

Abstract

This project details the design, manufacture, and testing of Mjöltnir, an RC airplane designed to compete in the 2022-2023 American Institute of Aeronautics and Astronautics Design Build Fly competition. The theme of the competition is Electronic Warfare, with the objectives of carrying a surveillance package and attaching a radio jamming antenna.



Customer Needs and Requirements

General Requirements

- Takeoff in 60 feet
- Use 2 sets of interchangeable wings
- Fit in shipping box
- Assemble in 5 minutes
- Place higher at competition than Purdue and Notre Dame

Mission 1

- 3 laps in 5 minutes

Mission 2

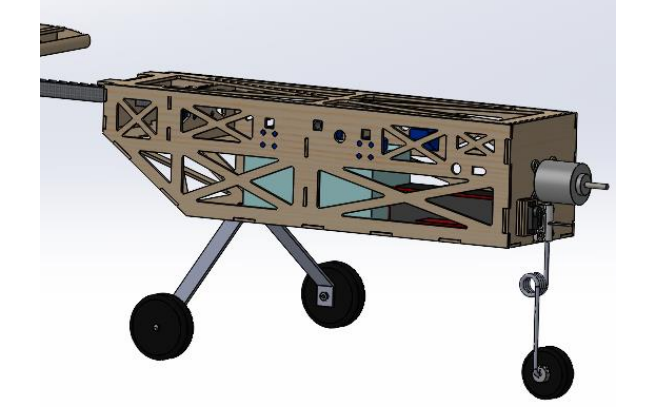
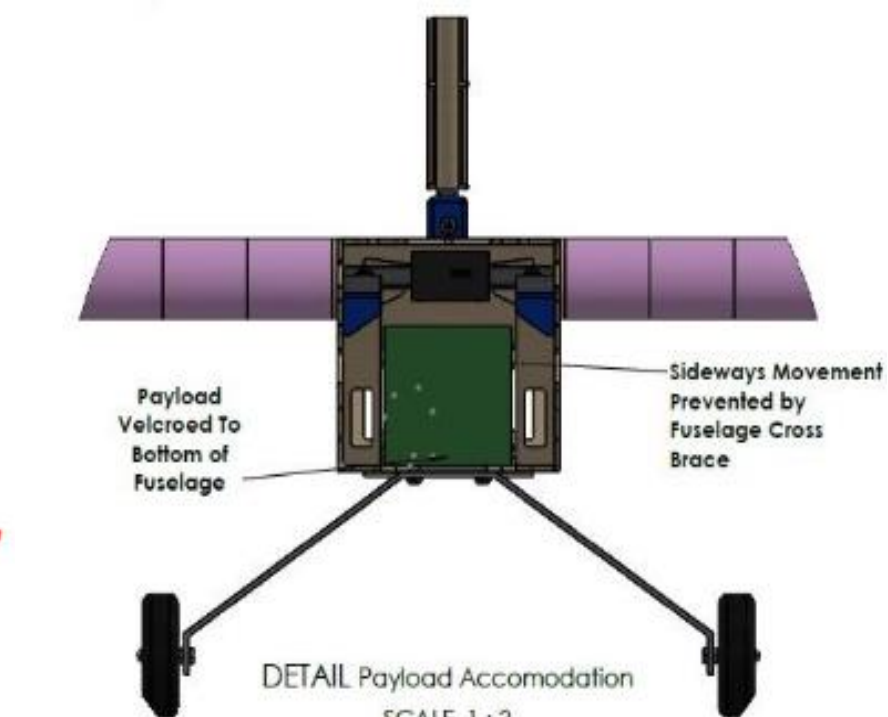
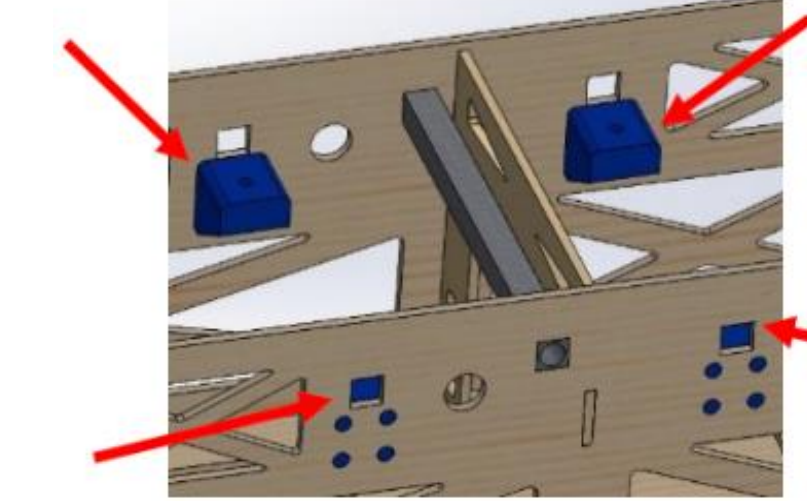
- Number of laps in 10 minutes
- Fly with a payload weight (30% of plane weight)

