



## SeaPerch: Environmental Monitoring: Coral Restoration

### Deep-Sea Exploration

As in previous years, the competition will be split up into the Mission, Obstacle Course, Presentation, and Technical Design Report categories. This document will focus on the Mission and Obstacle Course.

Teams will be registered in one of two classes with two differing mission requirements. The two classes are Captain's Class and Admiral's Class. Participating teams must choose either Captain's Class or Admiral's Class when registering. Teams scoring in 1<sup>st</sup> or 2<sup>nd</sup> place overall in either class from the last two years will be required to compete in the Admiral's Class. Vehicle design rules for each class are provided in the Greater Philadelphia SeaPerch Challenge SeaPerch Design Rules document found at <http://phillynavalstem.com>

The Greater Philadelphia SeaPerch Challenge will be mimicking the International SeaPerch Competition mission in its entirety this year with some slight modifications. From the 2025 SeaPerch Team Handbook:

“The 2025 theme is **Environmental Monitoring: Coral Restoration**. Coral reefs provide coastal protection for communities, habitat for fish, and millions of dollars in recreation and tourism, among other benefits. But corals are also severely threatened by rapidly worsening environmental conditions. Efforts to help corals recover include the following activities:

- Planting nursery-grown corals back onto reefs.
- Making sure habitat is suitable for natural coral growth, including the removal of invasive species.
- Building coral resilience to threats like climate change.”

### Vehicle Compliance

Each SeaPerch ROV must complete a safety and maneuverability compliance check during check-in, and approved prior to the team competing in the pool events. For more information see the Design Rules Document.

Your team cannot proceed to any of the events on the day of the competition unless these requirements are fulfilled.

Only two team members are permitted at the Compliance stations at a time.

### **Triage**

The vehicle may be worked on by the teams during the competition at the triage station.

1. The triage station is equipped with select spare parts and hand tools
2. Triage engineers are not permitted to build ROV replacement parts
3. Triage is to be utilized for repairs and not for building the ROV
4. Triage engineers are there to ensure the safety of the students and assist with minor repairs

### **Pool Access**

Absolutely NO glass, chemicals, CO<sub>2</sub> Cartridges or loose materials are permitted in the pool or on the pool deck.

Only two team members are allowed on the pool deck in the competition area during an event.

Advisors are not permitted on the pool deck during competition events.

One driver and a second person on deck able to control the tether and to operate any secondary controls such as buoyancy control. The second person can also deploy the ROV in the pool, remove it, and any other objects from the pool.

In the extraordinarily rare event of all team members except for one becoming incapacitated on the day of the event, an advisor may be permitted to operate the tether of the SeaPerch vehicle on the pool deck ONLY.

All team members must wear shoes with rubber soles on the pool deck.

Each team should bring their own charged vehicle battery to the pool. Make sure your battery is fully charged.

- The vehicle MAY NOT be dragged via the tether by hand or any other means.
- The vehicle may be reset by the teams during the competition.
- The ROV may be worked on in triage by the teams during the competition.

### **General Pool Event Rules**

Prior arrangements are required for waivers to any of the following rules to accommodate students' special needs. Any special accommodations must be made two weeks in advance of the starting date of the Greater Philadelphia SeaPerch Challenge by contacting [gpssc@temple.edu](mailto:gpssc@temple.edu).

1. The team must use the same ROV that was presented at compliance for both pool events.
2. Each team must have their own ROV – teams are not allowed to share an ROV.
3. Teams are not allowed to share ROV attachments or devices, but they are encouraged to provide assistance to other teams such as aiding in minor repairs or providing access to tools or basic materials.
4. Spare parts are allowed; however, spare ROVs are not allowed.
5. Any design or structural modifications made to the ROV after a compliance check requires the team to re-submit the ROV for a compliance check. Team's should come to the competition having already tested their vehicle buoyancy which can be done in any container deep enough to submerge the vehicle in water.

