# CALIFORNIA STATE SCIENCE FAIR
# 2008 PROJECT SUMMARY

**Name(s)**
Connor Werner

**Project Number**
**J0130**

**Project Title**
## You Are Cleared for Takeoff: Propeller Design

**Abstract**

**Objectives/Goals**

The purpose of this experiment is to test different characteristics of airplane propellers (number of blades, blade pitch, and chord) to find which propeller design is most efficient, and which is the most powerful.

**Methods/Materials**

1. Propellers were built using sheets of curved plastic to create the propeller blades. To test the effect of different chords, some plastic model airplane propellers were bought. For variety#s sake an ellipse propeller was also tested.

2. A wind tunnel was built out of a cardboard tube using a motor cannibalized from a remote control airplane to turn the propeller.

3. Each propeller was tested at different RPM. Motor speed was varied using a variable voltage power supply. RPM was measured using an optical tachometer designed for RC Airplanes. Airflow (ft/m) at the end of the wind tunnel was measured using an anemometer. At each RPM step, the voltage, current and airflow were recorded.

4. All of the data was put into Excel to calculate Watts (Volts * Amps) and create graphs of ft/m vs. RPM, ft/m vs. Watts, and RPM vs. Watts for each propeller.

**Results**

The 4-bladed, wide chord propeller at 30-degrees of pitch was the most powerful, creating 395 ft/m (feet per minute) at 1000 RPM, however it was also the least efficient.

The most efficient propeller was the 3-bladed, narrow chord propeller with a 20 degree pitch. The efficiency was determined by dividing the ft/m by the amount of Watts used. As the ft/m went up the efficiency went down.

**Conclusions/Discussion**

Generally, the higher the blade count and pitch, the higher the airflow generated, and vice versa. Propellers with large chords and high pitch were best for moving air at low RPM, and propellers with smaller chords were best at high RPM.

**Summary Statement**

To test different characteristics of airplane propellers (number of blades, blade pitch, and chord) to find which propeller design is most efficient, and which is the most powerful.

**Help Received**

My father helped build the wind tunnel and suggested I measure energy in watts. He borrowed the power supply and anemometer from work.