

2023-2024 AIAA Design, Build, Fly Competition: The Wolfline



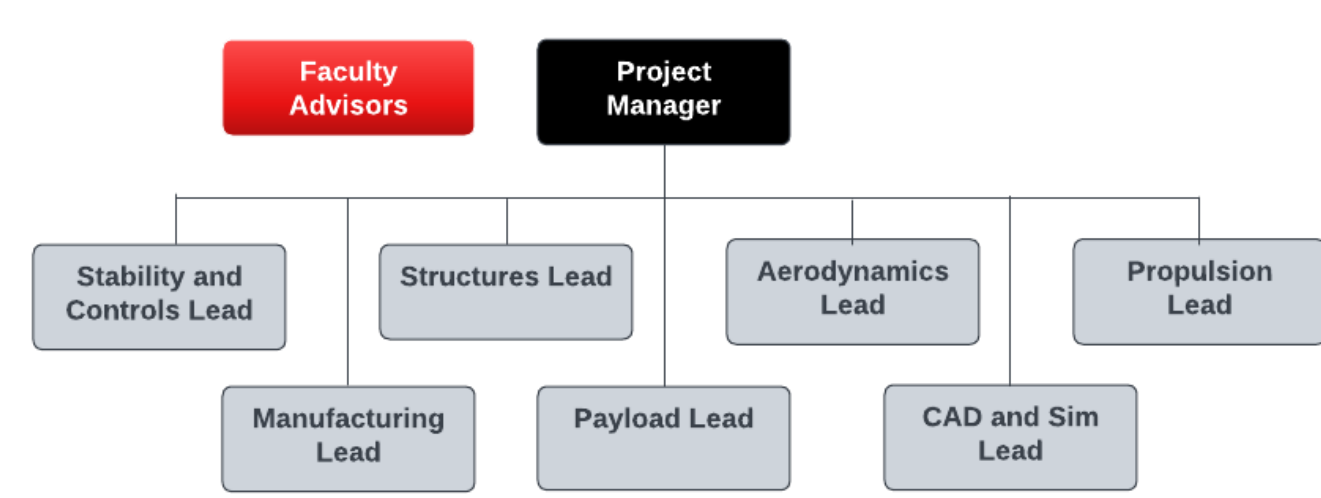
Aerospace Engineering Capstone Senior Design Project

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Team Organization

Team Members: Emily Hayman, Alex Elchik, Ajay Pandya, Rishi Ghosh, Nathan Baker, Maya Keele, Aaron Hart
7 sub-team leads, 18 underclassmen



Project Overview

Mission Statement: The 2023-2024 AIAA Design, Build, Fly competition has the need for an Urban Air Mobility aircraft that can perform a medical transport flight and carry passengers in separate configurations. Additionally, big cities are investing heavily in UAM technology, reducing the dense traffic and high commute times that residents experience daily. The purpose of this project is to design and manufacture a fixed-wing, STOL Urban Air Mobility Vehicle that can be utilized for multiple purposes.

Objectives: The overall objectives of the Wolfline are to act as a UAM vehicle that can carry flight crew, medical crew with equipment, and passengers.

