CHIEF OF ENGINEERS
ENVIRONMENTAL ADVISORY BOARD
WASHINGTON, D.C. 20314-1000 (CECW-P)

3 December 2015

LTG Thomas P. Bostick,
Commanding
Headquarters, US Army Corps of Engineers
411 G Street NW
Washington, DC 20314-1000

RE: Report on Science, Technology, Engineering, and Mathematics (STEM) Education

Dear LTG Bostick,

While the economic evidence currently indicates a sufficient supply of STEM trained personnel in the aggregate, there is an "achievement gap" within the economy that is unequivocal and problematic. This "achievement gap" is the long observed gap between the scores of white students and their African American and Hispanic counterparts in nationwide tests. Factors perpetuating the achievement gap disparity have been extensively studied. The social science data suggest that military service and postsecondary STEM training independently serve as social mobility pathways for underrepresented groups. However, the author of the attached report, Dr. Kurt Preston, found that no federal activities, to include DoD or Army activities, specifically encourage current or departing service members, minority or majority, to pursue undergraduate or graduate STEM education. Both the nation and the Army would benefit, if service members were so encouraged.

In the attached report, the Environmental Advisory Board (EAB) recommends that the Corps of Engineers encourage the formation of a Department of the Army working group to accomplish two goals. The first is to gather data to better understand their potential STEM resources with the goal of recommending mechanisms to encourage service members, especially minorities, to pursue undergraduate or graduate STEM education relevant to the future of USACE, the Army, and the Nation. The second goal is to recommend to the Chief specific steps for assisting service members, especially minority service members, in navigating the three critical decision points that impact minority student participation rates. These are the decision to: (1) enroll full-time in four-year undergraduate institutions; (2) enroll full-time in a STEM program; and (3) graduate from STEM programs with Bachelors' degrees.

Subsequent to the initial submission of the EAB's STEM report, additional issues were raised by another EAB member, Dr. Melinda Daniels. We offer the following concerns and suggestions for your consideration:

> While active duty personnel often earn STEM degrees during their time in service, they struggle to find employment within STEM fields following departure from the Army. While military service is often perceived as an asset by prospective employers, the less

well understood secondary effects of gaining degrees while in military service can be significant disadvantages when competing for employment. These disadvantages include:

1. Interruptions to education timeline.

Service members' pursuits of degrees are often complicated by deployments. These deployments result in large temporal gaps in educational activity (even years between earned course credits). They also result in a dependency upon distance learning (large proportion of credits earned through on-line courses). Both gaps in the educational timeline and excessive remote learning are viewed as highly negative by graduate schools as well as employers.

2. Lack of internship experience.

For traditional students, summer or semester internships often lead to first employment offers. Military service members often cannot apply for these opportunities because of time limitations on availability, inability to relocate, or uncertainty regarding future deployments.

Some possible solutions to these problems are:

- Formal arrangements with military friendly universities located near major Army installations (e.g. Kansas State University, collocated with Ft. Riley)
- Specific programs targeting departing personnel that may, for example, facilitate placement in internships with military contractors or other private companies.
- 1 year collaborative graduate Masters STEM programs that would enable the service member to refresh training, with 6 month private or public sector internship
- Special GI bill type program that would focus exclusively on STEM degrees.

Finally, another problem is the tracking of military service members into "leadership studies" type degree programs. For exiting service members this is a natural and comfortable "fit", yet not a degree that provides employment advantage and certainly not a degree that provides any track into STEM fields. It is quite likely that most departing service members are already accomplished leaders, thanks to their military experiences. This is a broader issue, similar to the expenditure of GI Bill monies at for-profit universities providing little marketable skills or career prospects. The problem could be addressed through both an exit counseling program and conversations with universities promoting these degree programs.

This concludes the comments from EAB member Dr. Melinda Daniels. The EAB appreciates the opportunity to provide input on this important topic.

