



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

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Project Title
Straighten Up and Fly Right: Variable Geometry Wing Analysis on a Model Airplane

Abstract

Objectives/Goals
I believe that a variable geometry wing design will decrease drag and increase speed on a model airplane. The variable in this experiment is the angle between the wing's lateral axis and the relative wind. Whichever angle produces the highest airspeed, will indicate best performance. I am going to repeat this experiment at least three times, unless in-flight failure occurs. The control group is as follows: all of the wing angles can be compared to the straight wing configuration with the lateral axis at 90 degrees to the relative wind.

Methods/Materials
EXPERIMENTAL PROCEDURE: 1. Build a model airplane with variable geometry wing design. 2. Fly model with wing at different angles. The wing will change angles at five degree increments and airspeed will be recorded at each increment. 3. Download data from the air speed telemetry device. 4. Measure and record air speed at different angles and graph results. 5. Determine what kind of performance gains we can see with this geometry wing and model airplane.
MATERIALS LIST: SIG LT-40 Model Airplane Kit; Balsa Wood Sticks, Various Sizes; Balsa Wood Sheeting; 1/2 inch x 3/8 inch Aluminum Bar; Monokote Top Flite 6#; Exacto Knife; Two-Part Epoxy Glue; Water Based Glue; Cyanoacrylate Adhesive; Hobby Saw; 12# Plastic Mitre Box; Heat Gun; Handheld Iron; (4) DC Electric Servo Motors - Model HS-311 Standard Hitec Servo; Pitot Airspeed Telemetric Device (Winged Shadow Device); Hitec Digital Servo Programmer; PN 57351S Extension Wire; 5 Channel RC Radio Control Box; .40 Two Stroke Engine; Propeller; Rubber Bands; Light Weight Wood Filler; 4 oz. of Fuel-Proof Paint.

Results
The variable geometry wing was heavier, had less lift, and was less controllable. The real problem, however, was the weight imbalance. This occurred whenever the wings were swept beyond fifteen degrees.

Conclusions/Discussion
OVERWEIGHT, OVER BUDGET AND OVERRATED
Testing quickly revealed that slightly sweeping the wings back decreased our speed. Sweeping the wings back more than fifteen degrees made the model uncontrollable due to insufficient elevator authority. When the wings were swept back, the model's center of gravity moved aft. When the center of gravity moved aft, more elevator down deflection was needed to maintain level flight. This elevator deflection

Summary Statement
The central focus of my project is to determine how variable geometry wing design affects model airplane airspeed.

Help Received
I would like to thank my Mom for her excellent typing skills. I would especially like to thank my Dad, for all the countless hours we spent at his shop, La Quinta Aviation, in Thermal, California.