



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Zachary S. Bobbitt	Project Number J0202
Project Title Massive Impact	
Abstract Objectives/Goals To determine if the mass of an arrowhead affected the penetration depth of a fixed target. I believed that as the mass of the arrowhead increased that the penetration would decrease due to the pull of gravity. Methods/Materials Using a fixed bow trigger mechanism, an arrow was launched at a fixed target. The mass of the arrow was varied by using 6 similarly shaped arrowheads with different masses. The penetration depth was measured and the experiment was repeated with each mass for accuracy. Results Data shows two things; first, I believe that some of my earliest tests were faulty because the 9.6 gr. mass penetrated the target deeper than the other masses. I corrected for this error with the other experiments. Secondly, the data shows that as mass of the arrowhead increases, the penetration increases. Conclusions/Discussion My hypothesis has been proven incorrect. According to my data when the mass of the arrow increased, the arrow penetrated further into the target. With 2 of my arrowheads, those with masses 5.8 and 6.5, the experiments did not produce data consistent with either my original hypothesis or the pattern that I observed with the other arrowheads. I have kept these experiments in my project because I want to research more to see what went wrong with these experiments. At this point, I believe that the inconsistent data produced in tests with these arrowheads was a result of human error during early testing that was taken care of during the later tests. I have learned an important law of physics that I did not understand when I started my project. That law is that the force of the arrow which causes it to penetrate the target more is increased when the mass is increased and the acceleration remains constant. $F=ma$.	
Summary Statement I learned that the penetration of the arrow increased as the mass of the arrowhead increased.	
Help Received Dad supervised building of the bow trigger mechanism.	