Sincerely,

Rollin Hotchkiss
Chair

Attachment: STEM Letter Report

Report on Science, Technology, Engineering, and Mathematics (STEM) Education

by

Environmental Advisory Board
Lead Author: Dr. Kurt Preston
Additional EAB Members: Dr. Samuel F. Atkinson, Dr. Rollin H. Hotchkiss, Dr. Mary Barber, Dr. Tammy Newcomb, Mr. Charles Simenstad, Dr. Melinda Daniels, Dr. Fred H. Sklar, Dr. Chuck Somerville, Dr. Lydia Olander
16 June 2015

Purpose

LTG Thomas P. Bostick, Chief of the US Army Corps of Engineers (the Chief) requested that the Environmental Advisory Board (EAB) examine the issue of science, technology, engineering, and mathematics (STEM) education in the United States with a particular focus on minority involvement. The purpose of the examination was to suggest activities the Chief and U.S. Army Corps of Engineers (USACE) might pursue in regard to STEM education. This letter report responds to that request.

Summary

In spite of what appear to be clear signals of STEM education scarcity (low international rankings, indifferent teacher quality, global STEM competition, and perceived STEM shortages in the U.S. labor pool), the principal economic indicator of STEM scarcity (higher wages driven by a scarcity of qualified job seekers) has yet to be observed by either the national economy nor by USACE human resource personnel. On the other hand, national policy makers have continually warned of STEM worker shortages for seventy years. As a result, the nation has and continues to respond to a perceived shortage. Unfortunately, this federal response to STEM education has been "complex and subject to methodological challenges."[1]

Given the contradictions, the USACE Human Resources Directorate takes a focused, metric-driven approach to the hiring of engineers and scientists. It seeks to build and foster relationships with the military and civilian education community. In addition, it has established a well-developed pipeline through the development of a successful intern program. The intern program allows students an opportunity to connect with the Corps of Engineers before entering its ranks. Although USACE hires nearly one thousand scientists and engineers a year, it recruits quickly and reports no shortage of STEM trained personnel.

There remains, however, a persistent concern that the United States is not producing enough STEM workers. While the economic evidence indicates a sufficient

[1] P.3 (Gonzalez and Kuenzi 2012)

supply in the aggregate, there is an "achievement gap" within the economy that is unequivocal and problematic. This "achievement gap" is the long observed gap between the average scores of white students and their African American and Hispanic counterparts in nationwide tests. Factors perpetuating the achievement gap disparity have been extensively studied.[2] For the most part, the factors appear to be outside the Department of Defense's (DoD) mission to address.

There is, however, one area within the DoD mission space related to both STEM education and the achievement gap that to date has gone largely unnoticed and unaddressed. In spite of the consensus among social scientists that military service and postsecondary STEM training independently serve as social mobility pathways for underrepresented groups, there is no federal activity to encourage service members, minority or majority, to pursue undergraduate or graduate STEM education. While it is known that approximately 10,000 active duty service members are enrolled in degree programs related to STEM, the capability to examine the extent of the relevance of the STEM programs to USACE is lacking. The dataset does not allow differentiation of the types of STEM education. For example, within the dataset Criminal Justice Science[3] is a STEM degree program, but may not be as relevant to USACE.

It is also known that these STEM-trained individuals have unique military insight, are generally qualified for security clearances, and, if members of a minority, positioned on a recognized pathway of upward social mobility. The bottom line is that minority members of this group appear to represent an untapped resource in the effort to fill the nation's achievement gap.

Our recommendation therefore is that the Chief and USACE should encourage the formation of a Department of the Army working group to accomplish two goals. The first is to gather data to better understand their potential STEM resources with the goal of recommending mechanisms to encourage service members, especially minorities, to pursue undergraduate or graduate STEM education relevant to the future of USACE, the Army, and the Nation. The second goal is to recommend to the Chief specific steps for assisting service members, especially minority service members, in navigating the three critical decision points that impact minority student participation rates. These are the decisions to: (1) enroll full-time in four-year undergraduate institutions; (2) enroll full-time in an engineering program; and, (3) graduate from engineering programs with bachelor's degrees.

