
Engineering Pipeline Under Pressure

A rebounding commercial aviation sector and robust market for business aviation drive demand for engineers with avionics expertise

By Emily Feliz

Avionics companies are preparing for what could be an engineering talent crunch in the coming years, as baby boomers retire and demand for qualified personnel jumps.

Continuing conflicts in Iraq and Afghanistan, coupled with the robust business aviation market and a rebounding commercial industry, are buoying demand for skilled avionics engineers in all sectors. In addition, the retiring baby boomers, and fewer new graduates entering the market are leaving an experience hole in the avionics engineering field. As a result, companies are ramping up hiring for developers of everything from ground-based communications and navigation equipment to systems integrators to software developers.

"The demographics are rapidly approaching a cross point between supply and demand. Quite frankly, the supply is far under the demand already," said Andy Day, Rockwell Collins director of talent acquisition. Rockwell Collins, Cedar Rapids, Iowa, has reiterated plans announced in 2004 to expand its total workforce by 7,000 by 2010. The company currently employs about 4,850 engineers at its various facilities.

Aircraft retrofits, in addition to increasingly digital and networked cockpits, are creating more jobs and opportunities, with fewer new graduates to fill the positions. Education and recruiting experts attribute the lower graduation rate to factors including more interest in software than hardware and students opting for engineering disciplines other than avionics.

"One of things I've determined is that electrical engineering does not seem to appeal to young people," said Albert Helfrick, chair of the electrical and systems engineering department at Embry Riddle Aeronautical University. "... When it comes down to the science of it, they're not interested."

"Aerospace," said Mike DeLaney, president and executive account manager of GNR Global Network Recruiting, "is just not as sexy as it once was.... A lot of the military, defense and large-size companies have to withstand a significant workforce shortage in the next two to five years. There is a shortage of engineers to design avionics electronics today to keep up with the demand."

GNR, a high-tech recruiting firm based in Rochester, N.Y., represents clients including ARINC, BAE Systems, Harris Corp., L-3 Communications, Lockheed Martin and MITRE Corp.

Supply and Demand

According to the most recent annual report of The Princeton Review educational firm, 352 U.S. colleges and universities offer degrees in electrical engineering. Eighty-eight colleges and universities offer degrees in aerospace engineering, while 254 schools offer major degree programs in computer engineering.

In 2006, there were 86,720 aerospace engineers in the United States, with an average annual salary of about \$89,000, according to the U.S. Department of Labor. Of those engineers, about half worked in aerospace product and parts manufacturing. California, which hosts operations of major aerospace companies including Northrop Grumman, Boeing and Lockheed Martin, had the highest concentration of aerospace engineers, with 25,100, according to the government.

Companies are hiring graduates with complementary degrees in electrical engineering and computer science/engineering, reflecting the networked nature of the modern aircraft. Avionics and aviation-specific training comes on the job.

Avionics manufacturers say they are looking into other industries, namely consumer electronics, automobiles and telecommunications, to recruit talent. The specifics may be different, but there is definite overlap in skill sets, companies said.

"What I have found in this industry is that these engineers are some of the most creative and vital employees I've seen," said Norma Kraft, senior technical recruiter for Universal Avionics Corp. in Redmond, Wash. "I find that a lot of good senior employees are reluctant to retire because it is really stimulating."

Kraft said Universal Avionics employs about 150 engineers, company wide, in the engineering disciplines of electrical, software, avionics systems, mechanical and test.

When more seasoned employees do leave, the institutional knowledge goes with them. Companies are becoming increasingly aware of their aging work force and are attempting to bridge the "knowledge gap" that develops. Many companies experience a dichotomy between the "old gray-haired guys, with years and years of experience and well versed in a lot of different things, and a bunch of newbies trying to get caught up," Helfrick said. "There's no middle."

The mid-career professional, a person with 10 to 15 years experience in the field, is in particular demand. But those professionals can be difficult to recruit due to location preferences. So the retention of both new entrants and mid-career engineers becomes key. Recruitment can be fickle, and dependent on a company's success in winning high-profile contracts. Word-of-mouth knowledge of a particular program or technology can be enough to draw engineering talent.

After Rockwell Collins won a contract in 2004 to participate in the Boeing 787 Dreamliner program "we saw sizable spikes in our applicant traffic on our Web site," Day said. "I've never seen such a close tie between winning a new platform or program and the sudden, immediate expression of interest from a large number of people in the workforce."

Rockwell Collins is providing the 787's core network cabinet, which hosts a variety of third-party applications and manages onboard information. The company also is supplying the flight deck display system, crew alerting system, pilot controls, communication and surveillance systems and common data network. It also serves as systems integrator.

"This industry, these individuals are tied into what's going on, they see it, they know it. And when these program platforms are awarded, they're aware of it and they want to come work with the companies that are winning business," Day said.

