Association of the United States Army

Voice for the Army—Support for the Soldier October 2013

Addition Through Subtraction

Empowering the Soldier by Lightening the Load

A key lesson of the past eleven years is that the American Soldier remains the most discriminately lethal force on the battlefield. . . . Our modernization efforts will prepare the entire force for the complex and uncertain battlefield by putting a squad with precise information and overmatch capability in the right place at the right time to accomplish their mission.

General Raymond T. Odierno
Chief of Staff, Army
Waypoint 1, January 2013[1]

Introduction

A complex and dynamic global security environment, coupled with an uncertain fiscal environment, demands that the Army continue to invest wisely in innovation and technologies. The prospect of a smaller yet more capable Army demands an approach that balances increasing capabilities and reducing resource requirements. Digital connectivity links the Soldier and squad, their tactical vehicles and the command post to provide unprecedented mission command. Recent advancements in Soldier-worn equipment have allowed the dismounted Soldier to be more informed, more agile and more lethal than ever before. However, the increased digital capability also generates an increased demand for power. Historically, innovations in Soldier power struggle to keep pace with the growing power requirements that accompany these increased capabilities. The dismounted Soldier knows the real cost of more power—additional batteries that add weight and consume more space in the combat load.

Power management is a significant mission planning consideration for the dismounted squad leader who manages combat loads. Dismounted squads operating in the most austere environments have traditionally carried enough batteries to sustain individual Soldier devices for up to 72 hours before resupply. The mission profile of a typical Soldier's combat load for 72 hours demands up to 23 batteries (a total weight of about 10 pounds or 9.8 percent of a 102.1-pound combat load).[2] Army logisticians are very effective at pushing supplies to the forward edge of the battlefield, but not without significant cost and risk.

The Soldier and squad are the centerpiece of the modernization strategy.[3] As the Army develops strategies to effectively equip and train the Soldier of 2020, it must reconcile how to power the growing number of Soldier-worn devices while also reducing the Soldier's battery load and decreasing the logistical demand for battery resupply. "Every time we deliver fuel or batteries on the battlefield we put Soldiers at risk."[4] A reduced battery load also frees up limited space for the dismounted Soldier to carry other mission-essential equipment such as water, ammunition and rations, thus reducing sustainment requirements. Developing operational energy alternatives must allow the dismounted squad to conduct extended missions while reducing the battery load and the reliance on battery resupply.

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[1] Department of the Army, "Waypoint 1," January 2013, http://usarmy.vo.llnwd.net/e2/c/downloads/280914.pdf.

[2] Lieutenant General Raymond V. Mason as quoted in "Army Energy Summit at West Point Focuses on Operational Energy and Power," *Defence Talk*, 2 April 2013, http://www.defencetalk.com/army-energy-summit-at-west-point-focuses-on-operational-energy-and-power-47317.

[3] Department of the Army, "Army Strategic Planning Guidance," 2013, http://usarmy.vo.llnwd.net/e2/rv5_downloads/info/references/army_strategic_planning_guidance.pdf.

[4] Office of Operational Energy, Deputy Chief of Staff G-4, Department of the Army, "The Power is in Your Hands," 23 October 2012, http://usarmy.vo.llnwd.net/e2/c/downloads/269569.pdf.

Addition Through Subtraction
Empowering the Soldier by Lightening the Load

Soldier Power Core Portfolio

Modular Universal Battery Charger

Integrated Soldier Power/Data System

Conformal Battery

Squad Power Manager

Source: PEO Soldier

Operational Energy

The Army's senior leadership has defined operational energy as the energy and associated systems, information and processes required to train, move and sustain forces and systems for military operations. Its four categories of operational energy include Soldier Power and Energy; Aviation Systems Power and Energy; Surface Systems Power and Energy; and Contingency Base Camps Power and Energy. Power generation, energy storage, energy conversion and power distribution remain significant challenges across each operational energy category. Improvements in energy efficiency, interoperability and redundancy offer great potential for making the Army more capable, flexible and resilient. Improved performance in Soldier Power and Energy is a primary near-term (Fiscal Year 2014–18) outcome of the *Army Equipment Modernization Strategy*.[5]

Soldier Power and Energy

Program Executive Office (PEO) Soldier, specifically Product Director Soldier Systems and Integration (PD SS&I), is the lead organization responsible for developing, acquiring and fielding expeditionary, lightweight Soldier power solutions that reduce Soldier load, improve Soldier survivability and expand operations in the most austere environments. Soldier Power and Energy leverages lightweight solutions (portable or wearable) in the areas of power generation, power scavenging, renewable energy, power distribution, power management and power storage. The current Soldier Power portfolio includes the following components:

