

## **PIONEER/RANGER CLASS: MATE Floats! 2023**

*MATE Floats! 2023* is inspired by the National Science Foundation (NSF)-funded GO-BGC Project. The goal of GO-BGC is to help 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.

- **Prior to the competition, design and construct an operational vertical profiling float – 5 points**
- **Float communicates with the mission station prior to descending – 10 points**
- **Float completes up to two vertical profiles –**
  - **Vertical profile 1**
    - **Float completes first vertical profile**
      - **Using a buoyancy engine – 10 points**
      - **Not using a buoyancy engine – 5 points**
    - **Float communicates time to mission station – 10 points**
  - **Vertical profile 2**
    - **Float completes a second vertical profile**
      - **Using a buoyancy engine – 10 points**
      - **Not using a buoyancy engine – 5 points**
    - **Float communicates time to mission station – 15 points**

### **Product Demonstration Notes:**

Prior to the competition, companies must build a float capable of completing a vertical profile (i.e., travelling from the surface to the bottom and back to the surface) and communicating data to the mission station. Companies that design their float with a buoyancy engine will receive additional points. A [buoyancy engine](#) moves fluid from inside the float to outside the float, displacing seawater and changing the density of the float. Using thrusters to directly move the float constitutes “Not using a buoyancy engine”. Companies not using a buoyancy engine to complete their vertical profiles will receive fewer points. The float must also be capable of communicating data to a receiving device (i.e., the receiver) located at the surface at the mission station. The company is responsible for designing and constructing both the transmitter on the float and the receiver that displays the data at the mission station.

Companies will receive 5 points for designing and building a float. Companies must submit a one-page Non-ROV device document outlining their float design, detailing its operation, including if the float uses a buoyancy engine or does not use a buoyancy engine, and demonstrating that it does not violate any safety rules. This document must also detail how the float communicates with the company’s receiver at the mission station. This Non-ROV device document must be submitted in advance of the competition.

Companies competing at a regional may or not be required to submit this document. [Contact your regional coordinator or visit your regional contest's website](#) to determine if you must submit your float design document prior to the competition. See DOC-004 for more information. IF REQUIRED BY THE REGIONAL COMPETITION, COMPANIES MUST SUBMIT THEIR FLOAT DOCUMENTATION OR THEY WILL NOT BE RECEIVE POINTS FOR BUILDING THE FLOAT. Companies MUST present a copy of the float documentation to the station judges.

Companies will deploy their float in a designated location. Once the float has been deployed, it must communicate to the receiver located on the surface at the mission station. Companies are responsible for constructing both the transmitter on the float and the receiver at the mission station. Companies should design their float so that the transmitter can be maintained high enough above the surface of the water to communicate with the mission station.

The float must communicate (i.e., transmit) the following data to the mission station:

- company number (provided by MATE a few weeks prior to the competition)
- the current [Coordinated Universal Time](#) (UTC)

NOTE: MATE is requiring WHAT data is transmitted (i.e., company number and UTC). Companies must determine HOW to transmit that data and should consider that there will be other companies transmitting data at same time.

The float must transmit the UTC data to the receiver; the receiver should not access the Internet, nor should it receive transmissions from any source other than the float. The transmission should refresh and advance the time displayed every second.

Companies will receive 10 points when their float successfully transmits their company number and the UTC to the receiver at the mission station upon deployment. Successfully transmitting the information is defined as the station judge seeing the company number and UTC (displayed in hours, minutes, and seconds) on the receiver after the float has been deployed. The data can be displayed at any time after deployment, but prior to the float completing its first vertical profile. The data should be transmitted constantly provided the float is on the surface of the water.

The float should attempt to complete two vertical profiles. A vertical profile is defined as any part of the float on or above the surface, descending in the water column until any part of the float touches the bottom, then ascending to and breaking the surface once again. Companies may use a buoyancy engine or thrusters to move their float through the water. A buoyancy engine is defined as moving air or liquid from inside the float to outside the float, changing the volume and thus the density of the float. 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, constitutes not using a buoyancy engine to complete a vertical profile. Companies will receive 10 points for completing their first vertical profile using a buoyancy engine, or 5 points if they do not use a buoyancy engine.

After the first vertical profile has been completed and the float is still at the surface, the float must communicate the company number and the UTC. Companies will receive 10 points when the float successfully communicates to the mission station. The float MUST have completed one vertical profile to receive points for transmitting data to the receiver. Successfully transmitting data to the receiver is defined as the station judge seeing the company number and UTC (displayed in hours, minutes, and seconds) on the receiver at the mission station. If the float descends before the station judge verifies the data, companies will not receive points for transmitting data, but will receive points for a successful vertical profile. The data should be transmitted constantly provided the float is on the surface of the water.

The float should then attempt to complete a second vertical profile. Companies will receive 10 points for completing a second vertical profile using a buoyancy engine, or 5 points if they do not use a buoyancy engine.

After the second vertical profile has been completed, the float must communicate the company number and the UTC. Companies will receive 15 points when the float successfully communicates to the mission station. The float MUST have completed a second vertical profile to receive points for transmitting data to the receiver. Successfully transmitting data to the receiver is defined as the station judge seeing the company number and UTC (displayed in hours, minutes and seconds) on the receiver at the mission station. If the float descends before the station judge verifies the data, companies will not receive points for transmitting data, but will receive points for a successful vertical profile. The data should be transmitted constantly provided the float is on the surface of the water.

If the float fails to communicate to the mission station after its first or second vertical profile, it can continue to complete vertical profiles until it is successful. For example, if the float completes its first vertical profile but fails to communicate to the mission station before descending for its second vertical profile, companies would receive points for a vertical profile, but would not receive points for communication. After completing a second vertical profile, if the float communicates successfully with the surface station, companies would receive points for their second vertical profile and would receive points for their first communication. If the float then completes a third vertical profile and successfully communicates to the mission station, companies would not receive any additional points for the third vertical profiles, but they would receive points for their second communication attempt.

The float must be less than 1 meter in overall height. The float may not have a diameter/length/width greater than 18 cm.

The float must move independently from the ROV. The float must operate independently; it may not be connected to the shore by a tether nor can the ROV interact with the float after deployment. The float will operate as a non-ROV device (see 3.3.1 Non-ROV Device Power Specifications in the competition manual) for additional rules on powering a non-ROV device.