IT STARTS HERE.

2014 YEAR IN REVIEW

ARMY EDUCATIONAL OUTREACH PROGRAM

The United States Army has long recognized that a scientifically and technologically literate citizenry is our nation's best hope for a secure, rewarding, and successful future. For over 50 years, the Army has supported a wide range of educational opportunities in science, technology engineering, and mathematics (STEM) for our youth and valued teachers.

The need for STEM literacy – the ability to understand and apply concepts from science, technology, engineering and mathematics in order to solve our nation's most complex problems – is growing exponentially. The requirement for STEM literacy goes beyond the traditional STEM occupations of scientist, engineer and mathematician. The Army also has a growing need for highly qualified, STEM-literate technicians and skilled workers in advanced manufacturing, logistics, management and other technology-driven fields. Success and sustainment for the Army's Science & Technology Enterprise heavily depends on the continuous development of innovative solutions that protect the Army's greatest asset – our Soldier – and our nation, against current and emerging threats.

Through AEOP, the Army continues its long tradition and strong commitment to the advancement of STEM education and literacy. Leveraging its most valuable assets – world-class scientists and engineers and research facilities – AEOP offers our nation's youth and teachers a collaborative, cohesive portfolio of opportunities that effectively engage future workforce generations in meaningful, real-world STEM experiences, competitions and paid internships.

The Army, along with our academic and industry partners, is pleased to present its 2014 Annual AEOP Report, showcasing the collective program outcomes across its STEM education portfolio over the course of the past year!

Mary J. Miller, Deputy Assistant Secretary of the Army (Research and Technology)

AEOP IMPACT BY THE NUMBERS

The Army is committed to ensuring maximum impact and effectiveness of the AEOP STEM programs. In an effort to ensure continued relevancy and to increase program participation, the AEOP conducts comprehensive program evaluations on an annual basis as a critical element to its program management, planning and execution.

AEOP's 2014 Evaluation Reports are publicly available at: www.usaeop.com/about/our-impact/

9,970 Adults participated in AEOP programs. Teachers, mentors, volunteers and Army scientists and engineers contributed their experience and expertise to the enrichment of AEOP programs.

41,802 Students were placed in programs across the AEOP portfolio. Students from elementary school through college applied and were selected to participate in a wide array of AEOP programs consisting of apprenticeships, STEM enhancement activities and competitions.

585 Students were awarded AEOP apprenticeships at various Army research laboratories and university partners. They had the opportunity to contribute to authentic research projects and to immerse themselves in a real-world laboratory setting.

27% Title I Schools out of 2,918 K-12 Schools that participated in AEOP programs brought Army-sponsored STEM opportunities to underserved student populations.

100% of HSAP students indicated that they are more confident in their STEM knowledge, skills, and abilities.

1,216 Army and DoD scientists and engineers contributed their knowledge and expertise to AEOP programs, engaged students and teachers in cutting-edge research, and exposed them to STEM careers across the Army and DoD.

$1 MIL in Scholarships and Incentive Awards were awarded to middle and high school students who presented their research findings in AEOP competitions and made it to the top.

81% of GEMS students indicated that they are more interested in pursuing a STEM career.

$4.2 MIL in Apprenticeship Stipends were issued to high school students in SEAP, REAP and HSAP and to college students in CQL and URAP in recognition of their research achievements.

More than **95%** of the students in REAP and UNITE were from groups that are historically underserved and under-represented in STEM.

85% of eCYBERMISSION students reported being very confident or confident in coming up with creative solutions to a problem.

AEOP PARTNERS

Through AEOP, the Army partners with academia, industry, not-for-profit organizations and other government agencies to effectively engage, inspire and attract the next generation of STEM talent through K-college programs and expose them to DoD STEM career opportunities.

GOVERNMENT

ASA (ALT) – Assistant Secretary of the Army for Acquisition, Logistics and Technology
AMC / RDECOM – Army Materiel Command / Research, Development and Engineering Command
USACE / ERDC - US Army Corps of Engineers / Engineer Research and Development Center
MRMC - Army Medical Research and Materiel Command
USMA - United States Military Academy
DoDEA - DoD Education Activity

ACADEMIA

VT - Virginia Tech
UNH - University of New Hampshire

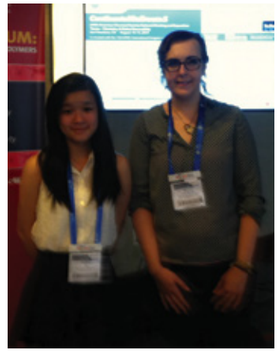
NOT FOR PROFIT ORGANIZATIONS

NSTA - National Science Teachers Association
ASEE - American Society of Engineering Education
TSA - Technology Student Association
AAS - Academy of Applied Science