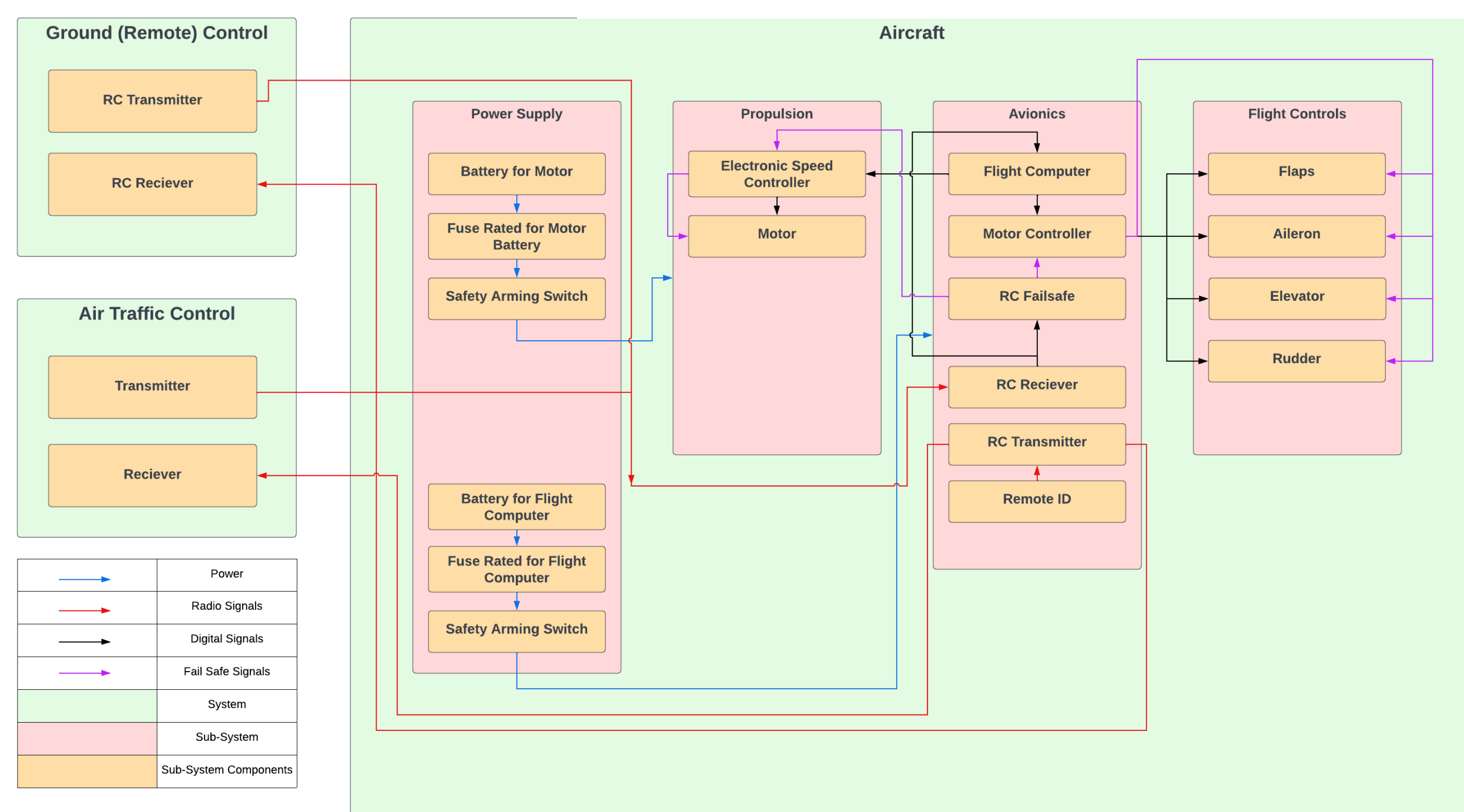
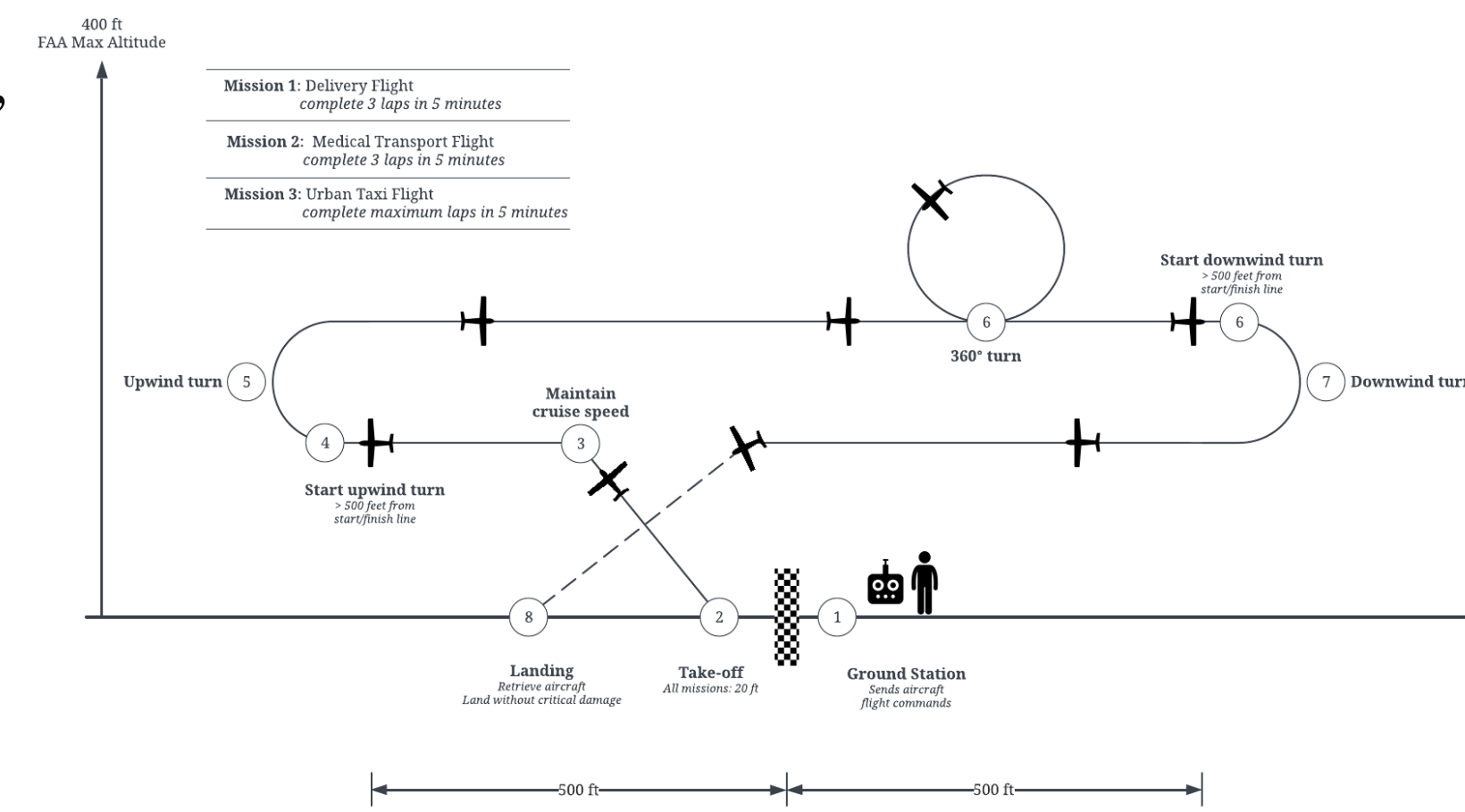
Mission Overview

