

The Yamato I

IN the movie, *The Hunt for Red October*, top secret Soviet submarine is powered by a superconductor electromagneto-hydrodynamic propulsion system. By running without vibration and cavitation (the churning up of water) of a propeller, this fictional submarine was as invisible to sonar in water as our Stealth fighters are to radar in the air.

In 1992, Mitsubishi Heavy Industries started sea trials of the *Yamato I*, the world's first publicly announced superconduction electromagneto-hydrodynamic (MHD) propulsion ship. One of the most significant advantages of this drive system is the fact that it contains no moving parts. Replacing the screw-driven propeller with MHD eliminates the vibration and cavitation most sea crafts cause. The churning effect of a propeller limits speed and wears the mechanical drive parts of ocean vessels. The sound that these vibrations

begin until the 1960s, however. Recent advances in superconductors made it possible for Mitsubishi Heavy Industries to build the *Yamato I*.

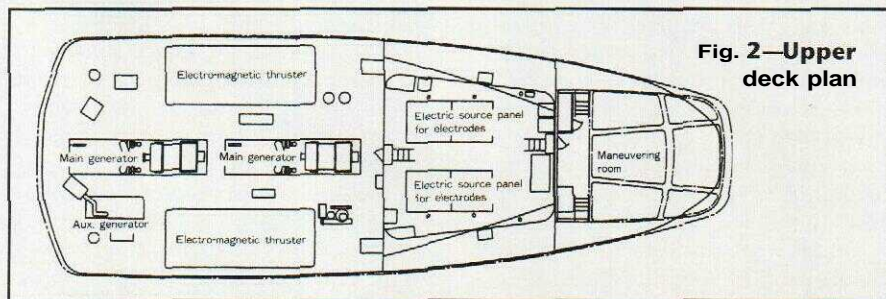
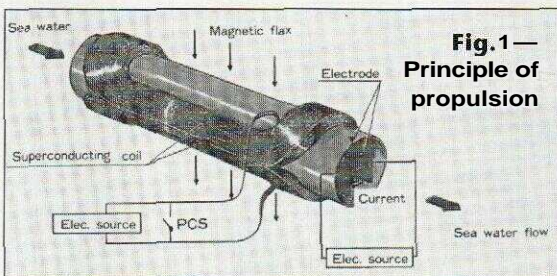
The *Yamato's* power drive has been



The *Yamato I*

designed to maximize thrust by passing an electric current through a magnetic field submerged in sea water. The interaction of the magnetic field charges the chlorine and sodium atoms in sea water, and their physical movement creates thrust.

A superconducting electromagnet surrounds each of the ship's two thrusters. To keep these electromagnets cold, they are vacuum sealed in a chamber filled with liquid helium. Two electrodes are set into the tubes of each engine so that they are covered with sea water. The magnetic field, in combination with electric current, excites the atoms in the sea water, creating thrust. The ship's diesel en-



generate provides the signature sonar uses to locate and identify vessels.

Science recognized the principle behind the MHD about 150 years ago, and it is relatively simple. Serious exploration into the feasibility of MHD didn't

generate all electricity needed to run the ship.

With the potential to drive ocean vessels at 100 knots, the MHD power drive could easily become the engine for seagoing ships built in the early twenty-

first century. The propeller might soon join the sail as a historical example of developments in modern sea transportation.

Sources at Mitsubishi inform me that the *Yamato I* has completed all tests to date "almost as expected." In order to reach practical application and production, researchers are now focused on increasing densities of the magnetic flux (see Fig. 1), reducing weight of the superconductors, and improving performance of the electrodes.


Recalling the Facts

1. How long ago was the basic principle for this power system discovered?
2. When did serious research into MHD as a power drive for ships begin?
3. Explain how an MHD drive works.

TD




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