> **We celebrate innovation, but before we can do that we have to nurture it. We have to invest in the minds of our future leaders and we have to do it collaboratively with our academic and industry partners.**
>
> Jagadeesh Pamulapati, Ph.D., Director for Integration and Laboratory Management Policy, Office of the Deputy Assistant Secretary of the Army for Research and Technology

> **I couldn't believe my eyes when less than a month later I received an email from the ACS saying that my abstract had been accepted.**
>
> **Phoebe Hu**

STEM FILES



NAME: Phoebe Hu
HOME STATE: Michigan
PROGRAM: REAP

Phoebe Hu, a high school student from Michigan, presented her original research to acclaimed university professors and researchers at the 248th American Chemical Society (ACS) National Meeting and Exposition in San Francisco, Calif.

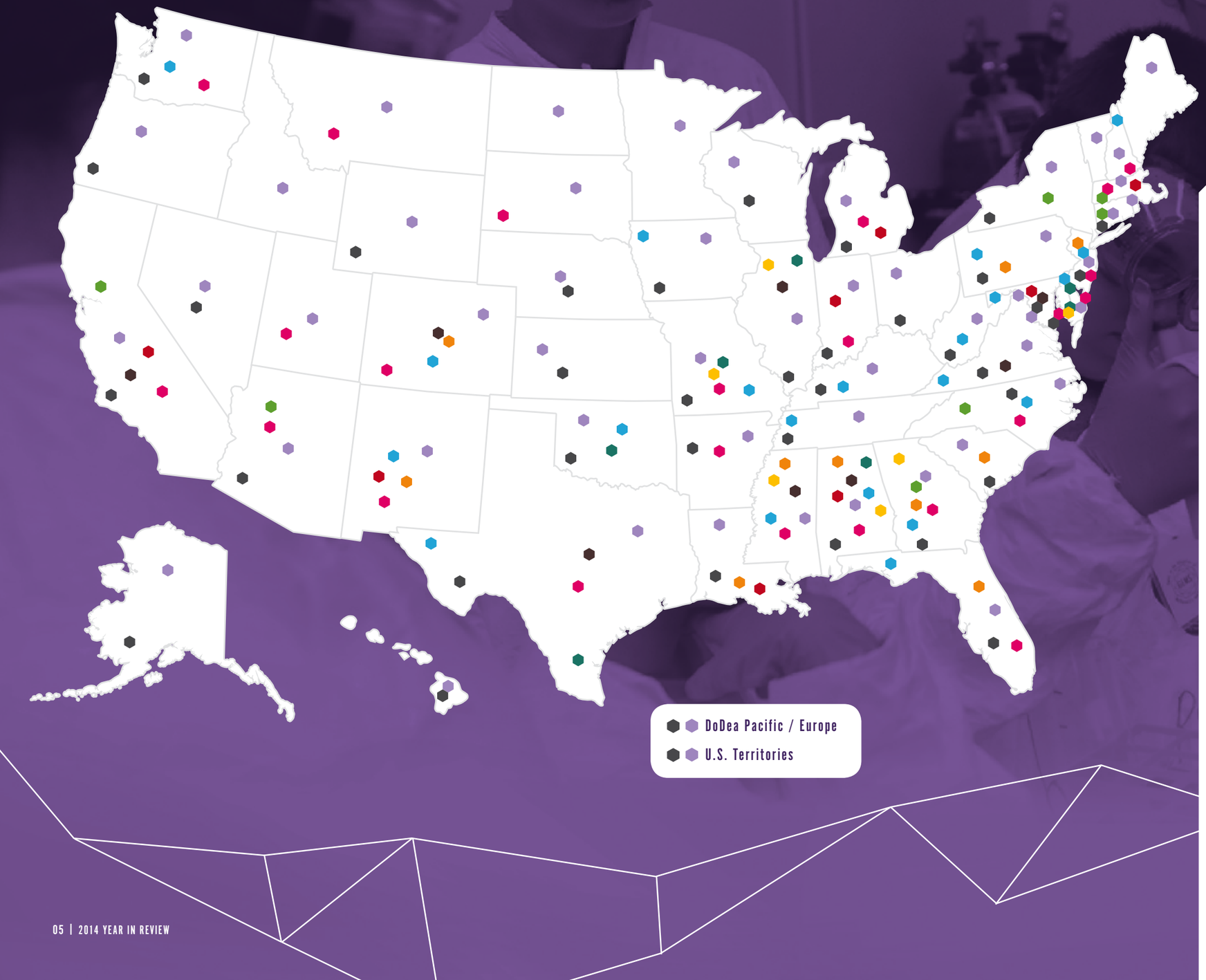
Hu completed this advanced-level research with support from the U.S. Army Educational Outreach Program (AEOP)'s Research and Engineering Apprenticeship Program (REAP). Hu worked in the biomedical lab through REAP at Michigan Technological University (MTU) and collected significant data under the guidance of her mentor, Dr. Megan Frost who is a part of the Biomedical Engineering Department and Materials Science and Engineering department at MTU. Hu wrote an abstract for the "Development of Biodegradable SNAP/PLLA Particles for Local Nitric Oxide (NO) Delivery." With her mentor's help, she submitted the abstract to ACS, hoping it would be accepted and that she could earn a spot as a presenter at their 248th national convention in San Francisco.