Mission 3

- 3 laps in 5 minutes
- Fly with a pipe on one wing

Concept Selection

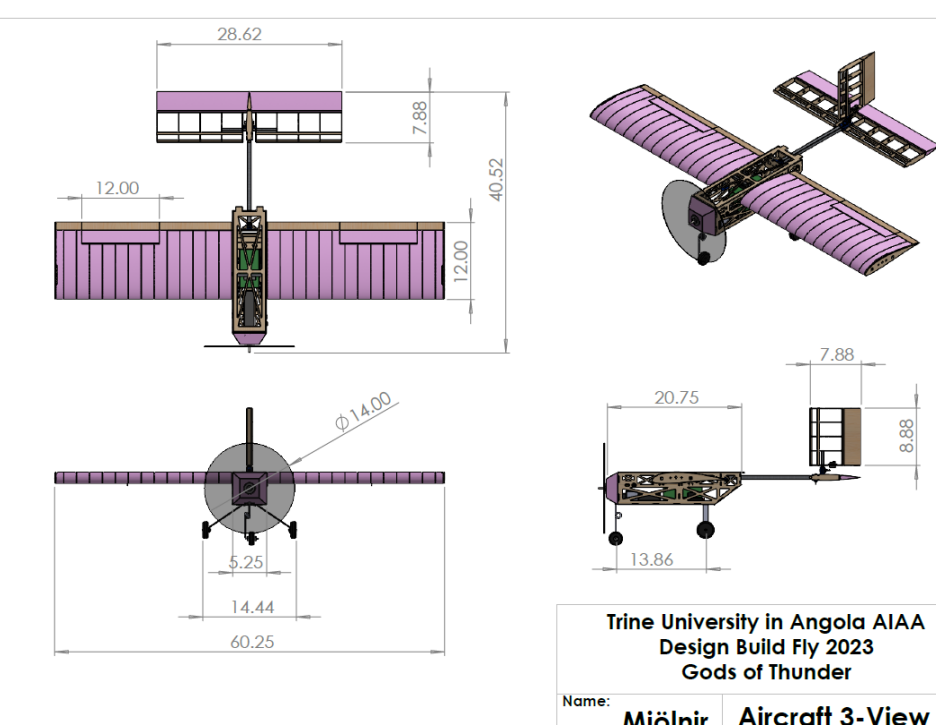
- Foam wing design
- SD7062 Airfoil
- Easy connect wings (slot and screw)
- Rectangular fuselage
- Balsa wood
- Tricycle style landing gear



Design Solution

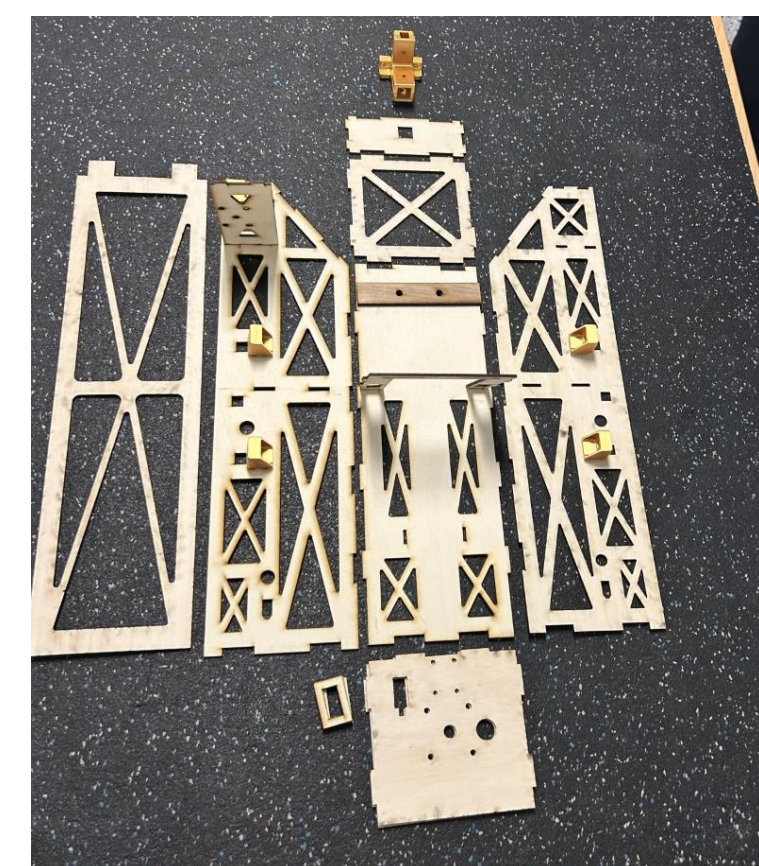
A code was generated in MATLAB to size our aircraft. This provided us with the aspect ratio, span, and other variables needed for a full design. As well as design requirements for the wings and tail

Propeller, motor, and battery were chosen by testing combinations to ensure enough thrust at for a 60 ft takeoff while also meeting power requirements.



