



Fall 2014

Soldier

Science & Engineering

Science and Technology News from the Natick Soldier Research, Development and Engineering Center (NSRDEC)

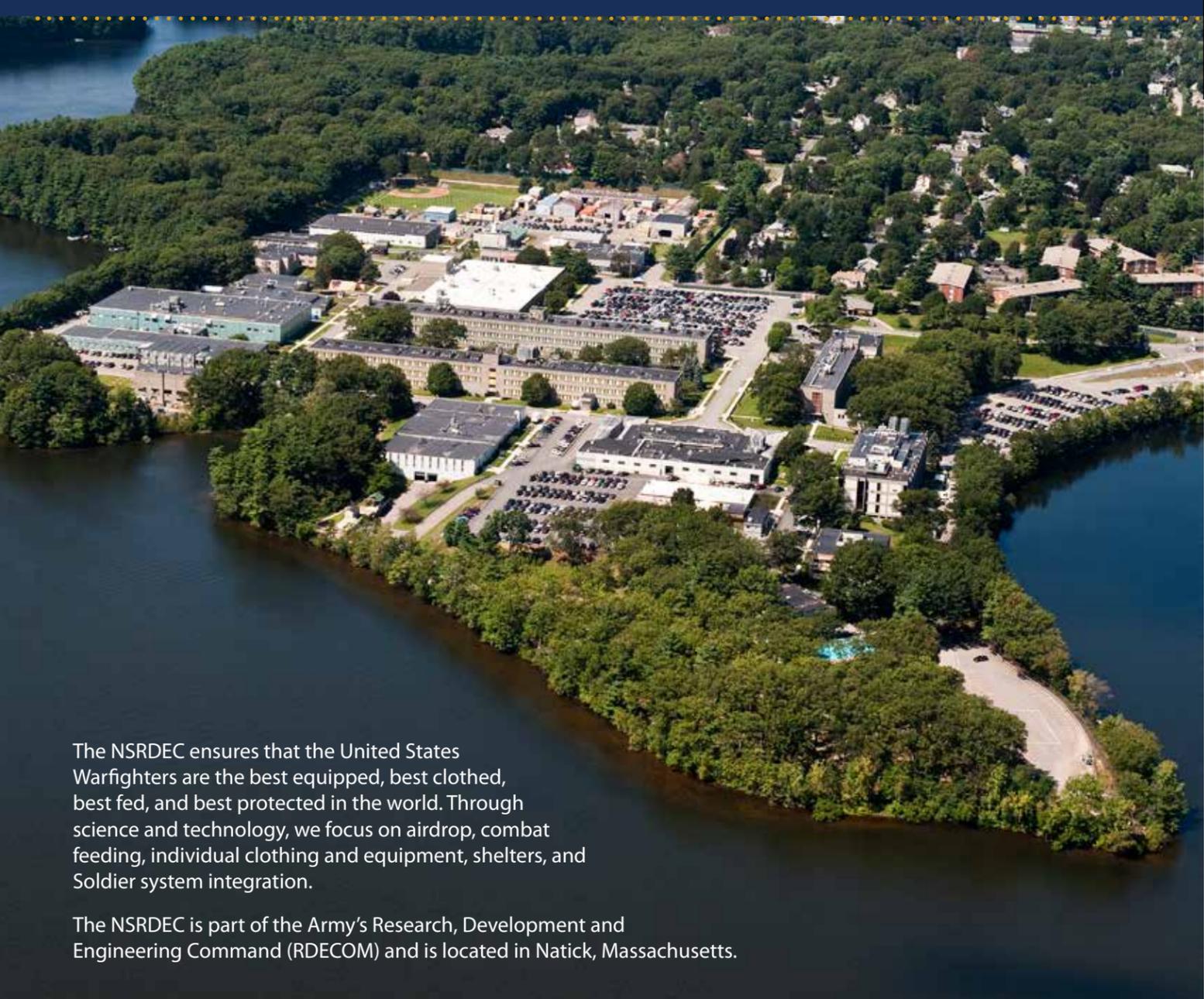
Photo: Jason Kays, U.S. Navy

A More Dignified Return

Natick designs custom-fitted flag for remains transfers



U.S. ARMY NATICK SOLDIER RESEARCH, DEVELOPMENT & ENGINEERING CENTER (NSRDEC)



The NSRDEC ensures that the United States Warfighters are the best equipped, best clothed, best fed, and best protected in the world. Through science and technology, we focus on airdrop, combat feeding, individual clothing and equipment, shelters, and Soldier system integration.

The NSRDEC is part of the Army's Research, Development and Engineering Command (RDECOM) and is located in Natick, Massachusetts.

OUR MISSION

Research, Development and Engineering (RD&E) to maximize the Warfighter's survivability, sustainability, mobility, combat effectiveness and field quality of life by treating the Warfighter as a system.

ADDING VALUE THROUGH:

- Basic Science
- Technology Generation, Application, and Transition Enabling Rapid Fielding of the Right Equipment
- Soldier Systems Technology Integration and Transition
- Solving Field Problems Rapidly

OUR VISION

The leader in empowering the world's most capable Soldiers

OUR FOCUS

Deliver world-class research, development and systems engineering and services, with a unique warrior-centric focus.



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Soldier on

Whenever someone is facing extreme difficulty in life, people tend to say "Soldier on." They say this because we know that the life of a Soldier is difficult each and every day. We know that each and every day a Soldier digs deep down and finds the moral and physical courage, the toughness, and the strength of will and spirit to "Soldier on."



This strength of mind, body and spirit is why I'm proud to lead an organization that serves the Soldier every day. Those who work at the Natick Soldier Research, Development and Engineering Center, or NSRDEC, labor tirelessly to ensure that our Soldiers have the best food to fuel them through their missions, the best clothing to protect them, the best shelters to live in, and the best parachute technology to safely get them, and their equipment, wherever they need to be in the world. It is the Soldier who drives NSRDEC's science and technology.

The NSRDEC workforce is known for its dedication and for its ingenuity. I believe in enabling people to do their best by allowing them to be innovative while addressing measurable organizational goals. A leader should provide a clear overall vision and strategic intent, then trust and empower his or her people to get the job done.

I have no doubt that the workforce will continue to focus on Soldiers and their needs. By working together, I hope to move forward on some strategic issues for NSRDEC and lay some important groundwork for the next permanent NSRDEC director to consider. I plan on fully utilizing the knowledge of the strong leadership team in my office and the NSRDEC staff as a whole. We will continue to build strong partnerships with industry and academia to stimulate and capitalize on scientific discoveries and technical advances for the joint warfighter.

By "Soldiering on," we will ensure that NSRDEC continues to be on the cutting edge of advances in science and engineering. Through a common vision and a single-minded dedication, NSRDEC will continue to improve the performance and quality of life for our nation's most valuable resource: our Soldiers.

Patrick J. Baker

Dr. Patrick J. Baker, SES
Acting Director
Natick Soldier Research, Development and Engineering Center

Questions regarding NSRDEC Science & Technology?



- NSRDEC is part of the U.S. Army Research, Development and Engineering Command, which has the mission to develop technology and engineering solutions for America's Soldiers.
- RDECOM is a major subordinate command of the U.S. Army Materiel Command, whose mission is to develop and deliver global readiness solutions to sustain Unified Land Operations, anytime, anywhere.

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Reducing the Tail

Advancing base camp technology at the BCIL

By Bob Reinert, USAG-Natick Public Affairs / FORT DEVENS, Mass. (Oct. 24, 2014)

As the Army rightsizes and transitions to a more expeditionary force, how efficiently its Soldiers can live during deployments becomes increasingly important.

Current and future technologies that will help realize that goal by saving fuel, water and money were on display here, Wednesday, during the annual stakeholders meeting at the Base Camp Integration Laboratory, or BCIL, which contains systems that are already deployed, those being tested, and new technologies.

Katherine Hammack, assistant secretary of the Army for Installations, Energy and Environment, supported this event, hosted by Lt. Gen. Gustave Perna, the Army G-4,

and Scott Davis, program executive officer for Combat Support and Combat Service Support. They and other attendees saw everything from energy-efficient rigid-wall shelters to next generation photovoltaics.

“Operational energy is about force protection,” Perna said. “You’re going to see some great efforts on how we are improving our capabilities to reduce operational energy, eliminate requirements in the force structure because of that, which will eventually save lives.”

As Lt. Col. Ross Poppenberger, with Product Manager Force Sustainment Systems, pointed out, the BCIL is more than just an impressive technology display.

Katherine Hammack, assistant secretary of the Army for Installations, Energy and Environment, listens as Bob Graney explains details of the energy-efficient rigid-wall shelter system, Oct. 22, 2014, at the Base Camp Integration Laboratory on Fort Devens, Mass. Hammack was on hand for the annual stakeholders meeting at the BCIL, where new base camp technologies are tested.

“It’s proving those technologies so that those things go to the fight and make a difference for Soldiers (who) are in those fights,” Poppenberger said. “At the end of the day, it’s about rapidly integrating new technologies and putting capability in the Soldiers’ hands.”

Among technologies assessed at the BCIL already deployed in operational environments with Soldiers, are the shower water reuse system that recycles 75 percent of the water it uses, and a microgrid that reduces fuel usage by 30 percent. The ultimate goal is a “zero footprint” base camp.

“I am impressed by the great work that Natick Soldier Systems (Center) and PEO Combat Support & Combat Service Support are doing in reducing the logistical tail of fuel and water in our contingency base camps.”

Katherine Hammack

“It’s really all about, within the force structure and funding constraints, how do we protect the real tooth of our formations by reducing the tail and not requiring as much support to sustain our formations?” Davis said.

“I am impressed by the great work that Natick Soldier Systems (Center) and PEO Combat Support & Combat Service Support are doing in reducing the logistical tail of fuel and water in our contingency base camps,” Hammack said.

The BCIL is getting plenty of practical use. According to Lt. Col. Steve Egan, the Fort Devens garrison commander, more than 35,000 Soldiers have stayed at the base camp over the past three years while training at Devens.

“We expect those numbers to increase as word gets out there,” Egan said. “It’s been a great opportunity for the Soldiers and a great capability for Fort Devens.”

“They get to see what they’re going to encounter downrange, which is huge,” Egan said. “Given our primary customers are the [Army] Reserve and [National] Guard, this maximizes their training time. So this is a huge benefit.”

Fit Kit

Studying the link between body armor, Soldier performance

By Bob Reinert, USAG-Natick Public Affairs / NATICK, Mass. (Oct. 9, 2014)

Body armor has saved countless lives in Iraq and Afghanistan, but an Improved Outer Tactical Vest, or IOTV, that doesn’t fit properly can actually hinder a Soldier’s performance in combat.

That’s why members of the Anthropology and Human Factors Teams at the Natick Soldier Research, Development and Engineering Center are conducting a range-of-motion and encumbered anthropometry study to better understand the link between fit and performance with the IOTV Gen III.

“We have this belief that if the fit of the body armor is really good, then the performance is going to be maximized,” said Dr. Hyeg joo Choi, the principal investigator for the study. “So the question is, how can we quantify a good fit so that Soldiers’ performance is maximized?”

To help answer that question, Choi and her fellow researchers collected measurements from 23 Soldiers at Natick, including 21 males and two females.

“We look at the body size first,” Choi said. “And then everybody is tested in approximately three different (vest) sizes. Out of these sizes, we basically look at what the best performance size would be.”

According to Human Factors project lead Blake Mitchell, after the IOTV was introduced in 2007, fit was identified as an issue for some wearers. Mitchell said this was a particular problem for female Soldiers.

In 2009, along with a team of human factors subject-matter experts, Mitchell



and anthropologist Dr. Todd Garlie went to the field and measured 139 female Soldiers. Their results contributed to the 2012 issuance of IOTVs designed specifically for women.