"At that point, I didn't have high hopes," Hu said. "I was a high school student, nearly half the age of most of the other presenters. I was inexperienced, less prepared, and my confidence level was almost rock bottom. I couldn't believe my eyes when less than a month later I received an email from the ACS saying that my abstract had been accepted." REAP is a summer STEM program that gives talented high school students, from historically under-represented and undeserved groups, the opportunity to experience research apprenticeships at area colleges and universities. Students in REAP work under the direct supervision of a mentor on a research project. Participants work 5-8 weeks exposed to the real world of research, gain valuable mentorship, and learn about career opportunities in STEM. The mixture of research experience and mentorship was important for Hu. From a young age, she knew she had a passion for making an impact in the lives of others and wanted to become a doctor. After working in the biomedical lab, Hu had more confidence in her knowledge and discovered her ultimate dream: to work permanently in an environment similar to the one at MTU. Although she had worries of being accepted by the college students in this program because of her age, she was welcomed and quickly realized that those who work behind the scenes in labs are just as impactful as doctors and people in the field.

"The acceptance letter was two-sided, though," Hu said. "It represented the fact that I'd reached my goal of presenting my research at the meeting, but I didn't have the monetary means to travel from Michigan to California." With the help of Renie O'Mara, director of REAP, and Jill Malcom Academy of Applied Science Development Director, Hu appealed to Dr. Sheldon Apsell and Toby Kusmer, Esq., board members of AAS, who donated the funds she needed to travel.

After much perseverance and commitment, Hu's presentation in San Francisco makes her one step closer to fulfilling her dream. She continuously expresses gratitude to all who helped her reach her goal. ★

AEOP'S EXPANSIVE REACH



STUDENT PARTICIPANTS // PROGRAMS

860 **CAMP INVENTION INITIATIVE** // K - 5th Grade // A summer STEM enrichment experience using the problem-based learning approach in which students participate in fun, hands-on STEM activities.

891 **JSS** // 5th - 8th Grade // Junior Solar Sprint is an inquiry-based engineering challenge in which students design, build, and race model solar cars.

29,682 **ECYBERMISSION** // 6th - 9th Grade // A web-based STEM competition in which students use either best scientific practices or the engineering design process to propose a solution to a real problem in their communities.

2,095 **GEMS** // 5th - 12th Grade // Gains in the Education of Mathematics & Science is a summer STEM program that provides students with hands-on learning experiences alongside Army scientists and engineers and student mentors in world class Army research laboratories.

280 **UNITE** // 9th - 12th Grade // A summer engineering program that provides high school students historically underserved in STEM with a hands-on academic and enrichment experience.

7,409 **JSHS** // 9th - 12th Grade // The Junior Science & Humanities Symposium promotes the original research of high school students, and provides recognition and awards for their research pursuits in STEM areas.

APPRENTICESHIPS // High School & Undergraduate // Provides students with hands-on research experiences in both military laboratory and university laboratory settings, while conducting real-world research and being mentored by senior Army, or Army-sponsored researchers.

