

December 5, 2014

NSSC This Week



U.S. Army Garrison Natick Public Affairs Office

R&D

Top 10 stories of 2014 highlight
NSSC's support for warfighters

2013 Department of Defense Thomas Jefferson &
U.S. Army MG Keith L. Ware Award-winning Digital Publication



Publisher's Note

John Harlow
USAG-Natick and NSSC Chief of Public Affairs



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It is truly an honor to work with the people who put this publication together.

Over the past three years, we have averaged one story on the front page of Army.mil per week. Considering we are one of the smallest installations in the Army, that is pretty amazing. Natick has more time on the front page than the power-projection platforms of Fort Hood or Fort Drum. Natick has more time on the front page than the training bases of Fort Benning or Fort Leavenworth.

It is a great credit to the subject-matter experts here at the Natick Soldier Systems Center who take the time to share their stories with our staff. They trust that we will tell their stories and it will get shared with the Army as a whole.

The team of people who put this newsletter together are top-notch. They have received recognition from IMCOM, the Department of the Army, Department of Defense and the National Association of Government Communicators.

Research and development are why the Natick Soldier Systems Center exists. It is the great work here that keeps our Soldiers, who are in harm's way, the best equipped and best protected in the world.

As we wind down 2014, I want to say thanks to everyone here at Natick for what you do on behalf of our Soldiers. I also want to say thanks for sharing your stories.

Please take a moment and think of the Soldiers who won't be with their families this holiday season. Keep their families in your thoughts as you celebrate the holidays.

We look forward to telling more great stories in 2015 about the work done here at Natick to benefit our Soldiers.

John Harlow
USAG-Natick and NSSC Chief of Public Affairs



NSSC This Week

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About this newsletter

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R&D

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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 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.



Photo Credit: Tom Zikas

Going for GOLD in the COLD

Natick tests Olympic fabrics



Photo Credit: Bob Reinert, USAG-Natick Public Affairs

Dr. Phil Gibson, supervisory physical scientist with the Molecular Sciences Engineering Team at Natick Soldier Research, Development and Engineering Center, explains the Dynamic Moisture Permeation Cell testing he performed on swatches of Burton Snowboard's proprietary clothing.

He shrugged it off as just another routine day in his lab, but testing conducted by Dr. Phil Gibson helped [Burton Snowboards](#) pick a fabric for uniforms that the U.S. Olympic Snowboarding Team will wear at next month's 2014 Winter Games.

"They just wanted me to test fabrics," said Gibson, supervisory physical scientist with the Molecular Sciences Engineering Team at [Natick Soldier Research, Development and Engineering Center](#), or NSRDEC. "I do lots of testing for companies, and (Burton is) just one of the companies that asked me to do some testing."

The results of that testing, done last year under a Testing Service Agreement between NSRDEC and the Burlington, Vt., company, were used by Burton to develop its new "DRYRIDE Vaporshell laminate" for the unique patchwork quilt competition jackets that will be worn by such Olympic riders as Shaun White and Kelly Clark in Sochi.

"We're really proud that the 2014 uniform builds on Burton's legacy of creating fun, unconventional designs that stray from the formal, traditional look of most uniforms," said Greg Dacyshyn, chief creative officer at Burton. "The vintage quilt and flag print of the jacket combined with the corduroy pants give the uniform an 'heirloom hippy' vibe that lines up with snowboarding's laid-back culture, while paying respect to America's longstanding creative heritage. It will stand out in Sochi for sure."

Dr. Jack Obusek, NSRDEC director, said that Testing Service Agreements provide "an important technology transfer vehicle that can help promote working with the commercial sector to find military solutions. This provides a great opportunity for us to collaborate with industry, including small businesses, in understanding and advancing the state of the art

in our areas of expertise. Collaborations such as these provide us a great opportunity to engage based on our technical expertise with industry to find solutions for the Soldier."

Well into his third decade at NSRDEC, Gibson, a snowboarder himself, has considerable experience working with well-known outdoor clothing companies.

"This wasn't any different from the testing that I usually do," Gibson said. "The reason I do it is just sometimes I do see things that we would be interested in. So it's a way to kind of have a continuous survey of what the state of the art is.

