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Wed-Mo-Po.05-02: Design and cost analysis of an HTS magnet array for ship magnetic signature replication in naval minesweeping

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Naval minesweeping is a crucial initial operation in naval warfare, ensuring safe passage for friendly forces by clearing sea lanes of mines deployed by adversaries. Current minesweeping methods utilize permanent magnets or copper cables to trigger magnetic mines. Generating stronger magnetic fields enables the clearance of deeply laid mines and the replication of larger vessels' signatures. However, permanent magnets are limited by their remanent flux density, while copper cables require significant volume due to their low current density. To address these limitations, the application of superconducting technology has been explored to develop lighter, higher-flux minesweeping magnets. In particular, No-Insulation (NI) High-Temperature Superconducting (HTS) magnets offer the potential for generating significantly stronger magnetic fields, providing substantial advantages in minesweeping operations. This study focuses on calculating ship magnetic signatures and designing an NI HTS magnet array to replicate these signatures. Furthermore, we calculate the required HTS conductor length for replicating signatures of various vessel sizes and conduct a cost analysis of NI HTS minesweeping magnet based on these calculations.

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