10 **HSAP** // High School Apprenticeship Program

92 **SEAP** // Science and Engineering Apprentice Program

307 **CQL** // College Qualified Leaders Program

117 **REAP** // Research and Engineering Apprenticeship Program

59 **URAP** // Undergraduate Apprenticeship Program

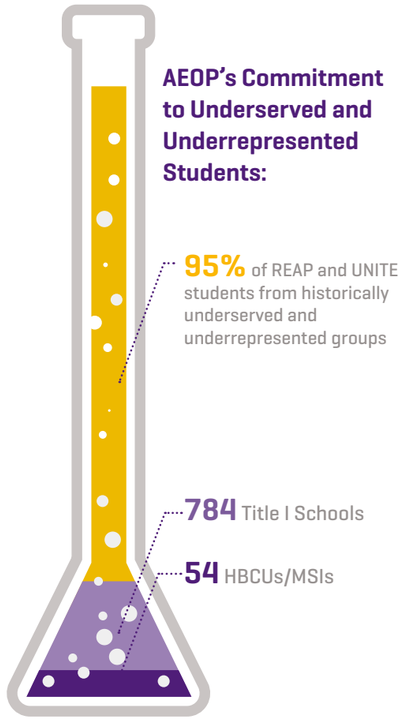
"My [CQL] mentors were very helpful, and I learned so much from them in the one-on-one setting that I got to work in. The hands-on experience was incredible. I got to use equipment that I could only look at in catalogs before my internship... I am very thankful for this internship and I feel like it has contributed a lot to my overall engineering education."

- CQL Apprentice

AEOP PERIODIC TABLE OF IMPACT

51,772

Program participants, to include K-12 students, teachers, Army scientists and engineers, mentors, volunteers and Army scientists and engineers, engaged in programs across the AEOP portfolio.



AEOP's Commitment to Underserved and Underrepresented Students:

95% of REAP and UNITE students from historically underserved and underrepresented groups

784 Title I Schools

54 HBCUs/MSIs

72%

of eCYBERMISSION indicated that "strengthening participants' STEM knowledge and skills" describes the eCM experience very well.

88%

of URAP students reported a large or extreme gain in feeling responsible for a STEM project or activity.

"I really enjoyed my summer with the SEAP program. I not only learned a lot about the field my mentor does research in, but I also learned what it is like working in a lab and being part of the scientific community. My mentor has encouraged me to submit my research to a scientific journal for high school students, so she is helping me to write it and go through the process. I think submitting my work to a journal will be a great experience and a great accomplishment. I also discovered exactly what it's like to work in a lab, and I was never really sure what this would be like before SEAP."

– SEAP Student

97%

of National JSHS participants indicated that they are more aware of DoD STEM research and careers.

74%

of CQL students indicated being more interested in pursuing a STEM career with the DoD.

2,375

Students experienced the application of real-world STEM concepts during hands-on summer STEM enrichment activities in AEOP's GEMS and UNITE programs.

"[JSHS] gave me confidence in public speaking. I learned so much from other's research and met amazing new people from all across the country. I learned the technical aspects of presenting research, writing technical papers and effectively communicating my research to the public." - JSHS Student

54

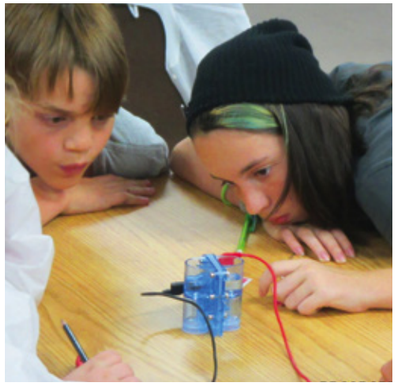
HBCUs/MSIs partnered with AEOP and hosted STEM apprenticeship programs, enrichment activities and competitions. Collaborating with HBCUs/MSIs is part of AEOP's concerted effort to engage underserved and underrepresented students in its programs.

100

Colleges/Universities partnered with AEOP and hosted STEM apprenticeship programs, enrichment activities and competitions.

47

DoDDS schools, 982 DoDDS students and 71 DoDDS teachers participated in AEOP programs through eCM, JSHS and GEMS. AEOP plans to continue and expand its collaboration with DoDEA in hopes to increase its reach to military dependents in the U.S. and overseas.



64%

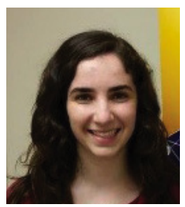
of JSS students indicated that JSS made them more aware of AEOP programs, and 60% credited JSS with increasing their interest in participating in other programs.

"Above all, I am really enthusiastic knowing that the work I'm doing could contribute to real life situations. It feels great knowing that the research that I'm working on could help people in the world. While I continue to have a never ending passion for STEM learning, HSAP has made me grow more interested in STEM learning."

