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# Army Educational Outreach Program



## 2017 Summative Evaluation Report

### PART 1: Executive Summary

May 2018



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Full versions of the FY17 portfolio evaluation reports as well as individual program evaluation reports are available on AEOP website: [www.usaeop.com](http://www.usaeop.com) (About > Our Impact).

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## 3 | Introduction

The Army Educational Outreach Program (AEOP) vision is to offer a collaborative and cohesive portfolio of Army sponsored science, technology, engineering and mathematics (STEM) programs that effectively engage, inspire, and attract the next generation of STEM talent through K-undergraduate programs and expose them to Department of Defense (DoD) STEM careers. The consortium, formed by the Army Educational Outreach Program Cooperative Agreement (AEOP CA), supports the AEOP in this mission by engaging non-profit, industry, and academic partners with aligned interests, providing a management structure that collectively markets the portfolio among members, leveraging available resources, and providing expertise to ensure the programs provide the greatest return on investment in achieving the Army's STEM priorities and objectives toward a STEM literate citizenry, STEM savvy educators, and sustainable infrastructure.

In FY17, the AEOP central application tool included 41,553 unique program participants, 32,947 were youth program participants and 8,714 were adult participants. Adult participants included Army Scientists and Engineers (S&Es) in various roles, such as mentors, judges, and presenters, as well as teachers participating in the new RESET program. Of the total participants in 2017, 855 students and 40 teachers were from 46 DoDEA schools from the Pacific, Europe and the U.S. The number of unique youth program participants in 2017 (32,947) represented an increase from 2016 (30,973), but was still lower than in 2015 (38,039).

### AEOP Priorities

**Goal 1: STEM Literate Citizenry.**

Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base.

**Goal 2: STEM Savvy Educators.**

Support and empower educators with unique Army research and technology resources.

**Goal 3: Sustainable Infrastructure.**

Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.

2017 AEOP Participation by Youth and Adults			
		Youth	Adults
CII	Camp Invention Initiative	1,425	112
CQL	College Qualified Leaders	229	206
eCM	eCYBERMISSION	21,277	3,253
GEMS	Gains in the Education of Mathematics & Science	2,845	510
HSAP	High School Apprenticeship Program	54	40
JSHS	Junior Science & Humanities Symposium	5,577	3,555
JSS	Junior Solar Sprint	892	327
REAP	Research & Engineering Apprenticeship Program	118	118
RESET	Research Experiences for STEM Educators and Teachers	NA	20
SEAP	Science & Engineering Apprentice Program	113	119

Unite	Unite	358	402
URAP	Undergraduate Research Apprenticeship Program	59	49
<b>Total 2016 AEOP Participants</b>		<b>32,947</b>	<b>8,714</b>

In 2017 the AEOP portfolio included participation from various collaborating schools, laboratories, Army/DoD S&E's and other collaborating organizations. AEOPs involved participants from 3,476 K-12 schools (compared to 3,607 in FY16), including more than 1,333 Title I schools (an increase from 962 in FY16). The portfolio of programs also involved 485 colleges/universities (a decrease from 568 in FY16), including at least 92 HBCUs/MSIs (an increase from 69 in FY16). AEOP programs self-reported 77 Army and DoD research and development laboratories or Army organizations involved in the work of the programs. The AEOP worked with 77 Army-funded laboratories at colleges/universities (compared to 74 in FY16). There were 2,307 Army and DoD S&Es who participated in 2017 programming (compared to 1,287 in FY16).

Costs for the individual 2017 AEOP elements as well as the average cost per student for each program element are detailed in the table below. Apprenticeship program costs ranged from \$3,313 per apprentice (REAP) to \$8,186 per apprentice (CQL). The higher cost of CQL reflects the longer duration of the program, which may take place in the summer or through portions of the academic year (sometimes lasting the entire year). AEOP competitions ranged in cost from \$140 per student (eCM) to \$362 per student (JSHS). GEMS, which is typically a 1-week summer STEM enrichment activity that takes place at Army laboratories, had an average cost of \$459 per student in 2017. While Unite, a 4-6-week summer STEM enrichment activity for students from historically underserved and under-represented groups that takes place in an existing University pre-collegiate program, had an average cost of \$1,849 per student.