"We're not endorsing," he explained. "We're just providing information, and they decide how they want to use it."

Gibson performed Dynamic Moisture Permeation Cell testing on swatches of Burton's proprietary clothing. After he developed the DMPC in the NSRDEC laboratories, the Army obtained a U.S. patent for the device and test method in 1999, which has since become a widely used standard in the outdoor clothing industry.

"They didn't even tell me what they were," Gibson said of the swatches. "You're just measuring how much water vapor goes through, how breathable it is.

"I have a set of standards that I test, and then I usually have whatever the company sends, and then I just provide them (with results that compare them to other fabrics)."

When he's not monitoring the commercial market, Gibson works with his Natick team on garments for American warfighters. He is especially proud of advances NSRDEC has made in flame-resistant and chemical-protective materials.

"That's, I think, been one of our big contributions over the past decade," Gibson said. "We've made a lot of advances here at Natick, which have been transferred to industry or are going into prototype garments that we're developing now."

Meanwhile, Gibson will continue to test for companies such as Burton in hopes of coming across materials that can benefit U.S. service members in the future.

"Things have gotten continuously better," said Gibson, "and people understand how to combine different materials together in different environments, even within the same garment."

The new U.S. Olympic Snowboarding Team uniform jacket features the "DRYRIDE Vaporshell laminate," which was tested by Dr. Phil Gibson of the Natick Soldier Research, Development and Engineering Center.

Photo Credit: Burton Snowboards



Natick tests lightweight, body-worn system

Helping Aircrews Keep Their Cool

By Bob Reinert, USAG-Natick Public Affairs / NATICK, Mass. (May 29, 2014)

For years, helicopter pilots have kept cool by plugging into aircraft-mounted microclimate cooling systems, but their crews have used them less frequently to avoid becoming entangled in the tethers that connected them to the systems.

That's why researchers at the [Natick Soldier Systems Center](#) have been testing the "Light-Weight Environmental Control System," or LW ECS, a body-worn microclimate cooling system that allows crew members to move around inside the aircraft without tripping on tethers, and to exit the aircraft while still being cooled.

"Basically, it's a small refrigeration device," said Brad Laprise, a mechanical engineer with the Warfighter Directorate, [Natick Soldier Research, Development and Engineering Center](#), or NSRDEC. "It's the same technology that's in your air conditioner or in your refrigerator, except instead of conditioning air, it chills a fluid. And then it pumps that fluid through a tube-lined cooling vest."

The cooling unit is a cylinder 3 ½ inches around that connects to a cooling vest and provides 120 watts of cooling. The vest has approximately 110 feet of tubing through which fluid can pass, and it is worn against a Soldier's skin. The system is powered by a plate-like conformal battery that can fit inside body armor.

"So we're hoping that this small, lighter-weight system would give them a lot more autonomy in the rear of the aircraft," said Laprise, "and to allow them to get the cooling when they need it."

Researchers from NSRDEC and the [U.S. Army Research Institute of Environmental Medicine](#), or USARIEM, working with Product Manager Air Warrior, have been

testing LW ECS at Natick's [Doriot Climatic Chambers](#). With the assistance of volunteers wearing MOPP 4 chemical-protective gear, they have been simulating 11-hour missions in desert and jungle conditions.

"We've been living in the desert for the last 20 years, but we also know that the Pacific Rim is the next area that we're looking at," said Bruce Cadarette, a research physiologist with USARIEM's Thermal and Mountain Medicine Division. "We've been providing microclimate cooling for the pilots ... for 16 years now. It made them be able to prolong their mission, their endurance time, and able to perform at a higher level."

The hope is that their crews will be able to realize similar benefits with LW ECS, without being tethered to an aircraft-mounted system.

"Right now we're looking at crew chiefs that have to load and unload cargo and maintain the cargo," Cadarette said. "They also have to sit as rear gunners in some of the helicopter frames."

"The other people that we're concentrating on ... are the medics, who have to fly out in the back of the helicopters and who have to go out and treat wounded in the field, load them onto stretchers, (and) get them onto the back of the helicopter."

