Electrolight Aircraft Team

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Project Background

The E-Racer project, launched with the Aero Knowledge Center (AKC) at Las Cruces Airport, began as an electric racing aircraft concept. It later shifted to a scaled ultralight prototype to validate key performance metrics.

Project Objectives:

- Design **electric propulsion** system
- Optimize for long flight duration
  - **3-5 minutes** per **Amp Hour**
- Construct a scaled ultralight airframe
- Integrate battery, motor, and ESC
- Validate aerodynamics and control surfaces
- Test proof-of-concept flight capability
  - Stall speed of **less than 25 mph**
  - Max cruise speed of **55 mph**
  - Maximum weight of **30lb**

Through collaboration and engineering rigor, the team produced a functional scale prototype demonstrating the feasibility of electric ultralight aircraft for future full-scale development.

Final Design

A modular, all-electric ultralight aircraft optimized for aerodynamics, structural efficiency, and FAA Part 103 compliance.

Platform Selection:

- **GT 400 Quicksilver** chosen for adaptability, lightweight frame, and ease of manufacturing. Modified for electric propulsion while preserving modularity and structural integrity.

Propulsion System:

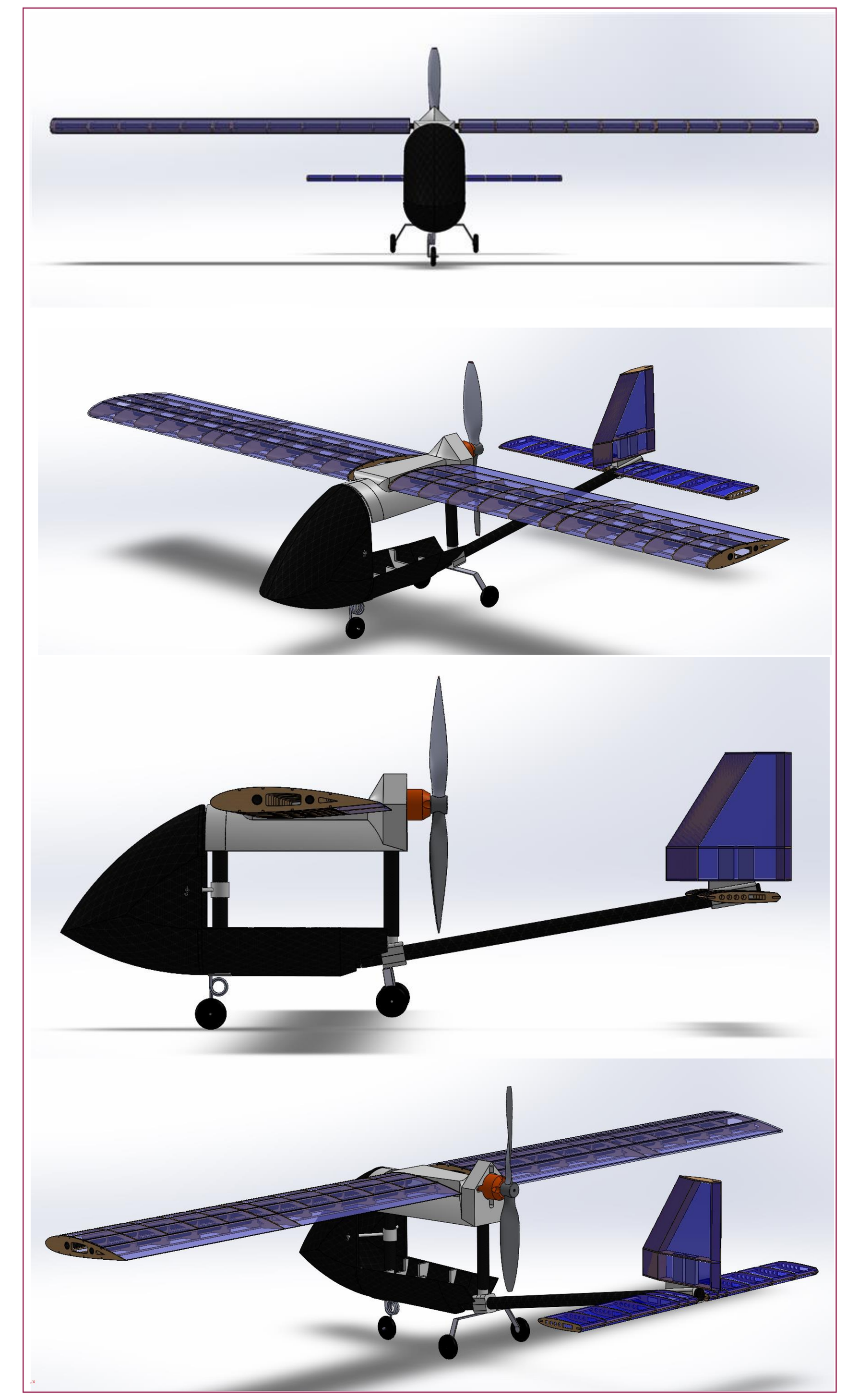
- Replaced combustion engine with **electric motor**.
- Reconfigured ESC, battery, and avionics for balance & endurance.
- Conducted **propeller performance testing** to inform thrust and efficiency characteristics.