2017 AEOP Costs				
	Program Type	Program Cost	Cost Per Participant	Average Stipend Per Participant
CII	STEM Enrichment Program (grades K-6)	\$337,583	\$237	NA
CQL	STEM Apprenticeship Program (undergraduate/graduate)	\$1,874,600	\$8,186	\$7,620
eCM	STEM Competition (grades 6-9)	\$2,980,003	\$140	NA
GEMS	STEM Enrichment Program (grades 5-12)	\$1,306,404	\$459	\$311
HSAP	STEM Apprenticeship Program (grades 9-12)	\$230,961	\$4,277	\$3,044
JSHS	STEM Competition (grades 9-12)	\$2,019,112	\$362	NA
JSS	STEM Competition (grades 5-8)	\$150,000	\$168	NA
REAP	STEM Apprenticeship Program (grades 9-12)	\$390,924	\$3,313	\$2,127
RESET	STEM Educator Program	\$141,661	\$7,083	Varies by level
SEAP	STEM Apprenticeship Program (grades 9-12)	\$419,955	\$3,717	\$3,152

Unite	STEM Enrichment Program (grades 9-12)	\$662,000	\$1,849	NA
URAP	STEM Apprenticeship Program (undergraduate)	\$246,405	\$4,176	\$2,924

As in previous years (FY14 to FY16), the apprenticeship programs had the highest cost per participant while the competitions were the least costly of the AEOP elements on a per student basis for FY17. The variation in costs between programs is largely due to the cost of participant stipends, which are dependent upon the educational level of the student and duration of the program. Several programs appeared to be more efficient in FY17 than in FY16 based upon their slightly lower cost per student participant in FY17 (CQL, eCM, JSS, Unite).

In regards to participation of the DoDEA and Army/DoD laboratories, there was a 26% increase in student participation (855) compared to FY16 (679 students). Teacher participation decreased (FY17 40 teachers compared to 57 in FY16) from DoDEA schools in the Pacific, Europe and the U.S. that participated in the AEOP through the GEMS, eCM and JSHS program. Additionally, through the AEOP competition programs (eCM, JSHS, JSS) and Unite, the AEOP engaged and collaborated with 242 organizations external to schools and the Army and DoD laboratories (e.g., professional STEM organizations, businesses, Technology Student Association state delegations, etc.).

Number of 2017 Collaborating Schools, Laboratories, Army/DoD S&Es, and Other Organizations								
Program	K-12 Schools		Colleges/Universities (represented by participants or serving as host sites)		Army and DoD Research Labs/Army Agencies	Army-Funded University Labs	Army and DoD Scientists & Engineers (S&Es)	Other Collaborating Organizations
	Total	Title I	Total	HBCU/MIs				
Camp Invention (CII)*	19	17	NA	NA	11	NA	NA	NA
College Qualified Leaders (CQL)	NA	NA	102	4	12	NA	206	NA
eCYBERMISSION (eCM)	776	290	62	NA	46	NA	1,204	12
Gains in the Education of Mathematics and Science (GEMS)	924	315	74	3	15	NA	281	NA
High School Apprenticeship Program (HSAP)	54	15	36	20	NA	36	NA	NA

Junior Science and Humanities Symposium (JSHS)	1,024	378	112	11	37	NA	246	200
Junior Solar Sprint (JSS)	312	92	NA	NA	NA	NA	37	3
Research and Engineering Apprenticeship Program (REAP)	72	46	41	24	NA	NA	NA	NA
Research Experiences for STEM Educators (RESET)	19	10	1	NA	3	NA	6	7
Science and Engineering Apprentice Program (SEAP)	55	14	NA	NA	11	NA	119	NA
Unite	149	110	18	13	2	NA	38	20
University Research Apprenticeship Program (URAP)	NA	NA	39	17	NA	41	NA	NA
<b>Total Sites</b>	<b>3,404</b>	<b>1,287</b>	<b>485</b>	<b>92</b>	<b>NA</b>	<b>NA</b>	<b>163</b>	<b>242</b>

Data for the 2017 AEOP portfolio evaluation were collected and analyzed by Purdue University, the evaluation arm of the Lead Organization (LO) of the AEOP CA, Battelle Memorial Institute. With the support of the AEOP CA Consortium Members, Individual Program Administrators (IPAs), and Government POCs, evaluation studies for the CQL, eCM, GEMS, HSAP, JSHS, JSS, REAP, RESET SEAP, Unite, and URAP programs as well as an alumni evaluation were completed by the Purdue University team.