Data collection began in June for the current two-year study, which used the vest portion only of the Gen III IOTVs.

“There wasn’t any mission-essential gear included with this study, which might impact performance a little bit more,” Garlie said.

Choi’s early data suggest the current legacy size chart should be updated to reflect body size changes, which will be consistent with what Natick’s ANSUR II anthropometric survey revealed in 2012 -- today’s Soldiers are bigger than they were 20 years ago. The key measurement for IOTV fit, said Choi, is chest circumference.

“There are some people who are not really affected by the body armor size,” said Choi, “and then there are some people who didn’t really perform that well in any of the sizes.”

Mitchell said she hopes that Choi’s work will provide not just updated sizing information for the IOTV Gen III, but design guidelines going forward.

“So that it’s not just this body armor system,” said Mitchell, “but it can help drive future body armor system designs.”

The study may also support the development of other protective clothing and equipment systems.

Pocket Spy

NSRDEC developing nano UAV

By Jeffrey Sisto, NSRDEC Public Affairs / NATICK, Mass. (July 21, 2014)

Researchers at the U.S. Army Natick Soldier Research, Development and Engineering Center are developing a pocket-sized aerial surveillance device for Soldiers and small units operating in challenging ground environments.

The Cargo Pocket Intelligence, Surveillance and Reconnaissance program, or CP-ISR, seeks to develop a mobile Soldier sensor to increase the situational awareness of dismounted Soldiers by providing real-time video surveillance of threat areas within their immediate operational environment.

While larger systems have been used to provide over-the-hill ISR capabilities on the battlefield for almost a decade, none of those delivers it directly to the squad level, where Soldiers need the ability to see around the corner or into the next room during combat missions.

When Soldiers and small units need to assess the threat in a village, or in thick canopy terrain where traditional ISR assets cannot penetrate, the CP-ISR can be deployed to provide that capability.

“The Cargo Pocket ISR is a true example of an applied systems approach for developing new Soldier capabilities,” said Dr. Laurel Allender, acting NSRDEC techni-

cal director. “It provides an integrated capability for the Soldier and small unit for increased situational awareness and understanding with negligible impact on Soldier load and agility.”

NSRDEC engineers investigated existing commercial off-the-shelf technologies to identify a surrogate CP-ISR system.

Prox Dynamics’ PD-100 Black Hornet, a palm-sized miniature helicopter weighing only 16 grams, has the ability to fly up to 20 minutes while providing real-time video via a digital data link from one of the three embedded cameras and operates remotely with GPS navigation. Tiny, electric propellers and motors make the device virtually undetectable to subjects under surveillance.

The size, weight and image-gathering capabilities of the system are promising advancements that fulfill the burgeoning requirement for an organic, squad-level ISR capability, but more work still needs to be done.

Several efforts are underway to develop three different aspects of the technology to ensure it is ready for the Soldier and small unit.

The first of these efforts is focused on a redesign of the digital data link to achieve compatibility with U.S. Army standards.

The second focuses on developing and integrating advanced payloads for low-light imaging, allowing for indoor and night operations.

Lastly, researchers are continuing to develop and enhance guidance, navigation and control, or GNC, algorithms for the CP-ISR surrogate system. This will allow the airborne sensor to operate in confined and indoor spaces, such as when Soldiers advance from room to room as they are clearing buildings.

In November 2014, NSRDEC will collaborate with the Maneuver Center of Excellence, the Army Research Laboratory and other organizations to support the Army Capabilities Integration Center’s Manned Unmanned Teaming (Ground) Limited Objective Experiment, or LOE, by demonstrating the current capabilities of mobile Soldier sensors.

While the final system could be different from the surrogate system, NSRDEC is focused on proving the basic capability first.



Photo: Prox Dynamics

Army engineers are working to create 3-D solid models and prototypes from computer-aided design data. These prototypes enable researchers to evaluate and detect component and system design problems before fabrication.

The U.S. Army Natick Soldier Research, Development and Engineering Center Computer-aided Design and Rapid Prototyping Laboratory uses an additive manufacturing process of selective laser sintering, known as SLS. The printer relies on lasers to sinter, or melt, powdered, nylon materials layer upon layer into a prototype.

Over the years, researchers have created numerous prototypes and product components. NSRDEC engineers created prototypes for the pack frame of the Modular Lightweight Load-carrying Equipment system and fabric attachments for the MOLLE pack itself. Engineers also created a battery case, as well as the individual electronic components contained in the case, which were later tested and used in the field.

“We’ve built components that could interface with unique equipment like chemical gear,” NSRDEC engineer Gary Proulx said.

Engineers also use the lab to develop testing tools and meters, some of which aid in testing of equipment in Natick’s climatic chambers.

Rapid prototyping helps engineers find design issues early on and strive for continuous prototype improvement, Proulx said.

“With some items, it is how it feels,” NSRDEC engineer Karen Buehler said. In the case of a snap-type closure buckle on your backpack...it’s about how it snaps. Just a little bit off on a dimension can really change how it feels or how it works. If you have four or five ideas, you can pop them in there and make a couple of each and go try it and touch it and test it. Then you can make important changes that make sense.”

“It’s much easier to do things with this process than to mold it and build it,” Proulx said. “You can build something one day and put it in someone’s hand the next and then make your changes and then reiterate. It’s a short cycle to do so, and it’s relatively inexpensive.”

The results are high-quality rapid prototypes. “It provides a better way to interface with industry,” NSRDEC engineer Matthew Hurley said. “We can give them parts that are 80 to 90 percent ready to be produced.”

The engineers also create prototypes and scale models for illustrative purposes.



Photo: PEO Soldier

Natick Puts Rapid in Prototyping

By Jane Benson, NSRDEC Public Affairs / NATICK, Mass. (July 11, 2014)

“We do a lot of prototyping of emerging concepts for demonstrations,” Hurley said. “We’re bridging the gap between concept and field-ready equipment.”

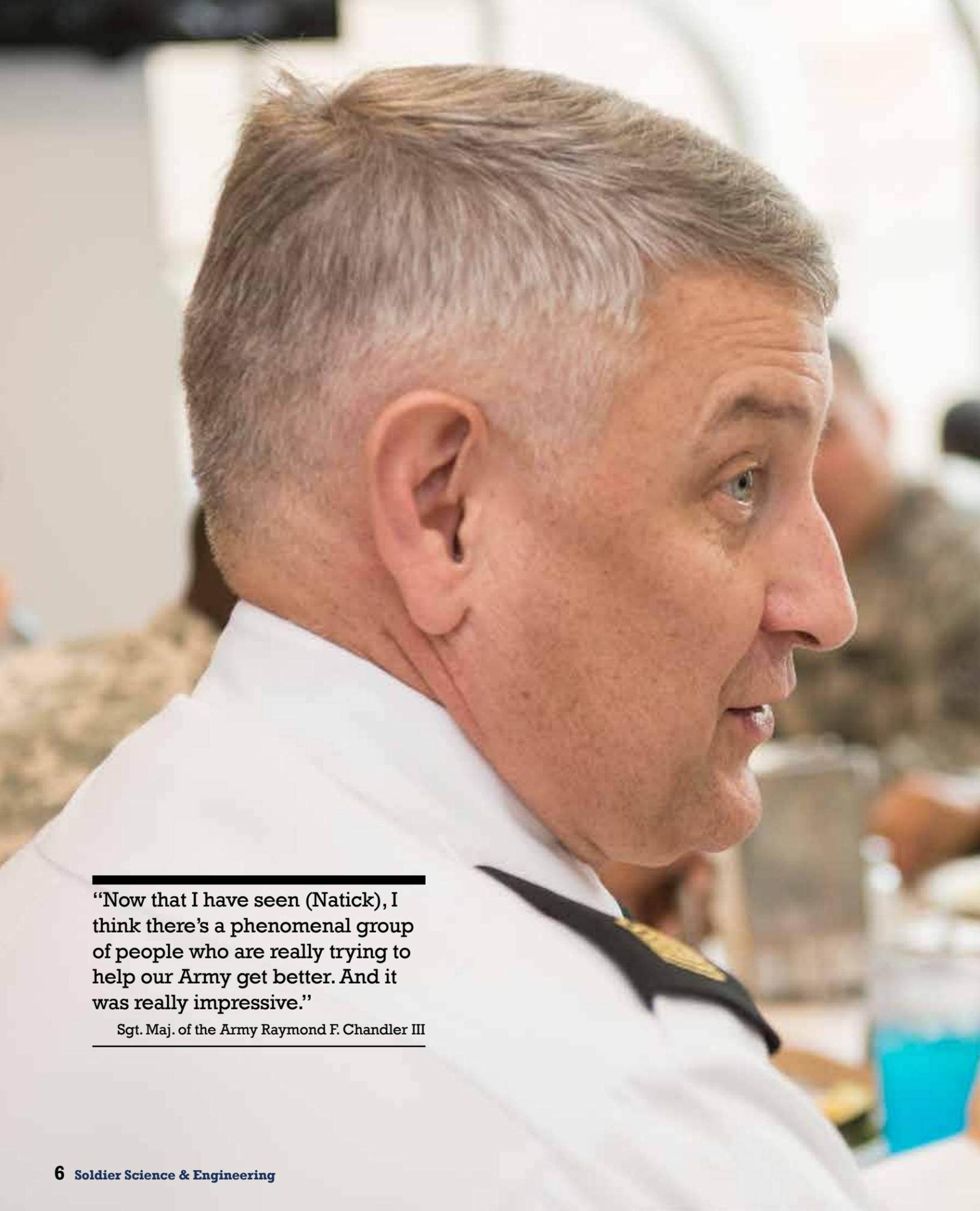
“So many people are visual in terms of understanding information,” Buehler said. “You touch it. You see it. It’s not necessarily words that get through. ‘Oh, I get it now. I’ve seen that. It looks like this. I can envision what the future looks like. Or at least now I have an idea of what it can do.’”

In the near future, engineers hope to add a new 3-D printer with will add multimaterial

stereolithography capabilities. The process uses ultraviolet cured liquid resin to form layers that comprise the prototypes.

“With the new machine, we can mix hard and soft materials,” Buehler said. “We will be able to make a button. Or I can make something where I can press something and make it turn on and off.”

“We will be able to produce more types of models to find errors in different applications because we have that wide range of mechanical properties,” Hurley said.



“Now that I have seen (Natick), I think there’s a phenomenal group of people who are really trying to help our Army get better. And it was really impressive.”

Sgt. Maj. of the Army Raymond F. Chandler III

On the 13th anniversary of a day etched in the nation’s collective memory, the Army’s highest-ranking non-commissioned officer visited the Natick Soldier Systems Center, or NSSC.

Sgt. Maj. of the Army Raymond F. Chandler III began the day by participating in NSSC’s Patriot Day Ceremony, which recalled the terrorist attacks of Sept. 11, 2001.

“This is a day that we should recognize and remember,” Chandler said at a town hall later in the day. “What we do today and over the last 13 years has been predicated on events that happened (on 9/11).”

Chandler pointed out that he had joined the Army 34 years ago.

“But it’s a different circumstance than you that have chosen to join after 9/11,” Chandler said. “You make up one percent of the American population. You’re the top one percent. You’ve chosen to do something that 99 percent of the American people are either unwilling or unable to do.”

After attending the ceremony, Chandler toured Natick’s unique facilities and learned more about research underway around the installation. He heard about the Physical Demands Study, which will determine the physical requirements for combat-related jobs; received a combat rations overview; visited the High Performance Fiber Facility and the Thermal Test Facility; and was briefed on operational energy and base camp technologies.