Ground Mission: Demonstrate efficiency in changing flight configurations by placing the aircraft in flight configuration, loading and securing all Crew, EMTs, Patient on gurney, and Medical Supply Cabinet, and securing all hatches on doors.

Mission 1: Complete 3 laps in under 5 minutes with no payload or passengers

Mission 2: Complete 3 laps in under 5 minutes carrying Crew, EMTs, Patient on gurney, and Medical Supply Cabinet

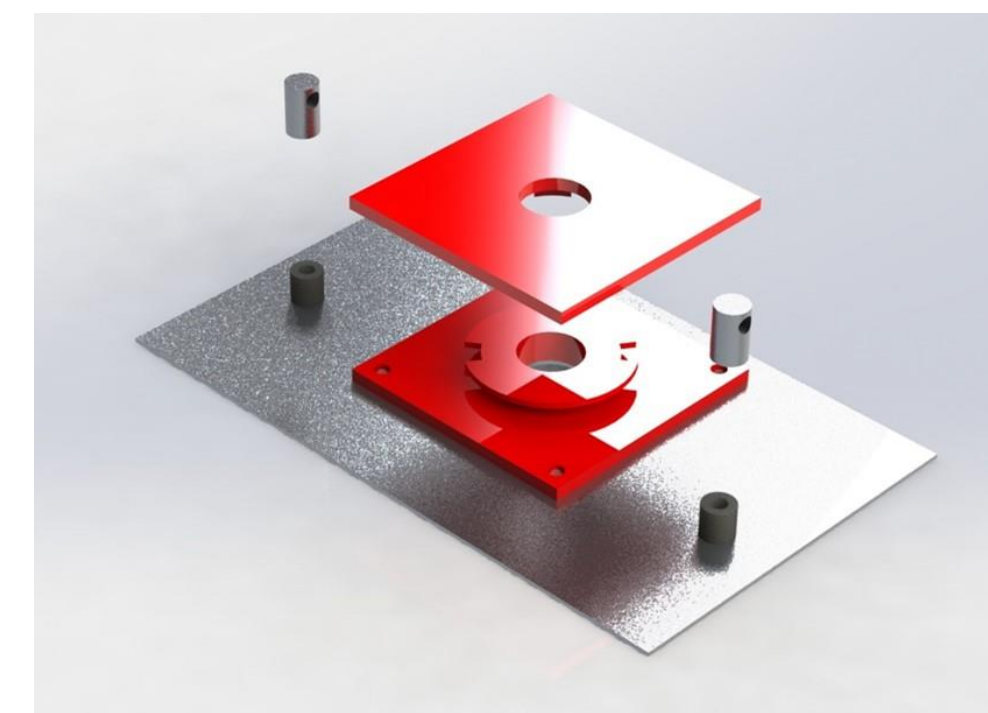
Mission 3: Complete maximum number of laps in 5 minutes with Crew and Passengers



Design Solution

Design Goals: A scoring analysis determined that the optimal design for the given missions features: 18 Passengers, 2.5-pound Medical Supply Cabinet, and a cruising velocity of 35 knots. The conceptual design process is shown in the figure to the right.

Design Features: Through sensitivity analyses and various trade studies covering all possible design solutions and methods, the design of the Wolfline was developed. See the below table and figures for results from the detailed design of the Wolfline.



Wing Rotation Mechanism: Since the Wolfline is required to fit within a 2.5-foot-wide parking space, the wing rotates when in its parking configuration. The Wing to Body mounting system is shown to the left.