6. No parts or materials, except as noted in this section, may be added to or removed from the ROV between pool events. The ROV must compete in both pool events with the same attachments and parts connected with the exception of mission-specific elements. Violations may result in disqualification.
7. Attachments and parts may be *repositioned* (i.e., rotated or swiveled) between the two pool events. Attachments or parts may not be disconnected and relocated; they must remain connected to the same point on the ROV when they are repositioned.
8. The ROV may be worked on or adjusted during competition. This may include adjusting buoyancy by adding or removing buoyancy materials or adding materials like tape or cable ties necessary to secure parts. However, the run timer will continue.
9. Replacement of failed or damaged parts is permitted. Teams replacing failed or damaged parts must resubmit their ROV for a compliance check conducted by staff at the Triage Station.
10. Passing compliance checks does not guarantee the right to compete. Lead judges in the competition area have the final say on safety and compliance issues and may require teams that have already passed the compliance check to fix issues prior to competing.
11. Teams may provide their own battery for the ROV.
12. Teams may provide an additional battery for auxiliary equipment such as cameras, advanced controllers, sensors, and electromechanical ROV attachments.
13. Team supplied batteries must not be larger than 6.5" long x 3" wide x 4" high and must be 12 VDC maximum with a 9-amp hour maximum rating.
14. Teams may not bring anything to the pool deck that requires 110-volt or any other alternating current (AC) power. Laptop computers are allowed if they are battery powered and do not need to be plugged into 110-volt power. The Greater Philadelphia SeaPerch Challenge is not liable for lost, stolen, or otherwise damaged materials brought poolside.
15. The ROV must move only under its own power. The tether may not be pulled to expedite the ROV's navigation of the course by hand or other means.
16. If the ROV or tether becomes tangled on the course structure or is otherwise unable to move on its own power, a team member must notify the judge that they would like to try to free the ROV by pulling on the tether. Under this circumstance teams may gently pull on the tether; however, the run timer will continue. If the ROV is pulled by the tether, the ROV must be returned to the location that it was moved from before it may continue competing.
17. Divers will assist teams with tangled tethers or inoperable ROVs at the end of the competition run time. Teams may be permitted a repeated attempt at the obstacle or mission course that the incident occurs during a designated redo round, time permitting. The final call on this decision will lie with the Lead Pool Judge and is not disputable by any team.

### **Redress, Challenges and Disputes**

Sportsmanship is expected at all times. Should a protest or dispute occur during the competition it is the intent to resolve the grievance at the time it occurs, and the ruling by the lead Judge is final.

A team that wishes to have an issue considered shall send the student team captain and one additional student member to the lead judge for discipline in question, with the inquiry or question. The lead judge will render a decision on the issue, and this decision is final. The same issue may not be brought to the judge a second time by any member of the team. Adults may not approach the lead judge on the pool deck regarding any perceived issues.

In the event that a vehicle is inadvertently interfered with during a competition, or a malfunction of a vehicle's parts (i.e., the motor) occurs that is beyond the design and construction, the lead pool judge will have the sole authority to provide the team with time to fix their vehicle and to allow them to compete later in the round. Malfunctions will be evaluated on a case-by-case basis.

Teams may not question the legality of other competing vehicles; it is the SeaPerch Compliance Leader's role to determine if vehicles meet the entry and compliance requirements.

Unsportsmanlike conduct is grounds for the disqualification of a team. Team members and advisors are responsible for the conduct of all members and adults accompanying the team.

The Greater Philadelphia SeaPerch Challenge reserves the right to make judgement calls on the alteration of rules as it deems necessarily and appropriate on the day of the event due to extenuating circumstances outside of its control.

## **Overall Scoring**

### **Individual Events**

Each event will be scored in accordance with its rubric. Teams will then be ranked, by their score.

### **Combined Scores**

Overall Challenge Winners - Each team will receive a score for each of the competition categories. Scores from all categories except the Make a Splash category will be combined to determine the overall Greater Philadelphia SeaPerch Challenge Champion. There will be one overall Middle School champion and one High School champion for each of the competition classes (Captain's and Admiral's classes).

Award categories include Technical Design Report, Presentation, and Vehicle Performance. Vehicle Performance awards are a combined score of both pool rounds (Obstacle and Mission courses).

