A war-weary nation grapples with how to cut military spending and a dysfunctional Congress allows meat-ax budget cuts to fall on the Defense Department and NASA, one might expect that the U.S. aerospace and defense (A&D) industry’s best and brightest talent would be heading for the exits. Indeed, one-in-five A&D professionals under the age of 35 submitted resignations in 2012, up from 12% the year before. The good news: most left to go work for another aerospace company.

The findings of Aviation Week’s 2013 Workforce Study reveal that the industry’s employers are well aware of the challenges they face as they reduce payrolls to prepare for leaner times ahead. And by and large, most are seeking to use a scalpel, rather than the blunt force of across-the-board cuts. More than 36% of the companies responding to this year’s study have planned layoffs for 2013. Yet those plans are often crafted to minimize damage to their technical workforce—and their ability to bring in new college graduates that will be crucial to their long-term success. Indeed, A&D companies have set aside 15% of their 22,000 job openings this year for new college graduates. And even as contractors reduce head counts, they are seeking to maintain pay raises and training and education for those who remain. Whenever possible, they are shifting defense workers to the expanding civil aircraft sector.

A separate survey of under-35 workers undertaken in conjunction with the study shows that despite dire headlines of budget cuts for the Defense Department and NASA, coupled with an exceptionally fractious Congress, many young professionals continue to view A&D as an industry that offers them technical challenge and an opportunity to grow in their careers. An impressive 70% of respondents said they would recommend their employer to a friend, while 60% would recommend working in the industry. That is hardly the picture of an industry facing end times.

The U.S. A&D workforce may be shrinking, but retaining talent remains a top priority

Carole Rickard Hedden Washington

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R e p e a r s  t o b e l e s s a b o u t b u d g e t  c u t s t h a n  f r u s t r a t i o n s t h a t h a v e l o n g  b e d e v i l e d  y o u n g  p r o f e s s i o n a l s  i n  g o o d  t i m e s  a n d  b a d , r e g a r d l e s s  o f  g e n d e r  o r  e t h n i c i t y .  T h e  c u l p r i t s  i n c l u d e  p o o r  m a n a g e m e n t ,  b u r e a u c r a c y  a n d  i n c o m p e t e n c e  o r  p o o r  a t t i t u d e s  a m o n g  c o - w o r k e r s .  T h e r e  i s  a l s o  f r u s t r a t i o n  t h a t  m a n y  w o r k e r s  e l i g i b l e  t o  r e t i r e  h a v e  c h o s e n  t o  r e m a i n  o n  t h e  j o b ,  s l o w i n g  t h e  p a t h  t o  a d v a n c e m e n t  f o r  t h o s e  c o m i n g  u p  t h e  r a n k s .  I n  2012, 8% of the U.S. A&D workforce was eligible to retire—and just 1% did.

Aviation Week’s Workforce Study, now in its 10th year, was undertaken in cooperation with the Aerospace Industries Association, American Institute of Aeronautics and Astronautics, and National Defense Industrial Association. This year’s study drew a record response from companies that collectively employ 86% of the U.S. A&D workforce. One common concern with past year’s responses: aerospace com-
David Thompson, who founded Orbital Sciences Corp. in 1982, has been blazing away at new technologies ever since, providing satellite systems and support for commercial communication, missile defense and communication. Thompson’s team designs and develops systems to endure the depths of space, compete with terrestrial alternatives and provide flexibility to upgrade consistently over a decade or two of life. And these systems must be developed and launched in about 36 months. It is an array of technological discovery that focuses on materials, software, systems integration, and the basics of astronautics and aeronautics.

Paul Graziani’s Analytical Graphics Inc. has been named to the top companies list for six of the last seven years as his group continues to push new software capabilities and now apps into the market for defense and space.

Tony Parasida, Boeing’s senior vice president for human resources and administration, followed a different trajectory than Musk, Graziani and Thompson. He joined Boeing’s commercial aircraft operations 35 years ago, working his way up the engineering ladder in air transport. His claim to fame, however, was on the defense side—bringing the V-22 technologies to market, an accomplishment that earned him Aviation Week’s top honor, the Laureate, in 1997. Today he watches over the systems needed to put the right person in the right job, shepherd the high-growth demand of the commercial business while assuring minimal loss of talent from the space and defense businesses.

