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US ARMY NATICK SOLDIER RESEARCH, DEVELOPMENT & ENGINEERING CENTER

Science, Technology, Engineering and Math (STEM) Outreach

FY15 PROGRAM REPORT

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

OVERVIEW

The mission of the Natick Soldier Research, Development and Engineering Center (NSRDEC) Science, Technology, Engineering and Math (STEM) Outreach is to share our technical story of the science behind the Soldier with the students and educators of today in order to inspire the great leaders and problem solvers of tomorrow. Our mission is in accordance with the 5-year Federal STEM Strategic Plan of 2013 to:

1. Improve STEM instruction.
2. Increase and sustain youth and public engagement in STEM.
3. Enhance STEM experiences of undergraduate students.
4. Better serve students who are historically under-represented in STEM fields.
5. Design graduate education for tomorrow's STEM workforce.

Department of Defense STEM outreach is a national initiative managed through the Office of the President of the United States, Office of Science and Technology Policy (OSTP), and is supported at the state level through the Massachusetts Governors STEM advisory council board. NSRDEC's STEM outreach connects the science and technology conducted across the installation with students and educators through onsite and offsite programs and in accordance with both local and national efforts.

Our current outreach focuses on five main areas:

1. Onsite tours and interactive technical demonstrations across the installation.
2. Development and implementation of real-world STEM problem statements for our academic community partner schools.
3. Supporting science/career fairs through mentoring and judges for school events.
4. Offering annual teacher trainings to the teachers and educators across the Commonwealth.
5. Actively sharing and connecting with academic and industrial partners through social media platforms such as LinkedIn, Facebook and Twitter.

These five focus areas are achieved through the continued support of the scientists and engineers across the NSRDEC, who volunteer their time and talent toward STEM activities and through our collaborative partnership with US Army Research Institute of Environmental Medicine (USARIEM). The scientist and engineers actively support STEM activities through hosting visitors within their labs, conducting interactive STEM demonstrations, and volunteering as mentors and science fair judges. USARIEM, with support from NSRDEC personnel, manages a successful Army sponsored summer program called Gains in the Education of Math and Science (GEMS). The GEMS program alone hosts approximately 200 middle school students and 20 near peer mentors over the course of a six-week long program in July and August, and allows students to conduct STEM related experiments and activities.

The NSRDEC hosts over 1,000 students annually on the installation and participates in monthly activities off post such as science fairs and offsite technical demonstrations. The NSRDEC STEM outreach team established a STEM charter for FY14 and continues to assess and update the charter on an annual basis. The STEM charter sets annual team goals/objectives and communicates the mission within the organization and with external stakeholders. The report below will outline the FY15 goals and objectives, the status of each objective, lessons learned from FY15 and the proposed charter for FY 16.

STEM OUTREACH CHARTER:

STEM Mission: To share our technical story of the science behind the Soldier with the students and educators of today to inspire the great leaders and problem solvers of tomorrow.

Key Project Stakeholders

NSRDEC, K-12 public/private/charter schools, college/universities, RDECOM, USARIEM/GEMS, Massachusetts Governors' STEM Council, Massachusetts STEM Pipeline networks, National Defense Education Program, Army Education Outreach Program (AEOP), eCybermission, Department of the Army, Department of Higher Education, National Science Teachers Association (NSTA) and industrial partners.

Team Structure

STEM Project Lead: Strategic project lead; Oversight of project funding and internal and external interactions; NSRDEC representative on the Governors STEM Council and with external Stakeholder. Primary decision maker for overall project direction and funding activities.

Project Coordinator: Manage and organize day-to-day STEM activities such as maintain STEM schedule, primary POC on internal tours for schools and STEM stakeholders; coordinate base-wide support for STEM activities; communicate all STEM requests through designated POCs within each technical commodity area; maintain STEM outreach tracker for all STEM activities for reporting purposes; communicate all STEM activities to Project Lead and STEM team at least on a monthly basis and as needed.

Strategic Outreach/Social Media Coordinator: Lead external communications through social media platforms (facebook, Twitter, LinkedIN, NSRDEC website); Alternate lead for internal and external STEM activities (school tours, STEM stakeholder tours, external committees) as needed.

