Wecoso LLC

Ultra-Lightweight Expeditionary Power System (U-LEPS)

USMC seeks to develop a renewable 1kW-class hybrid energy power source that will reduce the weight and volume by 50% versus currently deployed systems. West Coast Solutions (WCS) is meeting the challenge with the hybrid/solar Ultra-Lightweight Expeditionary Power System (U-LEPS). Our approach is anchored in our industry-leading, inherently safe, high energy density (150 Wh/kg) lithium-Ion batteries. Peak power handling capacity of U-LEPS is up to 2 kW with over 6400 Wh energy storage, meeting or exceeding the capabilities of existing systems. U-LEPS is inherently more robust and user-friendly than currently-fielded technology. Simulations, risk reduction tests, and engineering reviews have been accomplished to ensure requirements will be met. U-LEPS solves SWaP issues, saves fuel, and reduces convoys, thus reducing operational costs and, most importantly, saving lives.

Technology Category Alignment:
Electronics Integration
Energy storage
Power Control and Distribution
Power Generation/Energy Conversion
Survivability

Contact:
Dr. Carl S. Kirkconnell
carlk@wecoso.com
(714) 222-0424
http://www.wecoso.com

SYSCOM: MARCOR
Contract: M67854-17-C-6510

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=M67854-17-C-6510
**WHY**

**Sponsoring Program:** PM Combat Support Systems (CSS), PdM

**Transition Target:** PM LCES (Logistics Combat Element Systems), PM ES (Engineer Systems), Power Team

**TPOC:** sbir.admin@usmc.mil

**Other transition opportunities:**
- System (U-LEPS): hybrid solar/DC/AC expeditionary power system: CERDEC/ Power Integration
- Battery (U-LEB): high energy density, intrinsically safe, long cycle life, Lithium-Ion battery: various tactical communications power systems, including portable satellite terminals
- Controller: main controller electronics: accomplishes configurable, high efficiency, zero dropout power distribution: Aerospace Corporation PMMCE

**Notes:**
- CERDEC - Communications-Electronics Research, Development and Engineering Center
- GREENS II - Ground Renewable Expeditionary Energy System
- PMMCE - Precision Mirror Mechanism Control Electronics
- U-LEB - Ultra-Lightweight Expeditionary Battery
- U-LEPS - Ultra-Lightweight Expeditionary Power System

**WHAT**

**Operational Need and Improvement:**
By 2025 the USMC would like to reduce the weight and volume of currently deployed renewable hybrid systems in the 1kW power range by 50%.

**Specifications Required:**
USMC is looking to improve current state of the art systems, they must:
- Reduce total weight to 350 lbs
- Reduce total volume to 22 ft $^3$
- Rethink the construct of hybrid energy harvesting system
- Provide either 24VDC or 120VAC output
- Provide power both night and day in all weather environments

**Technology Developed:**
A 1 kW class, hybrid solar-generator-battery power system designed to be lightweight and robust. The Ultra-Lightweight Expeditionary Battery (U-LEB) has a unique design for the lithium-ion cells; therefore, causing the batteries to be 50% lighter in weight, giving a 50% improvement in specific energy density.

In addition, WCS implemented a novel light-weight, highly efficient architecture that vastly improved the robustness of the system by avoiding undesirable voltage fluctuations and drops on both the charge (solar) and discharge (load) sides of the system.

**Warfighter Value:**
Robust – safe and reliable in all environments and conops
Ultra-Lightweight Batteries – lighter, smaller, easier to transport; with more power
Modularity – easy to assemble, design is scalable, giving more options

**WHEN**

**Contract Number:** M67854-17-C-6510

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Risk Level</th>
<th>Measure of Success</th>
<th>Ending TRL</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPPT Power Sharing Demo</td>
<td>Med</td>
<td>Greater than 90% power sharing efficiency demonstrated using representative SBM solar panels</td>
<td>4</td>
<td>2nd QTR FY18</td>
</tr>
<tr>
<td>12Ah LNCO Cell Development</td>
<td>Med</td>
<td>Compliant safety and performance demonstrated: energy capacity, power, UL impact, UL crush, over temperature, and over voltage</td>
<td>4</td>
<td>3rd QTR FY18</td>
</tr>
<tr>
<td>Critical Design Review Level</td>
<td>Low</td>
<td>CDR Design Package including all supporting solid models, analyses, and risk reduction data</td>
<td>4</td>
<td>4th QTR FY18</td>
</tr>
<tr>
<td>Brass Board Test Demonstration</td>
<td>Low</td>
<td>Compliant U-LEPS operation demonstrated: maximum power charge/discharge, zero dropsouts, endurance testing, solar/AC/DC inputs</td>
<td>5</td>
<td>3rd QTR FY19</td>
</tr>
<tr>
<td>Qualification of Productized U-LEB</td>
<td>Low</td>
<td>Full demonstration of MIL STD 810 and 416 compliant operation</td>
<td>6</td>
<td>4th QTR FY19</td>
</tr>
</tbody>
</table>

**HOW**

**Projected Business Model:**
- WCS provides customer interface, systems engineering, and implementation support
- Manufacturing is sourced and managed by WCS through specialized contract manufacturing partners
  - e.g., U-LEB to be packaged by Spear Power Systems
- WCS continues to lead parallel and next generation development programs to support Continuous Product Improvement

**Company Objectives:**
- Program of record transition to USMC of U-LEPS system
- Transition of U-LEB technology to wider range of USMC and DoD Programs of record
- Adaptation of U-LEPS component technologies for custom Prime contractor applications
  - e.g., solar-battery system for portable satellite ground terminals

**Potential Commercial Applications:**
- Off grid micro power systems
- Maritime emergency power systems
- Power for commercial perimeter security systems
- Electric vehicle charging
- Long cycle life battery banks

**Contact:** Dr. Carl S. Kirkconnell, carlk@wecoso.com, (714)222-0424