



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Karin E. Fisher	Project Number S0707
Project Title The Effect of Core Geometry and Bias on Solenoid Efficiency	
Abstract Objectives/Goals My objective was to determine how much I could improve the efficiency of a solenoid (used to actuate a target arm in a game system) by varying the geometry of the core and by using a permanent magnet to bias the core. Methods/Materials A testing apparatus and one solenoid were built. Six different core geometries were tested on the solenoid: a tube core, a rod core, a tube and rod core, a washer configuration, and two different U-bracket configurations. Also, four different bias magnets of varying strengths were tested in conjunction with the cores. The minimum current and voltage needed to pop the apparatus target arm was measured. Results The larger diameter core required slightly less current than the smaller diameter, and the U-bracket that didn't extend all the way to the top of the solenoid decreased the required current significantly. The bias magnets dramatically reduced the required current. Conclusions/Discussion I increased the efficiency (power usage in watts) of my solenoid by 92% from last year's solenoid with the tube core. A U-bracket that extends the core around the solenoid, but not too far, increases efficiency. Bias magnets can effectively compensate for both the weight of the target arm and the sticking force of the target arm magnet to the core.	
Summary Statement This project explored the effect of core geometry and magnetic bias on the efficiency of a solenoid in actuating a target arm.	
Help Received Dad helped with circuit	