Manufacturing

Fuselage



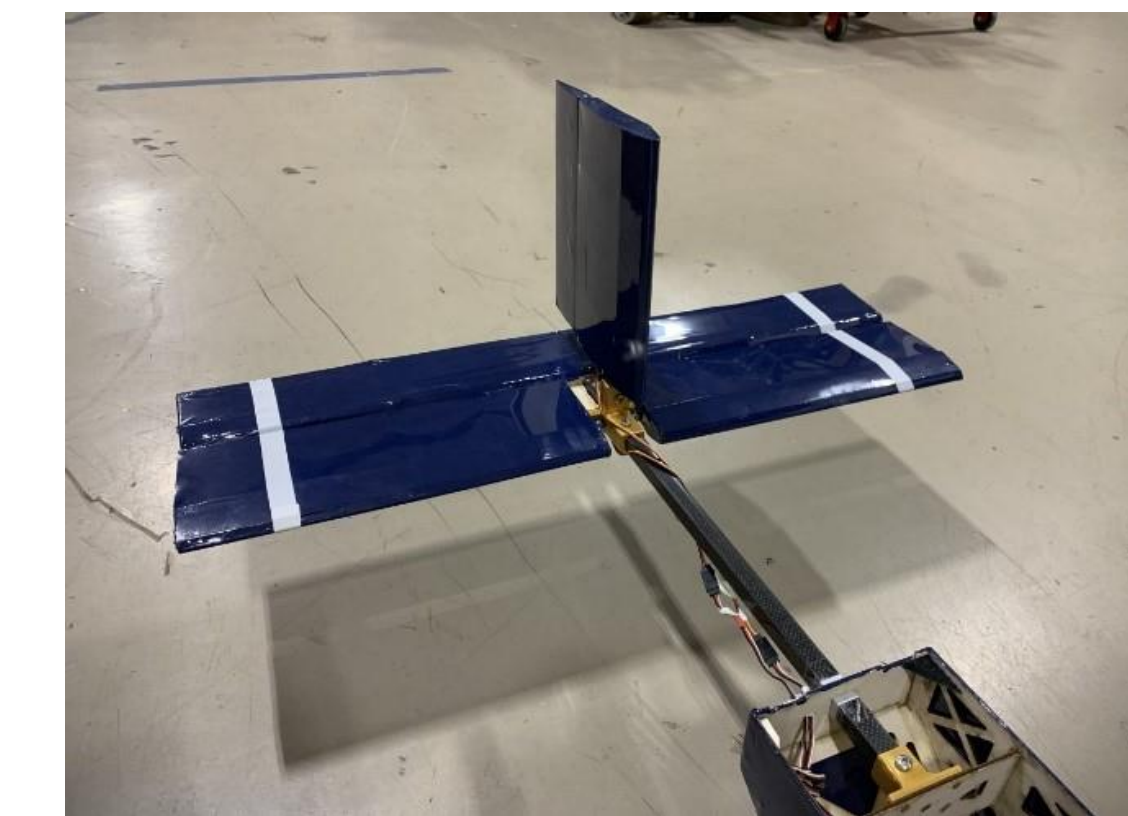
- Laser cut plywood walls
- 3D printed holders to ensure quick assembly

Wing



- Laser cut plywood and foam ribs
- Hot wire foam into airfoil shape
- Connect with carbon spars

Tail



- Laser cut plywood tail connector
- Laser cut balsa wood spars
- Connected spars to carbon fiber rods

Assembly



- Fit plane into shipping box
- Assemble plane in 5 minutes

Testing and Validation

Prototype I

- Less than 60 ft takeoff
- Successful flight
- Unstable due to incorrect Center of Gravity



Prototype I

Prototype II

- Longer fuselage
- Lower weight
- Tested all flight missions successfully



Prototype II

Prototype III

- Switched to carbon fiber wings
- Completed flight missions 1 and 2
- Considered too heavy



Prototype III

Mjöltnir

- Completes all missions
- Returned to foam wings
- Longer wing spars
- Taken to Competition
- Unable to fly all missions at competition



Mjöltnir

Acknowledgments

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