



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Ronald W. Lee	Project Number S0911
Project Title The Construction and Testing of a Hybrid Rail/Coil Electromagnetic Launcher	
Objectives/Goals This project aims to build an operational dual stage electromagnetic launcher with a coil gun as its initial stage and a rail gun as the second stage. A number of tests will be conducted that includes measuring of the velocity of the steel projectile and its energy efficiency to assess the practicality of the launcher.	
Abstract Methods/Materials The launcher itself was built in accordance to a schematic created with the help of my mentor. Also, in order to measure the velocity of the steel projectile shot from the launcher, an improvised velocity meter was built. The test itself quantifies the velocity, kinetic energy, and energy efficiency when the projectiles were fired from only the coil and rail stage, and the combined electromagnetic launcher. The time the projectile takes to cover an established distance was recorded for several voltage values stored in the capacitor banks. When the separate stages were tested, the capacitors were charged to approximately the same voltage and fired. For the use of both stages together, the capacitors attached to the rails were charged to a constant charge of 250V. With the measured time and distance, the velocity and kinetic energy was calculated and the energy efficiency (energy output to energy input) was determined. The velocity was measured in meters/second while the energy was measure in joules.	
Results Overall, through the three trials conducted at 175, 200, and 275 volts, the combined launcher#s velocity, energy, and efficiency were greater than that of the separate stages.	
Conclusions/Discussion This data showed that the dual stage launcher is overall more effective (in efficiency and velocity) in shooting a steel projectile. In conclusion, the project demonstrates the feasibility of constructing such a launcher.	
Summary Statement My project succeeded in constructing a working hybrid electromagnetic launcher and demonstrated that this setup produces a higher projectile velocity, kinetic energy, and efficiency than those produced by the separate launchers.	
Help Received Worked under supervision of Mr. Lee (my father); Mr. Starodub gave guidance in conducting the research; Ines Madison helped in providing tools to construct parts of the project; Sister helped in taking pictures and videos of the project	