



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

Name(s) Donald Novak; Rey Ruiz	Project Number S0213
Project Title The Effect of Barrel Length on Velocity and Percision of a Paintball Marker	
Objectives/Goals The purpose of the project was to find the optimum length of a paintball marker barrel that would yield the most precise fire possible without reducing projectile velocity.If the barrel length of a paintball marker is increased,then the precision will be higher,but the velocity will decrease.	
Abstract A ballistics pendulum and a chronograph machine were used to measure projectile velocity.Five different barrel lengths were used:a 15.75in.,14in,12in,9.625in,and a 9.375in barrel.The paintball marker was fired at the pendulum and as the pendulum reacted to the shot,an attached marker recorded the movement onto paper.The paintball marker was clamped to a bench to preclude movement.A digital scale was used to measure the masses of the pendulum and projectile.The projectile velocity was calculated using the formula $V=M/m \cdot 2.018 \cdot d$. V=velocity of paintball.M=mass of pendulum.m=mass of paintball.d=distance of swing in inches.Precision was measured by firing 20 paintballs from each barrel at a grid 15 meters from the beginning of the barrel.	
Methods/Materials A ballistics pendulum and a chronograph machine were used to measure projectile velocity.Five different barrel lengths were used:a 15.75in.,14in,12in,9.625in,and a 9.375in barrel.The paintball marker was fired at the pendulum and as the pendulum reacted to the shot,an attached marker recorded the movement onto paper.The paintball marker was clamped to a bench to preclude movement.A digital scale was used to measure the masses of the pendulum and projectile.The projectile velocity was calculated using the formula $V=M/m \cdot 2.018 \cdot d$. V=velocity of paintball.M=mass of pendulum.m=mass of paintball.d=distance of swing in inches.Precision was measured by firing 20 paintballs from each barrel at a grid 15 meters from the beginning of the barrel.	
Results Of the five barrels tested,the longest barrel measured 15.75in.,which shot the paintball at a lower velocity than the other barrels.The 15.75in. barrel was the second most imprecise barrel at 2.2SS.The 14in. barrel avg. a velocity of 219.6FPS and avg. 1.66SS,which was the second best barrel.the 12in. barrel was the best barrel in both categories;it avg. 1.63SS and 220.1FPS.The shortest barrel which was 9.375in. shot at 215FPS and had an avg.of 2.12SS which did support the hypothesis because it had low precision.The barrel with the lowest precision was the 9.625in. barrel at 2.3SS.	
Conclusions/Discussion The data did not support the hypothesis.The longest barrel partly refuted the hypothesis because it did not shoot as precise as hypothesized,this could be due to the extra length and the friction exerted on the ball that could slow the paintball down.The 9.375in. barrel refuted the hypothesis because it shot at lower velocity than all the other barrels besides the 15.75in. barrel.The data did support that the barrel lengths between 12-14in. maintained a higher velocity.The 12-14in. barrels offered the most precision.The data concluded that the optimal barrel length was the 12in. barrel.The 12in. barrel yielded an avg. of 1.63SS and 220.1FPS.	
Summary Statement To determine the optimal length of a paintball barrel that would yield precise fire while not compromising velocity.	
Help Received	