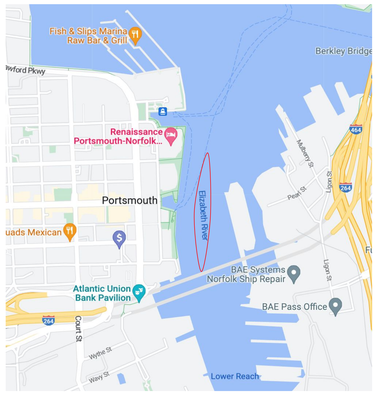
ASNE23 - PEP Electric Boat Competition

David DeScherer, Eric Guo, Sara Pardee, John Wu

Project Background

We are participating in this year's annual Promoting Electric Propulsion (PEP) competition hosted by the American Society of Naval Engineers (ASNE). To inspire the creation of eco-friendly alternatives, this competition challenges student groups to design and manufacture fully electric-powered boats. The boats will compete in a five-mile race that will be held in Portsmouth, Virginia this June.



Design Requirements

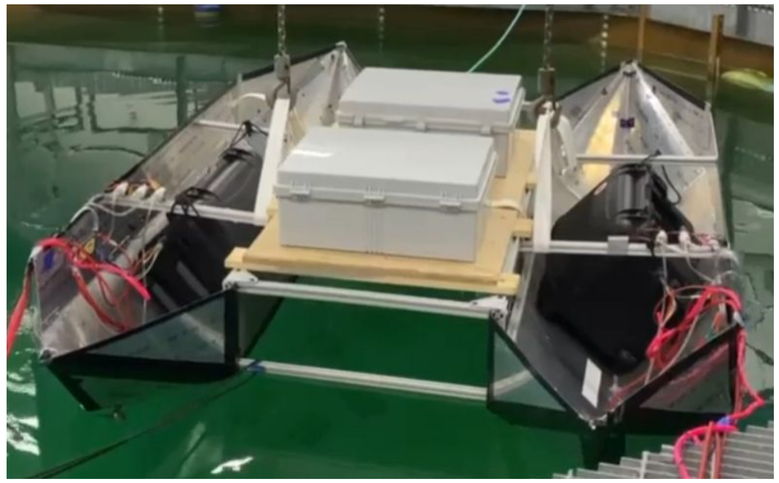
- Must complete the five mile course in under 40 minutes
- Cannot be powered by gasoline engines, sails, or manual propulsion
- Design must comply with USCG safety regulations
- Operated by human pilot

Design Objective

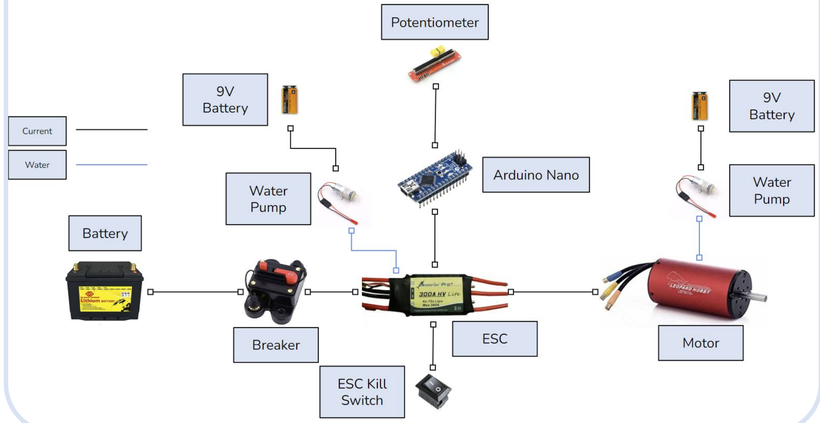
ASNE23 aims to submit a human piloted entry to this year's competition capable of completing the race course in record time.

Design Overview

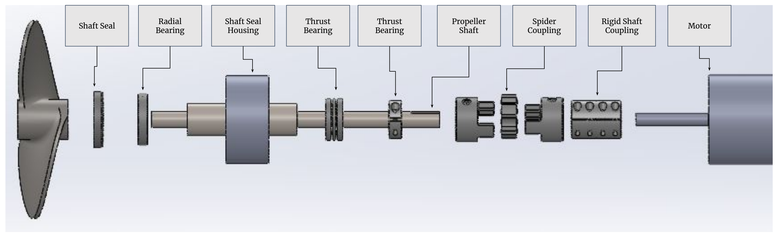
Our design is a low drag catamaran-style hull design that allows for high stability. The propulsion system is composed of two high-power 7600W brushless DC motors powered by 3 LiPoFe batteries wired in series. This system is connected to our custom made powertrains. An ergonomic driver cell allows for a low center of gravity, and the dual motors allows sharp turning without the added drag and complexity of a rudder.



Electronics Overview



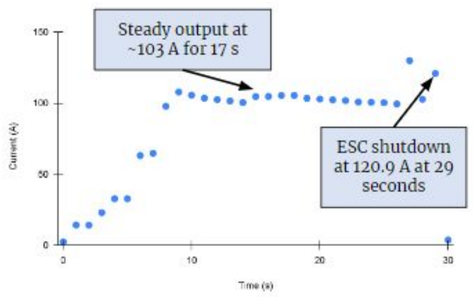
Powertrain Exploded View



Testing, Optimization, and Evaluation

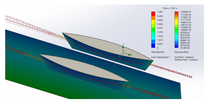
Prolonged "Dry" Test:
One hull was propped over a storm drain and the shaft seal was sprayed with water as it ran at 20% power for 22 minutes. This provided cooling and lubrication for the rubber shaft seal outside of the tank for an extended time. The motor reached 145 ℉ so the test was stopped. Watercooling is being implemented for the motors and ESC.

In-Water Test:
The boat will be lifted into Professor Whitcomb's ROV tank and tethered from the sides and rear. Current draw measurements were taken over a 30 second test., Motor and ESC temperatures were constantly monitored. Following this test, we will adjust propeller size, and prepare the boat for a full 5-mile in water test at Merritt Point Park.



Design Process

- Brainstorm Solutions
- Model and Simulate
- Manufacture
- Test
- Identify Problems
- Repeat



CFD Simulation

Hull Fabrication

Float Test

Next Steps

- Modify boat design based on ROV tank test results
- Test design by piloting the boat for a 5-mile test at Merritt Point Park
- Make any necessary final improvements
- Compete!

Acknowledgements
Special thanks to Dr. Stephen Belkoff, Dr. Greater Tryggvason, Rich Middlestadt, Dr. Louis Whitcomb and Michael Briscoe