During demonstrations related to the Physical Demands Study, Chandler told Soldiers from the U.S. Army Research Institute of Environmental Medicine how important their work was.

“What you’re doing now is going to make a difference in what we do for physical training,” Chandler said. “You’re making history for the Army, because out of this will come change. I’m excited about what you’re doing.”

Chandler added that the study was helping to bring about “transformational changes in the Army.”

Following lunch with Natick Soldiers, Chandler held his town hall, in which he spoke about the “plague” of sexual assault and suicide on the Army that “we, as Soldiers and civilians, can solve.”

Before departing from Natick, Chandler took a moment to talk about what he had seen during his visit, including “capabilities that I had no idea the Army even had. The ability to take a polymer and turn it into a material that could be developed to lighten the Soldier’s load or provide them better comfort in extreme weather — to me, that was one of the most impressive things I saw today.”

Chandler, a Massachusetts native, said it took him three and a half years to get to Natick as sergeant major of the Army.

“But now that I have seen it, I think there’s a phenomenal group of people who are really trying to help our Army get better,” said Chandler, “and it was really impressive.”

Top: Sgt. Maj. of the Army Raymond F. Chandler III shakes hands with a Soldier after a demonstration of the Physical Demands Study at Natick Soldier Systems Center. Center: Chandler listens to Jeremy Whitsitt during a visit to the Combat Fielding Directorate. Bottom: Chandler, left, speaks to Lt. Col. Ross Poppenberger, Product Manager Force Sustainment Systems, second from right.



Inset photos: Top: Sgt. Don Vetch, Massachusetts Army National Guard

SMA Visits Natick

Talks of ‘transformational changes’ in Army

By Bob Reinert, USAG-Natick Public Affairs / NATICK, Mass. (Sept. 11, 2014)



NSSC This Week Video News Release:
Tazanyia Mouton reports on the Sergeant Major of the Army visit to Natick.
<http://bit.ly/1utn1MY>

Bug Out

**Ensuring
insect-repellent
clothing is safe,
effective**

Photo: World Health Organization

By Jane Benson, NSRDEC Public Affairs / NATICK, Mass. (Oct. 14, 2014)

When it comes to insect repellent, the Natick Soldier Research, Development and Engineering Center, or NSRDEC, makes sure Soldier uniforms are treated just right.

The Textile Materials Evaluation Team, or TMET, evaluates uniforms before they are issued. The team verifies that the insect repellent treatment meets the requirements of the specification, which are derived from the Environmental Protection Agency, or EPA, application rate. The verification ensures that the uniforms are treated at the appropriate levels with permethrin and provide adequate protection from biting insects.

In the past, the Individual Dynamic Absorption Kit, or IDA Kit, was used by Soldiers in the field to apply permethrin to individual combat uniforms. A two-gallon sprayer (hand can) was also used to treat multiple uniforms, but it could only be used by certified applicators.

For many uniforms, these methods were later replaced by industrial application in factories, which provides more uniformity and consistency in permethrin application. It also helped ease the logistical burden since uniforms that are issued to Soldiers are already treated. Therefore, the Soldiers don't need to carry the supplies with them, and they don't have to dispose of containers and repellents after use.

"Logistically, it gets rid of that extra step," said Amy Johnson, NSRDEC textile technologist. "So when Soldiers are getting ready to deploy, it is not yet another thing they have to do. A senior commander doesn't need to make sure that everyone did it. It's already done. And a big benefit is that (factory application) lasts through multiple launderings. We found in testing that it lasts much longer than the aerosol individual treatment methods."

"Factory Treatment has better durability," said Melynda Perry, an NSRDEC textile chemist.

"It is good for the life of the garment," Johnson said.

Although the factory application improved the consistency in the amount of permethrin applied to the uniforms, the garments still

Natick makes sure insect-repellent clothing treatment is at safe and effective levels. Bites from sand flies, which carry the disease leishmaniasis, are a problem for Soldiers. Natick evaluates permethrin insect repellent levels in uniforms to ensure adequate and safe protection from sand flies and other insects.

need to be evaluated by NSRDEC through an extraction process.

"Permethrin, because it is an insect repellent, is regulated by the Environmental Protection Agency," Perry said. "Extraction and analysis must be done to make sure the uniforms are meeting EPA-approved levels. Prior to moving forward with factory treatment, the doses were run through the U.S. Public Health Command to ensure that the amount of permethrin being applied was well below toxicity levels for people."

"Insect repellent textiles that require testing are sent to TMET for extraction of the active ingredient, which is measured and quantitated on the gas chromatograph/mass spectrometer," said Lauren Heim, a textile technologist/technician with Battelle Memorial Institute (contractor)/NSRDEC. "This testing is performed on treated end items and on developmental fabric and garments."

The team works collaboratively with project officers to provide input into fabric and end-item specifications.

"We require a certain dose rate based on the fabric weight," said Perry. "We provide the minimum and maximum requirements that go into the specifications (for the factory application). "(Percent) Bite Protection" requirements are based on the fabric type. It's not just the permethrin that helps prevent bites -- it's the permethrin in conjunction with the fabric construction. The fiber type or blend and the weave type also come into play."

"So there is a lot of work done upfront," Johnson said.

Insect bites are not only a nuisance, they can be dangerous. Mosquitoes, sand flies, ticks and other insects can carry diseases, such as malaria, leishmaniasis, Lyme disease and West Nile disease. Illnesses carried by insects can impact Soldier morale, health, performance and survivability.

"Some of these diseases can cause death or cause a Soldier to be incapacitated for a period of time, which can affect the mission," Perry said.

Perry emphasized that the permethrin-treated clothing is only one element in the Department of Defense Insect Repellent System.

"It is important to note that permethrin is a contact repellent," Perry said. "It will not repel mosquitoes from exposed areas of skin. So

even if you are wearing a permethrin-treated uniform, if you are not wearing your topical repellent, such as DEET, on your hands, face and other exposed areas, you're not going to be protected on those areas. All components of the DoD Insect Repellent System must be used. The system consists of the treated uniform, worn properly, and topical insect repellent on exposed skin, applied as necessary."

The system also includes using bed netting while sleeping and taking anti-malarial medication. NSRDEC's work protects those serving in the Army, Navy, Marines and Air Force.

Currently, permethrin is only approved for use on outer garments. NSRDEC is looking to expand protection through the development of novel textiles and methods that will help prevent insect bites, especially from insects that are known to carry pathogens. NSRDEC is also starting to investigate the development of base camp protection to minimize the threat of insect-carried diseases within the camp.

"We're not just focusing on permethrin, we're investigating other ways to protect the Soldiers, as well," Perry said. "NSRDEC is investigating natural oils and spatial repellents (to be used in base camps or on gear). DEET and permethrin are contact repellents. We want to prevent the mosquitoes from even reaching the Soldiers. Soldiers are often most vulnerable when they get back to the base camp and they take off their (treated) uniforms. So, we are looking into repellents that could possibly be incorporated into PT (physical training) uniforms and other items."

"We are also looking into spatial repellents that could potentially be used to treat a shelter or even a latrine or placed around base camps. In the future, we could look into placing attractants outside the base camp, where we could lure insects away."

The team is dedicated to its work.

"It's rewarding to know that the work we do protects the Soldier and that the work we do is relevant to morale, mission and comfort," Perry said.

"It helps keep them more mission ready," said Johnson. "It keeps them safe."

"It keeps me going in the lab," Heim said. "I just focus on the Soldier. This is why I am driven to keep the extraction testing process going every day."

A More Dignified Return

Natick designs custom-fitted flag for remains transfers

By Bob Reinert, USAG-Natick Public Affairs / NATICK, Mass. (Oct. 8, 2014)

When the remains of a fallen U.S. service member arrive at Dover Air Force Base, Delaware, from overseas, an American flag is always draped over the transfer case borne by the carry team.

Because a standard flag is used, it can shift position or be affected by wind during movement from the aircraft. With great respect for the solemn occasion, a combined team at Natick Soldier Systems Center has designed a custom-fitted flag for the transfer case that is now undergoing 90 days of testing in five locations. Evaluations will then be reviewed.

The project began when Lee Green, director of the Joint Mortuary Affairs Center, or JMAC, at Fort Lee, Virginia, contacted Tim Benson of Product Manager Force Sustainment Systems at Natick with the concept.

"They were looking for ... a stitched version of the flag," Benson recalled. "They had actually prototyped something in-house themselves, but they wanted to take it to the next level and eventually try to get it into the ... supply system.

"I know nothing about fabric products, so I approached the experts here at (Natick Soldier Research, Development and Engineering Center) to try and take that on."

Benson went to Annette LaFleur, the Design, Pattern and Prototype Team leader at NSRDEC. LaFleur turned to clothing designer Dalila Fernandez of her team and later enlisted Pete Stalker of the Parachute Shop to help verify the design templates, table of operations and manufacturability.

"I felt really good having these folks work on it," LaFleur said. "They both have really great work ethic, and they immediately handled this project with the greatest respect."

The team faced a unique set of challenges in turning out a prototype from a standard flag. "There are regulations in regards to altering or changing the appearance of the flag," LaFleur said. "The flags have to be returned to their normal state when they're disposed of. That's the procedure. It was a learning experience."

Fernandez began by making the corners fit around the case, which wasn't as easy as it sounds. As she pointed out, because of the stitching, actual flag sizes can vary by inches.

"So I designed a template ... to be used for all the flags that come in, so that at least the finished product is (uniform)," Fernandez said. "I like my end product, as far as presentation, to be a hundred percent. One of the things I wanted to do is to give this project the honor that it deserves."

Stalker suggested that they use filament thread -- about the thickness of fishing line -- attached to a thin needle to avoid damaging the flag. He also suggested a different stitch type that would be more readily available at numerous manufacturing facilities.

"Every flag was form-fitted on the (transfer) case at the Parachute Shop," Stalker said. "It was like it was never sewn."

Fernandez also worked to make sure that the flag folded just right so that it would be "presentable to the eye."

According to LaFleur, JMAC finally settled on a tentative design. Then Fernandez and Stalker produced 25 flags that are now out for three months of evaluation. Users will provide feedback by completing questionnaires created by Alan Wright of NSRDEC's Consumer Research Team.

"We tried to take into consideration the perception people might have when they looked at these (flags)," Wright said. "So when we formulated the questions, we were trying to take a broad view."

Early feedback on the custom-fitted flags has been positive.

"I think the users at the Joint Mortuary Affairs Center are very pleased," Benson said. "Obviously, this wasn't in the PM's bailiwick, and I couldn't be happier with the way (NSRDEC) picked up and ran with this project."

"It was a really nice collaboration between four teams in different areas/organizations," LaFleur said. "I'm glad that Tim came to seek us out. It was a great opportunity."

To a person, those involved in the project at Natick spoke of how honored they were to be included.

"It was more like an emotional project," Fernandez said. "(Pete and I) were working one day, and we actually teared (up) together, because we were talking about what an honor it is. There's something about the flag when you look at it -- it's just gorgeous; it's beautiful."

Wright said it was important to him that fallen service members and their families be remembered properly.

"There's a lot of heartfelt feeling about what the flag represents and what it means to the Soldiers and their families when they make that ultimate sacrifice," Wright said. "For me, personally, it's a great honor to participate."

"I've worked at Natick ... for over 46 years, and I never got so emotionally involved in a project," Stalker said. "If you look at that flag, it's meant for somebody. It's very moving."

"I've worked at Natick ... for over 46 years, and I never got so emotionally involved in a project. If you look at that flag, it's meant for somebody. It's very moving."

Pete Stalker, Parachute Shop

A joint team at Natick Soldier Systems Center has designed a custom-fitted American flag for the remains cases used in "dignified transfer" ceremonies such as this one held April 20, 2012, in Papua New Guinea, where a standard flag was used.

