



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Christopher Sauer; Jonathan Zdasiuk	Project Number J0828
Project Title Electromagnetic Propulsion System for Magnetic-Levitation Train	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Our objective was to build a propulsion system using electromagnets to drive the magnetic-levitation train car that we built for last year's science fair.</p> <p>Methods/Materials We built last year's train car and track using static magnets on a wooden frame lined with Plexiglas for very low friction. This year we used a steel plate, static magnets, electromagnets from disassembled solenoids, wire, various switches, and power supplies to develop and test various propulsion prototypes.</p> <p>Results First, we tried to pull a piece of steel attached to the top of the train car with an electromagnet, but the attraction between them was too weak. Second, we lined the bottom of the track with five static magnets of alternating polarity, put an electromagnet in the train car, and switched the electromagnet's polarity as it moved over the magnets. However, when in the third prototype we added more static magnets along the track, the train car seesawed back and forth because it was being pulled in both directions by similar forces. In the fourth prototype, we put static magnets on the train car and electromagnets along the track and tried first pushing and then pulling the train car, but neither alone was strong enough to actually propel it. When we combined the two--pulling from the front and pushing from the back--our train car moved successfully. We then measured the magnetic field strength of the various parts of our system as a function of distance. The maximum magnetic fields from both the static magnets and electromagnets were roughly one kiloGauss.</p> <p>Conclusions/Discussion We succeeded in reliably propelling a train car with a static magnet attached to it, by using a line of electromagnets in the track that we wired to pull the train car from the front and push it from behind.</p>	
Summary Statement We built a push-pull electromagnetic propulsion system for our continuously-levitated magnetic-levitation train.	
Help Received Our parents taught us how to solder and use power tools, helped us buy parts, and helped us with the troubleshooting, wiring diagrams, and typing. Varian Medical Systems lent us a Gauss meter. After our project, Sam Gurol's group at General Atomics gave Jonathan's family a tour of their mag-lev project.	