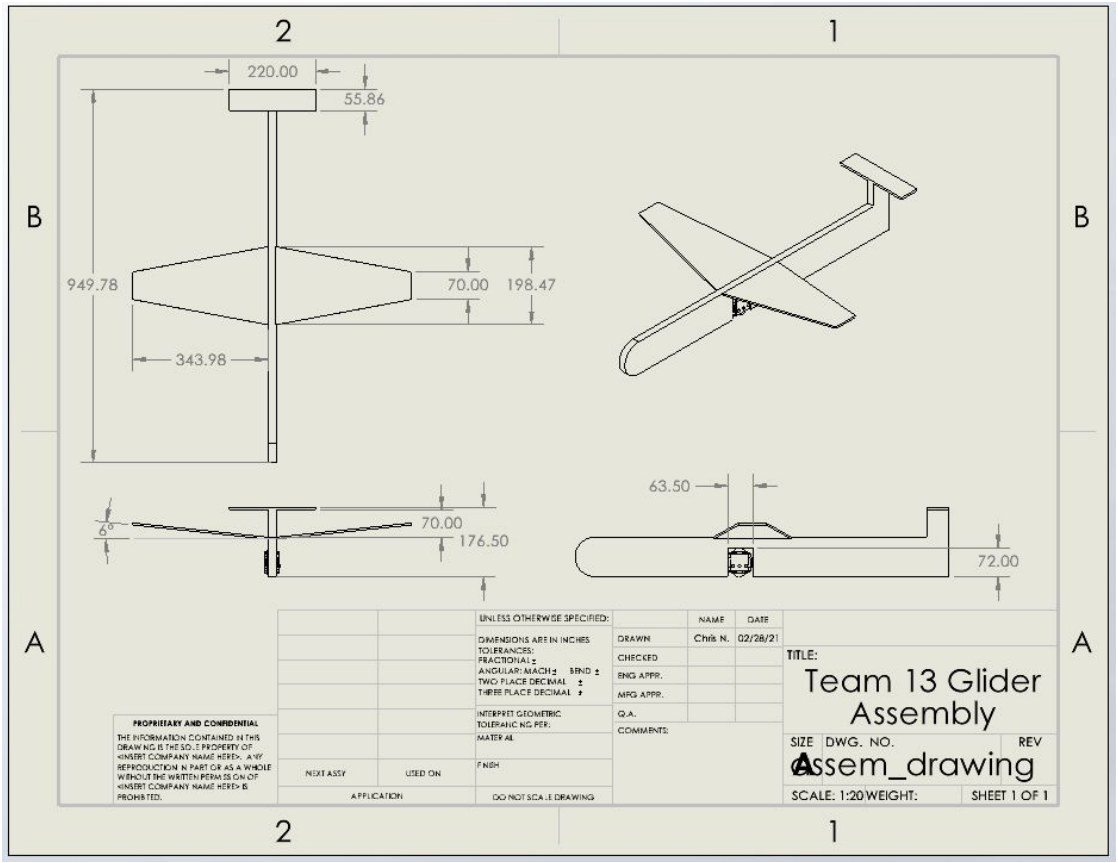
ASEN 2004 Aero Lab Milestone 2

Section 013- Group 13



Design Overview: Final Tri-View

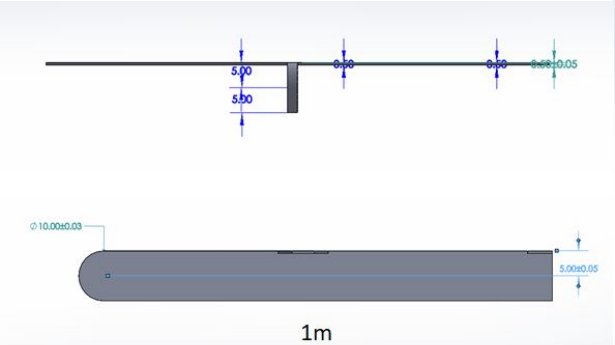
Alec Macchia

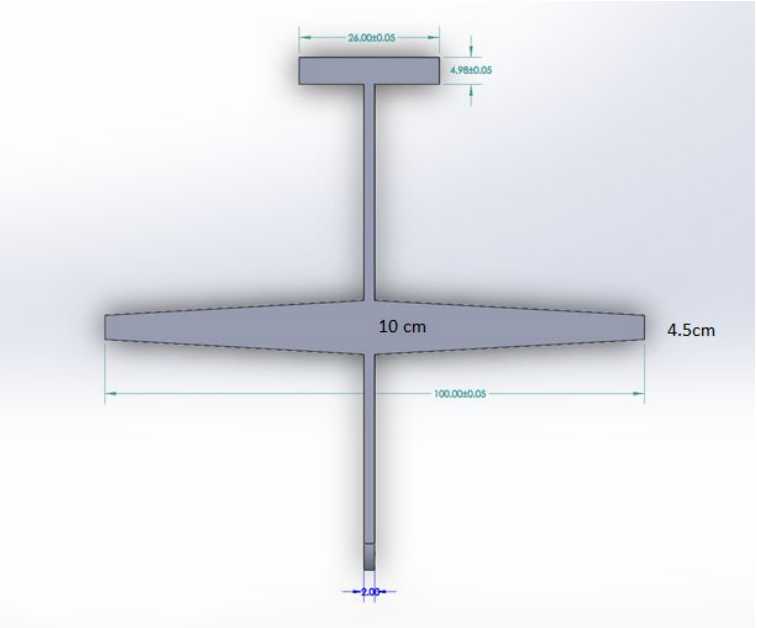
Design Overview: Influential Designs

Andrew's individual design

Hexagonal Wings

T-Tail





Design Overview: Key Features

- Tapered hexagonal cantilever wing design
  - Higher Aspect Ratio, $AR = 5.185$
  - Dihedral angle
  - No sweep angle
- Rear elevated T stabilizer
  - Planform area $S_v = 0.0049\ m^2$
- Rounded nose section
- Thin rectangular fuselage
  - Section in the fuselage is cut out at the center of mass of the glider to hold the payload

