CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Canyon C. Robins

Project Number
J0128

Project Title
The Green Machine: It's Only Rocket Science

Abstract

Objectives/Goals
The objective of my project was to determine the effect of altering the mass and aerodynamics of a vehicle (rocket) on its fuel efficiency.

Methods/Materials
A pressurized, water powered, bottle rocket was chosen as the vehicle to remove the variables of ground friction and driver's style. After designing the optimal test rocket and establishing the controlled variables--namely the amount of fuel (propellant) and engine thrust (air pressure)--through testing, experiments were conducted to determine the effect of varying amounts of mass and different aerodynamics on the relative fuel efficiency of the rocket as measured by the altitude achieved during each test flight.

The effect of mass on fuel efficiency was determined by placing varying amounts of cargo in the test rocket and calculating the altitude that each flight reached. The effect of aerodynamics on fuel efficiency was determined by placing nose cones of varying angles on the test rocket and calculating the altitude that each flight reached. The altitude was determined by using a sight, distance measurements, and trigonometry.

Results
The mass of a vehicle has a significant impact on its fuel efficiency. For every gram added to the mass of the test rocket, the altitude reached was reduced on average by 0.4 feet (using the controlled amount of fuel and engine thrust).

A vehicle#s aerodynamics has a significant impact on its fuel efficiency. Within a certain range, for every degree added to the angle of the nose cone (worsening its aerodynamics) the altitude reached was reduced on average by 0.6 feet(using the controlled amount of fuel and engine thrust).

Conclusions/Discussion
Lighter vehicles (rockets carrying less mass) and more aerodynamic vehicles (rockets with sharper nose cones) were much more fuel efficient (achieved higher altitudes) when controlling for the amount of fuel (propellant) and engine thrust (air pressure). These results confirmed my hypothesis and helped me understand the impact mass and aerodynamics have on a vehicle#s fuel efficiency.

Summary Statement
My project was to determine the effect of altering the mass and aerodynamics of a vehicle on its fuel efficiency.

Help Received
My dad taught me the math and physics I used to design and complete this experiment. He was also an extra set of hands during rocket launches. My mom helped me lay out my backboard.