- HSAP Apprentice

The Army offers a unique, hands on STEM experience to AEOP participants working alongside the nation's best and brightest scientists and engineers in world class research facilities.

STEM FILES



NAME: Emily Ashkin
HOME STATE: North Carolina
PROGRAM: eCYBERMISSION / JSHS

Emily Ashkin of Providence Day School in Charlotte, North Carolina, presented original research - A Novel Synergistic Approach for Enhancing Immunotherapy in the Treatment of Melanoma- at the 53rd National JSHS in the Medicine & Health category.

Emily is an alumna of the Army Educational Outreach Program (AEOP) having received a 1st place award for her 8th grade project at the 2010-11 eCYBERMISSION competition. Emily's team, "Team Charger4" came away with $3,000 in U.S. Series EE Savings Bonds per student for creating an inexpensive and easily accessible way to improve unsanitary water conditions in underdeveloped countries, testing a water purification system using the process of reverse osmosis. The team's results showed that their purification system filtered out large particles, reduced turbidity levels and increased to the pH level to a value closer to pure water.

Emily said her experience at AEOP's eCYBERMISSION was the first time she was exposed to the "science fair" world. It opened her eyes to the incredible opportunities that the Army has to offer, and to what opportunities that can come from having a passion.

> **"I wouldn't be where I am today if it weren't for AEOP. With eCYBERMISSION I was invited to the White House Science Fair, and that was the first time that I really got to interact with cancer biologists, people in the field that I've been passionate about since I was 11 years old."**
>
> **Emily Ashkin**

"I wouldn't be where I am today if it weren't for AEOP. With eCYBERMISSION I was invited to the White House Science Fair, and that was the first time that I really got to interact with cancer biologists, people in the field that I've been passionate about since I was 11 years old [when her Mother was diagnosed with skin cancer]. That was the moment that I knew that I don't have to wait until I graduate from college to start doing research, I don't have to wait to start trying to make an impact, I can do it now." Emily went home and set to work finding mentors, professors to research with who could give her an opportunity to work in a lab.

Through research experiences working with Dr. Pinku Mukherjee's lab at the University of North Carolina-Charlotte and Drs. Patrick Hwu and Jodi MacKenzie at the University of Texas MD Anderson Cancer Center, Emily has furthered her work. She has been recognized for her scientific accomplishments by the AEOP as well as many other STEM competitions (ISEF, Siemens, Beijing Youth Science Creation Competition, etc.). Currently a senior at Providence Day School in Charlotte, NC, Emily plans to attend Rice University in the fall. ★

NAME: Caleb Kruse
HOME STATE: Colorado
PROGRAM: JSHS

For Stanford University graduate Caleb Kruse, conducting in-depth, award-winning research is part of his family's way of life. Caleb Kruse and his older brother Cameron both attended JSHS (with separate projects) in 2008.

