UCI Design, Build, Fly 2023-2024

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Executive Summary

The goal of this project is to design and manufacture a modular aircraft for an annual competition held by American Institute of Aeronautics and Astronautics. The competition assigns constraints while also determining performance based on mission scoring. Mission criteria includes multiple variations on payload configurations such as a ground staging mission, a medical transport mission, and a passenger transport mission,

What is DBF?

Design, Build, Fly is a national, annual competition held by the American Institute of Aeronautics and Astronautics. Universities world-wide compete in three predetermined missions, where the competition is being held in Wichita, Kansas this year.

Mission Description

Mission 1:
- 3 laps in 5 mins
- Payload is the Crew

Mission 2:
- 3 laps in 5 mins
- Payload is the Crew, EMTs, Patient on a Gurney, and Medical Supply Cabinet

Mission 3:
- 5 mins to fly as many laps as possible with smallest battery
- Payload is the Crew and Passengers

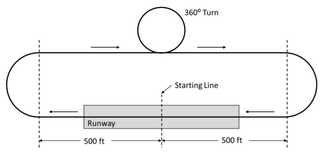


Figure 1: Course Map

Ground Mission:
- Timed mission to demonstrate efficiently changing mission configurations

Figure 2. Crew, EMTs, and Passengers.

Figure 3. Patient.

Design Constraints

WIngspan cannot exceed 5 feet	Aircraft must take off within 20 feet
Aircraft must fit within 2 ½ foot parking space during taxi	All payload must be perpendicular to fuselage floor
Passenger must not touch each other or aircraft structural components	Passengers must be secured to prevent any movement during flight
Doors must hinge between the centerlines of the aircraft fuselage	Doors must be less than 6 inches in width

B-Line

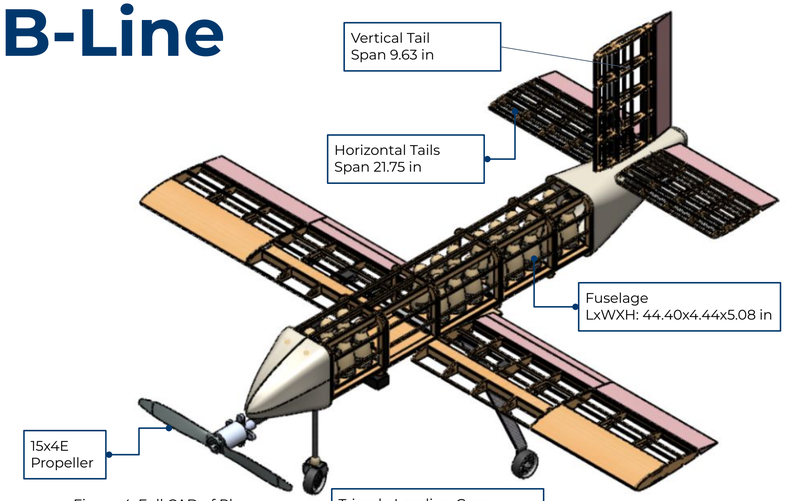
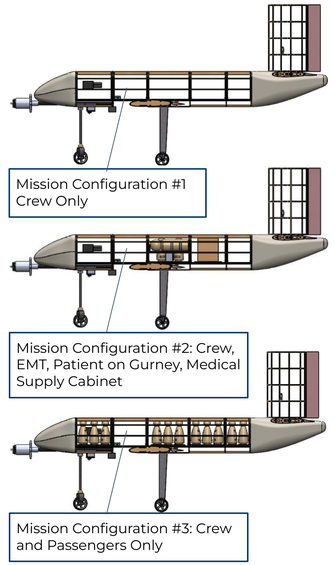
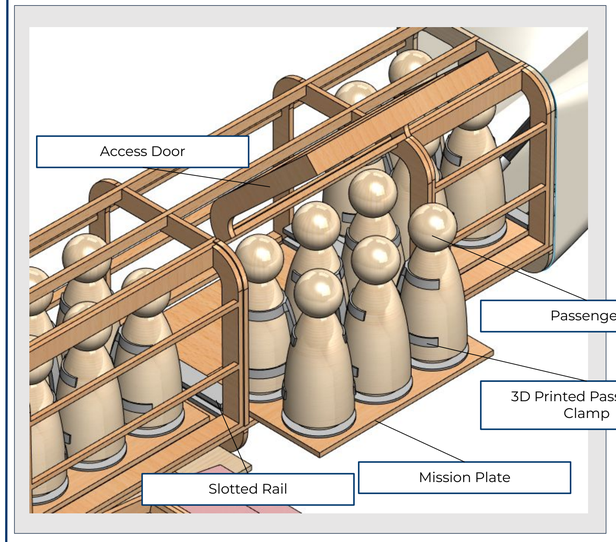


Figure 4: Full CAD of Plane





Fuselage Loading

- Fuselage loading loading system:
  - Slotted rails for mission plates
  - Securing clamps
  - Mission specific loading plates
  - Side loading doors for fuselage access

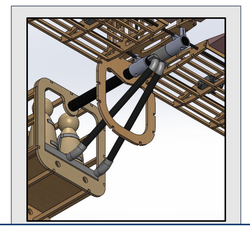


Figure 5: Tail Cone Assembly (Under the Tail Cone)

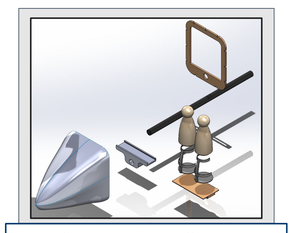


Figure 6: Exploded Nose Cone

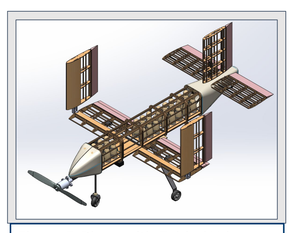


Figure 7: Plane with Folded Wings

Analysis

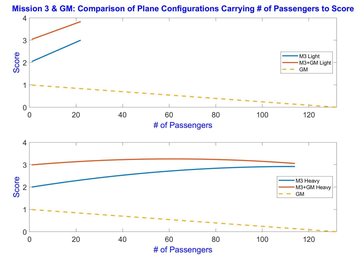
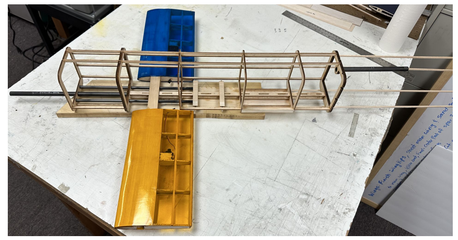


Figure 10: Mission 3 & GM Scoring Analysis

- Mission 3 and GM scores are complimentary
- Iteratively increasing number of passengers and battery capacity to find best aircraft sizing combination
- Determined the best possible combination to obtain a top score
  - Battery capacity most sensitive parameter
  - Low battery capacity and low passenger count performed the best

Hardware Performance



Future Improvements

Iterative Sizing	Changes based on testing results
Center of Gravity	Placement of electronics & payload based on testing results
Payload Plates	Improve the sliding of the payload
Electronics	Location of components, election wiring & routing
Wing Folding	Decrease time required to fold the wings

Impact on Society/ Safety

- Teaching future engineers important designing skills
- Mishandling of flying

Acknowledgments
Professor Jacqueline Huynh, Nathan Yeung, Collin Sledge for your expertise and mentorship.

References
Anderson. Fundamentals of Aerodynamics. McGraw-Hill Education, 2011. Shevell, Richard Shepard. Fundamentals of Flight. Prentice Hall, 1989.