The FY17 AEOP program evaluation utilized participant questionnaires, 21<sup>st</sup> Century Skill Assessments, as well as focus groups and/or interviews with participants and adults who led educational activities or supervised research projects (herein called mentors). This report summarizes the 2017 evaluation of the AEOP portfolio. Eleven individual program evaluation reports are available under separate cover. Executive summaries for these eleven reports are attached as appendices to this document. This report includes a program overview, evaluation and assessment strategy, study sample, and evaluation findings. The final section offers evidence-based recommendations intended to inform decisions for future program development.

## 4 | Summary of Findings and Recommendations

The 2017 AEOP evaluation collected data about participants, their perceptions of program processes, resources, and activities, and indicators of achievement related to outcomes aligned with AEOP, Federal guidance and program objectives. A summary of findings and recommendations for FY18 are provided.

### 2017 Summary of Findings - Near Term

#### Priority 1: STEM Literate Citizenry

*Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base.*

<p><b>Finding #1</b></p>	<p><b>Growth in Overall Participation and Some Program Participation.</b> In FY17, the AEOPs increased participation overall 6%, from 30,972 in FY16 to a total of 32,947 participants in STEM programs, STEM competitions, and STEM apprenticeship programs. This increase reflects outcomes of increased investments in marketing and promoting AEOPs through a variety of methods at local, state, and national levels and reverses a three-year downward trend from enrollments of 41,802 in FY14, 38,039 in FY15, and 30,972 in FY16 respectively. Programs that experienced participation increases in FY17 include: CII 17% growth (1,425 compared to 1,185 in FY16); eCM 3% growth (21,277 compared to 20,607 in FY16); GEMS 15% growth (2,845 compared to 2,427 in FY16); JSHS 5% growth (5,577 compared to 5,300 in FY16); JSS 34% growth (892 compared to 585 in FY16); Unite 21% growth (358 compared to 282 in FY16); URAP 12% growth (59 compared to 52 in FY16). JSHS and JSS reversed a downward trend in enrollment in FY17. It is important to note that in previous years, prior to the implementation of the use of the Cvent online registration system, most of AEOP program participation data were self-reported.</p>
<p><b>Finding #2</b></p>	<p><b>Decline in Participation for Most Apprenticeship Programs.</b> Despite overall growth in participation and some growth for programs mentioned in Finding #1, the remaining four apprenticeship programs stayed the same or experienced a decline in participation for FY17. CQL 3% decrease (229 compared to 236 in FY16); HSAP 17% decrease (54 compared to 65 in FY16); REAP 2% decrease (118 compared to 120 in FY16); and SEAP stayed the same at 113 for FY17 and FY16.</p>
<p><b>Finding #3</b></p>	<p><b>Three-Year High Number of Applications to Participate in AEOPs – However, Placement Rates Declined in FY17 for some AEOPs.</b> The overall placement rates across AEOPs decreased from 83% from FY16 to 68% in FY17, despite a three-year high number of applications submitted to participate in AEOPs. For FY17, there were 46,518 applications, an increase of 20% over the 37,399 applications received in FY16 and a 4% increase over the number of applications received in FY15 when 44,632 applications were received. As a result of the increasing number of applications, apprenticeship programs have experienced a downward trend in placement rates due to limitations in funding and availability of placements/mentors. CQL placed 41% of applicants in FY17, as compared to 51% in FY16; HSAP placed 9% of applicants in FY17 as compared to 18% in FY16; REAP placed 17% of applicants as compared to 25% in FY16; URAP placed 9% of applicants in</p>

