



**CALIFORNIA STATE SCIENCE FAIR  
2008 PROJECT SUMMARY**

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| <b>Name(s)</b><br><b>Mitchell T. Maas</b>  | <b>Project Number</b><br><b>S0808</b> |
| <b>Project Title</b><br><b>Electromagnetic Propulsion: Phase II</b>  |                                       |
| <b>Objectives/Goals</b><br>Does changing the permanent magnetic field affect the launch height of the rocket more than changing the strength of the electromagnetic field?   |                                       |
| <b>Abstract</b>  |                                       |
| <b>Methods/Materials</b><br>Methods: Create an electromagnetic launcher to fire a rocket at a 45 degree angle to see whether permanent magnets or electromagnets launch the rocket farther.<br><br>Test method: Test the difference between the electromagnetic field utilizing 1, 2, 3 and 4 parallel wired capacitor configurations vs varying the permanent magnetic field by testing 3, 6, 9, and 12 magnet configurations.<br><br>Materials: Magnet wire (29 ga.) to build coil, four 4400 uf capacitors, limiting resistor, 110 volt DC bridge, electrical wire (18 ga.), 1/8 in wood dowel x 6 in long, 1 in diameter cardboard tube, balsa wood, foam, glue, 12 1/4 in rare-earth permanent magnets, 2 electrical switches, and 110v AC power connector, box to hold electronics, and a contactor. |                                       |
| <b>Results</b><br>I experimented using a different number of capacitors and magnets to see which one would launch the rocket farther on a 45 degree angle. There were 17 total tests completed. I was able to observe that adding more capacitors did not help the distance the rocket traveled. In fact, when I tested for three and four parallel charged capacitors, I observed that the distance the rocket flew was the same. I compared and graphed the results by calculating the percentage difference between the electromagnet configurations and the permanent magnet configurations. This positively showed that the permanent magnets have more affect on the launch distance of the rocket in my test model, than increasing the electromagnetic field.                                      |                                       |
| <b>Conclusions/Discussion</b><br>My hypothesis was incorrect. I had predicted that the energy stored in the additional capacitors would make the electromagnetic field stronger than the permanent magnetic field, therefore causing the rocket to go farther, but I was wrong. I can conclude this because of the fact that when I analyzed all the test data, the electromagnetic field outperformed the permanent magnetic field by over 3X. I concluded that there were no performance benefits after the fourth capacitor was added. I feel that the additional capacitance was not being utilized in my test model. I believe that if two parallel coils were used, the additional capacitance could have resulted in a higher electromagnetic launch.   |                                       |
| <b>Summary Statement</b><br>A study to find the effect of changing the electromagnet field vs a fixed permanent magnetic field.  |                                       |
| <b>Help Received</b><br>Mr. James Edman reviewed my schematic diagram. My father helped assemble the box and measure the rocket launch distance. My mother also verified the rocket launch distance.   |                                       |