Over two weeks, the five test subjects each took two turns in the simulated desert conditions and a pair in the jungle conditions – one using the cooling system and one without it – in the chamber.

"It's really a critical step, ... proving out the efficacy of this microclimate cooling technology and the capability that it provides," Laprise said. "If we don't have Doriot, we need to find somewhere else to do it, and I'm not

so sure there's a place in the world where we can do this testing. So it is absolutely critical that we have this capability here at Natick."

The cooling systems and the volunteers performed well, according to the researchers.

"We really haven't had any issues with (the LW ECS)," said Laprise, who looked at the fluid temperature before and after it passed through the system, and monitored flow rate. "By and large, they've been very reliable."

Cadarette said the same for the volunteers, who sat for 50 minutes and walked for 10 minutes each hour to simulate missions during which they would get off and back on the aircraft.

"A lot of the day is not heavy work, but for brief periods of time, they work very, very hard," Cadarette said. "Now you've got a battle between your muscles calling for blood in order to exercise and your skin calling for blood in order to cool off."

During the 11-hour sessions, Cadarette and his team monitored core and skin temperature, heart rate, and everything that went into or came out of the subjects' bodies.

"From our point of view, we monitor everything we can, physiologically," Cadarette said. "So now we know, are you doing better with the cooling?"

Cadarette has a great deal of data to sift through, but the early indications are that the LW ECS is making a difference.

"Physiologically, we're seeing that their body core temperatures are lower, their heart rates are lower," Cadarette said. "So far, what I'm seeing looks really good. I think we can show that the cooling portion of this does what we're asking of it."

Volunteers wear MOPP 4 gear during testing of a body-worn microclimate cooling system for the helicopter aircrew members in Doriot Climatic Chambers.



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





"Blitz" and officers from the Plymouth County Sheriff's Department recently came to the U.S. Army Research Institute of Environmental Medicine to meet with scientists from USARIEM and MIT Lincoln Laboratories, who are involved with the program to evaluate thermal stress in Military Working Dogs, which is led by Kate O'Brien, a research physiologist with USARIEM, pictured with Blitz.

Last summer, Ken Ballinger, a K-9 officer with the Plymouth County Sheriff's Department, was conducting a training session with working dogs on a hot and humid New England day.

For safety, Ballinger had arranged for two veterinarians and three paramedics to be on site. When the dogs were not working, they were resting in air-conditioned vehicles and checked on every 15 minutes. On one of these routine checks, Ballinger's dog, "Blitz," a 3-year-old Shepherd, did not respond.

The vehicle had failed, so that instead of blowing cool air, 200-degree engine air flowed into the cabin where Blitz was. Blitz was unconscious when he was pulled from the vehicle. Emergency treatment began immediately, including application of ice packs, administration of intravenous fluids and rapid transport to Angell Animal Medical Center, located only five minutes away.

An hour later, Blitz's core temperature was still 109 degrees, far above normal; yet within two weeks he was back to work. In the veterinary community, this was the highest temperature documented with survival.

"Heat stress is a significant concern for military working dogs, both during training and deployment," said Kate O'Brien, a research physiologist at the [U.S. Army Research Institute of Environmental Medicine](#) in Natick, Mass. "If heat illness occurs, even if it is not fatal, MWDs are often retired from service, resulting in loss of a valuable resource that is costly with respect to both time and money."

USARIEM's [Biophysics and Biomedical Modeling Division](#) is working with the Massachusetts Institute of Technology's [Lincoln Laboratory](#) to solve this problem through a program to examine thermal stress in military working dogs.

"Real-time physiological monitoring can be used in humans to identify individuals who are at risk of excessive heat strain," said O'Brien.

For example, O'Brien said, Weapons of Mass Destruction Civil Support Teams have used handheld "buddy" displays to see when an individual is becoming too hot and could use that information for better mission management.

"A similar approach could be used with MWDs to send information to the handler when the dog is overheating," O'Brien said. "The handler could then take action to both avoid performance degradation and reduce risk of heat illness."

O'Brien said that while heat illness occurs less often in civil working dog populations, sometimes things happen despite your best efforts to prevent it.