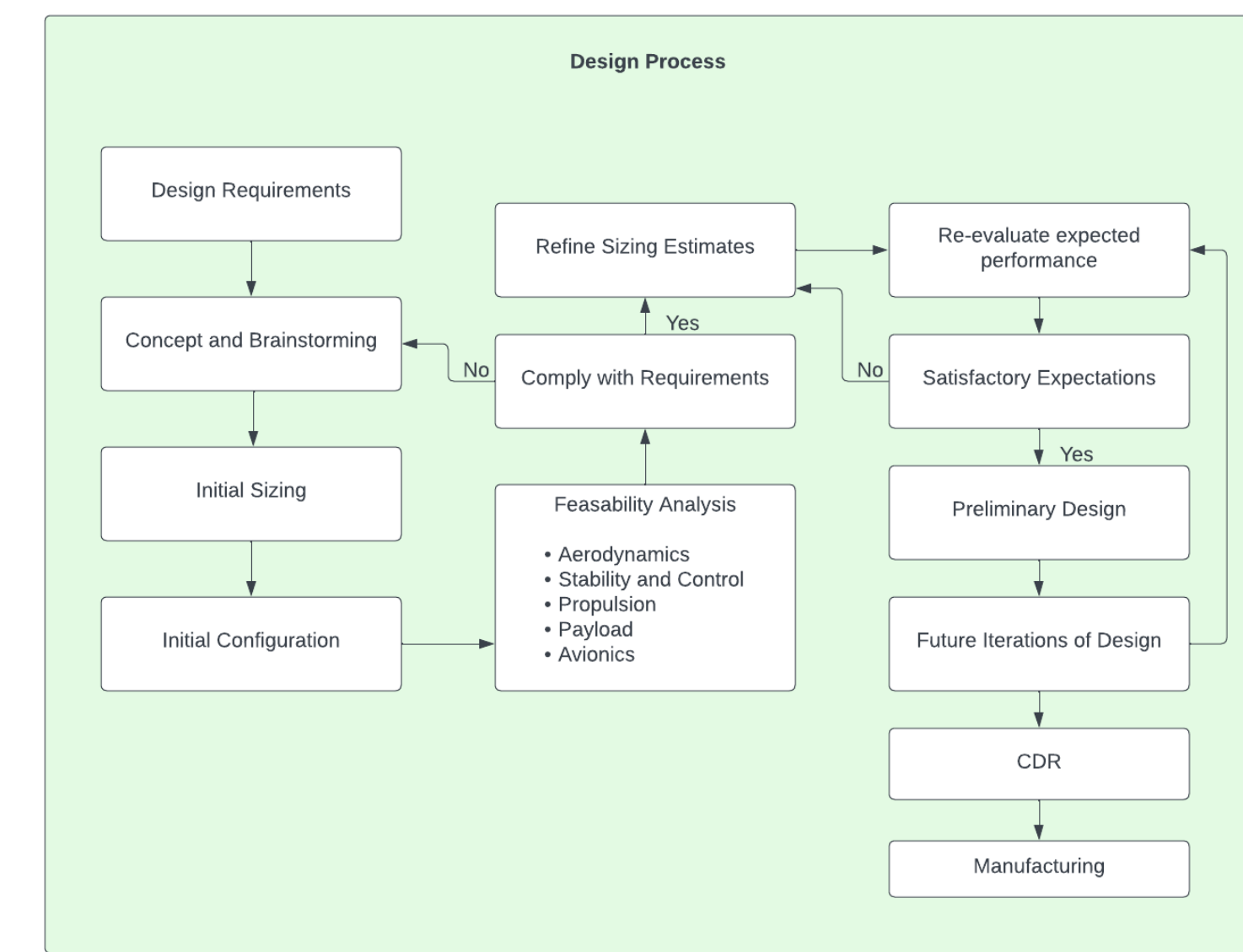
