Soldier Power at ExFOB 2014 Tactical Energy Harvesting Demonstration, Camp Pendleton, CA. From 12-14 May, Product Director Soldier Systems & Integration, Soldier Power (PD SS&I, SP) participated in the US Marine Corps Expeditionary Energy Office (USMC E2O), Experimental Forward Operating Base (ExFOB) demonstrations at Marine Corps Base Camp Pendleton. There were 11 government and 10 industry partners showcasing and demonstrating energy harvesting technologies spanning the range of applications from the dismounted Warfighter to the FOB. Naval Sea Systems Command Carderock will provide government attendees reports on all formal experimental data and Marine feedback collected during the event. These reports will inform PD SSI, SP on those technologies for the dismounted Warfighter that can address Small Unit Power Soldier Power Generation requirements, to include knee harvesters, rucksack frames, footwear, and more. PD SSI escorted PM SWAR Senior Technical Advisor, Bob Shively, through the SPG technologies of interest for PM SWAR. VIP visits to ExFOB 2014 included HON McGinn, Assistant Secretary of the Navy, Energy, Installations & Environment and HON Hammack, Assistant Secretary of the Army (Installations, Energy & Environment). Created by the USMC Commandant in 2009, ExFOB brings together stakeholders from across the requirements, acquisition, and technology development communities in a dynamic process to quickly evaluate and deploy technologies that reduce need for "liquid logistics" today, and to establish requirements for tomorrow. ExFOB guides the development of new requirements documents and informs investment decisions, taking new capabilities "from concept to combat."

HON Hammack with Lockheed Martin Kinetic Boot
Each system on display was formally tested by Naval Sea Systems Command (NAVSEA) Carderock. Marines visited each booth with a clipboard and survey sheet in hand. The Marines tried on but did not necessarily go through formal trials of equipment.

**NAVSEA Experiment and Data Acquisition Setup**

**Bionic Power – PowerWalk™ Energy Harvester**

- Energy generated during leg deceleration, so as not to increase metabolic load.
- NAVSEA conducted 1 hour test at 3 speeds - 2, 4, and 6 mph.
- Marine feedback varied from positive to negative.
- Multiple uses of knee harvester (i.e. tourniquet built in, holster for pistol/magazine)
BrenTronics/SBM Solar - Wearable Solar Charger for BB-2590 Battery

- Foldable, rigid mono-crystalline-Silicon panel with integrated max power point tracking.
- 22 Watts output at approximately 1 lb.
- Dimensions, opened - 24” x 10.5” x 0.2”
- Dimensions, folded - 5.75” x 10.5” 1.5”

iLand Green Technologies, Inc. TUBE Portable Solar Charger & Battery

- Rollable amorphous Silicon cells for tube transportation
- 16’x15.5” - $1.60/ Watt – 144 Watts
- 9’x30” - $2.40/ Watt – 144 Watts
- Vendor can produce 33 Watts at 1.5 lbs

InStep NanoPower, LLC - Energy Harvester

- First introduction of company to DOD / Low TRL level, but we can help shape development
- Working with Italian company Vibram to produce a militarized boot harvester
- Energy produced from heel-toe motion and movement of inert liquid/gel in sole.
- Energy stored in small internal 2800mAh battery / Can integrated Bluetooth, WiFi, GPS
- Produce 1W at about 3.5oz. / Micro-USB output interface
- 6mm increased height from existing sole
- Potential cooperative opportunity with Italian MOD with assistance from RDECOM ITC.

InStep Rep explains harvesting technology
Lightning Packs LLC - Electricity-Generating Backpack

- NSRDEC will run tests to produce their own metabolic rate data to verify vendor claims
- Great feedback event from Marines.
  - “Where has this been all my life”, “This is great stuff”, “Good even without the electric”
- The ergonomic only system, utilizing a quieter belt drive in lieu of the spring, is also available
- Overall comments include desire for reduced weight and noise

Lockheed Martin (US) / STC Footwear (Canada) - Kinetic Boot

- Lockheed Martin and STC internal R&D
- Utilize turbine to harness energy from air under compression during heel-toe walking.
- In 16-18 months LM/STC will have system integrated into a military boot
- Projected power output of 3 Watts/2 oz per boot
- Tested only at walking speeds of 2, 3, and 4 mph – no running tests

Protonex Technology Corp. - Personal Energy Harvester (PEH-632)

- The PEH-362 can scavenge from 4 sources at once
- Output SMBus for integration into ISPDS-C second energy scavenging port
SA Photonics – Powercell
- Tube, magnetic induction for generating energy while moving.
- Currently capable of .2 Watts at 1 lb
- Goal of 12 watts at less than 3 lbs

Tremont Electric Inc – nPower®
- Tube, magnetic induction for generating energy while moving
- Currently weighing 3lbs and producing 3-4W
- Utilize analog PPT in lieu of digital to enable significant power savings
- SMBus pins available for use
- Inquiring about getting back to NIE with more mature and developed system.

Media links:
ExFOB'14: Warfighters Do More With Less
MarinesTV - The USMC’s official YouTube channel managed by active-duty Marines
http://youtu.be/EbkVJVzujjk

ExFOB'14: Advanced Gear Tested by Marines, for Marines
MarinesTV — The USMC’s official YouTube channel managed by active-duty Marines
http://youtu.be/jppdXI10QF

ExFOB 2014: Marines Voice Opinions on Possible New Gear
MarinesBlog - The Official Blog of the United States Marine Corps

Marines test new energy-harvesting gear (Still images):