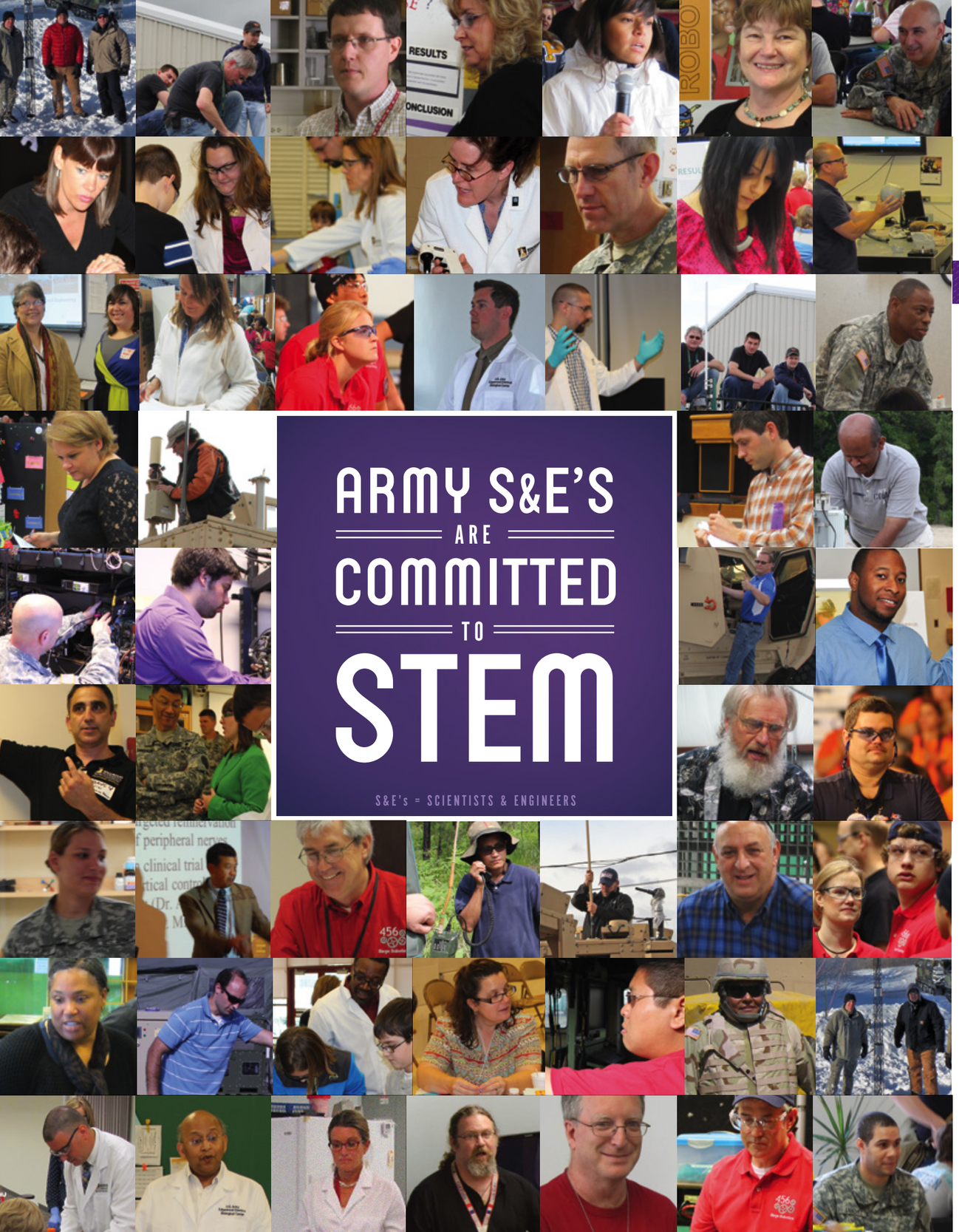
This year, Caleb presented original research to 53rd Annual JSHS National Finalists on the topic of The Role of Reactive Oxygen Species in Coral Bleaching during the Reverse Science Fair. His younger brother Shepherd Kruse also presented his research on Designing and Evaluating an Aerospike Rocket Engine for Increased Thrust in the Engineering category at this year's event. All boys were home schooled and represented the State of Colorado.

"Participating at JSHS as a high school sophomore propelled me on my path into the sciences. It gave me confidence that the research I was doing in my basement was relevant and meaningful, connected me with a group of passionate young scientists who encouraged me to push myself further, and inspired the basis of my undergraduate honors thesis. In stark contrast to the watered-down societal expectations for young people in today's society, the programs run by AEOP elevate students to work at a level that they previously did know existed. I am so grateful to have had the opportunity to participate in JSHS, and I now recommend AEOP programs to every young student I mentor."

Caleb recently graduated from Stanford and plans to return to work on his graduate degree. He said that JSHS was important in validating the research that he had done at an early age and on an unusual topic. At that time, he loved coming to the competition where judges were interested in the work he was doing and asking knowledgeable questions.

Caleb was challenged by being with a peer group that appreciated what he'd done. "It's very rare to find a collection of high schoolers that are as high-achieving and care so much about the process of research. It's very inspiring." He strongly encourages students to participate in JSHS, saying, "Science competitions and JSHS in particular are wonderful avenues to be able to apply yourself to a project that you're passionate about, to complete it, and then to be rewarded for it. You get to meet with a lot of like-minded friends... I couldn't encourage participating in science fairs and JSHS more." ★

> **"Participating at JSHS as a high school sophomore propelled me on my path into the sciences. It gave me confidence that the research I was doing in my basement was relevant and meaningful..."**
>
> **Caleb Kruse**



STEM FILES

NAME: Lisa Skandalis
HOME STATE: New York
PROGRAM: CQL / SMART / Civilian Employee

Lisa Skandalis is a stand-out student who participated in both the CQL and SMART programs, and is now currently a Civilian employee at the U.S. Army Criminal Investigation Command, Defense Forensic Science Center (DFSC).