Background

Historical Context. National leaders have long focused attention on the importance of science and engineering education. Indeed, "(i)n the first State of the Union address President George Washington called upon Congress to promote

[2] P.12. (Gonzalez and Kuenzi 2012)

[3] The authors take no position whether a degree in Criminal Justice Science is a STEM degree. The purpose is to note that the limits of the information to be derived from the available dataset.

scientific knowledge for the sake of the republic and the polity."[4] In modern times, concerns regarding these intellectual pursuits have been a near constant theme. At the end of World War II, Vannevar Bush, then Director of the U.S. Office of Scientific Research and Development noted that "(w)ith mounting demands for scientists both for teaching and for research, we will enter the postwar period with a serious deficit in our trained scientific personnel."[5] More recently, successful industry leaders such as Steve Jobs[6] and Bill Gates[7] have shared their concern that the nation's workforce and employers faces a crisis in regard to STEM education.

Federal Response. Given the duration and level of this concern, it is no surprise that the federal government has an active, some might say chaotic, effort to encourage STEM education. The effort is so large that Congress has tried with limited success to count the number of federal STEM programs.[8] In 2012, the best estimates were that there were "between 105 and 252 STEM education programs or activities at 13 to 15 federal agencies" with a combined annual appropriation somewhere between $2.8 billion and $3.4 billion.[9]

Since that time, strenuous efforts by the White House to focus federal STEM efforts resulted "in substantial reduction in the fragmentation of the STEM education portfolio, with the number of STEM education programs reduced by almost 40 percent in the past two years. This reduction from approximately 228 STEM education programs in 2012 to an estimated 138 as reflected by FY14 agency operating plans, has improved the ability of agencies to evaluate programs, locate strategic partners, and deploy resources against priorities. The President's 2015 Budget builds on this record by further reducing fragmentation to 111 requested programs."[10]

As noted in a recent Congressional Research Service report, "The discrepancies between these inventories indicate that establishing the federal effort in STEM education is complex and subject to methodological challenges. Differences between the inventories are due, in part, to the lack of a common definition of what constitutes a

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[4] P.1. (Gonzalez and Kuenzi 2012)

[5] P.5. (Charette 2013)

[6] P.5. (Committee on Science , Technology , Engineering 2012)

[7] P.7. (Charette 2013)

[8] "At the request of Congress, four inventories of federal STEM education programs and activities have been published in recent years; two by the Government Accountability Office (GAO), one by the Academic Competitiveness Council (ACC),11 and one by the National Science and Technology Council (NSTC). The first GAO study, in 2005, found 207 distinct federal STEM education programs funded at about $2.8 billion in FY2004 (hereinafter this report is referred to as "GAO-2005").13 In 2007, the ACC found 105 STEM education programs funded at about $3.1 billion in FY2006 (hereinafter this report is referred to as "ACC-2007"). A 2011 report by the NSTC identified 252 "distinct investments" in STEM education funded at about $3.4 billion in FY2010 (hereinafter this report is referred to as "NSTC-2011"). A second GAO study, published in 2012, reported 209 programs funded at about $3.1 billion in FY2010 (hereinafter this report is referred to as "GAO-2012")." P.7. (Gonzalez and Kuenzi 2012).

[9] P.2. (Gonzalez and Kuenzi 2012)

[10] P.17. (OSTP 2014)

STEM."[11] Nonetheless, it is possible to gain a very general understanding of the federal response to STEM education. Federal STEM programs are nearly ubiquitous, meaning that almost every federal agency has some type of STEM education program.[12] Of the various programs, the National Science Foundation (NSF), the Departments of Education (ED), and Health and Human Services (HHS) programs account for the bulk of the total federal STEM education funding. Over half of federal STEM education funding is intended to serve the needs of postsecondary schools and students. The remainder goes to efforts at the kindergarten-through-Grade 12 level (K-12).