Working Up a 'SWET'

USARIEM app helps determine body's water needs

By Kelly Field, USARIEM Public Affairs / NATICK, Mass. (Oct. 24, 2014)

Clean, potable water is one thing the world universally cannot live without. It hydrates. It cleans. It keeps us alive and well. No doubt, water is very valuable to Soldiers.

However, as many mission planners know, water planning can be a nightmare. Too much water can strain already heavy combat loads, perhaps forcing some Soldiers to pack too little in favor of a lighter pack. When Soldiers don't have enough water, dehydration could set in, decreasing performance and increasing the risk of serious heat illnesses.

"Water is a huge logistical problem for training and field missions," said Dr. Nisha Charkoudian, a research physiologist from the U.S. Army Research Institute of Environmental Medicine, known as USARIEM, Thermal and Mountain Medicine Division. "Obviously, planners do not want too much, but having too little can lead to serious problems. Dehydration exacerbates symptoms caused by heat and altitude exposure, and makes a lot of things worse, including the ability to perform physical tasks in hot and high-altitude environments."

To help solve this logistical problem, Charkoudian worked with researchers from USARIEM -- Dr. Sam Chevront, Dr. Robert Kenefick and Ms. Laurie Blanchard -- and a team from the Massachusetts Institute of Technology Lincoln Laboratory -- Dr. Anthony Lapadula, Dr. Albert Swiston and Mr. Tajesh Patel -- to develop an app that will help unit leaders accurately predict water needs with the goal of minimizing the burden of water transport and sustaining hydration.

"Research into heat stress has been going on for over 50 years at USARIEM," Charkoudian said. "We have been providing guidance to the Department of Defense about sweat loss and hydration, and refining it for many years through TB MED 507. Paper doctrine provides generalized look-up tables generated from complicated equations. The app meets requests from the increasingly digital battlefield for paperless guidance that is simple, accurate, mission-specific and available in real time."

Called the Soldier Water Estimation Tool, or SWET, this Android-based smartphone app is a decision aid that translates a complicated biophysical and physiological sweat prediction model into simple user inputs regarding the anticipated intensity of activity (low, medium, high, including example activities), three category choices of military clothing ensemble and weather conditions (air temperature, relative humidity and cloud cover).

The SWET app has user-friendly inputs and provides the user with the amount of water required for the specified conditions in liters per hour. A separate "Mission Calculator" tab further simplifies planning by providing total amounts of water required for a given unit (number of people) for a given mission duration (total time, in hours). Total water amounts are provided in liters, one-quart canteens, two-quart canteens and gallons.

Charkoudian said this app was designed for unit leaders to determine group water needs. The average amount of water needed per person does not reflect individual differences, but

the model error for individuals is estimated to be small. Soldiers should expect to see this app within the year on the Army's Nett Warrior platform.

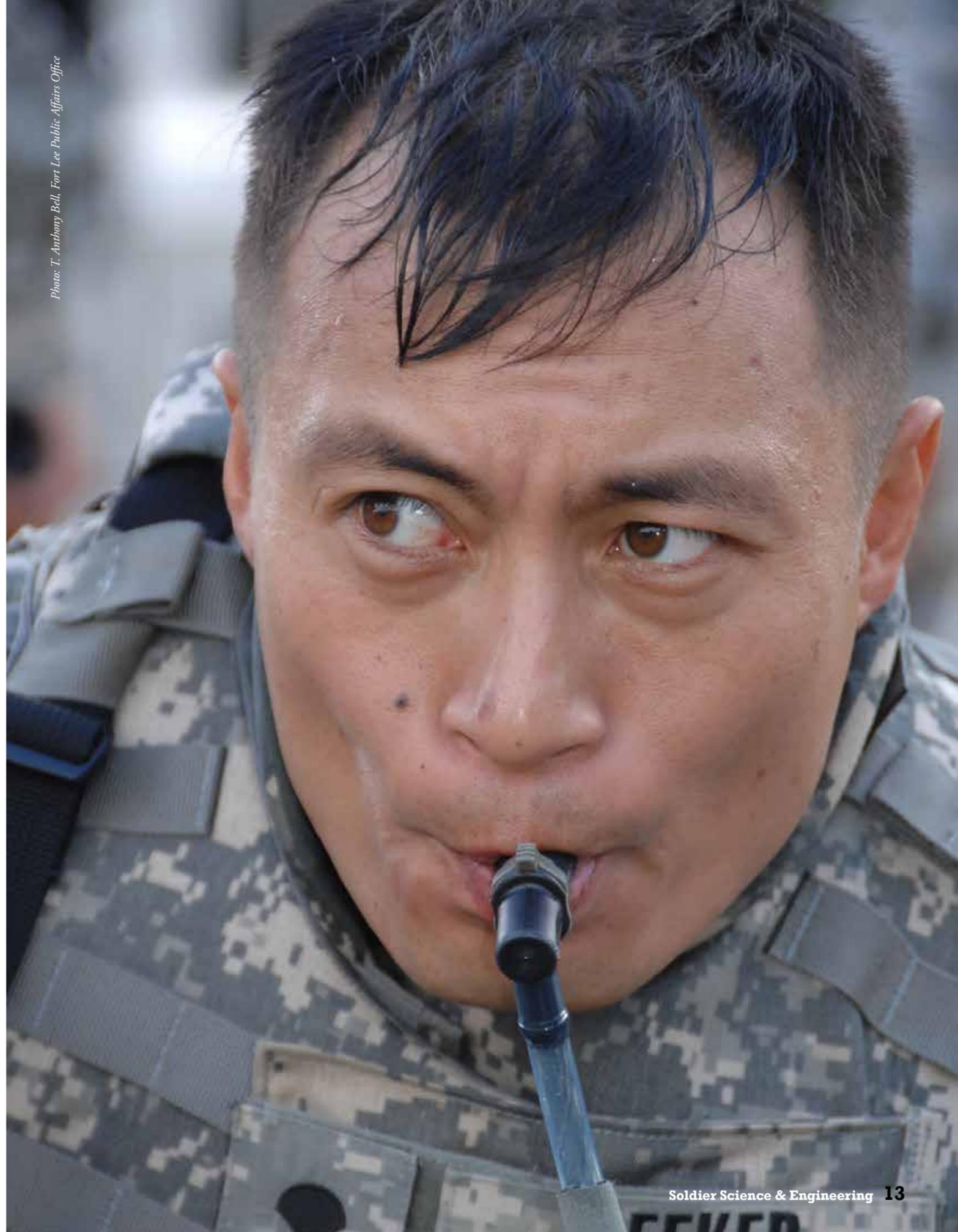
"This will be one of the first apps rolled out in the Nett Warrior platform," Charkoudian said. "I am so excited to be doing stuff that is directly helping Soldiers in the field. I think that's just so cool."

In the meantime, Charkoudian said that the app has already undergone limited user testing with the Army Mountain Warfare School in Jericho, Vermont, where Soldiers gave very positive feedback. She is looking forward to more feedback once the app goes live, to make updates and possibly explore its uses in the commercial world.

"There is the potential here for future versions of SWET for sports and sports drink companies, for team sports, as well as for humanitarian and disaster-relief organizations," Charkoudian said. "People want apps; that's what they are excited about. It's something everyone can relate to."

Spc. Heyz Seeker gets a drink from a hydration device during the Urban Warfare Orienteering Course event of the Department of the Army Best Warrior Competition at Fort Lee, Va., Oct. 1-5.

Photo: T. Anthony Bell, Fort Lee Public Affairs Office



You eat them when you're deployed or in training, and some people even claim to pick them up at the commissary for date night. They're your Meals, Ready-to-Eat (MRE) ration, and deployed service members have been relying on them for more than 30 years. MREs have come a long way since they first made their debut. Since research and development of the MRE began in 1959, the MRE has improved significantly, mainly due to feedback on satisfaction from warfighters, but also because of technological innovation, and improved understanding of performance-oriented nutrition and operational mission performance demands.

MRE's Nutritional Standards Today

MREs today are designed to meet nutritional needs and satisfy our deployed warfighters' food preferences. The main goal of the food technologists at the Combat Feeding Directorate (CFD), tasked with developing and continuously improving MREs, is to maximize warfighter performance. New MREs are chosen based on three primary factors. First is warfighter feedback and acceptance. If an MRE doesn't get good feedback from service members, it gets cut. The CFD also uses feedback from service members to develop concepts for new flavors and food items.

The second factor is the nutritional content of those meals. All MREs need to meet the nutritional standards for operational rations, as determined by scientific evidence, and set forth by the Surgeon General (TSG), Department of the Army (DA). The Nutrition Standards for Operational Rations (NSORs) include requirements for numerous macronutrients, vitamins, and minerals, which act together to maintain health and achieve optimal performance. Those standards are designed to meet the increased nutritional needs and sustain optimal performance of service members in operational environments, be it combat or combat training (read: this means they are not ideal for date night). Each MRE provides approximately 1300 calories, composed of approximately 170 g of carbohydrates, 45 g of protein, and 50 g of fat for the energy needed to accomplish any mission. This balance of nutrients is necessary to ensure all the complex systems of the body are functioning properly.

The third factor is the shelf stability. The CFD tests MRE production items to ensure the nutritional content and sensory quality don't degrade too quickly, and continue to meet the performance-oriented nutrition needs of service members in the field over the entire shelf-life of the MRE. The minimum shelf-life of an MRE is a whopping 3 years at 80 degrees Fahrenheit, and 6 months at 100 degrees Fahrenheit. This shelf-life ensures that service members serving in remote areas can not only feed their hunger, but also get the nutrition they need to sustain peak performance, even if logistics prevent regular delivery of rations. If an MRE prototype passes all three criteria, CFD then presents its recommendations to the Joint Services Operational Ration Forum, for their decision on whether to give the approval for the new items.

Leading-edge Technology

Meeting the three criteria of an MRE is no easy task and requires leading-edge technology. For example, in order to meet the required shelf-life the food and its nutrients are preserved through leading-edge food science processing and packaging methods. The keys to maintaining nutritionally optimal rations and food safety over extended periods of time are to limit the food's exposure to light, oxygen, and moisture, all of which may deteriorate the food and its nutritional content. An example of these methods could be as simple as foil that creates a barrier to light and moisture. On the other hand, it could be as complex as a bakery item that includes an oxygen scavenger to minimize the impact oxygen might have on that bakery item, or

a humectant which binds available water and keeps bakery products moist. Invariably, some degradation of the foods does occur over the shelf-life, but those degradations are taken into account to avoid nutritional deficiencies, maintain taste, and of course, maximize warfighter performance.

Improving the shelf-life of MREs is just one way food scientists at the CFD are using leading-edge technologies. CFD food scientists have been studying whether they can add performance-enhancing nutrition elements, like omega 3 fatty acids (a nutrient important for metabolism typically found in fish and some seed oils) into new MREs. The challenge with adding something like omega 3 fatty acids, is that over time you can get a fishy taste as the fatty acids in omega 3s break down. And no one wants to eat fishy chicken. However, the CFD scientists have figured out how to add it without that fishy taste! While this technology isn't being used yet (pending review of NSOR requirements), it could be the future of MREs and performance-oriented nutrition in the Services.

Taking Performance-Oriented Nutrition into Your Own Hands

The CFD is also looking at ways to empower service members to take control of their nutritional needs, both at home and while deployed. They believe education is a key component of performance nutrition, and are currently striving to increase service members' awareness of the nutritional content of rations, and what service members actually need to consume to sustain peak-performance. One such way they are doing this is by collaborating with the DoD Nutrition Community and the U.S. Army Research Institute of Environmental Medicine (US-ARIEM), to update the nutrition education messages that accompany the MREs, and improve access to this information. In addition, CFD is collaborating with the Human Performance Resource Center (HPRC) to develop a website that will provide nutritional information at the component and menu level. The objective of the updates is to empower the warfighter to make appropriate performance-oriented nutrition choices. The nutrition education panels will soon focus on the role of nutrition to promote peak-performance and will also include nutritional needs information for when service members may be in extreme environments. These updated messages will be tested as early as the fall of this year.

