"I have not failed. I've just found 10,000 ways that won't work."

~ Thomas Edison

IT STARTS HERE.

2013 YEAR IN REVIEW

U.S.ARMY

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aeop 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 2013 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

146 PARTICIPATING **UNIVERSITIES**

1,481 **TEACHER** PARTICIPANTS

2,351 **ARMY S&E** VOLUNTEERS

66,484 **STUDENT** PARTICIPANTS

17 PARTICIPATING **ARMY LABS**

443 **INTERNSHIPS** PROVIDED

$4,049,787 IN **STUDENT INTERNSHIPS**

$985,740 IN **SCHOLARSHIPS / AWARDS**

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

> **The Army's K-12 STEM education program success is critically dependent on a strong academic and industry partnership – just as our research is critically dependent on a strong relationship with the Defense Industrial Base.**
>
> Jeff Singleton, Director for Basic Research & Education Outreach, ASA(ALT)

STEM FILES

NAME: "The Falcons" John Liddy, Christopher Mabie, and Eric Jenny
HOME STATE: Massachusetts
PROGRAM: eCybermission

> **I am delighted to have had a small role in the efforts and success of these sixth-graders in their competition. I think it is terrific that the U.S. Army invests the effort in promoting interest and education in science and engineering.**
>
> Dr. Doug Katz, Medical Director (Brain Injury Program), Braintree Rehabilitation Hospital

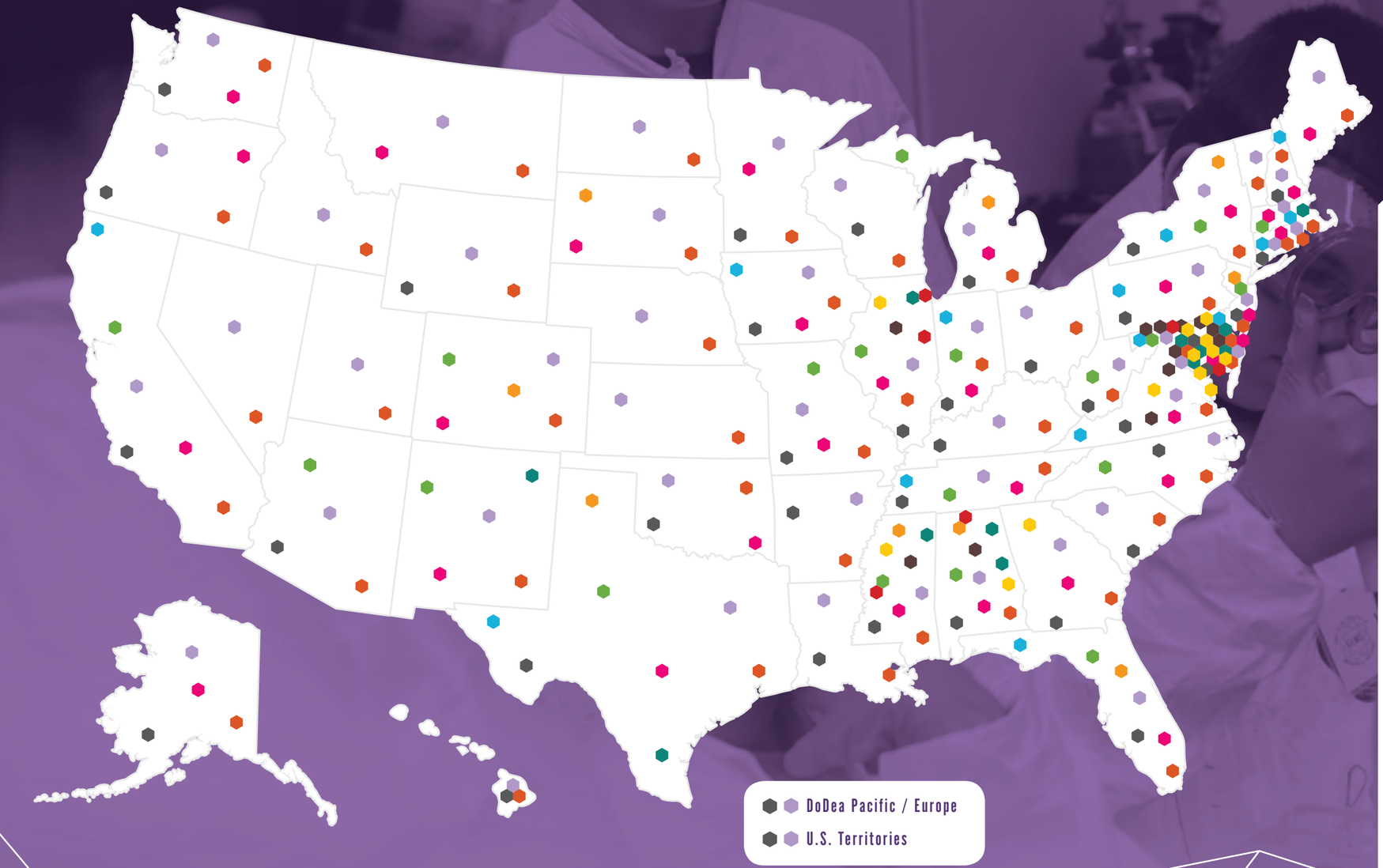
The Falcons were recognized as the 6th Grade First Place National Winning Team for the 2012-2013 program year for their project entitled "Preventing Concussions in Sports Activities".