But, is there even a problem? The question remains open of whether or not there is even a STEM "problem" to be solved. Those who perceive a problem, voice principal concerns of low international rankings, K-12 teacher quality, global STEM competition, and a perceived achievement gap.

On the one hand, low international rankings, K-12 teacher quality, global STEM competition, and perceived STEM shortages in the US labor pool appear on balance to suggest there are problems related to both the quality and quantity of STEM trained personnel. The litany of discouraging factoids often quoted in the popular press is well known and appears impressive.[13] However, the picture is not as clear as one might expect. Detractors note that in spite of the factoids and dire projections, there are more U.S. STEM workers than STEM jobs. They argue that if there were a shortage of STEM workers, the shortage would be reflected by higher wages driven by a scarcity of qualified job seekers. They note that that STEM wages have been largely flat and, for example, "wages for U.S. workers in computer and math fields have largely stagnated."[14] This contrary picture is, in fact, the picture observed by the USACE Human Resources Directorate.

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[11] P.3. (Gonzalez and Kuenzi 2012)

[12] P.4. (Gonzalez and Kuenzi 2012)

[13] A sampling of the litany of concerns would include the following:

- The World Economic Forum ranks the United States 48th in quality of mathematics and science education.
- The United States ranks 20th in high school completion rate among industrialized nations and 16th in college completion rate.
- Sixty-nine percent of United States public school students in fifth through eighth grade are taught mathematics by a teacher without a degree or certificate in mathematics.
- Ninety-three percent of United States public school students in fifth through eighth grade are taught the physical sciences by a teacher without a degree or certificate in the physical sciences.
- In 2000 the number of foreign students studying the physical sciences and engineering in United States graduate schools for the first time surpassed the number of United States students.
- The United States ranks 27th among developed nations in the proportion of college students receiving undergraduate degrees in science or engineering.
- China's Tsinghua and Peking Universities are the two largest suppliers of students who receive PhD's—in the United States.
- China has now replaced the United States as the world's number one high-technology exporter.

Pp. 6 - 11 (Augustine 2005)

[14] P.2. (Charette 2013)

USACE Human Resource Posture. The requirements of the Corps in terms of technical personnel bear detailed examination. Headquarters US Army Corps of Engineers (USACE), Human Resources Directorate is well aware that "a workforce with robust STEM capabilities is critical to the success of the U.S. military mission" and that USACE, the Department of Defense, and the nation must ensure there is a pipeline of students engaged in STEM and prepared for careers in engineering, the natural sciences, and research and development."[15]

