SOCOM222-001: Solid State High Energy Desity Batteries

ADDITIONAL INFORMATION
N/A

TECHNOLOGY AREAS:
Electronics | Materials

MODERNIZATION PRIORITIES:
General Warfighting Requirements (GWR) | Microelectronics

KEYWORDS:
lithium ion; lithium; battery; thermal runaway; graphene; energy storage

OBJECTIVE:
The objective of this topic is to develop applied research toward an innovative capability to enhance battery safety and enhance the energy capacity of batteries used in a maritime environment.

DESCRIPTION:
The objective of this topic is to develop applied research toward an innovative capability to conduct the research, development, and assessment of a viable overall system design options with respective specifications detailed below.
Current lithium-ion battery systems are inherently unsafe. While they are the current technology that blends the attributes of affordability and energy capacity, they pose risks that can be detrimental to operating/stowage on maritime vessels, operating in an undersea environment, and operating while forward. Lithium batteries carry the risk of thermal runaway. Any lithium battery, when exposed to fire, can sympathetically ignite, which worsens the severity of a fire, thereby possibly igniting other lithium batteries nearby and releasing a toxic off-gas biproduct. SOCOM seeks to implement improved systems that allow for safe, efficient, and effective energy storage. Traditional batteries in inventory use vendor-specific means of using multiple 18650-based cells to produce the power and current levels needed unique to each system. The following attributes describe key characteristics that would be sustained and/or desirable in a battery system over current lithium battery systems:

1. More energy storage (longer duration of use at a fixed discharge rate) than an 18650-based battery.
2. Safe static storage (specifically, in a fire event, the battery does not contribute to additional severity of the fire).
3. Safe dynamic use in discharge (in use, the battery does not pose risk of fire, electric shock, nor release of toxic off-gas biproduct).
4. Maintain overall small size and weight for integration in a variety of maritime platforms. Improve performance over lithium 18650-based battery.
5. Faster charge than current lithium-ion batteries without detrimental effects (reference current Li-O battery charging speed) – performance improved over lithium 18650-based battery.
6. Able to integrate into a pressure system operating in an undersea environment up to 200 feet of seawater (fsw).

PHASE I:
Conduct a feasibility study to assess what is in the art of the possible that satisfies the requirements specified in the above paragraphs entitled “Objective” and “Description.”
The objective of this USSOCOM Phase I SBIR effort is to conduct and document the results of a thorough feasibility study (No more than a Technology Readiness Level 3) to investigate what is in the art of the possible within the given trade space that will satisfy a needed technology. The feasibility study should investigate all options that meet or exceed the minimum performance parameters specified in this write up. It should also address the risks and potential payoffs of the innovative technology options that are investigated and recommend the option that best achieves the objective of this technology pursuit. The funds obligated on the resulting Phase I SBIR contracts are to be used for the sole purpose of conducting a thorough feasibility study using scientific experiments and laboratory studies as necessary. Operational prototypes will not be developed with USSOCOM SBIR funds during Phase I

feasibility studies. Operational prototypes developed with other than SBIR funds that are provided at the end of Phase I feasibility studies will not be considered in deciding what firm(s) will be selected for Phase II.

PHASE II:

Develop, install, and demonstrate a prototype system determined to be the most feasible solution during the Phase I feasibility study on a solid state high energy density battery.

PHASE III DUAL USE APPLICATIONS:

This system could be used in a broad range of military applications where stable, safe battery power with high energy density is needed.

REFERENCES:

1. https://news.mit.edu/2021/designing-better-batteries-electric-vehicles-0816

TOPIC POINT OF CONTACT (TPOC):

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