And while Parasida, Graziani, Thompson and even Musk have earned the gray hair that comes with guiding these new technologies into place, the industry is also marked with the accomplishments of much younger professionals who helped inform and guide this year’s workforce study.

One of the newer breed was onboard an aircraft carrier and recorded data for the first unmanned aircraft landing. The real accomplishment, he says, was not the landing of the unmanned aircraft but rather the landing of a tailless aircraft onto a carrier deck and the realization that crosswinds and gusts had little effect on the landing.

Another, an under-35 woman, is pushing advanced technologies through The Aerospace Corp.’s labs. And a copatriot is participating in a leadership job-rotation program, learning how to analyze business intelligence and connect the dots to form business strat-
economy, while strained against the system to get back to a technical assignment. They are living what students say they dream about in a future job: the technological challenge.

Rockwell Collins’s new president/CEO, Kelly Ortberg, says while he has to compete within the industry for employees like these, he must also compete with other industries. “It is one of the biggest challenges I see in the short- and long-term—our industry’s ability to attract and retain engineering and technical talent.” I think young professionals—or all professionals for that matter—like to know they are making a difference, and making life better.” Ortberg’s play to technical professionals is a strong one. In the past 24 months Rockwell Collins rolled out a new product that is emblematic of the approach: the Pro Line Fusion technology, including synthetic vision. The R&D investment was in the commercial side of the business, but the technology was leveraged for the military market, specifically for Embraer’s KC-390 military transport.

Gina Burns, vice president of workforce analytics and strategy at Lockheed Martin, led the young professionals study. She says that in tough times it is crucial for companies to retain funding for internships and other efforts to attract the next generation of talent. Once they are on board, the secret to keeping them is the same today as it has been for generations. Burns says creating a nurturing and challenging work environment where good performance is valued and rewarded will be the most important focus for an industry in transition.

**TALENT PIPELINE**

**A&D Companies’ Preferred “Suppliers” of Talent**

- Pennsylvania State University
- Embry-Riddle Aeronautical University
- Georgia Institute of Technology
- Rochester Institute of Technology
- Massachusetts Institute of Technology
- Cal Poly-San Luis Obispo
- Purdue University

**Where the Greatest Number of A&D Hires Came From**

- University of Washington
- Iowa State
- Embry-Riddle Aeronautical University
- Washington State University
- University of Iowa

**Alma Maters Most Valued By Employee In Landing a Job/Promotion**

- University of Washington
- Embry-Riddle Aeronautical University
- Texas A&M University
- University of Illinois
- Penn State
- Purdue University
- Virginia Tech
- Arizona State University

**WHERE THE JOBS ARE**

**Carole Rickard Hedden Washington**

A erospace and defense companies large and small plan to hire in 2013. While much of the hiring will replace workers leaving for retirement or a new opportunity, the numbers also include some all-new jobs and new skills.

As of April 1, the companies responding to the Aviation Week Workforce Study had 22,000 funded, open job requisitions. Last year, the industry forecast hiring at 28,000; at year-end 31,000 people had been hired and the industry-wide headcount had risen to 629,000—a gain of 5,000 new jobs for the year. That optimistic outcome is not anticipated this year.

Boeing, the industry’s largest company with just over 174,000 of the 649,000 workers, already has shifted 7,500 employees from defense to commercial operations. The company plans to hire 8,000 to 10,000 people this year. However, Boeing leaders also anticipate that the total headcount for the company will go down by year-end, despite heavy hiring in its commercial business.

Almost half the jobs to be filled this year are in STEM—science, technology, engineering and math—job categories. The most in-demand skills are systems engineering and computer software engineering. While systems engineering is increasing in all industry sectors, software is the one watch. Plain and simple, A&D relies on legacy architectures and languages to keep aircraft, satellites and ground systems operating for decades-long spans. At the same time, other industries are pushing software and apps into a growing number of formerly manual operations. Among the big names scooping up software engineers this year are General Motors and Ford as they race to keep up with Tesla Motors’ touch-screen driving machine.

