

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

NAVAIR 2020-868

Topic # N172-113

On Demand High Power Primary Battery
Physical Sciences Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: Air Anti-Submarine Warfare Systems Program Office (PMA-264)

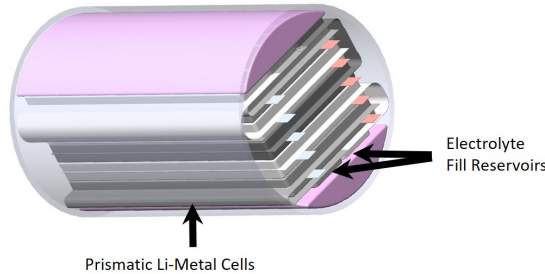
Transition Target: Surveillance Sonobuoys

TPOC:
(301)342-2188

Other transition opportunities: Emergency power generators and as a replacement for current power sources employing primary and thermal batteries, such as munitions, sensors, and Unmanned Underwater Vehicles (UUVs).

Notes: This program is demonstrating a high power primary battery design that can be stored in an inert state and rapidly activated on demand to provide >3500W/L, 450Wh/L and 150Wh/kg.

- Novel storage and activation protocols (1) allow storage of the battery for years without losing charge and (2) provide for rapid activation (<2 minutes) to full operation.
- Proprietary cell designs enable increased energy and power density of the active cell.



3D representation of prototype sonobuoy battery to be constructed during Phase II.

WHAT

Operational Need and Improvement: Batteries with enhanced performance and storage life are required to expand the operational capabilities and endurance of both active and passive sonobuoys. The technology being developed allows for extended storage in an inert state, while providing enhanced energy density (over current off the shelf batteries) increasing operating time after activation.

Specifications Required:

- Fit within current form factor
- Operate over established voltage range
- Exceed current performance spec and/or reduce system mass
- Safe for Navy use (verify through 9310 testing)

Technology Developed: The battery being developed delivers increased operating times over commercial off the shelf batteries while also offering storage in the inert state, extending the achievable shelf-life. This is achieved by combining:

- Proprietary cell design and construction techniques enabling a high energy and power density design.
- Patented High Active (HA) coating technology enables designs that maximize the energy and power density.
- Novel storage and activation protocols.

Warfighter Value:

- Extended shelf-life of battery system with on demand capability.
- Increased energy density/mission capability.
- Adaptable technology platform can incorporate materials developed in the future for electric vehicles and similar large-scale markets.

WHEN

Contract Number: N68335-19-C-0668 **Ending on:** September 17, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate feasibility of the system components and reactivation concept.	N/A	Lab scale demonstration of the components and reactivation demonstrating the targeted performance is achievable.	3	August 2018
Validate the seal and cell performance over extended time periods.	N/A	Demonstrate the seal holds and that the performance of the cell is maintained following extended storage.	4	June 2020
Cell level integrated demonstration.	Low	Demonstrate activation of cell in unit cell format.	5	September 2020
Demonstrate component scale-up to the sizes required in the final application.	Low	Demonstrate cell meets SWAP requirements of the application and components perform as demonstrated in smaller scale testing.	5	October 2020
Safety assessment	Med	Characterize safety of the cell in both active and inactive state.	5	February 2021
System level demonstration	Med	Construct initial battery prototype and demonstrate performance.	6	April 2021

HOW

Projected Business Model: PSI has a dedicated battery manufacturing facility in Wilmington, MA capable of producing 250 kWh of specialty Li-ion batteries per year. At this facility, under the Imperia Batteries brand name, PSI produces the specialty Li-ion batteries for its small unmanned aerial systems (sUAS) that are being used in ongoing, ONCONUS military operations. Imperia brand batteries are tailored specifically to provide an optimum combination of battery performance by balancing energy density, power density, cycle life, safety, and cost. As a domestic supplier, we provide a traceable and verifiable, manufacturing process. This ensures that each cell and battery is manufactured with known, tested chemicals and verified processes. We are committed to working with our customers to deliver custom high performance energy storage solutions for their applications.

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. The Imperia Batteries division is focused on the design, fabrication and delivery of safe, high energy and power storage solutions for DOD customers.

Potential Commercial Applications: The technology could increase storage life and safety during storage for all commercial and DOD applications.

The battery could be used in:

- Emergency power generators
- Remote sensors
- Unmanned Aerial Vehicles (UAVs)

Contact: Christopher M. Lang, Area Manager, Energy Technologies
lang@psicorp.com 978-835-1388