Wing and Airframe Redesign:

- Utilized **carbon fiber, balsa wood, and PLA Aero** for the prototype to balance structural integrity with mass reduction.
- Increased aspect ratio to achieve better lift performance.
- Achieved stall speed (>25 mph) & max cruise speed of 55 mph.

Modular Nose Cone System:

- Integrated a modular nose cone for rapid aerodynamic testing.
- Wind tunnel data validated aerodynamic advantages of the asymmetrical design at nominal angles of attack.
- Final nose geometry is carbon fiber for durability and weight

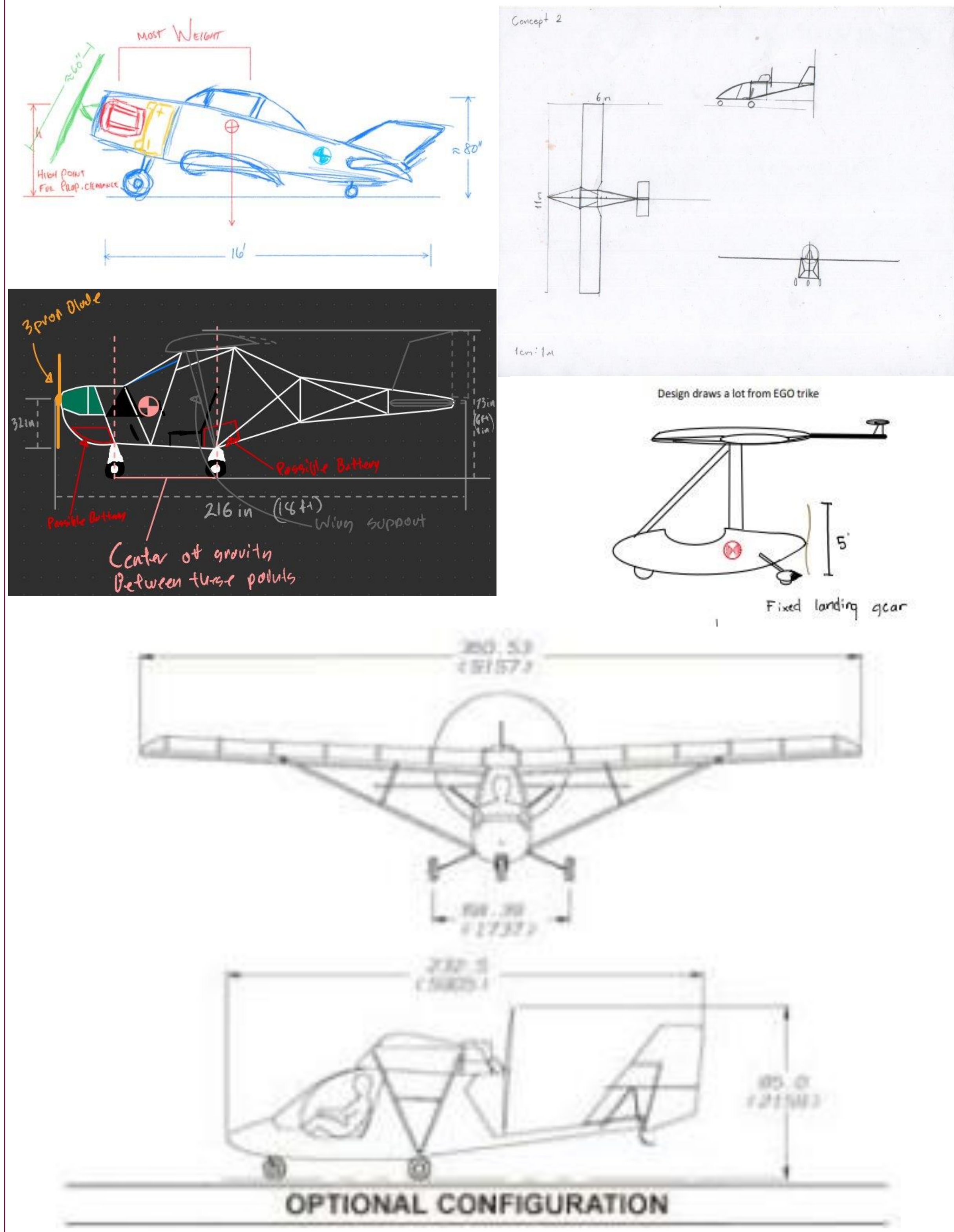


Concept Development

Pursuing the ultralight design objective, we surveyed the current selection of current ultralight designs.

