

August 2018

# NSSC This Month



## Feel the Heat

**Army Researchers Partner  
with Fort Benning  
to Study Heat Illness  
in 2,000 Soldiers**

### Also inside:

- \* Run to Home Base
- \* Lessons in STEM
- \* The Science of Spit
- \* Combating Injury



Installation Management Command  
Maj. Gen. Keith L. Ware Awards  
First Place, 2017, PDF Publication



## Publisher's Note

John Harlow  
*USAG Natick Public Affairs*



September is Suicide Prevention Month.

This is something that personally hits home to me.

Thankfully, I have never lost anyone to suicide, but it's not because the thoughts weren't there.

As a teenager, a member of my family was struggling. Everything seemed to be going against them. Their partner cheated on them, they lost their job and the family was living on unemployment, food stamps and in low income housing. They didn't see a reason to go on.

For some reason, I happened to walk in and talk to them all night and they decided to get help.

My first night of basic training, when I jumped out of the top bunk for my turn on fire guard, I landed in a pool of blood that came from the guy in the bottom bunk who slit his wrist because he was homesick. The guys in my platoon helped save him that night.

I think of Justin Fitch telling me about when he was in his dark place in Iraq in 2007. He had the M-4 in his mouth, switched the selector from safe to fire, but didn't pull the trigger.

Because he got help, he was able to help many people see that there is light outside the darkness in their mind.

An ABC News report that just came out that self-injury mortality is now the seventh leading cause of death moving past diabetes.

Suicide is preventable.

Check on your friends, check on your neighbors and ask the tough question if you see them in a dark place. Ask them if they are thinking about killing themselves. Try to find a way to help them.

There are plenty of places to get help. The Home Base Program, the VA, your local hospital, the Employee Assistance Program are there to help.

As a teenager I told a family member their life was worth living and they got help. Maybe you could be the difference and saving someone's life by letting them know that help is there and their life is worth living.

Be safe this Labor Day weekend.



John Harlow  
Chief of Public Affairs/Legislative Liaison  
USAG Natick

## NSSC This Month

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### About this newsletter

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Cover story by Mallory Roussel, USARIEM. Photo by David Kamm, NSRDEC.



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# RUN

to  
Home  
Base

## Running to Wipe Out the Invisible Wounds of War

By John Harlow, USAG Natick Public Affairs/Natick, Mass.

On a sunny and muggy 85-degree day, more than 2,500 runners navigated through the streets of Boston for one purpose: to wipe out the invisible wounds of war.

That was the vision of Boston Red Sox Chairman Tom Werner after visiting Walter Reed Army Hospital after the team won the 2007 World Series.

"It was a good idea ([Home Base Program](#)) and through the work of all the people who come out here and donate money, I think we feel that we are making progress against what we all know is a stubborn challenge," said Werner.

"Part of the problem is that some of these brave men and women come back from combat and they are worried about showing a vulnerability. One of the things that makes the Home Base Program great is that there are people here who will care for you," Werner continued. "It's okay to say you're vulnerable and all we really want is to have these people who have served their country to be able to lead productive lives. We all know the statistics of the number of veterans who take their own lives every day. This program not only welcomes them, but I have seen first-hand how transformative it is."

Home Base is dedicated to healing the invisible wounds of war for service members, veterans and their families through clinical care, fitness and wellness-based programs, community outreach, education and research. Goals include developing an effective treatment plan that meets each individual's needs and improves their quality of life, help them overcome or ease the effects of post-traumatic stress or traumatic brain injury, and help the service member or veteran successfully return to family life, job, school and community.

Home Base's clinical services are part of the [Massachusetts General Hospital](#) and affiliated with [Spaulding Rehabilitation Hospital](#). For

the past 16 years, Massachusetts General Hospital has ranked first in the nation in psychiatry by [U.S. News & World Report](#). The hospital consistently ranks among the top 10 hospitals in the nation overall for patient care. Spaulding Rehabilitation Hospital provides outstanding care for veterans with traumatic brain injury, was ranked fifth nationwide by U.S. News & World Report in 2011, and is the only rehabilitation hospital in New England to make the list since 1995.

[Gen. James McConville](#), the 36th Vice Chief of Staff of the Army, and native of Quincy, Massachusetts, ran the race and took part in pre-race ceremonies.

"It's great to come back to your home town and see the people of the city and the whole state supporting our troops, our families and our veterans," said McConville. "It's very very special to be here."

The general has a message for any Soldier, family member or veteran who are struggling with post-traumatic stress or any factor in life that could cause them to think that living wasn't worth it.

"It is absolutely essential to reach out for help," said McConville.

"There are a lot of programs both inside and outside the military depending on what our troops need. They absolutely should get the help that they need."

Many military leaders will encourage subordinates to make sure they take care of themselves and have a good work-life balance, but at times don't listen to their own words.

"We make sure that our leaders get help if it is necessary," said the general. "Our senior leaders are required to get annual physicals and part of the physical is their mental health to make sure they are being checked out. Like any good race car or vehicle, you have to take the car in for service. It's not a sign of weakness to get help, it's a sign of strength."



Of the more than 2,500 who ran or walked the 9K or 5K routes, several were veterans who have received treatment through the Home Base Program, like former Army medic Denise Florio.

"I carried my best friend Justin Fitch, my cousin Private 1st Class Brian Moquin and Nick Xiarhos with me today during the run," said Florio. "I have been a member of the Home Base Program for quite a few years now. When I was going through a really dark time, a good friend introduced me to Home Base and they put me into a two-week boot camp for female veterans with PTSD and it turned my life around."