A few months later, Blitz had an implanted temperature sensor in his chest. Data is transmitted so that handlers can monitor Blitz's temperature in real-time, as well as be alerted if he reaches a critical preset threshold temperature.

"It may not be feasible to surgically implant every MWD with a temperature sensor," O'Brien said. "However, USARIEM has demonstrated in humans that heat tolerance can be tracked in real-time using data obtained from non-invasive physiological measurements in combination with algorithms and models that predict core temperature."

This capability for monitoring humans was developed through USARIEM's expertise in thermal physiology, biophysics and mathematical modeling. Expertise from MIT Lincoln Laboratory in signal processing, data storage and microprocessing contributed to the methodology for transmitting this

"USARIEM has demonstrated in humans that heat tolerance can be tracked in real-time using data obtained from non-invasive physiological measurements in combination with algorithms and models that predict core temperature."

*Kate O'Brien,
research physiologist, USARIEM*

By Kelly Field, USARIEM Public Affairs / NATICK, Mass. (Jan. 31, 2014)

Working Dogs

**USARIEM
studying how to
cool K-9s**

information to the individual. Together, USARIEM and MIT Lincoln Labs are currently working on a very low power, size and weight physiological status monitoring system for humans. This same approach is being applied to monitoring heat strain in MWDs.

"Through partnerships with the MWD community, local police K-9 units, and MIT Lincoln Labs, USARIEM will be developing products and strategies to reduce heat injuries and sustain performance in working dogs for military and law enforcement," O'Brien said.

'Maj. Clo' sweats it out at Doriot Climatic Chamber

1 Feeling the heat at Natick

By Bob Reinert, USAG-Natick Public Affairs / NATICK, Mass. (Jan. 15, 2014)

If he's a bit of a hot head these days, you'll have to excuse him. "Maj. Clo" is just doing his job.

Lately, he's literally been feeling the heat at work, because Maj. Clo is the thermal test manikin at the [U.S. Army Research Institute of Environmental Medicine](#).

Maj. Clo has been getting a real grilling recently as USARIEM researchers placed him under solar lamps at the [Doriot Climatic Chambers](#) of the [Natick Soldier Research, Development and Engineering Center](#) in an effort to measure the thermal burdens of different-colored garments.

"Different materials absorb different amounts of solar radiation," said Tony Karis, a research physical scientist at USARIEM, "and this testing will help us quantify how much solar radiation is being absorbed."

Doriot's Tropic Chamber became just the place to do that in January 2013, when it was outfitted with a Solar Simulation Unit

that brought daylight conditions indoors. The 18 1,500-watt metal halide vapor lamps, arranged in three rows of six apiece, allow Doriot to produce artificial sunlight that replicates different climates in every season at various times of day — in the mountains, desert and everywhere in between.

"All of the tests in the past that we've done for 50 years in this facility have been without sun," said Josh Bulotsky, Doriot's manager. "This is like real sunlight. You don't realize how really hot it is."

It was only a matter of time before Maj. Clo and his 5-foot-9-inch carbon fiber, epoxy resin and copper frame, featuring 200 sen-

sors and simulated sweat pores, would be deployed there.

"There (are) not too many places that have these solar lamps that we can actually use a full-size manikin," Karis said. "A lot of times, it's done on a smaller scale. To be able to use a full-size manikin in an operational room is something that — as far as I know — no other place is doing."

Karis explained that USARIEM researchers are measuring how much heat is being transmitted from the clothing to Maj. Clo.

"Another thing that complicates this is the coverage," Karis said. "As coverage changes, the absorbtivity changes, too. Short-sleeve shirt versus long-sleeve shirt, shorts versus long pants — each one of them, there's different coverage, so there are different thermal burdens to each ensemble."

Karis and his USARIEM colleagues have placed Maj. Clo in the chamber at 80 degrees and 50 percent relative humidity with a 3.5 mph breeze. Then they have hit him with either 1,000 or 500 watts of solar load.

"A thousand watts is a good choice for the highest value in most locations during the summer, but more extreme conditions may occur," Karis said. "We also did 500 watts, which may be a more representative value for conditions between late morning and early afternoon for the warmer part of the year."