- **Modular Universal Battery Charger (MUBC)**: A lightweight universal charging solution for Soldier-worn systems, USB-powered equipment and radio batteries. The MUBC draws power from solar and AC/DC power sources and can scavenge remaining power from primary batteries. The MUBC replaces multiple battery chargers and will support a variety of common and peculiar batteries currently in the Army supply system.
- **Integrated Soldier Power/Data System (ISPDS)**: A modular power distribution system designed to provide power from a central power source to multiple worn peripherals and to collect and display data from multiple worn devices onto an end-user device. ISPDS with a conformal battery provides a 32 percent weight savings in battery load.
- **Conformal Battery**: A ruggedized battery pack that provides 150 watt hours at 5 amperes with a weight of 2.3 pounds. The battery serves as the Soldier's worn power source for multiple worn devices. The battery is flexible and conforms to the body armor plate.
- **Squad Power Manager (SPM)**: A lightweight, portable power management system that can provide device power or battery charging for up to five devices, including Army radios, global positioning systems and USB-powered equipment. The SPM can scavenge power from solar, AC/DC power sources, military batteries and North Atlantic Treaty Organization (NATO) receptacles.

[5] Department of the Army, *Army Equipment Modernization Strategy*, 4 March 2013, http://www.g8.army.mil/pdf/AEMS_04March2013_lq.pdf.

Soldier Load

Uniform – 12.4 lbs

- Boots
- ACU
- Multi Tool
- Rigger Belt
- Patches
- Patrol Cap
- ID Tags
- Undershirt
- Gloves
- Eye Pro
- Notebook
- Drawers
- Socks
- Wrist Watch
- Ear Plugs
- Chapstick
- ID Card

<25 hr Sustainment Load – 19.3 lbs

- Assault Pack w/waist pack
- 2QT Canteen w/Cover and Sling w/water
- Liner Poncho
- Poncho
- Improved Rain Suit Top and Bottom
- Neck Gaiter
- Meal Ready To Eat 1 ea (1.50/.068 kg)
- Undershirt Moisture Wicking x 1 ea
- Socks x 1 pr
- Improved Cleaning Kit
- Flexi Cuffs (4 large per Soldier)
- Chemlight (2 per)
- Water Purification Tablets
- Camo Face Paint
- VS-17 Panel (small)

Personal Protective Equipment and Weapon (PPE) – 70.4 lbs

- Improved Outer Tactical Vest w/neck/groin protector (Size Large)
- Enhanced Small Arms Protective Inserts (Size Large)
- Enhanced Side Ballistic Insert set with Side Plate Carrier
- 100oz Hydration System (with water)
- Fighting Load Carrier
- 30-round Magazine Pouch (3 x 0.25)
- Hand Grenade Pouch (2) with (2) M67 Fragmentation Grenades
- Lensatic Compass with case
- Individual First Aid Kit
- Mag Light Flashlight w/2 ea AA battery
- Infrared Signal Beacon, PHOENIX w/battery
- Ballistic Knee/Elbow Pads
- Visual/Language Translator Card
- Casualty Feeder Report/Witness Statement
- Advanced Combat Helmet (ACH) Band
- Helmet Cover w/camouflage cover
- Night Vision Goggle mounting plate
- Ballistic Protection Goggles (ESS)
- M4 Carbine w/fully loaded magazine
- M68 Close Combat Optic w/battery
- 3-point sling
- Back-Up Iron Sight
- M-4 Rail Adapter System & Forward Pistol Grip
- 5.56mm Magazine with 30 rounds each (6 ea)
- Sure Fire light w/battery
- PAQ-4C w/batteries

Approach March Load – 102.1 lbs

Source: Maneuver Center of Excellence

Energy Innovation through Teamwork

The Army recognizes that no single entity has a monopoly on energy innovation. The engagement of Army senior leadership has been instrumental to the planning and execution of a comprehensive energy innovation strategy. The Office of the Assistant Secretary of the Army for Installations, Energy and Environment provides strategic direction and supervision of the Army's multifaceted approach to energy innovation. Headquarters, Department of the Army's Office of Operational Energy, Deputy Chief of Staff G-4, provides coordination and integration of all operational energy initiatives and actions across the Army and with other services. Research and development partnerships, lessons learned and evaluation and testing results contribute significantly to operational energy advancements and innovations.

With constrained financial resources, partnerships provide a way for the Army to maximize its return on investment for energy innovation. The Army's partnerships include the military and governmental research and development organizations and academic institutions. PD SS&I maintains continuous partnerships with the U.S. Army Natick Soldier Systems Center, the Communications–Electronics Research, Development and Engineering Center (CERDEC), the U.S. Army Research Laboratory (ARL), the Office of the Secretary of Defense (OSD), the United States Military Academy (USMA) at West Point, the United States Marine Corps and the United States Navy for the Soldier Power Portfolio. These partnerships involve component evaluation, collaboration of test results and user feedback and teamwork on modeling. The unique partnership with USMA has also resulted in an adjustment to the academic curriculum that challenges Cadets with planning for operational energy requirements on the battlefield. Ultimately, the Army's partnerships help reduce the costs of energy research and development while also providing awareness of other technological improvements and developments in energy innovation.

