



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

Name(s) Ryan D. Barry	Project Number J0998
Project Title Velocity Gain in a Gaussian Rifle	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project was to determine how the velocity of a projectile is affected by adding additional stages to a Gaussian Rifle (or Magnetic Linear Accelerator) that is made up of half inch neodymium magnets and half inch steel ball bearings.</p> <p>Methods/Materials To test my objective, I built 3 components. The first component was the Magnetic Linear Accelerator (MLA), which was built using 2 straight pieces of aluminum, taped to a piece of wood, creating a 1/4" gap for the steel ball bearing to roll on. Each stage of the MLA was created using two 1/2" neodymium magnets and two 1/2" steel ball bearings. The second component was a ramp to provide a consistent starting velocity. This was made using a 10" long piece of 3/4" PVC pipe taped to a wooden dowel. The final component was a sandbox to provide a landing area for the projectile. I first tested the MLA with one stage, launching the steel ball into the sandbox 5 times to ensure valid data. I then tested the MLA with additional stages until I had a total of 6 stages. For each number of stages, I ran the test 5 times. I then plugged the average distance for each number of stages into an equation to determine the velocity of the projectile and compared the result.</p> <p>Results The results showed that increasing the number of stages, increased the velocity of the projectile. For one stage the data showed a velocity of 5.02 m/s, for two stages the average velocity was 5.79 m/s, for three stages the average velocity was 6.60 m/s, for four stages the average velocity was 7.18 m/s, for five stages the average velocity was 7.49 m/s and for six stages the average velocity was 7.78 m/s. These velocities provide increases between stages of 15.34%, 13.99%, 8.79%, 4.32% and 3.87%.</p> <p>Conclusions/Discussion As you can see from the results, adding stages to the MLA did increase the velocity of the projectile, however the amount of increase for each additional stage got smaller. My hypothesis of a 15% increase was almost exactly the percentage increase between one stage and two stages but after two stages the percentage of velocity increase dropped significantly. Each additional stage is less significant, and I would guess that if I kept adding additional stages, the amount of increase in velocity would eventually drop to almost 0%.</p>	
Summary Statement My project is to determine the velocity increase from adding stages to a Magnetic Linear Accelerator.	
Help Received Dr. Dunn provided advice; Mother and Father helped with board; Father assisted with building components and running tests.	