

IN-FIELD APPLICATIONS OF AN AUTONOMOUS UNDERWATER VEHICLE MAGNETOMETER FOR MUNITIONS AND EXPLOSIVES OF CONCERN DETECTION

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The proliferation of commercial fishing, recreational activities, and offshore energy development on the continental shelf has led to increased contact with legacy munitions and explosives of concern (MEC), thereby requiring more effective methods for MEC detection. The application of traditional acoustic technology, while effective in largely homogenous substrates, becomes problematic for detecting MEC with increasingly cluttered environments and in cases where MEC burial has occurred. Alternative remote sensing technology, such as optics and electromagnetics, are less susceptible to detection issues associated with burial or heterogeneous settings, but are often range limited. To overcome this issue, the University of Delaware has utilized an autonomous underwater vehicle (AUV) equipped with a magnetometer, allowing for near-seabed surveying for surficial and buried MEC. A Geometrics 880 caesium vapor magnetometer was fitted to the front of a Teledyne Gavia AUV, and protocols for calibration, diurnal variation compensation, and vehicle noise removal were established, with a system noise threshold determined at $< 5\text{nT}$. The AUV magnetometer was initially field tested in Tampa Bay for an ESTCP study, where munitions as small as 60mm mortars were detectable at altitudes of 2m after vehicle noise removal. As part of a Bureau of Ocean Energy Management (BOEM) study, surveys simulating buried munitions determined objects as small as 155mm artillery shells could be detected at burial depths of 2m or less with the AUV magnetometer. Further, the magnetometer aided MEC detection in side-scan sonar by identifying anthropogenic targets from other surficial objects that could not be clearly identified. In an ongoing SERDP study, the AUV magnetometer performance is being compared to the positioning of an acoustic tracking system monitoring the position of acoustically tagged surrogate munitions in the Delaware Bay. Challenges remain concerning classification of MEC targets and considerations are given concerning future efforts to address MEC classification with magnetometry.