The RoboBoat Autonomous Surface Vehicle

Christian Gary
Executive Coordinator
Mechanical Engineering
Undergraduate

Luke Matt
Technical Programming Lead
Mechanical Engineering
Undergraduate

Tristan Lee
Design Analyst
Mechanical Engineering
Undergraduate

Kaleb Gautreaux
Quality Assessment Director
Mechanical Engineering
Undergraduate

Grant Bellard
Fabrication Technician
Mechanical Engineering
Undergraduate

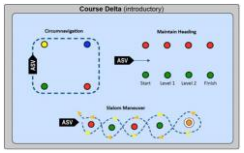
Dr. Joshua Vaughan, Ph.D.
Sponsoring Project Advisor
Mechanical Engineering
Associate Professor

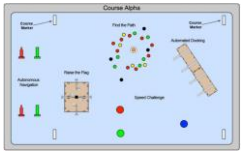
Background

Autonomous Surface Vehicles are on the rise in today's technological age. Unmanned Boats have the ability to complete a wide variety of tasks, including:

- Environment Surveying, Unmanned Military Missions, and Commercial Transport

The RoboBoat Competition, to be held in South Daytona, Florida, from June 17th to June 23rd, involves a multitude of teams from around the world. Each team competes in multiple challenges in which their boat must function autonomously.





Hull Analysis

Boat Hull Measurements		
Parameter	Abr.	Value
Volume in the Water (in^3)	D	770.40
Largest Submersed Cross Sectional Area of a Pontoon (in^2)	Am	22.30
Length of Waterline (in)	Lwl	47.92
Width of Waterline (in)	Bwl	8.59
Length of Hull (in)	Lh	60.00
Width of Hull (in)	Bh	10.00
Depth of Hull in Water (in)	Tc	3.94
Area of Hull in Water (in^2)	Aw	332.24

Prismatic Coefficient:
Tells how well the boat will cut through the water and break waves

Midship Coefficient:
Tells how rounded the bottom of the hull is

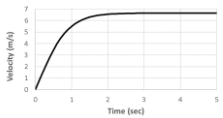
Water Plane Coefficient:
The ratio of the area of the water-plane to the area of the circumscribing rectangle (with equal length and breadth

Calculated Boat Hull Coefficients		
Parameter	Equation	Value
Prismatic Coefficient	Cp=D/(Am*Lwl)	0.721
Midship Coefficient	Cm=Am/(Tc*Bwl)	0.659
Water plane Coefficient	Cw=Aw/(Bwl*Lwl)	0.807

Standard, All Purpose Catamaran Style Coefficients	
Parameter	Value
Prismatic Coefficient	0.59
Midship Coefficient	0.785
Water plane Coefficient	0.71

Buoyancy and Drag

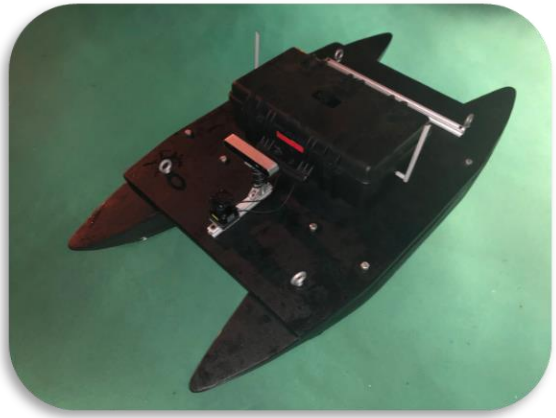
Buoyancy Calculations	
Parameter	Value
Weight of Boat (lbs)	55.640
Total Volume of Submerged Hull (ft^3)	0.892
Volume of One Catamaran (ft^3)	0.446



Boat Specifications	
Drag Coefficient	0.295
Max Reverse Thrust (Single Motor) (N)	40.030
Reverse Thrust w/ 20° Angle (N)	37.618
Max Thrust (N)	187.274

Drag Force		
Shape	Drag Coefficient	Force (N)
Flat Circular Plate	1.12	81.6
Bullet	0.295	21.5
Streamlined Body	0.04	2.9

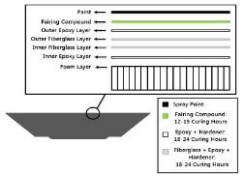
Design



Manufacture

Foam Shaping
Planar Foam Shapes Adhered and Sanded to Round Surface for Pontoon and Bridge Core

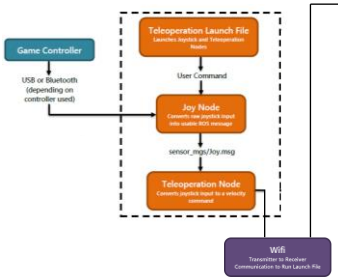
Layering
Fiberglass/Epoxy Composite Layers Applied and Structure Completely Formed by Fairing

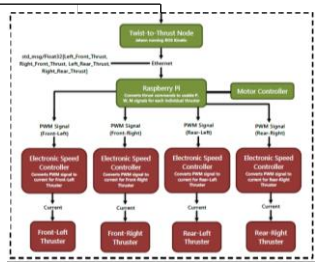


Structure & Aesthetics
Final Surface Shaped, Hull Painted, and Bulk Structures Mounted

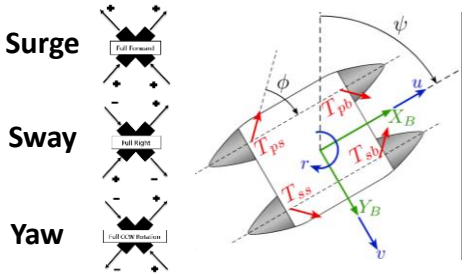
Component Calibration
Components Positioned, Tested, and Moved As Needed

Operation





Thruster Mapping



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References

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[2] "Catamaran Design Formulas." Catamaransite, 2018, www.catamaransite.com/catamaran_hull_design_formulas.html.