



CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

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Project Title A Comparative Analysis of Computer Simulated and Actual Rocket Launches	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this study is to determine whether there is a statistically significant difference between the maximum altitudes and velocities predicted by RockSim rocketry simulation software and those achieved by actual rocket launches. It is hypothesized that if the exact conditions from model rocket launches are inputted into RockSim, then the differences will not be significant.</p> <p>Methods/Materials The materials used in this experiment are as follows: RockSim rocketry design software, 3 Madcow Rocketry Kits (DX3, Momba, and Scooter), PerfectFlite Pnut altimeter, payload kits, materials to put together rockets (Epoxy glue, fin jig, electric sander, sheet metal, balsa wood), materials to launch rockets (weather recorder, launch pads, masking tape, control panel, wires), Cesaroni F59 WT model rocket motors and motor casings, and a computer to download altimeter data. The major steps in this experiment are as follows: obtain materials, design ideal rockets in RockSim, build actual rockets based on RockSim parameters, construct altimeter bays for rockets, launch rockets at Lucerne Dry Lake, record maximum altitudes and velocities from a total of nine actual launches (three for each rocket), and complete analysis with altimeter and RockSim data.</p> <p>Results The mean altitudes and velocities from the three flights for each rocket were compared to the corresponding mean altitudes and velocities of RockSim simulations, using paired T-tests. In each case, the comparison between the altitudes reached by actual flights and altitudes predicted by RockSim showed no significant difference. The comparisons of velocities for the Momba and Scooter showed no significant difference, but the velocity comparison of the DX3 did show significant difference (p value 0.0046). Secondary analysis, using one-sample T-tests and ANOVAs, was also done.</p> <p>Conclusions/Discussion The hypothesis for this experiment was validated for the most part. When means were compared with paired T-tests, almost all cases showed no significant difference. Based on this, RockSim is a reasonably accurate program and is a helpful tool in rocketry when limitations are taken into account. RockSim can be incorporated throughout the design process to eliminate the wasting of resources on rockets that will not launch or achieve the desired goals.</p>	
Summary Statement This project compared the maximum altitudes and velocities from nine actual rocket launches to the corresponding values predicted by RockSim; parameters from rockets and conditions from actual launches were inputted into the software.	
Help Received Mr. Robert Koepke and Mrs. Jann Koepke of the AIAA OC Rocketry organization helped in the building and launching of the rockets. My parents assisted in the gathering of materials, such as rocket kits, motors, and RockSim software.	