BAA Call N00014-23-S-C003
Special Program Announcement for Office of Naval Research
Research Opportunity:
Naval Energy Storage System Safety and Assessment

I. INTRODUCTION

This announcement describes a technology area, entitled "Power Generation and Energy Storage," under the N00014-23-S-B001, Long Range Broad Agency Announcement for Navy and Marine Corps Science and Technology which can be found at https://www.nre.navy.mil/work-with-us/funding-opportunities/announcements. The submission of proposals, their evaluation and the placement of research grants and contracts will be carried out as described in the above Long Range Broad Agency Announcement.

The purpose of this announcement is to focus attention of the scientific community on (1) the area to be studied, (2) dialogue amongst those interested in this arena, and (3) the planned timetable for the submission of white papers and full proposals.

II. TOPIC DESCRIPTION

The Office of Naval Research (ONR) is interested in receiving white papers and proposals in support of advancing energy storage system technology for future Navy ships applications. Work under this program will consist of applied research, and it will be funded under Budget Activity 2 (as defined in DoD Financial Management Regulation Vol. 2B, Ch. 5). The overall Science and Technology (S&T) effort is envisioned to be conducted at Technology Readiness Level (TRL) 3-4.

Background and Objectives:

ONR is examining the shipboard integration and safety associated with large scale energy storage, consisting of batteries or flywheels in megawatt (MW) and up to MW-hour (MWh) scales, with interfaces up to 1000V. These systems will be embedded into the platform and operated across the host platform's lifecycle. High profile energy storage system casualties in both terrestrial and commercial maritime applications provide some insights into the potential types of failures, the magnitudes, and scenarios that may be encountered. However, none of these applications are as deeply embedded with as aggressive concepts of operation (high rate discharge and charge, challenging thermal conditions), and high power application (high power to energy ratio). This special notice pursues to generate a better understanding of failures, risk assessment, and mitigation approaches through the synergistic use of modeling, prototyping, and experimentation associated with large scale lithium-ion batteries and flywheel energy storage systems

White papers for potential FY23 Applied Research (Budget Category 6.2) projects are sought under the following focus areas:

Lithium Battery System Failure Event Scaling and Assessment:

- **Objective:** Develop methodologies to evaluate what a plausible maximum credible event (MCE) failure event could be for large-scale battery systems.

- **Background:** The current Navy state of the art to evaluate a battery system MCE is to perform multiple abusive experiments that include a large number of full scale test assets, or even full-size systems. However, this approach is costly, and does not allow for evaluation of a diverse set of safety scenarios. The intent of this area is to develop methods to efficiently and effectively evaluate MCE scenarios to support risk assessment, based upon fewer tests, and smaller scale testing (i.e. at the cell and module level). Methodologies that converge testing and simulation are desired, but must also consider uncertainty in the event assessments. Proposed methods should explain why they provide the ability to evaluate a diverse range of scenarios and converge to a reasonable evaluation of casualty outcomes for larger systems based upon experimental results performed at a reasonable level. Approaches for validation should also be proposed and included in the scope.

Lithium Battery System Detection:

- **Objective:** Develop methodologies for sensing of anomalous behavior large scale battery systems.

- **Background:** Battery management systems typically evaluate voltage, current, and temperature behaviors, but are often limited in the number of sense points. While lithium-ion batteries are generally considered sealed, there may also be chemical or thermal methods that could be applied to help provide insights into degradation, failure, and release. Approaches for detection must be scalable to large battery arrays and should provide basis as to how they will be demonstrated to indicate scalability. The intent of this area is to address the risks inherent in large scale batteries, including designs with many parallel cell arrays. Proposals should define how the approach helps to find latent or slowly changing conditions leading to energetic cell failure, and also mitigate the risks associated with cells not performing consistent with others in the group or with multiple paralleled batteries.

Lithium Battery System Suppression:

- **Objective:** Develop Navy shipboard battery system fire suppression concepts and evaluate resultant efficacy.

- **Background:** Various battery manufacturers and facilities recommend the use of different gaseous or liquid agents. In addition, present Navy doctrine also acknowledges the need for water mist or deluge because of the challenges of removing latent heat from tightly packed batteries. However, a more universal suppression solution and understanding of performance, and issues associated are desired. This should include agent-induced toxicity due to burning or breakdown of the suppression agent (e.g., creation of toxic halogenated gas). This effort should account for pathways to get agents to actively failing and propagating cells as well as

the realities of a shipboard environment, accounting for tightly packed spaces, difficult access to the weather, and the need to limit collateral damage. It is anticipated that for embedded batteries with limited access to the weather, a multi-stage mitigation approach will be necessary to manage exhausting a flammable atmosphere, while also providing cooling to the battery itself.

Lithium Battery System Containment:

- **Objective:** Develop containment approaches for embedded batteries accounting for protection from shock, vibration, internal/external fire, overpressure, kinetic effects, etc., and should provide a level of isolation between battery modules inside of the container so that propagation potential is minimized.