STEM INTERACTIONS AT A GLANCE	
# of Students interactions	4550*
# of teacher interactions	720
Total number of Teacher training modules	0**
# of STEM Facebook page followers	1,395
# of Twitter followers	822
# of LinkedIn connections	9,315

* *Student interactions based on STEM tracker. Some numbers were estimated based on size of venue (career fairs/science fairs) and most estimates were conservative. Numbers DO NOT include the number of students interacted with through the annual Ecybermission events.*

** *Due to limitations in available external funding, teacher trainings were not offered during FY15.*

Workforce/Employee Liaison: Communicate all internal employment activities in support of STEM workforce with regard to attracting future workforce; Lead communication between the workforce and available hiring vehicles to attract new student interns/employees from STEM fields. Oversee annual intern poster presentation.

STEM Lab Coordinator: Manage STEM lab activities, equipment and safety protocols; responsible for communicating all lab activities to the Project Coordinator on a monthly basis to be added to the STEM monthly calendar.

Project Administer Assistant: Manage taskers and stakeholder activities from project lead and disseminate information to team as needed. communicate all STEM related activities to the project coordinator as needed; facilitates purchase requests for STEM team.

GOALS/OBJECTIVES

The NSRDEC STEM goals/objectives are governed primarily by the 5-year Federal STEM strategic plan of 2013 and in collaboration with the state's STEM plan 2.0.

5-Year Federal STEM Strategic Plan:

1. Improve STEM instruction.
2. Increase and sustain youth and public engagement in STEM.
3. Enhance STEM experiences of undergraduate students.
4. Better serve students who are historically under-represented in STEM fields.
5. Design graduate education for tomorrow's STEM workforce.

Massachusetts STEM Plan 2.0 Goals

1. Increase student interest in STEM areas.
2. Increase student achievement among all PreK-12 students in order to prepare graduates to be civically and college and/or career ready.
3. Increase the percentage of skilled educators who teach PreK-16 STEM.
4. Increase the percentage of students completing postsecondary degrees or certificates in STEM subjects.
5. STEM degrees and certificate attainment will be aligned with corresponding opportunity in STEM-related fields to match the state's workforce needs for a STEM talent pipeline.

GOALS/OBJECTIVES

Goal #1: Increase and sustain youth and public engagement in STEM.

Objectives:

1. Host a school onsite or participate in classroom STEM activities at least twice a month.
2. Participate in STEM pipeline network meetings.
3. Conduct a half day interactive tour (with SME's across all directorates) with at least Wilson and Kennedy Middle School on an annual basis.
4. Re-institute Bring your Daughter/Sons to work day as a STEM sponsored event.

Goal #2: Improve STEM instruction.

Objectives:

1. Host or supply resources to at least one teacher training annually.
2. Support HR monitor program through Millis public schools.
3. Communicate NSRDEC STEM resources for educators through social media on a monthly basis. (ie: Fun Experiment Friday)

Goal #3: Enhance STEM experiences of undergraduate students.

Objective:

1. Establish high school mentoring program for local community partner school for students interested in STEM careers.
2. Acquire student interns through various employment opportunities to foster collaborations with local/national colleges/universities.

Methods of Internal Team Communication:

1. Monthly Team Meetings: Meet the first Tuesday of every month.
2. STEM sub-committee meeting: meet every third Wednesday of the month.
3. External communication through social media on a daily/ weekly basis.

FY 15 CHARTER ACCOMPLISHMENTS

Goal 1: Increase and sustain youth and public engagement in STEM.

- Hosted 13 schools/school programs for onsite tours/demos of the installation during FY15 to include: Newton Extended day program, Natick cub scouts, WPI ROTC Cadet visit, Dover/ Sherborn Citizens action group, Natick Girl Scouts, Weston High School, Air Force Research Laboratory design challenge group, Fitchburg State Exercise Science Club, Framingham State University Experimental Study of foods, Kennedy Middle School's 6th grade stay at home program, Boston Dietetics Student Tour, Assabet Technical High School, and Northeaster Young Scholars.
- Conducted annual Wilson Middle School and Kennedy Middle School 7th grade trips to the installation, totaling approximately 400 students.
- Held the annual Bring your Daughters/Sons to work day incorporating a morning session with over 15 STEM demonstrations and an afternoon session with a STEM presentation on next generation material solutions.
- The STEM "road show" participated in 15 offsite school career days/STEM demonstrations to include: Nipmuc High School Career Day (Mendon/Upton, MA), Archbishop Williams High School, Braintree MA, Touchstone School, Grafton MA, Worcester North High School Go Public Event, Millis High School, Mass Bay Community College, Everett High School, Mount Wachusett Community College, Martin Middle School, East Providence RI, Mansfield Middle School, Bristol Community College, Rochester Elementary School, Pembroke High School, Chelsea Middle School, and the Envision STEM camp held at Bridgewater State University.
- Participated in MA STEM Pipeline Network quarterly meetings.
- STEM lab heavily utilized for the summer GEMS program in July and August.
- Participated in a number of science fairs across Massachusetts, to include Worcester Regional Science Fair, Southeastern Massachusetts Regional Middle School Science & Engineering Fair, Hopkinton Science Fair, Hour of Code at Natick High School, and ScienceFest in Holliston MA.
- Participated in the annual online science competition, eCybermission, through online judging, regional judges, and supporting the annual final competition held in Washington, DC.