This run was vitally important to the Home Base Program, with the money being raised this year funding two new programs to include a first of its kind Families of the Fallen program.

"[The Families of the Fallen Program](#) started with a conversation with Kim Ruicco from [TAPS](#) (Tragedy Assistance Program for Survivors)," said Brig. Gen. (Ret.) Jack Hammond, executive director of the Home Base Program. "She explained that there is no program for survivors. They don't have a clinical program anywhere in the country. These are spouses who have lost everything. In most cases they walked in on or saw a completed suicide. Widows and widowers in their 20s with young children. They are pretty injured folks, so we took our two-week program for veterans and modified it and tested it with a group of surviving spouses and it worked magnificently."

"This program is completely unfunded and we needed to have a great turnout this year to be able to pay for this program while we search for a permanent funding source," said Hammond. "We fly the spouses in from anywhere in the country and they get a year of therapy compressed into two weeks and they leave transformed. We were going to make this program happen one way or another and today's turnout will do a lot of good to get this program off the ground."

Because of the efforts of more than 2,500 runners on a hot July morning, lives are transformed and saved and some great memories are made.



Gen. James McConville, the Vice Chief of Staff of the U.S. Army speaks during the opening ceremony of the ninth annual Run to Home Base at Fenway Park. More than 2,500 runners braved the hot and humid conditions to run or walk the 9K or 5K course and cross home plate. (U.S. Army photo by John Harlow, USAG Natick)



Brig. Gen. Vincent Malone, senior commander, Natick Soldier Systems Center (NSSC), shakes hands with a Run to Home Base participant. (U.S. Army Photo by John Harlow, USAG Natick).

"As a kid, I was sitting out in the right field bleachers," said McConville. "Now I get to come out here and cross home plate. It's very, very special to me."

"Today has been uplifting for me," said Florio. I am overwhelmed by the support that all of these people have shown by running and cheering us on. It's just an amazing day."

Help is available if you are a Soldier, family member or veteran who is struggling with the invisible wounds of war.

"I have been there. I had to get help when I returned from Iraq in 2004," said Hammond. "It made a difference in my life. I have talked to thousands of people who have been served by the Home Base Program to include [Medal of Honor](#) recipients. If you think you're too tough to reach out for help, you're not."

"The weak part of you is not asking for help," Hammond continued. "The strength is you coming in and stepping over that threshold. It is probably one of the hardest and bravest things you can do, but it will change your life and you can regain the life you once had."

Resources:

Contact your unit Chaplain

[National Suicide Prevention Hotline](#): 1-800-273-8255

Home Base Program: [www.homebase.org](http://www.homebase.org)

Tragedy Assistance Program for Survivors: [www.taps.org](http://www.taps.org)









NSRDEC

# Natick's Technical Data Packages Have Far-Reaching Impact



By Jane Benson, NSRDEC Public Affairs/Natick, Mass.

Some of the most significant contributions are sometimes made quietly behind the scenes. This is the case for the team who works on technical data packages, or TDPs, at the U.S. Army Research, Development and Engineering Command Soldier Center.

TDPs include technical drawings, as well as other information, that drive the design, prototyping and manufacturing of a wide range of warfighter equipment. The Soldier Center team is responsible for the Army's TDPs and also many TDPs for other branches of the Armed Services.

Produced by the center, the TDPs are an incredibly important because without them cutting-edge items invented by their top-notch scientists and engineers, as well as inventors from other organizations, could not come to fruition.

"Everything out there needs a drawing or else it doesn't go into production," said Robert Galyan, a drafter on the Technical Services Team.

The technical data packages are key to prototype development and to making sure things run smoothly when items go out to mass production. The packages play a huge role in making sure the Army and the other branches of the Armed Services get the equipment and capabilities that they need.

"Technical data packages are really the blueprint for us to procure equipment or to send it out to industry so that industry is able build a product according to our specifications," said Caleb Singer, team leader of the Technical Services Team.

"TDPs control everything that we make and everything we use," said Galyan. "The TDPs take an item to a functional level, including making a prototype or incorporating an item into an already widely used piece of equipment, such as a rucksack that is used by every Soldier."

"It's essentially formalizing a prototype," said Singer. "So here at

*Robert Galyan -- a drafter on the Technical Services Team at the Natick Soldier Research, Development and Engineering Center -- works on a technical data package, or TDP. TDPs include technical drawings, as well as other information, that drive the design, prototyping, and manufacturing of a wide range of warfighter equipment. (U.S. Army photo by David Kamm, NSRDEC).*

NSRDEC, they will build an item, test it, bring it out to the Soldiers and have Soldiers test and use it, and then make modifications based on Soldier feedback. Then once you have that prototype, you have to formalize it into a technical data package listing all the different pieces of equipment that are required to build this item. It has to be standardized and approved. This is one of our core missions at NSRDEC."

The team works closely with the center's scientists and engineers from several teams, as well as several Product Managers and outside entities.

"The whole process is really intricate," said Galyan. "It takes a lot of different people to do their piece of it. There's a lot of back and forth with the engineers and the people actually making the items. Everyone has to be on the same sheet of music to make things happen efficiently."

Singer is proud to lead such a talented and competent team.

"It's a very technical job," said Singer. "You have to understand multiple systems and manage configurations, including storing all the data and making sense of it."

As technology advances, the TDP process is always evolving.

