BAA Call N00014-23-S-BC09
Special Program Announcement for Office of Naval Research
Research Opportunity:
"Science and Technology for Shipboard Robotic Repair and Maintenance"

I. INTRODUCTION

This announcement describes a technology area titled "Unmanned Surface Vehicle and Small Combatant Craft" 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 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) the opportunity to present during the Navy Small Business Showcase at the Navy Sea Air Space Conference and Exhibition on April 4, 2023, with an opportunity to speak directly with the program officer for 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 proposed topic will explore and exploit the use of robotics for performing repairs and maintenance on-board maritime vessels with no humans aboard and mission durations measured in weeks or months. The program will pursue development of robotic technologies for performing repairs on shipboard systems.

Background:

The Office of Naval Research (ONR) in conjunction with the Office of Small Business Program (OSBP) is interested in receiving proposals for the exploration and exploitation of robotics for performing repairs and maintenance on-board maritime vessels with no humans aboard and mission durations measured in weeks or months.

The Navy is developing medium and large Unmanned Surface Vessels (USVs) that will operate weeks or months at a time with no human setting foot on board and with only a low bandwidth, over the horizon communications link to the remote human operator. While significant progress has been made in the maneuvering autonomy of such vessels, a significant impediment to the goal of months-long missions is the need to perform repairs and maintenance during these extended missions. Today, approaches exist or are being developed that can handle some of the faults that may occur. These include, for example, software that monitors data streams from shipboard machinery and electrical systems to diagnose faults and reconfigure the affected system to mitigate the effects of the fault; and shipboard systems that are designed with sufficient redundancy or capacity to provide the necessary vessel endurance. Examples of the latter include multiple generators and increased oil sump capacity. These approaches require

additional space on the vessel, involve additional cost and cannot mitigate all types of faults and malfunctions that may occur. One purpose of this BAA Call is to minimize the required redundancies and extra maintenance capacity requirements using robotics. Many mechanical and electrical faults that commonly occur aboard maritime vessels require mechanical manipulation to repair, for example, turning a wrench or screwdriver, pushing a button, throwing a switch or removing a failed component and replacing it with a new one. These faults also require diagnosis prior to a repair being made. Very often, a fault that would be very simple to remedy if a human were present is sufficient to cause a ship with no crew aboard to go dead in the water or create darkship situation. Robotic capabilities are continually increasing and they are capable of performing certain shipboard repair and maintenance activities. For example, robots have been developed to perform some activities on maritime vessels such as hull cleaning, firefighting and ship inspections.

Objective:

This BAA Call seeks to evaluate the science and technology gaps that must be addressed to use of robotics for repair and maintenance functions aboard a USV while it is underway. The robots shall have the ability to perform repair and maintenance on shipboard systems such as (but not limited to) propulsion, electrical generation and distribution, cooling and Command, Control, Communications and Computers (C4) systems. The robots should have (1) sufficient mobility to be able to maneuver and perform their intended function in the interior of a vessel in confined spaces while the vessel is undergoing wave-induced motions, including maneuvering over hatch sills between compartments and up/down to different decks and through areas with pipes, conduits and cables, as well as the ability to right themselves; (2) perception and sensors to inspect systems and detect faults (optionally, data streams from existing sensors on shipboard systems may be used to supplement the perception that is organic to the robot); (3) the ability to reason about their sensor data to diagnose and locate faults (optionally, the robot's sensor data may be transmitted to a remote, over-the-horizon human operator over a low bandwidth communications link for assistance in diagnosis of a fault); and (4) be capable of manipulating the necessary tools and components to perform the above mentioned functions. Transmission of the robot's sensor data to an offboard human operator is less desirable due to the very limited communications bandwidth. While low-resolution still images may be able to be transmitted offboard, high-resolution images and video will not be possible.

A project resulting from a successful proposal will evaluate present-day science and technology gaps and anticipated future developments in robotics in the 5-20 year time horizon to address those gaps against the shipboard repair and maintenance activities required for a typical maritime vessel with diesel propulsion and diesel generators. No specifics are provided in this BAA Call regarding the vessel - rather than designing a robotic system to requirements of a specific vessel, this BAA Call seeks an assessment of the "art of the possible" for robotic repair and maintenance aboard a maritime vessel over the next 5-20 years.

Repair and maintenance activities of highest interest to ONR are: (1) those that will be amenable to being performed by robots in the 5-20 year timeframe, and (2) those that are expected to have the largest positive impact to the operational availability of the maritime vessel (those that address frequently occurring faults of high consequence to vessel operation - Additionally, these

robots must be reliable – they must be able to maintain their functionality as they operate in a challenging environment in which there will be no human crew for weeks or months at a time to repair the robot if it experiences a failure. Furthermore, these robots will be operating in a maritime environment with corrosive salt air.

