



CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

Name(s) Ryan D. Kmet	Project Number J0921
Project Title Railgun: Turning Current Resources into Tomorrow's Shocking Solutions	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment was to determine, of copper, aluminum, brass, and molybdenum sheet, which material would allow the best conductivity and lowest level of degradation when used with a limited power source as rails in a railgun. The hypothesis was that, given its electrical conductivity rating and degradation point, copper would achieve the most effective results.</p> <p>Methods/Materials Sets of four miniature railguns were constructed using wood blocks and cut sheets of copper, aluminum, brass, and molybdenum, a 6-volt battery pack, and a projectile made of a 1.5-inch steel nail and two 3/8-inch cylindrical magnets with the poles opposing. The rails were charged, the projectile was released ten times on each set of rails, and the results were recorded.</p> <p>Results The conclusion partially supported the hypothesis in that the copper sheet was an effective conductive material for the railgun rails. However, the aluminum, brass, and molybdenum were successful, as well, though to lesser degrees. Additionally, there was an undesirable arcing seen with the propulsion of the projectile along all the rails, which is demonstrative of one of the biggest issues of the railguns in use today.</p> <p>Conclusions/Discussion The limited power source in this experiment failed to adequately stress the materials used for the rails, so an absolute conclusion on the optimal material is not possible without further research. Though the copper rails were slightly more conductive, considerations for the optimal material also need to include cost and degradation. A highly conductive but costly material with a low degradation point will not be any more optimal than a less conductive and less expensive material with a higher degradation point. Further research could include alloy metals and protective coatings applied to them for the rails, as well as a larger power supply and possibly a capacitor bank to store this power in order to more effectively charge the rails and adequately stress them to better determine degradation.</p>	
Summary Statement The purpose of this experiment was to determine, of copper, aluminum, brass, and molybdenum sheet, which material would allow the best conductivity and lowest level of degradation when used with a limited power source as rails in a railgun.	
Help Received Mother and stepfather purchased the materials and supervised the experiment, and Cal City Ace Hardware generously assisted in cutting the metals and wood blocks to size.	