California Science Center

CALIFORNIA STATE SCIENCE FAIR
2001 PROJECT SUMMARY

Your Name (List all student names if multiple authors.)

Ben F. Kahn

Project Title (Limit: 120 characters. Those beyond 120 will be ignored. See pg. 9)

Lift Off: What airfoil shape produces the most lift?

Science Fair Use Only

J0915

Division

J Junior (6-8) J Senior (9-12)

Preferred Category (See page 5 for descriptions.)

9 - Fluid Mechanics/ Aerodynamics/ Thermophysics

Abstract (Include Objective, Methods, Results, Conclusion. See samples on page 14.)

Use no attachments. Only text inside these boxes will be used for category assignment or given to your judges.

PURPOSE: The purpose of my project was to test different airfoil shapes to find out which shape can produce the most lift. My hypothesis was that the teardrop shapes would get the most lift. I thought the thin teardrop would do best, followed by the medium teardrop, curved bottom teardrop, shallow curved bottom teardrop, and the thick teardrop. I expected the box shape to get the least lift.

EXPERIMENTAL METHOD: I built a wind tunnel out of wood and plexiglass. Originally, I was going to measure the lift of several balsa wood airfoil shapes by suspending them on string tracks in the tunnel and blowing on them with a hair dryer. The balsa wood was too heavy, so I switched to airfoils made of paper, straws, and tape, and I used a reversible vacuum cleaner to blow more air.

To measure the amount of lift, I used a hanging postage scale. To adapt the scale so that an airfoil could pull up on it, I used a pulley. I built a base structure out of K'Nex for the wind tunnel to sit on, and I mounted the scale and pulley inside this base. I drilled a hole in the bottom of the wind tunnel so I could attach a piece of string from the bottom of an airfoil, down around the pulley, and up to the scale. I measured the lift of 9 different airfoil shapes with this apparatus.

RESULTS: These were the results, from most lift to least lift:

1. Curved-bottom tear shape; 2. Semi curved-bottom tear shape; 4. Short tear shape; 5. Tear shape; 6. Kite shape; 7. Tall tear shape; 8. Airplane fuselage shape; 9. Box shape.

CONCLUSION: My hypothesis was partially correct. Although the two best airfoils were both teardrop shapes, the rest of the teardrops didn't do as well. Both of the two best shapes had indented undersides. The third best shape was a triangular wedge, with the narrow side facing forward. I don't know why this airfoil did so well.

Summary Statement (In one sentence, state what your project is about.)

The purpose of my project was to test different airfoil shapes to find out which shape can produce the most lift.

Help Received in Doing Project (e.g. Mother helped type report; Neighbor helped wire board; Used lab equipment at university X under the supervision of Dr. Y; Participant in NSF Young Scholars Program) See Display Regulation #8 on page 4.

Dad's friend cut the wood for my wind tunnel, and Dad helped me assemble it. Mom and Dad helped me glue the pages on my display boards.