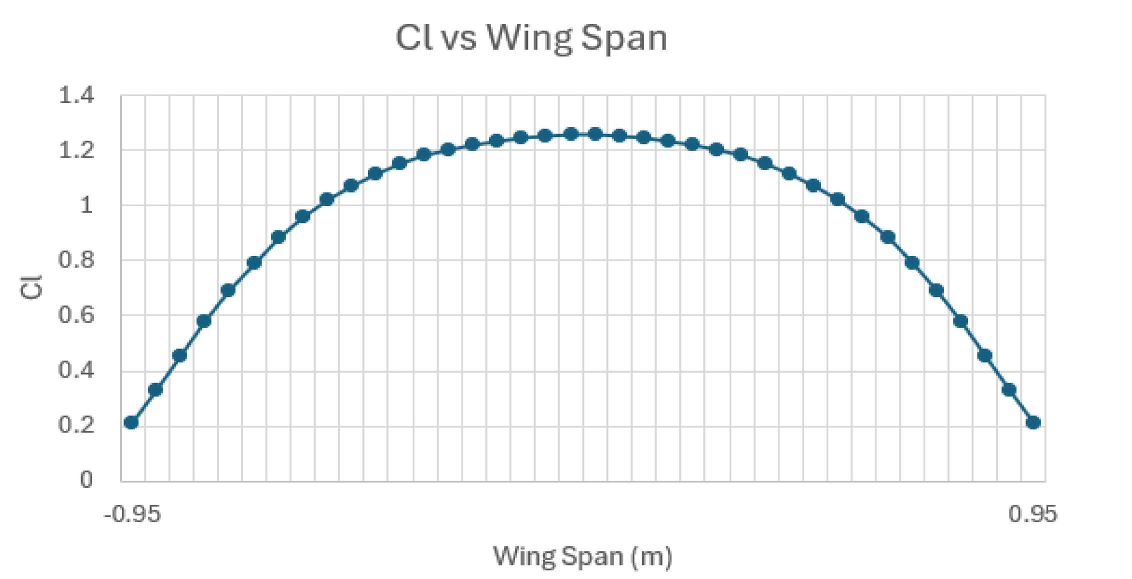
Our market research identified several inspirations optimal for electrification:

- GT 400 Quicksilver
- Aeroprakt A-22 Foxbat
- Skymax Nano
- Hummel UltraCruiser

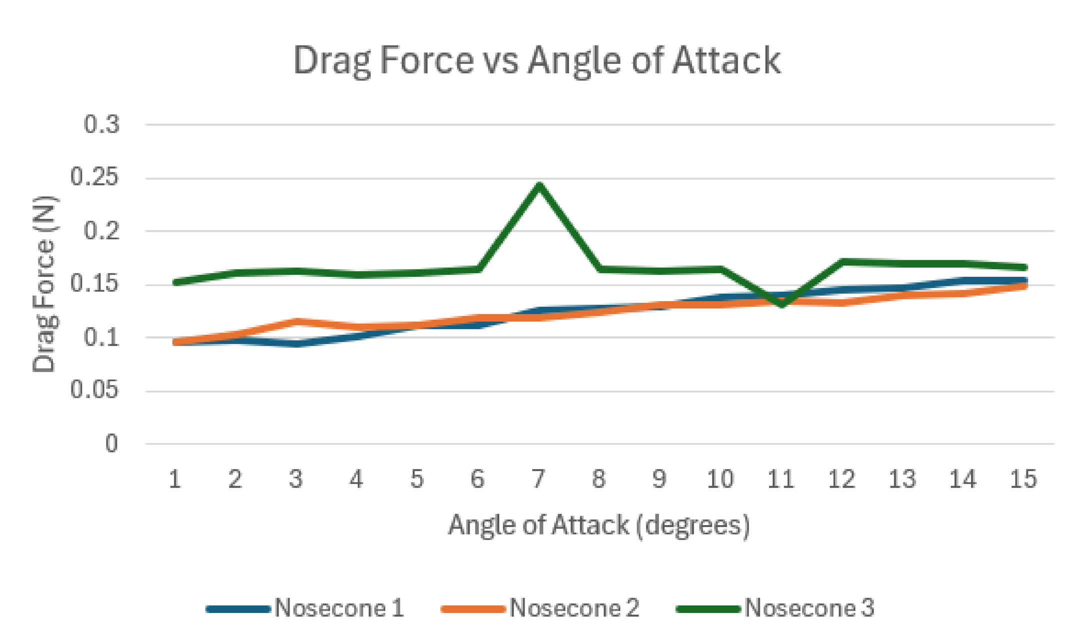


Research

- Investigated **FAA Part 103 regulations** related to ultralight aircraft, including restrictions on weight, speed, and electric power, to guide feasibility considerations for full-scale design.
- Researched the operation of **sting balances** used for measuring aerodynamic forces for wind tunnel testing.
- Identified lightweight fabrication methods using **composite molding**, and **FDM additive manufacturing**.
- Analyzed wings using **xflr5** to ensure stall requirements are met and with **Solidworks™** to perform a bending stress analysis on wing spars.