"The direction in which things are going is very exciting," said Singer. "Developments like 3D printing will expedite and improve testing methods and allow for easier replication. All this will enable us to build and track our products better."

"Our 2D legacy work is important, but we need to also embrace the 3D trends, stay on top of them, and be prepared for whatever comes next," said Galyan.



# Lessons in STEM

## USARIEM Gives Kids Hands-On Experience in Science Through 2018 GEMS Program

By Mallory Roussel, USARIEM Public Affairs/Natick, Mass.

The [U.S. Army Research Institute of Environmental Medicine](#), or USARIEM, is once again sponsoring the [Gains in the Education of Mathematics and Science](#), better known as the GEMS program, an extracurricular summer science education program that enables middle-school-aged students to experience science in a laboratory setting.

GEMS has a multidisciplinary educational agenda, and students participate in grade-appropriate activities related to science, engineering, mathematics, computational sciences, computational biology, biomedical sciences, chemistry and biology.

There are also a few new faces this year. Capt. Thomas Cotrone, a neurophysiologist from USARIEM's Military Nutrition Division, has taken over as the new GEMS program director for USARIEM. Cotrone said his goal in this year's GEMS program is to encourage budding scientists to learn and explore by doing hands-on science activities that can be applicable to real-life science.

"What we are really trying to shoot for is getting the kids to appreciate science, technology, engineering and math, better known as STEM," Cotrone said. "Beyond that, we hope that we can spark kids' interest in science and build a foundation where they can pursue a future scientific career."

On its eighth year, the USARIEM GEMS program has three programs, GEMS I, II and III, with xxx children in attendance. Each



*Students learn about blood types in a crime scene investigation laboratory exercise as part of the Gains in the Education of Mathematics and Science, better known as GEMS program, which is sponsored by the U.S. Army Research Institute of Environmental Medicine, or USARIEM. (U.S. Army photo by K. Houston Waters, USAG Natick).*

GEMS session allows students to return the following summer, slowly building on the lessons learned the summer before and encouraging the growth of future scientific leaders.

Advanced high school- and college-age students called "near-peer mentors" lead the GEMS programs and serve as role models for the students. Prior to their arrival, near-peer mentors completed extensive training at a science boot camp, in which they learned how to conduct and teach GEMS experiments.



“The near-peer mentors are actually the ones who are with the kids on a daily basis,” Cotrone said. “They are the ones who are actually running the laboratories, teaching the kids and interacting with them one-on-one.”

Cotrone mentioned that younger high school students who graduated from the GEMS program can also serve as assistant mentors.

Every day in the lab offers new and exciting activities for the GEMS kids, such as extracting DNA from strawberries and spinach, learning about blood types in the crime scene investigation class, programming robots to navigate through obstacle courses, and taking field trips to the Combat Feeding Directorate in Natick Soldier Research, Development and Engineering Center, or NSRDEC, to learn how scientists create tube food for Soldiers.

Cotrone said that USARIEM continues to sponsor the GEMS program, which is part of the [U.S. Army Educational Outreach Program](#),

or USAEOP. The USAEOP has a long history of recognizing that having scientifically and technologically literate citizens is the country’s best hope for a secure, rewarding and successful future.

GEMS began in 2005 as a single program at [Walter Reed National Military Medical Center](#). The GEMS program has grown to 12 sites in eight states across major U.S. Army research installations, including USARIEM, which runs annually from July to August.

**“The GEMS program is part of USARIEM’s effort to educate the next generation, so they can positively contribute to our nation.”**

**Capt. Thomas Cotrone, USARIEM**

“The GEMS program is part of USARIEM’s effort to educate the next generation, so they can positively contribute to our nation,” Cotrone said. “By instilling an enhancement in general scientific literacy in our population, particularly the future workforce, we are going to ensure the nation’s hospitals, industries, universities and military have the best scientific, medical, engineering and technological advancements.”



*Lauren Francis, a near-peer mentor, teaches students about blood-typing during a crime scene investigation laboratory exercise at Natick Soldier Systems Center. The exercise was just one of many during the week-long Gains in the Education of Mathematics and Science event, an annual program sponsored by the U.S. Army Research Institute of Environmental Medicine, or USARIEM. (U.S. Army photo by K. Houston Waters, USAG Natick).*



# Leapfest 2018

August 5, 2018

**Focal  
Point**



A U.S. Army Paratrooper jumps from a U.S. Army CH-47 Chinook helicopter during airborne operations at Leapfest 2018 at the University of Rhode Island in West Kingston, R.I., Aug. 5, 2018. Leapfest is the largest, longest-standing, international static line parachute training event and competition hosted by the 56th Troop Command, Rhode Island Army National Guard, to promote high level technical training and esprit de corps within the International Airborne community. Over 300 Paratroopers from nine different countries will participate this year. (U.S. Army photo by Staff Sgt. Justin P. Morelli)



Soldiers and Department of the Army civilian employees supporting Team Natick pose for a group photo after competing in Leapfest 2018 at the University of Rhode Island in West Kingston, R.I., Aug. 5, 2018 (U.S. Army photo by David Kamm, NSRDEC).