Goal 2: Improve STEM instruction.

- Conducted two of the four soldier performance education modules with Millis High school's physical education class. Modules were demonstrated with a class of 15 students and feedback was used to modify lessons one and lessons two.
- Participated in the annual STEM summit networking with educators from across Massachusetts and sharing resources and lesson plans from the GEMS program and other NSRDEC programs with teachers and program leaders.
- A chemist from combat feeding conducted a food science presentation for the freshman at UMASS Lowell.
- Supported an MRE project with the Army recruiting battalion, Harrisburg PA.
- Supported request from DoDEA schools in Korea with MRE samples and STEM lesson plans during BG Coles visit to the school.

Goal 3: Enhance STEM experiences of undergraduate students.

- Mentored student from Natick High school for 7 months to test a pilot mentoring program allowing the student to job shadow personnel within STEM disciplines as well as business/ career development. Program elements will be utilized for future mentoring programs.
- Supported the Summer GEMS program that hosts approximately 200 middle school students and employs approximately 10 near peer mentors, 2 lead mentors who are responsible for running the STEM related activities with the students, and a resource teacher responsible for overseeing the curriculum used throughout the program. This program is the gold standard on STEM education programming since it engages students at the middle school level with interactive hands-on STEM activities across our technical commodity areas and taught by high school students giving them the opportunity to learn key leadership and organizational skills while teaching students basic science and engineering principles.
- Hosted the 9th Annual Student Intern poster session with 32 projects highlighted by 39 student interns and with the support and mentorship from 30 NSRDEC scientists and engineers.
- For FY15, there are 17 recent graduates enrolled and rotating through the two-year intern cohort program.

Special Events/Awards:

- Attended annual STEM summit, hosted at DCU Center, Worcester, MA for academia, industry and government partners across Massachusetts to learn of the opportunities and STEM programs across the commonwealth.
- Combat Feeding Directorate supported the annual eCybermission National Judging & Educational Event (NJ&EE) conference in Washington DC with two hands-on STEM projects, a MRE food demonstration, and a junior scientist mentor for the week of activities.
- Supported AMC Girls in Engineering/Science Day in Huntsville, Alabama through MRE product samples and literature on the science behind combat rations.

- Support for USFIRST robotics teams, specifically Natick High School, who sent 4 teams to this year's robotic competition.
- Supported Natick High School's second advanced robotics team with a real world problem statement for the class. NSRDEC representatives videotaped the problem statement to be viewed by the class and participated in mid-point and final design reviews.

Public Relations/Social Media Activity:

Through the use of key social media platforms (such as Facebook, Twitter, and LinkedIn) the NSRDEC STEM team is capable of connecting the outreach activities with students nationwide and connects with key stakeholders and collaborative partners. Below is an overview of the social media activity for FY15:

Social Media Platform	# of Followers	Average # of STEM Posts	Average # Views Per STEM Post
Facebook	1,395	50	620
LinkedIn	9,315	25	5,040
Twitter	822	30	N/A

Plans for FY15:

At the end of FY15, the STEM team will revise the team charter to reflect new goals and objectives for FY16, incorporating the lessons learned from this fiscal year, and use this charter as a guide and reference point on all STEM activities. The event tracker will be continued to capture all STEM related activities across the installation and highlight trends and areas for improvement on future outreach efforts.

APPENDIX

August 11, 2015

By Jane Benson/NSRDEC Public Affairs

Natick has summer fun for kids down to a science

For the fifth summer in a row, the U.S. Army Research Institute of Environmental Medicine -- with support from the Natick Soldier Research, Development and Engineering Center -- is hosting its Gains in the Education of Mathematics and Science Program, or GEMS. The program is held at the Natick Soldier Systems Center.

The GEMS program originated at Walter Reed in 2005 and has since been adopted by many other Army research installations. Through GEMS, USARIEM provides middle and high school students the opportunity to participate in age-appropriate, hands-on experiences in science, technology, engineering, and mathematics, or STEM. Advanced high school as well as college students serve as near-peer mentors who lead the programs and serve as role models for students.

