or probabilities. The data show a rise in retirement rates in 2016, in some part due to encouragement by companies seeking to balance their age distribution as well as their costs.

Attrition Among YPs Hovers at 10%

The A&D industry represents more than 2 million people, but this report deals specifically with those who design, build and support end-use products and services. This total, according to AIA, represents a head count of 845,500. The A&D industry represents slightly more than 1% of the total U.S. workforce and 13% of the manufacturing workforce. In 2016, the industry workforce grew by half a percentage point, and the jobs shed were most often within the supply chain.

The trend at the beginning of 2017, however, saw Boeing—the industry’s largest employer—drop 6,000 manufacturing jobs and begin reductions within its senior management ranks. This change has trickled through the supply chain, with companies such as L3 and Honeywell restructuring to consolidate senior management as well.

Figure 10: Voluntary Attrition 2017 vs 2016

Attrition	Aggregate for industry	50k+	10-49.9 K	1-9.9K	Less than 1K
	Overall	4.3%	2.6%	1.3%	5.8%
Attrition among those with less than 5 YOS	10.5%	8.7%	9.6%	10.4%	Insufficient Data
Attrition among those 25 and younger	7.5%	7.5%	1.3%	7.5%	Insufficient Data
Attrition among those 26-30	9.8%	9.8%	2.3%	9.8%	Insufficient Data
Attrition among those 30-35	8.2%	8.2%	2.2%	8.2%	Insufficient Data
Attrition among those under age 35	8.7%	6.0%	2.0%	11.8%	Insufficient Data
% of those who left who were women	14.3%	12.5%	17.8%	21.6%	Insufficient Data
% of those who left who were Black	4.1%	3.2%	6.1%	5.4%	Insufficient Data
% of those who left who were Hispanic	3.8%	2.8%	6.0%	5.9%	Insufficient Data
% of those who left/all minorities	13.2%	11.1%	18.1%	16.4%	Insufficient Data

Source: 2017 Aviation Week Workforce Study

Figure 11: Rate of Attrition by Demographic

	Rate of Voluntary Attrition
Female	5.1%
American Indian/Alaska Native	5.3%
Asian	4.4%
African-American	6.5%
Latino/Hispanic	5.9%
Hawaiian/Pacific Islander	5.1%
Employees of 2 or more races	9.6%
Employees Not Identifying	13.5%

Source: 2017 Aviation Week Workforce Study

Respondents to our survey reported 48,000 employees left through retirements and voluntary and involuntary attrition. At the same time, about 47,000 employees were added.

Attrition among employees with five or fewer years of service was 10.5% for the industry, compared with 14% in 2007 and 21% in 2009. Attrition was highest among employees over age 26 but younger than 35 and most often was due to the desire for new technological challenges or promotions.

Sponsored By



Note also that the attrition rates were lower among engineers than for the overall population. The data also vary widely by head-count category, and reflect the tendency of employees at smaller companies to seek opportunities in larger companies. During 2016, 17% of new hires for the largest of companies came from within the industry.

Why Leave?

If there is one industry characteristic that has remained the same for decades it is that A&D is nomadic. Employees follow programs and contracts. Companies value what employees gain in learning and development at their suppliers and while non-compete handcuffs exist, there also is a careful balance designed to keep expertise within A&D rather than losing it to other industries.

But what makes for a top employer and why do employees leave? In the Young Professionals Survey, respondents said the reasons for leaving were salary, desire for a new challenge and the ability to expand their competencies and skills. Once the decision was made to look, factors most affecting their career decisions were base pay, benefits and work/life balance (tied), and company work environment.

Competing for the Best and Brightest

Among the dumbfounding millennial myths is that young people do not care as much about pay as did previous generations. In fact, as our surveys for the past five years have indicated—it is false.

Compensation and benefits remain among the top concerns for this generation. No generation has had a higher level of debt tied to student loans. In this year's survey of young professionals, 56% used student loans to pay for college and 37% are still paying for them. The percentages are significantly higher for blacks and Hispanics: 50% and 49%, respectively.

