CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Amber J. Schisler

Project Number
J0128

Project Title
Which Airfoil Design Generates the Most Lift?

Abstract

Objectives/Goals
The purpose of this experiment was to determine which of four airfoil designs would generate the greatest lift. Airfoil One was the most similarly shaped to common aircraft wings. Airfoil Two was shaped in a triangular fashion with the same height and peak position as Airfoil One. The peak of Airfoil Three was moved to the center of the wing with an oval arced shaped top. Airfoil Four was rectangular. The hypothesis states that if airfoil models One through Four are all tested in a wind tunnel with a 0º angle of attack, Airfoil One will generate the most lift.

Methods/Materials
On December 23, 2008 four different airfoil models with equal bottom areas and varying only the top shapes, were tested in a 20.9 m/sec (approx. 46 mph) speed wind tunnel constructed for this experiment. Each airfoil was leveled at a 0° angle of attack before each test. Before each test, the scale was zeroed. The electric powered blower was then turned on and permitted to reach full speed. The grams of lift were then measured in negative to show the amount of lift. The blower was unplugged and allowed to stop. Each wing was tested 20 times.

Results
It was concluded that Airfoil Three generated the most lift, with an average 72 grams of lift. Airfoil One generated the second most lift with an average of 35 grams. Airfoil Two was third with an average of 29 grams of lift. Airfoil Four generated no lift, (0 grams).

Conclusions/Discussion
The hypothesis was proven incorrect. Airfoil One did not generate the most lift. Airfoil Three generated the most lift due to the oval arc shape. Lift is caused by the faster movement of air on the top side of an airfoil. Having the peak of Airfoil Three in the center of the top span of the wing provided a greater surface area for the air pressure to build up as the air moved over the wing, thus creating a more concentrated area of low pressure in back of the peak. Airfoil Four was rectangular, and this was the reason it did not generate any lift with a 0º angle of attack. This airfoil is symmetrical (top to bottom) and at a 0º angle of attack, there was equal pressure on the top and bottom side of the wing; therefore, no lift was generated. It was noticed that airfoils Three and Four needed to be anchored to the scale to prevent them from blowing backwards. Presumably, these two designs had the most drag.

Summary Statement
The focus of this project was to test the amount of lift generated by differently designed airfoils.

Help Received
My mother helped me proof-read my report, and a family friend, Paul Lechner, built the wind tunnel for me.