



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) David A. Zarrin	Project Number S0331
Project Title The Z-Engine: My Internal Combustion Rotary Engine with Only Four Moving Parts	
Objectives/Goals I researched internal combustion engines. Unlike traditional engines, Wankel rotary engines have few moving parts but have other problems. HYPOTHESIS: One can architect a rotary internal combustion engine that doesn't have Wankel rotary engine issues and yet, offers advantages over traditional combustion engines. GOAL: eliminate such problems through the following properties: 1) Has no more than four moving parts. 2) Resilient compression & oil seals design that don't wear out due to lateral motion of compression seal. 3) Combustion forces must be fully aligned with rotation tangential forces. 4) Combustion force must drive the main shaft at 100% duty cycle. 5) Full-cycle engine - one combustion for every cycle vs. one combustion every four cycles. 6) Each combustion must drive the main shaft nearly 300 degrees instead of 180 degrees in traditional four-stroke engines. 7) No pistons, valves, valve rods, valve springs, cam-shaft, cams, timing chain, or such moving parts. 8) Eliminate or minimize reverse motion of mechanical parts such as pistons, piston rod, valves and the Wankel core.	
Abstract	
Methods/Materials To better understand motors, I will take apart several motors (two lawnmowers a trimmer and a rototiller). Next, I will build prototypes. The first prototype with clear Plexiglas to view motion. The next prototypes will be hard steel by machining to a +/- 0.008" accuracy. I plan to use some off-the-shelf components such as sparkplugs, coil, natural gas carburetor, or fuel injector. The prototype will use two steel chambers: one for air intake and compression and the second for combustion. Each chamber will have a solid core that rotates around the main engine shaft. The prototype will be designed for a 301cc rotary engine. The properties of the rotary engine are compared to both a conventional and rotary engine with the same combustion volume of 301cc.	
Results My final prototype was a success and proved the concept. It worked.	
Conclusions/Discussion The design eliminates some of the flaws of the Wankel engine; is more efficient and has only four moving parts. To my knowledge, such a rotary engine is novel and has never been built. This engine can be used in many applications.	
Summary Statement I built an internal combustion rotary engine with only four moving parts that solves the Wankel engine flaws.	
Help Received I told my advisor where to make the cuts and then he operated the power equipment .	