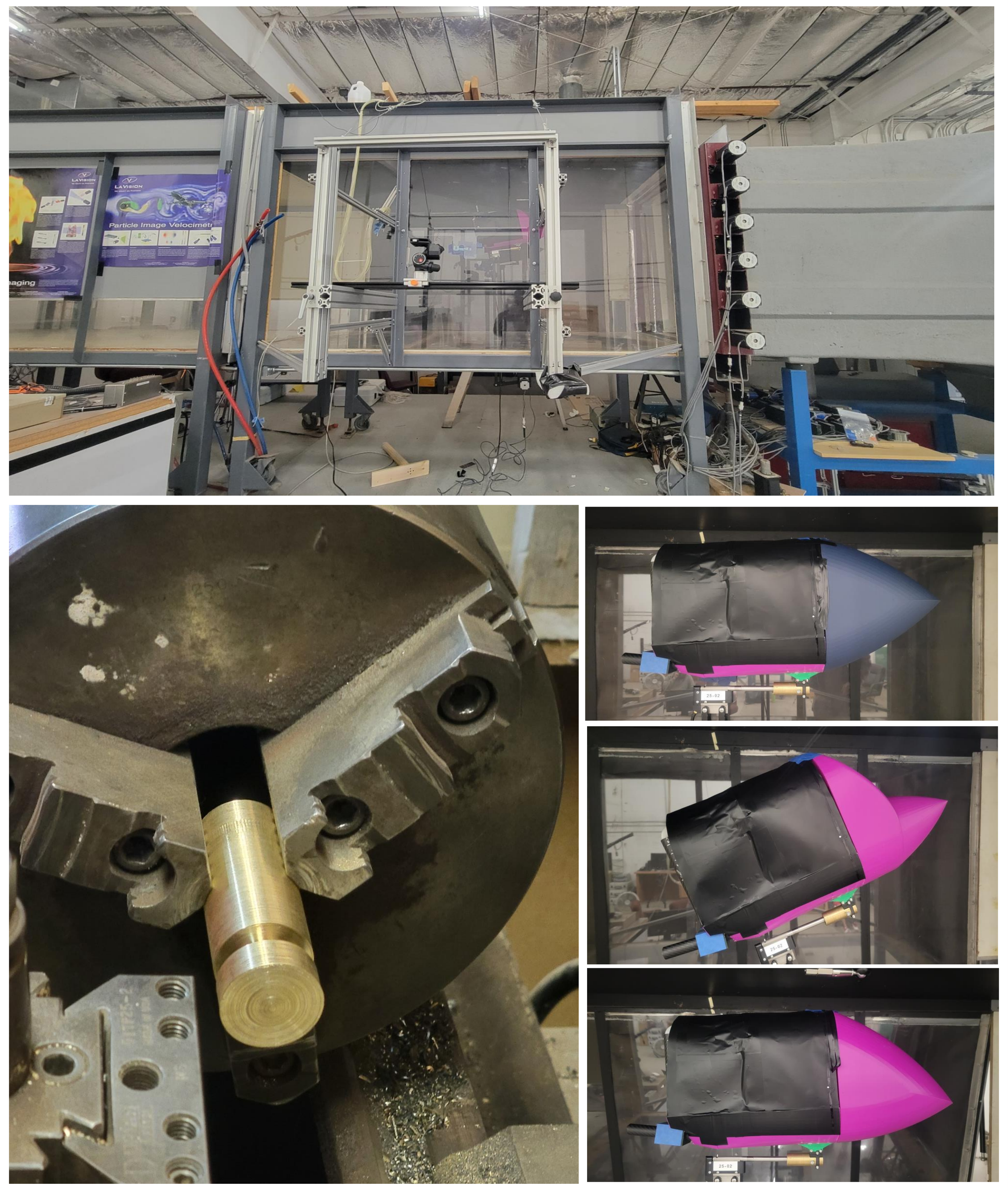


Wind Tunnel Results



- We expected that our nose design would be significantly more aerodynamic in the head on direction.
- This was verified by the drag data obtained from the wind tunnel tests.
- The test results showed that the vertically symmetrical nose cone generated more drag at high angles of attack than our other design.

Wind Tunnel Pictures



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