Soldiers of Future Will Generate Their Own Power

JEFF SISTO

Wearable technologies may provide U.S. Soldiers with on-the-move, portable energy and reduce the weight of gear they carry into combat.

Researchers at the Natick Soldier Research, Development and Engineering Center (NSRDEC) are developing Soldier-borne energy-harvesting technologies.

During the Maneuver Fires Integration Experiment (MFIX), a combined, multi-phase joint training exercise held in September 2014 at Fort Benning, Ga., researchers tested prototype energy-harvesting technology solutions.

"My initial impression is that they fulfill a need for instant power generation on long-range missions when displaced from traditional resupply methods," said SFC Arthur H. Jones, an Infantryman with the Maneuver Center of Excellence (MCoE) who participated in the demonstration.

A sharp rise in Soldier-worn power capabilities has resulted in a dramatic increase in the number, variety, and weight of batteries carried by warfighters in the field.

This weight prompted NSRDEC researchers to begin developing and evaluating small, lightweight, efficient, on-the-move, portable energy-harvesting and distribution systems that eliminate the need to carry extra batteries.

Energy harvesting works by capturing small amounts of energy that would otherwise be lost as heat, light, sound, vibration, or movement. It uses that energy to recharge batteries and provide power for electronic devices such as a Soldier's communication equipment, sensors, or battlefield situational displays.

Researchers first demonstrated the concept to Army and government representatives at Fort Devens, Mass., in April 2014. The demonstration consisted of experienced Soldiers wearing three energy-harvesting devices while traversing a four-mile course that included hard-surfaced roads, lightly wooded areas, open fields, and hilly terrain.

The technologies, which included wearable solar panels, backpack, and knee kinetic energy-harvesting devices, are now being tested at MFIX as ways to reduce the weight and number of batteries Soldiers must carry to power electronic devices.

Photos by David Kamm

A Soldier conducts dismounted maneuvers wearing Lightning Pack's Rucksack Harvester, Bionic Power's Knee Harvester, and MC-10's photovoltaic Solar Panel Harvester, during an energy-harvesting technology demonstration held at Fort Devens, Mass., by NSRDEC.

Lightning Pack's Rucksack Harvester relies on the weight of the backpack to produce kinetic energy when the backpack oscillates vertically in response to the Soldier's walking or running stride. As the backpack is displaced vertically, a rack attached to the frame spins a pinion that, in turn, is attached to a miniature power generator. It is capable of producing 16 to 22 watts while walking and 22 to 40 watts while running.

Bionic Power's Knee Harvester collects kinetic energy by recovering the power generated when walking. The articulating device is attached to both the upper and lower part of each leg and extracts energy when the knee is flexed. Through software control, the knee harvester analyzes the wearer's gait and harvests energy during the phase of the stride when negative work is being performed. This attests that the Soldier is exhibiting less metabolic activity descending when compared with descending without wearing the device.

MC-10's photovoltaic (PV) Solar Panel Harvester operates by converting sunlight into electrical energy. The panels, which cover a Soldier's backpack and helmet, are constructed from thin gallium arsenide crystals that provide

flexibility to the panel's material and allow it to conform to a Soldier's gear. Under bright sunlight conditions, with the PV panel facing the sun, the backpack panel is capable of delivering 10 watts while the helmet cover panels provides seven watts of electrical power.

At MFIX, NSRDEC researchers collected power-management data and assessed user feedback from the Soldiers wearing the technologies. Once the energy-harvesting technologies themselves are validated, the next step will be to sync with the Integrated Soldier Power Data System as a way to distribute the energy to a Soldier's electronic devices.

Additionally, "MFIX is looking at new concepts with energy-harvesting devices and how they fit in a tactical environment," said Noel Soto, project engineer for the Power and Data Management Team of the NSRDEC Warfighter Directorate.

"MFIX is an important opportunity that allows us to quantify the energy-harvesting technologies that generate Soldier power on the move," said Henry Girolamo, lead, Emerging Concepts and Technologies, Warfighter Directorate, who has been involved with the effort since 2011. "The MFIX data collected in the experiment will inform us of the power harvester efficiency by comparing energy harvester-equipped Soldiers and non-energy harvester-equipped Soldiers and states of charge from the energy harvesters versus discharge from non-energy harvester-equipped Soldiers."

(Jeff Sisto writes for the NSRDEC Public Affairs Office.)

A helmet cover equipped with MC-10's photovoltaic Solar Panel Harvester material was used at an energy-harvesting technology demonstration held at Fort Devens by NSRDEC.

Photo by Noelle Wiehe

Art Petit, training and services manager for InstantEye, launches the system during a hands-on demonstration for students of the Maneuver Captains Career Course.

Soldiers Help Develop New Unmanned Aircraft

NOELLE WIEHE

Students of the Maneuver Captains Career Course at Fort Benning, Ga.,evaluated an InstantEye unmanned aerial system (UAS) to aid in the advancement of a new generation.

InstantEye Mk-2 Gen 3, by Physical Science Inc., is a small UAS able to be launched by hand with vertical takeoff and landing, said Art Petit, training and services manager for InstantEye. The system demonstrates integrated squad-level airborne intelligence, surveillance, and reconnaissance with the ability to provide a cursor on target and battle damage assessment, according to a release on Army Expeditionary Warrior Experiments of 2015.

InstantEye Mk-2 Gen 3 was designed directly from feedback from Soldiers, Petit said. Most in attendance had already been exposed to the system and gave positive feedback, but with their feedback PSI Technology is constantly developing new and improved versions of the system.

"Bottom line behind the aircraft's design is it wasn't designed in a vacuum by a bunch of engineers; it was designed by the guys that get their boots dusty on the ground every day" Petit said.

Being prior Infantry, Petit emphasized the advantage of having a third-eye perspective as a ground Soldier where it may not have existed before because of priorities not going to ground Soldiers.

"That's really important for the safety and force protection of the Soldiers " Petit said.

CPT Brett Matzenbacher, small group leader of the MCCC, compared the system to the Raven, a rucksack-portable UAS currently used in combat overseas.

"I like the Raven because it is something I own," Matzenbacher said. "Pretty much every aspect of performance I can think of (makes InstantEye) superior to what we currently have at the company level "

Read more about the InstantEye at http://www.army.mil/article/139281/Aerial_system_could_enhance_capabilities.

(Noelle Wiehe writes for Fort Benning's Bayonet & Saber *newspaper.)*