This summer, USARIEM is hosting three GEMS sessions, giving students the chance to experience STEM in an interactive and meaningful way. Some of the experiences range from building a robot from toothbrushes to creating a chemical reaction resulting in molten iron.

"The GEMS staff and I are excited about science and are excited about engaging the minds of young scientists by applying complicated concepts in a particular way so that middle school students experience that 'lightbulb' moment," said Spc. Sonya Edler, a medical laboratory technician at USARIEM and the program director for this year's GEMS program.

Edler said she believes that the Natick Soldier Systems Center provides students with unique learning opportunities and is impressed with the dedication of both the students and staff.

"This summer we had 193 student interns (participants) and a total of 18 staff members who truly deserve the credit for the success of the program," said Edler. "The resource teacher, near-peer and assistant mentors are an honor to work with. Also, Kelly Field, our Public Affairs officer, and Joanna Graham, our NSRDEC (point of contact), have played critical roles in helping this program run seamlessly. The new (lead) officer in charge is Maj. Joseph Kardouni, who has truly immersed himself into the program and provides a huge military relevance to GEMS."

"It is a unique program that combines building up leadership skills and teaching science with young adults, as well as a broad introduction to STEM -- especially the application of science and engineering to students in a variety of exciting ways," said Dan Eggers, the program/resource teacher for the GEMS program at USARIEM and a local high school teacher.

"The program gives kids a leg up when they return to their classroom, because they have already been exposed to complex topics," said Lauren Francis, a student mentor for the program.

Jake Heinlein, along with Andrea McDonagh, is one of the head near-peer mentors. In his role, he designs and leads fun experiments with the students and helps other student mentors.

"What I find the most rewarding is seeing the students come back each year and seeing how they've grown and how their love for science has grown," said Heinlein.

"The students and their parents always make the effort to thank our team for how awesome the program is and the fact that they leave here wanting more," said Edler.

"I love GEMS," said Sabrina, a student who was involved in the third GEMS session. "It's such a fun experience. GEMS really makes learning exciting."

NSRDECStudents participating in the U.S. Army Research Institute of Environmental Medicine's Gains in the Education of Mathematics and Science, or GEMS, program witness a chemical reaction resulting in molten iron. The Natick Soldier Research, Development and Engineering Center also takes part in the program, which is held at the Natick Soldier Systems Center. Photo Credit: Dave Kamm

Natick employee helps students bring robots to life

July 2, 2015

By Jane Benson, NSRDEC Public Affairs

Jerry McCarthy's skills and experience benefit Soldiers, students and even a few robots.

McCarthy is an engineering technician at the Natick Soldier Research, Development and Engineering Center, or NSRDEC, and he is committed to science, technology, engineering and mathematics outreach at Natick High School. He works extensively with the robotics teams.

"Jerry is a terrific asset to the Fabrication Cell at NSRDEC, where his talents run the gamut from expert operation of a variety of Computer Numerical Control machines, such as lathes and milling machines, to welding and fabrication of new prototypes and equipment for the Soldier," said Ken Rice, team leader for NSRDEC's Design Engineering and Fabrication Team. "Jerry has taken a strong interest in STEM outreach, taking considerable personal time to help local students compete in national robotics competitions."

McCarthy enjoys bringing his knowledge to local students.

"Teaching is something I like doing," McCarthy said. "I have a passion for what I do, and I like to share it with people."

McCarthy believes that hands-on learning is essential. By building the robots themselves, the students increase their mechanical understanding of how things operate.

"Participant involvement is a huge part of teaching," he said.

Doug Scott, 2014 Massachusetts STEM Teacher of the Year, values McCarthy's help and expertise. Scott is a lead teacher for ROBONATICK. He led the Natick High School Lemelson-MIT InvenTeam to the White House Science Fair, where the team presented a robotic device used to assist firefighters performing underwater rescues.

"The skills Jerry taught to my students will last a lifetime," said Scott. "He was generous with his time, patient with the students, and made sure each student had an opportunity to learn. I am thankful for the time he was able to spend with my students."

One Natick High School student believes that by teaching them fabrication skills, McCarthy helped students take their robots to a higher level. Fabrication skills enabled club members to be better able to make custom parts, an important aspect of robot creation.

"Little tricks make a big difference," said McCarthy. "Typically, you have to work in the trade for years to know these things."

Another student appreciated the chance to use an arc welder and other tools that would have been difficult for her to learn on her own. McCarthy also taught the team about the drill press and band saw.

