



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Alexander J. Sercel	Project Number 31910
Project Title The Hunt for Red October: Fact or Fiction? An Experimental Validation of Magnetohydrodynamic Propulsion	
Abstract Objectives/Goals The purpose of this experiment was to test the analytical MHD propulsion theory. The theory states that thrust will increase linearly with current and magnetic field strength and therefore inversely with increased ohmic resistance of the working fluid and linearly with voltage. Methods/Materials To test the theory, I built an MHD propulsion system using rare earth magnets and a series of batteries, and I prepared a bath of saturated salt water in which to run my propulsion system. To predict thrust, I measured the magnitude of the magnetic field, the resistance of the water, the chamber dimensions, and the applied voltage. Then I measured the thrust using a video camera tracking jet velocity by following jet bubbles as they moved past a ruler and then calculated thrust with the fluid momentum equation. I employed the MHD equations and used spreadsheets to analyze the data and compare the expected and measured thrust values. Results The relationship between the voltage driving the engine and the thrust produced is linear and is highly correlated. The theoretical model was perfectly linear and followed the experimental values at low voltages, but at higher voltages, the experimental values were greater. Conclusions/Discussion I found the expected and measured thrust values to be significantly similar and measured thrust trending closely to prediction. The relationship between voltage and thrust produced is statistically significant, allowing me to perform inference on the population of all MHD systems. These results confirm the appropriateness of using classic MHD theory to model MHD propulsion system performance.	
Summary Statement This study modeled MHD theory and attempted to provide evidence to either validate or discredit the theoretical model by comparing it to an experimental trial.	
Help Received My father tutored me in electrical and MHD theory and my mother helped as a lab assistant while I constructed my apparatus and assisted me with display construction.	