MRE

A lesson in performance nutrition

By Jeannette Kennedy, Combat Feeding Directorate (NSRDEC), and Cmdr. Connie Scott, Navy and Marine Corps Public Health Center



Photo: Mike Seppin, NSRDEC, DOD Combat Feeding Directorate



Keeping It Clean

Natick fabric goes commercial

By Jane Benson, NSRDEC Public Affairs / NATICK, Mass. (Sept. 17, 2014)

Quoc Truong, a physical scientist at the Natick Soldier Research, Development and Engineering Center, or NSRDEC, is making sure that it all comes out before the wash.

Truong provided technical guidance and direction to NSRDEC's industry partner, Luna Innovations, Inc., to successfully develop a durable, "omniphobic" coating used to produce self-cleaning fabrics. The technology, which was developed for use in Soldier clothing, has now made its way to the commercial market.

The coating greatly reduces how often Soldiers need to clean their clothes and enhances chem-bio protection. The omniphobic-coated fabric significantly lowers dirt and dust attraction, and repels water, oil and many liquid chemicals.

"It's omniphobic. That means it hates everything," Truong said.

Truong's technical guidance and leadership were provided to Luna's scientists and engineers through close communications with Luna principle investigator Bryan Koene. Truong's oversight continued through various stages of lab-bench testing and evaluation, ensuring that the optimized, omniphobic-coating formulations were compatible for use with various Army fabrics.

"Care was taken to also ensure minimal impact to Army fabrics' original physical properties and performances, such as comfort, while providing added repellency to water, oil and toxic chemicals," said Truong.

The self-cleaning clothing then underwent field testing to assess field durability, performance and user acceptance.

"We tested it, and the Soldiers really liked it," said Truong. "The treated fabric also has an anti-microbial additive. It slows microbe

growth that causes odors. Some Soldiers had asked to keep their uniforms after the field tests. However, it was essential to collect these field-tested uniforms for a post-field-test evaluation to assess their liquid-shedding performance and durability."

The omniphobic coating's predecessor, Quarpel, is a durable, water-repellent coating that has been used for the past 40 years. Compared with Quarpel, the new coating is more repellent to oil and toxic chemicals. It is also "greener" than its predecessor.

"What we developed with our industry partner, Luna, is based on a C6 chemistry," said Truong. "It contains shorter, six-carbon molecular side chains containing fluorine atoms as compared to its predecessor having longer, eight-carbon chains, and C6 chemistry is considered by the Environmental Protection Agency to be environmentally friendly."

Even greener versions without fluorine are planned for the future.

UltraTech International, Inc., has been working with NSRDEC partner Luna Innovations to market the omniphobic coating, and it has made this material available commercially under the name of Ultra-Ever Shield™. So far, UltraTech has 150 potential business leads for the product. The technology is being applied to everything from outdoor wear to diapers. One country is even interested in using this self-cleaning coating to make bank notes more water- and stain-resistant.

"It would give new meaning to 'laundering' money," said Mark Shaw, chief executive officer, UltraTech International.

In an unusual sequence of events, the technology is making its way to the commercial market before becoming widely available to Soldiers.

"This new coating became commercialized before the Army has adopted it to replace its older Quarpel coating, but we are working on that," said Truong.

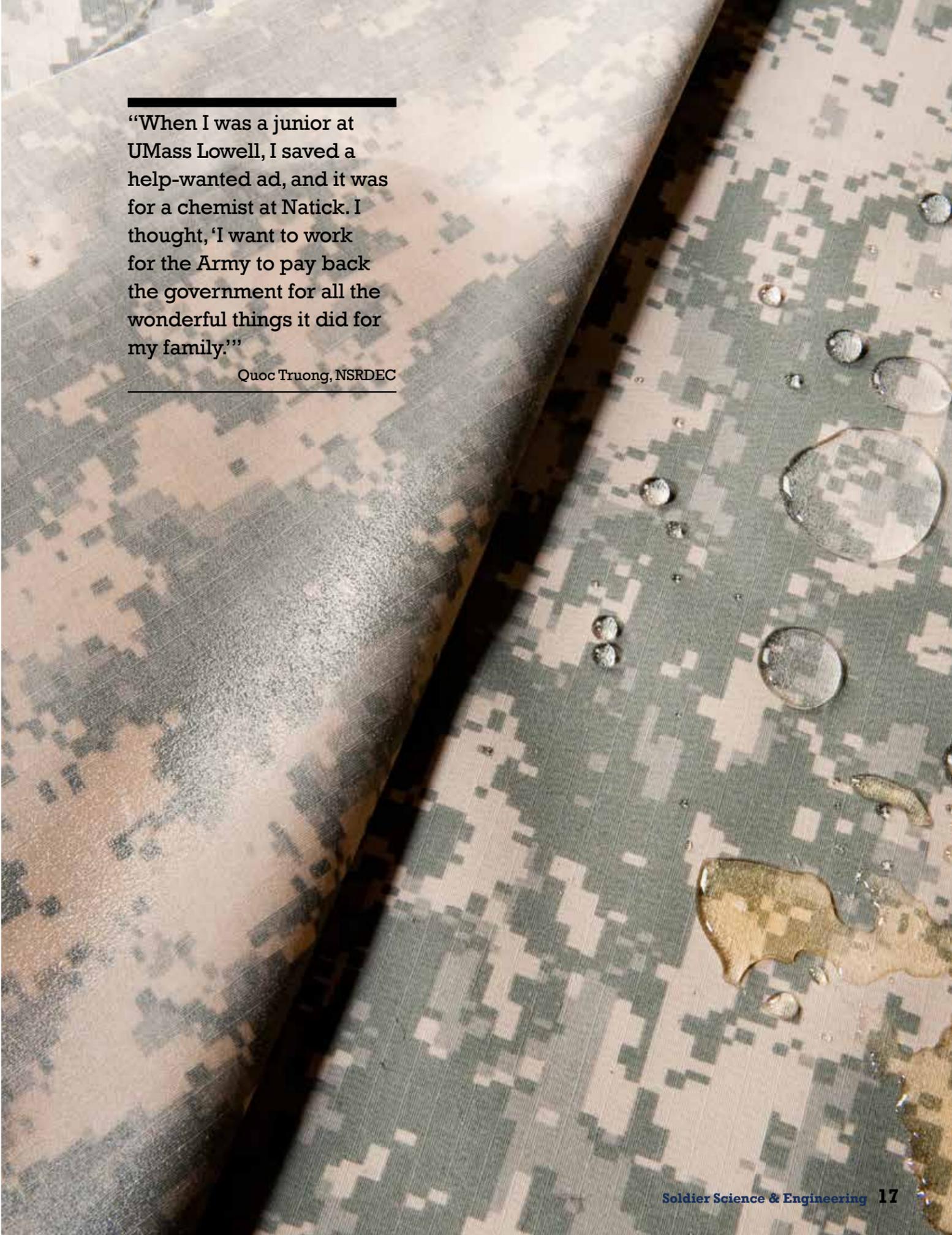
Additional military uses are also already in the works. Truong said that right now the coating is for textiles, but NSRDEC is working with a team of academic and industry partners to develop super-omniphobic coatings. The next generation of self-cleaning technology could be used on leather boots and gloves. Down the road, the self-cleaning technology may be possibly applied to flexible/hard surfaces, such as goggles, visors, shelters, and marine structures such as ship hulls.

"We've just scratched the surface, as far as applications go," Truong said.

Truong has been working on leading-edge technologies and the development of advanced, innovative materials and textiles for decades. He has personal reasons for his dedication to his work for the Soldier.

"When I came here (from Vietnam), I was only 15," said Truong. "The American government and people were so helpful and so welcoming to our family. As a result, my eight brothers and sisters are now productive citizens. We will forever remember the kindness of our American friends.

"When I was a junior at UMass Lowell, I saved a help-wanted ad, and it was for a chemist at Natick. I thought, 'I want to work for the Army to pay back the government for all the wonderful things it did for my family.' When I graduated, I was hired by Natick. I feel really fortunate that I have this job with the opportunity and the freedom to explore new ideas. Some ideas may seem crazy, but they can be done."



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Quoc Truong, NSRDEC

MORE Nutrients for Soldiers

Enhancing rations to
improve performance

By Yolanda R. Arrington, Health.mil / July 23, 2014



Photo: U.S. Army

Warfighters trekking through cold, mountainous regions or sweating through hot, dry conditions have new rations to keep them energized. Army researchers discovered that many service members were losing weight in combat situations, despite having regular access to field rations. The rough terrain and strenuous activity requires service members to consume as much as an additional thousand calories per day. A new food source is helping these troops reload on nutrients.

What is MORE?

Army regulations require that Meals, Ready-to-Eat provide a minimum of 3,600 calories per day, which they do. That is assuming soldiers eat all of the food in them, but many of them don't. "We know that there are certain environmental conditions and stressful events where warfighters need additional calories," said Julie Smith, an Army senior food technologist at the Natick Soldier Research, Development and Engineering Center in Massachusetts. Smith's team has spent years looking at the nutritional needs of warfighters and devised a way to make getting an energy boost quick and easy. Enter the Modular Operational Ration Enhancement.

The ration enhancement supplements the service member's daily caloric intake by providing a carefully researched offering of foods. The packets include carbohydrate-dense snacks, chewing gum and caffeinated treats. The latter are part of a caffeinated dosing strategy in combat environments that aids cognitive function. The packets are lightweight and ready-to-eat. The service member doesn't have to stop and prepare anything. Just open and eat.

The Modular Operation Ration Enhancement "is a bag of snacks to supplement your meal. Having that supplemental snack bridges the gap," said Dr. Scott Montain, an Army research physiologist at the U.S. Army Research Institute of Environmental Medicine, referring to periods when service members aren't getting all the calories they need to maintain performance. "It's not nutrition if it's not eaten," noted Lt. Col. Christine Edwards, an Army Medicine nutrition consultant.

The Need

"These service members are doing physical labor. They are relying on the MRE, but they are eating only as time permits," Montain said, adding that they usually eat too little. One of the goals of the ration enhancement is to enable them to snack on the go, improve their energy and aid in recovery from the demands of battlefield life. The ultimate goal of the nutrient reload is optimal performance readiness for the warfighter, a tenant of the Army's Performance Triad.

The Modular Operational Ration Enhancement allows the service member to have snacks in between meals so he doesn't get tired and have to slow down. It keeps energy levels where they need to be throughout the day. "If you're not eating well, you are dependent on a break to recover. [The ration enhancement] gives us a tool for helping them eat on the go, so they are less dependent on the recovery period. They can refuel and recover," said Montain.

Researchers sought feedback from service members to create the ration enhancement packs. Focus group testing revealed that soldiers want comfort foods like chocolate and muffins while deployed. Smith and her team took those findings into account when devising what would go into the ration enhancement. The packets are designed to meet shelf-life requirements in extreme conditions. They last two years at 80 degrees Fahrenheit and six months at 100 degrees Fahrenheit. The ration enhancements are tailored for cold and hot weather conditions. Service members deployed in high altitude or cold climates will receive the packets that include a carbohydrate beverage, applesauce in a pouch, caffeinated chocolate pudding, an energy bar, beef jerky, and caffeinated chewing gum.