First overall winners from each rank (Admiral & Captain) and each level (middle school & high school) will receive an invitation to represent the Greater Philadelphia SeaPerch Region at the International SeaPerch Challenge. We have been notified this season that RoboNation will accept two additional qualifying teams for the International SeaPerch Competition from the Greater Philadelphia SeaPerch Region. Teams scoring second place overall in the most populous rank (Admiral or Captain) will also receive an invitation to represent the Greater Philadelphia SeaPerch Region at the International SeaPerch Challenge this season (one team at the middle school level and one team at the high school level).

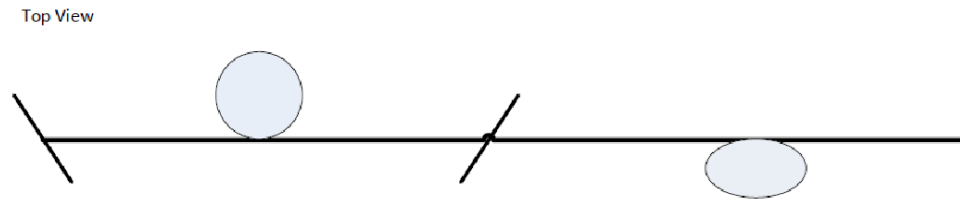
### **Breaking Ties**

Scoring ties will only be broken where it is required to determine trophy places. (i.e., ties will not be broken when ties do not affect the top three results in any event or class overall) Pool Performance ties to the 100th of a second will be broken by the faster time.

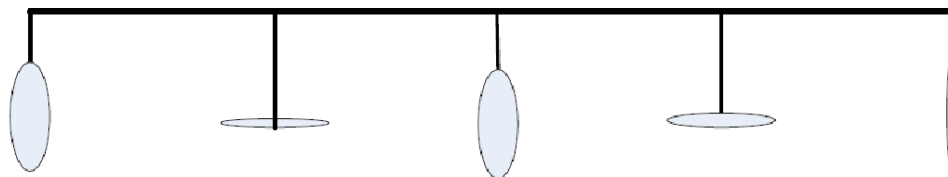
## **Obstacle Course Overview**

The Obstacle Course tests high-speed maneuverability and requires the SeaPerch ROV to navigate the course as quickly as possible.

The Obstacle Course includes a set of 5 pre-arranged hoops submerged at a depth of 4 feet from the surface of the water. These are oriented as shown in the following diagram.



Side View



1. An underwater remotely operated vehicle (ROV) must be able to maneuver successfully under its own power. If a vehicle cannot maneuver to the appropriate location to perform its task, the vehicle is of no use. In this round, teams must navigate their ROV through a submerged obstacle course and make contact with the pool bulkhead (wall), regardless of depth.
2. Start of run: The ROV must be surfaced, within six inches (6") of the wall, and under its own power. Team members are not allowed to touch the ROV after the lane judge begins the countdown to start the run.
3. The ROV is required to pass through each of the five obstacle course hoops in order starting at the hoop closest to the pool wall.
4. The SeaPerch must navigate through the obstacle course, clear the furthest ring, and surface after clearing the furthest ring before starting its return back through the course in reverse order. Surfacing is considered complete when any part of the ROV breaks the surface of the water
5. End of run: The clock stops once the SeaPerch reaches the pool deck wall or if the SeaPerch becomes incapacitated or inoperable.
6. If your team is not able to make it through a hoop, you may skip it.

7. The run will be aborted if the allotted time expires even if the ROV has not completed the course.
8. The vehicle cannot be dragged through the obstacle course via the tether.
9. The submerged obstacle course involves five large rings (22"–24" minimum diameter), oriented in various directions, For every hoop your team makes it through you will receive points. Scores for this round will be based on the fastest time for successfully navigating the obstacle course. Please note that the diameter of the Obstacle Course hoops at the International SeaPerch Challenge is 18" and compliance requires that vehicles must fit within an 18" diameter circle.
10. Consideration of optimal maneuverability, control, and speed should be given when constructing your SeaPerch (thruster placement and orientation, tether attachment, buoyancy and ballast, etc.) and control box.

### **Mission Course Overview**

The Mission Course incorporates a mission that teams must complete related to environmental monitoring and coral restoration. This course simulates the tasks and environment that a ROV might encounter.

SeaPerch ROVs from all lanes can start simultaneously when the lead judge gives the signal to go. Each team is to accomplish each challenge as rapidly as possible.