This level of debt makes it difficult for young professionals to change locations, even when actual moving costs are covered. There is the matter of deposits for utilities and new apartments. The much-touted rotation programs thus create a set of unintended consequences for those who are paying more than \$700 a month for a student loan.

Beyond the pain of pay for young professionals, corporations must balance the high level of pay for those who are over 50 with that of younger workers. As an example, top-quartile Level 1 aerospace engineers are, on average, paid \$75,891 per year. At Level 5, top-quartile aerospace engineers are paid \$193,318—2.5 times more. The experience is needed and required, but it represents the complex challenge companies face in navigating the compensation equation. So is A&D paying too little to young professionals? According to Korn/Ferry International, new college graduates on average are being paid slightly less than \$50,000 per year—or 14% higher than wages paid to new college graduates in 2007.

Because opportunities for aerospace engineers tend to be limited to this industry, it is probably more instructive to look at the pay awarded to software engineers. Entry-level A&D software engineers in 2007 were, on average, paid slightly more than \$68,000. In 2017, this had risen to \$75,891.

In 2007, companies had to pay dearly for talent as the U.S. continued to deal with right-here, right-now demands for new defense capabilities. However, in the past decade there was a recession and, beginning in 2011, an aggressive war on costs by government customers.

Unfortunately, as the economy has recovered—driven in large part by the enormity of companies that write applications and deliver consumers' every want or need overnight—A&D faces a serious challenge in meeting new compensation realities. A&D's top-quartile Level 1 software engineer's pay reflects the industry's growth in the lower-wage southern tier of the country (note heavy movement to South Carolina and Alabama), but also compares to \$95,000 as the national average for a young software engineer (GlassDoor.com).

In addition to examining average and top-quartile pay levels for professionals in a full range of disciplines, the study also looked at manufacturing specifically. The U.S.-based industry faces two major ramp-ups—one commercial and one defense—in Boeing's 787 airliner and Lockheed Martin's F-35 Joint Strike Fighter. In fact, on one summer day this year, hundreds of applicants formed lines around the exterior of a downtown Fort Worth hotel to apply for jobs at Lockheed Martin, waiting for hours and in some cases being offered a job on the spot.

Sponsored By



Figure 12: A&D Salaried Compensation Averages, And Top Quartile Averages

	Level 1		Level 3		Level 6	
	Average Salary Paid	Average Pay Top Quartile	Average Salary Paid	Average Pay Top Quartile	Average Salary Paid	Average Pay Top Quartile
Aerospace Engineering						
2016	\$66,236	\$75,891	\$99,697	\$111,940	\$176,682	\$193,318
2015	69,198	82,347	114,775	129,966	183,057	200,112
Difference	-2,962	-6,457	-15,078	-18,026	-6,395	-6,794
% Difference	-4.28	-7.84	-13.14	-13.87	-3.49	-3.40
Chemical Engineering						
2016	\$64,650	\$71,161	\$90,714	\$102,898	\$176,662	\$193,318
2015	60,733	66,358	90,248	109,415	183,057	200,112
Difference	3,917	4,803	465	-6,517	-6,395	-6,794
% Difference	6.45	7.24	0.52	-5.96	-3.49	-3.40
Civil Engineering						
2016	Insufficient Data	Insufficient Data	\$87,965	Insufficient Data	Insufficient Data	Insufficient Data
2015	NA	NA	NA	NA	NA	NA
Difference	NA	NA	NA	NA	NA	NA
% Difference	NA	NA	NA	NA	NA	NA
Electrical Engineering						
2016	\$68,215	\$78,674	\$101,625	\$121,490	\$176,848	\$199,233
2015	70,852	80,750	109,441	138,994	178,829	214,612
Difference	-2,637	-2,075	-7,816	-17,504	-1,981	-15,379
% Difference	-3.72	-2.57	-7.14	-12.59	-1.11	-7.17
Industrial Engineering						
2016	\$61,121	\$66,238	\$91,869	\$105,433	\$161,334	\$184,750
2015	65,480	76,720	89,115	103,303	135,557	165,463
Difference	-4,359	-10,482	2,754	2,129	25,777	19,297
% Difference	-6.66	-13.66	3.09	2.06	19.02	11.66
Manufacturing Engineering						
2016	\$64,325	\$72,524	\$93,391	\$110,207	\$170,390	\$190,527
2015	60,703	73,545	91,929	106,159	152,173	180,858
Difference	3,622	-xxx	1,462	4,048	18,217	9,669
% Difference	5.97	-xxx	1.59	3.81	11.97	5.35
Materials Engineering						
2016	\$67,591	\$72,940	\$96,457	\$111,004	\$168,045	\$196,775
2015	71,259	86,981	92,805	118,709	165,872	198,618
Difference	-3,668	-14,041	3,652	-7,704	2,173	-1,843
% Difference	-5.15	-16.14	3.94	-6.49	1.31	-0.93
Mechanical Engineering						
2016	\$67,019	\$75,971	\$98,606	\$113,481	\$177,607	\$198,229
2015	69,528	80,284	111,173	132,676	184,773	213,193
Difference	-2,508	-4,313	-12,567	-19,195	-7,166	-2,962
% Difference	-3.61	-5.37	-11.30	-14.47	-3.88	-4.28

