Special Notice N00014-21-S-SN01
Special Program Announcement for 2021 Office of Naval Research Research Opportunity:
EO/IR Sensors and Sensor Processing

I. INTRODUCTION

This announcement describes a technology area, entitled "EO/IR Sensors and Sensor Processing", under the N00014-21-S-B001, Long Range Broad Agency Announcement for Navy and Marine Corps Science and Technology which can be found at https://www.onr.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 and (2) the planned timetable for the submission of white papers and full proposals.

II. TOPIC DESCRIPTION

The ONR Code 312 EO/IR portfolio seeks discovery and invention proposals to develop and demonstrate technologies for the next generation of systems in electro-optic and infrared sensors and sensor processing. White papers and subsequent proposals should address technology developments in one or more of the following Research Opportunity Technical Areas 1-2.

Background:

The EO/IR Sensors and Sensor Processing program has the objective of developing high-performance, low-cost, next generation electro-optic sensors, devices and autonomous processing to provide real-time detection, tracking, classification, and identification of air, sea-surface, and ground targets in all weather conditions. The primary interest is for systems working in the visible and infrared (near, short-wave, mid-wave and long-wave) regions of the electromagnetic spectrum; however, passive millimeter wave systems may also be of interest due to their superior atmospheric transmission properties in degraded visual environments. To fully sense and image the operational area, naval forces (including Marine Corps and Navy) must have reliable access to large format infrared imaging sensors to provide real-time detection, tracking, classification, and identification of air, sea-surface, and ground targets in all weather conditions.

Technical Area 1 (TA1): Si compatible infrared focal plane arrays for large format sensing

Introduction:
In order to widely deploy infrared imaging and detection across the fleet, the cost of each individual array needs to be decreased while also increasing the size of those arrays for increased situational awareness. Modern focal plane arrays (FPAs) in these imaging bands rely upon III-V or II-VI group semiconductors for the substrate and detector absorber materials. These material systems have yielded some of the highest performing imaging systems but they have relatively low throughput production lines, low FPA yield at high array sizes, and costly die-to-die level bonding. Additionally, matching the infrared array and pixel size to that of a read out integrated circuit (ROIC) with the desired functionality is not always possible.

Objective:
The primary interest for TA1 is for novel detector materials as imaging sensors in the infrared (short-wave, mid-wave and long-wave) regions of the electromagnetic spectrum. TA1 seeks proposals towards large format infrared arrays (larger than 6k x 4k) produced in a manner that has high wafer throughput and high yield for large format arrays. This effort seeks novel detector materials and concepts that achieve this objective by leveraging commercial 300 mm Si tooling and processing.

Specifically, TA1 seeks proposals with the infrared detector array directly deposited and fabricated on the ROIC wafer yielding a monolithic FPA wafer. Proposed efforts should take into account how their solution will remain compatible with the underlying Si CMOS elements. Direct to Si CMOS is preferred, however solutions on 300 mm Si, compatible with wafer to wafer bonding to the ROIC, will also be considered. Die-to-wafer and die-to-die solutions are not of interest under TA1.

Solutions operating in the mid-wave infrared (MWIR) band are preferred, however solutions in the long-wave infrared (LWIR) and short-wave infrared (SWIR) will be considered also.

While increased operating temperature of infrared arrays is always of interest, it is not the focus for this Special Notice so long as performance and cooling levels of the proposed solutions are comparable to the state-of-the-art in infrared FPAs. It is anticipated that solutions may still require cooling in order to operate in the short-wave infrared (0.9 – 1.8 μm), mid-wave infrared (3 – 5 μm), or long-wave infrared (8 – 12 μm) imaging bands.

Proposed efforts should highlight the detector performance of their approach compared to current state-of-the-art and specifically address metrics such as detection sensitivity (e.g. quantum efficiency, absorption coefficient, NEDT), spectral bandwidth, fill factor, pixel size, and maximum array size (in terms of pixel count or physical size).

