

Examination of the U.S. Air Force's Science, Technology, Engineering, and Mathematics (STEM) Workforce Needs in the Future and Its Strategy to Meet Those Needs

AIR FORCE STUDIES BOARD

In the past, the United States Air Force has been an attractive career destination for individuals educated in science, technology, engineering, or mathematics (STEM) disciplines. However, force reductions, budget pressures, and ongoing military operations are creating new challenges to the Air Force's ability to recruit and retain personnel with the necessary technical expertise. The Air Force depends on a skilled technical workforce for the development, fielding, and employment of its air, space and cyber operations. The growing complexity of missions is also placing new demands on education, training, career development, system acquisition, platform sustainment, and the development of operational systems. In response to these changing circumstances, the Deputy Assistant Secretary of the Air Force for Science, Technology, and Engineering asked that the National Research Council conduct a study to assess the STEM capabilities the Air Force needs to meet the goals set forth in its strategic plan, and identify and evaluate options for meeting those needs. This report, the result of that study, discusses the role that STEM capabilities play in the



achievement of the Air Force's vision and strategy and assesses the current STEM requirements for positions within the Air Force, paying particular attention to the need for STEM expertise within the acquisition workforce. It also provides a discussion of the variables that will affect the future of the STEM-degreed workforce in the United States as a whole.

Role of STEM Capabilities in Achieving the Air Force Vision and Strategy

STEM-degreed:

Having an undergraduate or graduate degree in science, technology, engineering, or mathematics (STEM)

STEM-cognizant:

Having a minimum of 30 hours of undergraduate course work, training, or experience in a STEM field and being conversant in these subjects

Personnel with skills and experience in STEM disciplines are critical to operational missions and roles across the Air Force, as well as to the entire life cycle of Air Force weapon systems. Therefore, the study committee recommends the following:

- The Air Force should incorporate as a goal in its strategic plan the ability to conceive, develop, acquire, operate, and sustain advanced weapon systems, and that it set out recruiting, developing, and retaining STEM skills and experience as key enabling objectives of this goal.
- The Air Force should also review and revise as appropriate its current requirements and preferences for personnel with STEM capabilities in every career field and occupational series, paying particular attention to requirements within the acquisition community and in emergent areas such as space and cyberspace.

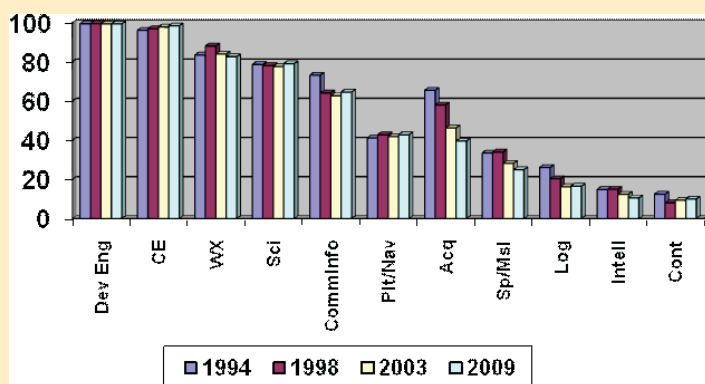
STEM Personnel in the Acquisition Workforce

Recent assessments have identified a loss of technical competence within the Air Force as an underlying factor in development and acquisition process failures. In order to ensure delivery of the complex warfighting systems needed to protect the nation, it is essential that the Air Force have a fully trained and qualified acquisition workforce. While current requirements state that acquisition managers must have a baccalaureate degree for the first level of career certification, it is not required that they be STEM-degreed or STEM-cognizant. Also, experience prerequisites established by the Defense Acquisition Workforce Improvement Act (DAIWA) are often waived for senior ranked personnel in the acquisition community. The Air Force should change the implementation of DAIWA by establishing STEM cognizance as a minimum criterion for certification, and should ensure that general officers in the Materiel Command, Space Command, and Office of the Secretary of the Air Force for Acquisition meet all requirements. The training and career development plan for acquisition managers should be modified to provide more opportunities for STEM-degreed personnel to develop their technical skills during the first five years of their careers with the Air Force.

A key goal for the Air Force should be to establish a process and a set of tools that will ensure that future STEM requirements can be filled by trained personnel. To do this, the study committee recommends that the Air Force take the following actions:

- It should establish a STEM council to review policies and implementation and recommend improvements. The council should also determine what educational requirements should be for STEM cognizance and which positions require such knowledge.
- Next, a model should be developed to predict future requirements, inventory, and impacts of personnel policies and decisions. An advocate should be assigned to oversee this process and to recommend and implement STEM personnel policies at the Air Force Headquarters level.
- Under the supervision of the STEM council, the Air Force should establish a process to systematically review all of its STEM degreed officers with the goal of assigning these officers to the Air Force's highest priority requirements.

Officers with Technical Degrees in Career Fields with STEM Needs



While the proportion of technical degree holders has remained relatively constant in traditional technical fields such as developmental engineering and civil engineering, technical degree holders in other career fields have declined notably over the past 14 years. Communications and information dropped 9 percentage points, and logistics dropped 10 percentage points. Of particular concern to this study is the large decline in acquisition and contracting from 65 percent to 40 percent.

SOURCE: Headquarters U.S. Air Force Personnel Database, data extracted in September 2008.

In order to increase the overall level of STEM expertise within the Air Force, the following sources of personnel or training should be considered:

- The potential for the Air Force Reserve and Air National Guard to contribute to STEM expertise, either through existing programs or new initiatives, should be assessed.

- The Air Force Institute of Technology (AFIT) could help meet projected future requirements for STEM-degreed personnel by providing selected officers and civilians with appropriate educational opportunities, including graduate level STEM education and continuing education in STEM disciplines.
- AFIT could also be directed to develop modules of instruction to help increase the STEM-cognizance of officers and civilians who do not have prior experience in STEM disciplines.
- The Air Force Chief of Staff should establish a goal for the minimum percentage of U.S. Air Force Academy graduates with a STEM major, based on an assessment of requirements by the Force Management and Development Council and recommendations from the Deputy Chief of Staff for Manpower and Personnel.
- The Air Force should make use of its scholarships and incentives to encourage Air Force Reserve Officers Training Corps (ROTC) students to pursue degrees in STEM disciplines or at least complete the necessary courses to qualify as STEM cognizant.
- The Air Force should establish annual goals for assessing STEM-degreed officers through Officer Training School.

Finally, to effectively promote the development of a robust U.S. STEM workforce in the future, the Air Force should create a vehicle to coordinate and evaluate its existing STEM-related outreach, education, and training activities. Current activities of this type include Project STARBASE, the Falcon Foundation, Civil Air Patrol, and Junior ROTC as well as activities in partnership with the American Institute of Aeronautics and Astronautics, the Air Force Association, and other organizations. The charter for this group should include creating connectivity between such programs so that promising participants from across the entire demographic makeup of our nation have ready access to the next academic level or program that builds on the experience gained from interacting with the Air Force STEM-related outreach efforts.

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The National Academies appointed the above committee of experts to address the specific task requested by the United States Air Force. The committee members volunteered their time for this activity; their report is peer-reviewed and approved by the authors and the National Academies. This report brief was prepared by the National Research Council based on the committee's report. For more information, contact the **Air Force Studies Board**.

Copies of the full report can be downloaded or purchased from the National Academies Press, 500 5th Street NW, Washington DC, 20001; (800) 624-6242; **www.nap.edu**.

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