"My experiences with AEOP and the summer internship I participated in back in 2012 was a turning point in my educational and professional career. Without the opportunity to spend my summer at USACIL I would not be where I am today, and that is not an understatement. I was able to participate in a research project that helped hone my forensic DNA skills as well as understanding how forensics plays a role at USACIL and, more importantly, seeing that this could lead to a career down the road. It was that summer that convinced me to go to graduate school for my masters, as well as convincing my to apply for the SMART scholarship program I was later accepted to. Everything in my life right now is a direct effect from the opportunity AEOP gave me as an undergraduate."

Ms. Skandalis' research project examined the effects of salt water on the recovery of DNA. This project was in response to questions raised from the USS Cole bombing and recovery of DNA for identification of lost military personnel. She was highly impressive and based upon her time at the DFSC continued forward to graduate school at the University of North Texas. In fall of 2013 Ms. Skandalis applied and was awarded a SMART scholarship sponsored by the DFSC. SMART is a service-to-scholarship program sponsored by DoD to bring on STEM students into government service.

"I have known that I wanted to be a forensic scientist since I was about 12 years old, and 12 years later that is still the case. I've directed my education towards this end goal since high school, and it culminated with graduating with my masters in Forensic Genetics this past May. Knowing that soon I will finally obtain the goal I set for myself over a decade ago is both exhilarating and a bit terrifying. I have worked extremely hard to get to where I am today, and I'm excited to see all that work finally pay off. People have always asked me why I picked forensics, and for me it was always a simple answer: this field allows my love and appreciation of science to help others in a way many other professions can't, and I can't wait to get started."

Ms. Skandalis graduates with her Masters degree in May 2015 and will officially be a DFSC employee by August 2015. ★

> **"Everything in my life right now is a direct effect from the opportunity AEOP gave me as an undergraduate."**
>
> **Lisa Scandalis**

STEM FILES

NAME: Crabyotics" (Andrea Chin-Lopez, Anthony Archuleta, James Valerio, Julia Johnson)
HOME STATE: New Mexico
PROGRAM: eCYBERMISSION

The Crabyotics were recognized as the 9th Grade National Winning Team for the 2013-2014 program year for their research on the topic of antibiotic resistance caused by over-prescription of antibiotics and under metabolism of synthetic drugs. The team discovered that Chitosan could be used to filter antibiotics from water, reducing antibiotic over-exposure. They were also awarded a $5,000 STEM-in-Action Grant to fund further development of their STEM projects into mature and scalable solutions under the mentorship of U.S. Army Scientists and Engineers.

After receiving the STEM-In-Action Grant, the team was able to expand their experimentation to 16 different antibiotics, including those that are in the 'danger zone' of causing antibiotic resistance, and were able to work on a new filter design that is more efficient at removing all foreign particulates from water at higher pressures. The team was able to expand upon their project's impact and testing phases due to the funding provided through the STEM-In-Action Grant.

Crabyotics is also using part of the funding to apply for a patent on the final individual filter design. Other, younger members of the lab have been added to the team to spread awareness of antibiotic resistance, testing practices, and to continue multiple phases of the Crabyotics design so that it can pass FDA regulations and the Patent Process. In addition to presenting their project at the White House Science Fair, Anthony Archuleta and Andrea Chin-Lopez presented the team's most recent results at the Intel International Science and Engineering Fair, where they received the King Abdul-Aziz and His Companions Foundation for Giftedness and Creativity Water Technologies Award.

"eCybermission and the STEM-in-Action grant have opened up horizons that we didn't have available to us before. Crabyotics was most likely a 'one-off' effort because the current budgets for Scientific Research in public schools are gone, but thanks to the STEM-in-Action grant, we were able to keep it up." - James Valerio

"The budget support and and the attention brought to the project has enabled us to expand Crabyotics closer to reality, and has opened it up as a community effort." - Julia Johnson

"We are able to do things that we would have never had a chance to do before with the project and the experiences. We would have never had a chance to not only make this filter system closer to reality, but to also be able to present it at the White House and ISEF, we were able to show that people from small towns have legitimate ideas too." - Andrea Chin-Lopez

"The opportunities to present our project and the base budget to take it to another level other than a simple science experiment have been life-changing, not just for us on the team, but the people who we will be able to help. We may be from small town Taos, but we can prove that we can hang with the big cities in intelligence, ideas and innovation with a little help from grants."
- Anthony Archuleta ★

