



**CALIFORNIA STATE SCIENCE FAIR  
2005 PROJECT SUMMARY**

<b>Name(s)</b> <b>Robert G. Wright</b>	<b>Project Number</b> <b>S0110</b>
<b>Project Title</b> <b>Rocket Stability: Are Simplified Methods of Calculating the Center of Pressure Reliable Indicators?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose of this project is to determine if the widely used, simplified methods of calculating the center of pressure (CP) of a rocket are reliable. In order for a rocket to be stable, the generally accepted rule is that the CP needs to be at least the width of the body behind the center of gravity (CG). When modifying or scratch-building model rockets, it is very important to know whether the rocket is stable or not. The problem in determining the CP is that complicated math is required. Several simplified methods have been developed so that the average person building model rockets can determine if his/her rockets are stable. However, each method yields a different result. This experiment tests four of the most popular methods.</p> <p><b>Methods/Materials</b> In order to test the simplified methods, five identical model rockets were built except with varying fin heights. Reducing the fin height moves the CP forward. The CG and the CP (using four methods) were measured for the five rockets. In addition, the Swing Test was performed. Each method predicted a different degree of stability for each rocket. After noting what the methods predicted, each of the rockets was launched multiple times to see which ones were stable and which were not. The actual stability of the rockets, based on observing the launches, was compared to the predicted stability of the different methods.</p> <p><b>Results</b> For all five of the rockets, the launches tended to be more stable than the methods predicted.</p> <p><b>Conclusions/Discussion</b> The results showed that the common methods of determining rocket stability are too conservative, in light wind conditions. Rockets that should have been unstable, according to the models, had stable flights. Only one method, the Complete Barrowman Equations, was a reliable predictor of stability.</p>	
<b>Summary Statement</b> This project tested whether the common methods of determining the center of pressure in relationship to the center of gravity of a model rocket are reliable indicators of its stability.	
<b>Help Received</b> Father provided some advice and proofreading for the written portion of the project. He also retrieved the rockets after the launches.	