



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

Name(s) Dylan E. James	Project Number J0114
Project Title Rocket Nozzle Efficiency	
Abstract Objectives/Goals To see how much useful thrust energy for powering model vehicles I could get out of a CO(2) cartridge by varying the size of the nozzle formed by puncturing with a needle. Methods/Materials 17 CO(2) cartridges were punctured to form rocket nozzles and their total useful output was recorded. The cartridges were mounted on a counter balanced bicycle wheel and the time of each revolution was recorded using a video recording system and a computer stopwatch program. Excel spreadsheet was used to calculate the speed as a function of time and to plot the data. Results The hole (nozzle) diameter was not the factor determining how many revolutions the bicycle wheel made in a given run. However, hole size was found to determine time to top speed for the wheel. Conclusions/Discussion The efficiency of the nozzle was determined more by the hole shape than by the size. The literature says that the most efficient nozzle is an expansion nozzle and my nozzles had widely varying shapes due to an inability to control the shape when puncturing the foil on the CO(2) cylinder. When using needle-punctured CO(2) cartridges for power, use a large hole for short, high thrust bursts and a small hole for longer, lower thrust applications.	
Summary Statement My project is to study how the efficiency of a rocket formed from a CO(2) cartridge varies with the nozzle size.	
Help Received Father punctured holes in cartridges while I video-recorded the run, and father taught me how to use excel. Mother assisted with gluing the sheets on display.	