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>
> **James Valero**

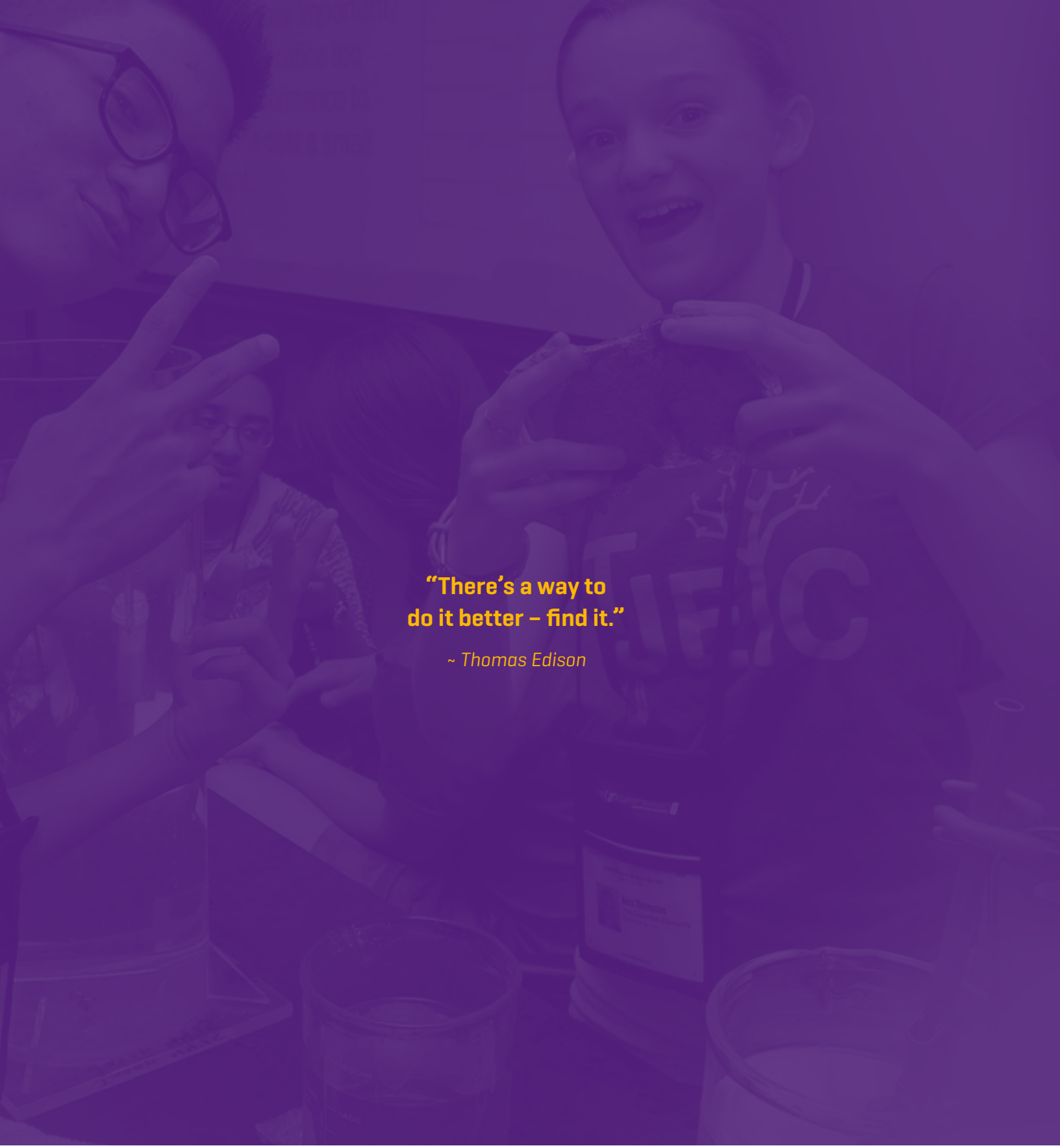
AEOP PRIORITIES SUPPORT THE FEDERAL & DoD STEM STRATEGIC PLANS:

Federal STEM Strategic Plan Priorities:

- ★ Improve STEM instruction;
- ★ Increase and sustain youth and public engagement in STEM;
- ★ Enhance STEM experience of undergrad students;
- ★ Better serve groups historically underrepresented in STEM fields.

AEOP STEM Outreach Priorities:

- ★ STEM Literate Citizenry – Broaden, deepen and diversify the STEM talent pool in support of our defense industrial base.
- ★ STEM Savvy Educators – Support and empower educators with unique Army research and technology resources.
- ★ Sustainable Infrastructure – Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.



"There's a way to do it better – find it."

~ Thomas Edison

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