After having a friend suffer a concussion as the result of a sporting accident, The Falcons decided to come up with a solution to reduce damaging force to the brain upon an impact hit. The students did some research and spoke with subject matter experts about the causes of concussions, and the design of helmets. They came up with five different helmet designs to test, and a method to measure the force inside the helmet when the helmets were dropped (stimulating a hit to the helmet). The Falcons used the data collected to produce a prototype that was a hybrid of two of the previous tests.

"We brainstormed solutions of different types of padding and we thought outside the box and maybe putting the padding on the outside would be better than putting more padding on the inside," Jenny said. "We all had a kind of a-ha moment. Our eyes just lit up, so we knew that putting the padding on the outside of the helmet was actually really better," explained John Liddy. The prototype's data produced better results than the other models. The students shared their results with a helmet manufacturer and a neurologist who both stated the students should continue exploring their idea.

Since winning the National title, the Falcons' project and resulting research have been featured in various media outlets, including a feature on Showtime's "Inside the NFL". ★

AEOP'S EXPANSIVE REACH



STUDENT PARTICIPANTS // PROGRAMS

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

589 **JSS** // 4th - 8th Grade // Junior Solar Sprint is an inquiry-based engineering challenge in which students design, build, and race model solar cars.

21,345 **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.

2,075 **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.

34,356 **WPBDC** // 6th - 12th Grade // West Point Bridge Design Contest allows students to model, test, and optimize a steel highway bridge, based on realistic specifications, constraints, and performance criteria.

188 **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.

8,200 **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.

INTERNSHIPS // 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.

68 **HSAP** // High School Apprenticeship Program

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

170 **CQL** // College Qualified Leaders Program

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

URAP // Undergraduate Apprenticeship Program

"This GEMS experience was truly phenomenal experience that helped me decide to pursue a career as, hopefully, an army research engineer."

- GEMS Student

AEOP PERIODIC TABLE OF IMPACT

19%

of students that applied to the SEAP program were able to be placed

eCYBERMISSION:

- **21,405** Students
- **1,050** Teachers
- **521** Schools
- **260** Title 1 Schools

60%

of **UNITE** participants receive free or reduced school lunch

Nearly

22%

of past **eCYBERMISSION** winners are now employed in STEM fields

1000

high schools participated in **JSHS** nationwide including DoDea Pacific/Europe

47%

of **CQL** mentors were first time mentors

"It is worthwhile for the mentors, the laboratories, and the students. A lot of these students want to go into STEM industry. These students get the experience that they need to get the jobs that they want – professional development."

