



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Jesse T. Houser	Project Number J0112
Project Title Weighty Matters: Paper Airplanes and Center of Gravity	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of my experiment was to find the best position for added weight in front of the neutral point on a paper airplane for long distance flight. My hypothesis was that weight positioned in the very tip would give the greatest distance.</p> <p>Methods/Materials I assembled a launcher to control the variables of hand launching and researched a plane design, folding enough planes to average human error. I weighted them with a constant weight in a range of positions forward of the neutral point. I launched multiple trials indoors. The launcher misfired continuously in the first test, and I had to hand-launch. I altered the plane design to suit the launcher, and repeated the test. I graphed & evaluated data.</p> <p>Results In the hand-launched trial, the evenly weighted plane performed best, but only marginally better than the nose-weighted plane, and all planes performed in a similar range. However, I feel that the auto-launched trial was more accurate due to reduced variables, and in it the nose-weighted plane out-performed the evenly weighted plane narrowly, but both clearly out-performed all other planes.</p> <p>Conclusions/Discussion My hypothesis was supported, but not conclusively because the evenly weighted plane performed similarly to the nose-weighted plane, which my hypothesis favored over all other planes. I think this is because positioning weight in any one place may be good at certain points in flight, but at other points it can become unstable. For the plane to be consistently stable, it must either be able to shift its weight to adapt to all conditions along its flight path, or have weight which is evenly distributed. However, if weight is placed in any one point, it should be as far forward as possible, since then more wing area behind the center of gravity is given over to lift. I plan to conduct more trials in order to further support or deny my hypothesis.</p> <p>Information such as this could help airplane designers plan where to place fuel tanks or cargo bays for stable glide in case of engine failure. It is applicable anywhere that gliding flight is involved.</p>	
Summary Statement My experiment evaluates the effect that changing weight distribution and shifting the center of gravity has on a paper airplane's long distance flight.	
Help Received My parents helped me measure & record data; my Dad taught me how to use Microsoft Excel; my Mom helped me clarify data and edit my report; I received useful advice from paper plane expert Ken Blackburn and former aerospace engineer Bob Bengard.	