Source: 2017 Aviation Week Workforce Study

	Level 1		Level 3		Level 6	
	Average Salary Paid	Average Pay Top Quartile	Average Salary Paid	Average Pay Top Quartile	Average Salary Paid	Average Pay Top Quartile
Propulsion Engineering						
2016	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
2015	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Difference	NA	NA	NA	NA	NA	NA
% Difference	NA	NA	NA	NA	NA	NA
Quality Engineering						
2016	\$62,127	\$68,734	\$92,546	\$107,643	\$164,540	\$195,151
2015	60,300	72,782	85,593	103,649	136,359	163,060
Difference	1,828	-4,048	6,953	3,994	28,181	32,092
% Difference	3.03	-5.56	8.12	3.85	20.67	19.68
Software Engineering						
2016	\$68,978	\$76,217	\$103,490	\$121,058	\$176,015	\$199,300
2015	70,435	80,389	102,457	118,698	173,574	197,592
Difference	-1,456	-4,172	1,033	2,360	2,441	1,709
% Difference	-2.07	-5.19	1.01	1.99	1.41	0.86
Structures Engineering						
2016	\$67,150	\$75,398	\$100,656	\$117,426	\$182,060	\$208,552
2015	66,161	76,034	95,982	111,625	174,148	209,406
Difference	989	-636	4,673	5,801	7,912	-854
% Difference	1.50	-0.84	4.87	5.20	4.54	-0.41
Systems Engineering						
2016	\$68,698	\$76,405	\$103,089	\$121,286	\$297,910	\$217,853
2015	71,003	82,645	104,102	116,998	169,512	200,074
Difference	-2,305	-6,240	-1,013	4,288	128,397	17,779
% Difference	-3.25	-7.55	-0.97	3.67	75.75	8.89
Other Engineering						
2016	\$66,104	\$76,341	\$98,250	\$118,900	\$180,034	\$198,648
2015	63,214	76,273	95,407	113,026	168,573	198,417
Difference	2,890	68	2,844	5,874	11,462	231
% Difference	4.57	0.09	2.98	5.20	6.80	0.12
Program/Project Management						
2016	\$60,459	\$74,542	\$98,752	\$119,646	\$202,617	\$244,179
2015	66,841	82,725	98,553	126,586	157,906	203,893
Difference	-6,383	-8,183	199	-6,940	44,710	40,286
% Difference	-9.55	-9.89	0.20	-5.48	28.31	19.76
Business/Development Strategic Planning						
2016	\$61,112	\$70,411	\$98,923	\$117,005	\$212,411	\$235,437
2015	63,485	78,143	101,008	120,050	177,672	203,285
Difference	-2,373	-7,732	-2,085	-3,045	34,738	32,152
% Difference	-3.74	-9.89	-2.06	-2.54	19.55	15.82
Information Technology						
2016	\$58,989	\$64,918	\$99,481	\$119,189	\$186,955	\$214,691
2015	56,749	66,583	84,771	96,290	157,086	173,131
Difference	2,241	1,924	14,710	22,899	29,689	41,560
% Difference	3.95	2.89	17.35	23.78	19.01	24.01
Supply Chain Management						
2016	\$55,370	\$64,918	\$81,753	\$100,630	\$190,917	\$220,589
2015	50,826	57,388	74,392	91,686	165,536	197,856
Difference	4,544	7,530	7,361	8,944	25,381	22,733
% Difference	8.94	13.12	9.89	9.75	15.33	11.49
Manufacturing Production (salaried)						
2016	\$58,103	\$66,246	\$85,625	\$101,827	\$180,431	\$217,255
2015	NA	NA	NA	NA	NA	NA
Difference	NA	NA	NA	NA	NA	NA
% Difference	NA	NA	NA	NA	NA	NA
Manufacturing Production (hourly)						
2016	\$36,488	\$46,526	\$53,630	\$66,244	\$55,645	\$70,123
2015	42,153	61,223	54,899	69,646	91,573	111,375
Difference	-5,665	-14,698	-1,269	-3,401	-35,928	-41,252
% Difference	-13.44	-24.01	-2.31	-4.88	-39.23	-37.04