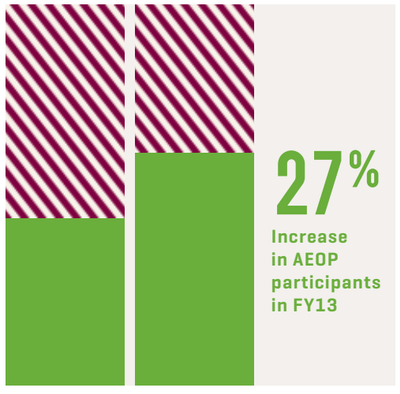
- SEAP Mentor

30%

of participating universities in the **REAP** program were HBCUs or MSIs

"I am so blessed that I had the chance to participate in JSHS at the Regional and National levels this year. The experience was absolutely life-changing, and has reaffirmed my interest in majoring in a STEM field in college."

- JSHS Student



27%

Increase in AEOP participants in FY13

93%

of **JSHS** participants indicated an intent to major in a STEM discipline

66,484

AEOP Student Participants

2,351

Army S&E Volunteers

17

participating Army Labs

"ECYBERMISSION has increased my confidence and passion that I can excel and contribute towards the STEM fields, and has no doubt increased my desire to attend a STEM-based high school and college."

- eCYBERMISSION Student

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

"The Army Educational Outreach Programs that I participated in, from GEMS to SEAP to CQL, have given me valuable, hands-on lab experience that I would not have attained otherwise."

NAME: Nicole Racine
HOME STATE: Maryland
PROGRAM: GEMS / SEAP / CQL

Nicole is a sophomore studying mechanical engineering at the University of Maryland, Baltimore County (UMBC), where she is a member of the Center for Women in Technology (CWIT) scholars program.

She currently works in the Army Research Laboratory's Weapons and Materials Research Directorate as an undergraduate research scientist in the Multi-Scales and Rates Experimental Mechanics Laboratory. Of her experience working alongside Army scientists and engineers in a world class Army facility, she says "I love working in this lab because I know the research is directly applicable to real-life situations. I know that I have a role in ensuring the safety of our Soldiers."

Nicole participated in the Gains in the Education of Mathematics and Science (GEMS) program her freshman, sophomore, and junior years of high school, which solidified her desire to pursue math and science as a career path. "I have always loved math and science, but I really didn't know how science could be applied," she said. "GEMS helped me realize what I can do with science and engineering... I developed a passion that will last me for the rest of my education."

In an effort to spark an interest in technology among her peers, Nicole applied and was accepted to the Science and Engineering Apprenticeship Program (SEAP) her senior year. During the 8 week program, she studied the effect of weaving on the strength of Kevlar single fibers at different loading rates. Last summer, she studied the mechanical behavior of Dyneema single fibers at different loading rates as a CQL student. ★

