



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Kevin C. McGiffen	Project Number J0220
Project Title Investigations into the Art of Hurling: Effects of Trebuchet Arm Length and Counterweight Mass on Projectile Distance	
Abstract Objectives/Goals My project was to determine how changing the length of the throwing arm and the mass of the counterweight would affect the distance a golf ball could be thrown by my trebuchet. I hypothesized that one of the mid length arms would throw the farthest, and that the 10 lb. counterweight would work better than the 7.5 lb. counterweight. Methods/Materials I used a trebuchet of my own design and construction, golf balls, two different counterweights, one 7.5 lbs. and one 10 lbs, and throwing arms that measured 6", 12", 18", 24", 30", 36", and 42" long. I fired ten shots with each arm length/counterweight combination, and measured the distance each golf ball traveled. Results On average, the 18" arm threw a golf ball the farthest with both weights. The 10 lb. counterweight shot farther than the 7.5 lb. counterweight with every arm except the 6". The 10 reps for each combination tended to be centered near a certain point. Conclusions/Discussion My conclusion is that a beam ratio (length of arm between axle and counterweight to length of arm between axle and long arm tip) of 1:3 can launch a golf ball the farthest. Also, heavier counterweights tend to throw farther than lighter counterweights.	
Summary Statement After experimenting with different arms and counterweights for a trebuchet of my design, I found that an 18" arm and a 10 lb. counterweight hurled golf balls further than shorter and longer arms tested and the lighter counterweight used.	
Help Received While building my trebuchet, dad suggested ways to make it sturdier. Mom machine-stitched the seams on the slings. During the experiment, mom marked where the golf balls first hit the ground with flags. Mom also helped with photocopying, some editing, some cutting, and spraying pictures with glue.	