CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Loren J. Newton

Project Number
J0122

Project Title
Fly Like an Eagle: Ornithopter Dynamics

Abstract

Objectives/Goals
To investigate & determine which shape & angle of attack of an ornithopter's wings would produce the best thrust performance.

Methods/Materials
Based on proven laws of physics, use of Algebra, and Geometry theory, I derived a formula with factors I could work with to design my experiment.

An onithopter test rig & platform were then constructed. Three sets of mylar wings of varying shapes, but with equal area were crafted.

With each set of wings mounted, nine angles of attack were set respectively.

The distance traveled by each flapping wing configuration in 15 seconds were recorded.

Results
Least thrust was generated at 0 degree angle of attack, while negative angles of attack caused braking drag.

The larger the positive angle of attack, the more thrust was generated, to cause the further the distance traveled.

The curved shape wings had the least wing tip area to cause the least drag, and therefore had the greatest distance traveled.

Conclusions/Discussion
Ornithopters with flapping wings at a larger positive angle of attack, generated more thrust. Flapping wings with the least tip area (curved wings) caused the least drag.

In practice, there is a need to actively control each individual wing's amplitude and angle of attack in order to generate different combinations of thrust & lift forces for different flight functions.

Summary Statement
To examine the design factors contributing to the thrust performance in ornithopter dynamics. (F= P* (l*w*cosine A) + (D/t) + f)

Help Received
My Dad helped in purchasing the material, and help construct the test fixture. The Onithopter Society web site provided technical reference.