CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
35480

Project Title
What Is the Most Efficient Angle of Attack of an Airplane's Wing?

Abstract

Objectives/Goals
The objective of this science project was to determine the critical angle of attack, or most efficient angle of attack, of an airplane's wing. The hypothesis stated that the efficiency of the airfoil would continue to increase until the force of drag was too great compared to the force of lift for the airfoil to be efficient.

Methods/Materials
The materials used for this project were wood for the wind tunnel, an attic fan to go inside the wind tunnel, two Vernier force sensors, a Vernier LabQuest Mini, and foam for the airfoil. The wind tunnel consisted of a contraction cone, a test section, a diffuser, and an attic fan. The contraction cone at the front increases air speed and pressure. The test section in the middle is the area where the object is tested. The diffuser at the end decreases air speed and pressure. The attic fan is installed at the end of the diffuser. The airfoil was tested inside the wind tunnel at five-degree increments from zero to sixty degrees. Each sensor measured a different force: lift and drag. The amount of both forces at each increment were recorded, graphed, and charted for analysis. The experiment was repeated three times.

Results
The results recorded from all three trials indicated that the critical angle of attack was at five degrees. This pertained to the objective of this experiment because the critical angle of attack of the foam airfoil tested was obtained.

Conclusions/Discussion
The hypothesis was proven correct, as the force of drag continued to increase, and eventually the force of lift began to decrease toward zero. However, research indicated that the critical angle of attack should be about fifteen degrees. Thus, it can be concluded that the critical angle of attack of an airfoil varies based on shape, surface area, speed, and the density of the air around the airfoil.

Summary Statement
The central focus of this project was to determine the critical angle of attack of an airplane's wing.

Help Received
Father helped cut plywood down to size.