"These tools are handy to have," said McCarthy. "But if you misuse them, they are also very dangerous. It's important to teach the students proper techniques and safety."

"The best and most effective STEM outreach occurs when individuals, such as Jerry, share their time and talents with the young adults in our community," said Joanna Graham, NSRDEC's STEM outreach coordinator. "Natick High School's robotics team not only had the opportunity to learn from one of our subject matter experts in the field of metal fabrication and welding, they got to see firsthand how important science, technology, engineering and mathematics is in creating tangible solutions to real-world problems."

"These kids are very open to learning," said McCarthy. "The evolution of their knowledge is amazing. They are doing this on their own time after school. They take it seriously. These kids are brilliant. I'm hoping some will become future (NSRDEC) employees."

Jerry McCarthy, an engineering technician at the Natick Soldier Research, Development and Engineering Center, or NSRDEC, is committed to Science Technology Engineering and Mathematics, or STEM, outreach. He helps high school students take their robotic designs to the next level by teaching them fabrication skills and how to safely use tools. Photo Credit: Dave Kamm, NSRDEC

Natick demonstrates career possibilities to Northeastern University's Young Scholars

July 31, 2015

By Jane Benson/NSRDEC Public Affairs

The possibility of a career in science, technology, engineering and math, or STEM, became a little more real to a unique group of high school students visiting the Natick Soldier Research, Development and Engineering Center on July 30, 2015.

The students visited NSRDEC as part of their participation in the highly selective Northeastern University's Young Scholars Program. The program provides high school students interested in STEM the opportunity to garner hands-on experiences while still in high school.

"In addition to conducting research on campus, Young Scholars have the opportunity to visit several corporate and government research facilities," said Claire Duggan, director for Programs and Operations, the Center for STEM Education at Northeastern University. "These experiences provide students a window into research currently being conducted and an opportunity to explore career opportunities for the future."

The group of about 30 students interacted with NSRDEC scientists and engineers and learned about the science and technology behind protective gear, advanced textile technologies, aerial delivery, shelters, and combat feeding -- to name a few. Students also toured unique testing facilities, including the Doriot Climatic Chambers.

"This is a great opportunity to provide these students a chance to see a developmental technology we're evaluating for potential use by our military," said Peter Lavigne, member of the Equipment & Energy Technology Team in NSRDEC's Combat Feeding Directorate.

"It was really interesting to apply what we've learned in school to real-world situations, especially the Army," said Vindhya Kuchibhotla, a Sharon High School student and participant in Northeastern's Young Scholar Program.

Senior Research Scientist -- Soldier Nanomaterials, Dr. Ramanathan Nagarajan, is a top Army expert on nanomaterials-based technology. He believes that interaction between students and seasoned professionals is important for both groups.

"NEU Young Scholars visiting NSRDEC will see many examples of the work we do every day to make sure that Soldiers have protective clothing against various kinds of threats, food rations to sustain them during combat, shelters to protect them, and supplies delivered to them aerially in combat zones," said Nagarajan. "The striking thing the students will notice is how science and technology make the difference in each case."

"This experience was thrilling for me," said Megi Maci, a Quincy High School student and participant in Northeastern's Young Scholars Program. "I had the chance to walk in the shoes of an American Soldier. I was able to see how perilous a Soldier's life is and the technology that enhances their safety."

"Young students are intrinsically bright -- even if they may not recognize it," said Nagarajan. "They have no, or limited, preconceived opinions, but are capable of limitless imagination. When exposed to NSRDEC examples, they may come up with ideas of their own about how the Soldier's life and work can be improved. Possibly, a number of them will end up in scientific fields and at least some may consider a scientific career at NSRDEC, or another Army lab, to become the next generation of innovators."

The Natick Soldier Research, Development and Engineering Center hosted high school students participating in Northeastern University's Young Scholar Program. The highly selective program gives students the chance to experience STEM professions firsthand. Here students use a Flameless Ration Heater to warm up a Meal, Ready to Eat.

Photo Credit: Dave Kamm, NSRDEC

UMass Lowell and Natick come together as HEROES

January 29, 2015

By Jane Benson, NSRDEC Public Affairs

The Natick Soldier Research, Development and Engineering Center, or NSRDEC, and the University of Massachusetts Lowell are working together to make life better for the Soldier.

The two organizations are collaborating as part of a joint research and development initiative called Harnessing Emerging Research Opportunities to Empower Soldiers, or HEROES.

