



SOUTH DAKOTA MINES

RoBoAT ROBOTICS

2024-2025 COMPETITION TECHNICAL DESIGN REPORT

2024-2025 RoBoat Robotics Team Members:

Abstract

Our team contains several new and aspiring members that we want to impart our knowledge and skills onto. Using the knowledge we gained at previous competitions and the mistakes of our own robot, we hope to provide a template for the newer members to learn the boat and be able to expand from it in continuing years. For this reason, we are improving upon our existing boat to establish a basis for our newer members. Even with utilizing our older design, we are still applying several innovations into the boat to improve its abilities from earlier years.

Competition Goals

Our overall goal for this year is to build on last year's design and get the robot functional in order to compete at the obstacles that the team intended to complete last year. This is due to the majority of new and learning members on the team this year. The team intends to have the robot properly working autonomously and is aiming towards attempting all of the obstacle navigation - based challenges. Because of the shortened timescale, the team is moving towards a more robust design that will provide a base to work off of for later years.

Design Strategy

The different design teams each have their own goals for this year's competition. First, for the mechanical engineering team, the hulls themselves are not being changed but are undergoing some small repairs to fix some slow leaks where the motors attach to the hull. We are redesigning most of the motor and sensor fittings to properly hold and prevent further leaks. The mechanical team is also changing the deck design to connect the hulls with a series of carbon-fiber tubes, onto which the battery and electronics box will also be attached. The carbon fiber tubes will be much sturdier than the previous deck design, making the overall design much sturdier.

Next, the electrical engineering team is working on updating the internal electronics for the boat, and has updates both regarding general upgrades to the electronics as well as with respect to the new electronics box. Instead of one single, giant battery, this year the team will be using two smaller lithium-ion batteries wired in series for robot power. The new setup will also allow for batteries to be swapped out and substituted easily in the future. Another update to the electrical system is a redesign that allows the processors such as the Arduino and Jetson to maintain power when the e-stop is pressed, which will make things easier on the coding team and allow the robot to come back from the e-stop faster. The last major improvement to the electrical system is the addition of an antenna booster to allow for a more stable connection to the computer onshore with the boat while on the water.

Finally, the computer science team is working on getting working code together for the robot to be properly automated for this year's competition. This is focused mostly on the color and depth detection with the camera. Among general code updates, the computer science team is also working on implementing ROS coding to allow for future expansions (such as additional modules for different course objectives) to be added easier in the future.

Testing Strategy

For testing, the plan is to test individual components as the assembly progresses and eventually do in-depth bench tests on the whole assembly. Most of the testing is being performed by the software team to test new software. Some tests have already been performed, relating to ensuring individual components are working and outputting the necessary data. For the full bench test, the plan is to create mockups of the buoys that will be used on the course and use those to make sure the full system is interacting with its environment like it should be. If given enough time, the team will also attempt to do an in-water test at the local YMCA, where the team has gotten permission to use one of the pools for testing purposes (given advance notice). Any in-water tests would be comprehensive tests of the entire system and not individual components.

Acknowledgements

This project would not have been possible without the time and effort put in by each of this year's team members:

Caleb Henderson - President

Jack McIntosh - Secretary

Andrew Johannsen - Electrical Lead

Ky Duyen - Software Design

Christopher Butsavage - Software Design

Jacob Shafer - Electrical Design

Elizabeth Fox - Mechanical Design

Joseph Romero - Vice President

Grant Lewis - Treasurer

William Lewis - Software Lead

Henry Porisch - Mechanical Lead

Alex Pekelder - Mechanical Design

Steven Aldrich - Mechanical Design

This project would also not have been possible without the contributions of our sponsors:



South Dakota School of Mines

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Appendix A: Component List

Component	Vendor	Model/Type	Specs	Custom/ Purchased	Cost/Each	Year of Purchase	Quantity
Hull	N/A	N/A		Custom		2022	2
T200 Thruster	Blue Robotics	T200		Purchased	\$200	2022	2
Thruster Mount Plate	N/A			Custom		2022	2
Carbon Fiber Deck Tube	Dragon Plate	Roll Wrapped Carbon Fiber Round Tube	x" OD x x" T x x" LG cut to 3x33" LG	Purchased		2023	1
Deck Clamp						2024	6
Box Tube Clamp						2024	2
Electronics Box				Purchased		2024	1
Electronics Board			16" LG x 11.75" W x 0.25" T	Purchased		2024	1
Electronics Board Clip				Purchased		2024	4
Arduino				Purchased		2024	
Jetson				Purchased		2024	
E-Stop Button				Purchased		2022	
Antenna Booster	Ubiquiti Networks	Bullet M2 HP		Purchased	\$85	2024	2