Just behind systems and software engineering, in terms of demand, is aerospace engineering, with jobs evenly distributed between commercial and defense assignments.

Jobs can be found at every level. For companies with 1,000-9,999 employees, there are nearly 4,000 openings including 1,000 engineering slots, close to 200 information technology workers and almost as many manufacturing/operations positions.
Women Wanted

U.S. universities are graduating more engineers, but the percentage of women remains low

Carole Rickard Hedden Washington

Young people seem to be getting the message that engineering offers opportunity: 84,000 U.S. students graduated from universities in 2012 with engineering degrees. That is up 12% from 73,000 just six years ago, according to the National Academies. And despite the downturn in the economy and in federal spending, the aerospace and defense industry continues to provide at least some of that opportunity.

But one statistic is still gnawing at the people who work so hard to attract young people to engineering. While more than 50% of today’s U.S. university students are women, slightly more than 25% of those enrolled in engineering programs are women. This percentage has been stuck since at least 1991.

One theory is that young people are attracted to math and science by the time they reach fifth grade. But if they do not take algebra in eighth grade, they are off the coursework track to prepare them for an engineering curriculum. And girls are moving off that path.

Those committed to filling the engineering pipeline include Walt Havenstein, retired CEO of SAIC and chairman of First Robotics; Richard Coppola, founder of Real World Design Challenge (RWDC); and the staff at the Aerospace Industries Association with its Team America Rocketry Challenge. There are dozens of others, from the Society of Women in Engineering Egg Drop to Project Lead the Way, which provides programs to support science, technology, engineering and mathematics (STEM) education in middle and high schools.

In the near term, it is going to be difficult to secure funding for these efforts in a time of declining defense budgets. The programs’ leaders make appeals, but they also are focusing on individuals who can provide time as valued mentors to Grades K-12 competitors and teams. The costs are manageable—as little as $600 to sponsor a rocketry team and just over $80 for an RWDC student.

Cyber Challenge

At least 10,000 new cyber-related positions must be filled in the next two years

Carole Rickard Hedden Washington

One hundred years ago, the University of Michigan hired Felix Pawlowski to teach the first U.S. students the subject of aeronautical engineering. Preparing a generation of engineers to build and assure the safety of a country’s fledgling airline and aircraft industry was a daunting task. Today, the industry faces a similar challenge in laying the path to develop the nation’s next generation of cybersecurity professionals.

Conservative estimates call for the hiring of at least 10,000 cybersecurity workers during the next two years, without benefit of an accredited degree program or, in many cases, adequate job descriptions. Positions range from entry-level operators to senior executives.

It seems only fitting that an aerospace engineer is among those working in support of government agencies to clear the way: Michael Papay, vice president and chief information security officer for Northrop Grumman Information Systems. Papay says the skills and competencies for the cybersecurity job category are varied, from systems engineering and architecture through the strategic knowledge of how social systems and people think and act. “Cybersecurity is one of those areas where we can throw infinite money at the problem, but the smart people will know where the best places are,” he says. “This new job discipline is those people.”

Investing in getting the people aspect correct has been no small task. The Air Force Association CyberPatriot competition is among the premier events designed to interest young people, pitting teams of high school stu-
Microgravity University

NASA program offers no degree, just valuable experience

Mark Carreau Houston

Joseph Huseman, a Rice University senior this fall, has gazed into a possible future, one that includes a promising career as a mechanical engineer, perhaps leading ground-breaking aerospace projects.

“I’ve always been interested in spaceflight,” said Huseman, who grew up in a small farming community in the Texas panhandle. “As a kid, I looked for spots where I could be a leader.”

To improve his employment prospects, he is navigating a succession of learning experiences beyond the classroom. This summer, Huseman interned with General Electric Oil and Gas in Houston as part of a new products introduction team. As a 2012 summer intern with UTC Aerospace Systems, he learned of the Reduced Gravity Education Flight Program (RGEFP), headquartered nearby at NASA’s Johnson Space Center.

A division of the 18-year-old RGEFP known as Microgravity University (MU) allows undergraduate engineering teams to compete for time aboard a Boeing 727-200 0g aircraft, sometimes called a Weightless Wonder or Vomit Comet, to expose their student projects to brief periods of microgravity. Gravity is eased briefly as the jet transport rises then descends over a series of high-altitude parabolas.