Those in hotter climates will receive ration enhancement packages that are focused on

sustaining hydration and energy. The hot weather ration enhancement packets include two carbohydrate-electrolyte beverages, caffeinated chocolate pudding, dried berries, mixed berry energy gel, and cheese-filled pretzels.

Smith and her team created varied combinations of snacks, coming up with three different versions of the packet for both types of weather. Each food item has been carefully selected to provide a balance of calories, carbohydrates, protein and fat.

What's Next?

So far, a small number of Marines and soldiers have used the Modular Operational Ration Enhancement packs in combat. The next step for Smith is to devise a Modular Operational Ration Enhancement pack that's solely for recovery from strenuous activity. Smith is in the first year of that project with focus groups coming soon. The evolution of the ration enhancement pack is a critical element to supporting the Performance Triad's mission of empowering the soldier-athlete. Ultimately, researchers want the warfighter to be able to easily identify what to eat and when to eat it for best performance.

"This is life or death we are talking about, so we want the soldier to be as ready as possible at all times. The idea of a recovery ration is taking advantage of the metabolic recovery that goes on after strenuous exercise. We want them to fuel as they go; don't wait for recovery," Edwards stressed.

In an effort to put nutrition at the fingertips of the service member, the Army is also collaborating with the Human Performance Resource Center to create a public website that will provide up-to-date and easy-to-access nutrition information on all combat rations. Smith said she hopes to launch the initial phase of the site by the end of the summer.

Which Way Is Up?

Steering Soldiers in the right direction

By Jane Benson, NSRDEC Public Affairs / NATICK, Mass. (Oct. 2, 2014)

When the going gets tough, Dr. Tad Brunyé wants to help. A member of the Cognitive Science Team at the Natick Soldier Research, Development and Engineering Center, Brunyé is investigating spatial and non-spatial influences on Soldier navigation choices.

Spatial influences pertain to things in an actual space, such as topography, local and distant landmarks, or the position of the sun. Non-spatial influences are a little harder to define and can include a Soldier's emotional state, level of stress, mission and task demands, skills, abilities, traits, and his or her past experience in a geographical area, all of which can affect navigational choices.

"We are still trying to identify and characterize the full range of spatial and non-spatial influences and how they interact with emerging representations of experienced environments," Brunyé said. "We all have our current mental states. So, you may see the same landmarks as I do, you may see the same topography that I do, but I might be in a very different state that leads me to interpret and use that same information in very different ways.

"How confident do I feel in my environment? Is there a history of enemy activity? Are there certain areas I want to avoid? Are there certain safe spots that I want to keep in mind? There is always interplay between what you sense in the environment, what you perceive, what you know, what you predict will occur, and ultimately how you act."

Soldiers face special challenges during navigation. Their jobs are physically demanding.

They are often under extreme stress, and they often need to make quick decisions in an ever-changing and sometimes dangerous environment. They may be cold, hot, hungry or tired. All of these factors can affect the ability to make wise navigation decisions.

Individual cognitive abilities and individual personalities can also affect navigation choices. Brunyé has found that good navigators tend to be more open to new experiences and are less anxious than poor navigators.

There are also misperceptions that influence navigation choices. One of the key discoveries made by Natick Soldier Research, Development and Engineering Center researchers is that many people will choose a route that goes south because they equate going south with going downhill. They perceive a southern route as easier than a northern route, which they equate with going uphill. This incorrect assumption can lead to less than optimal navigation choices.

"This finding has been coined the 'north-is-up' heuristic, and has been replicated in not only the USA, but also in Bulgaria, Italy, and the Netherlands," Brunyé said.

Moreover, Brunyé said that right-handed people tend to prefer making right turns. Left-handed people prefer going left, and most people will choose a route that is straight initially, even if it curves and becomes suboptimal later in the journey.

By studying and monitoring people's choices in navigation (through non-intrusive devices and methods) and by observing patterns of

physiology and neurophysiology, Brunyé is developing ways to predict behavior and optimize navigation performance. The goal is to incorporate his observations into Soldier training, providing Soldiers with concrete tips for becoming better navigators in a variety of situations. In addition to training, Brunyé is exploring redesigning tasks and support technologies to better match individual and contextually guided Soldier capabilities and limitations.

The team is also investigating stimulating areas of the brain with low-current, electrical charges. Brunyé said that the low-current charges have been shown to help some poor navigators become better navigators, but the charges do little to help those who are already competent navigators. Brunyé pointed out that brain stimulation could also ultimately be used to accelerate learning or help Soldiers overcome barriers to flexible performance, such as fear, anxiety or lack of confidence.

The research is expected to have a major impact in the future.

"The knowledge garnered from this research could ultimately affect military strategy, including predicting which way an enemy will go," Brunyé said. "The research also could help predict the movement of friendly personnel who are disoriented or lost. By understanding the way the mind works, we can make some predictions about what people are going to do when they are lost or isolated. This knowledge will help improve survivability and mission effectiveness."



Photos: Tazanyia Newton, USAIG-Natick Public Affairs

Life Line

Arctic warriors summit North America's highest point, put Army gear to the test



By Staff Sgt. Jeffrey Smith / JOINT BASE ELMENDORF-RICHARDSON, Alaska (June 24, 2014)

Driven by determination and trained in arctic survival, five paratroopers from the 4th Infantry Brigade Combat Team (Airborne), 25th Infantry Division, along with one Soldier from the Army's Northern Warfare Training Center, and two Soldiers from the Vermont Army National Guard, scaled the highest point in North America by reaching the summit of Mount McKinley, June 15.

The mountain, located in the Denali National Park and Preserve in the state of Alaska, ascends to an elevation of 20,237 feet above sea level. It has an 18,000-foot base-to-peak rise in elevation, which is the highest in the world in that category.

The Alaskan Native Athabaskan name for the mountain itself is Denali, which, when translated means "The High One."

Weather conditions on the mountain are often extreme. Bitter cold temperatures, blistering sun, and high winds create very difficult climbing conditions. Dangerous crevasses concealed by snow bridges scatter the surface of glaciers, presenting treacherous obstacles for climbers.

This climbing season has been particularly difficult, which according to the 4/25's climb team leader, Capt. Matthew Hickey, has seen less than 30 percent of climbers reaching the summit so far.

Hickey credits the discipline, training, and equipment he and his team employed on their way up as key factors to their successful attempt. He said the team's mountaineering skills, cold weather operations training, teamwork, and conditioning allowed them to keep their momentum as they pressed forward.

Spartan Brigade teammates who made up the team in addition to Hickey were, Staff Sgt. John Harris, Sgt. Lucanus Fechter, Spc. Matthew Tucker, and Spc. Tyler Campbell. They joined forces with 1st Sgt. Nathan Chipman and Staff Sgt. Taylor Ward, from the

Army's Mountain Warfare School in Jericho, Vermont, and Staff Sgt. Stephon Flynn from the Northern Warfare Training Center in Black Rapids, Alaska, to make up the entire eight-member team.

The team followed the West Buttress Route to the summit of Mount McKinley, with each Soldier hauling 140 pounds of gear. They ate Army-issued dehydrated meals twice each day, boiling the water they needed to prepare the meals from snow they collected from the mountainside, while snacking between their meals for added energy and nourishment.

Key mission objectives were to test and strengthen tactics, techniques, and procedures, while operating in a mountainous, high altitude, cold weather environment.

The U.S. Army Alaska-sponsored team took 13 days to reach Denali's summit. The mountain's oxygen-depleted air left team members with headaches and fatigue, to which they countered by stopping at intermediate camps along the way to acclimate to the high altitudes and weather conditions.

The team reached the top of Denali using primarily Army-issued equipment.

Harris, the assistant team leader, said the Army's pull-behind sled system is heavier than a lot of similar sleds, but because of its rigid poles, which are used to pull the sled, navigating downhill and along the sides of slopes was made easier.

"We brought it along, despite the weight," said Hickey. "That was one of the reasons why we were on the mountain, was to test some of this new equipment, or equipment that has been in the inventory for a while that hasn't been used in an environment such as Mount McKinley."

The team's safety equipment was tested when Campbell suddenly fell into a snow-bridged

crevasse. The safety harness and tethered line they wore every day saved him from plummeting to the bottom of the 80-foot deep crevasse.

"Personally, I love this piece of equipment," said Campbell. "It's part of the reason why I'm still here today."

"I think it was our fourth day on the mountain, not too far in," Campbell explained. "It was gray out, you know, [there] was a little drizzle, a little snow, and it just looked like a normal slope to me."

"We knew there were crevasses around, but we didn't see them. There was a snow bridge that I walked on, and it was just too weak to hold me up, and I just started falling," Campbell added.

His fall was stopped at about 15 feet down when the safety line rope went tight. He used his training in crevasse rescue to climb nearly to the top where he was then assisted the rest of the way.

"[It was] probably one of the scariest experiences of my life," said Campbell. "We were doing everything as safely as we could, and I'm still here today because of the equipment we used."

The team agreed that safety training and risk mitigation planning were key factors to their successful and safe journey. They also said that even though they were in a bitterly cold, unforgiving environment, turning back before reaching the summit never crossed their mind.

In all, the team spent 16 days on Mount McKinley. On summit day, they reached the top of the mountain inside of a cloud. With limited visibility, nausea, fatigue, and heads pounding, they celebrated, snapped some pictures, and with that, began their rapid descent home for a hot shower and a warm meal.

Gut Check

Natick investigates gut bacteria to improve Soldier rations, performance

By Jane Benson, NSRDEC Public Affairs / NATICK, Mass. (July 31, 2014)

It takes guts to research Soldier nutrition and performance—or, more specifically, it takes gut bacteria.

Researchers at the U.S. Army Natick Soldier Research, Development and Engineering Center, or NSRDEC, are investigating gut bacteria and its effects on Soldier performance. Natick's research is in the early stages but could eventually be used to improve rations to help Soldiers combat the effects of stress and to improve their overall performance.

“What’s really created this wave of interest (in gut bacteria) is the Human Microbiome Project,” said Ken Racicot, a food technologist/nutritional biochemist in NSRDEC’s Combat Feeding Directorate. “What came out of that is not only a lot of great research but also the tools—the tools to study in this area. There is a huge wave of interest, partly because the tools are now allowing us to study it better.”

The Human Microbiome Project is a U.S. National Institutes of Health initiative. The goal of the project is to identify and characterize microorganisms, or bacteria, that reside in the human body in order to gain insights into human health and well-being. In terms of actual numbers, there are approximately 10 times the number of bacterial cells in the body as human cells, but the bacterial cells are much smaller than the human cells.

The gut microbiome, specifically, refers to the gut microbe system. Gut bacteria has an impact on the immune system and is also believed to play a role in obesity and several diseases, including diabetes. It may also affect cognitive and physical abilities. The type of gut bacteria a person has is determined at a very early age, but researchers believe that it may also be influenced and altered somewhat by diet or physical and emotional stress.

“We’re at the early stages of this work,” said Racicot. “We’re doing basic research, and

we’re establishing in-vitro models to evaluate the influence of dietary input on the gut microbiome and how that can influence biological function—specifically, local inflammation and immune function. Our long-reaching goal, ultimately, is to be able to gain insight into dietary inputs that improve all of those functions and to develop combat rations in a way that can lead to those improvements.”

Racicot is working with Steve Arcidiacono, a microbiologist, and Jason Soares, a research chemical engineer. Both Arcidiacono and Soares work for NSRDEC’s Warfighter Directorate. The U.S. Army Research Institute of Environmental Medicine, or USARIEM, is also an important collaborator in the research.

“Soldiers are facing physiological, psychological, cognitive and physical stress,” Soares said. “Anytime you are carrying a load, you are creating physical stress. Physical stress and mood have been linked to changes in gut microbiome. These studies are being done in the civilian sector, but there isn’t really a lot of work being done for Soldiers, and that’s where our work comes in. We think we have a great opportunity to tailor some of this work specifically toward the Soldier, because the Soldier is subject to a lot of different stresses than you and I are.”

