CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Zheqi Tan

Project Number
S0223

Project Title
Optimal Projectile Mass

Abstract

Objectives/Goals
When designing projectiles, an important consideration is the mass, for it affects the range of the projectile. The hypothesis states that due to air resistance, the optimal mass is not necessarily the lightest possible, for the force of drag increases as the velocity increases. Instead, the prime mass would be the one that maximizes the distance based on the impact of air resistance and mass.

Methods/Materials
To determine this number, a launch machine propelled numerous cardboard projectiles, each with all variables fixed except the weight, multiple times to note the distance each traveled. The launches were done under mostly controlled conditions, although the wind proved somewhat unpredictable.

Results
The data was then consolidated into charts and analyzed to determine the optimal mass, which was found to be projectile #4#s. The lightest projectile (#1) traveled significantly less than projectile number 4, while the heaviest one (#5) also had less range than #4. However, there was more variance than expected in the launches of projectile #1.

Conclusions/Discussion
While the hypothesis is supported, more data is needed to conclusively accept it. With the construction of some heavier cylinders, the parabolic trend would have stronger support.

Summary Statement
The goal is to optimize the mass of the projectile so that it travels the farthest as a result of minimizing the drag and maximizing the launch velocity.

Help Received
Lance Wright helped with building the launch machine, advised on how to do the experiment, and helped with the experimentation; Ms. Haws helped edit drafts; Mr. Hendrick allowed us to use his classroom