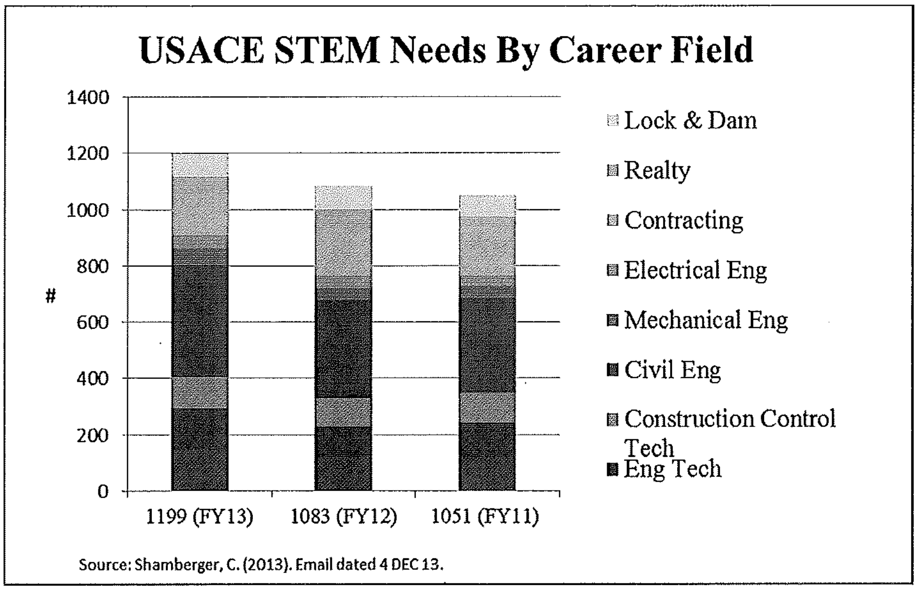

Figure 1. USACE STEM needs by career field. [This data represents Mission Critical Occupations only. While the numbers are smaller, there are many more occupational series USACE hires for that would be considered STEM. For example: General Engineering (0801), Chemical Engineering (0893), Industrial Engineering (0896), General Physical Science (1301), Physics (1310), Chemistry (1320), Math (1520), Information Technology (2210), Materials Engineering (0806).]

The employment needs (provided in the figure above) indicate that USACE annually hires approximately 1000 personnel that require a STEM related education; of these approximately 39% require a professional degree. In spite of the need, USACE reports that it does not have a STEM hiring problem. The lack of difficulty is evidenced by the USACE's able to recruit quickly. At approximately 50 days, the average USACE position fill time is less the Office of Personnel Management reform goal of 80 days and the overall Army goal of 70 days. Recently (the last 5 quarters), USACE has seen a rise in fill times to 81days; whether this trend will continue is unknown.

[15](Department of Defense Science, Technology, Engineering, and Mathematics (STEM) Executive Board)

USACE is able to recruit quickly despite the fact that many consider its workplace limited in desirability; a recent survey of 60,000 college students assessed the desirability of 100 potential employers, in engineering fields, the Air Force ranked 15th, followed by the Navy at 34th and the Army at 41st.[16] USACE Human Resources Directorate accomplishes its success by focusing its efforts through the USACE campaign plan, a plan with metrics that develop relationships with STEM students early in their academic careers. For example, USACE seeks to hire approximately 1,000 students every year in professional positions such as Scientist, IT professionals, Engineers, Resource Management etc.[17]

In addition, USACE seeks connections with the broader military and civilian education community. In the military community, USACE partners with Department of Defense Education Activity (DODEA) schools to establish student project competitions with awards ceremony and participates in DoD and Army Education Outreach Program events (STEM-Up, GEMS, eCYBERMISSION, Camp Invention, etc.). In the civilian setting, USACE seeks to be involved in local schools grassroots efforts such as JROTC programs, teacher training workshops, student mentoring activities, science fairs, etc. Finally, USACE possesses formal partnerships with universities, including historically black colleges/universities and minority-serving institutions through organizations such as the Society of American Military Engineers (SAME), Black Engineer of the Year (BEYA), and Great Minds in STEM (formerly HENNAC)[18]. USACE clearly benefits from a very proactive human resources team.

The USACE human resources team recognizes that there may be clouds on the horizon. Despite the current success, there remains a concern that the US is not producing enough STEM workers. Only 4 out of every 100 graduates in the U.S. is an engineer, among the lowest in the world and on a par with Bangladesh, Cambodia and Cuba. USACE human resource leaders do wonder if U.S. production of engineers and scientist will meet future needs.

Achievement Gap. In regard to both ethnicity and gender, the achievement gap provides the clearest and most compelling argument that something is amiss. The achievement gap is marked by a steady disparity in the achievement and participation of minorities in STEM education and professions. "For example, there was at least a 20-point gap between the average scores of white students and their black and Hispanic counterparts on the 2011 4th and 8th grade NAEP mathematics assessments." In the case of gender, "only about a fifth of bachelor's degrees in engineering go to women."[19] The EAB was not specifically requested to address gender, therefore, gender disparities will be given limited scope in this discussion. While gender disparities remain an

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[16] (Committee on Science, Technology, Engineering, and Mathematics Workforce Needs for the U.S. Department of Defense and the U.S. Defense Industrial Base)
[17] (Shamberger)
[18] (Shamberger)
[19] P.12. (Gonzalez and Kuenzi 2012)

important issue,[20] the Chief explicitly requested that the nature of the ethnicity achievement gap be examined.

