Machinery Research & Engineering Department
Advanced Machinery Research Division Proposal SOW
NSWC
High Temperature Superconducting (HTS) Degaussing System Assessment

POC: Dr. Peter Cho, Code 984
TPOCs: Tom Fikse, NSWCCD, Code 984 and Brian Fitzpatrick, Code 984

Technical Objective:
The technical objective of this task is to perform a feasibility study to determine the quantitative impact at the ship system level to replace existing copper degaussing coils with high temperature superconducting (HTS).

Background
Stealth, specifically underwater electromagnetic signature reduction, has been identified as a major naval requirement. The need for improved signature reduction technologies is especially urgent in light of the change in the navy's missions toward littoral zones, and the ever-increasing availability of naval mines that are equipped with improved sensing technologies to accurately target a ship based on its electromagnetic field signature. The U.S. Navy has a critical need for near field underwater electromagnetic signature reduction systems.

The Advanced Degaussing Technology program has developed and demonstrated technologies that can reduce a surface ship's ferromagnetic field signature to levels significantly lower than present limits. This technology is being installed on the LPD-17, and is planned for the T-AKE, DD(X), and other future classes. The improved signature reduction comes at a cost of increased system weight and volume and issues associated with the installation of the system as part of the ship fabrication process.
The proposed feasibility study will begin development of a parametric tools which can be modified to evaluate the installation of the a HTS degaussing system on specific ship classes. The parametric tools would quantify potential reductions in weight, assess any changes in system cost, and address savings in ship fabrication versus existing copper cable degaussing systems. The study will use the LPD-17 as the comparative baseline. The study will be based upon more than 15 years of experience with naval applications of superconductivity. The analysis will draw upon NSWCCD lessons learned demonstrating superconductive applications such as the low temperature superconductive homopolar motor, the high temperature superconductive homopolar motor, the Advanced Lightweight Influence Sweep System (ALISS) (the largest conductively cooled superconductive magnetic influence mine countermeasures system ever built), the HTS synchronous motor work, and the associated cryogenic cooling work for these initiatives.

Statement of Work:

Task 1: Superconducting Cable Assessment

The contractor will assess and document the state of technology for High Temperature Superconducting (HTS) power cables to shipboard degaussing, focusing on cables developed under the Department of Energy's (DOE) Superconducting Partnership with Industry (SPI) program. Projections will be made as to performance, fabrication techniques (including splicing of cable segments), costs, refrigeration requirements, and maturity of conductor material (BSCCO, MgB2, and 2nd Generation YBCO). The mechanical properties of the cables will be reviewed to develop preliminary installation guidelines and assess the applicability of those guidelines to current ship installation practices. (Period of performance not more than 3 months)

Deliverables:

- Monthly Progress Report
- Superconductive Cable Assessment