CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
J0112

Project Title
Pro-Newton vs. Pro-Bernoulli: Which Theory Is Misconcepted?

Abstract

Objectives/Goals
The objective is to determine if wing-shape is the sole factor to creating lift on airfoils.

Methods/Materials
A NACA 0019 and NACA 4219 airfoil were each made out of poster board and foam core. An open circuit wind tunnel was made out of the materials suggested and figures and directions given from the Baals company website in conjunction with NASA kids' curriculum (http://Idaps.arc.nasa.gov/Curriculum/tunnel.html#test_section). Each airfoil was tested in the wind tunnel from a zero-degree to a twenty-degree angle of attack. Lift and drag were measured using two force probs from Vernier Instruments.

Results
At a zero degree angle of attack, the symmetrical airfoil, NACA airfoil 0019, was not able to lift at all, while the cambered airfoil, NACA airfoil 4219, was able to lift a little amount at a zero degree angle of attack. Finally, between a four-and-five-degree angle of attack, both airfoils lifted the same amounts. Finally, alhtough lift was the main measurement in this project, when both airfoil's drag were measured, the symmetrical airfoil had less drag than the cambered airfoil.

Conclusions/Discussion
Symmetrical airfoils are most commonly used with high-speed aircraft because they create less drag since they have equal surface area at their stagnation points at a zero-degree angle of attack. Although aifoils increase their surface areas, and therefore their lift, at higher angles of attack, too high an angle can cause the air on a wing to trail off and create drag. This is why some airplanes need to have cambered airfoils, so that they can create better lift at lower angles of attack. This is needed for short runways or carrying heavy loads. Because cambered (shaped) and non-cambered airfoils can fly, but better in different conditions, we should use this knowledge to our advantage by creating each for performing different tasks.

Summary Statement
The purpose of this experiment is to see if wing shape is the limiting factor to creating lift.

Help Received
First Pilot Mr. Kooistra helped me with explaining the math and calculations associated with lift, my dad helped me build my wind tunnel, and my mom got me the supplies I needed for my display board.