CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34469

Project Title

Frozen Flight: The Aerodynamic Effect of Ice Contamination

Abstract

Objectives/Goals

The objective of this project was to determine what, if any, was the aerodynamic effect of ice on an airfoil. The aim was to specifically determine the differences in lift and drag between a clean airfoil and an airfoil contaminated with simulated ice. The goal was also to determine where on the airfoil the simulated ice had the most effect on lift and drag.

Methods/Materials

A wind tunnel was constructed of Plexiglas, wood, straws and cardboard. A household fan was used to produce the air flow for the wind tunnel with an anemometer to measure the air speed within the tunnel. The airfoil was made from foam board with play dough and sandpaper to simulate the ice shapes. A gram scale was used to measure the differences in lift and drag.

Results

A clean airfoil was first tested for lift and drag measurements to establish control . An simulated ice shape was then placed at three different positions on the airfoil. Sandpaper was then placed on the airfoil to simulate rime ice contamination and lift and drag measurements were taken. It was noted that the ice shape had the greatest negative effect on lift when it was placed on the leading edge. When the simulated ice shape was placed on the trailing edge of the airfoil, there was minimal negative effect on lift. The sandpaper tests also showed minimal effect on lift. When testing drag, it was found that the most drag was produced when the simulated ice shape was placed on the trailing edge. There was less effect on drag when the ice shape was placed on the leading edge or middle of the airfoil. Sandpaper was found to only have a minimal effect on drag.

Conclusions/Discussion

The test results indicate that the most aerodynamic loss in lift was found when the simulated ice shape was placed on the leading edge. However it was also observed that the most drag was produced when the ice shape was placed on the trailing edge. Sandpaper was not observed to have a significant effect on lift or drag. It is also concluded that the simulated ice shapes have an overall negative aerodynamic effect on airfoil performance.

Summary Statement

Testing which position of an simulated ice shape on the airfoil causes the most aerodynamic loss.

Help Received

Mother helped find relevant research, Father helped construct wind tunnel.