Estimated weight without payload: 1.30 *N*

Estimated weight with payload: 2.93 *N*

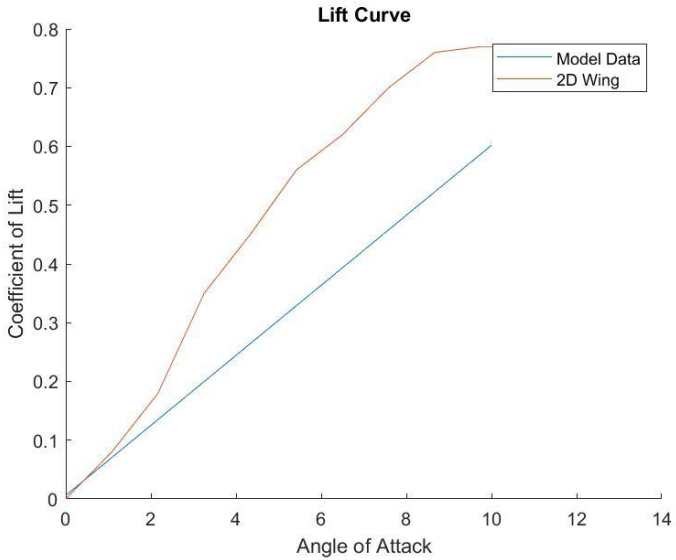
Estimated unit cost: $133.00

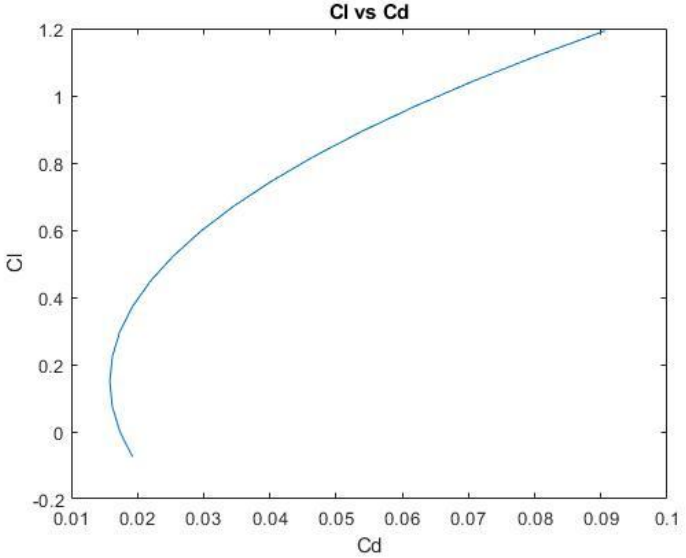
Wingspan: 0.7 *m*

Length: 1.2 *m*

Mark Olszewski

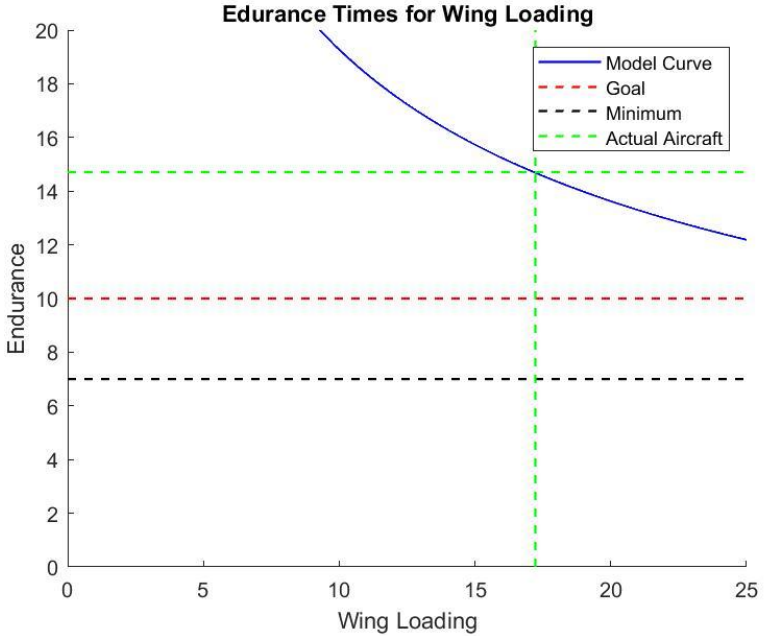
Aerodynamic Analysis

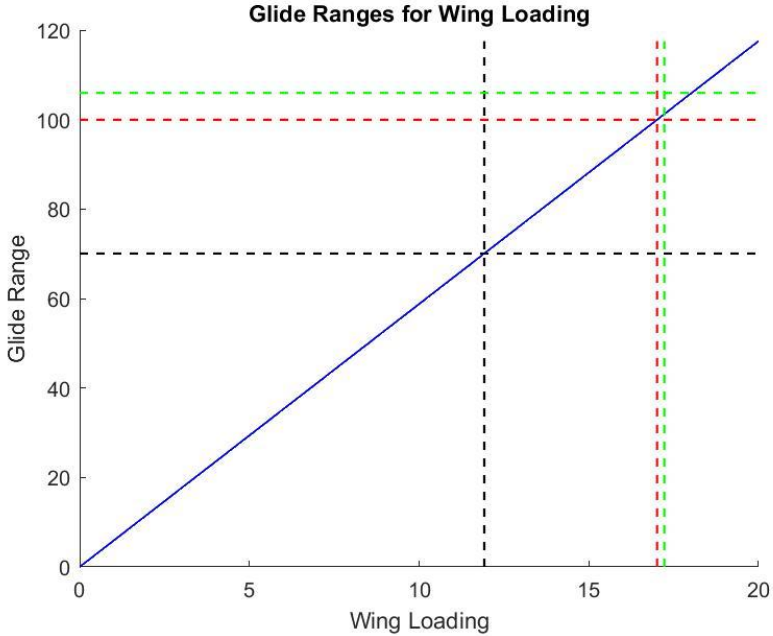




Tim Shaw

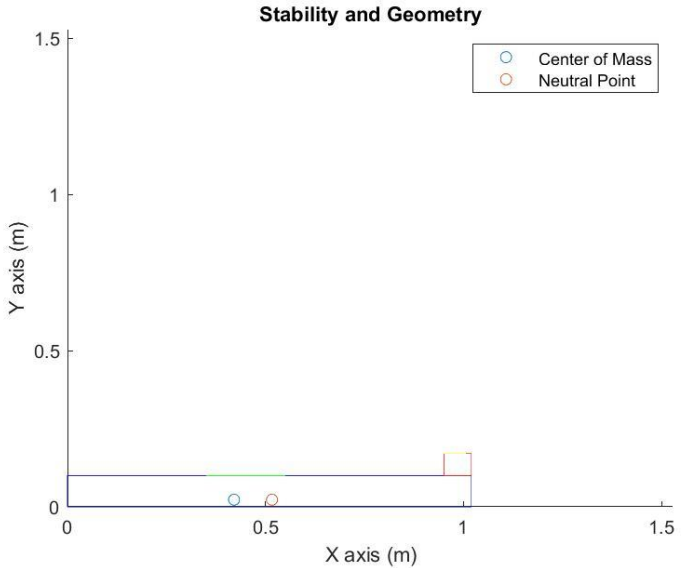
Performance Analysis: Sizing





Performance Analysis: Stability Discussion (Ian Wong)

- High wing: more stable, center of mass is beneath the center of lift
- Vertical Tail Volume Coefficient: 0.042
- Horizontal Tail Volume Coefficient: 0.50
- Dihedral angle: 6.2 degrees
- Spiral Parameter: 9.92
- h_{NP}: 0.516 (%chord)
- h_{cg}: 0.4205 (%chord)
- Static Margin: 9.6%



Victoria (Vicky) Lopez

Table 1: Performance Summary

System Requirements	Threshold	Objective	Min or Max	Design
Max Glide Range	70 m	100 m	Max	101.4493 m
Max Glide Range Velocity	12 m/s	7 m/s	Min	8.0453 m/s
Max Glide Endurance	7 sec	10 sec	Max	12.6098 s
Elevator Pitch Control	+/- 8 deg	+/- 10 deg	Max	+/- 10 deg
Longitudinal Stability	Inside wing chord	x_{cg} = 0.25c	-	0.4205
Longitudinal Stability	V_H = 0.3	V_H = 0.6	-	0.4438
Lateral Stability	V_V = 0.02 B ≥ 5	V_V = 0.05 B ≥ 5	-	V_V = 0.0418 B = 9.9442
Wingspan	1.0 m	n/a	Max	0.7 m
Unit Cost	n/a	n/a	Min	$133

Andrew Logue

Conclusion

I.
- Calculate the optimal dihedral angle to increase lateral stability
- Calculate the optimal wing sweep angle to minimize drag rise of the glider
- Explore and apply other wing and tail designs e.g., winglet, bi-plane wing, or box wing, and conventional, cruciform, or dual tail
- Test and implement different materials e.g., balsa wood, carbon fiber, and plastics
- Exploration of airfoils for increased aerodynamic performance

II. We learned the importance of having a dihedral angle in order to achieve a stable spiral, and how having too small of an angle resulted in the instability of our glider. Additionally, we learned how the wing planform area affected the wing aspect ratio, which in turn determined the glider's range and flight time.

III. We do plan on building and subsequently flying our glider, and would like to learn how the sweep and dihedral angles of the wing impact the duration and stability of our glider's flight.

Thank you for your attention