



TASK: *MATE Floats Under the Ice!*

Once again, this year the preview mission focuses on *MATE Floats!* and includes all of the details of this task as well as hints and specifications for building a vertical profiling float (non-ROV device). The mission outlined below will be included in the competition manuals as **one of the tasks** for the 2026 competition season.

MATE Floats! 2026 is inspired by the National Science Foundation (NSF)-funded [GO-BGC Project](#). The goal of GO-BGC is to build a global network of profiling floats with chemical and biological sensors to monitor circulation, chemistry, biology, and overall ocean health. Scientists, engineers, and technicians are using NSF grant funds to build and deploy 500 robotic ocean-monitoring floats around the globe. GO-BGC hit the 300 mark, with 325 out of the targeted 500 GO-BGC floats deployed or en route to be deployed from research vessels. These include floats deployed in the polar waters.

Operating floats in polar waters where they may encounter ice is a real-world challenge faced by GO-BGC float technicians. Sensors and antennas, not to mention the float itself, run the risk of being damaged if the float attempts to surface with an ice sheet overhead. There is also the possibility of floats becoming entrained in sea ice and crushed. Therefore, floats deployed in polar waters must be engineered with ice-avoidance capabilities and with the ability to store data during under-ice profiles and delay transmission until the float is clear to surface in open water. “Ice-avoidance capabilities” translates to sensors measuring water temperature and chemistry to assess if ice is detected as the float ascends to the surface, along with the decision-making capability (i.e., an ice-avoidance algorithm) to reverse course and descend rather than continuing to surface.

Given the location of the 2026 MATE World Championship, this year’s EXPLORER, PIONEER and RANGER *MATE Floats!* mission scenario takes place UNDER the ice in the [National Research Council’s \(NRC\)](#) ice tank. But for NAVIGATOR and SCOUT class teams at regional competitions, this translates to a simulated under-ice task.

While SCOUT class companies are not tasked with operating under the ice, they are being tasked with a new challenge – designing a float with a buoyancy engine. A [buoyancy engine](#) moves fluid from inside the float to outside the float, displacing seawater and changing the volume and thus the density of the float. This moves the float vertically (up and down) in the water. And like last

year, *MATE Floats!* is also challenging SCOUT class companies to incorporate decision-making into their floats by developing a program or code that controls the movement of the float. This means that the float is programmed to autonomously descend to the bottom and return to the surface (i.e., complete a vertical profile).

This task involves the following steps:

Design and construct an operational vertical profiling float

- **Prior to the competition, design and construct a vertical profiling float – 5 points**
- **Deploy the float in the designated area – 5 points**
- **Float completes two vertical profiles**
 - **Float uses a buoyancy engine**
 - **Completes first vertical profile operating autonomously – 15 points**
 - **Completes second vertical profile operating autonomously – 15 points**
 - or
 - **Completes first vertical profile operating manually – 10 points**
 - **Completes second vertical profile operating manually – 10 points**
 - or
 - **Float uses another mechanism**
 - **Completes first vertical profile operating autonomously – 10 points**
 - **Completes second vertical profile operating autonomously – 10 points**
 - or
 - **Completes first vertical profile operating manually – 5 points**
 - **Completes second vertical profile operating manually – 5 points**
- **MATE provided temperature and depth data is graphed**
 - **MATE provided data is used to graph depth over time – up to 10 points**
 - **Graph is plotted using a computer program – 10 points**
 - **Graph is plotted by hand on paper – 5 points**

Total Points = 50 points

Product Demonstration Notes:

Prior to the competition, companies must build a float capable of completing two vertical profiles (i.e., traveling from the surface to the bottom of the pool, then ascending back to the surface).

Companies have two major choices when designing and building their float. The float can use a buoyancy engine or a different mechanism (something other than a buoyancy engine) to complete vertical profiles. As described above, a [buoyancy engine](#) moves fluid from inside the float to outside the float, displacing seawater and changing the volume and thus the density of the float. This moves the float vertically (up and down) in the water. Using motors to move air or liquid does constitute a buoyancy engine. Using motors as thrusters to directly move the float, by turning a propeller or emitting a jet of water, is considered using a different mechanism.

