Background:
Superconducting Quantum Interference Device (SQUID) magnetometers provide high sensitivity vector measurements of the magnetic field. First order gradiometers are typically designed with five independent gradient channels, which permits characterization of the local tensor-gradient field. As with total field magnetometers, tensor gradiometers are insensitive to field changes arising from sensor rotation in mobile operation. The SQUID sensor array to be used was developed in previous projects with the Department of Energy and Naval Explosive Ordnance Disposal Technology Division.

Objective:
This project will explore the viability of deploying a SQUID sensor array in an airborne platform in order to improve sensitivity to unexploded ordnance (UXO).

Summary of Process/Technology:
The research approach will focus on developing and demonstrating the capability of high temperature superconducting (HTS) SQUID multi-axis magnetometers and gradiometers for standoff detection of surface and buried UXO. To meet these objectives, the following issues will be systematically addressed: (1) HTS SQUID sensor performance when exposed to large fields and field changes; (2) Compensation of magnetic noise generated by movement of the cryogenic vessel; (3) Active real-time compensation of HTS SQUID sensors based on linear movement through the Earth's field; (4) Development and construction of an extremely stable boom for mounting the SQUID on a helicopter platform; (5) Integration of HTS SQUID electronics packages with current Oak Ridge National Laboratory airborne magnetometer positioning, navigation, and recording systems; and (6) Determination and quantification of the detection footprint from a single HTS SQUID array.

Benefit:
The SQUID array is expected to provide a level of sensitivity and detection previously unavailable in airborne-based systems, thus enabling the detection and mapping of smaller ordnance items than possible with current cesium vapor magnetometer arrays. As a corollary, this system is expected to enable detection and mapping from greater standoff distances than with current airborne platforms. Vector anomaly attributes also have the potential to improve classification.

Accomplishments:
This project began in FY 2002. Accomplishments will be noted upon completion of the project.

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