The final deliverable of this effort shall be a detailed report that describes: (1) repair and maintenance functions of high priority to a maritime vessel operating for weeks or months with no one on board that are amenable to being performed by a robot; (2) the state of the art and expected developments in robotics during the next 5-20 years that are relevant to this BAA Call; and (3) identification of present-day science and technology gaps that must be addressed to achieve the envisioned capability. Robotic capabilities to be considered include all of those required to achieve the objectives of this BAA Call, for example, the perception and sensor capabilities of the robot, its ability to maneuver in confined spaces while the vessel is undergoing wave-induced motions, the robot's ability to reason about its perception and sensor data to locate and diagnose faults and the ability of the robot to manipulate required tools and components. Optionally, the robot's perception and sensor data may be transmitted to a remote, over-the-horizon human operator over a low bandwidth communications link for assistance in diagnosis of a fault. The successful proposed team will ideally possess subject matter expertise both in robotics and shipboard mechanical and electrical systems.

III. Presentation Opportunity

ONR is funding this BAA Call in honor of the Naval Research Laboratory's 100th anniversary and in conjunction with the Navy's Small Business Showcase at this year's Navy Sea Air Space Exhibition (SAS). ONR and a panel OSBP will hold a Small Business Showcase to provide feedback on 4 April, 2023 at Sea-Air-Space (SAS) located at the Gaylord National Resort & Convention Center, National Harbor, Maryland.

Based on the white pages submitted, ONR may select one or more companies to present at the Showcase. All white paper submissions will be evaluated and, if requested, feedback will be provided to the submitter. Interested small businesses should plan on attending the Showcase (even if not selected for presentation), to speak with the Program Office regarding their submission. You do not need to register for SAS or be a member of the Navy League to attend the Showcase. More details will be provided regarding the Showcase as an amendment to this BAA call. **You do not have to register for or attend SAS to submit a white paper.**

Please visit this website for the exhibition details: https://seaairspace.org/attend/

Note: This announcement is neither a contract, nor a request for proposal, nor a promise to contract, nor a commitment of any kind. The Government assumes no liability for costs incurred by any participant for travel or participation.

Invitation to present at the Showcase will be announced on or about 21 March 2023.

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.

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

(1) Title of the proposed effort, principal investigator, organization, telephone number, and e-mail address;
(2) Relevance of the proposed effort to the research areas described in Section II;
(3) Technical objective of the proposed effort;
(4) Technical approach that will be pursued to meet the objective;
(5) A summary of recent relevant technical breakthroughs that the technical approach leverages;
(6) A summary of the science and technology (S&T) advancements that the technical approach is expected to produce;
(7) Summary of qualifications of key team members;
(8) Summary of capabilities of participating organization(s) and how these capabilities address all those required to address Section II;
(9) Rough Order of Magnitude (ROM) cost estimate;
(10) Proposed Period of Performance

White papers must be submitted through Fedconnect at www.fedconnect.net in accordance with Section D. Application and Submission Information, Section II. 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 12:00 PM EST on 13 March 2023. 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 21 March 2023.

V. FULL PROPOSAL SUBMISSION AND AWARD INFORMATION

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

ONR anticipates that only contracts will be issued for this effort. ONR anticipates that up to four (4) contracts valued at $250,000 each or less will be issued for this effort. Although all eligible Offerors may submit proposals, this BAA Call primarily seeks participation from the Small Business community.

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

The period of performance for projects may be from 6 months to 1 year.

Although ONR expects the above described program plan to be executed, ONR reserves the right to make changes or cancel the program altogether.

Funding decisions should be made by 30 May 2023. Selected projects will have an estimated award date of 15 September 2023.

VI. SIGNIFICANT DATES AND TIMES

Event	Date	Time
Recommended White Paper Submission Date*	13 March 2023	1200 EST
Notification of White Paper Valuation/Invitation to present at SAS*	21 March 2023	
Showcase Presentations	4 April 2023	0900 EST
Recommended Full Proposal Submission*	24 April 2023	1200 EST
Notification of Selection: Full Proposals *	30 May 2023	
Awards *	15 September 2023	

Note: * These are approximate dates.

VIII. POINTS OF CONTACT

In addition to the points of contact listed in N0014-23-S-B0001 the specific points of contact for this announcement are listed below:
Technical Points of Contact:
Robert Brizzolara, Program Officer, robert.a.brizzolara.civ@us.navy.mil

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

Navy Small Business Showcase Point of Contact:
Ellen Simonoff, ONR Small Business Director, ellen.simonoff.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 no later than the date recommended below.

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:

- Beta.sam.gov Webpage –Contract Opportunities – https://beta.sam.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 one (1) week before the dates recommended for receipt of White Papers and/or Full Proposals. Questions after this date may not be answered.