	<p>FY17 as compared to 29% in FY16; and SEAP placed 13% of applicants as compared to 16% in FY16. However, placement rates grew slightly for STEM enrichment activities. GEMS placement increased from 55% in FY16 to 61% in FY17 and Unite enrollment grew from 41% in FY16 to 45% in FY17. Acceptance rates for STEM enrichment programs increased in FY17 (61% GEMS, 38% Unite) as compared to FY16 when 55% of GEMS applicants and 41% of Unite applicants were selected for these programs. eCM continued to accept all applicants in FY17 to participate in the program, as in previous years. The JSHS competition does have restricted participation due to regional capacities. However, JSHS increased placements to 65% in FY17 compared to 60% in FY16.</p>
<b>Finding #4</b>	<p><b>AEOPs Continued to Serve Underserved Populations.</b> The AEOPs continued to prioritize the participation of students from traditionally underserved groups, per the AEOP definition: <i>AEOP's definition of underserved includes at least two of the following: low-income students; students belonging to race and ethnic minorities that are historically underrepresented in STEM; students with disabilities; students with English as a second language; first-generation college students; students in rural, frontier, or other federally targeted outreach schools; females in certain STEM fields.</i></p> <p>As reported by AEOPs, apprenticeship programs included 38% of underserved students in their total population. CII achieved 100%, while Unite registered 65% and REAP 54% respectively. The next highest enrollment of underserved students was eCM with 45%. GEMS and JSS both had 29% participation of underserved students. All remaining programs had 19% or less underserved participation – with CQL and SEAP having the lowest percentages at 6%. Others included: HSAP (19%); JSHS (19%); and URAP (8%).</p>
<b>Finding #5</b>	<p><b>Participants reported engaging in STEM practices significantly more in their AEOP programs as compared to in their typical school experiences for each program.</b> Evaluation findings indicated that AEOPs consistently provided opportunities for participants to engage in authentic STEM activities that are significantly more intensive than those they experience in their typical school settings.</p>
<b>Finding #6</b>	<p><b>Participants reported increased STEM competencies, STEM skills, STEM knowledge, STEM practices, and confidence in STEM after participating in AEOPs.</b> The programs with the highest level of agreement (some gain to large gain) with growth in 21<sup>st</sup> Century STEM Skills; STEM Knowledge; and STEM practices after participation included: CQL, eCM, GEMS, HSAP, JSHS, REAP, SEAP, Unite, and URAP. Participants from all programs indicated some to a large gain in their STEM identity after participation. Participants from CQL, eCM NJ&amp;EE, GEMS, HSAP, REAP, SEAP, Unite, and URAP reported 90% or higher agreement with the statement “I am more confident in my STEM knowledge, skills, and abilities” after participating in the AEOPs.</p>
<b>Finding #7</b>	<p><b>Participants demonstrated increased attainment toward mastery of the 21<sup>st</sup> Century Skills across their participation in the AEOPs in the FY17 pilot of the assessment.</b> Participants from apprenticeship programs (REAP, URAP, HSAP) and STEM enrichment program Unite demonstrated growth in all areas of the 21<sup>st</sup> Century Skills Assessment from baseline (first days of program) to end of program. Participants exhibited growth in Creativity &amp; Innovation; Critical Thinking &amp; Problem Solving; Communication, Collaboration, and Social and Cross-Cultural Skills; Information, Media, &amp; Technological Literacy; Flexibility, Adaptability, Initiative, &amp; Self-Direction; Productivity, Accountability, Leadership, &amp; Responsibility.</p>

