



R.C. Hydrofoil Sailboat

20 October 2023

Project Summary



Project Scope: To design and develop a remote-controlled (RC) sailboat, capable of sustained, stable hydrofoiling.

The project encompasses the creation of the entire sailboat structure, including three hulls, two different styles of hydrofoils, the mainsail and headsail, the sail control system, the rudder control system, and the propulsion system.

Although the intermediate goal is to design a rough “version 1.0” prototype, by the end of the year, the ultimate goal is to develop a high-performance hydrofoil sailboat that can be remotely controlled for recreational or competitive purposes.

Team Members (Presenting)



Structural Lead: Aric D. Hansen

Hydrodynamics Lead: Daphnie Ellis

Sail Lead: Shelby Harris

Team Lead/Control Integration: River Schreckengost

Structural

Main/Outrigger Hull(s)

- 100cm length, 51cm spacing
- Trimaran design provides high stability
- No counterweight/keel, reduces weight and height
- Carbon fiber/fiberglass construction
- Reduce hull cross-section

Frame

- Adjustable, to optimize force distribution after construction
- Exploring mounting options which ease in assembly

Mast/Sail Spar

- Use Sail Team specifications to design mast, jib sail spar, tension rigging points



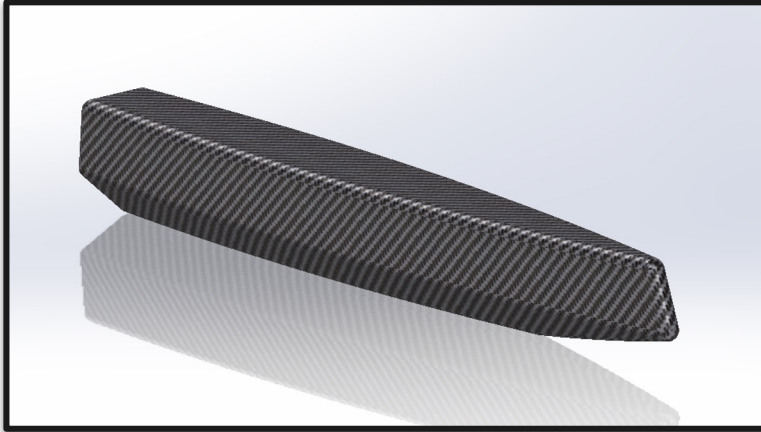
(Figure 1)



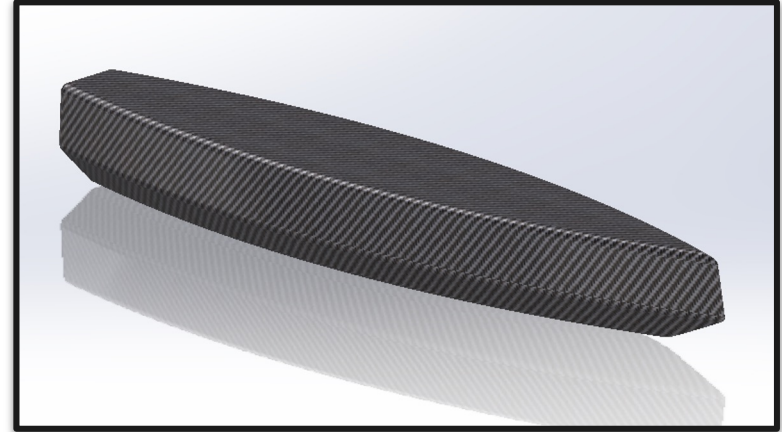
(Figure 2)

Image of an E-Foiling Trimaran from:
<https://www.boatdesign.net/threads/foiling-radio-control-trimarans.55840/>

Structural



- Outrigger Hulls Design Concept x2
- Length: 80 cm
- Width: 10 cm
- Height: 10 cm



- Center Hull Design Concept x1
- Length: 100 cm
- Width: 20 cm
- Height: 10 cm

Hydrodynamics



Picture of exposed hydrofoils.

file:///D:/Downloads/rc-multihulls-boats_1%20(1).pdf

Fixed/Rigid Outrigger Hydrofoils

- **2 V-Foils:** V-shaped hydrofoil (pictured) designed to be mounted on a sailboat to provide lift and reduce drag. This allows the vessel to sail more efficiently and at higher speeds.
- The foils are fitted inside rectangular transverse cases, installed just below the decks of the hulls. They are set up with screws that can adjust the take and the toe-in and toe-out of the foils.

