



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Reid D. Cordry	Project Number J0204
Project Title How Far Can You Hurl? Hinged vs. Fixed Trebuchet Counterweight Design	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Which trebuchet counterweight design performs most efficiently: fixed or hinged? A hinged counterweight utilizes gravity more effectively, and should outperform fixed designs.</p> <p>Methods/Materials One convertible counterweight trebuchet was built, tested, tuned. A firing range was built to control trebuchet alignment and projectile impact. Four designs were tested: Hinged with wheels; Fixed with wheels; Hinged without wheels; Fixed without wheels. Each had ten firings. Adding 1.8ozs. to the fixed trebuchet's weight controlled for removing the hinge arm. Impact was labeled and measured for distance and angle. Indoor trials controlled air current. Criteria used to determine the most efficient design was the mechanism which produced the longest projectile distances and most consistent trajectory angle.</p> <p>Results Angle variances were similar for all designs: 1.5 - 2 degrees. "Hinged, wheels" and "Hinged without wheels" have the most consistent angles: .5 degrees variance, 70% firings. "Wheel less" designs experienced no "kickback", which could cause greater angle variances. "Hinged, wheels" outdistanced other designs 90%. "Fixed, wheels" hurled slightly farther than "Hinged, without wheels", 70%. "Fixed, without wheels" launched the shortest distances, 90%.</p> <p>Conclusions/Discussion Results indicate the "Hinged counterweight with wheels" is the most efficient design (.5 degrees angle accuracy, 70%; greatest distance 90%). "Hinged, without wheels" also shows the same angle accuracy/consistency (.5 degrees, 70%). Therefore, the hypothesis is correct. However, "Fixed with wheels" slightly outdistanced "Hinged without wheels", 70%. This suggests the importance of wheels to the overall design.</p>	
Summary Statement The objective of this experiment is to determine which trebuchet counterweight design performs the most efficiently, fixed or hinged, by evaluating projectile distances and trajectory angle variances in a controlled environment.	
Help Received My father let me use the scales at the Corona Post Office for weighing parts. My mother helped with typing, and helped me figure out how to build my display.	