Technical Area 2-A (TA2): Rapid training of object detection within EO/IR data streams

Introduction:
Object detection of complex maritime and expeditionary environments using data driven algorithms (e.g. convolutional neural networks) have shown high accuracy when enough relevant data is available to train the model. The accuracy of the model typically has an inverse

relationship with the false alarm rate and a direct correlation to the volume and accuracy of the training data set. Additionally, data sets of targets in all spectral bands are not always known beforehand and once a new object is encountered in the real world, the model is not flexible enough for a real time update. A typical cluttered environment might include maritime wave conditions with solar reflections, complex sea states, and large amounts of debris in the water. For expeditionary, these complex scenes might include foliage, dense urban, and other low contrast scenes.

Objective:
TA2 seeks research that increases the accuracy of EO/IR object detection and identification algorithms for scenes in challenging and cluttered environments. Proposed concepts shall introduce methods to rapidly ingest large amounts of data for near-real time updates on object detection models. Novel methods for user input and labeling of these real time data streams is requested. Solutions should focus on ways that accelerate the time from data collected to model trained with quantified comparisons of their approach to the state-of-the-art. Each approach should also address standard accuracy and false alarm rates. Hardware and software teaming is strongly encouraged to create a holistic solution. However, solutions that focus more strongly on the algorithm or software side can make assumptions about existing or future hardware to be deployed. Hardware solutions may make similar state-of-the-art assumptions about the algorithm or software model to be used.

Proposers may address either a maritime or expeditionary use-case for TA2. For the maritime case, very large format EO/IR imagers (i.e. very high bandwidth) should be assumed, but with less constraint on size weight and power (SWaP) of the hardware, and proposers should anticipate multi waveband streams (simultaneous visible and infrared) at high bit depths (12+ bits) and large format (> 4k x 4k sensor formats). Alternatively, proposals can focus on the expeditionary use-case with smaller sensor formats (i.e. lower bandwidth) but much more computationally constrained SWaP. For the expeditionary use-case proposers should anticipate one wave band stream at a time, but able to ingest both data streams. Formats expected are 4k x 6k visible and 1k x 2k infrared.

Offerors are encouraged to use data relevant to the use-case to which they are proposing. The government may provide test and evaluation data sets. Offerors to TA2 should discuss their ability handle Controlled Unclassified Information (CUI) data. Unclassified, non-CUI data sets are available for Offerors who cannot process CUI.

III. 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 should be labeled "White Paper for ONR 2021 Research Opportunity: "Electro-Optic and Infrared Technology" and include the following information: title of the proposed effort, technical point of contact, telephone number, and e-mail address.

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

(1) Principal Investigator;
(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;
(6) A brief program plan and schedule summary with a one year base period and option years for continuing the effort; and
(6) A funding plan showing requested funding per fiscal year.

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

To ensure full, timely consideration for funding, white papers should be submitted **no later than** 11 December 2020. White papers received after that date will be considered as time and availability of funding permit.

ONR evaluations of the white papers will be issued via email notification on or about 21 December 2020

IV. ORAL PRESENTATIONS

ONR requests that Project Managers (PMs)/Principal Investigators (PIs) provide an expanded oral presentation from those Offerors whose proposed technologies have been identified as being of "particular value" to ONR. The purpose of the oral presentation is to provide greater detail than can be contained in the White Paper and to permit the evaluation panel to ask questions to better understand particular aspects of the proposed effort. However, any such request does not assure a subsequent award. Any Offeror whose White Paper technology was not identified as being of "particular value" to ONR will not be invited to make an oral presentation. The requested oral presentations will be scheduled separately. Due to current limitations presented by the COVID-19 pandemic, the oral presentations may need to be virtual. The time, location, and briefing format of the oral presentations, if requested, will be provided at a later date via email notification.

ONR evaluations of the oral presentations will be issued via email notification on or about 8 January2021.

V. FULL PROPOSAL SUBMISSION AND AWARD INFORMATION

Full proposals should be submitted under N00014-21-S-B001 by **5 February 2021** 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 N00014-21-S-B001. Full proposals for grants should be submitted via Grants.gov in accordance with Appendix 1 of N00014-21-S-B0001.

Technical Proposal/Content shall be single spaced and not exceed 15 pages. The cover page, resumes, bibliographies, and table of contents are excluded from the page count. For contract proposal submission, all submissions should be submitted electronically per section VIII unless submitting a classified proposal. Classified submissions can be mailed.

