**Underwater targets detection and classification Using**

**Enhanced EMI models**

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UXO contamination in underwater environments is a significant military and civilian problem worldwide. In the USA alone, there are ten million acres of underwater areas, that are contaminated with UXO and requires cleanups. Underwater UXO remediation efforts are very expensive, dangerous, and time-consuming process. Although, most underwater targets sensing technologies such as, magnetometry, side scan sonar and laser line scanners can provide wide-area coverage, they often do not provide enough information to accurately distinguish UXO from buried clutter. To improve the efficiency and effectiveness of UXO remediation efforts, advanced sensing technologies and data processing and analysis methods have been developed to distinguish UXO more accurately from harmless scrap metal in underwater environments. Among these systems an underwater EMI sensor, called the UltraTEMA-marine towed array, has emerged as one of the potential single-pass marine dynamic classification technologies for wide-area assessment and full coverage surveys. The system uses four transmit (Tx) coils and twelve vector receivers to detect the presence of objects in the seabed. It illuminates targets from multiple sides and records their responses in a vector form. As a result, the system provides high spatial resolution data, which in return support the enhanced EMI models and signal processing algorithms to detect, localize, and characterize underwater metallic objects accurately. In 2019, the SERDP/ESTCP MR program established a testbed site at Sequim Bay to evaluate multiple underwater sensing technologies under different environmental conditions. The site is in native UXO-free water and encompasses a mixture of muddy and sandy sediments at depths of 5-30 meters. In this paper, the enhanced UW EMI data inversion and classification algorithms are applied to single-pass UltraTEMA data sets collected at Sequim Bay, WA UW calibration and blind grids. Both data sets are processed, and targets are classification results are demonstrated.