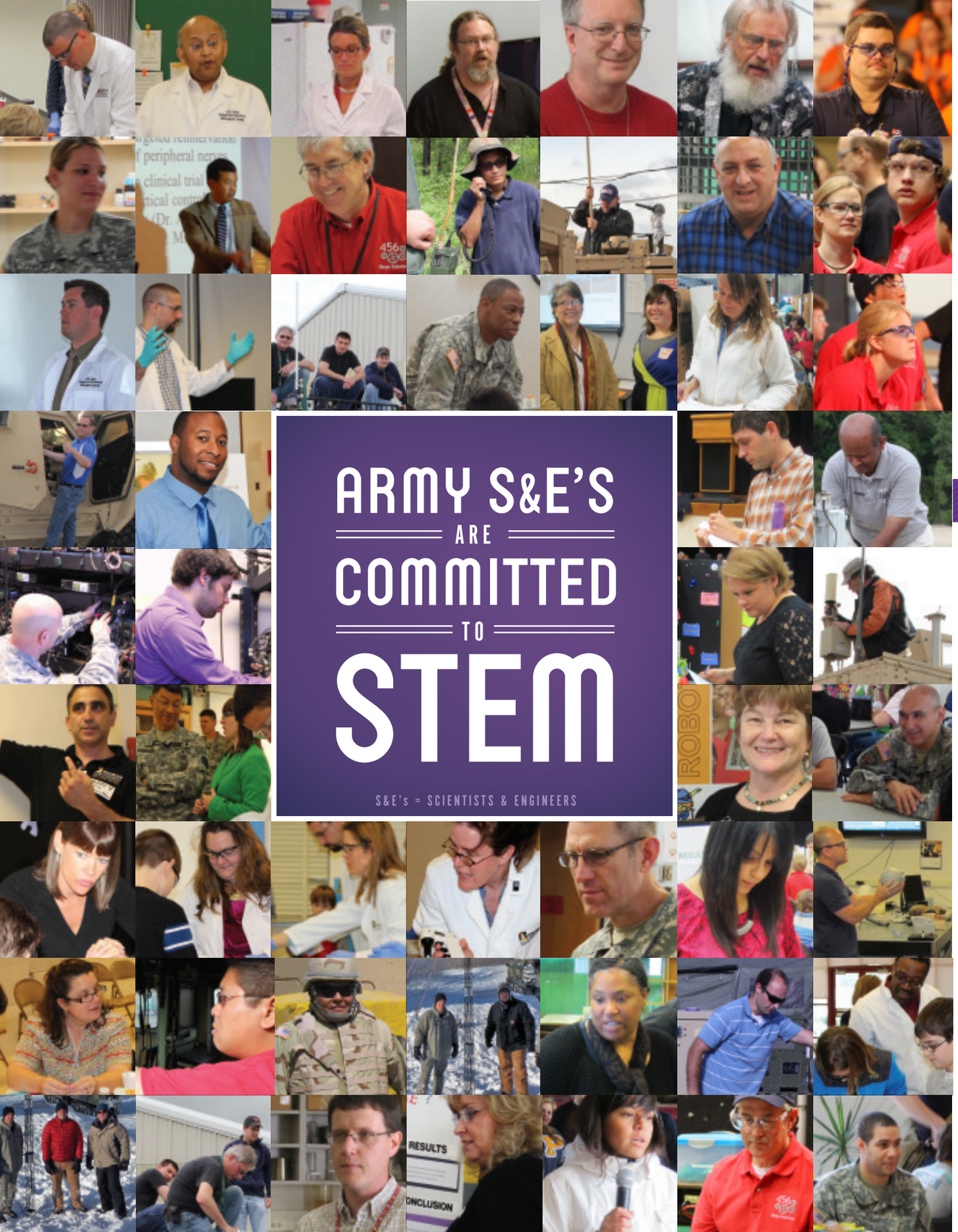
NAME: Shelby Bartram
HOME STATE: Maryland
PROGRAM: GEMS / SEAP / ORISE / SMART

Shelby's journey in pursuit of STEM began in high school, led her to an internship at the Army's Edgewood Chemical Biological Center and has continued through her undergraduate studies at the Western New England University in Massachusetts, where she is currently pursuing a Bachelor's degree in Biomedical Engineering and a Master's degree in Engineering Management.

After her sophomore year in high school she participated in the GEMS program, which allowed her to tour Aberdeen Proving Ground and experience the variety of STEM fields that Aberdeen employs. She then participated in the SEAP program the following year, which gave her the opportunity to see firsthand what it's like to be an Army scientist and engineer, and see the detailed steps that go into ensuring that a piece of equipment is safe for military and personnel use. "Through this experience," Shelby said, "I've been able to put the concepts I've learned in my engineering classes to use in a real-world application."