Sponsored By

However, as noted previously, much of this hiring is occurring in the South, where wages tend to be lower than on either coast. This has benefitted the industry by keeping wages under control, and overall moves to this region have created an all-new phenomenon: chasing low-wage manufacturing right here in the U.S.

Benefits Matter

The 2017 Workforce Study questions asked companies for information about benefits—from tuition reimbursement to health care. And as with all areas of operating costs, the findings showed the impact of cost-cutting measures and escalating expenses faced by the industry.

Employees paid 22% of their health-care costs this year, versus 18% a year ago. It is important to note that in the 20 years we have conducted this survey, the highest level of employee contribution for health care was 23% in 2006. Throughout the past decade, the level has stayed at 18-20%. The average employee share for Fortune 500 companies for last year was 18%.

While health care has emerged as a priority for young employees, they also are focused on other components of their benefits package—most importantly, the flexibility to balance work and personal life. This has been interpreted as not being willing to work as hard as previous generations. Again, a millennial myth.

Today's young employees were not raised on a keyboard. They were raised tapping their smartphones, managing every aspect of their lives from a single source. According to the Aviation Week Workforce Study Young Professionals Advisory Board, this ability has raised expectations that they can and should be able to work in a fluid manner. It does not negate their belief that they need to work hard, nor does it mean they do not want to show up in the office where they forge the important relationships they need to succeed.

It does mean they see the flexibility provided by technology as much a part of work as many of us did when a machine was added to our desktop allowing us to connect with one another and the outside world. Envisioned was a work life where not every meeting with a customer involved getting on an airplane, and where documents and designs could be exchanged in minutes rather than

through an internal mail system that at times took more than 24 hours for delivery within the same building.

Another benefit cited in the research is ongoing development, training and education. The percentage of A&D employees enrolled in tuition-reimbursement programs dropped to 4.3% from 5%. The good news is that 49% of YPs have taken advantage of a tuition-reimbursement program.

Hiring Outlook

Aviation Week's Workforce Study began in 1997 to identify hiring trends and opportunities, and see how the industry was meeting the expectations of the best and brightest people. That work continued this year, as we looked at the number of open job requisitions, where they were located and what disciplines were most needed.

We also looked at what employees cared about most in terms of their work. Those factors have not changed in the past two decades—employees care about technological challenge, pay/benefits, and the opportunity to learn and move ahead in their careers.

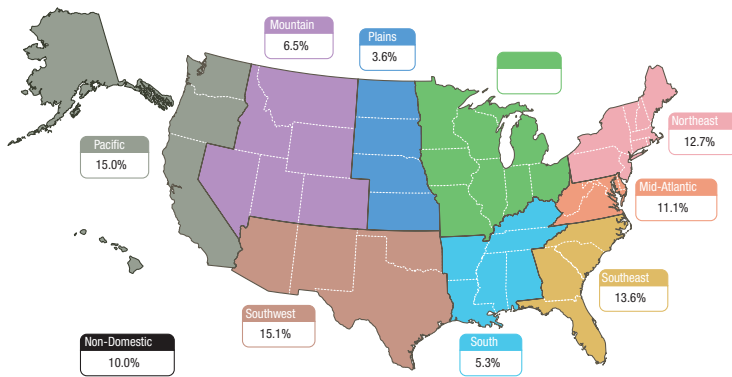
In 2016, companies responding to the corporate survey reported hiring 47,615 people: 16% were new college graduates, 9% were former active-duty military personnel and 16% were hired from other A&D companies.

