CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Laurel A. Kroo

Project Number
J0111

Project Title
Drag Reduction of a Mini Cooper

Abstract

Objectives/Goals
The objective of this project is to reduce the drag or the air resistance on a Mini Cooper (a type of car). From my references, I read that 2/3 of the power used by a car (and the fuel required) is caused by aerodynamic drag. By reducing the drag on the Mini Cooper, I hope to raise the efficiency (miles per gallon), and therefore be conservative with car gas, and precious nonrenewable resources like oil.

Methods/Materials
One of the main problems I came across was how to measure drag, and came up with a set up, that with sensitive enough equipment, would work. A small model of a Mini Cooper was placed on top of a car, and in a wind tunnel. A string was tied to the front of the car, and the string was threaded over a pulley. At the end of the string was a weight, so when the car was pulled back from wind, the weight lifted a certain amount. The weight rested on a scale, so by subtracting the original weight from the drag-impacted weight, the drag was measured. This worked but I had to make sure that variations between each test could be avoided. This setup was tested in a wind tunnel and also mounted on top of my dads car.

Results
From research, I found that most of the drag on the car is related to how the air comes off the back of the car. This separated flow creates a partial vacuum that is responsible for most of the drag. By creating attachments, I found I could make that area of separated flow smaller. A good visualization of this is the process of narrowing the wake of a boat. My first attachment design consisted of two vertical wings attached at the back sides of the car and curved inward, which narrowed the flow. My second design was one wing down the center. This resulted in increasing the drag instead of lowering it. Several other designs were tested, but they had little effect on the drag. The results I collected in the wind tunnel supported the results I got from testing the set up on the car. My first attachment design was the most successful and it reduced the total drag by 12.5%.

Conclusions/Discussion
This project is interesting because it can save money for people if applied to full sized cars, and it can help our environment. It can keep the air clean, and the ground still full of oils that are taken to make car gas.

Summary Statement
By adding attachments to the back of a Mini Cooper, I reduced the drag by 12.5% and therefore substantially increased the miles per gallon.

Help Received
My dad helped me with many of the equations in measuring drag, such as Drag coefficients, and explained a few concepts to me such as Reynolds numbers. I used lab equipment (wind tunnel) under supervision of Professor Bradshaw at Stanford University.