Aerospace Engineering Glider Project

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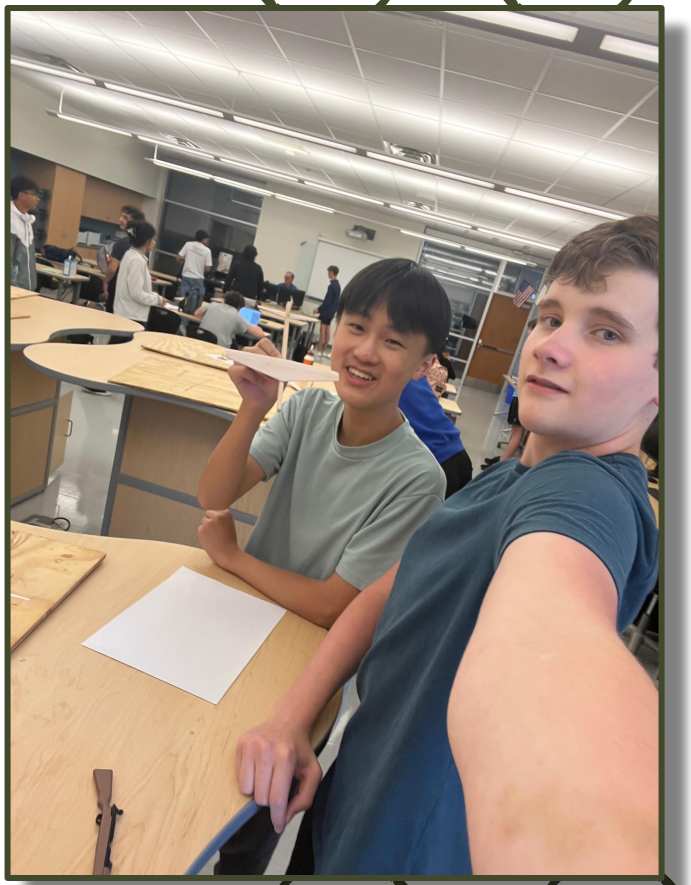
Design Statement:

To design a glider for long, stable flight using Aery software to evaluate flight performance while specifying dimensions for wings, fuelselage, and stabilizers.

Constraints:

1 piece of Basswood - 3/16" x 3/8" x 12"
1 piece of Balsa Wood - 3/32" x 3" x 12"

Aery Evaluation Number: 162
Throwing Velocity: 40.00 km/hr
Flight Angle of Attack: 3.56 degrees
Center of Gravity Location: 6.42 cm
Mass at Nose: 3.00 g
CD: 0.020
Wing CL: 4.43
Stabilizer CL: 5.26
Wing Span: 16.75 cm
Aspect Ratio: 5.98



Design Process & Features

1. **Describe how you accomplished the design objective?**
   In order to complete the design objective we looked at our constraints and requirements, then kept innovating until we got an Aery number of 150.
2. **Describe the Aery software design process and your specific design objectives and attributes?**
   It was complicated at first because we didn't understand the controls, but once we were familiar with the software, we were able to start designing. We started to change some variables, then tested and kept going until the design worked.
3. **What planform did you pick and why?**
   We chose to do a tapered wing design because it allowed the glider to produce more lift with its increased surface area near the root. Furthermore, the tapered wings get thinner at the tips, which helps reduce drag.

Design Process & Features

4. **What design attributes / features contribute to long, straight flight?**
   The lightweight of the balsa wood, the specifications for the wings and their area, a strong vertical stabilizer to keep it straight, even sanding to prevent any tilting in the horizontal direction.
5. **How did you determine what a good CL would be?**
   We decided to choose a lower CL because we wanted it to be a much more relaxed flight, as opposed to a higher CL, meaning a steeper climb.
6. **How did you decide the wing surface area to use?**
   We chose a relatively small glider area mainly because if it was too big, then the lift would be too much for our desired purpose. Also, a smaller wing reduces the weight of the glider, which allows it to stay airborne longer.

Conclusion

1. **What design or construction techniques enabled gliders for long distance, straight line flight?**
   In order to make gliders fly well, there are a few specific things that can help. Primarily, it requires a good design and it needs to be able to fly in ideal circumstances. Secondly is the quality of the design. The precise measurements, angles, and sanding all affect how far the glider will ultimately fly.
2. **What conclusions can you make about optimal glider designs (mention important design features) for long distance flight?**
   An ideal center of gravity, balanced lit to drag ratios, and realistic launch specifications affect the possibilities for a long distance flight.
3. **If your test results were not straight line, stable flight, explain why you think that happened.**
   If the results for the flight were skewed, what most likely happened was that there was a flaw in our building technique, such as uneven sanding or an unbalanced front tip.

Conclusion

4. **How far did your glider travel? Did you time your glider flight and measure the distance traveled? What launch angle did you use? Report the estimated speed (distance / time) and compare to the Aery launch velocity and angle.**

   The furthest our glider traveled was 42 feet and flew for about 5 seconds. We launched it at an angle of 0 and its velocity was roughly 8 ft/s. Compared to Aery, the variables did not match up. Our Aery was set at a higher launch angle, with 40 ft/s as a velocity.

5. **What is the lift formula and which variables were part of your Glider design and testing.**

   Lift = Coefficient of Lift times one half pressure times velocity squared, times area. So we could change velocity by the speed we launched, area by the shape of our wings, and coefficient of lift by changing the wing size and the overall glider design.

6. **What would you do to improve your design or flight performance?**

   I think to improve our glider design, we would focus more on the building aspect of it. Since our glider was unevenly sanded, so it underperformed in some aspects.

Flight	Time Aloft(s)	Distance (Feet)	Velocity (feet/second)	Pitch Stability	Directional Stability
1	2	30	15	UD	GT-L
2	1.5	15	5	UD	Straight
3	3	32	10.6	UD	GT-L
4	1.7	19	11.1	UD	Straight
5	2.5	33	13.2	UD	GT-L
6	1.7	18	10.5	UD	GT-L
7	5	42	8.4	UD	GT-L
8	2.44	25	10.24	UD	DT-L
9	2.1	29	13.8	UD	DT-L
10	3	36	12	UD	GT-L

Final Flight Statistics

Distance Rating	Pitch Stability	Directional Stability
4	4	3

2/3 4s	2/3 5s	Total
1	0	12

Aery Planform