

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0348

Topic # N152-093

Risk Mitigation and Design Alternatives for Non-flammable HA Cells for Navy

Applications

Physical Sciences Inc.

## WHO

**SYSCOM:** NAVSEA

**Sponsoring Program:** PMS 495 - MINE WARFARE

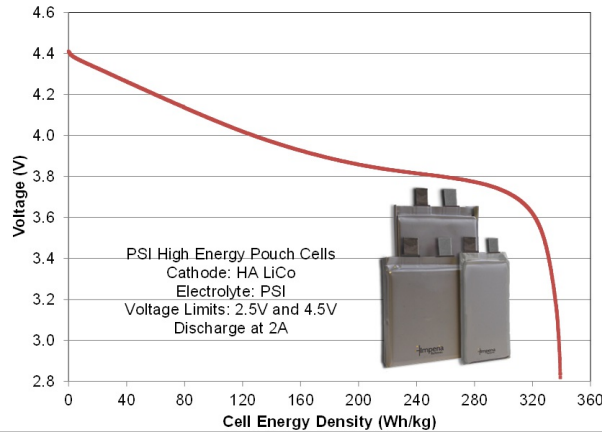
**Transition Target:** Barracuda Expendable Mine Neutralizer

**TPOC:**  
(301)227-5685

**Other transition opportunities:**  
Navy to power new sensors and other Underwater Unmanned Vehicles (UUVs).

**Notes:**  
This technology simultaneously offers higher gravimetric and volumetric energy and power densities than achievable using standard primary or rechargeable batteries.

The battery could be utilized to enable increased energy density for all commercial and DOD applications. The energy storage system size, weight, and volume can be reduced and/or system operating capacity increased.



Demonstrated performance of lithium metal cell design exceeds 340Wh/kg on discharge over one hour.

## WHAT

### Operational Need and Improvement:

Batteries with enhanced performance are required to expand the operational capabilities and endurance of the Barracuda Expendable Mine Neutralizer Unmanned Underwater Vehicle (UUV).

### Specifications Required:

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

### Technology Developed:

This technology offers improved safety and performance by combining:

- Proprietary cell design and construction techniques that enable a lithium free design.
- Patented High Active (HA) coating technology enables designs that maximize the energy and power density.
- Non-flammable electrolyte results in safer lithium ion batteries.

### Warfighter Value:

Safe cells/batteries for use in numerous Navy applications with:

- 20+% increase in mass energy density
- 30+% increase in volumetric energy density
- Reduced manufacturing complexity

## WHEN

**Contract Number:** N68335-20-C-0189 **Ending on:** December 4, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate the proposed cell design can meet the objective energy and power density targets.	N/A	Completed electrochemical testing and accompanying cell design/modeling.	4	January 2020
Scale-up cell construction and demonstrate performance of targeted cell size.	Low	Demonstration of basic cell performance.	5	October 2020
Verification of cell performance by the Navy	Low	Demonstrate cell meets SWAP requirements of the application.	5	January 2021
Safety assessment	Med	Characterize safety of cell and components on abusive testing.	5	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 battery could be used in:

- Consumer devices such as cell phones and laptops
- Electric vehicles
- High power laser systems
- Unmanned Aerial Vehicles (UAVs).

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