"The manikin measures heating over different parts of the body, and the heating just due to solar loading can vary widely for different parts of the body. But that's the idea — to monitor and measure the solar load on different garments and its effects on different parts of the body."

This validates models that USARIEM already has.

"It's nice to be reassured that your models are predicting correctly," Karis said. "We will use this information to make our models more robust."

Karis said USARIEM had done about a dozen tests with another half-dozen remaining. One day, the data could have real-world applications.

"The battlefield has changed from a jungle battlefield or woodland," Karis said. "Now we're in open desert or mountain regions where there's very little overhead coverage from plant life. So now you're in direct sunlight for the majority of the time."



"All of the tests in the past that we've done for 50 years in this facility have been without sun. This is like real sunlight. You don't realize how really hot it is."

Josh Bulotsky, Doriot's manager

Sleepless in Natick

Study examines stress, Soldiers' immune systems

By Bob Reinert, USAG-Natick Public Affairs / NATICK, Mass. (March 21, 2014)

Training and operations can put such tremendous physical and psychological stresses on warfighters that their immune systems may be compromised.

A study being conducted by the [U.S. Army Research Institute of Environmental Medicine](#) at [Natick Soldier Systems Center](#) will examine how sleep restriction — the stressor — affects wound healing and whether nutritional supplements can help offset the effects. In a sub-study, the effect of sleep restriction on friend-foe recognition during marksmanship is also being observed.

“Immune responsiveness is suppressed in warfighters exposed to physical and psychological stress,” said Tracey Smith, Ph.D., a research dietitian with USARIEM’s Military Nutrition Division, who used Ranger School and Special Forces Assessment School as examples. “Research has shown that modest improvement in immune responsiveness, as determined from blood markers, was noted when Soldiers were provided a nutritionally fortified energy bar during Special Forces Assessment School.”

Smith said the Special Forces research didn’t focus on whether nutrition helped wounds to heal or defend against a virus, however.

“Immune markers measured from blood samples provide an indication of systemic immune response,” said Smith, “but the systemic immune response does not necessarily reflect the functional status of the immune system — for example, wound healing time.”

In the study, male and female Soldiers were given suction blisters on their forearms. Some volunteers slept at least seven hours per night, and the current group is undergoing 50 hours of sleep restriction, with Soldiers allowed just two hours of sleep per night over that period.

“This was the amount of time that we thought would cause decrements in healing time and immune responsiveness at the wound site in young adults,” Smith said. “This model may provide a way to more effectively study effects of stress on wound healing, and a means to test prototype countermeasures, like nutrition interventions, to stress-related effects on healing.”

“We are using the suction blister model as a tool for studying immune responsiveness of warfighters coping with stress, and nutrition interventions to mitigate decrements in immune responsiveness caused by stress.”

Capt. Adam Cooper, Ph.D., a research psychologist at USARIEM, piggybacked his marksmanship research on Smith’s study.

“We are interested in how sleep restriction differentially affects marksmanship performance during a simple versus mentally challenging friend-foe task,” Cooper said. “The factors we are examining are reaction time, accuracy and correct decision.”

“Once it is known what factors are affected during low versus high mentally demanding marksmanship tasks, leaders can make

more informed decisions concerning what types of missions their Soldiers will be able to successfully complete given their current state of rest.”

Smith said that the marksmanship “keeps the volunteers awake, engaged and, hopefully, adds to the sleep restriction stressor.”

The USARIEM study is using 60 volunteer Soldiers, split into groups of four per session. Smith and her colleagues will soon examine preliminary data from eight volunteers to see if the sleep restriction is an adequate stressor to slow healing time. Once they are confident with the stressor, they will move on to test nutrition interventions to promote immune recovery.

“Blister wounds typically heal in five days for volunteers who receive adequate sleep,” Smith said. “We expect healing time to be delayed by one to two days in volunteers who are sleep restricted, and we expect that healing time will be back to five days in volunteers who consume a specially prepared nutrition beverage during sleep restriction and in the recovery period.”

Smith and her colleagues hope to provide warfighters with a food item or beverage that they can consume during and after periods of stress that will support their immune system and promote recovery.