Since MU’s inception in 1995, more than 800 university students have taken flight along with their experiments. On July 21, Huseman and a half-dozen other members of his Rice Pending Gravity team joined that special cadre by completing a 0g flight to push the development of an electromagnetic sensor package envisioned as a prospective power-efficient guidance device aboard deep-space probes. Their mission report, outlining their findings, is due to NASA in September. “We’re crunching the numbers,” says Huseman.

Over the years, other undergraduate teams have studied dust coagulation in microgravity for insight into planet formation; the cellular mechanisms behind the bone loss experienced by cancer patients against an elusive cyberthreat. The team’s responsibility is to keep the information technology system working, assess and defend against threats, and conduct forensics on breaches to service. The students may be ready to enter the profession as operators, or they may need additional education and certification.

Diane Miller, who leads Northrop Grumman’s cyber outreach efforts, says that in addition to entry-level jobs, companies are offering internships and scholarships to build the future cyber workforce. For current needs, companies such as Northrop Grumman created their own training capability, sometimes in partnership with universities. Northrop Grumman’s Cyber Academy offered 40 classes in the past year, with 750 participants. Demand is highest for courses in cybersecurity fundamentals and software security engineering.

Papay and his peers have departments that are responsible for enterprise-wide operations, security and defense. Cybersecurity specialists also embed within organizations and programs to help design, develop, and assure enterprise functionality.

Rice University students (from left) Alex Kendall, Daniel Volz and Robert Patterson are part of the Rice Pending Gravity Team that won a slot in the NASA Gravity Academy program this summer. In addition to their own turn at weightlessness, their project was flown in 0g. The team will submit its findings on the experiment to NASA in September.
As awareness operations and developing technology (available)
Submit its findings on the experiment to NASA in September. In addition to their
Additional protections spots where I could be a leader."
As a kid, I looked for
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Texas panhandle. "As a kid, I looked for
up in a small farming community in the
Northrop Grum
Grumman created their own training
capability, sometimes in partnership
with universities. Northrop Grum
Source: Aviation Week 2013 Workforce Study
Gap analysis, solution
upgrades and their security
evaluation, sustain

Cybersecurity Career Structure
Defense Protection (firewall
Additional protections
defense. Cybersecurity specialists
also embed within organizations and
programs to help design, develop,
build and deliver technology, products
and services for customers. Positions range from entry-level
operators to security analyst to the
top-level cyber-architect, similar to chief
engineer.
Pay ranges from $39,000 for entry-level persons to $220,000 or more
for cyber-architects, according to

Pay for Sample Cyber Job Descriptions

<table>
<thead>
<tr>
<th>Data Security Administration</th>
<th>Bottom 10%</th>
<th>Bottom Quartile</th>
<th>Mid/Average</th>
<th>Top Quartile</th>
<th>Top 10%</th>
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<td>54,936</td>
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<td>84,563</td>
<td>102,059</td>
<td>117,988</td>
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<td>59,839</td>
<td>68,680</td>
<td>77,794</td>
<td>86,091</td>
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<tr>
<td>Data Modeling</td>
<td>70,263</td>
<td>82,005</td>
<td>94,902</td>
<td>105,153</td>
<td>114,486</td>
</tr>
</tbody>
</table>

Source: Monster.com

Pay

Data Security Administration
Applications Systems Analyst
Data Security Analyst
Systems Security Analyst
Information Technology Auditor
Data Modeling

Bottom 10% Bottom Quartile Mid/Average Top Quartile Top 10%

Put braces eight flight education activities,
technology, engineering and mathemat-
ics for others like Huseman to enhance
their professional skills as they com-
plete their academic careers.

We are following the budget within
Congress very closely because it cer-
tainly will have some impact on us," says Frank Prochaska, Johnson Space
Center RGEFP program manager for
students, students at minority univer-
sities and community colleges, space
grant fellows as well as undergradu-
ates focused on systems engineering
who collaborate with NASA engineers
on Og flight experiments.

But NASA's educational budget is
facing decline and with it opportuni-
ties for others like Huseman to enhance
their professional skills as they com-
plete their academic careers.