- *Start of run:* The ROV must be surfaced, within six inches (6") of the wall, and under its own power. Team members are not allowed to touch the ROV after the lane judge begins the countdown to start the run.
- Objects falling past the suspended task frame are out of play and the ROV is not allowed to attempt to retrieve them.
- *End of run:* The run is complete when the ROV touches the pool wall while surfaced (any part of the ROV breaks the surface of the water). The run will be aborted if the allotted time expires even if the ROV has not completed the course.

The Mission Course consists of five tasks across multiple task frames and will be located at the bottom of the pool in a pool depth of 6 feet. Tasks are described in detail below and include:

- Task 1: Bio-Bucket Access
- Task 2: Marine Life Management
- Task 3: Coral Restoration
- Task 4: Coral Sample Collection
- Task 5: Marine Monitoring

The ROV may transport multiple objects simultaneously. Objects may be moved between platforms for staging without completing the task.

Tasks may be completed in any order with the following exception(s):

- To receive points for opening the hatch, it must be opened before placing objects in the bio-buckets. If the team fails to open the door, they may still place objects in the basket; however, points will not be awarded for opening the door once an object is placed in the basket.

**Scoring**

A maximum of 110 points can be earned on the Mission Course through successfully completing tasks with bonus points awarded for completion of the course under a time limit. Points are not official until verified by master scorekeeper.

**Task Points**

Tasks can be completed for a total of 100 points divided across the tasks as follows:

- Task 1: Bio-Bucket Access has a max of 14 points
- Task 2: Marine Life Management has a max of 25 points
- Task 3: Coral Restoration has a max of 21 points
- Task 4: Coral Sample Collection has a max of 24 points
- Task 5: Marine Monitoring has a max of 16 points

Points will be earned at completion of each task action. If tasks are disturbed in subsequent actions, teams will still earn the points for completion.

**Time Bonus Points**

Teams may earn bonus points for successfully completing all tasks in less than 6 minutes. Bonus points are based on adjusted finished time including any time penalties incurred during the run. Bonus points are applied for:

- Finish times less than 4 minutes earn teams 10 points
- Finish times less than 6 minutes earn teams 5 points

**Bio-Bucket Access (Task 1):**

At the start of the run, the bio-buckets will be placed under a closed hatch. This task includes two actions to earn points.

**Task 1.1:** The ROV must open a hatch to expose the bio-buckets (simulated in the image by the small baskets).

**Task 1.2:** The ROV must close and lock the hatch to secure the bio-buckets.

To collect points for opening the hatch, it must be completed prior to placing or removing objects in the bio-buckets. The hatch may be closed at any time during the run to collect points.

*Figure 1: Opening / closing the bio-bucket hatch (Tasks 1.1 & 1.2)*

### Scoring

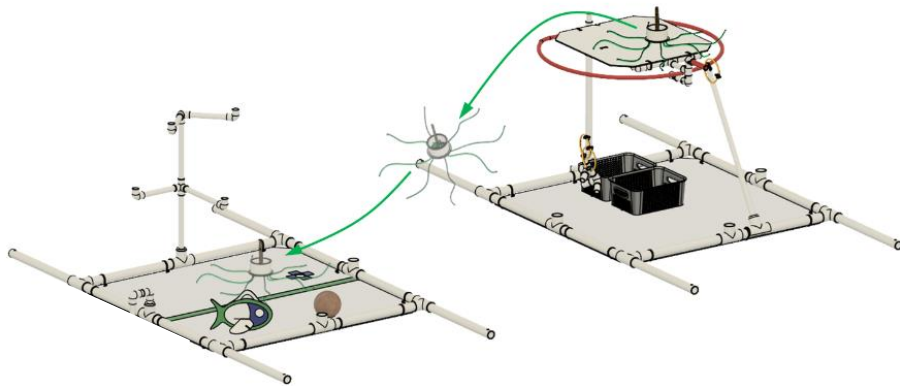
A maximum of 14 points can be earned in this task. This is a multi-step task and teams will earn points for completing each step of the task, including:

- Four (4) points for opening the hatch
- Ten (10) points for closing and latching the hatch

### Marine Life Management (Task 2):

This task includes multiple actions related to marine life.