One trend that appears to be changing is the use of contract employees to absorb surges and reductions in force. That number dropped by 6.7% in 2016.

As of April 1, the industry had 27,800 open requisitions, compared to 31,000 at the same time a year ago. Hiring during each year of this study has been about 1.5 times what was anticipated. If that trend holds true, the actual hiring rate for 2017 could be up to 41,700. Companies plan to increase their on-campus hiring to 28% of the total.

By the numbers, electrical, mechanical and software engineers will make up the majority of the engineering hires in 2017, followed by systems and aerospace engineers. The study did not include any of the new skills identified during the executive interviews.

Figure 13: Hiring Forecast 2017—U.S.



Source: 2017 Aviation Week Workforce Study

Geographically, hiring is concentrated across the southern tier with 31% of the job openings from the Southeast U.S. to Arizona.

While this jobs forecast covers all disciplines, companies indicated the “hot skills” required during the near future include traditional A&D engineering disciplines such as aerospace, electrical, systems and mechanical. But it also includes engineering and technical competencies in artificial intelligence, cognitive computing, materials, machine learning, cybersecurity, data and digitalization. These are the same growth areas for other high-tech companies, forcing A&D to compete with a broader range of companies than ever before.

In addition, senior executives advising the study indicate systems engineering continues to morph to fit increasingly complex technological challenges. Cost-competitive products and services and the incorporation of new technical capabilities—decision-making support, design tools, etc.—have changed the nature of the systems and thus the skills required.

Another area of growth is in manufacturing, from industrial engineering requirements to those working in collaboration with automated systems on the factory floor. The smaller the company, the more significant the challenge as young production employees want to work with the latest tools and technologies, which are most often being implemented with larger, more complex systems.

The study also identified where new college graduates were hired in 2016:

Preferred Universities

1. Georgia Institute of Technology
2. Purdue University, Virginia Tech, San Diego State, University of Colorado (tie)
3. Cornell University

The Data Say ... Top Employers

Each year Aviation Week names companies whose data indicate they are the best at meeting the criteria most important to employees and students. Over the years, we have validated what the factors are through the YP and Student Surveys, but also through Aviation Week reader/user surveys.

Overwhelmingly, once compensation is deemed competitive, employees list three important factors: technological challenge, the opportunity to learn and advance in one’s career, and demonstration by a company’s leaders that they value each individual’s contribution.

Companies Getting It Done

The study looked at index of data that correlated to employee focus on pay/benefits, technological challenge and opportunity. The five companies best meeting these demands for 2016 were:

1. Boeing
2. Northrop Grumman
3. Raytheon
4. Rockwell Collins
5. Harris

Figure 14: 2017 Annual Pay Averages

Level 1/Entry Level		
	Average Pay	Average Pay Top Quartile
Aerospace Engineering		
2016	\$66,236.19	\$75,890.55
2015	69,197.90	82,347.15
% difference	-4.3%	-7.8%
Electrical Engineering		
2016	\$68,215.33	\$78,674.46
2015	70,851.91	80,749.66
% difference	-3.7%	-2.6%
Software Engineering		
2016	\$68,978.46	\$76,217.44
2015	70,434.84	80,389.12
% difference	-2.1%	-5.2%
Systems Engineering		
2016	\$68,697.98	\$76,405.21
2015	71,002.67	82,644.81
% difference	-3.2%	-7.5%
Non-Exempt Manufacturing Employees		
2016	\$36,488.27	\$46,525.69
2015	42,152.95	61,223.46
% difference	-13.4%	-24%

Source: 2017 Aviation Week Workforce Study

Compensation

Compensation is a challenge for all industries as there is a careful calculus between a desire for the most talented people and the need to hold the line on costs. The factors in this for A&D are further complicated by the influence of government customers who apply constant pressure to drive down costs while also demanding

expertise/experience from those working on their programs. Expertise tends to relate to years of experience, requiring the most expensive workers and an impediment to YPs gaining a seat on high-profile programs where they will be the conduit to retaining corporate knowledge.