<p><b>Finding #8</b></p>	<p><b>Participants reported positive attitudes toward Army/DoD STEM Research.</b> AEOP participants in CQL, eCM NJ&amp;EE, GEMS, HSAP, REAP, SEAP, Unite, and URAP reported 75% or more agreement with the statements: “DoD researchers advance science and engineering fields”, “DoD researchers develop new cutting-edge technologies”, “DoD researchers solve real-world problems”, and “DoD research is valuable to society”. Programs that reported less than 75% agreement with the statements included JSHS, JSS, and eCM (regional).</p>
<p><b>Finding #9</b></p>	<p><b>Evaluation findings indicated that the AEOP exposed participants to STEM careers generally and to Army and DoD STEM careers, and participating in AEOPs increased their interest in pursuing STEM careers.</b> A majority of participants (range of 53%-97%) in CQL, eCM National, GEMS, HSAP, JSHS, REAP, SEAP, and Unite reported learning about 3 or more STEM careers. Fewer students (range of 32%-44%) in eCM Regional, JSS, and URAP had learned about 3 or more STEM careers. In regards to specific DoD STEM Careers, participants reported less exposure in FY17 AEOPs than to STEM careers overall. However, a majority of students (range of 64%-84%) in all programs except for eCM Regional (39%) were more interested in pursuing STEM careers after their AEOP participation and more than half of responding apprentices reported interest in DoD STEM careers in FY17 (range of 66%-87%).</p>
<p><b>Priority 2: STEM Savvy Educators</b> <i>Support and empower educators with unique Army research and technology resources.</i></p>	
<p><b>Finding #1</b></p>	<p><b>Adult participants (i.e. mentors, S&amp;E’s, Team Advisors, teachers) reported use of effective mentoring strategies in varying degrees across the AEOPs in FY17.</b> Strategies to engage students in authentic STEM activities (range of 82%-94%) were used most frequently, while strategies to support participants STEM educational and career pathways (range of 47%-69%) were used the least. A majority of all adults (range of 63%-86%) reported using strategies to support the needs of diverse students as learners. Further, a large majority of adults (82%-94%) reported the use of authentic STEM activities.</p>
<p><b>Finding #2</b></p>	<p><b>In FY17, participants continued to be satisfied with the support received from their mentor/S&amp;E/Team Advisor/teacher.</b> Most apprentices and students in all programs reported high levels of satisfaction with the mentorship they received and the quality of instruction they received (range of 62%-84%). The levels of satisfaction for several programs, CQL, GEMS, REAP, SEAP, and Unite, were somewhat lower than those reported in FY16, however levels satisfaction in HSAP and URAP were higher than in FY16. Overall, the percentage of satisfaction with instruction or mentorship in FY17 was very similar to that reported in FY16 (range of 62%-83%).</p>
<p><b>Priority 3: Sustainable Infrastructure</b> <i>Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.</i></p>	
<p><b>Finding #1</b></p>	<p><b>The primary means of learning about AEOPs and associated opportunities in FY17 continues to be personal connections, school/university connections, past participants, or someone connected directly with AEOPs.</b> A continued strength of AEOP is the expansive network of connections to local communities that serves as a continued means of recruitment for the program. Overwhelmingly, participants and mentors reported that AEOP social media, AEOP website, and other materials were much less frequently used as a means for introducing them to the program.</p>



Finding #2	<p><b>Despite limited awareness of participants and mentors of the full AEOP and DoD/Army portfolio of opportunities, FY17 participants reported interest in continuing on to participate in another AEOP in the future.</b> Some individual programs made progress in FY17 in increasing awareness of AEOP programs overall. However, participants in some programs were not aware of other opportunities within AEOP.</p>
Finding #3	<p><b>Participation in the AEOP evaluation in FY17 improved for apprentices/students in most programs. Mentor/adult questionnaire completion is still less than desired.</b> Programs including CQL, eCM NJ&amp;EE, GEMS, HSAP, REAP, SEAP, URAP, Unite all improved apprentice/student participation in FY17 – reaching 46% to 94% response rate. Mentors from HSAP, REAP, and URAP also achieved acceptable return rates.</p>

## 2017 Summary of Findings - Mid to Long Term

### Priority 1: STEM Literate Citizenry

*Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base.*

Finding #1	<p><b>AEOP alumni indicated interest in pursuing a STEM degree and career.</b> A majority of alumni participating in the survey indicated they were both interested in earning a STEM degree (88%) and pursuing a STEM career (88%).</p>
Finding #2	<p><b>Alumni are interested in completing additional elective STEM courses and other STEM opportunities.</b> More than three-quarters of alumni reported interest in taking elective STEM courses (80%), learning about new things in STEM (83%), and potential STEM projects/experiments in a university or professional setting (87%).</p>
Finding #3	<p><b>AEOP Alumni continue to be engaged in STEM.</b> Nearly three-quarters or more of alumni reported sometimes or frequently engaging in activities such as: learning about new things in STEM (88%), talking with family and friends about STEM (75%), and solving math/science puzzles (73%).</p>
Finding #4	<p><b>Alumni hold positive views toward STEM generally and Army/DoD STEM specifically.</b> Over 80% of AEOP alumni believe that all people can be successful in STEM. Alumni report agreement with the following statements: <i>I enjoy solving real-world problems</i> (97%); <i>STEM careers are a good fit with my interests</i> (97%), <i>I feel successful in STEM classes</i> (95%), and <i>I can use STEM to help improve my community</i> (95%). In regards to Army/DoD STEM attitudes specifically, 95% percent or more of alumni indicated feeling Army/DoD research is valuable to society, 97% agree that the Army/DoD solves real-world problems, as well as develops new, cutting edge technologies.</p>
Finding #5	<p><b>Alumni report interest in STEM careers generally, as well as with the Army/DoD specifically.</b> Nearly all alumni reported being interested in pursuing a STEM career (93%) in general. Three-quarters indicated they were aware of Army/DoD STEM careers (75%), and 82% of alumni indicated they would be interested in learning more about Army/DoD STEM careers. Approximately two-thirds (64%) of alumni were interested in pursuing an Army/DoD STEM career at the present time.</p>

