



CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

Name(s) Ronak K. Mundkur	Project Number 34854
Project Title Surfing on Nano-Magnets	
Objectives/Goals Determine if surfing trains on nano-magnetic Ferrofluid would permit higher transportation efficiency, relative to magnetic levitation - Maglev, by either reducing transportation costs by one third, or increasing speeds by three times today's fastest trains to outperforming air travel. Abstract Methods/Materials Set up a Maglev track of 609.6 mm length, 40.54 mm width and 19.05 mm height, on a leveled glass base board. Levitated a pinewood block on the track representing the Maglev Train, measuring 38.10 mm wide, 127 mm long and 19.05 mm high, with repelling magnetic strips on the under side. Used a plunger to push the train along the track, for 6 loads from 0.18 to 0.92 Kgs. Took 3 readings each for the distance traversed by the train to one one-hundredth mm accuracy, using laser beams and digital calipers. The experiment was repeated with Ferrofluid between the magnetic track and the train. Resultant distances traversed for the two experiments were compared for equivalent loads applied. Results The train surfing over Ferrofluid moved between 3.18 to 3.77 times further than the magnetic levitation train, for the same loads applied to move it. As the plunger loads were increased, the distance moved by the train followed Newton's second law of motion - parabolic curve. All readings showed very high level of consistency and repeatability. Conclusions/Discussion In the scaled experiments, Ferrofluid based transportation is at least 300% more efficient than Maglev transportation, per the hypothesis. For about 50 readings, graphs consistently validate Newton's second law of motion. For land transportation, this provides tremendous opportunity for reliable travel at a speed of up to 1503 Km/h or Mach 1.23. Alternatively, it creates opportunity for low transportation cost of 1.46 cents per ton Kilometer, at today's peak speed of 501 Km/h, down from 4.38 cents/ton Km. Further research must be done to overcome challenges: a. Ferrofluid is expensive at 40 cents/cc, with opportunity to reduce costs. b. Ferrofluid is messy to handle and jumps in strong magnetic fields, requiring containment. c. Dimensional tolerances for the train and track need to be down to the millimeter, with ability to build accurately over long distances. d. Ferrofluid tracks will be 100 times costlier than conventional tracks, at \$20M per Km, with opportunity to reduce costs.	
Summary Statement Determine if surfing today's Magnetic Levitation trains on nano-magnetic Ferrofluid would permit 3 times transportation efficiency, by reducing transportation costs by 1/3, or increasing speeds by 3 times, to outperform airplanes.	
Help Received Science teacher, Mrs. Anuradha Murthy guided me to develop research scope, structure and ensure compliance. My father, Kiran Mundkur guided me during project setup and while taking the readings.	