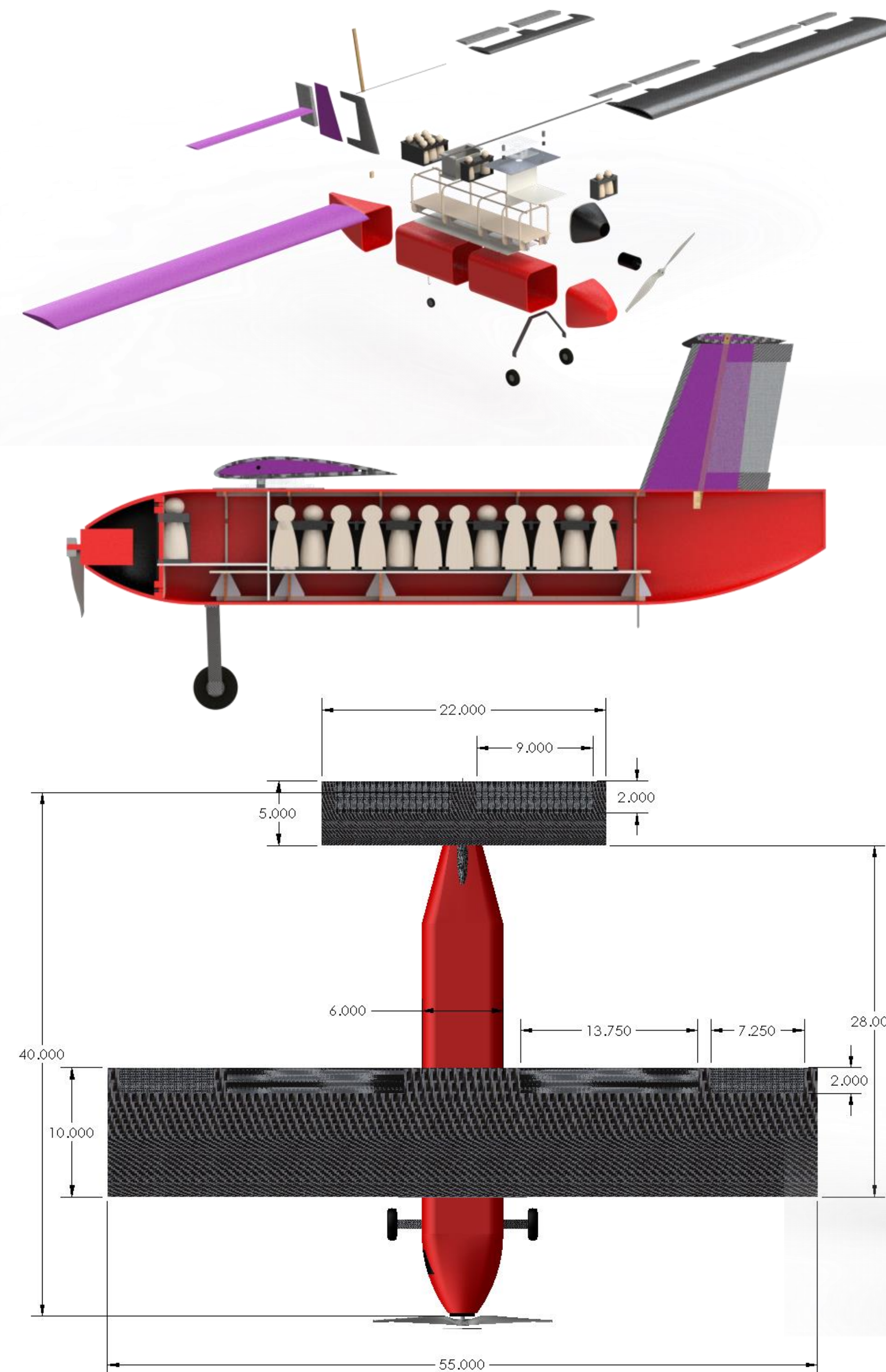


