



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Aren R. Gates	Project Number S0807
Project Title Microprocessor Controlled Electromagnetic Accelerator, Year 2	
Abstract Objectives/Goals The project goal was to improve upon my year one project, an electromagnetic accelerator, and compare the performance between pre-wrapped and hand wrapped magnetic coils with lower inductance. Methods/Materials In year one of the project the accelerator was operated with pre-wrapped coils, purchased from an electronics store. Then I wrote a program for a microprocessor which would turn on coils in advance. This was done in order to allow the magnetic field in each coil to build in advance. In year two of the project I made coils by hand with larger gauge wire. These coils had less resistance and less inductance than the previous coils; this meant that the magnetic field in each coil would form and collapse faster. I also developed a new timing program for the microprocessor. Results The performance of the new coils was compared to that of the old ones. The new coils performed much better, giving a 60% improvement on exit velocity. All together, due to the addition of zener diodes to further speed the magnetic field collapse, and the creation of a new microprocessor program, there was a 100% improvement in speed. Conclusions/Discussion The experiment supported my hypothesis which stated that coils with lower inductance and resistance will give a greater pull, because the magnetic field will form and collapse faster, therefore accelerating the projectile more.	
Summary Statement During year 2 the Microprocessor Controlled Electromagnetic Accelerator was refined to use lower inductance, higher current coils, and new timing to optimize the formation and collapse of the coil's magnetic fields increasing velocity 100%.	
Help Received Multiple engineers at Xirus Inc. mentored me: Patrick Parker on the coil winder, Kirk Mathews on the drive circuit, George Gu on the schematic, and Dennis Izumigawa on the PCB. My father was my programming mentor and helped format the final report. My mother helped create my project board.	