Racicot’s focus is on the nutritional aspect of the work in terms of optimization of Soldier performance through diet and immune function.

Soares and Arcidiacono are focusing on the bio-fermentation aspect—essentially trying to mimic the action of the human colon.

“Steve and I are trying to create a model of the human gut where we can also look at other aspects that are connected to nutrition, but more in terms of human performance,” said Soares. “So, external stresses specific to a Soldier, such as sleep deprivation. Or certain cognitive stresses that a Soldier will get that

no one else will get. Those external stresses have been linked to changes in the gut microbiome. So what we’re interested in is trying to develop a model where we can see some of those changes. Then we work with Ken and the Combat Feeding Directorate and see if through dietary intervention, if we can overcome that external stressor to reinstate the Soldier’s original level of performance under that particular stress condition.”

“Ultimately, the goal is to improve performance in multiple areas where performance can hopefully be improved by dietary additives,” Arcidiacono said. “Perhaps, it will help Soldiers overcome stress or fatigue from load carriage or no sleep—those kind of things.”

“So we’re putting the bacteria in (the reactor), and working with Ken, we are also putting in the dietary inputs and seeing how that bacteria breaks down that dietary input,” said Soares. “The samples then go to Ken and he analyzes them in the human cell lab. He can look at the immune function of that dietary input. And we can look at how the population changes because of that the dietary input. For instance, does the dietary input increase beneficial microbes or change the balance of the gut bacteria?”

“It’s a good opportunity for us to really make an impact here,” Arcidiacono said. “It’s been great working with Combat Feeding, because they operate with that path to the Soldier, with transitions in mind.”

Racicot initiated the collaboration with Soares and Arcidiacono. The three researchers share a special chemistry, a great enthusiasm for pointing out one another’s unintentional puns, and an even greater enthusiasm for their work.

“Bacteria is my life,” said Arcidiacono.

“Working in an emerging field is exciting,” Racicot said, “It is fulfilling to be part of this early wave.”

Photo: Jeff Sisto, NSRDEC Public Affairs



Steve Arcidiacono of NSRDEC’s Warfighter Directorate peers into a microscope at a Natick laboratory.

Natick investigates the effect of shelter lighting on Soldier thinking and mood

By Jane Benson, NSRDEC Public Affairs / NATICK, Mass. (July 3, 2014)

Seeing the Light

A light bulb drawn over someone's head usually symbolizes an idea — but could the type of light bulb, or type of lighting, actually affect how well someone is able to think?

Researchers at the Natick Soldier Research, Development and Engineering Center, or NSRDEC, are investigating the effects of different types of lighting in military shelters on Soldiers. Specifically, members of NSRDEC's Cognitive Science Team are examining the effect of lighting on mood, or affective state, as well as visual acuity, cognitive alertness/awareness and the ability to perform tasks.

The team is investigating two types of lighting — traditional fluorescent lighting and newer light-emitting diodes, or LED, technologies. The lighting is being studied at varying color temperatures ranging from low color temperatures of yellow/red to high color temperatures of blue/white. Twenty-four human research volunteers, Soldiers between the ages of 18 to 31, participated in the study, which took place at NSRDEC over five consecutive days.

“The ultimate aim of the project is to develop efficient spaces that promote well being,” said Breanne Hawes, member of the Cognitive Science Team and lead researcher on this particular project. “We were thinking of Soldiers in tents doing mission planning. This is where they set up their maps and have their meetings in shelters, and we wanted to see how the lighting would affect that especially, among other things.”

Dr. Caroline Mahoney, leader of the Cognitive Science Team, explained that one of the goals of the team — which does basic and applied research to monitor, predict and enhance cognitive performance — is to help shape technology and material development. On this study, the Cognitive Science Team worked with the Shelters Team and the Special Projects Team.

“This (study) was about helping material/product developers and designers make deci-

sions about the technology,” said Hawes. “We were trying to analyze different lighting systems. Currently, all the tents use fluorescent lighting, and (the Shelters Team and the Special Projects Team members) were trying to analyze three LED systems, which are newer lighting technologies. They were analyzing them based on technological differences, such as how long they last and how easy they are to set up. So the goal for our project was to tie in how (the lighting choice) is actually affecting the people sitting under the lighting, how is it affecting the Soldiers.”

“There is a ton of past research on what lighting can do to humans. It can affect how sleepy you are, your sleeping patterns, or how productive you are. But this has rarely been studied as a military application.”

Breanne Hawes, Cognitive Science Team

“The goal of the Cognitive Science Team is to enhance the Soldier's capability and survivability within the context that they operate,” said Mahoney. “So we strive to have a really good understanding of their context — whether it is stress, physical fatigue, or a new technology that they need to use and manipulate. How do those things affect their ability to maintain awareness of their situation and their ability to make timely and correct decisions? Ultimately, we want to provide information to predict a Soldier's abilities in a given context, keep them safe, and optimize performance.”

“There is a ton of past research on what lighting can do to humans,” Hawes said. “It can affect how sleepy you are, your sleeping patterns, or how productive you are. But this has rarely been studied as a military application.”

LED lighting uses less energy than fluorescent lighting and has a longer lifetime, but its use in room lighting is still relatively more expensive than traditional lighting.

“This study is important because it is the first study that has considered the tradeoff between the differences in cost between the lighting technologies and the impact of the lighting on Soldier mood and performance,” Mahoney said.

Compared with fluorescent lighting, the NSRDEC researchers concluded that LED lighting in a work environment seems to foster positive mood, increased alertness, and faster performance on visual perceptual and cognitive tasks. Soldiers working in fluorescent lighting tended to feel less alert, more fatigued and more depressed over time. Under fluorescent lighting, Soldiers showed slower response times on cognitive tasks measuring spatial and verbal memory.

This data has both military and industrial applications and could help designers to create workspaces where lighting improves concentration and mood.

“The results from this study impact the bigger picture because these LED lights are a very new technology,” Hawes said. “There hasn't been a lot of human-centered research on them yet. There have been many previous studies on how lighting affects sleepiness and other measures but those studies have focused on fluorescent lighting. This study adds to the research on LED lights.”

“This approach to research is something I'm really interested in — really keeping the human element in mind,” Hawes said. “Really thinking it through and keeping in mind how it is going to affect the end user: the Soldier. It's important to consider how we can make things so they can perform their best and help ensure their well-being.”



Bodies in Motion

A new Army Physical Fitness Uniform will become available service-wide, beginning in October next year.

Its design is based on Soldier feedback, said Col. Robert Mortlock, program manager, Soldier Protection and Individual Equipment, Fort Belvoir, Virginia.

There's a three-year phase-in program and the cost will be about \$3 less than the current IPFU, or Improved Physical Fitness Uniform, he said.

The Army Physical Fitness Uniform, or APFU, program was actually initiated because of Soldier feedback. A February 2012 Army Knowledge Online survey of some 76,000 Soldiers found that Soldiers had issues with the IPFU, he said. They liked its durability but believed the IPFU's textiles had not kept pace with commercially-available workout clothes. They also had concerns with other things, particularly modesty issues with the shorts, especially in events like sit-ups. Those concerns were expressed by males as well as females.

The issue was of such concern that Soldiers were purchasing spandex-like under garments to wear beneath the trunks, Mortlock said.

Another issue was that there were not enough female sizes in the IPFU, he said, meaning IPFUs that would fit all shapes and sizes.

PEO Soldier worked closely with the Natick Soldier Research Development and Engineer-

trunks include a bigger key pocket and a convenient and secure ID card pouch.

In all, some 34 changes were made to the new APFU,

The APFU has five parts: the jacket and pants which resemble warm ups, trunks or shorts, and the short- and long-sleeve T-shirts, he said. The ensemble is modular; meaning parts of the APFU can be mixed and matched, for example, short- or long-sleeve T-shirts with the pants or trunks. During PT formations, the platoon sergeants will determine the appropriate combo.

PEO Soldier worked closely with the Natick Soldier Research, Development and Engineering Center to develop a new PT uniform that met Soldier concerns but did not cost more than the IPFU.

Soldier feedback not only determined the form, fit and function of the APFU, it also determined its look. The Army made prototypes of the APFU in a variety of colors and designs and taken to a series of Soldier town halls at Fort Hood, Texas, Fort Bragg, North Carolina, and Joint Base Lewis-McChord, Washington. Soldier feedback was solicited

providing feedback on form, fit, comfort and so on, Mortlock said. The APFU also was tested for things like durability, laundering, fiber strength, color fastness and color maintenance after laundering.

A key part of testing addressed the concern of some Soldiers that a black shirt may cause over-heating. Instrumented tests showed that the lighter weight material and superior moisture wicking fabric more than compensated for any increased heat from the dark material.

The response to the APFU was "overwhelmingly positive," he said, particularly with the trunks.

Not only that, Soldiers said they wear the APFU on weekends and off-duty outside the installations, Mortlock said, adding that many said they wouldn't wear the current IPFU off-duty. That means communities across the country will soon see Army pride as Soldiers do their workouts.

The APFU will come in two types, the Clothing Bag variant, and the Optional APFU, which will be visually the same as the APFU Issue variant, but uses some different materials. The individual items of the two variants can be mixed together. The Optional APFU variant will become available first when it arrives in Army military clothing sales stores sometime between October-December 2014.

The Clothing Bag issue variant will be issued to Soldiers from the clothing initial issue

New Army PT uniforms result of Soldier feedback

By David Vergun, Army News Service / WASHINGTON (Aug. 11, 2014)

ing Center to develop a new PT uniform that met Soldier concerns but did not cost more than the IPFU. The APFU met the goal of controlling costs and improving performance by adopting lighter high tech moisture wicking fabric. The APFU introduces multiple sizes, including female sizing, and has solved the modesty issue, Mortlock said.

The fabric of the trunks will continue to be made with durable nylon fabric, but it is lighter than and not as stiff as the IPFU trunks. Also, there will be a four-way stretch panel inside the trunks, sort of like bicycle pants, which eliminates the need for Soldiers to purchase their own under garments. The

about the design features as well as the preferred color scheme.

Then, the Army launched a second AKO survey, in which more than 190,000 responded, Mortlock said. Soldiers overwhelmingly favored a black T-shirt with gold lettering and a black jacket with gold chevron and the Army logo.

Then it was on to testing.

About 876 Soldiers at Fort Wainwright, Alaska, Joint Base Lewis-McChord, Fort Bragg, Fort Sill, Oklahoma, Fort Hood and Fort Jackson, South Carolina, wore the APFU during PT for a three-month period,

points, starting between April to June 2015, and to Reserve, National Guard, and Senior ROTC from July-August 2015. The APFU will be phased in as the IPFUs are used up and worn out. The mandatory wear date will go into effect approximately October 2017, or about three years after the APFU is introduced.

In conclusion, Mortlock said the Army reached out to Soldiers at "multiple touch points to ensure we got this right. The message is we're listening to Soldiers. We're continuing to listen to Soldiers, and this is the Soldiers' selection and Army leaders went along with this."

In-Tents Testing

Natick evaluating advanced, energy-efficient shelters and shelter components

By Jane Benson, NSRDEC Public Affairs / NATICK, Mass. (Aug. 14, 2014)

The Natick Soldier Research, Development and Engineering Center, or NSRDEC, is demonstrating and evaluating new advanced, energy-efficient shelters and shelter components.

Researchers are using the demonstrations/evaluations to develop new equipment and systems that will reduce fuel consumption.