Center Foil

- **1 E-Foil:** E-shaped foil (pictured) integrated onto the rudder was chosen for the main hull to house the electric motor, powered by a rechargeable battery. The motor is connected to a propeller located at the bottom of the hydrofoil. The motor will give us the ability to move the vessel without wind.

Sail

Mainsail & Headsail Configuration:

- **Mainsail:** Primary propulsion
- **Headsail:** Contributes to fine adjustments and balance.

This combination offers versatility in various wind conditions, allowing the trimaran to perform optimally.

Mast (128 cm, 62 cm from center hull rear):

- Mast of optimal length for improved sail efficiency and stability.
- Mast height is 1.3 times the overall length (LOA)
- Balanced Center of Effort will be aligned with the Center of Lateral Resistance for optimized forward motion.
- Utilizing .5 inch PVC pipe for the mast offers a lightweight, yet robust construction.
- This choice maintains the trimaran's agility while ensuring durability and longevity.



Picture of sailboat hydrofoiling.
file:///D:/Downloads/rc-multihulls-boats_1%20(1).pdf

Sail

Mainsail:

- Mainsail luff and foot dimensions optimize sail area.
- Luff length promotes proper sail shape and wind capture.
- Foot length contributes to balance and stability during foiling.
- Use of 3 battens on the mainsail to support the sails shape and improve durability
- Dimensions follow International One Meter (IOM) and Mini40 sail recommendations

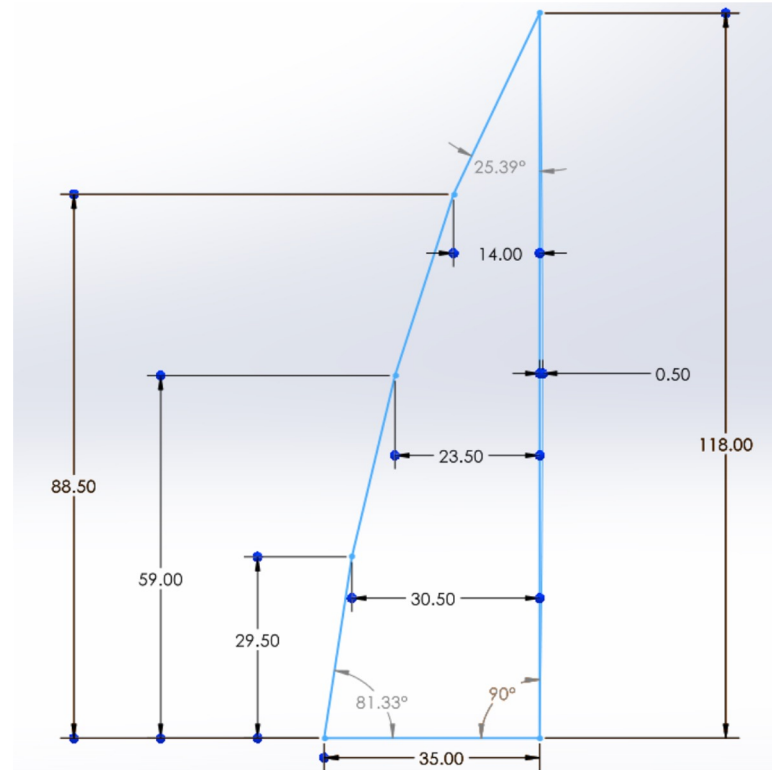
Headsail:

- Dimensions complement the mainsail.
- Helps in fine-tuning the trimaran's response to wind shifts
- Luff length: 62 cm, foot length: 35 cm

Sail Material:

- AIRX-600N
- Lightweight sailcloth with good strength to weight ratio

Mainsail Dimensions (cm)



Control Integration

Actuated Systems

- **Sail Control**
 - Mainsail servo (1:3 gear ratio) x1
 - Headsail Winches (1:2 gear ratio) x2
- **Rudder Control & Propulsion**
 - Servo (Internal potentiometer)
 - Brushless DC motor
 - Stabilization track for rudder
 - See (Contact Point 2)

Notable Electrical Components

- **Drive by Wire**
 - 9-channel transmitter/receiver
- **Battery**
 - 5,500mAh
 - Low voltage warning system