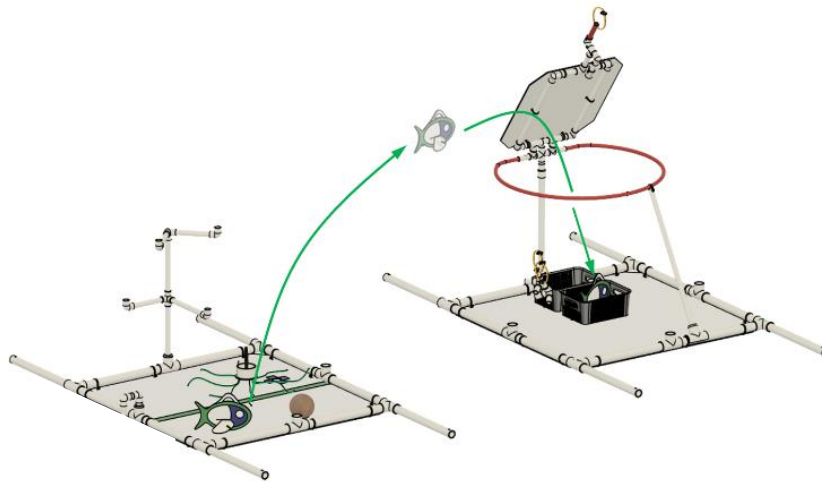
**Task 2.1:** At the start of the run, marine life will be located on top of the hatch on the back platform. The ROV must move marine life from the top of the hatch to the front platform.



*Figure 2: Moving the marine life from the hatch on the back platform to the front platform (Task 2.1)*



**Task 2.2:** The ROV must retrieve a new species from the seagrass area on the front platform and place it in the bio-bucket on the back platform. The ROV may maneuver through the open hatch for additional points.



*Figure 3: Moving the marine life from the front platform, through the hatch, and into the bio-buckets on the back platform (Task 2.2)*

### Scoring

A maximum of 25 points can be earned in this task. This is a multi-step task and teams will earn points for completing each step of the task, including:

- Three (3) points for removing the marine life from the hatch
- Six (6) points for placing the marine life on the front platform
- Ten (10) points for placing the new species in the bio-bucket
- Six (6) points for maneuvering through the hatch to place the new species (these points will only apply if the new species is placed in the bio-bucket)

### **Coral Restoration (Task 3):**

The ROV must remove two coral samples from the bio-bucket on the back platform and hang each sample onto the coral tree on the front platform. Coral may be hung on any branch of the coral tree and additional points will be earned for placing both samples on different branches.

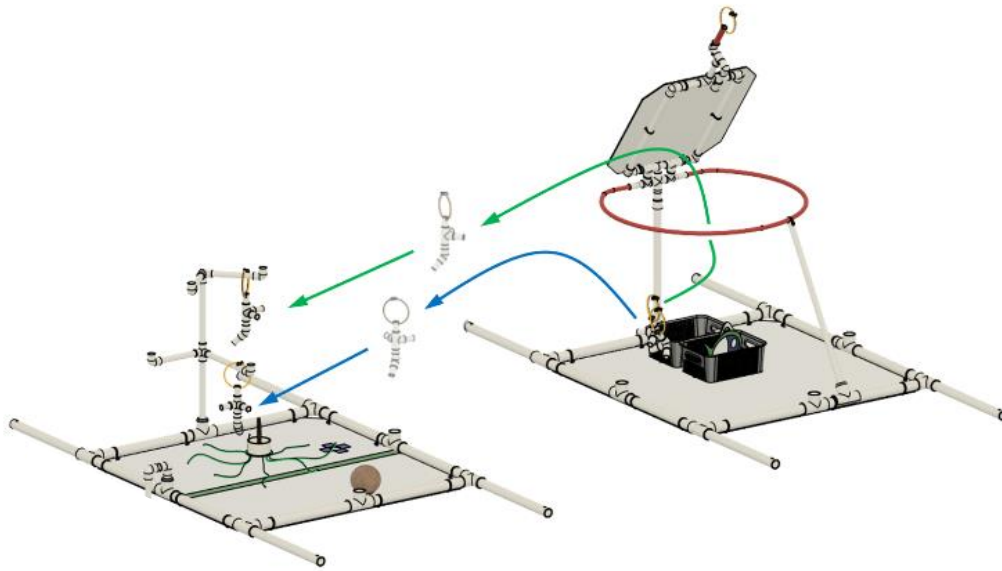


Figure 4: Green line shows path of ROV maneuvering through the hatch with a coral sample. Blue line shows path of ROV not maneuvering through the hatch. (Task 3)