<b>Finding #6</b>	<b>35% of AEOP Alumni reported enrollment in a STEM degree program.</b> Engineering was the highest enrolled field (11%), followed by medicine (7%), life science (6%), physical science (5%), mathematics or statistics and technology or computer science (2% each respectively), followed by Earth science and business (1% each respectively) and other 4%.
<b>Priority 2: STEM Savvy Educators</b> <i>Support and empower educators with unique Army research and technology resources.</i>	
<b>Finding #1</b>	<b>Participants reported very positive impacts of their mentors and agreed mentoring is a valuable aspect of AEOPs.</b> Many alumni also believed their AEOP mentor helped influence their future academic career decisions (83%), and helped them learn about Army/DoD careers (78%). While the reported mentoring relationships appeared to be strong, nearly half indicated they have stayed in touch with their AEOP mentor after the program (43%).
<b>Priority 3: Sustainable Infrastructure</b> <i>Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.</i>	
<b>Finding #1</b>	<b>Alumni reported strong interest in participating in other AEOPs, though less than 60% indicated they were familiar with other AEOPs.</b> In fact, 80% of alumni who responded to the mid to long term evaluation questionnaire indicated interest in future participation.

## What AEOP Participants are saying.....

*“I have had a fantastic experience [in **CQL**]. I owe a lot to my mentors who guided me every step of the way. Thanks to them, I have had the opportunity of publishing scientific articles, giving talks at conferences, and performing cutting edge research. I recently was accepted into graduate school for Ph.D. studies and I believe a major part of my acceptance was the experience I gained from this program.” --CQL Apprentice*

*“[**CQL**] provides full immersion of students into nonacademic labs to gain further experience in STEM programs to understand other available professional paths. It is an excellent summer program and I wish I had participated when I was in college.” --CQL Mentor*

*“I never really thought of pursuing STEM because it seemed like a job where you had to sit behind a desk and type on a computer...After doing **eCM** and talking to the Army officers and everyone, it makes it seem like there are so many more opportunities.” --eCM-NJ&EE Student*

*“I think the [**eCM**] program is so well organized and it’s got so many resources that I can get a group of sixth grader to stick with a topic and work on a project for almost an entire year... it’s very open-ended and they get to pick a topic. It’s part of their community. They feel that direct connection. They take ownership for what they’re doing. They become experts in what they’re doing. They develop patience. They’re collaborating. They’re managing time. Their developing all of these skills, I think, is invaluable.” --eCM Adult Participant*

*“[In **GEMS**], you get to meet people who do the jobs and hear their side of the story about what the [jobs are like] that you may be considering going in to.” --GEMS Student*

*“[GEMS] kids are able to learn principles and apply them immediately, as opposed to the typical classroom setting where they would learn something but not get the direct application. They’re able to conceptualize how it would happen in the real world as well as what skill sets they could use in a career” --GEMS Mentor*

*“I am very impressed by every single hard-working researcher in our group. Each of them contributed to my learning experience and were always willing to address any questions I had. I am especially thankful for my mentor, who worked closely with every day and helped me discover all the theories behind our optical pressure sensor research project. He ensured that I always had the opportunity to involve myself in cutting-edge research and allowed me to make the most of my **HSAP** experience. I was exposed to areas of the engineering world, such as resonances, semiconductor fabrication process, and so much more, that I never knew existed. I am endlessly grateful for AEOP for this eye-opening opportunity, and I am confident that this experience will lead me to unimaginable paths and direct my future for the better.” --HSAP Apprentice*

*“I am very happy with the three excellent **HSAP** students worked in my lab not only for the work they have done (two manuscripts in preparation with them as co-authors), but also their passions and hard works in learning. I could see the changes in them within this short 8 weeks of lab experience and all three will pursue STEM in college (Physics, Engineering and pre-med).” --HSAP Mentor*