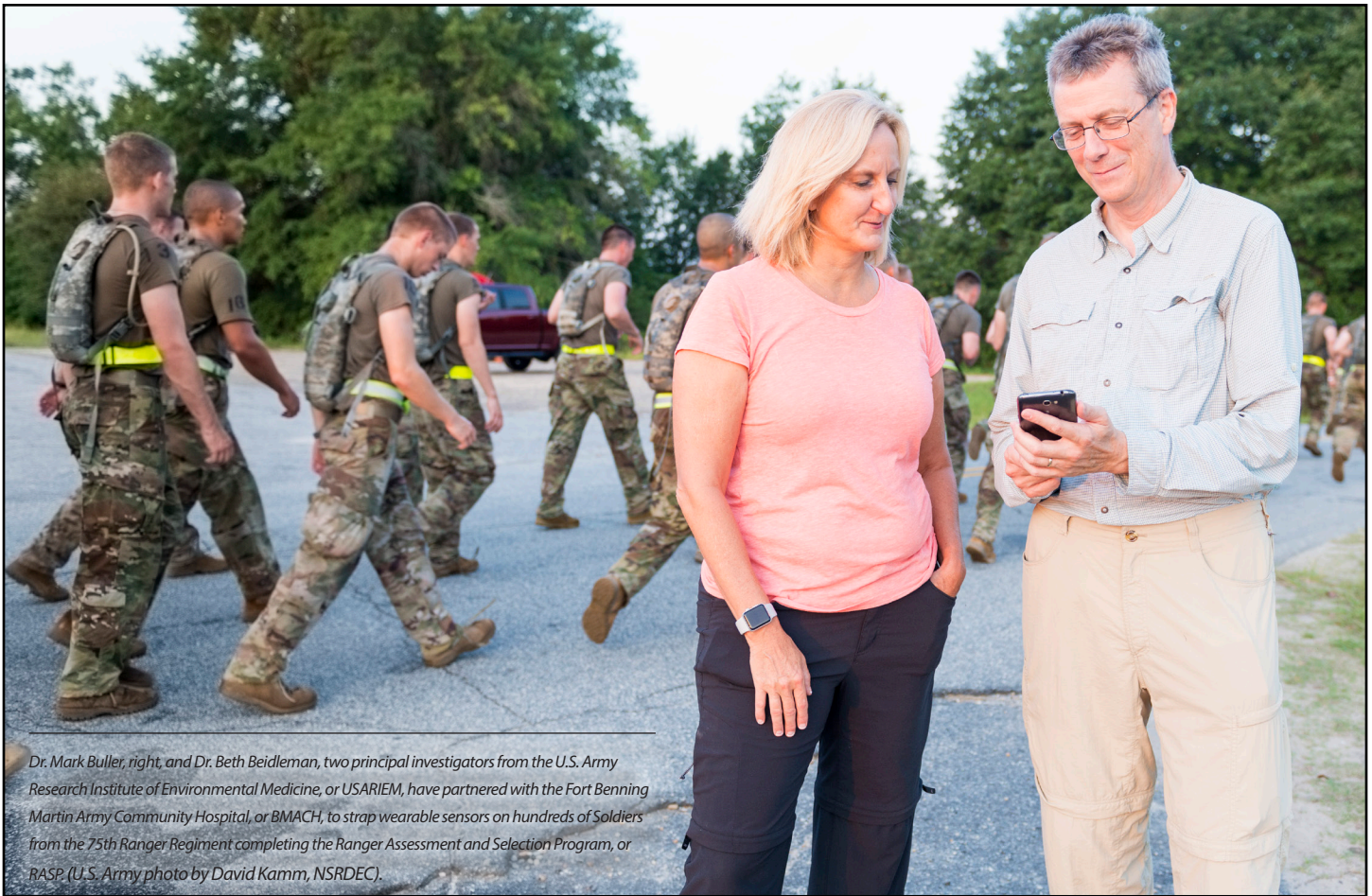


# Feel the Heat

**Army Researchers Partner  
with Fort Benning  
to Study Heat Illness  
in 2,000 Soldiers**

*Soldiers from the 75th Ranger Regiment at Fort Benning, Ga., wore real-time physiological status monitors, or RT-PSMs, under their shirts while completing a five-mile run during the Ranger Assessment Selection Program. Analyzing data collected from the RT-PSMs will help U.S. Army Research Institute of Environmental Medicine researchers find heat illness predictors and establish thresholds for what is considered dangerous during training, which could help the Army develop better preventative practices against heat illness. (U.S. Army photo by David Kamm, NSRDEC)*





Dr. Mark Buller, right, and Dr. Beth Beidleman, two principal investigators from the U.S. Army Research Institute of Environmental Medicine, or USARIEM, have partnered with the Fort Benning Martin Army Community Hospital, or BMACH, to strap wearable sensors on hundreds of Soldiers from the 75th Ranger Regiment completing the Ranger Assessment and Selection Program, or RASP. (U.S. Army photo by David Kamm, NSRDEC).

**By Mallory Roussel, USARIEM Public Affairs/Natick, Mass.**

Recently, in an effort to study ways to predict heat illness, researchers from the U.S. Army Research Institute of Environmental Medicine, or USARIEM, strapped wearable sensors on Soldiers from the [75th Ranger Regiment](#) as they completed the first and second Ranger Assessment and Selection Program, or RASP, in Fort Benning, Georgia.

The data collection was part of a larger research study in collaboration with the [Fort Benning Martin Army Community Hospital](#), or BMACH. USARIEM researchers have been using real-time physiological status monitors, or RT-PSMs, to collect physiological data from 2,000 Soldiers completing airborne and basic combat training. The RT-PSMs, which can track Soldiers' core and skin temperatures and heart rates as they train, will help researchers see how the body responds when healthy and when experiencing a heat illness. The researchers aim to complete their study by the end of this summer.