Shelby then continued her journey through the AEOP program pipeline by participating in the ORISE (Oak Ridge Institute for Science and Education) program, and then during her senior year of high school, she applied and was accepted to the SMART (the Science Mathematics and Research for Transformation) program, which offers full tuition scholarships in exchange for equivalent years of service, and a guaranteed job upon graduation. ★

"Through [the SMART] program I have the luxury of being debt free, and being paid to go to school. This program has been an enormous blessing in my life...and I am currently working towards achieving my dreams."



STEM FILES

NAME: Saumil Bandyopadhyay
HOME STATE: Virginia
PROGRAM: JSHS

As a high school student in his hometown of Richmond Virginia, Saumil Bandyopadhyay didn't wait until college to begin developing innovative technologies for use by cutting edge organizations.

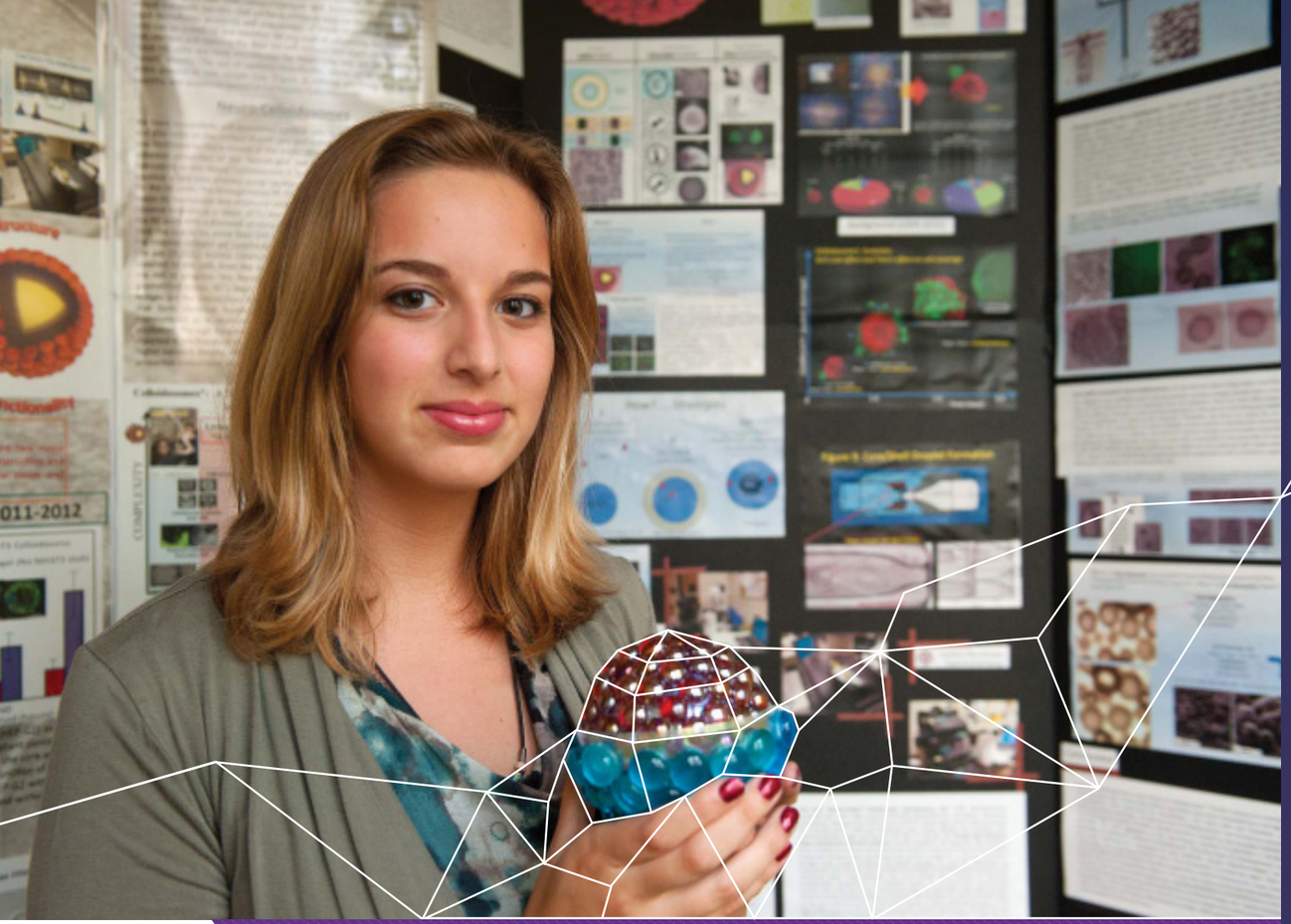
In fact, by the time he turned 18, Saumil had already published five scholarly papers, gained international recognition, and had a job as a researcher at a U.S. Army lab, where he created a cutting-edge infrared sensing technology that has vast real-world implications.

