



# CALIFORNIA STATE SCIENCE FAIR 2006 PROJECT SUMMARY

<b>Name(s)</b> <b>Robert G. Wright</b>	<b>Project Number</b> <b>S0111</b>
<b>Project Title</b> <b>Optimizing a Model for Rocket Stability</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> This experiment tested whether using the RockSim method to calculate the center of pressure (CP) in conjunction with the generally accepted #rule# that the CP must be at least one caliber (one diameter of the rocket's airframe) behind the center of gravity (CG) accurately predicts a stable rocket flight. The experiment identified which relationship between the CG and CP results in a straight, near vertical rocket flight in a variety of wind conditions.</p> <p><b>Methods/Materials</b> In order to determine the optimal distance between the CG and CP, eight identical rockets were built with varying fin heights, which allowed for a varied CP/CG relationship. In order to classify each of the flights, four wind ranges and seven flight stability profiles were devised. The intent was to launch each of the rockets at least once in each of the four wind ranges and categorize the stability of each flight into one of the flight stability profiles. Using the results, the optimal placement for the CP in relation to the CG was determined.</p> <p><b>Results</b> The results of launching the rockets showed that flights are near vertical when the relationship between the CG and CP falls within a certain range. This range decreases as the wind velocity increases. Outside of this range, rockets either weathercock into the wind or fly in an unstable manner.</p> <p><b>Conclusions/Discussion</b> The experimental results supported the hypothesis. Using the RockSim method for calculating the center of pressure in conjunction with a caliber range of 1 to 1.5 is an accurate method for predicting a stable, near vertical rocket flight in varying wind conditions.</p>	
<b>Summary Statement</b> This experiment determined the optimal relationship between the center of pressure and the center of gravity to predict a stable, near vertical rocket flight in varying wind conditions.	
<b>Help Received</b> My father helped by driving me to the launch site, aiding in the recovery of the rockets, measuring the wind speed, and proof-reading. I discussed rocket aerodynamics with Dr. Knox Millsaps of the Naval Postgraduate School.	