Also, companies can design a float that operates autonomously or manually. A float that operates autonomously uses a computer program to move the float vertically through the water, while a manually controlled float is controlled by a company member on the surface, side of the pool. Companies that use a computer program to control the float are allowed to manually start the process, but once started, the computer program must issue commands so that the float descends to the bottom. Companies may not manually reverse the process to bring the float to the surface; a computer program must do this autonomously. Companies that manually control the float are allowed to have a company member controlling the buoyancy engine or thruster motor. This would include a switch controlling the direction of a thruster motor, a manual pump pushing air into an open bottomed section of the float, or a manually operated syringe on the surface opening and closing a syringe on the float.

Design specifications for the vertical profiling float:

- Propellers (if used) must be enclosed inside the frame of the float or shrouded. The propeller should not be able to touch any surface of the pool. Floats with propellers protruding outside the framework will not pass safety inspection and cannot be used.
- Must operate independently of the ROV. The float must go down and up independently of the ROV (on its own).
- Any power source for the float must be on the surface. Electronics/computer boards (Arduino/Raspberry Pi, etc.) may be on the surface or on the vehicle.
- All profiling floats must be connected to the surface by a tether and/or other lines. Floats using electrical power must be connected to the MATE power supply. Onboard batteries or onboard power is not allowed. Floats not using electrical power must still be connected to the surface by an airline tube, rope or other line.
- Must be less than 50 centimeters in overall height. The float may not have a diameter/length/width greater than 15 cm.
- May not use an air compressor to send compressed air to the float but may use a manually powered pump to push air into an open bottom container. Likewise a manually powered syringe could open and close a syringe on the float.
- MUST operate as a non-ROV device. See below for additional information on powering non-ROV devices.

Companies will receive 5 points for successfully designing and constructing a vertical profiling float. Successfully designing and constructing a float is defined as bringing the profiling float to the mission station and explaining to the judge how it operates (how it moves up and down in the water column). This explanation must cover whether your float uses a buoyancy engine or uses a different mechanism and whether your float operates autonomously or manually.

Companies must deploy their float in a designated location. The designated location is defined as anywhere beyond a green mark set 1.5 meters out in the pool. Companies will receive 5 points when they successfully deploy their float. Successfully deploying the float is defined as the float no longer in contact with the ROV, floating on the surface, and beyond the green mark 1.5 meters

away from the side of the pool. The ROV must deploy the float; companies cannot throw their float beyond the 1.5 meter mark. If the float is released before reaching the designated location, companies are permitted to retrieve the float and reposition it in the designated location. However, the team can alternatively choose to forgo the 5 points for successfully deploying the float and begin its vertical profile tasks.

The float should attempt to complete two vertical profiles. A vertical profile is defined as the float on the surface of the water, descending to the bottom of the pool, then ascending to and breaking the surface of the water. Depending on the float design, companies will receive variable points for completing two vertical profiles.

If a company designs its float using a buoyancy engine, and the float operates autonomously, companies will receive 15 points for completing the first vertical profile and 15 points for completing their second vertical profile. If a company designs their float using a buoyancy engine and the float operates manually, companies will receive 10 points for completing their first vertical profile and 10 points for completing their second vertical profile.

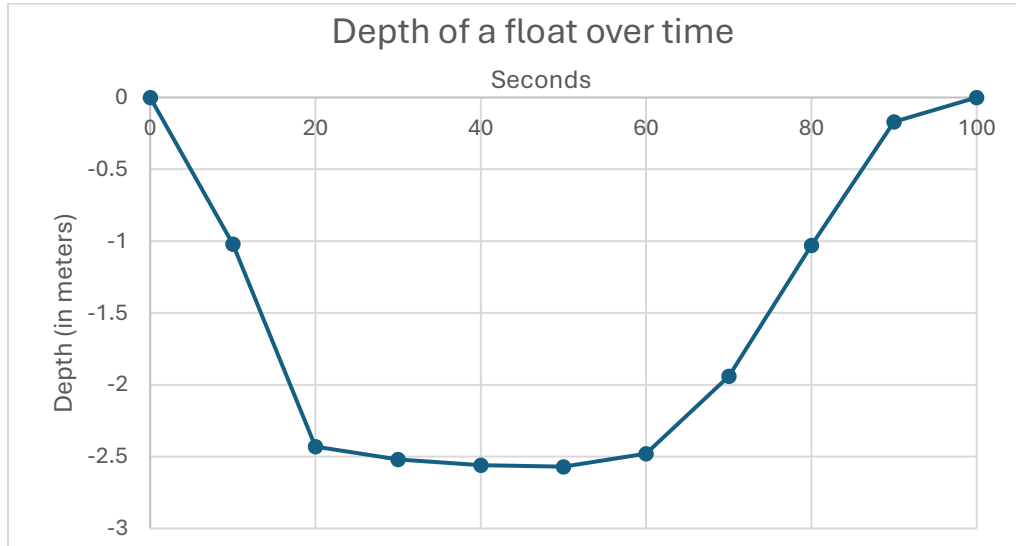
If a company designs their float using another mechanism (i.e., uses something other than a buoyancy engine), and the float operates autonomously, companies will receive 10 points for completing their first vertical profile and 10 points for completing their second vertical profile. If a company designs their float using another mechanism, and the float operates manually, companies will receive 5 points for completing their first vertical profile and 5 points for completing their second vertical profile.