The existence of an ethnic achievement gap is no mystery; the appropriate response to the gap remains to be determined. Literally hundreds of books and articles have been written on the topic. Below is a summary of the body of knowledge that has developed:

> Researchers have identified dozens of school and non-school variables that may contribute to racial and ethnic achievement gaps in STEM. For example, in 2011 researchers reviewed over 400 books, book chapters, journal articles, and policy reports on factors that influence minority student success in STEM (hereinafter referred to as the "2011 review"). The 2011 review found that the following factors positively influence the success of minority students in STEM:
>
> - K-12—parental involvement and support
> - availability of bilingual education
> - culturally relevant pedagogy
> - early exposure to STEM fields
> - interest in STEM careers
> - self-efficacy in STEM subjects, and
> - STEM-related educational opportunities and support programs.
>
> The 2011 review also identified the following school-based factors as contributing to minority under-preparedness in elementary and secondary STEM education:
>
> - K-12—a lack of resources (underfunding) and less qualified teachers at schools that serve minority students
> - limited access to Advanced Placement courses
> - disproportionate tracking of minority students into remedial education
> - teachers' low expectations
> - stereotype threat
> - racial oppression and oppositional culture, and
> - premature departure from high school."[21]

Beyond K-12 challenges, higher education also contains a host of challenges for minority students. While postsecondary access has increased for African Americans and Hispanics, two separate pathways have arisen, one for whites and another for Hispanics and African Americans. Whites capture most of the enrollment growth at the 468 most selective and well-funded four-year colleges, while African Americans and

[20] P.12. (Gonzalez and Kuenzi 2012)
[21] P. 24. (Gonzalez and Kuenzi 2012)

Hispanics have captured most of the enrollment growth at the increasingly overcrowded and under-resourced open-access two- and four-year colleges. The 468 most selective four-year colleges, where whites are disproportionately enrolled, have greater financial resources, higher completion rates, higher rates of graduate school enrollment and advanced degree attainment, and higher future earnings. " Between 1995 and 2009, 82 percent of new white freshman enrollments were at the 468 most selective four-year colleges, compared to 13 percent for Hispanics and 9 percent for African Americans; 68 percent of new African-American freshman enrollments and 72 percent of new Hispanic freshman enrollments were at open-access two- and four-year colleges, compared to no growth for whites."[22] The importance of where to attend cannot be overstated. Open access[23] universities have relatively high dropout rates, while students who graduate with professional degrees, 76 percent of whom are white, will earn $2.1 million more over a lifetime than workers who dropped out of college.[24]

Researchers have identified three critical decision points that impact minority student participation rates. These are the decision to: (1) enroll full-time in four-year undergraduate institutions; (2) enroll full-time in an engineering program; and, (3) graduate from engineering programs with bachelor's degrees.[25] To the extent that the Chief envisions focused engagement in an effort to raise minority participation in STEM, generally, and engineering specifically, an engagement activity that addresses these decision points appears critical.

Opportunity. In investigating these issues, the EAB uncovered an opportunity which calls for closer examination by USACE, the Army, and DoD. No federal STEM activity was discovered, including those within the DoD and the Veteran's Administration that assists or encourages service members, especially minority service members in the navigation of the three critical decision points that impact minority student participation

[22] P.8. (Carnevale and Strohl 2013)

