

Non-ROV Device Design | Skaði

Marooned Mariners | Ranger Class | 2026

Bristol Tennessee High School, Bristol, Tennessee, U.S.A.

Philosophy:

For the 2026 MATE ROV Competition, the Mariners decided to attempt Task 4: MATE Floats! By building our autonomous vertical profiling device, Skadi. This float is capable of safely descending to 2.5m, and ascending to a subsurface depth, recording data to be reported. The design draws on the strengths and weaknesses of past designs like Vidar and Ratatoskr, the previous attempts at the task. Several improvements were made to the design, and the capability of the float has expanded wildly over past iterations. Improvements have been made to the structure, size, and programming of the device, which have allowed the increase of capability we have seen.



Fully Integrated Device

Design & Testing:

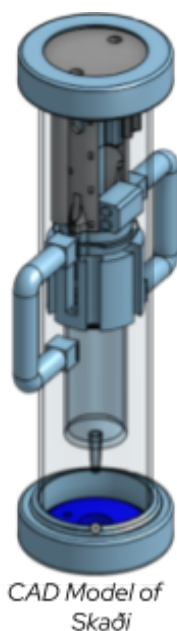
Dozens of hours were put into a CAD model of the device, which has enabled us not only to visualize the design, but also 3d print many aspects of the design. 3d printing our structure allowed us to rapidly prototype the design, find issues, and fix them as quickly as they arose.

After full integration, we have achieved extensive pool testing, to varying degrees of success, allowing us to fine-tune the hardware and code of the device. We found and addressed issues with cap sealing, as well as the code of the device, all of which would not have been discovered or addressed without our extensive test campaign.

Safety:

A rubber stopper is placed within a hole in the bottom cap so that if the pressure on the inside of the float would exceed that of outside the float, the stopper would pop off to relieve pressure. The 1-amp blade fuse and 9.6V

NiMH battery are both in accordance with size and type regulations. The exterior of Skadi has no sharp edges or hazardous elements.



CAD Model of
Skaði

Electronics:

Skadi is powered by a 9.6V-rated NiMH battery pack, consisting of eight AA-size batteries. A Blue Robotics bulkhead penetrator switch controls the power of the device, making sure power flows only when we are ready to operate, and allowing us to fully break the circuit when the circuit needs attention. Approximately 4 cm from the positive terminal of the battery connector, a 1-amp ATO blade fuse is in place to break the circuit in the event that the load exceeds 1 amp.

The 9.6V, 2000mAh battery was chosen because similar batteries have powered our past designs, Ratatoskr and Viðarr, without issue.



Battery and Fuse Assembly

Computing and Sensing:

Skadi's processing is undertaken by an Arduino Nano 33 IOT located at the top of the device. The Arduino receives data from the BlueRobotics Bar02 Depth/Pressure Sensor at the top of the device. This data is then wirelessly transmitted to a laptop by the Arduino via Bluetooth. The pressure sensor has the capability to compute depth automatically, allowing us to quickly interpret and use data.

Mechanics:

The primary structure of the device comes from a 17-inch-long polycarbonate tube. The endcaps now feature a system resembling a mason jar, with a disc being held and sealed onto the tube by a ring. The top cap has a fully 3d-printed sled extending into the float, which provides the structure for all components in the device. Fitted into the bottom cap is a pressure release plug and a port to allow the syringe to pull water.

Movement Control:

The vertical movement of Skadi is made possible by an interior syringe and Actuatorix L16-100-150-6-R linear servo motor. The servo is attached to the plunger of a 250mL syringe, pumping water in and out of the device. As the device takes on water in the syringe, it sinks towards the bottom of the pool. In the same way, as water is pushed out of the syringe, Skadi rises to the surface. The Arduino runs a PID control loop in order to accurately descend to the proper depths by responding to its current depth. This will be backed up by a failsafe such that the device will return to the surface after a given time.

Non-ROV Device SID:

