Which Wing?

New Mexico Adventures in
Supercomputing Challenge
Final Report
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Koogler Middle School

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Executive Summary

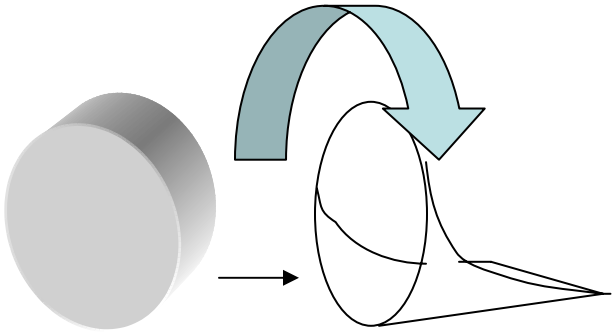
As the world moves along through everyday life, an increasing interest is shown in aerospace and aviation. Although much information on the topic already exists, more knowledge is yet to be learned. In our project we plan to add to that knowledge with a little of our own. In past years other projects that have dealt with flying have concentrated on things like center of gravity, drag, fuselage shape, and powered flight (velocity highly used), but ours is a bit different. Our focus is on wing dynamics of non-powered flight. Lucky for the team, one of us has grand parents that own Durango Air Service, a flight school in Durango, CO.

Our Inquiry

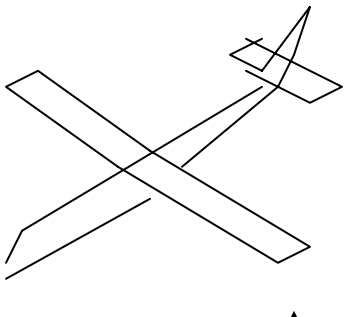
Based on all the other projects ordeals, we decided that shape would lead the way to our goal of finding an aerodynamically effective wing. What we mean by aerodynamically effective is it will perform best along the lines Of: volume (what are the dimensions like)? Is it stable? How can we manipulate the design to weigh as little as possible? In other words, what will float the best?

Hypothesis

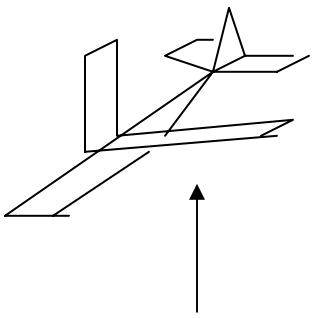
In the field of aviation there is, and always have been numerous ideas about different or odd types of designs. So in our project we opted to incorporate one of three models that would be slightly different. This design would resemble that of a cylinder with basically a tail. The two remaining designs will model more orthodox methods of wing performance. We think that the “flying circle” will out do the other models due to its factor of less thrust resistance and simple designing scheme. Design two would have very thin wings, and the third design would have wider one.



Curved forward section for design 1 w/ slipstream tail section acting as a horizontal stabilizer.



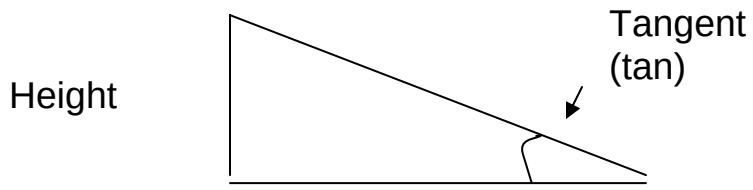
The conventional wing design on aircraft design 2.



Design 3 will exercise the swept wing configuration.

The Experiment

The experiment part is where we got actively involved in the flights of our differently shaped planes. First, at the hanger we acquired in Durango, we were able to release our gliders from a fixed height of 20 ft. Design 1 was floated to a length of 80 ft. (all flights were performed in as straight a path as possible). Design 2 was then floated and touched down at about 64 ft. and design 3 flew to 60 ft. Next we plugged the numbers into the simple part of the experiment to find the tangent of the glide angle.



$$\text{Tan} = \frac{h}{d}$$

Results

The tangent of the glide angle is equal to the starting height (h) divided by the distance (d) flown of the object. Then we relate that information to the drag/lift ratio equation. Putting in the tangents of each plane (plane 1's tangent was .25, plane 2's was .31, and plane 3's tangent was .33) into the formula of, D/L = cd/cl = tan, whereas cd/cl are the coefficients of lift and drag. Then combining the equations and inverting all of the equations we get L/D = cl/cd = d/h = 1/tan. After inputting the data into the equation the result is the higher L/D, the lower the glide angle, increasing the distance the model will travel. This formula helps us to decide the aerodynamic efficiency of the designs.

Conclusion

In conclusion we have learned that the circular model flew the best as was hoped for in our hypothesis. We figured that since the plan behind glider #1 was a simple profile with less drag dynamics than the other two build-ups, it flew the best. This design could also be useful in the areas of speed if it were looked into. Someone could really make a killing if they came out with a hang-gliding design such as the circular “ring wing.”

Acknowledgments

We would like to thank our teacher Mrs. Pam Arzu, our mentor Ben Martinez, and our tutor, Mr. Ted Raaymakers. We would also thank Durango Air Service. Lastly we would like to thank our parents for all of their support.

Bibliography

http://www.grc.nasa.gov/WWW/Wright/airplane/Idrat.html