“The ultimate goal is a 50-percent power reduction, which will equate to a large reduction in fuel. And then you’d hopefully only have to use 50 percent of the generators,” said Clinton McAdams, a mechanical engineer in NSRDEC’s Expeditionary Basing & Collective Protection Directorate. “So instead of having to use six generators for a 150-man camp, we could theoretically cut it down to three.”

McAdams said that they are using each demonstration to add to, and build upon, existing findings and will use the data to drive prototype system designs. The shelters and their components will eventually be used in the Army’s Force Provider base camps, Air Force contingency base camps, and other applications.

“We’re focusing on lighting, liners, environmental control units (air conditioners and fuel-fired heaters), solar shades, and thermal coatings,” said McAdams. “We’re also doing modeling and simulation work so that in the

future we can plug in information on the external conditions before we send (the shelters) somewhere or before we go to environmental testing.”

NSRDEC is performing the demonstration/evaluation efforts with support from the Air Force; the U.S. Army Engineer Research and Development Center/Construction Engineering Research Laboratory, or ERDC/CERL; Transformative Reductions in Operational Energy, or TROPEC; and the Cold Regions Test Center, or CRTC.

“NSRDEC is uniquely qualified to do this testing as we are the U.S. Army’s shelter experts,” McAdams said. “Along with that, we have extensive knowledge of doing shelter evaluations/demos in various locations, including hot-dry, cold, hot-humid, and (the Doriot) Climatic Chambers.”

“NSRDEC provides the labor for setup and teardown, and we also do data collection,” McAdams said. “The data we collect is from the internal temperatures, internal humidity, power draw on the (environmental control unit) or fuel used on a fuel-fired heater, and

ambient weather conditions along with other data points. NSRDEC also does the analysis of the data. The demos also allow us to get some idea of the durability of these systems in various conditions.”

NSRDEC is currently evaluating four shelters in Guam, using two different liners and two different environmental control units, or ECUs. Two of the shelters are frame shelters with radiant barrier liners. One of the frame shelters is equipped with a five-ton ECU and one with a three-ton ECU.

“We are hoping to see what the power savings of the three-ton ECU is, if any, in a hot, humid environment,” said McAdams.

The other two shelters in the Guam evaluation are airbeam shelters.

“Both shelters have rigid doors, rigid floors, and five-ton ECUs,” McAdams said. “One shelter has a lofted liner and one has a radiant barrier liner. The plan is to compare the liners and see what liner performs best in this environment. We will also be looking to see how these items stand up to the high humidity of a tropical environment. All shelters are equipped with data logging, and we are taking temperature, humidity, power consumed by each ECU and other data points.”

NSRDEC plans to keep the shelters up for a few months. The unit in Guam may possibly use the shelters for billeting, which would give NSRDEC the chance to collect operational data in addition to static data.

Following evaluations/demonstrations in Guam and also in Kuwait, some new shelters, including two prototype shelters and prototype liners, will be sent to the CTRC at Fort Greely, Alaska.

“Typically, the shelters need to accommodate extreme weather conditions ranging from minus 25 to 120 degrees (Fahrenheit). When we do the evaluation in Alaska we’re going to see not only minus 25, but minus 30, minus 40,” McAdams said. “When it’s that cold, we are hoping to see that the tents will meet our requirements. We’re hoping to see that we can maintain the internal environment and that the tent can withstand that temperature. There’s a lot that goes into it. We want to give Soldiers the heating, the cooling, the lights, and the convenience outlets so they can plug in whatever they need.”

The goal is to not only reduce fuel and other forms of energy, but to also maintain a quality-of-life level found in the Army’s Force Provider, a base camp also known for enabling rapid Soldier deployment and mobility.

Photo: Clinton McAdams



“The Soldier’s comfort is still a very high priority,” said McAdams. “It’s clear that there are some things (that) if the Soldiers don’t have them, they don’t perform as well. It would be very easy for us to just say ‘Bundle up, you’ll be fine.’ But if we do that, Soldiers don’t get as good a night’s sleep. So anything we can do to help them, we try to do it.”

“This work will improve warfighter quality of life by allowing the warfighter to focus on the mission rather than refueling a generator,” added McAdams. “This work will also give the warfighters a more comfortable environment to work in.”

Shelter lighting options are also being investigated.

“We are looking at a flat string of LED lighting that we can leave in the tent,” said McAdams. “The current fluorescent lights use a good amount of power, and they don’t have the long life. The LED lights have such a long life that they should last the life of the shelter. They’re durable enough that you can

take the tent down and you can leave the lights in place. So, when you get to where you need to set them up next, you open up your tent and the lighting is already there.”

In addition to reducing energy and maintaining quality of life, NSRDEC’s work will also help reduce the logistical burden, enable more rapid mobility, and reduce maintenance costs. NSRDEC will be sharing what it discovers during the evaluations with the Air Force, the Navy and the Marine Corps.

“A lot of doors are opening up for a lot of collaboration,” said McAdams. “People are starting to realize that Natick is a tent expert in the Army and on the RDEC side. There is a ton of knowledge here. Also, to be working in the research and development portion and to actually have your transition partner (Product Manager Force Sustainment Systems, or PM FSS) working right next to you and to be able to get their input helps prevent transition gaps. It gives you a bit of vision regarding possible future issues.”

Four shelters (in the foreground) and their components are currently being evaluated by the Natick Soldier Research, Development and Engineering Center, or NSRDEC, in Guam. The goal of the evaluation is to determine which components best increase energy efficiency.



Natick Takes Shelter Ballistic Protection to the 'X' Level

By Jane Benson, NSRDEC / NATICK, Mass. (July 17, 2014)

Sometimes going ballistic is a good thing; particularly, if it means working to enhance ballistic protection where Soldiers live, work, sleep and eat.

Researchers at the Natick Soldier Research, Development and Engineering Center, or NSRDEC, with help from the Advanced Structures and Composites Center at the University of Maine, have developed the Improved Modular Ballistic Protection System, or MBPS-X.

Compared with the Modular Ballistic Protection System, or MBPS, the MBPS-X offers

increased armor protection. The MBPS-X protects against threats that are most likely to hit a base camp, and it provides significantly more protection from direct fire and munitions fragments than the MBPS.

"The MBPS has been perfected with the MBPS X, which has a lot more protection," said Karen Horak, lead program engineer, Collective Protection Systems Team, Expeditionary Basing and Collective Protection Directorate at NSRDEC.

In addition to improved protection, the MBPS-X has all the benefits of MBPS, which

was also developed by NSRDEC and the University of Maine. Both systems provide protection for personnel and equipment in expeditionary base camps. Both systems include highly mobile, re-deployable, reusable, quickly erectable, lightweight panels that provide ballistic protection to Soldiers in a variety of shelters.

Neither system requires any special tools to assemble.

"We wanted to look into what can we do to protect the individual tents, as opposed to just the perimeters," Horak said. "There are sandbags, but sandbags take a lot of time and a lot of manpower to put up. And sometimes (sandbags) don't get put up in certain scenarios or immediately upon arrival — or if they think they are going to be moving quickly. So the challenge is, what can you put up quickly?"

"Our goal is to give them the equivalent protection of their body armor the first day they are there," Horak added. "So, think about it: You get in your tent, and you take off your body armor, you take off your helmet and you want to go to sleep. We want to give them something that, from the very first night, they can wrap around their tent and feel that they have some decent protection. If you've slept through the night and you felt safe, you're going to be able to function better."

The system consists of a panel with a strut behind it that can be strapped to other panels. The panels do not attach to the shelter, so the system can be used with any type of shelter to protect personnel and equipment.

"We test and test and test," Horak said. "We want the Soldiers to know what they have and be confident in what they have."

The technology has also been incorporated into other types of buildings.

"The MBPS technology has been leveraged to protect embassies and consulates around the world," Horak said.

The MBPS-X is expected to be fielded in 2016, and the MBPS technology has also been incorporated into the development of the elaborate Overhead Protection System for the roofs of shelters.

"It's a rewarding program to work on because we're protecting Soldiers in places where sometimes they don't have protection," Horak said. "We can feel good about the fact that if we can give them peace of mind on day one of their deployment, it gives them comfort and it makes them better Soldiers."



Hot & Green

Natick cooks up energy-efficient kitchen appliances

By Jane Benson, NSRDEC Public Affairs / NATICK, Mass. (Sept. 3, 2014)

The Natick Soldier Research, Development and Engineering Center, or NSRDEC, is revamping the Expeditionary TRICON Kitchen System, or ETKS, with energy-efficient appliances.

The goal of the appliance conversion is a 50-percent reduction in energy usage, all while maintaining the quality and functionality of the current high-performance appliances.

The ETKS was developed by Product Manager Force Sustainment Systems' Force Provider team to meet the needs of Soldiers deployed to remote locations in Iraq and Afghanistan. The container-based kitchen provides Soldiers with an all-electric kitchen, equipped with commercial appliances and capable of feeding three meals a day to 150 to 300 Soldiers.

"It's absolutely important for us to meet the capability that we have currently," said Joe Quigley, the project engineer and operations research analyst in NSRDEC's Combat Feeding Directorate, or CFD. "The top priorities are that it's reliable, maintainable, efficient,

and that it enables Soldiers to accomplish their mission. So we want to meet the current level of capability but reduce the energy usage associated with whatever meal is being prepared. We want to use less energy and maintain quality of life."

The ETKS, with its new appliances, is currently undergoing joint testing by CFD and PM-FSS. A demonstration is planned for October 2014 at the Base Camp Integration Laboratory, Fort Devens. Another demonstration is planned for June 2015, as part of the Technology Enabled Capability Demonstration 4a — Sustainability and Logistics-Basing.

"We are going to be doing a lot of testing using operational rations," Quigley said. "It's important because we want the laboratory environment to reflect the operational environment, so part of our testing regimen will involve preparing the same meals Soldiers will prepare in an operational environment, which will allow us to verify the performance and capacity of our prototype appliance suite. So, we basically want to make sure that re-

Project engineer and operations research analyst Joe Quigley steps into the kitchen of the future at the Natick Soldier Research, Development and Engineering Center. This prototype has been outfitted with modular, energy-efficient appliances.

ardless of the meal being prepared, Soldiers will have the right equipment to prepare the meal and do so in a reasonable amount of time."

The new, more energy-efficient appliance choices have been made possible by the Rapid Innovation Fund Broad Agency Announcement program, or RIF BAA. The RIF supports innovative science and technology solutions to challenging problems.

"RIF BAA has enabled us to do some really good work," said Quigley.

The appliance technology is being developed by Advanced Mechanical Technology, Inc., or AMTI, under NSRDEC direction.

Same stove, different kitchen

CFD/PM-FSS joint testing of the new ETKS appliances is part of an ongoing collaborative modular appliance development program. One of the aims of the program is to develop a suite of appliances that can be integrated into any Army field kitchen.

"Uniformity makes life easier," said Quigley. "Basically, the idea behind a modular appliance is that you can use the same appliances in different field kitchens. Right now, there are a lot of different field kitchens out there with very specific parts that you can't interchange. We want to get it to the point where we can use the same ovens, skillets, cabinets, drawers, etc., and make them standard across all platforms. The number of appliances can then be increased or decreased, depending on the required capacity of the kitchen."

Quigley believes that the uniformity of appliances in different kitchens will benefit the warfighter.

"Soldiers could train in one kitchen, and then step into another kitchen that uses this suite of appliances — and it would be the same appliances they've always used," Quigley said. "Ultimately, they won't have to learn multiple systems. Furthermore, there will be fewer national stock numbers that the Army will need to store, which reduces life-cycle costs associated with Army field kitchens.

"I really enjoy knowing that I am developing something that will make it into the hands of the Soldier and that they'll benefit from that."



Soldier
Science & Engineering

Soldier Science & Engineering

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