Saumil was a curious teenager who cold-called university researchers near his home to see if someone would allow him to their lab and let him bring his science dreams to life. After hearing 'no' several times, he finally got an invitation from Gary Tepper, a professor of engineering at Virginia Commonwealth University, to be an intern in Tepper's lab. Saumil got to work creating infrared and other types of sensors that are much smaller than existing sensors and that don't require super-cold temperatures.

Tepper helped Saumil compete in AEOP's Junior Science and Humanities Symposium, where he connected with other bright young minds from across the country. Saumil says that experience was invaluable for him in his development as a scientist. Shortly after competing in JSHS, Saumil was invited to work in a U.S. Army lab to help put his new sensor into practice. He is now studying at Massachusetts Institute of Technology, and recently received an American Ingenuity Award from the Smithsonian Institute.

Saumil is committed to inspiring others to pursue STEM, and has mentored high school students in engineering under the Richmond Area Program for Minorities in Engineering, which caters to students from under-represented groups. He has also taught English to indigent students in India. ★

> **"Being able to work in a lab... and be in this competition... is an amazing experience, and one that definitely changed my life."**
>
> **- Saumil Bandyopadhyay**



STEM FILES

Courtesy of the Davidson Institute for Talent Development.

NAME: Samantha Marquez
HOME STATE: Virginia
PROGRAM: JSHS

Samantha Marquez is a young innovator, scientist, entrepreneur, and a strong example of the success of the Army Educational Outreach Program. She, along with her younger sister, Michelle, was born in Hartford, Connecticut while their parents were at Yale pursuing their PhD's. Growing up in a household where both parents' careers are ingrained in science, Samantha found she had a passion for the sciences as well.

She truly began pursuing her passion in the 7th grade when curiosity and an idea merged together into what is now a multidisciplinary, multi-institutional project. Her work, creating a 3D, spherical capsule of living tissue, has applications in Tissue Engineering, Bioengineering, Environmental Science, Genetic Engineering, and cell/drug delivery as well as many other fields of science. She has worked vigorously in collaboration with researchers from Texas A&M, Harvard, Georgia Tech, and Arizona State University to obtain groundbreaking results and earn a highly respected reputation in the international scientific community.

Samantha has been featured in Popular Hispanics magazine, "At Fifteen, Hispanic High School Scientist is Making World-Wide History, and has been named by Newsweek in their Women in the World list: 25 under-25 young women to watch.

Samantha isn't completely focused on research; she's also dedicated to her responsibilities as a role model. She believes that her time spent mentoring and inspiring young minds proves more effective than monetary donations. ★

> **"I take my role as a contributor to society through mentoring, sponsoring, and leadership very seriously... the key is quality and quantity of time dedicated to helping others find direction."**

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.