[23] The Georgetown University, Center on Education and the Workforce (CEW) relied on Barron's ranking of four-year institutions to create the top tier of 468 colleges. This aggregation is from their Most Competitive, Highly Competitive, and Very Competitive Colleges. The center obtained these data from the restricted use NCES-Barron's Admissions Competitiveness Index Data. The selection criterion for the six relevant tiers used in this analysis has been taken from text in Barron's Educational Series, 2009 (see section 3). The middle tier, discussed only in appendix B, is from Barron's Competitive Colleges. The open- access sector is basically a residual category that consists of the last two tiers of Barron's selectivity, Less and Non-Competitive Colleges, the four-year institutions (specialty schools and small colleges for the most part) not included in Barron's, and the two-year and less than four-year institutions. .... The center's earlier work demonstrates a clear hierarchy within these levels of selectivity, and it is highly correlated with educational and labor market outcomes (Carnevale and Strohl, 2010; Carnevale and Rose, 2004)." Therefore, the term open access refers to the following two Barron ranking categories, "Less Competitive — Median scores in this tier are generally below 1000 on the SAT or below 21 on the ACT, though some that require admissions tests do not report entry medians. Many of these colleges accept students with below C averages in high school and in the top 65 percent of their class. Acceptance rates are above 85 percent. Noncompetitive — Noncompetitive colleges require only evidence of high school graduation. Entrance exams are sometimes used for placement purposes. Seating capacity can limit the acceptance rates in these colleges, but those with acceptance rates of 98 percent and higher are automatically included." P.45. (Carnevale and Strohl 2013)

[24] P.42. (Carnevale and Strohl 2013)

[25] P. 148. (Johnson and Sheppard 2004)

in STEM higher education. Service members are left on their own to make the three critical decisions noted in the previous paragraph. The hypothesis is that USACE, the Services, and the individual active duty service members would benefit from assistance in regard to these decisions.

The reason for focusing on active-duty service members is threefold. Firstly, it is common for this group to work toward STEM undergraduate degrees while actively serving. This makes active-duty service members an ideal, nontraditional population for recruitment to STEM undergraduate and graduate programs once they leave the service. Secondly, research is needed that focuses on veterans' career trajectories and this research cannot adequately be accomplished without capturing the factors that lead to the pursuit of STEM degrees and careers. Thirdly, research shows both military service and postsecondary STEM training independently serves as social mobility pathways for underrepresented groups, including first-generation college graduates, women, rural and ethnic minorities, and other non-traditional groups.

As Major General Mustion reported to Lieutenant Bostick,[26] data are "remarkably lacking." What is known, however, is that approximately 10,000 active, Army duty service members are enrolled in a degree program related to STEM; of those, 1500 are enrolled in the sciences, 6500 in technology programs, 1000 in engineering, and 173 are studying mathematics. Assuming a 20% percent separation rate, it can be estimated that approximately 2000 service members depart the Army with some relevant STEM undergraduate training. At the same time, neither the Veteran's Administration nor the DoD has programs to specifically encourage departing service members to pursue graduate-level STEM education. Existing data collected by the federal government (NCSES) does not contain information about service in the Armed Forces or among doctoral or terminal degree recipients in the United States. Similarly, while Veterans Administration data tracks basic trends in veterans' training trajectories, it fails to provide information about post-collegiate training or the employment paths veterans take.

The bottom-line is that in spite of all the federal programs, none encourage the thousands of young veterans departing the service already in possession of STEM training to pursue further undergraduate or graduate STEM education. As a result, this disciplined corps of students with unique military insight are scattered to the wind. Some may pursue STEM careers, but those that do, do so without specific encouragement or connections to possible careers with the USACE. The losses are especially unfortunate for the minority members who are not encouraged to pursue STEM studies.

Recommended Actions

With the above analysis concluded, the EAB recommends that the Chief and USACE should encourage the formation of a Department of the Army working group to accomplish two goals. The first is to gather data to better understand their potential

[26] (Mustion 2014)

STEM resources with the goal of recommending mechanisms to encourage service members, especially minorities, to pursue undergraduate or graduate STEM education relevant to the future of USACE, the Army, and the Nation. The second goal is to recommend to the Chief specific steps for assisting service members, especially minority service members, in navigating the three critical decision points that impact minority student participation rates. These are the decisions to: (1) enroll full-time in four-year undergraduate institutions; (2) enroll full-time in an engineering program; and, (3) graduate from engineering programs with bachelor's degrees.

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