Dr. Mark Buller and Dr. Beth Beidleman, both principal investigators and research physiologists from USARIEM, explained that there is little research that shows whether some individuals might be more susceptible to heat injury than others. This effort would not only help the researchers get closer to finding that answer, but it would also help the researchers evaluate the RT-PSM's capabilities.

"We are collecting data on Soldiers during hot weather training to determine if those who develop heat illness possess a unique physiological profile compared to their peers who perform the same training activities but do not develop heat illness," Buller said. "We would like to use this data in order to evaluate the capabilities of the current RT-PSM, as well as develop an alerting system similar to a radiation badge that can track impending heat casualties without changing

training standards."

"The Army has gotten better at treating heat illness when it occurs, but we want to work at preventing it in the first place," Beidleman said. "We are studying to see if using real-time modeling can do that."

Because of the climbing number of heat casualties during the past few years, this data could help the Army develop better preventative practices when dealing with heat illness. [The U.S. Army Public Health Center](#) recently reported there have been 480 cases of heat illness since January 2018, with 272 cases occurring in June. Out of those 480 cases, according to Maj. Michael Bursey and Maj. Meghan Galer, the Medical Director and Assistant Chief of BMACH's Department of Emergency Medicine, Fort Benning reported 219 of them.

When Buller's team heard about the magnitude of the problem, they traveled down to Fort Benning to meet Bursey and Galer. When Buller demonstrated the RT-PSM's capabilities, USARIEM and BMACH agreed that using RT-PSMs in a study with a large, diverse population of Soldiers could help advance heat illness research and develop practical prevention guidance. Due to the "high heat and humidity and the numerous training programs involving intensive outdoor activity," as Galer described it, Fort Benning was the perfect place to do this.

Bursey and Galer have been two of the biggest driving forces on preventing heat-related deaths across the [Department of Defense](#), or DoD, and are working to establish Fort Benning as the DoD's first "Heat Center." The Heat Center initiative, according to Galer, focuses on developing and optimizing strategies to educate, manage and provide treatment for the force on heat illness prevention. BMACH's



partnership with USARIEM is part of this initiative.

“At Fort Benning, we are truly on the cutting edge of clinical management of heat-related illnesses,” Galer said. “We see the highest volume of heat-related illnesses in the Army, including over 219 cases to date in 2018. Despite these astronomical numbers, we are very proud that we have had no deaths in over two years. Developing the Heat Center at Fort Benning will be an invaluable means by which to improve readiness through sustainable prevention and mitigation strategies, as well as provide life-saving medical care while advancing the state of medicine.”

To collect data, the USARIEM researchers outfitted volunteering Soldiers with RT-PSMs, and the Soldiers completed their training as usual. The RT-PSM, a chest harness, can track a person’s heart rate and skin and core temperatures while they train. One of the ways the RT-PSM is able to do this is because of the Estimated Core Temperature, or ECTemp, algorithm that is incorporated into the chest harness.

Buller, the developer of the ECTemp, explained that the algorithm uses mathematics to provide accurate estimates of core body temperature, simply by analyzing heart rate changes over time. USARIEM developed the ECTemp based on years of physiological data collected from multiple studies.

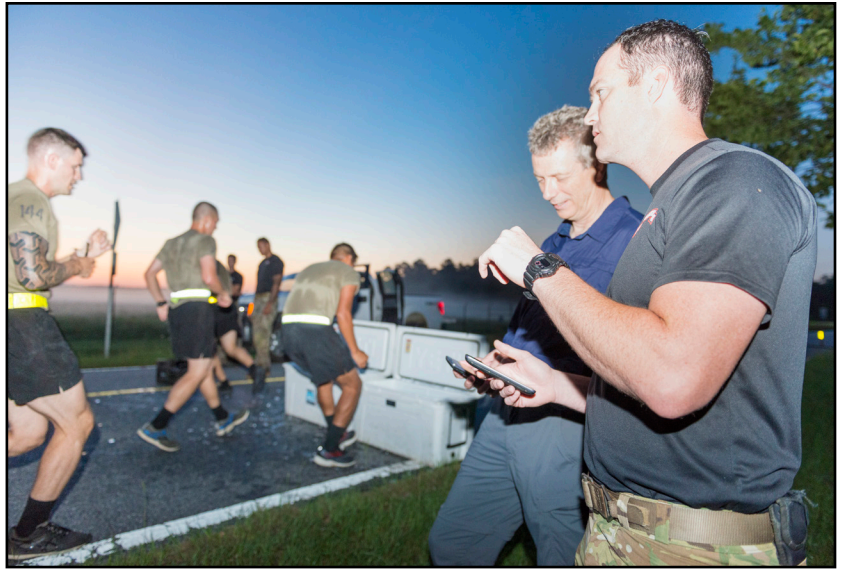
Additional studies have indicated that the ECTemp has been successful in real-world scenarios. In a notable example, researchers from the [Air Force Research Laboratory](#) who equipped 350th Training Squadron trainees with wearables using the ECTemp presented data that showed “using the ECTemp has helped them identify and mitigate over 30 cases of heat stress and prevented more serious heat stress casualty situations.”

“The ECTemp is incorporated into the RT-PSM in order to provide situational awareness,” Buller said. “It is not meant to replace the current procedures for assessing or evacuating people, but it is meant to provide leaders and medics with more objective information so they can identify at-risk people earlier and apply their heat mitigation strategies or casualty standard operating procedures. This kind of technology could improve readiness by helping to increase the number of Soldiers who complete their training successfully.”