Pvt. 2 Daniel Pardo dozes off after a period of sleep restriction in a study conducted by the U.S. Army Research Institute of Environmental Medicine to see how nutritional supplements might help wounds heal in warfighters under stress.



Sharing Knowledge

International scientists discuss Soldier physical performance

By Bob Reinert, USAG-Natick Public Affairs / NATICK, Mass. (Aug. 21, 2014)

TIn an era of downsizing and budget cuts, placing the right Soldiers in the right jobs, keeping them healthy and optimizing their physical performance have never been more important.

With that in mind, 325 scientists from around the world gathered in Boston this week for the 2014 3rd [International Congress on Soldiers' Physical Performance](#), or ICSP, to share ideas and increase efficiency in those areas.

"The whole notion here is to get international scientists together to network and to have scientific exchange and dialogue, with a goal of really trying to have a better understanding of how to improve the health and performance of our Soldiers," Dr. Brad Nindl, ICSP co-chair, told participants in a media roundtable Aug. 19. "If you look at the program here, so many countries, so many militaries, are working on the same issues."

Nindl, science advisor at the U.S. Army Institute of Public Health for the U.S. Army Public Health Command and an Army Reserve lieutenant colonel, noted the fiscal constraints under which the U.S. military is now operating.

"So things are going to get leaner," Nindl said. "To improve efficiency, I think we have to look to collaborating with our international neighbors. My goal would be that when people leave here that they have a network of fellow scientists who are working in similar areas."

Nindl's co-chair, Marilyn Sharp of the [U.S. Army Research Institute of Environmental Medicine](#) at [Natick Soldier Systems Center](#), has been working to develop physical performance standards for Soldiers in an effort to predict who would be the best fit for a given job.

"Our goals right now are to try to come up with ways to place the best Soldier in the right job, and in that way, we will reduce injuries and optimize performance," Sharp said. "This is coming at a critical time. Everyone has to be able to do their job and do it well as we reduce the number of Soldiers that we have in our Army."

As the Army rolled out its Performance Triad, which focuses on improving Soldiers' activity, nutrition and sleep, the international gathering also looked at ways to keep warfighters healthy.

"There's so much scientific information known in terms of how to improve Soldiers' sleep, activity and nutrition that the challenge for all of us is to operationalize this for the Soldier on the ground, for the leader on the ground," Nindl said. "There are many things that we can do, many effective strategies that we can implement, if we continue to be innovative."

"The way that's going to be successful, I think, is by partnering with other nations, our international partners, and by breaking down stove pipes, breaking down communication barriers across different Army commands, different Army units, so that there's a unity of effort going forward."

Advances in Soldier equipment present ongoing challenges for these scientists.

"I think Soldier load has been a problem for decades," Sharp said. "And every time we lighten Soldiers' load, we add another piece of equipment to make it worse."

Sharp added that Soldier load has steadily increased since the Civil War, despite a recent 20-year effort to lighten it.

"The amount of load that you carry both in absolute terms and relative to your body weight is going to increase your injuries while you're deployed," Sharp said. "So I believe it's a very big problem that we need to continue to work to solve."

Dr. Nigel Taylor, an associate professor in the Centre for Human Physiology, School of Medicine, [University of Wollongong, Australia](#), said that location of the load is also important.

"For instance, placing one kilogram on the foot is eight times more metabolically inefficient than placing that one kilogram on the torso," Taylor said. "So it's not just the load

that they're carrying; you've got to be smart about where it's located, as well."

Sharp noted that load can inhibit a Soldier's ability to move.

"We've seen, particularly, women whose body armor goes across the hip joint," Sharp said. "They can't do their job effectively. They're far less mobile than they need to be."

According to Nindl, training and advances in material science and textiles can help with Soldier load, which is more than just a matter of comfort.

"When you survey the medical evacuations from a combat theater over ten or twelve years — 35,000 medical evacuations, plus — the major reason for those medical evacuations was not due to combat-related injury, but is due to musculoskeletal injury. And most of those injuries are from training and overuse," Nindl said. "I think a lot of those injuries would be related to load carriage, as well. Musculoskeletal injuries, particularly of the lower body, are a major problem, a major threat to our force, whether in garrison or whether in a combat theater."