- **Background:** Battery systems will need to be enclosed in containment structures that protect from internal (e.g., other failing modules) and external (e.g., fires, weapons effects, moisture) threats. Containment should not be tied to a specific battery design or form factor, as it is likely that battery module approaches and designs will change in time. Thus, containment approaches that are universally useful (e.g., standard rack widths or designs that can intrinsically be adapted to a space) are recommended.

Lithium Battery System Testing:

- **Objective:** Develop new and novel methodologies for testing of cells, battery modules, and larger constructs which are desired to help provide additional insight into the failure and release characteristics.

- **Background:** The Navy performs standard testing such as over charge, over discharge, short circuit, over temperature, etc., and while other testing methods from outside sources are also employed on different batteries, there is no consensus that the outcomes of these tests provide a truly realistic and indicative basis of what a cell or battery failure will look like. New methods that better characterize the thermal characteristics, release rates (material, heat, and directionality), and ultimately inform the energetics of a failure are desired. Approaches should be cost effective, accurate, and not require significant (proprietary) knowledge regarding cell construction, manufacturing attributes, etc. Testing should be aligned to modeling functionality in a way that it supports validation of a model attribute. However, new and novel testing approaches should be considered independent of the overall evaluation of a maximum credible event.

Flywheel Energy Storage System Event Assessment:

- **Objective:** Examine and analyze high speed composite flywheel failure mechanisms and resultant (pressure, thermal, kinetic material, gas composition output, etc.) operating in a shipboard environment.

- **Background:** Flywheel systems are intended to employ high rotational speeds, requiring high strength materials in order to achieve tip speeds and inertia levels within compact

(potentially hatchable) packages. These high speed carbon fiber wheel designs have deployment experience in terrestrial applications but are limited in maritime applications. The potential for a high speed rotating machine to encounter a failure, and a carbon fiber wheel to make contact with the surrounding containment or enclosure is significant. When such an item makes contact and begins to slow due to friction, it is anticipated that significant dust, debris, and potentially larger chunks of the wheel will be released. The resultant situation is one that is uncertain.

Flywheel Energy Storage System Containment:

- **Objective:** Develop containment approaches for shipboard high speed composite flywheel energy storage systems accounting for protection from shock, vibration, internal/external fire, overpressure, kinetic effects, loss of wheel or machine material, etc., not allowing any penetration of material into manned spaces.

- **Background:** Machines with high power and energy density, intended to be as compact as possible, will require significant speed to provide a meaningful amount of total energy. The failure of a kinetic storage system, be it the flywheel or the machine itself will result in the potential for high energy pieces to be ejected. Therefore, the flywheel must be contained in a manner that provides protection from the release, as well as prevent any moving components from leaving the package. Evaluation of flywheel containment must consider that a variety of designs and sizes will be feasible, and must evaluate the potential worst-case release scenario, its energetics, and the containment approaches required to contain it. Because machines have the potential to be life-of-ship systems, the containment may be specific to the flywheel system design.

III. NO EVENTS ARE PLANNED

IV. WHITE PAPER SUBMISSION

Although not required, white papers are strongly encouraged for all offerors seeking funding. Each white paper will be evaluated by the Government to determine whether the technology advancement proposed appears to be of particular value to the Department of the Navy. Initial Government evaluations and feedback will be issued via e-mail notification from the Technical Point of Contact. The initial white paper appraisal is intended to give entities a sense of whether their concepts are likely to be funded.

Detailed Full Proposal (Technical and Cost volumes) will be subsequently encouraged from those Offerors whose proposed technologies have been identified through the above referenced e-mail as being of “particular value” to the Government. However, any such encouragement does not assure a subsequent award. Full Proposals may also be submitted by any offeror whose white paper was not identified as being of particular value to the Government or any offeror who did not submit a white paper.

For white papers that propose efforts that are considered of particular value to the Navy but either exceed available budgets or contain certain tasks or applications that are not desired by the Navy, ONR may suggest a full proposal with reduced effort to fit within expected available budgets or an effort that refocuses the tasks or application of the technology to maximize the benefit to the Navy.

White papers should not exceed 5 single-sided pages, exclusive of cover page, references, and resume of principal investigator, and should be in 12-point Times New Roman font with margins not less than one inch. White papers shall be in Adobe PDF format (preferred) or in Microsoft Word format compatible with at least Microsoft Word 2016.

The Cover Page can be found at https://www.nre.navy.mil/work-with-us/how-to-apply/submit-contract-proposal for contract submissions and at https://www.nre.navy.mil/work-with-us/how-to-apply/submit-grant-application for grant submissions.

The 5-page body of the white paper should include the following information:

- Technical Concept: A description of the technology innovation and technical risk areas.
- Future Naval Relevance (where applicable) – A description of potential Naval relevance and contributions of the effort to the agency's specific mission.
- Operational Naval Concept (where applicable) – A description of the project objectives, the concept of operation for the new capabilities to be delivered, and the expected operational performance improvements.
- Operational Utility Assessment Plan (where applicable) – A plan for demonstrating and evaluating the operational effectiveness of the Offeror's proposed products or processes in field experiments and/or tests in a simulated environment.
- Rough Order of Magnitude (ROM) cost estimate

A resume of the principal investigator, not to exceed 1 page, should also be included after the 5-page body of the white paper.

