

Topic: N151-048

Physical Sciences Inc.

High Energy, Long Life Cells for On-Board Sensors

Physical Sciences Inc. (PSI) is developing a high energy density battery that will extend the operating time or enable new capabilities of Navy devices. This battery, currently targeted for use in high data rate sensors, combines advanced materials and provides 50% more energy density than the batteries in use now. PSI's unique cell design leverages novel anode materials and coating technologies as well as innovative cell build/formation techniques to offer both increased energy density and cycle life. PSI has successfully demonstrated the ability to scale the required component and cell level technologies necessary to build and deliver the targeted high energy density battery. PSI's goal is to deliver safe, high energy batteries to meet the increased power needs of Navy sensors and equipment.

Technology Category Alignment:

Autonomy

Energy storage

Unmanned Ground and Sea Vehicles

Sensors

Weapons Technologies

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SYSCOM: NAVSEA

Contract: N00178-17-C-0011

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2018-0560

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High Energy, Long Life Cells for On-Board Sensors
Physical Sciences, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PMS 450

Transition Target: PEO Submarines

TPOC:

(215) 897-1957

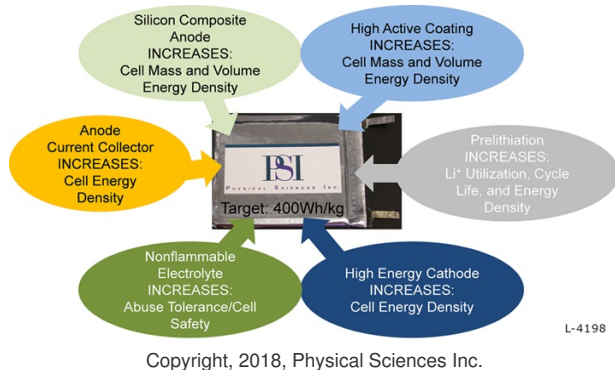
Other transition opportunities:

Consumer electronics, electric vehicles, power sources for emergency transmission signaling devices in airplanes and watercraft, stand-by emergency power generators and reserve power packs for emergency situations.

Notes: Physical Sciences Inc. (PSI) is developing a high energy density battery that will be able to extend the operating time and capabilities of Navy devices.

This battery combines advanced materials to offer more than 50% greater energy storage density than the state of the art.

The image shows the impact of the proposed technologies on the PSI silicon based cell performance.



WHAT

Operational Need and Improvement: Shipboard wireless technologies are currently limited to sensor systems with low data rate and duty cycle requirements. The demands of more capable sensor systems would quickly deplete the power and energy in currently available batteries due to poor cycle life and energy density. PSI is developing a high energy battery that will extend the operating time and capabilities of Navy devices. This battery, initially targeted for use in high data rate sensors, combines advanced materials to offer more than 50% greater energy storage than the state of the art.

Specifications Required: The requirements guidelines for the energy storage system are: 1) 2-5V operating range; 2) "D" sized cell or smaller; 3) increased gravimetric energy density; 4) increased volumetric energy density; 5) rechargeable, with a max input power of 1 watt and retains >60% capacity after 300 charge/discharge cycles; 6) must operate in harsh conditions.

Technology Developed: PSI is developing a silicon based lithium ion cell with an energy density of 400Wh/kg. The targeted energy density will be achieved by combining together:

- PSI's patented silicon composite anode material that delivers reversible capacities >1200mAh/g.
- A high energy lithium mixed metal oxide cathode material.
- PSI's high active (HA) electrode technique which minimizes the amount of carbon and polymer in the electrodes and increases the energy and power density.
- A novel anode current collector that is <30% the mass of a standard Cu current collector.

Warfighter Value:

- Energy storage/power source for high data rate ship sensors.
- Increased energy density/mission capability for all current applications that use secondary/rechargeable batteries.

WHEN

Contract Number: N00178-17-C-0011 Ending on: March 30, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate the proposed technologies can deliver the targeted performance and complete a cell design that can deliver an energy density of 400Wh/kg in the targeted operational environment.	N/A	Completion of cell design with projected energy density of 400Wh/kg.	3	February 2016
Achieve the required performance from the targeted materials. Scale the component and cell level technologies necessary to build and deliver the targeted high energy density cell.	N/A	Demonstration of basic cell performance.	4	October 2017
Demonstration of targeted cycle life performance over 100 cycles.	N/A	Less than 20% fade.	4	June 2018
Construction of cell with energy density of 400Wh/kg. Demonstration of performance over typical operating cycle.	Med	Achieve the targeted energy density.	5	February 2019
Operation of targeted sensor with the PSI battery in a representative environment.	Med	Demonstrate 15 days of uninterrupted operation.	6	February 2020

HOW

Projected Business Model: PSI's goal is to deliver safe, high energy batteries to meet the increased power needs of Navy sensors and equipment.

Company Objectives: PSI develops advanced technologies and products for the military, aerospace, industrial process, energy, telecommunications, environmental, and medical markets. PSI is strongly committed to developing products and services based on innovative technologies to support the missions of the Department of Defense.

Potential Commercial Applications: The PSI battery could be utilized to enable increased energy density for all commercial and DOD applications by reducing the size and volume of current energy storage systems. Potential commercial applications include consumer electronics, electric vehicles, power sources for emergency transmission signaling devices in airplanes and watercraft. The system may also be used in stand-by emergency power generators and reserve power packs for emergency situations.

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