“Real-time monitoring allows us to compare the core temperature and heart rate data in Soldiers who did not get heat illness to the ones who did,” Beidleman said. “We have actually been able to capture data on individuals who have suffered heat stroke. If our analysis shows there are physiological differences between Soldiers who developed heat illness versus the ones who did not, this information could help us find heat illness predictors and establish thresholds for what is considered dangerous during training.”

For the past few weeks, the USARIEM researchers have collected physiological data from Soldiers completing a vast array of training courses. Galer and Bursey, using their hospital records, identified events that were considered high-risk, from completing five-mile runs in the summer heat to sitting in a hot cargo plane during Airborne training.

In the July study iteration, 31 Soldiers from the 75th Ranger Regiment, all from diverse climates, wore RT-PSMs while completing RASP training. RASP training includes events where Soldiers have



*While Fort Benning Soldiers rush to cool down in the Georgia heat through arm immersion cooling, a method that helps cool the body faster so Soldiers can continue training, Dr. Mark Buller, a principal investigator from the U.S. Army Research Institute of Environmental Medicine, or USARIEM, and Capt. Donald Frazee, a physician assistant for the Regimental Specialist Troops Battalion at Fort Benning, GA, collect physiological data with the help of wearable sensors and smart phones. (U.S. Army photo by David Kamm, NSRDEC).*

gotten historically hot, such as a five-mile run, 12-mile ruck march and field exercises. USARIEM researchers also outfitted 162 Soldiers from the Officer Candidate School who were completing land navigation training. Buller added that land navigation can be especially high-risk because a Soldier could collapse in the woods from heat stroke while isolated from their battle buddies.

USARIEM continues to respond to the risk of heat illness by advancing their understanding of heat illness and hydration, so that the Heat Center at Fort Benning and the Army’s other training centers can continue to use the most accurate scientific information to educate the force on prevention and treatment.

The Army’s guidance on heat illness prevention and hydration requirements, [Technical Bulletin Medical 507](#), was written by USARIEM in 2003 based on decades of research and is currently undergoing revision. Meanwhile, USARIEM thermoregulatory scientists are providing up-to-date guidance as members of the [Training and Doctrine Command](#) Safety Officer Heat Injury Prevention Subcommittee. In addition to the RT-PSM study at Fort Benning, USARIEM scientists are conducting additional studies at other sites to identify biomedical markers of increased risk for heat-related illness.

Buller and Beidleman hope the findings they gather from the RT-PSMs will support the Army’s initiative to improve preventative measures against heat illness so Soldiers will be fit to fight when they train and when they come home.

“You have to be careful about what information you push out there on heat illness prevention,” Buller said. “Will the Soldiers understand the quality of the data they’re getting, and what will they do with that information? In the last few years, BMACH has rolled out a whole series of procedures and training sessions on heat illness prevention measures.

“They have tried to get the treatment piece down by encouraging fast response and treatment of injuries. Now, they would like to see if USARIEM technology can help prevent heat injury from occurring in the first place.”



# The Science<sup>of</sup> *Spit*

**Saliva Samples Provide Gauge  
for Warfighter Readiness**



A Soldier with the 82nd Airborne Division spits into a test tube that researchers from the U.S. Army Research, Development, and Engineering Command tested for cortisol levels during a stress shoot test. (U.S. Army photo by David Kamm, NSRDEC)



By isolating and analyzing certain biomarkers found in saliva, scientists can determine a warfighter's physical condition and determine whether to pull him out of combat or to extend the recovery time before re-engaging.

"This data could help draw a correlation between various metabolite biomarkers and warfighter performance; for example relating an increase or decrease in a particular marker to performance in a drill or exercise," said research biologist Trevor Glaros, Ph.D.

Basically, this data could enable leaders to determine a warfighter's status almost like a gas gauge in a car or a health bar in a video game. In doing so, troop deployment can be made more effective and strategic, supporting Army priorities like soldier lethality.

The study, called [Monitoring and Assessing Soldier Tactical Readiness and Effectiveness \(MAS-TR-E\)](#), started in late May and is conducted in collaboration with the RDECOM Soldier Center and numerous other Army organizations. The program is being observed at a high level, gaining the attention of multiple generals.

Research under the study is diverse and far reaching, but the RDECOM C&B Center's focus is on biomarkers in saliva.

Using liquid chromatography-mass spectrometry (LC-MS), researchers are essentially isolating biomarkers of interest found in saliva and determining which ones might be the best markers of performance. For example, cortisol relates to stress and melatonin relates to the sleep cycle, while lactate relates to muscle fatigue.

Recently, researchers performed a field study with three platoons of paratroopers at [Fort Bragg](#), with saliva samples being taken before, during and after a three-day simulated combat exercise. The field test evaluated Soldiers for strength measurements, sleep, cognition, shooting performance and other exercises.

"We're looking at biomarkers and how they changed over time to see if there's a particular way they respond to physical exertion and stress," explained research biologist Elizabeth Dhummakupt, Ph.D. "With this data, we can say when a specific biomarker reaches a certain level, we should probably pull this Soldier from combat and let him recover."

"We're really focused on looking at Soldiers as they recover," she added. "At what level can we say they're ready to go back to the field?"

Following that study, researchers are now analyzing over 3,500 saliva samples for eight analytes or biomarkers that correlate to performance. As a part of this study, researchers also obtained "Average Joe" saliva samples from private companies for comparison, Dhummakupt said.

