



**CALIFORNIA STATE SCIENCE FAIR  
2011 PROJECT SUMMARY**

<b>Name(s)</b> Canyon C. Robins	<b>Project Number</b> <b>J0325</b>
<b>Project Title</b> <b>A Long Shot: Optimizing a Projectile Launching Apparatus</b>	
<b>Objectives/Goals</b> This past summer, my dad and I invented a toy, a SLOTTTER, for playing table-top coin games. The purpose of my project was to discover the optimal combination of variables that maximizes the throwing capability of a SLOTTTER, allowing it to throw a projectile the greatest distance.	
<b>Abstract</b> <b>Methods/Materials</b> The variables I tested were: projectile mass, card material and size, pull-back angle, and SLOTTTER angle. I tested a combination of three different projectiles (penny, nickel, quarter), four types of card material (polyethylene, PVC, PVC laminated, PVC varnished), four card widths (full, 1/2, 1/3, 1/4), four pull-back angles (31, 38, 45, 52 degrees) and six different SLOTTTER angles (25, 35, 45, 55, 65, 75 degrees). I sequentially tested, optimized, and controlled each variable in a systematic order. High speed video was used to confirm that the final set of variables were the optimal combination.	
<b>Results</b> The results of my project were consistent with my background research on projectile trajectories, spring dynamics, and basic laws of motion. However, there was still a surprising finding. The optimal combination of variables were: the lightest projectile (penny), the card with the highest modulus of elasticity (polyethylene), the widest card (full width), the largest pull-back angle (52 degrees), and surprisingly, a SLOTTTER angle of 75 degrees.	
<b>Conclusions/Discussion</b> From these results I can conclude that the following combination of variables will cause a projectile to travel the maximum distance: a)A projectile with the least mass b)A spring made of a material with the highest modulus of elasticity, while still being able to deform the maximum amount without surpassing its elastic limit c)The largest spring possible for the launching apparatus d)The largest amount of spring deformation possible for the launching apparatus e)A launching apparatus angle that combines with the amount of spring deformation to cause a projectile launch angle of 45 degrees (for this experiment a SLOTTTER angle of 75 degrees was optimal, not 45 degrees like my hypothesis stated).  Next, I hope to use my knowledge gained from this and previous science fair projects to improve on spring powered toy cars and airplane launchers.	
<b>Summary Statement</b> The goal of this project was to optimize a spring-based toy that my dad and I invented last summer.	
<b>Help Received</b> My dad acted as a co-inventor, mentor, and assisted me during the testing process.	