"This unique partnership benefits all by being able to effectively combine the best of both organizations -- people, facilities and expertise -- to work together to find creative and innovative solutions to improve the safety, mobility and sustainability of our warfighters," said Lynne Samuelson, Ph.D., NSRDEC co-director of the HEROES program and an NSRDEC senior scientific adviser. "HEROES also helps draw in other external partners in academia and industry to all work together to advance (science and technology) for our warfighters."

Through the HEROES program, dozens of engineers and scientists from NSRDEC and faculty members and students from UMass Lowell are working together to solve complex scientific and engineering challenges.

"As NSRDEC co-director of HEROES, I am thrilled to be able to work with the UML co-director, Professor Ramaswamy Nagarajan and the team at UML, to identify, establish, mentor, and provide continual scientific, programmatic and logistical oversight to valuable and mission-relevant HEROES collaborations that will advance Soldier (science and technology)," said Samuelson.

Areas of collaboration include Soldier protection (flame and thermal, environmental, chemical/biological, ballistic and antimicrobial protective materials), and Soldier sustainability (airdrop parachutes and parafoils, nutrition, power-generating nanocomposites, wearable thermo-electrics, as well as combat rations, combat ration safety, and novel food packaging).

"It is anticipated that new, exciting advancements will be made in each of these areas that will benefit our warfighter," said Samuelson.

One of the NSRDEC scientists participating in the collaboration is Quoc Truong. Truong believes that the program brings together complementary expertise. The professors teach theory and concepts while NSRDEC scientists are working to develop practical applications.

"By working together, it's like the right hand working with the left hand," said Truong. "It makes things more complete."

"I am currently working with Quoc Truong on a project developing environmental, chemical/biological protective membranes that will be comfortable to wear, be selectively permeable, allowing breathability while protecting the Soldier from toxic chemicals, viruses/bacteria, liquids, vapor," said Bridgette M. Budhlall, Ph.D., associate professor, UMass Nanomanufacturing Center at UMass Lowell. "Being able to leverage my research's group expertise in polymer coatings to help and protect the Soldier is an honor for me."

"The UMass Lowell/NSRDEC collaboration provides the opportunity to work with an excellent scientist on projects that are important for our nation's well-being," said Nese Orbey, Ph.D., associate professor, chemical engineering, University of Massachusetts Lowell, who is also working with Truong.

Students benefit from the program, as well.

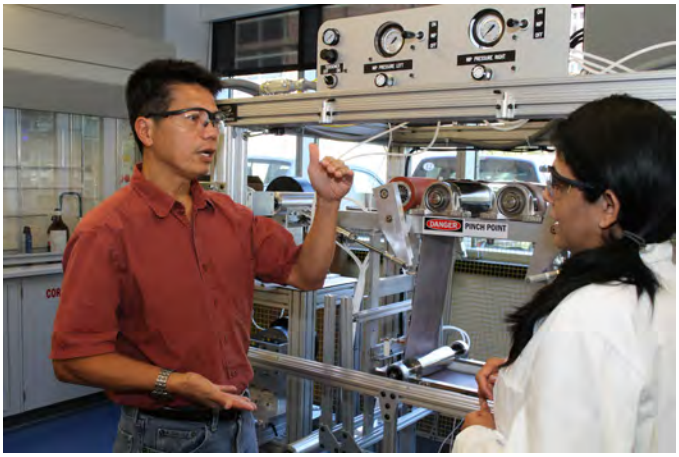
"HEROES is a great opportunity for NSRDEC (scientists and engineers) to provide UML students valuable firsthand experience in research, innovation and potential commercialization of promising Soldier technologies," said Samuelson. "For many of these students, it is their first exposure to a laboratory outside of academia, and through HEROES they are able to apply their studies to exciting real- world military applications. Our NSRDEC (scientists and engineers) also benefit from the fresh ideas, dedication, passion and excitement that the students bring to each project. Ultimately, the DoD may benefit from the development of future DoD scientists."

"It was a great experience to work with Quoc and the program," said Cody Langlois, who is majoring in plastics engineering at UMass Lowell. "Quoc was always focused on the final goal of the project but made sure that the different team members understood the individual steps to reach that goal. He was always friendly and helped give me a look at what a career at Natick Labs looks like."

"By being at the university, we have access not only to the professors, but also a pool of students," said Truong. "Many of them are very bright, and they really work hard."

The relationship between the university and NSRDEC also fuels brainstorming. NSRDEC organized a Human Augmentation Roundtable. The event was an open and welcoming venue for discussing ideas and presenting differing perspectives. The aim of the Army's human augmentation effort is to merge human and machine to enhance endurance, speed, agility and accuracy, while reducing potential injuries faced by Soldiers.