Terry Flaishans, L-3 Avionics vice president of engineering, said the employment of foreign nationals due to the tight supply of U.S. engineering graduates causes "green card" and export-compliance hurdles in performing military contracts.

Employees from other countries "are very good, very talented and very hard-working people, but they're foreign nationals," Flaishans said. "It's tough to get them through the visa system. Plus, if you have anything that's ITAR (International Traffic in Arms Regulations) controlled you definitely have to separate them from that."

Skill Sets

The evolving nature of avionics technologies also is prompting demand in backgrounds or experience in specific technologies, systems integration and networking.

But previous experience in technologies for navigational systems, communications, GPS and unmanned aerial vehicles (UAV) is hard to find. DeLaney said the rise of UAVs is spurring a new round of research and development in that area, which is driving a search for professionals with unmanned systems development experience.

"It's been a little bit of a challenge in that there aren't a lot of schools out there that teach navigation systems. The total number of graduates we're producing is not meeting the demand of industry, both in the civil as well as defense sectors," said Michael Braasch, director of Ohio University's Avionics Engineering Center.

Founded in 1963, the Ohio University center specializes in the research, development and evaluation of electronic navigational, communications and surveillance systems. The center has been awarded contracts totaling nearly \$85 million from sponsors including FAA, NASA and the U.S. Department of Defense, as well as from state and foreign governments and private organizations.

Projects have included studying and demonstrating the feasibility of expanding the applications of GPS and Loran-C; developing GPS interferometry for attitude determination and flight reference systems; theoretical studies of the Microwave Landing System (MLS); overseeing the instrument landing system (ILS) installation at Dulles International Airport near Washington, D.C.; predicting and measuring radio frequency interference with navigational systems; and collaborating with industry in the creation of collision-warning systems.

The center flight-tests systems with a fleet that includes the Brumby UAV (developed at the University of Sydney, Australia), L29 Delfin, Piper Saratoga, Cessna Centurion, Beechcraft Bonanza A36, Beechcraft Bonanza V35, Douglas DC-3 and King Air C90SE aircraft.

In addition to directing the center, Braasch's research deals with navigation systems including ILS, MLS, VOR, Loran-C, DME, INS and GPS. He teaches a sequence in inertial navigation systems and courses on GPS receiver design and inertial integration.

There are typically about 10 to 15 interns working at the Avionics Engineering Center and about 20 avionics graduate students enrolled at the school, Braasch said. Often times, he said, a graduate student's thesis or dissertation will double as the final report for an avionics research sponsor.

The Guggenheim School of Aerospace Engineering at Georgia Institute of Technology, located in Atlanta, has seen a leveling off of enrollment following years of steady growth. In his state of the department address in October, Robert G. Loewy, chair of the aerospace engineering department at Georgia Tech, said software engineering, UAV/rotorcraft, cognitive engineering, airport operations, electric propulsion, wind energy and novel fuels have been identified as new research areas for the university. Georgia Tech received \$22.8 million in sponsored research expenditures in fiscal 2007.

Software upgrades are far more common than hardware upgrades in avionics, lessening the demand for hardware engineers. Those "behind-the-board" developers are harder to find, companies say.

"Over the years, people want to see the output of their work. That's why everyone wants to work on displays, because you get immediate feedback. Whereas if you work on a navigation solution, it's a calculation — no one ever sees it, but those are the harder areas to fill and they're the more complicated," Flaishans said.

Universities are responding to industry requests to arm graduates with a solid foundation of basic engineering principles, supplemented with hands-on practical experience. More universities are melding their avionics curriculum into electrical engineering as opposed to aerospace engineering.

"A lot of young people are under the impression that if you want to work in the aerospace industry, you should have a degree in aerospace engineering, which is totally wrong," Helfrick said. "The truth of the matter is you have a much better opportunity with the aerospace giants if you have a degree in something else.... Even though they still need aerospace engineers, the number they need is considerably less and they end up taking them and retraining them to be mechanical engineers or computer (scientists) or whatever."

L-3, for example, said roughly 70 percent of its new hires are from the systems software arena and 30 percent from mechanical and electrical engineering. L-3 Avionics employs about 160 engineers.

"One of the challenges we face with avionics development is it's really an entire system, and so you're calling upon a broad range of disciplines in order to put the system together," Braasch said.

"That requires the ability to bring to bear the theoretical background from a variety of traditional disciplines.... If you say, well, I'm going to do avionics engineering, well, it's fine — you've just defined five majors at the same time," he said.

Avionics experience would be a plus to companies hiring a new graduate, but companies are generally happy to hire engineering graduates with strong communications skills and the ability to learn new technologies.

Embry Riddle University, in Daytona Beach, Fla., began phasing out its avionics engineering program four years ago. Helfrick was in the process of establishing and accrediting an avionics track within the electrical engineering department. He is aiming to have the program accredited by 2009.