Lessons learned from the field are critical to improving the Soldier Power portfolio and its overall fielding strategy. The Soldier Power portfolio achieved early success as a limited-issue item with the Rapid Equipping Force for Operation Enduring Freedom (OEF) between 2010 and 2012. The 1-16th Infantry Battalion, 1/82d Infantry Brigade Combat Team (Airborne) and 173d Infantry Brigade Combat Team (Airborne) deployed with a complete suite of Soldier Power capability. The Soldier Power systems proved to be instrumental in sustaining individual and small-unit operations throughout the deployments. In fact, the performance of the Soldier Power capability enabled the 3/73d Cavalry Squadron Commander from the 1/82d Infantry Brigade Combat Team (Airborne) to eliminate battery resupply to multiple OEF outposts due to the effectiveness of the Soldier Power systems. Employment of Soldier Power equipment with units from United States Army Pacific Command (USARPAC) also provided user feedback for operating in tropical environments.

The Network Integration Exercise (NIE) is a cornerstone of Army Modernization efforts. Semi-annually, 3,800 Soldiers of the 2d Armor Brigade Combat Team, 1st Armor Division (2/1AD) conduct a Soldier-led evaluation of commercial and developmental governmental networked and non-networked technologies. This melting pot of experimentation and evaluation allows the Army to deliberately assess new technologies and select the most promising for deployment to combat as part of the Capability Set packages. Most NIEs have featured Soldier Power and Energy technologies with many promising outcomes that resulted in the Army including Soldier Power equipment as part of Capability Sets 13 and 14 for 10 deploying brigade combat teams—3/10th Mountain (MTN), 4/10th MTN, 2/101st, 2/1 AD, 3/101st, 2/82d, 1/101st, 1/10th MTN, 2/10th MTN and 1/1 AD. The Army remains committed to resolving its operational energy challenges by selecting operational energy as three of the seven new capability gaps in the upcoming NIE 14.1:

- Brigade/Battalion Command Post (CP) Mobility and Scalability
- Network Visualization on the Common Operational Picture (COP)
- Aerial Layer Network Extension – Assured access for terrestrial network
- Integrated Network Assurance – Network Access Control
- Operational Energy – Energy sources with extended duration and power
- Operational Energy – Systems that monitor and manage power supply and demand
- Operational Energy – Reduced reliance on petroleum-based energy[6]

Teamwork fosters collaboration to comprehensive solutions in Operational Energy. Partnerships, lessons learned, evaluation and testing allow the Army to aggressively address operational energy to meet the current and future operational needs of the Army with the ultimate goal of reaching net zero[7] for battery resupply by 2020.

The Way Ahead

The Army has enjoyed significant progress in Soldier Power and Energy over the past five years, but there is still room for improvement. Ideally, the Soldier of 2020 will be 100 percent energy self-sustaining with a negligible impact on the combat load.

Many emerging technologies foreshadow the potential for breakthrough developments in operational energy. Advancements in solar technologies have realized a 20 percent increase in efficiency and will be tested and available for fielding in early Fiscal Year 2015. Ongoing research and development in several areas may individually or collectively help the Army realize leap-ahead improvements for Soldier Power:

- Improvements in battery technology – increased voltages, use of materials more resilient to recharging, innovations in other renewable energy sources
- Advanced thermoelectric harvesting – transfer of human-produced thermal energy (heat) into Soldier-stored energy (batteries)
- Photovoltaic harvesting – transfer of solar energy to Soldier-stored energy
- Kinetic energy harvesting – transfer of human-produced kinetic energy (dismounted tactical movement) into Soldier-stored energy
- Wireless charging – wireless transfer of energy from fixed sources (e.g., vehicles, command posts) to Soldier-stored energy
- Smart textiles – integration of wires and cables into Soldier garments to reduce weight and clutter

The Soldier and squad will remain fundamental to national security throughout the 21st century. Soldier-worn devices enhance situational awareness, speed the decision cycle and connect Soldiers and squads at the lowest level with one another and their higher headquarters to produce significant advantages over the adversary. Addition through subtraction—harnessing more operational energy with fewer resources—is imperative to lightening the load and sustaining these advantages.

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[6] U.S. Army Brigade Combat Team Modernization, "U.S. Army issues Sources Sought Notice to Support Network Integration Evaluation 14.1," 7 January 2013, http://www.bctmod.army.mil/downloads/pdf/NIE14.1SourcesSoughtPressRelease.pdf.

[7] Note: "The Army net zero approach is comprised of five interrelated steps: reduction, repurpose, recycling and composting, energy recovery, and disposal," Army Energy Program, http://army-energy.hqda.pentagon.mil/netzero.