"HEROES is a win-win for all: win for NSRDEC Scientists to tap into UML faculty, students, expertise and facilities to create new solutions to Soldier needs; Win for UML faculty to apply their valuable academic research and expose their students to real-world military problems; and most importantly, a win for our Soldiers, who will be the benefactors of cutting-edge research and innovation to improve their safety, agility and sustainability in the field," said Samuelson.



Quoc Truong, a physical scientist at the Natick Soldier Research, Development and Engineering Center, or NSRDEC, discusses a process used to create super-omniphobic surfaces with Dr. Artee Panwar, who is a postdoctoral researcher at the University of Massachusetts Lowell. NSRDEC and UMass Lowell are working together to solve complex science and engineering challenges. Photo Credit: Edwin Aguirre

Natick, Tufts team up to advance cognitive science

June 29, 2015

By Jane Benson, NSRDEC Public Affairs

Army researchers have teamed up with the Tufts University School of Engineering to create the Center for Applied Brain and Cognitive Sciences, or Center for ABCs.

The center is co-directed by Dr. Caroline Mahoney, team leader for the U.S. Army Natick Soldier Research, Development and Engineering Center, or NSRDEC, cognitive science team, and Dr. Holly A. Taylor, a professor of psychology in Tufts' School of Arts and Sciences who also has an appointment in mechanical engineering at Tufts.

"The new partnership between Tufts and NSRDEC will allow NSRDEC scientists opportunities to partner with Tufts faculty and students and utilize unique center resources," Mahoney said. "It will also afford the opportunity for Tufts faculty, undergrad and grad students to gain further real-world experience working collaboratively with NSRDEC scientists to solve Soldier problems in specialized NSRDEC facilities, such as the climatic chambers, that are not available to them at the university."

"This partnership will also extend the expertise available for innovative, collaborative projects for Tufts researchers and graduate students by involving the NSRDEC researchers," Taylor said. "Interdisciplinarity is highly valued at Tufts already, and this center fits that emphasis."

By bringing together experts in engineering, neuroscience, psychology, linguistics, computer science and robotics, the collaboration aims to advance researchers' understanding of how people think, respond and perform in demanding, real-world situations. The center will ultimately provide insight into how Soldiers think in response to ever more complicated and challenging environments.

"Our objective at the cooperative center is to identify innovative, interdisciplinary approaches to monitoring Soldier physiological and mental states, predicting how those mental states influence operational behavior, and optimizing behavior via adaptive, multimodal interfaces and robotic platforms," said Dr. Tad Brunyé, center program manager and member of NSRDEC's cognitive science team. "This objective is accomplished through fundamental and applied interdisciplinary research to inform the design and development of next-generation support and augmentation systems, enhancing future Soldier capabilities and performance during kinetic operations."

The center's research will be divided into four areas.

The first area will examine the principles, which govern interactions between people and intelligent supporting systems.

"These include hand-held and person-borne devices [smart phones, head-mounted displays and tablets] and autonomous robotic platforms aimed at augmenting and optimizing human cognition, effect, and/or physical capabilities in mixed initiative teams," Mahoney said.

The second area involves monitoring, characterizing and optimizing cognitive and non-cognitive states.

"Research efforts will focus on establishing and testing multimodal - physiological, neurophysiological, behavioral, hormonal - measures and metrics for monitoring and characterizing relevant cognitive and non-cognitive states such as frustration, mental workload, stress, readiness for problem-solving, fear, uncertainty and fatigue - cognitive and physical," Mahoney said.

The third area involves studying ambulatory human performance of cognitive and physical tasks. The area will examine warfighters on the move engaged in environments based on real-world conditions and demands.

The fourth area of study will focus on applying cognitive science findings to team-based situations, which require interaction, communication and cohesiveness among team members.

Mahoney is excited about the center's possibilities.

"The Center for Applied Brain and Cognitive Sciences is a tremendous opportunity for NSRDEC human sciences to pioneer a truly innovative environment that brings together a multidisciplinary group of world-renowned experts in the fields of cognitive science, psychology, neuroscience, computer science, robotics, engineering, linguistics, and nutrition to push the state of the science on measuring, predicting and enhancing cognitive capabilities and human-system interactions for individuals and teams working in naturalistic high-stakes environments," Mahoney said. "The research focus for the center is the dismounted Soldier, but certainly data and knowledge products developed will have the potential to make a significant impact on law enforcement, emergency first responders, and the medical community, as well."

