



**CALIFORNIA STATE SCIENCE FAIR  
2005 PROJECT SUMMARY**

<b>Name(s)</b> <b>Paul W. Howard Mullan</b>	<b>Project Number</b> <b>J0111</b>
<b>Project Title</b> <b>Center of Gravity and Paper Airplanes</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective is to determine the effects of aft weight and nose weight on paper airplanes.</p> <p><b>Methods/Materials</b> I conducted five preliminary trials with eight different models of planes before discovering how to control many variables and redesigning my project. In phase 2, I weighted two new models with small paper clips. Both F42 and F2Tiger were new airplane designs that were not used in the first five trials. F42 and F2Tiger without paperclips served as my controls. I measured both their distances from the point of origin on the launch line and their distances off the centerline.</p> <p><b>Results</b> Adding weight to the rear of F42 caused it to fly a shorter distance than the control in 97% of 30 trials. Adding weight to the nose of F42 did not significantly increase flight distance until 3 paperclips were added, although the results varied. Adding weight to the rear of F2Tiger caused it to fly a greater distance than the control in 73% of 30 trials. Nose weight in F2Tiger decreased the distance it traveled. The average distance flown off course was reduced by weighting the aft of the F42, or weighting the front of the F2Tiger.</p> <p><b>Conclusions/Discussion</b> My hypothesis was incorrect because although the center of gravity affected the distance the planes flew; the size and shape of a plane's wings was more important. Part of my hypothesis was that when a plane was weighted in the back it would fly farther. This was only true for the F2Tiger. My results were inconsistent. My project shows that the aerodynamics of aft heaviness and nose heaviness affect the distance a glider travels, although not in the way my hypothesis stated, and not as much as wing design. Aspect ratio is important. I really thought the nose weighted F42 flights looked better. But the nose weight did not increase the average distance until I used three paperclips. However, since I was measuring the closest point of the plane after landing to the centerline, the planes bouncing backwards was an error in my experimental design, bringing down the averages. Projects on optimal center of gravity could help glider designers create gliders that are more efficient such as motorless aircraft used by the military to land infantrymen behind enemy lines. Center of gravity research might also benefit remote controlled gliders that are used to monitor ocean temperatures.</p>	
<b>Summary Statement</b> My project is about the effects of aft weight and nose weight on how far a paper airplane travels and how far off course the plane travels.	
<b>Help Received</b> My mom helped type the report, my dad read numbers aloud while I double checked my spreadsheet, he also showed me some planes he made when he was young, the school librarian helped me with the bibliography format, my Mom, Dad and Ms. French made suggestions for clarifying my writing.	