



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Norman Bae	Project Number S0202
Project Title Magnetorheological Fluid	
Objectives/Goals My objective was to find which tubing size and MR fluid mixture caused the greatest difference in force under different magnetic fields. In particular, how the iron particle size and amount of iron particle versus oil and grease combination affected force due to change in fluid viscosity.	
Abstract	
Methods/Materials The experiment was conducted using a fixture consisting of two syringes connected by tubing. Different MR fluid mixture was pushed through different size tubing to explore fluid characteristics under flow mode of operation. Permanent magnets were used to provide magnetic field. MR fluid mixture consisted of different size iron particles, light oil, and white lithium grease. Digital pull gage was used to measure the force. The syringe piston was moved slowly to keep the fluid flow speed constant for each test trial run.	
Results The results showed that the smallest (0.06 in) diameter tubing and mixture 3(smallest iron particle size and highest percentage of iron powder) performed the best. The largest 0.5 in diameter tubing and Mixture 1(larger iron particles) combination performed the worst with little difference in force under different magnetic fields.	
Conclusions/Discussion The mixture 3 with the highest percentage (71.5% iron particle, 26.2% oil, 2.4% grease) of smallest iron particles (35micron) moving through the tubing under different magnetic fields created highest difference in force under different magnetic fields. The small iron particles made significant difference in performance by reducing flow friction. It also allowed higher percentage of iron in the mixture to cause noticeable increase in viscosity under magnetic field. Mixture 3 opened up the possibility to explore force variation under different flow speeds. It is deduced from this experiment that further reduction in iron particle size would improve the performance.	
Summary Statement Using different size tubing and MR fluid mixtures, I tested the force required to move the mixture through the tubing under different magnetic fields.	
Help Received Father helped gather materials for project.	