The Tufts School of Engineering is one of the eight schools and colleges that make up Tufts University. The school, located in Medford/Somerville, Massachusetts, offers undergraduate and professional degrees in several fields of engineering and computer science.

Scientists at the Center for Applied Brain and Cognitive Sciences collect data on the efficacy of administering targeted brain stimulation on memory and navigation performance in novel environments. Photo Credit: Dr. Tad Brunye, NSRDEC

Students participate in research laboratory design challenge at Natick

April 22, 2015

By Tazanyia Mouton/ USAG-Natick Public Affairs

More than 150 students, from 17 colleges and universities and three service academies, were on hand at the Natick Soldier Systems Center, April 13-17, as they partook in the 2015 Air Force Research Laboratory, or AFRL, University and Service Academy Design Challenge.

The AFRL is a scientific research organization operated by the U.S. Air Force Materiel Command dedicated to leading the discovery, development and integration of affordable aerospace warfighting technologies.

The laboratory, formed in 1997, has conducted numerous experiments and technical demonstrations in conjunction with a wide range of agencies to include the Department of Defense.

The AFRL design challenge makes great efforts to deliver creative solutions to challenging problems, and presents an exciting opportunity for students to exercise their talents and contribute to the nation's defense.

This year's challenge asked students to design and prototype a heat stress prevention kit that could safely, rapidly and effectively remove undesired heat away from body exteriors during special operations in hot and humid environments.

The biggest constraint students had to work with was the fact that in hot environments, it is often difficult for the warfighter to wear heavy protective equipment.

The challenge also called for the kit to be rapidly deployable, self contained, and portable.

In September, students were given their mission, and they have had the last seven months to develop their ideas and create their prototypes.

Due to the nature of this year's challenge, it was only fitting that students' prototypes would be tested in the U.S. Army Natick Soldier Research, Development and Engineering Center's Doriot Climatic Chambers.

The chambers are a one-of-a-kind facility that can reproduce environmental conditions that occur anywhere in the world, producing tropic wind with temperatures as high as 165 degrees, and arctic wind with temperatures as low as minus 70 degrees.

The chambers can also simulate rain up to four inches per hour and wind up to 40 miles per hour.

Through these extreme conditions, testing of physical properties of military equipment, as well as testing of physiology and adaptations of human subjects, can be performed here.

Josh Osborne, an aerospace engineer and AFRL design competition program manager, said the challenge is unique because it can present a solution to a real-world need for Air Force Special Operations.

"The overall purpose is to get a system [or] an idea together to solve the problem," Osborne said. "At the same time, grow the future engineers that are ready to graduate and get them interested."

Osborne said that the students also had to consider the dimensions of the system.

"When a special operations person takes something with them, they have to think, 'Would I leave a (meal, ready-to-eat) behind to take this?' So it has to be important enough for them to bring it to begin with, so weight and size is a big thing," Osborne said.

After several months of working on their innovations, the challengers tested their prototypes in the chambers.

Test subjects donned the students' prototypes and walked on a treadmill for one hour at an approximate pace of three miles per hour with temperatures nearing 100 degrees Fahrenheit with 40-percent relative humidity.

Osborne said throughout the test, subjects' heart rates and skin temperatures were monitored.

Cadet Ioannis Wallingford, a senior at the U.S. Military Academy at West Point, New York, said he is proud of the work his team has done.

"It feels great; it's something that actually touches me pretty deep," Wallingford said.

Wallingford said that during cadet basic training, a classmate of his died due to a heat-related incident.

"I chose this capstone because this is something that would have decreased the risk for an incident like that to happen," Wallingford said.

Wallingford described his teams' prototype as sophisticated but also simple.

"Our system uses a passive system combined with an active system because we realized our passive system alone would not produce the cooling capacity required," Wallingford said. "It creates a synergistic effect between the two."

The winning university team of the AFRL challenge was not only awarded a symbolic "Wright Brothers" trophy, but the potential for a $100,000 grant to further develop their innovative idea.

The service academies were in a separate competition amongst themselves, where they had a chance to win bragging rights for the next year, as well as a trophy of their own.

Students also "win" by experiencing solutions to real-world problems, while getting an opportunity to contribute to products that could potentially help save the lives of our nation's warfighters.

Test subjects walk on a treadmill with student prototypes of heat stress prevention kits in the U.S. Army Natick Soldier Research, Development and Engineering Center's Doriot Climatic Chambers during the 2015 Air Force Research Laboratory University and Service Academy Design Challenge, April 17, 2015. Photo Credit: Tazanyia Mouton, USAG Natick Public Affairs

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