Sharp said she hopes that these scientists return home with "a better understanding of what other countries are doing in a more detailed way. A better understanding of the science of Soldiers' physical performance will continue to be critical in ensuring each country's national security."

Taylor said it's not enough for scientists to sit and wait for the next paper or book to come out with new information on Soldier physical performance. He added that years can be wasted that way.

"Knowledge is not a static phenomenon," Taylor said. "It's continually growing. We need to be contributing to the growth, sharing our knowledge, and learning from others in all countries, because no one country has a monopoly on expertise."



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.

The Aeromedical Biological Containment System, which has been used to transport Ebola patients to the U.S. from West Africa, sits next to the Gulfstream III aircraft that carries it.

Containing Ebola

Natick helped develop new system

By Bob Reinert, USAG-Natick Public Affairs / NATICK, Mass. (Nov. 26, 2014)

A containment system used to quarantine Ebola virus patients being transported out of West Africa was developed with help from the [Natick Soldier Research, Development and Engineering Center](#).

The Aeromedical Biological Containment System, or ABCS, manufactured by Production Products of St. Louis, can be hoisted into a specially modified Gulfstream III air ambulance and flown by Phoenix Air Group back to the U.S., or other countries, where patients can receive more intensive treatment. Several successful missions have already been conducted.

"We've designed a lot of chem-bio defense systems for Soldiers, like those for the Deployable Medical Systems, but it's all been ground based," said Tom Larkham, an equipment specialist on the [Fabric Structures Team of the Expeditionary Basing and Collective Protection Directorate](#) at NSRDEC. "There (were) a lot of things (with the ABCS) that had to be tested for that we had never really had any experience with."

NSRDEC began working on the concept in 2007, with the [Centers for Disease Control and Prevention](#), the [Joint Project Manager for Collective Protection](#), and the [U.S. Army Edgewood Chemical Biological Center](#).

As Larkham explained it, CDC was concerned about being able to transport its

personnel home if they became sick while deployed overseas battling infectious diseases. Ebola had yet to become the focus.

"At the time, what they were worried about was (severe acute respiratory syndrome)," Larkham recalled. "And the other one was the avian flu, or bird flu. So they were really concerned about those more infectious airborne diseases taking off."

The ABCS went operational in 2012, but had never been used prior to the Ebola outbreak, Larkham said. The tent-like, modular system keeps the patient under negative pressure, isolating and filtering the air inside, and protecting the aircrew and medical personnel aboard. "The materials themselves are impermeable but not really chem-bio resistant," Larkham said. "They're just inexpensive, general purpose tentage-type fabrics. What they do is they strip that fabric off and they incinerate it per (Environmental Protection Agency) standards when they come back."

The air inside the 190-cubic-foot patient compartment passes through a high-efficiency particulate air, or HEPA, filter.

"There's a front airlock so that medical attendants can go in and out during the flight," Larkham said. "That's at one negative pressure, which is slightly higher than the negative pressure that the patient's actually at. That way,

they can move from the positive pressure inside the aircraft into where the affected patient is, and then come back out again."

As Larkham pointed out, it was the first time that Natick had worked on something that needed to maintain negative pressure in an aircraft as cabin pressures change.

"There's also a small, lightweight low-pressure, high-pressure alarm system that's in there that we developed here at Natick, and Janet O'Callahan was the project engineer for that particular item," Larkham said. "It gives a visual and an audio tone when the pressure varies from where it's supposed to be."

According to Larkham, one of the biggest design problems involved the zippers.

"The zippers are all hermetically sealed, waterproof/vapor tight zippers," Larkham said. "You can get these style zippers, but to get them to go around corners, to get them to operate easily for people that are dressed in protective garments where they can barely see where they're going is always difficult."

Larkham found the work that he did on the project to be personally rewarding.

"I felt great about it, being involved with the program, and having that system there," said Larkham, "and having those people be able to be brought back and saved."



THANK YOU

The Public Affairs Office would like to thank
the men and women of the Natick Soldier
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