Embry Riddle's Bachelor of Science degree in electrical engineering is a systems-oriented program including analog and digital circuits, communication systems, computers, control systems, electromagnetic fields, energy sources and systems and electronic devices. The program includes avionics material for entry-level engineering positions. Students also use graduate work as a way to further specialize in avionics.

Helfrick also teaches a short course in avionics at the University of Kansas. He's seen a number of students from other engineering backgrounds sent to these courses by their employers to be exposed to avionics.

Companies "are hiring enormous amounts of avionics folks," Helfrick said. "And they're not getting avionics graduates; they're getting mechanical engineers, electrical engineers. Sure, they're well educated, but once you start talking about avionics, it's a foreign language."

Driving Professionalism in the Technician Sector

Industry organizations and avionics executives are looking to increase professionalism and credibility in the avionics technician field in hopes of attracting and retaining talent.

The National Center for Aircraft Technician Training (NCATT) in Fort Worth, Texas, established in 1999, has developed an aircraft electronics technician (AET) certification program. As of October, 227 technicians had been certified since the first certification award in April 2006. By next year, NCATT said it hopes to boost that number to 1,000.

The AET test, administered at some 1,300 testing centers worldwide, requires no prerequisites and no prior experience.

"If you have that knowledge, come demonstrate that you have that knowledge through this test and we'll recognize that," said Rick Hestilow, NCATT associate director.

More than 200 aviation-industry entities, including the U.S. military, FAA, airlines, the Aircraft Electronics Association and the National Business Aviation Association, have been involved in developing the procedures, processes and products supplied by NCATT. Tarrant County College manages the center, which has received \$1.5 million in funding from the National Science Foundation since 1999.

NCATT also accredits educational entities. The Delta Airlines Technical Operations Avionics Program at this writing was beginning the accreditation process. Only two institutions — the National Aviation Academy in Clearwater, Fla., and Pima Community College in Tucson, Ariz. — were NCATT accredited, but others, including Redstone College in Colorado and Tulsa Technology Center in Oklahoma, were moving through the process, Hestilow said.

The AET program is the result of an industry-government partnership to create a solid career path for the avionics technician, Hestilow said.

"We're talking about an individual technician's certification that recognizes them as an individual," he explained. "Repair stations have repairmen that have a repairman certificate. But that certificate, when it really comes down to it, belongs to the repair station and the FAA. It really doesn't belong to the individual. As soon as they leave that repair station, it's gone."

NCATT was in the process of completing further certifications, which will allow AET technicians to earn endorsements in such areas as systems integration and installation. The latter certification came about because of NCATT's work with Automatic Dependent Surveillance-Broadcast (ADS-B) in Alaska, Hestilow said. NCATT helped FAA and the University of Alaska develop a program for the university to train aircraft installers in ADS-B avionics. Areas identified by industry partners for future certifications include autopilot, enhanced vision, in-flight entertainment, and surveillance and weather avoidance systems.

Hestilow sees indications that industry is embracing the AET certification. Already, AET technicians can be found working at American Airlines, Delta Airlines and FedEx, as well as for FAA and the military.

Spirit Avionics, of Columbus, Ohio, and Blue Angel Aviation, of Pensacola, Fla., both require all new hires to be AET certified.

"I've always been a believer that it's never been enough to grant the privilege to work on avionics. An A&P certificate just doesn't cover the knowledge base required to be an effective avionics technician," said Rick Ochs, president of Spirit Avionics and a participant in NCATT programs.

The AET certification comes with some limitations. For example, because it is not bestowed by FAA, the AET rating does not grant return-to-service and sign-off privileges — those are still the responsibility of an A&P-certified mechanic. Possessing those privileges, the A&P mechanic will make more money, which could entice an avionics program graduate to opt for a higher-paying industry, such as the automotive or consumer electronics fields.

"The challenge is to not let" a new avionics technician "begin looking outside the industry because he is kind of looked on as a lesser technician than an A&P mechanic," Ochs said.

In its 2007 Salary Survey, *Avionics* sister publication *Aviation Maintenance* pegged average A&P salaries at \$50,100. The U.S. Department of Labor, in a 2006 survey, found there are 118,210 aircraft mechanics and service technicians in the United States, earning a mean annual income of \$49,300. The greatest concentration (16,120) were in Texas.

An A&P graduate already has a leg-up on someone coming out of an avionics training program. A&P mechanics, while technically certified to work on advanced avionics, "know just about enough to be dangerous because they don't have a lot of formal training on electronics theory, on how to operate a meter, on how to operate avionics test equipment," Ochs said.

The AET certification is important, Ochs said, to maintain a pipeline of well-trained, certified technicians, especially now that they are in demand.

"I attribute a fair amount of our situation with the lack of technicians to our arrogance and to never properly recognizing avionics technicians with the credentials they've worked so hard to attain," Ochs said. — *Emily Feliz*