



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Kaushik Shivakumar	Project Number J0227
Project Title Factors Influencing the Conversion of the Kinetic Energy of a Landing Airplane into Useful Electrical Energy	
Objectives/Goals The purpose of this project is to explore the conversion of an airplane's kinetic energy during landing into useful electrical energy. The hypothesis, based on Faraday's and Lenz's laws is: When an airplane fitted with electromagnets lands on a runway, underneath which lie coils of wire within which magnets can slide, the landing kinetic energy will be converted into useful electrical energy, and will in turn slow the airplane.	
Abstract	
Methods/Materials Hot wheels tracks were placed on top of solenoid(s) fitted with a clear lubricated polycarbonate tube containing cylindrical N48 neodymium magnets that could freely slide inside the tube. A car with N48 neodymium magnets was rolled down the track and an oscilloscope recorded the voltage. The circuit resistance measured by a multimeter along with the voltage was used to compute the electrical energy produced.	
Results With one solenoid, the electrical energy generated increased with greater kinetic energy of the vehicle. Although the electrical energy generated was greater for higher kinetic energies, the conversion efficiency was lower. By experimenting with two solenoids, with each wired separately, a higher percentage of energy could be converted. I also tested the effect of magnetic flux on the conversion of energy and observed that adding more magnets increased the peak voltage produced up to a certain point, beyond which the inertia of the increased weight of the magnet offset the increased magnetic flux.	
Conclusions/Discussion A significant percentage of an airplane's kinetic energy at landing can be converted to electrical energy. Multiple solenoids increases energy conversion efficiency. There is an optimum point for the size of magnets used for the amount of electrical energy generated. Based on our observations of a 30% energy conversion efficiency, this system can provide a constant supply of electricity of over 200 kilowatts at a busy airport like London's Heathrow.	
Summary Statement The goal of my project was to demonstrate the feasibility of converting the landing kinetic energy of an airplane into useful electrical energy using the principles of electromagnetism.	
Help Received My parents guided me in my research and provided feedback on my presentation.	