Companies must also create a graph of data provided by MATE. Companies will have access to this data at the beginning of their product demonstration run; companies do not need to successfully complete vertical profiles to receive the MATE provided data. Companies will receive 10 points for successfully graphing depth over time using a computer program, or 5 points when they successfully create a graph on paper. Successfully graphing depth over time is defined as showing the station judge a graph with time on the X axis and depth on the Y axis. All dots should be linked by a line. Companies may use Excel or another computer program to plot their data points. MATE will not provide computers or graph paper at the mission station; companies must provide their own method for graphing the data. All graphs must have their axes labeled.

An example of MATE supplied data and graph resulting from the data:

Time	Depth (in meters)
0	0
10	-1.02
20	-2.43
30	-2.52
40	-2.56
50	-2.57
60	-2.48

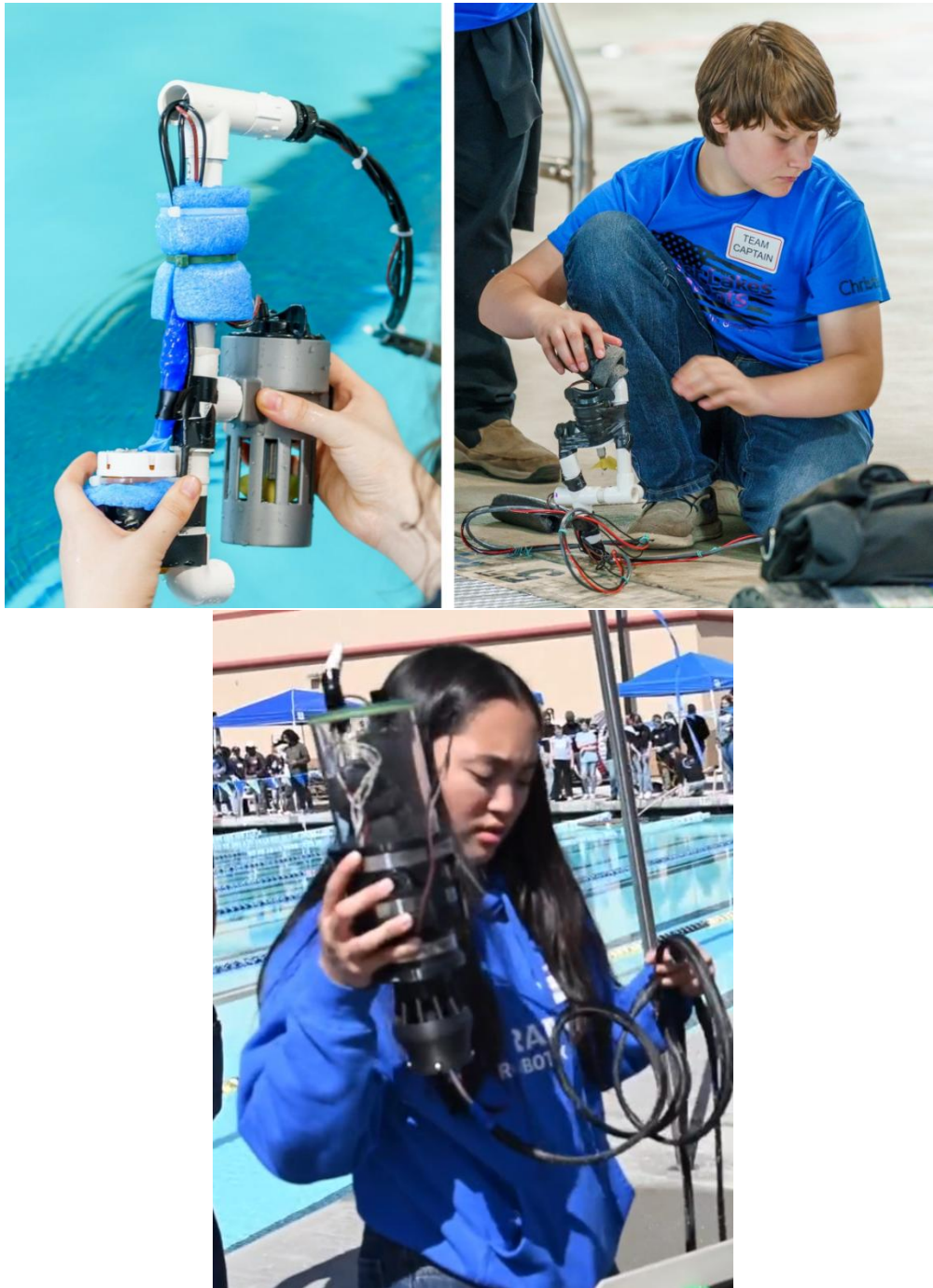
70	-1.94
80	-1.03
90	-0.17
100	0



Like ROVs, floats do not need to be overly complicated to work.

- One motor is sufficient to move your ROV up and down in the water. The same is true for a float.
- Your float only needs to move in two directions, up and down. For manual piloting, a DPDT switch is capable of controlling a bilge pump motor on your float.
- For a buoyancy engine, moving air into the float can make it positively buoyant (ascend). Pushing a syringe on the surface can open and close a syringe on the float.
- For autonomous control of the vertical profiling float, consider using a board such as Arduino, Raspberry Pi, or other to control the motor. The board can send signals through the tether to the motor to turn in one direction to have the profiler descend to the bottom, then send signals to reverse the motor direction to ascend. Consider how that motor could open and close a syringe on the float, changing its density and moving it up and down in the water. For all of these devices, companies can adjust the timing of their program depending on the depth of the pool. [Contact your regional coordinator or visit your regional contest's website](#) to determine the depth of the pool.

