CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
J0110

Project Title
How Does the Shape of a Wing Affect Its Lift and Drag?

Abstract

Objectives/Goals
The purpose of the project was to conduct wind tunnel studies to determine how the shape of an airplane wing affects the lift and drag of that wing. It was hypothesized that the wing with the biggest curvature or camber would generate the most lift and the wing with the most streamlined body would generate the least drag. It was also hypothesized that larger angles of attack would create larger lift and drag forces because of the greater surface area exposed.

Methods/Materials
A wind tunnel was constructed according to plans on a NASA web site, along with four balsa wood wings and one balsa wood control surface to test their lift and drag forces. Five angles of attack were tested for each of the five wings plus control to determine which gave the best results. Each wing was setup in the wind tunnel with the desired angle of attack, the power was engaged and the measurements were taken using a spring scale. Then the lift and drag forces were calculated for each wing. There were twenty total trials for each wing with four trials for each angle of attack. The variables were controlled by the test set up.

Results
The mean lift and drag forces were calculated for each of five wings and each of five angles of attack. Wing D (high camber and surface area, least weight) generated the most lift force and Wing C (most streamlined) generated the least drag force.

Conclusions/Discussion
It is concluded that the shape of a wing does affect the lift and drag of an airplane. The results supported the experimenter#s hypothesis. It is also concluded that higher angles of attack produce the most lift and the most drag because there is more surface area opposing the air. The lower angles of attack produce the least drag because there is less surface area being exposed to the airflow. The findings proved that wind tunnel studies can be used to design more efficient aircraft, saving fossil fuels and improving transportation.

Summary Statement
Using wind tunnel studies to determine how the shape of an airplane wing affects the lift and drag forces of that wing.

Help Received
Father helped in construction of wind tunnel and supervised testing.