Sample Abstract

Title: Magnetic Propulsion
Submitted By: Name 1, Name 2, Name 3..

Objectives/Goals
This study aimed to determine which ferromagnetic material makes the best electromagnetic projectile for use in magnetic propulsion systems.

Methods/Materials
Three common magnetic materials Iron, Cobalt, and Nickel were chosen for this study. An experimental apparatus was constructed of plastic tubing through which the magnetic projectiles are accelerated. To generate a strong magnetic field, magnet wire was wound in a coil around the tube. A large voltage stored in a capacitor was discharged rapidly into the coil providing sufficiently high currents resulting in a large magnetic field along the axis of the tube. Differences in the magnetic capabilities of each material can then be determined by measuring the speeds of the different magnetic projectiles. Projectile speeds are determined by measuring the time it takes the projectiles to cover a fixed distance inside the tube. Great care was taken to cancel out unwanted variation caused by the experimental setup including sidewall collision, air friction, and weight differences between elements. Each projectile was weighed to be approximately the same weight to cancel out the effect of gravity. Conducting multiple trials cancels out the random effects of sidewall collision and air friction.

Results
Iron was 6% faster than Cobalt and nearly double the speed of Nickel.

Conclusions/Discussion
Based on literature research, Iron has the highest coercive magnetic force and so Iron should be the best magnetic projectile. However, the results in this experiment are inconclusive because sample weight differences between Cobalt and Iron turned out to be about the same as the speed differences measured. The reason Iron did not go significantly faster than Cobalt is still unclear. Literature research shows that Iron could be saturating at the high flux densities experienced in the coil so this may explain the anomaly. Future experiments could include more elements like Niobium (NB) or Samarium-Cobalt (alloy) and also investigating a detachable mechanism that ejects the payload as it passes thru the coil thereby eliminating magnetic drag caused by reversing magnetic polarity as the projectile traverses the length of the coil. With these techniques, Magnetic propulsion may enable more efficient delivery of payloads into space using magnets instead of fossil fuels.

Summary
This project attempts to determine which ferromagnetic material is best for magnetic propulsion systems.