CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
S0212

Project Title
The Correlation Between a Propeller's Chord Length and the Electricity It Produces in Voltage

Abstract

Objectives/Goals

The objective of this experiment was to determine a propeller's efficiency when altering the chord length of the propeller. In an airfoil, which is a cross section of a propeller wing, the chord length is basically the entire length of the airfoil. When looked at as an entire wing or blade, it is basically the width of the wing/blade. My objective was to determine which propeller was efficient in producing the most amount of electricity meeting the changes of the chord length. This project shows the efficiency of a simple tool kit propeller against regular home use fan with all other variables constant, such as pitch angle, radius, shape, and airspeed from a fan.

When air moves over a surface of a rotating propeller, like one on an airplane, the air pressure in front of the propeller is reduced and the air pressure behind the propeller is increased. This pressure imbalance is what then pushes the airplane forward. In this project however, instead of a propeller being attached to an airplane, it is stationary and is instead moving to the air being blown at it from a conventional fan. Here the wing is specifically producing induced drag, which is related to how the wing creates lift.

Methods/Materials

The materials used were a simple propeller making tool kit, wood, DC motor, digital multimeter, a simple wire resistor, and small jumper cords. I attached each propeller to a DC motor. This was placed on a wood plank, against the airflow of conventional fan to test for efficiency. The propeller chord lengths were, 37 mm, 35, mm, 31 mm, and 27 mm.

Results

Through this experiment, the average results produced were, 39.63 mV for the 37 mm, 47.97 mV for the 35 mm, 42.78 mV for the 31 mm, and 29.16 mV for 27 mm propeller.

Conclusions/Discussion

In all, the 35 mm propeller produced the most efficient amount of electricity. In regards to the 37 mm propeller, there was a critical point where the propeller was simply to big to spin against the airflow of a conventional fan. On the other hand, because of a shorter chord length, the 35 mm propeller produced less induced drag then the 37 mm and thus had better effect. The 31 mm also had great efficiency. Nevertheless, it was not on par with the 35 mm propeller because the 35 mm propeller deemed to be the best fit for the airflow produced by the conventional fan. The 27 mm propeller was simply too small against the airflow from the fan to generate much electricity.

Summary Statement

I designed a testing station to test the efficiency of a propeller when I altered its chord length and placed it in front of a conventional fan to see how much electricity it would produce.

Help Received

Dad encouraged me and gave input on aerodynamic concepts. Mrs. Lisa Fox, science teacher, guided me through the basics of conducting my experiment and reviewed my lab manual.