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Wanted: Qualified Engineers to Keep the Aerospace Industry Flying: A Shortage of Engineers Threatens the Industry – and National Security

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Things look bleak for the aerospace industry in the United States during this economic downturn. Commercial airline operators are steadily canceling orders for new aircraft as corporate and personal travel plummets. The military is shifting its strategy away from multi-billion dollar fighter jets to less expensive jets and unmanned aerial vehicles. Countries that used to produce only components for U.S. aircraft now look to build entire airplanes at a lower cost.

As daunting as those current challenges appear, the biggest problem is only just beginning to appear on the horizon. Analysts worry that the domestic industry -- a potent engine for jobs and one of the few American industries with a trade surplus -- faces an unprecedented wave of retirements in the years immediately ahead. At the same time, there is a severe shortage of younger, qualified workers in the pipeline.

According to a 2008 *Aviation Week* workforce study, 58% of the aerospace workforce is over age 50, with only 22% under 35 years of age. In 2007, the rate of retirement was only 2%, which represented almost 13,000 people. As more and more boomers reach the end of their careers, a 13% retirement rate looms, which will mean the loss of nearly 85,000 workers.

That is the crux of the problem. Without a workforce with engineering skills, the U.S. aerospace industry will lose its innovative and productive edge. While the country graduates about 70,000 engineers annually, only a small percentage enters aerospace or the related defense industry. Instead, many enter professions where their engineering degrees are barely relevant -- such as finance, banking and law -- often lured by potentially very high salaries.

The crisis is exasperated by the rapidly declining number of American college students studying so-called STEM disciplines -- science, technology, engineering and math. And American students at the elementary through high school levels don't score as high on math and science as those from many developing countries. This combination will reverberate throughout the industry at some point soon.

"Unfortunately, we are not in a field that can take young, unqualified people and train them for the job," says Marion Blakey, president and CEO of the Aerospace Industries Association (AIA). Potential workers need to be well trained in engineering fundamentals. "We need that foundation before we can give them the requisite training in the field."

U.S. Interest Is Lagging

Without that training, potential workers will be qualified to land only production jobs in aerospace. The higher paying jobs will go to foreign guest workers, who are graduating with American engineering degrees in growing numbers. According to an AIA study, 60% of engineering PhDs in 2007 went to foreign nationals compared to only 40% in 2003. That source of workers has kept the U.S. aerospace industry humming, but appearances can be deceiving, especially in the defense sector. As more people with security clearances retire, foreign workers will not be permitted to replace them because of national security regulations.

By contrast, the National Academy of Sciences noted that India produced about 350,000 engineers in 2004 and China some 600,000. Many are trained in the U.S., still considered home to world's premier universities.

But other countries are beginning to catch up.

"You look at PhD. students in technology and the faculty that teaches them at U.S. universities, and you notice that the majority are foreign born," says [Morris Cohen](#), a professor of operations and information management at Wharton. "What is different now is that countries like China and India and other places have developed their own high-level education. We are beginning to compete for the best students."

Some of those students remain in the U.S. and take engineering jobs that do not require a security clearance. But a growing number are returning to their native countries with their U.S. university-granted PhD.s to help set up a domestic aerospace industry. China, in particular, has ramped up efforts to create a domestic industry that can expand production of short-to-medium-range, narrow-bodied commercial jets and begin to produce wide-body, long-range jumbo jets by 2020. [LINK: <http://executiveeducation.wharton.upenn.edu/wharton-aerospace-defense-report/upload/New-Investments-Are-Flowing-Into-the-Aerospace-Sector.pdf>]

"Education is a key concern as the United States considers its global competition policy," says Cohen. If we don't begin to invest more resources in training engineers and offering more incentives, we are going to start seeing many of the dire predictions come true, he adds.

A study by the Center for Technology and National Security Policy (CTNSP) in January connected national power to strategic educational capacity, defined as the application of acquired knowledge and skills. The study added that, "Education is gaining an increasing interest among American decision makers as a strategic component of American power and an essential asset for successful military operations in the new global security environment."

During the 1990s, there was an effort to shift American educational priorities toward post-Cold War concerns, but the investment was negligible. The CTNSP report noted that former U.S. senators Gary Hart (D-CO) and Warren Rudman (R-NH) conducted a study that found that by 2001 the entire institutional basis of American national security was in "decline and must be rebuilt."

The Hart-Rudman commission, as it was known, also noted in no uncertain terms that "second only to a weapon of mass destruction detonating in an American city, we can think of nothing more dangerous than a failure to [properly] manage science technology and education for the common good over the next quarter century." That study, released before the 2001 terrorist attack in New York, was certainly prescient. On the cover of the report appeared an image of the soon-to-be-destroyed twin towers of the World Trade Center, overlaid with the image of a bull's

eye, suggesting the towers as a potential target of a terrorist attack. Whether the commission's other warning proves equally on the mark remains to be seen, but it's clear that since the study's release, conditions have only deteriorated.

Immigration Not Enough

The late 1960s and early 1970s marked a period when immigration laws allowed more qualified foreigners to become naturalized citizens to fill the professional job gap in areas like medicine, computer sciences and engineering. Today, restrictive post-9/11 immigration rules make it harder to fill many openings. Some groups are lobbying Congress to alleviate the shortage by easing immigration laws. Others, however, believe the long-term solution is to shore up the U.S. educational system.

"We cannot immigrate ourselves out of" this problem, says Nathan K. Smith, an analyst at Frost & Sullivan, which consults on aerospace and defense issues. "The aerospace and defense industry does not need an adjustment of the immigration policy to ensure an adequate supply of qualified individuals." Smith notes that many countries educate their children on far less money than in America, yet many of these children regularly outperform American students in math and science. "As an industry, we must remain focused on encouraging and attracting the best talent from within."

Apart from China and India, the U.S. is not alone in experiencing a deficit of homegrown aerospace engineers. South Korea is struggling to set up an aerospace industry because it does not have enough engineers in the field, according to a recent article by *Korea IT News*.

"Korea lacks human resources for aerospace development," Lee Chang-Jin, chief of aerospace research at the Korea Research Foundation, told *Korea IT News*. He added that it needs about 1,000 core engineers but has only about 500. "It will take a decade at least" to develop the proper workforce, with coordinated government and industry initiatives.

Analysts and American industry leaders agree that the U.S. government must also become more engaged if the country is to increase the number of homegrown qualified engineers. "Congress has a lively concern, not only about the quality of American education, but specifically [about] areas like math, science and technology that are not being adequately focused on," said Blakey. She added that the AIA has testified before Congress on this issue, and the association is looking to see what commitment the President Obama and his Secretary of Education will offer to improve the quality of education.

Regardless of President Obama's education policy, the bulk of the effort will fall to individual states. The federal government provides only about 10% of the education budget, according to Blakey.

“You have to win the conviction of the state legislators, the local school boards and the public so that more funds can be allocated to these disciplines,” said Blakey. This would involve hiring more teachers who are qualified to teach math, science and technology-oriented curricula.

But industry watchers also point out that even if the quality of education improves, there appears to be a cultural aversion among young Americans to enter the STEM disciplines. “Parents must also encourage their children to enter these disciplines,” says Blakey. “Studying these fields is difficult and demanding, but the payoff is absolutely worth it.”