"In general, this is just a human performance study," she said. "This could mean something for athletes and even the everyday person."



*Soldiers with the 82nd Airborne Division conduct stress shoot testing with scientists from the U.S. Army Research, Development and Engineering Command Soldier Center during the Monitoring and Assessing Soldier Tactical Readiness and Effectiveness study. (U.S. Army photo by David Kamm, NSRDEC)*

Devising a process for analyzing the biomarkers required the development of a unique method that now must be refined.

"The literature is sparse in terms of providing a comprehensive technique to look at these analytes," Glaros said. "Our task in the first phase of this work was to develop a method that could rapidly and quantitatively measure these analytes in the samples."

Right now, the process takes just eight minutes, "which is pretty fast for liquid chromatography," Dhummakupt said.

With the first phase — focused on isolating the eight analytes — nearing completion, the team is now looking for an "X-factor" that they weren't previously looking for.

"At first, we only concentrated on these eight, primary markers," Dhummakupt said. "But if we open up these filters, then you have an untargeted method where instead of only looking at a select few, I'm looking at everything. How does everything change, globally? The point is to see if there's an X-factor or a handful of other analytes that are also changing."

After refining the process and identifying key biomarkers, Glaros and Dhummakupt hope to develop an assay, which could function similarly to a pregnancy test, which could work in the field.





# Combating Injury

## Army Trainees Volunteer for Study Aimed at Reducing Basic Combat Training Injuries

By Staff Sgt. Ronald Conley/Fort Jackson, S.C.



During a data collection at Fort Jackson, South Carolina, the principal investigators of the ARIEM Reduction in Musculoskeletal Injury, or ARMI, study, Dr. Julie Hughes, bottom left, and Dr. Stephen Foulis, middle, both research physiologists from the U.S. Army Research Institute of Environmental Medicine, or USARIEM, use a high-resolution scanner to image a 3rd Battalion, 39th Infantry Regiment recruit's bone and muscle microstructure in an effort to understand how recruits' bone and muscle change during Basic Combat Training and what factors can affect injury risk. (Photo by Matt Bartlett, USARIEM).



[Fort Jackson](#), South Carolina is leading the way by providing volunteers to help researchers from the U.S. Army Research Institute of Environmental Medicine study musculoskeletal injury during [Basic Combat Training](#).

More than 800 Army trainees have volunteered to participate in the multi-disciplinary ARIEM Reduction in Musculoskeletal Injury, or ARMI, study.

The ARMI study incorporates bone and body composition scans, urine and blood samples, physical testing, and detailed background surveys to identify trainees at the highest risk for musculoskeletal injuries.

Common musculoskeletal injuries during BCT are stress fractures, which develop in the bones of those who have recently increased their level of physical activity.

One of the principle investigators of the ARMI study, Julie Hughes, Ph.D., stated that "up to 5 percent of men and 20 percent of women attending Basic Combat Training may sustain a stress fracture during training, with the most common fractures occurring in the shin bone, in the bones of the foot, and at the hip."

According to Stephen Foulis, Ph.D., another principle investigator in the ARMI study, "the overarching goal of the study is to understand what factors contribute to musculoskeletal injuries during Basic Combat Training."

Hughes added, "We aren't just trying to identify which trainees get injured; we also want to know which trainees have a healthy physiological response to training."

The study, which will follow over 4,000 trainees over a span of four years, started last year here at Fort Jackson and is scheduled to continue in future years at [Fort Benning](#), Georgia, [Fort Sill](#), Oklahoma and [Fort Leonard Wood](#), Missouri. ARIEM researchers recognized that a large field study was necessary to achieve study goals.

"We needed a comprehensive effort following a large number of trainees if we want to finally understand which factors most contribute to musculoskeletal injuries," Foulis said.

[3rd Battalion, 39th Infantry Regiment](#) partnered with the ARIEM research team to accomplish the research mission.

"We fully support this vital study with ARIEM because we have seen firsthand how common musculoskeletal injuries are in our trainees," said Capt. Nicole A. Ono, Alpha Company commander, 3rd Battalion, 39th Infantry Regiment. "We are trying to identify ways we can intervene to reduce injury risk so that they can successfully complete training. This study is an important step on this path."

During this current study cycle, 300 trainees chose to participate in the study.

"I felt volunteering was a great way to help ensure the strength of the Army by reducing injuries," said Pvt. Dean Hannah of Alpha Company.

At roughly 4:30 am, early in the basic training cycle, trainees move into a classroom to begin the initial BCT surveys and testing. During the morning testing, blood is drawn and a urine sample is taken.

"We can get a lot of information from just a couple of tablespoons of blood, including measures of bone metabolism and nutritional status," Foulis said.



*A trainee from 3rd Battalion, 39th Infantry Regiment goes through a bone density scan as part of a study with the U.S. Army Research Institute of Environmental Medicine aimed at reducing musculoskeletal injuries. (U.S. Army photo).*

After the blood and urine is collected, a high-resolution bone scan is performed to measure bone formation from the start to the end of BCT.

"Like muscles, bones also get stronger with physical exercise. This imaging technology allows us to capture fine changes in the bone microstructure due to the physical activity that occurs during BCT," Hughes said.

Trainees also complete a body composition scan to determine how much muscle and bone mass they have and perform a series of tests to measure strength, flexibility and balance. Finally, the trainees complete a series of surveys that capture detailed information about their health history, including sleep, psychological traits, prior injuries, activity and eating habits. All of the tests are then repeated at the end of BCT to compare differences.

