

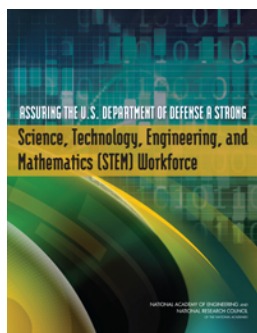
Assuring the U.S. Department of Defense a Strong Science, Technology, Engineering, and Mathematics (STEM) Workforce

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The ability of the nation's military to prevail during future conflicts, and to fulfill its humanitarian and other missions, depends on continued advances in the nation's technology base. A workforce with robust Science, Technology, Engineering and Mathematics (STEM) capabilities is critical to sustaining U.S. preeminence. Today, however, the STEM activities of the Department of Defense (DOD) are a small and diminishing part of the nation's overall science and engineering enterprise. This National Academies report presents five principal recommendations for attracting, retaining, and managing highly qualified STEM talent within the department based on an examination of the current STEM workforce of DOD and the defense industrial base. As outlined in the report, DOD should focus its investments to ensure that STEM competencies in all potentially critical, emerging topical areas are maintained at least at a basic level within the department and its industrial and university bases.

Background

The DOD's STEM needs, as well as those of its contractors, represent a relatively modest facet of the challenge faced by the nation's workforce as a whole in today's burgeoning, technologically driven economy. Total DOD civilian STEM employment is approximately 150,000, where 47 percent are in engineering and 35 percent are in computer and mathematical science occupations, even as this workforce represents only a small fraction (approximately 2 percent) of the total U.S. STEM workforce. For the private sector, while STEM jobs are a major component of the defense industrial base (approximately 3 in 10 jobs), these jobs also represent a small fraction of total U.S. STEM



employment (likewise approximately 2 percent). A notable exception is aerospace engineers, a substantial proportion of whom are employed in the aerospace and defense industry.

In this context, the DOD's demand for scientists and engineers is sufficiently modest that fulfilling its need for numbers should be achievable. DOD's challenge in the foreseeable future is filling its ranks with a suitable share of the best and brightest talent—particularly given the current perception of many young graduates—especially PhD candidates in the sciences—that working in government is less preferable, though still attractive, than careers in academic teaching and research or industry.

There are a number of constructive goals DOD could set to help assure that the needed cadre of highly qualified STEM workers will be available to support U.S. national security needs.

These include: 1) making the DOD a more attractive place for highly capable STEM employees to work; 2) creating more pathways for high quality scientists and engineers to work in DOD; 3) enhancing early-warning of new developments being achieved globally in science and engineering by increasing the involvement of DOD's workforce in global activities in core fields; 4) managing the careers of, high-quality civilian government scientists and engineers and giving them educational opportunities, as is already done for the most capable uniformed personnel; and 5) establishing and ensuring adaptable human resource development and management mechanisms that can respond to abrupt changes in STEM opportunities and needs that are fully competitive with the responsiveness found in industry.

Principal Findings

Science and technology and the DOD STEM workforce are increasingly critical to U.S. military capability. Technological surprise has proved to be decisive in past conflicts and will likely be so in the future. The ongoing globalization of STEM requires that DOD readdress its workforce policies and practices to ensure that it retains access to a significant share of the best and brightest STEM talents available. DOD is a microcosm of the larger and growing global STEM enterprise, where talent is in high demand. Access to highly qualified STEM talent should be a primary consideration in DOD workforce recruitment and retention policies, guidelines and practices.

Finding 1: Quantity of STEM Workforce

Because of the relatively small and declining size of the DOD STEM workforce there is no current or projected shortage of STEM workers for the DOD and its industrial contractor base except in specialized, but important, areas such as cyber security and selected intelligence fields. As a means of addressing any future shortages, experience has shown that students will respond to the demand signal of higher salaries in a STEM field, suggesting a mechanism by which DOD can stimulate supply in a critical area.

Finding 2: Quality of STEM Workforce

The STEM issue for the DOD is the quality of its workforce, not the quantity available. The DOD needs a suitable share of the most talented STEM professionals. The decisions they make within DOD are highly leveraged, impacting the efforts of very large numbers of people and enterprises both inside and outside the government.

Finding 3: Changing Character of STEM Workforce

New technological advancements, often from outside the defense sector and from abroad, are appearing at an increasing rate. Adapting to this new environment requires transformational and long-term changes within the DOD management of its STEM workforce.

Finding 4: Forecasting STEM Workforce Needs

Reliable forecasting of the STEM skills needed by the DOD beyond the near term is simply not possible because of the increasing rates of advancement in science and technology and the unpredictability of military needs. Flexibility, capability and relevance in the DOD STEM workforce are the essential characteristics sought.

