Department of the Navy SBIR/STTR Transition Program

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Topic # N152-093
Advanced Cathode for High Energy Li-Air Batteries
Lynntech, Inc.

WHO

SYSCOM: NAVAIR

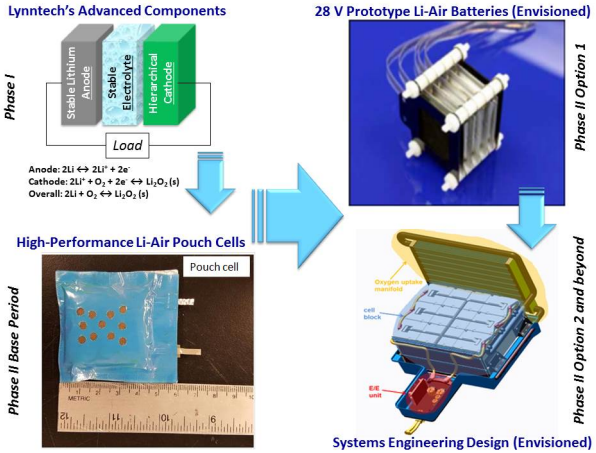
Sponsoring Program: PMA-234

Transition Target: 28V battery for ALQ-99 and ALQ-231

TPOC:
(301)342-0365

Other transition opportunities: Batteries for F/A-18 and EA-18G aircraft (PMA-265) and batteries for weapons and weapon systems (PMA-242)

Notes: V=volts
Wh/kg=Watt-hours per kilogram
Wh/L= Watt hours per litre
mAh/g= milliAmp hours per gram.



WHAT

Operational Need and Improvement: Rechargeable batteries play a critical role in next generation aircraft. Lithium-ion (Li-ion) batteries provide significant mass and volume savings compared to the nickel-cadmium batteries. However, the Li-ion batteries are approaching the energy density limits that intercalation materials can provide. Breakthrough cell technologies that far exceed the specific energy and energy density of current Li-ion batteries are required to achieve energy storage goals for naval aircraft.

Specifications Required: Future military missions will require rechargeable batteries that provide a specific energy of 600-1000 Wh/kg or higher, low self-discharge (<5% per month), good cycle life (>2000 cycles at 100% depth of discharge), and long calendar life (4-7 years' service life) at cell level (threshold) and at battery product level (objective). The requirements include sustained operation over a wide temperature range from -40°C to +71°C, including exposure to +85 °C.

Technology Developed: Non-aqueous Li-air cells have gained significant attention because their theoretical specific energy and energy density are 3,505 Wh/kg and 3,436 Wh/L, respectively. These are significantly greater than the 387 Wh/kg and 1,015 Wh/L of current Li-ion cells. In Li-air cells, the Li metal anode has a capacity of 3842 mAh/g, 10 times higher than that of conventional graphite anodes in Li-ion cells. The oxygen consumed by the cathode is readily available from the air. These developments lead to a significant reduction in the weight and cost of the Li-air batteries.

Warfighter Value: Li-air batteries based on an advanced cathode with high capacity, reversibility, and rate capability, as well as high cycle life can provide high energy density, power density, and long cycle life for military aircraft applications. Specific benefits of this technology for the Navy include extended mission time, reduced weight, and increased capabilities. Other DOD applications include military vehicles, soldier power, communication systems, weapons systems, remote sensors, detection devices, unmanned aerial vehicles (UAVs), and silent watch surveillance systems.

WHEN

Contract Number: N68335-17-C-0175 **Ending on:** March 27, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Pouch cell design, fabrication, & test	Low	> 600 Wh/kg	3-4	March 2018
28V battery design, fabrication, & test	Med	Pass testing for 28V battery	4-5	September 2018
Battery testing in simulated environment	Med	Pass full evaluation, safety tests	5-6	March 2019

HOW

Projected Business Model: Lynntech plans to transition this battery technology by either (i) licensing the technology to a battery partner(s); or (ii) producing the components (i.e., advanced cathode, electrolyte, and/or advanced anode) at Lynntech and selling the components to battery cell fabrication companies. The current business strategy is to sell or license to existing battery manufacturers since the base manufacturing processes are established and this will lower the required investment and provide an established customer base.

Company Objectives: Lynntech's objective for this project is to develop a 28V prototype Li-air battery with high energy density and long cycle life and high safety that meets the Navy's requirements. Lynntech is a for-profit business and believes that if we properly meet the above objective, sales and profit will follow.

Potential Commercial Applications: Civilian applications include electric and hybrid vehicles, consumer and industrial electronics devices, portable medical devices, telecommunications devices, and auxiliary power units.

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