*“I realized how much I love my research project and understanding how the universe [works], so I've decided to go into theoretical physics instead of computer science. I changed my mind after being inspired by the Nobel Laureate and speaking with **JSHS** alumni on Saturday morning.” --N-JSHS Student*

*“**JSHS** is a wonderful competition and symposium. It is worthwhile for all students that participate; regardless if chosen to present or move on to national level.” --JSHS Mentor*

*“I am very pleased with my **JSS** experience. It taught me so many things and made me confident in complicated scenarios. All of the people I met and my mentors helped me out so much. I loved my experience and had a great time.” --JSS National Student*

*“For [students in **JSS**] to have an opportunity to go and do something – fail at it, do well at it, or whatever – and then be pushed the next year to learn from those experiences, that is what life is all about.” --JSS Mentor*

*“I am extremely satisfied with [**REAP**]. I have learned a lot in very little time, and the program has definitely increased my interest in STEM! I also appreciate and respect the inclusion of minority groups in STEM. As a Hispanic woman, I know my demographic is vastly underrepresented in STEM careers, and it is very important that we change that. I very much enjoy being a part of this program and definitely will apply again next year. Thank you so much for allowing me to participate; **REAP** has definitely changed my life for the better!” --REAP Apprentice*

*“The [**REAP**] students were all brilliant, and we grew as a group over the summer. The students furthered my interest in research by helping me understand problems from different points of view.” --REAP Mentor*

*“My [**SEAP**] mentor was very helpful throughout the entire process and worked with me through every step. He helped me understand science concepts relating to my project and taught me various lab skills. Overall, the program was very beneficial and has allowed me to expand my knowledge in the areas relating to the STEM field.” --SEAP Apprentice*

*“The **SEAP** program was simple and provided a great opportunity for the student to learn more about Engineering and research prior to beginning a degree program in Mechanical Engineering. As a PhD researcher in engineering, I wish I had been afforded a similar opportunity. The program is a great way for the Army and ERDC to market ourselves to the community, gain summer help from eager students, and continue to build a pool of recruits for the future.” --SEAP Mentor*

*“I loved [**Unite**]. It was the perfect mix of learning and fun. Also, it was amazing to meet so many people also interested in similar topics. Over all it has helped me narrow down my career choices as it showed me what interests and skills I have in various forms of engineering.” --Unite Student*

*“This year my **Unite** experience was excellent! The curriculum that was designed strongly supported the goals of the program and there was clear growth and development in the participants from the beginning of the program to the end of the program. We incorporated several enrichment components that allowed students to explore their creativity, build teamwork and effective communication skills, improve their math and problem-solving abilities, and gain valuable knowledge about STEM careers.” --Unite Mentor*

*“The [**URAP**] apprenticeship program was one of the most inspiring and challenging experiences I have had as an engineering student. It will help me to grow as a Mechanical Engineer and also to be a scientist. I learned that we should not be afraid to be wrong during experiments. Not only is knowledge important, but patience, imagination, and creativity are important, too. I would love to be in a program like this again.” --URAP Apprentice*

*“[**URAP**] is very beneficial for undergraduate students interesting in exploring STEM research. This also gives them a chance to think and work independently, as well as in collaboration with other researchers, thereby preparing them for a future career in STEM research.” --URAP Mentor*

## **Recommendations for FY18 Program Improvement/Growth**

While the successes for AEOP detailed above are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY18 and beyond.

### **AEOP Priority: Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base**

**Increase and broaden participation in selected AEOP programs.** In FY17, AEOP experienced a 6% growth in participation, increasing to nearly 33,000 participants. The positive momentum should be catalyzed moving in to FY18. It is recommended that additional resources and efforts be expended in regards to eCM and JSBS specifically. Both of these programs produced growth in participation this year. eCM has the flexibility within the e-model to grow participation relatively easily. JSBS has large (~3,000 applications in Cvent alone in FY17) unmet need that could be transformed into additional participation if infrastructure is in place to accommodate more participants. This is likely just a percentage of the actual number of applications, as only 72% of the overall total JSBS regions used Cvent for registration in FY17. Cvent captured only 2,435 of the 5,577 students reported. It is suggested that these programs examine

strategies that programs such as Unite and JSS have used to produce growth in FY17 (over 20%). AEOPs should continue to work to grow the percentage and number of underserved students who are participating in the program. Unite, REAP and JSS can serve as potential models for the consortium of how to achieve this in a more rapid and impactful manner.

