



**CALIFORNIA STATE SCIENCE FAIR  
2009 PROJECT SUMMARY**

<b>Name(s)</b> <b>Madison E. East</b>	<b>Project Number</b> <b>J0908</b>
<b>Project Title</b> <b>The Effect of Air Molecules and Gravity on the Distance Traveled by a Maglev Train as Its Mass Increases</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> My objective was to determine what affect air molecules and gravity have on a Maglev train as the trains' mass increases. I believe that a Maglev train will travel 5 cm when carrying 12 U.S. quarters when it is affected by a constant force even as gravity and air molecules slow the trains' motion.</p> <p><b>Methods/Materials</b> A Maglev train was made by gluing high force magnetic strips to the bottom of a train model and also placing them as tracks on a wooden base. The magnetic polarity between the train and its' tracks was reversed and the train was levitated. The track sides were made of smooth plastic that did not significantly slow the Maglev (little friction). Firing a Pirates of the Caribbean pistol upside down and stabilized was used as a constant force on the train. The train started from the same Happy Bunny marker for each try. 1 U.S. quarter (average mass of 5.67 grams)was added and taped to the train each try to increase the trains' mass. I measured and graphed the distance traveled by the train in cm after each try.</p> <p><b>Results</b> The Maglev train traveled 5 cm when it carried 14 U.S. quarters. As the train mass increased with each quarter, the distance the train traveled decreased: there is a correlation between the distance the train can go and the weight it carries. The only forces that affected the train model besides the constant force (the pistol hammer) were the force of gravity (9.8 m/s/s) and the air molecules slowing down the train (it created drag).</p> <p><b>Conclusions/Discussion</b> The hypothesis was correct since the train carried 14 U.S. quarters the distance of 5 cm. Gravity (9.8 m/s/s) was pulling the free floating train down and the air molecules were slowing the trains' movement as the train slammed into them creating a drag on the train. The force of gravity and the drag of air molecules have a large impact on the distance the Maglev train travels as the trains' mass increases. The pistol hammer force is a constant and as the mass of the train is increasing, the acceleration will decrease and the train will not travel as far. Without the force of gravity and air molecules slowing the train, the train would travel forever at the same speed.</p>	
<b>Summary Statement</b> Gravity and air molecules affect the distance traveled by a Maglev train as its' mass increases.	
<b>Help Received</b> My Dad bought supplies for me and let me use the family computer.	