But many of the funding sources face
spending restraints as well. "I'm an-
ticipating we will have undergraduate
flight weeks next year," says Prochas-
ka. "When I look across the model we
have for this program, we are in pretty
good standing right now because we
have diversified our funding sources, If
Congress comes back and follows the
president's budget, then certainly there
is going to be a lot less funding for those
programs. Some may get cut. So that
would definitely have an impact."

The six-month run-up to the flight
experience is as demanding as it is
instructional for MU undergraduate
teams like Huseman’s.

Most of the Rice students, for exam-
ple, were enrolled in 18-20 hr. of course
work during the 2013 spring semester.
It was not unusual for team members
to assemble in the university's student
engineering lab well past midnight for
test sessions and troubleshooting as
they prepared for flight.

"Problems can set you back a whole
week; real things you never think
Pay Day
Smaller A&D companies are offering larger raises and performance-based bonuses

Carole Rickard Hedden  Washington

It pays to be the new guy, according to data gathered for the 2013 Aviation Week Workforce Study.

Pay for new college graduates rose by 3.4% between 2011 and 2012, according to the National Association of Colleges and Employers (NACE). In the aerospace and defense industry, the increase was slightly lower, at 3.2%. Companies with fewer employees worked to retain their workforces, awarding pay increases on average of 4.1%.

Engineers recorded the highest starting salaries, according to NACE, with an average base pay of $62,555, compared to $60,344 the year prior. The U.S. Bureau of Labor Statistics reports that petroleum engineers receive the biggest paychecks.

Young professionals surveyed in this year’s Aviation Week study took note as 38% changed jobs in the past year, most often within their own company or the industry, citing “ambition” as the key reason. Overall, 7.5% of A&D employees received promotions in 2012, while 49% of the industry’s employees qualified for some type of variable performance-based pay, with average awards of 23.6% of base pay.

A greater percentage of employees working at companies with fewer than 1,000 employees participated in the performance-based plans, but those working for organizations with 10,000 to 49,999 employees saw the biggest payout, at close to 64% of their base pay.

The project has an electrical component. With a lot of data recording, we have a big need for statistics. We’ve included ground-control members, one a materials science student and the other a business major.

The team asked for equipment donations from suppliers; members paid their own travel expenses. “It is a fantastic experience, and it’s one that university teams are willing to go to great lengths to participate in,” says Prochaska. The team also developed an hour-long classroom presentation illustrating the value of science and math to middle and high school classrooms. They focused 12 classroom visits on some of Houston’s underprivileged neighborhoods but also ventured to classrooms and college campuses in California, Tennessee and West Texas.

“The younger kids, those from middle school, asked a ton of questions about space. They just let loose,” says Huseman. He is now sizing up a 0g flight proposal for next year.

What Jobs Pay*

<table>
<thead>
<tr>
<th>Job</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>$51,074 - 191,416</td>
</tr>
<tr>
<td>Business Development</td>
<td>$56,586 - 184,485</td>
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<tr>
<td>Nuclear Engineering</td>
<td>$79,446 - 179,764</td>
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<tr>
<td>Physics</td>
<td>$70,304 - 174,649</td>
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<tr>
<td>Computer Hardware Engineering</td>
<td>$61,277 - 173,188</td>
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<tr>
<td>Aerospace Engineering</td>
<td>$64,210 - 168,010</td>
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<tr>
<td>Supply Chain Management</td>
<td>$49,946 - 167,117</td>
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<tr>
<td>Systems Engineering</td>
<td>$65,426 - 165,308</td>
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<tr>
<td>Applied Math/Statistical Analysis</td>
<td>$63,187 - 164,110</td>
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<tr>
<td>Electrical Engineering</td>
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<tr>
<td>Computer Software Engineering</td>
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<tr>
<td>Chemistry/Materials Science</td>
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<td>Industrial Engineering</td>
<td>$60,489 - 146,061</td>
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<tr>
<td>Chemical Engineering</td>
<td>$62,439 - 143,607</td>
</tr>
</tbody>
</table>

*Range covers entry to senior levels, but not executive positions.
Source: 2013 Aviation Week Workforce Study