Finding 5: Attracting and Retaining STEM Workforce

For the DOD to recruit top STEM talent in competition with commercial firms, universities and others, it must commit to improving the STEM workforce environment. The DOD must become, and be perceived as, an attractive career destination for the most capable scientists, engineers and technicians who are in great demand in the global talent marketplace. This implies, among other things, that DOD will need to reassess its requirement for security clearances for many STEM positions along with the processes by which many of its systems are developed and procured.

Finding 6: Managing the STEM Workforce

The career development support for the DOD uniformed STEM workforce is excellent, while the career development support for the DOD civilian STEM workforce is far less developed. The defense-related industry lies somewhere between them.

Principal Recommendations

Recommendation 1. Recruitment and Retention of Highest Quality STEM Workforce

The DOD workforce recruitment policies and practices should be reviewed and overhauled as necessary to ensure that the DOD is fully competitive with industry (not simply the “defense industry”) in recruiting the highest quality STEM talents. DOD should judge its recruiting competitiveness by the quality of its STEM hires, and it should continue to adjust its policies and practices until it has become fully competitive with overall industry and academia in the quality of its recruitments. Such practices might include the following:

- More active outreach and recruitment efforts aimed at civilian hires of needed scientists and engineers that emphasize the many exciting technologies that are being developed by DOD and their potential contribution to the nation;
- New measures to expedite recruitment offers for occupations in which DOD determines that it must compete with more nimble corporate recruitment practices;
- Additional authority to expedite security clearances needed for such positions, including authority for temporary hiring into non-sensitive roles pending confirmation of security clearance; and
- Actions to protect or “ring-fence” science and engineering positions determined by DOD to be critical capabilities, thereby protecting the loss of such capabilities due to RIFs and hiring freezes.

Further, the DOD STEM workforce management should have as a primary objective retaining its highest quality talent. Talented individuals include STEM professionals ranging from technicians to systems engineers to the most advanced scientists and engineers working in specialty fields. It is critical to include those at the forefront of emerging, potentially critical technical areas, as well as those capable of moving rapidly into these new areas. The DOD must ensure its STEM workforce management policies, procedures and incentives (in short, its business model) achieve that outcome. Its business model should explicitly make careers in the DOD attractive to top STEM talent. Achievement of this goal will require the explicit support, commitment and action by the highest level of DOD leadership.

Recommendation 2. Open More of the STEM Workforce Pool to non-U.S. Citizens

Because the DOD and its contractors need access to the most talented STEM professionals globally, the DOD should reexamine the need for security clearances in selected positions in order to permit non-U.S. citizens to enter the STEM talent pool available to the DOD under tailored circumstances consistent with applicable law and regulation governing military goods and services and their export and deemed export. Further, the H1-B visa system should be modified to provide the nation and the DOD with a substantially larger pool of extraordinary talent in areas of need.

Recommendation 3. Maintain Critical STEM Capabilities Through Unconventional Programs and Prototyping

To preserve design, creation and testing team skills (which have been called upon less and less as new weapons systems appear with decreased frequency) and to recruit, retain and advance a quality STEM workforce with the special talents needed by DOD and its contractors, the DOD should create “skunk works” in the industrial base, universities and the DOD to undertake targeted, unconventional, potentially disruptive programs through prototyping for technical concept verification. These programs could subsequently be transitioned to an operating unit for implementation if successful, or terminated if not. A system that provides rotational assignments for individuals from government, the industrial base and the private sector would be an attractive feature of these programs. This “skunk works” culture would nurture critical STEM skills within the DOD workforce as well as provide exciting, challenging and highly attractive opportunities for the STEM workforce.

Recommendation 4. Develop an Agile and Resilient STEM Workforce

The DOD should recruit and develop an agile and resilient STEM workforce that is attuned to the dynamism and future uncertainty of technical needs; is prepared to adapt to those needs as they arise; and is enthusiastic about working in this challenging environment. In addition, the DOD should be prepared to educate highly capable, but not yet STEM qualified individuals rapidly into STEM-capable professionals with masters’ degrees in science and engineering in times of urgent need—as is done at the Naval Postgraduate School today.

Recommendation 5. Upgrade Education and Training for the DOD Civilian STEM Workforce

The DOD should ensure that the education and training, and the re-education and re-training opportunities for its civilian STEM workforce are both commensurate with similar opportunities afforded career military personnel and tailored to the needs of the civilian workforce.

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