Trainees that take part in the study are then tracked through medical records for two years after BCT to see who gets injured and which factors most contributed to injury.

"The ultimate goal of this study is to determine which factors most influence injury risk during BCT so that we can develop more effective countermeasures to reduce this risk," Foulis said. "With the help of the volunteers and Fort Jackson BCT cadre, we're well on our way toward achieving this goal."

The ARIEM Reduction in Musculoskeletal Injury Study helps by providing solutions that optimize Soldier health and performance through medical research. The efforts of the ARIEM team, 3rd Battalion, 39th Infantry Regiment, and study volunteers will facilitate continued actions to reduce injuries in Trainees without reducing training standards.

The unit and researchers anticipate these efforts will lower attrition rates and build a stronger Army.





# Bright Future

## NSRDEC Future Workforce Poster Presentation Supports STEM and Promotes Innovation

By Jane Benson, NSRDEC Public Affairs/Natick, Mass.

The future looked bright at the U.S. Army Research, Development and Engineering Command Soldier Center's 12th Annual Future Workforce Poster Presentation, which was hosted recently by the DCS G-1/Human Resources Team.

The event showcased the science and technology excellence while providing students with the chance to gain invaluable presentation and public-speaking skills while recounting their learning/working experiences at the Soldier Center.

During their time at the center, students learn about careers in product development, solutions and technologies for the warfighter and benefits from interaction with renowned scientists and engineers.

The Future Workforce Poster Presentation serves as an important part of the Soldier Center's Science, Technology, Engineering and Math, or STEM, outreach and future workforce initiative.

Duane Young, training coordinator G-1/Human Resources, coordinated the event.

"The student poster presentation is an annual event that allows our students to showcase to the NSRDEC workforce the projects that they have been working on during their time here at NSRDEC," said Young. "The event allows our workforce to meet and interact with our students and engage in great discussions with them about their projects. For many of our students, this will be their first foray into the world of being a briefer/presenter, so it helps to build skills and qualities that they will need in the future. This event also allows the students to see what their fellow colleagues have been working on while here."



*The Natick Soldier Research, Development and Engineering Center recently hosted its 12th Annual Future Workforce Poster Presentation. The event showcased NSRDEC's science and technology excellence while providing students with the chance to gain invaluable presentation and public-speaking skills while recounting their learning/working experiences at NSRDEC. Student participants pictured (left to right): Benjamin Sottillare, Adrian Ajro, Jordan Whitman, Alanna Coughlin, Emma Ratigan, Michelle Lin, Jessica Mackesy, Alex Drake, Elizabeth Connors, and Marinos Blanas. (U.S. Army photo by David Kamm, NSRDEC)*

Alanna Coughlin, a student working in the Combat Feeding Directorate, was one of the presenters at the Future Workforce Poster Presentation Day. Coughlin worked with fellow student Adrian Ajro on a presentation focusing on CFD's efforts to increase fruit and vegetables in [Meals, Ready-to-Eat, or MREs](#).

Coughlin, who is a biology major at [Worcester State University](#), was on the Combat Ration Engineering & Support Team, or CREST. Coughlin had the opportunity to learn from her team leader, Mary Nash, as well as subject matter experts, Julie Smith and Britni Roy.

"I have worked on the CREST team for the last six years. What I like most about working at NSRDEC is that for the six years I have been here, there has always been a new mission or experience within our directorate that I have been able to be a part of," said Coughlin. "So while my day-to-day tasks may remain pretty much the same I know that in the summer there is always something new and different that I



can participate in -- which helps keep things fresh."

Student presenter Michelle Lin is finishing her first summer in the [Soldier Protection & Survivability](#) Directorate. Lin, who is a Psychology and Criminal Justice major at the [University of Massachusetts Lowell](#), worked on the Design, Pattern & Prototype Team and with the Textile Materials Evaluation Team.

Lin worked on developing a [U.S. Custom and Border Protection](#) Fabric Test Database to help establish standards and requirements regarding the quality and function of uniforms. She was supervised by Annette LaFleur, team leader for the Design, Pattern & Prototype Team, and was mentored by Laura Winters, team leader for the Textile Materials Evaluation Team.

"Working here at NSRDEC, I am given a huge variety of things to work on," said Lin. "Every day I am working on something new which exposes me to learning new things. One day I will be doing physical testing on parachutes in the lab, the next day I am pre-testing in the Arctic Rain room. There's lots to learn here at NSRDEC and I know that I am being mentored by the best. This internship has been very insightful and eye opening to say the least."

In addition to obtaining real-world work experience, students find the work itself incredibly meaningful.

"Knowing that what I am working on is helping the warfighter is one thing I love about being able to work here," said Coughlin.

"It honestly feels amazing to know that the work that I am doing helps the warfighter," said Lin. "Being able to see the effects of the work that we all do here at NSRDEC and how it supports our troops, it truly is a great feeling. Being able to say I worked alongside others to accomplish our main mission of protecting and aiding the warfighter is something that I will never forget. It has even sparked my



interest in continuing to work to support our troops in this way if the opportunity arises."

As coordinator of the event, Young is impressed with the dedication of the student participants.

"We have a wide array of students from all over the United States, so there is a wide range of talent and varying levels of technical expertise," said Young. "It's amazing the work that they do. For them to know and comprehend that what they have been doing isn't just some sort of summer project, that what they are doing could, and probably will, have a huge impact on Soldiers, is very impressive."





# Patriot Day

September 11, 2018