White papers must be submitted through Fedconnect at www.fedconnect.net in accordance with Section D. Application and Submission Information, Section 2. Content and Form of Application Submission, paragraph d. White Paper Requirements, ii. White Paper Submission in N00014-23-S-B001.

To ensure full, timely consideration for funding, white papers should be submitted **no later than** 19 DECEMBER 2022. White papers received after that date will be considered as time and availability of funding permit.

The planned date for completing the review of white papers is 20 JANUARY 2023.

V. FULL PROPOSAL SUBMISSION AND AWARD INFORMATION

Full proposals should be submitted under N00014-23-S-B001 by 24 FEBRUARY 2023. Full Proposals received after that date will be considered as time and availability of funding permit.

ONR anticipates that both grants and contracts will be issued for this effort.

Full proposals for contracts should be submitted in accordance with the Appendix 2 of the N00014-23-S-B001. Full proposals for grants should be submitted via Grants.gov in accordance with Appendix 1 of N00014-23-S-B001.

ONR plans to fund up to 5 individual grants and contracts with a total value of $375K each, using research funds. However, lower and higher cost proposals will be considered.

The period of performance for projects may be from 2-3 years.

Although ONR expects the above described program plan to be executed, ONR reserve the right to make changes.

Funding decisions should be made by 31 MARCH 2023. Selected projects will have an estimated award date of 9 JUNE 2023 for grants and 29 SEPTEMBER 2023 for contracts.

VI. SIGNIFICANT DATES AND TIMES

Event	Date	Time
Recommended White Paper Submission Date*	19 DECEMBER 2022	1400 Eastern Time
Notification of White Paper Valuation*	20 JANUARY 2023	
Recommended Full Proposal Submission	24 FEBRUARY 2023	
Notification of Selection: Full Proposals *	31 MARCH 2023	
Awards *	9 JUNE 2023 – Grants 29 SEPTEMBER 2023 - Contracts	

Note: * These are approximate dates.

VII. SMALL BUSINESS SUBCONTRACTING

As indicated in ONR Broad Agency Announcements large businesses and non-profit organizations must submit a subcontracting plan along with their research proposal. While large businesses and non-profits are responsible for making these subcontracting arrangements, ONR will help facilitate prime contractor/small business contracting connections by posting to the ONR external website contact information of small businesses that have indicated their subcontracting interests and technological niche for prime contractor consideration for this

program. This is not an endorsement, but an effort by ONR to help bring these parties together to provide superior solutions.

If you are a small business, and your company is interested in subcontracting activities with large businesses and/or non-profits considering your technology for this program, please provide the following information by email, to the ONR Small Business Director Elle Simonoff at ellen.simonoff.civ@us.navy.mil with the subject line, "N00014-23-S-C003."

Provide this information:

1) Company Name and Website
2) Individual Point of Contact (POC) name and POC email address
3) Business Size and socio-economic category
4) Brief Technology Description (no more than 3 sentences)
5) Technology Key Words (no more than 10 words)

Note: Do not include ANY proprietary information. This information will be posted on the ONR website under this BAA call and will available to the public.

VIII. POINTS OF CONTACT

In addition to the points of contact listed in N0014-23-S-B001 the specific points of contact for this announcement are listed below:

Technical Points of Contact:
Donald Hoffman
Advanced Naval Platforms Division, Code 331
donald.j.hoffman8.civ@us.navy.mil

John Heinzel
Naval Sea Systems Command, Code 05Z35
john.m.heinzel.civ@us.navy.mil

Business Point of Contact/Contracting Officer:
Leila Hemenway
Contracting Officer, Code 251
leila.k.hemenway.civ@us.navy.mil

VIII. SUBMISSION OF QUESTIONS

Any questions regarding this announcement must be provided to the Technical Points of Contact and/or the Business Point of Contact listed above. All questions shall be submitted in writing by electronic mail.

Answers to questions submitted in response to this BAA Call will be addressed in the form of an Amendment and will be posted to the following web pages:

- Sam.gov Webpage –Contract Opportunities – https://sam.gov/
- Grants.gov Webpage – http://www.grants.gov/
- ONR BAAs, FOAs and Special Program Announcements Webpage - https://www.nre.navy.mil/work-with-us/funding-opportunities/announcements

Questions regarding **White Papers or Full Proposals** should be submitted No Later Than two weeks before the dates recommended for receipt of White Papers and/or Full Proposals. Questions after this date may not be answered.

Reference Documentation:

1. Lithium Battery Hazards – Detection, Mitigation, and Safety
https://www.fire.tc.faa.gov/2016Conference/files/Battery_I/FuentevillaUSNavyBattery/FAA_cabin_fire_presentation_FINAL2_webrelease.pptx

2. Naval Power and Energy System Technology Development Roadmap
https://www.navsea.navy.mil/Portals/103/Documents/TeamShips/SEA21/ESO/2019%20NPES%20TDR%20Distribution%20A%20Approved%20Final.pdf