CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J0105

Project Title
The Sky's the Limit: How Do Fin Configurations Affect a Rocket's Altitude?

Abstract

Objectives/Goals
The objective of our experiment was to determine which of six different fin configurations was most aerodynamically efficient by observing which one achieved the highest performance (altitude) on several test flights conducted under consistent weather conditions.

Methods/Materials
Six model rockets of an identical type were equipped with altered fin configurations (with identical surface area, but different shapes and number of fins). These fin configurations were developed from designs that we had seen on actual rockets currently in use, or rocket designs which have been proposed, but not used. The rocket masses were verified and adjustments to weight were made if necessary to ensure consistency. All rockets were equipped with Estes B6-4 motors providing identical thrust. Each Rocket was flown 6 times. Altitude observations were made by multiple observers using home-made inclinometers.

Results
Tests showed that the Composite Trapezoid fin design achieved the highest altitudes, averaging 558 feet. Second highest was the 1950's style rocket fin which achieved an average altitude of 513 feet. Third highest was the Delta Control design which reached an average altitude of 396 feet.
Lower altitudes were achieved by the Wright Brothers (5 fin rectangular) fin configuration which averaged 375 feet and by the Space Shuttle (two larger wings and a smaller vertical stabilizer) fin configuration which achieved an average of 333 feet. The rocket with the tubular fin design was unstable and did not generate any meaningful altitude data.

Conclusions/Discussion
Our conclusion is that rockets with the minimum number of fins that provide stability (enough drag to keep the center of pressure behind the center of gravity) and generate the same amount of drag on all sides of the rocket, allow the rocket to maintain a vertical course while minimizing the aerodynamic drag which allows these rockets to achieve the highest altitudes.

Summary Statement
Determining which fin designs are most efficient (provide stability and generate the minimum aerodynamic drag) thus allowing a rocket to achieve the greatest altitude.

Help Received
Partner's father helped assemble the rockets, partner's father trained us on altitude calculations, partner's father supervised rocket launches