OBJECTIVE: Develop innovative radar-based imaging approaches to perform long-range battle damage assessments of ships.

DESCRIPTION: The timeliness, accuracy, and completeness of battle damage assessments (BDA) is critical to the success of any military engagement. BDA have traditionally utilized relatively short-range optical sensors onboard aircraft operating in close proximity. However, the safe airspace access required to observe the target at close range is not possible in anti-access/area denial situations. BDA utilizing long-range radar tracking and imaging is an alternative. Radar does not provide the level of high resolution and high definition consistent with human visual characteristics. As a result, there is a need for innovative approaches to extract comparable information from radar returns for the BDA of ships at sea from ranges that may exceed 50 nautical miles (nmi). Gross changes such as the vessel going dead-in-the-water or rotating antennas ceasing operation are easily discernable with radar. More challenging is determining if the vessel is listing and what type of external structural damage has occurred. Advances are needed in single and multi-channel inverse synthetic aperture radar (ISAR) imaging techniques. Advantages of interferometric ISAR should be considered, as some fielded radar systems are capable of supporting that mode. Consideration should be given to scenarios that allow imaging to be underway immediately prior to weapon impact, at the time of the impact, and at various times after impact. Transition of this product is to be as an appliance within the Navy's Minotaur control application.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by DoD 5220.22-M, National Industrial Security Program Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Security Service (DSS). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth by DSS and NAVAIR in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material IAW DoD 5220.22-M during the advanced phases of this contract.

PHASE I: Utilize self-generated simulated data to develop single and multi-channel (possibly interferometric) ISAR imaging approaches capable of providing ship BDA comparable in respects to that possible from short-range (20 km or less in mid-latitude oceanic environments) visual imagery. (Note: While computational resource restrictions will not be imposed in Phase I, the product will ultimately be hosted on existing Navy maritime surveillance platforms such as the P-8A, MQ-4C, MQ-8B and MH-60R.) The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Further design and develop the concept identified in Phase I. Working with the sponsor, prepare an at-sea airborne radar collection plan for use during a Navy live fire missile exercise involving a target ship and remote airborne collection platform. Utilize the collected data to mature the techniques explored in Phase I. Provide a complete assessment of the approaches and develop a transition plan. Work in Phase II may become classified. Please see note in Description paragraph.

PHASE III DUAL-USE APPLICATIONS: Mature the algorithms to be suitable for transition to Navy maritime surveillance radar systems or
as a capability within the Navy’s Minotaur control application. Possible dual use applications include long-range ship imaging and status assessment by organizations like the Coast Guard or possibly commercial radar satellite providers.

REFERENCES:


KEYWORDS: Battle Damage Assessment; BDA; Long Range Imaging; Ship Imaging; Inverse Synthetic Aperture Radar; Maritime Surveillance; Radar