NAVIGATOR / SCOUT Float examples from 2025:



The SeaMATE Store also offers a Profiler kit: [MATE Floats! Vertical Profiler Kit – SeaMATE](#). This kit is designed to run **manually** and **uses another mechanism** to move up and down (thruster with propeller). It could be modified to move autonomously but this design does NOT use a buoyancy engine.

Non-ROV Device Power Specifications

The vertical profiling float is considered a non-ROV device. This is a device separate from the ROV that a company can deploy and control to fulfill its mission. The following are rules for the float.

ELEC-NRD-001: If using electricity, the vertical profiling float MUST be powered from the surface, it may not use onboard batteries. **Voltage is limited to 12 VDC maximum; amperage is limited to 5 amps maximum.** All electrical power for the non-ROV device must come from a surface supply, must go down tether wires, and must go through a single fuse (see ELEC-NRD-004).

ELEC-NRD-002: The vertical profiling float non-ROV device may use thrusters or a buoyancy engine to descend/ascend but no cameras are allowed on the float.

ELEC-NRD-003: Connection to power must be red/black Anderson Powerpole Connectors. The red and black pole pieces must be attached together. Loose Powerpoles (those not attached together) will not pass safety inspection. MATE will provide a 12-volt power source for the float at the mission station.

ELEC-NRD-004: A 5-amp (or less) fuse is required. The fuse must be installed in the positive power supply line within 30 cm of the power supply attachment point.

- ATO type blade fuses or MINI blade fuses MUST be used for any fusing. These fuses provide easy visual inspection for amperage using industry standard color codes.

Fuse Reference: [ATO fuse](#) [MINI fuse](#)

These fuses are all rated for 32VDC and are color coded for amperage.

- All blade fuses MUST correspond to the standardized color codes listed on the fuse links above.