Complete compensation results are provided separately to those who responded to the survey, but several areas were worthy of note as declines in pay were documented versus increases, despite increasing competition. During review sessions held with human resources executives, it became clear that the geographic shifts were part of the reason.

In reviewing the data, GlassDoor.com was used as a comparison resource. The national average for Level 1 electrical engineers was \$62,856—lower than that of A&D. However, the average for software engineers in all industries nationwide was \$95,195—much higher than what A&D is paying. Systems engineers nationwide at Level 1 are earning \$85,000, also more than what A&D is paying.

So why the difference? There is no doubt that a strong shift of work to the South is having an effect on overall pay. Northrop Grumman, Boeing, GE Aviation, Raytheon, Pratt & Whitney all have expanded operations in the Carolinas, Florida and Alabama.

The cost of living and tax incentives are part of the reason for the shift, and these in turn affect wages. This will be interesting to watch in the coming years, as it is not just A&D that is “reshoring” work to the South. Automotive companies also are expanding their operations there.

In 2017, A&D continued to slightly outpace the annual increase to pay—this year awarding an average 3% increase to base pay. The industry felt the heat of increasing health care costs, with employees paying 22% in 2016 versus 18% a year ago.

Technological Challenge

Clearly being challenged on the job is a highly individual matter. For the purposes of the Aviation Week study, we gauged technological challenge by the level of investment in research and development, new tooling and software, and the technical environment—how

Sponsored By



many leaders hold engineering degrees and to what degree is the company engaged in design and development?

Overall, IRAD investment as a percentage of revenues remained stable at 5%. On the high end, one company allocated 32% of revenues to IRAD. Forty-five percent of senior executives hold an engineering degree, and just over one-third of the total workforce is engaged in engineering. Slightly more than 10% of all engineers were promoted during 2016, reflective of company efforts to provide ongoing education and opportunity. The 2016 rate was up from 8% the previous year.

Learning and Development

While 10% of engineers were promoted, 6% of the overall workforce gained a job promotion in 2016, on par with 5.6% reported for the previous year. Tuition reimbursement continues to be a major indicator of investment in learning and development, with 4.3% of all employees in some form of degree program in 2016.

The numbers were still stronger for younger employees:

- 31% of YPs indicate they earned a degree after entering the workforce.
- 36% are enrolled in a degree program while working full-time.
 - 17% are pursuing an advanced degree (M.S. or Ph.D.).
 - 72% are pursuing an additional engineering/technical degree (but only 19% of these are women).

Additionally, the industry identified 16% of the workforce as having high potential. And once such employees were identified, they left at a much lower rate than other employees—just 1% of high-potential employees left their companies in 2016.

Valuing the Individual

If ever there was a case of “subject to opinion,” it is whether an employee feels valued. Aviation Week looks at this element through the lens of data including pay, employee health-care contributions, investment in learning and development, promotions, attention to age distribution, availability of flexible work options, investment in tools and workspace, and demographics (age, gender and ethnicity).

And while it is not reflected in the rankings, YPs were asked about how their companies are handling change: 64% believe their companies are going through major change, and 41% believe it is being managed “moderately well.” In addition, 72% of the YPs believe the industry provides comparable incentives and benefits; 65% believe their organizations are providing appropriate opportunities for career growth— they are fairly considered for promotions and assignments.

For this year’s study, the YP Advisory Board decided to focus on the future and creating a better workplace rather than examining shortcomings. The goal was to identify those things that make for an “ideal” career situation.

And as with so many other areas of the study, what young professionals want is not so very different than what employees of every age and generation want:

- Fair consideration for promotions and challenging assignments.
- The tools and technology needed to complete my work in a timely manner.
- Open access to the supervisor and/or managers.
- The opportunity to grow a career, beyond just a job.
- Access to education/training to prepare for new challenges, opportunities.

Sponsored By