Table 1: Performance Parameters

Parameters	Size
Aspect Ratio	5.5
Wingspan	55 in
Wing Area	550 in ²
Nose to Tail Length	40 in
Wing Taper Ratio	1
Horizontal Tail Area	110 in ²
Horizontal Tail Volume Ratio	0.6
Horizontal Tail Taper Ratio	1
Vertical Tail Area	50 in ²
Vertical Tail Volume Ratio	0.05
Vertical Tail Sweep	20 deg
Vertical Tail Taper Ratio	0.78
Aircraft Wet Weight	13 lbs
Static Thrust to Weight Ratio	0.95
Cruise Speed	40 mph
Maximum L/D (at 5 degrees AoA)	12.41



Manufacturing Solution

The manufacturing process began in January 2024, with most of the work completed in the Senior Design fixed-wing lab space. The Wolfline had to be flight-ready by March 22, giving the team approximately three months to complete the full manufacturing process. The team had a 7-month window to go from the release of the DBF rules to the completion of the Wolfline.

Wings & Tails

- XPS Foam Core
- Carbon Fiber Skin
- Carbon Fiber Spars
- Fiberglass Hinges

Fuselage

- Fiberglass Composite

Wing Rotation Mount

- Aluminum Plate
- Titanium Bolts
- PLA & ABS Filament



Flight Testing



Initial Testing: The first and second flights took place on March 22nd, 2024, where the Wolfline proved taxi capability, control surface authority, and maneuverability.

Further Testing: Continual flight testing occurred on March 26th, 2024. Here, flight times were increased. Furthermore, the Wolfline demonstrated favorable controllability throughout the flights.



Results

- Proven favorable handling characteristics
- Ability to withstand increased rates of climb
- Benign stall characteristics
- Increased sensitivity to control surface deflections