Full proposals for grants should be submitted in accordance with the instructions at BAA Section IV, Application and Submission Information, item 5, Submission of Grant Proposals through Grants.gov. All full proposals for grants must be submitted through www.grants.gov. The following information must be completed as follows in the SF 424 to ensure that the application is directed to the correct individual for review: Block 4a, Federal Identifier: Enter N00014; Block 4b, Agency Routing Number, Enter the three (3) digit Program Office Code 312) and the Program Officer's name, last name first, in brackets (Green). All attachments to the application should also include this identifier to ensure the proposal and its attachments are received by the appropriate Program Office.

ONR plans to allocate $2-3M dollars for efforts related to the Technical Areas in this Special Notice. The period of performance for projects will be one to three (1-3) years. Proposed multi-year efforts are requested to be structured with a base effort of 1 year, followed by option years pursuant to a program review on an annual basis. It is anticipated that multiple awards will be

made in Technical Areas 1-2 based on the quality of the proposed efforts. White papers are strongly encouraged from all offerors seeking funding.

Although ONR expects the above described program plan to be executed, ONR reserves the right to make changes according to program priorities and funding availability.

Selected proposers will be notified by March 2021. Selected projects will have an estimated award date of April 2021.

VI. SIGNIFICANT DATES AND TIMES

Event	Date	Time
White Paper Submission Date	11 December 2020	5:00pm Eastern
Notification of White Paper Evaluation*	21 December 2020	
Oral Presentation - Invitation Only*	29-30 December 2020	
Notification of Oral Presentation* Evaluation	8 January 2021	
Full Proposal Submission Date	5 February 2021	5:00pm Easter
Notification of Selection: Full Proposals *	March 2021	
Awards *	June 2021	

Note: * These are approximate dates**.**

VII. POINTS OF CONTACT

In addition to the points of contact listed in N0014-21-S-B0001 the specific points of contact for this announcement are listed below:

Technical Points of Contact:
Dr. Ben Conley, Benjamin.conley@navy.mil

Please copy:
Dr. Andrew Pipino, Scientific Support Contractor to ONR, Andrew.pipino.ctr@navy.mil

Business Point of Contact:
Stephen Hughes, Contracting Officer, stephen.t.hughes@navy.mil

VIII. ADDRESS FOR THE SUBMISSION OF WHITE PAPERS AND FULL PROPOSALS FOR CONTRACTS

White Papers/Full Proposal:
Unclassified white papers and full proposals should be submitted electronically to onr.ncr.312.list.fct@navy.mil by 5:00PM EST on 11 December 2020 (white paper) and 5 February 2021 (full proposals). Files exceeding 10MB in size should not be emailed, but instead transmitted via a file transfer service, for example DoD SAFE, https://safe.apps.mil. If you will

be using DoD SAFE, please request a Drop-Off link from Dr. Ben Conley, Benjamin.conley@navy.mil, at least 5 days prior to the submission deadline.

Classified White Papers/ Full Proposals:

Classified white papers and proposals are not expected under this Special Notice. However, if an offeror feels a classified white paper or proposal is necessary then classified white papers and proposals up to the general service (GENSER) Secret level should be mailed via traceable means, with the outer envelope addressed to the Office of Naval Research, Attn: Document Control Unit, ONR Code 43, 875 N. Randolph St., Arlington, VA 22203-1995. The inside envelope should indicate the classification level and be addressed as: Office of Naval Research, Attn: Dr. Ben Conley, ONR Code 312, 875 N. Randolph St., Arlington, VA 22203-1995. If you will be mailing a classified white paper or proposal, please send Dr. Ben Conley, Benjamin.conley@navy.mil, an unclassified email to notify him of your submission.

IX. 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 Special Notice will be addressed in the form of an Amendment and will be posted to the following web pages:

- Beta.same.gov Webpage –Contract Opportunities – https://beta.sam.gov/
- Grants.gov Webpage – http://www.grants.gov/
- ONR Special Notice Webpage - http://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Special-Notices.aspx

Questions regarding **White Papers or Full Proposals** should be submitted NLT two weeks before the dates recommended for receipt of White Papers and/or Full Proposals. Questions after this date may not be answered.