**Examine means for increasing infrastructure to grow placement rates in JSHS and apprenticeship programs.** An important first step in examining strategies to increase enrollment for AEOP overall may be to take a look at the current unmet need and demand for programs within the portfolio that may not have the infrastructure (personnel and resources) to be able to accommodate additional participants. Any potential resources that may be redirected in the way of these programs, or from other potential future proceeds, could be used to translate into increased participation in FY18.

**Strengthen programs ability to impact STEM outcomes and awareness of DoD/AEOP.** In FY17, most programs had significant impacts on STEM outcomes and awareness for participants. Two of the AEOPs that did not produce as large of gains as the others were JSS and eCM NJ&EE. It is recommended that the AEOP examine the format, delivery, and feedback from these programs in partnership with the other partners to determine how there could be improvement in this area in FY18 and beyond.

**Continue to examine impact of AEOP participation on growth in skills beyond self-reports.** The FY17 pilot of the 21<sup>st</sup> Century Skills Assessment has provided a powerful glimpse into the significant impact that AEOP participation is having on extended-time programs (more than one-week in duration) including some of the apprenticeship programs and Unite. In FY18, the AEOP should continue to build upon this pilot to consider ways to implement a similar measure with other programs that have more sporadic or intermittent (not multiple-day) frequency. True independently assessed growth (not self-reported by the participant) in skills provides a more accurate measure of impact on skills and knowledge than self-reporting. However, self-reports (questionnaires) also serve as a data point that reveals participants attitudinal and interest data as well as their perceptions of growth in skills and knowledge.

**AEOP Priority: Support and empower educators with unique Army research and technology resources**

**Continue to focus on strengthening role of adults in mentoring and instruction.** In FY17, there was considerable improvement in the support of mentor use of effective mentoring strategies within and across AEOPs, in part due to increased focus and investment of AEOP to the findings of the FY16 evaluation. However, there is still room for more growth, as reported use of effective strategies still remains less than 50% for some programs and strategy areas. This is an area that should continue to be a key component of the continued efforts to provide more resources, onboarding, and potential mentoring (of mentors) to continue to make even greater impacts on student desired outcomes of the AEOP.

**Grow adult and youth participant awareness through support and innovative programming from AEOPs.** An area of concern that was prevalent across the majority of AEOPs in FY17 was the persistence of lack of information availability and/or utilization regarding AEOPs, as well as Army/DoD opportunities and information by mentors and/or adults leading programs. While we are cognizant of the increased

focus this area has received over the past couple of years, it appears that mentors need more support and/or resources/programming/speakers/etc. to provide to students in multiple modes so that participants become more deeply aware of AEOPs, and Army/DoD opportunities. It is recommended that the AEOP examine best-in-class practices such as what eCM NJ&EE uses and consider scaling-up effective strategies across the consortium.

### AEOP Priority: Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army

**Expand reach of AEOP marketing, recruitment strategies beyond current local networks.** Over the past three years of the AEOP evaluation, it has become increasingly clear that the portfolio has a vibrant, grass-roots network that has served the AEOP very well in the past and currently. It is important to note how difficult it often is to get deeply rooted within local contexts and communities to be able to produce such powerful networking and recruitment efforts year after year. However, it is the time to look to go beyond these networks to reach out to tap underserved populations that have little to no awareness of the outstanding opportunities that await them within the AEOP. This is not to say that the current AEOP network be disregarded – it should continue to be nurtured and leveraged. It is recommended that the consortium work to develop, at a minimum, a targeted plan for outreach and participation for FY18. The consortium began this work with the integration of Strategic Outreach Partners in FY16 and continued in FY17. To date 15 organizations have received funding to work with the AEOP to broaden participation through outreach to underserved communities. Additionally, in FY17 eCM awarded mini-grants to 183 team advisors to support participation in the program. Nearly 100 of those awards were to teachers at Title One schools. Potentially some of the strategic partners should be filling this role to help expand the reach of AEOP.