



# CALIFORNIA STATE SCIENCE FAIR 2016 PROJECT SUMMARY

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<b>Project Title</b> <b>The Effect of Air Temperature on Aircraft Propellers</b>	
<b>Objectives/Goals</b> The purpose of my experiment is to see if air temperature affects the speed of a spinning aircraft propeller. This experiment can help pilots and people understand more about airplanes. <b>Abstract</b> <b>Methods/Materials</b> Materials: clothes dryer heating element, power controller for heat, R/C airplane motor and propeller, R/C motor throttle, digital thermometer, digital tachometer. Method: hold the power to motor constant by choosing a throttle setting, then vary the air temperature by changing the temperature control, take samples of both air temperature and the propeller RPM for each variation in air temperature. Data collected is then plotted on a graph, and a computer fitted trend line is then displayed over the data points. <b>Results</b> On the first run (high throttle/torque setting) there was barely any change in the propeller RPM. On the second run, I used a medium throttle/torque setting. This reduced the airflow through the heating element and allowed hotter air to the propeller. This changed the results significantly and a relationship between heat and rpm could be seen. On the third run, I used a low throttle setting. The relationship between heat and rpm became even clearer. <b>Conclusions/Discussion</b> My hypothesis was partially correct, and partially incorrect. I thought that air temperature would not affect the speed of a spinning aircraft propeller. In the first run, there was no noticeable relationship between propeller RPM and air temperature. However, when I lowered the throttle setting in runs two and three, there was a clear relationship between propeller RPM vs. air temperature. I thought that the torque of the motor would keep the propeller speed constant even with air density changes due to the air being heated or cooled. I think it was because the higher airflow (caused by higher propeller RPM) did not allow the heating element to heat up as much, and the high throttle setting also means the torque produced by the motor is higher too. In the runs two and three, I think that it was more difficult for the motor to drag the propeller through the cooler and denser air and this caused the RPM to be lower when the air was cool. When the air was heated and less dense, it became easier for the motor to drag the propeller through the air and allowed it to speed up.	
<b>Summary Statement</b> I tested the effects of air temperature and density, on an aircraft propeller.	
<b>Help Received</b> Ukiah Aviation Flight School (John Eisenzopf) for basic aerodynamic principles and aircraft performance changes due to air temperature, my father (Derek Au) who helped me with selecting the materials, equipment and cutting the materials, and for discussion about the experiment's principles.	