### Scoring

A maximum of 21 points can be earned in this task. This is a multi-step task and teams will earn points for completing each step of the task, including:

- Three (3) points for maneuvering through the hatch with each coral sample (6 points total)
- Six (6) points for hanging each coral sample on the coral tree (12 points total)
- Three (3) points for hanging both coral samples on different branches of the coral tree

**Coral Sample Collection****(Task 4):**

This task includes multiple actions related to collecting coral samples.

**Task 4.1:** The ROV must collect the sea sponge from the front platform and place it in one of the bio-bucket on the back platform. The ROV may maneuver through the open hatch for additional points.

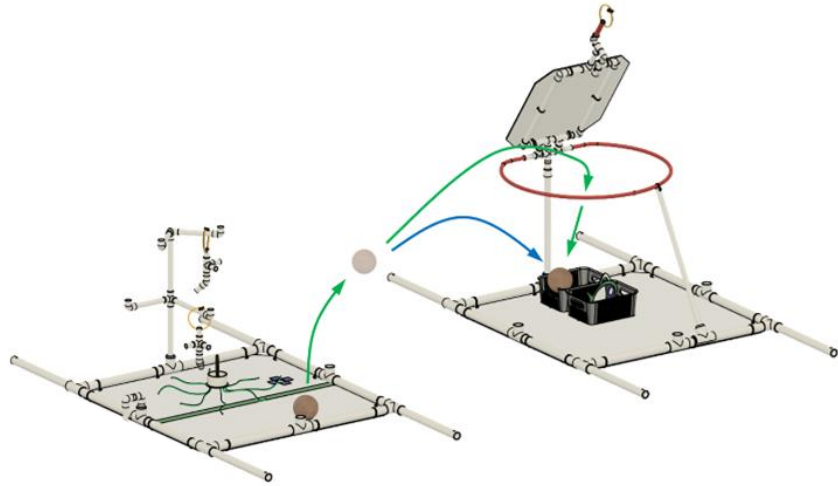


Figure 5: Green line shows path of ROV maneuvering through the hatch with the sea sponge. Blue line shows path of ROV not maneuvering through the hatch.

**Task 4.2:** The ROV must collect the deep-sea coral sample from the deep dive platform and place it in the bio-bucket on the back platform. The ROV may maneuver through the open hatch for additional points.

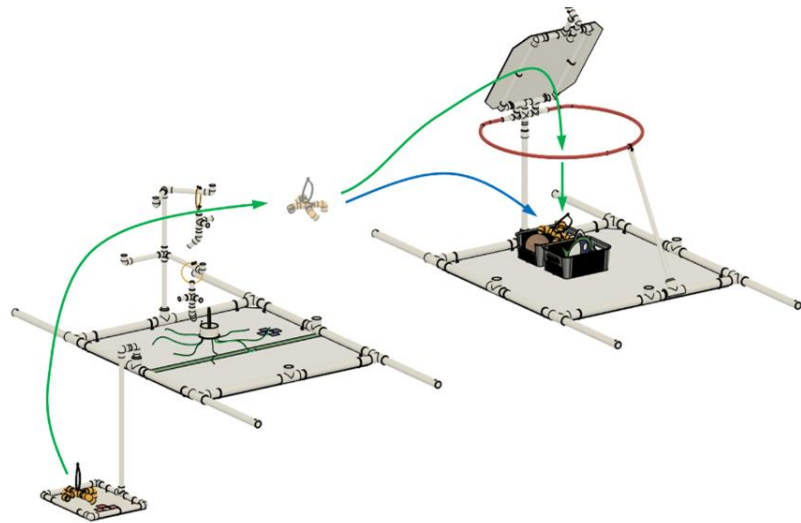


Figure 6: Green line shows path of ROV maneuvering through the hatch with the deep-sea coral. Blue line shows path of ROV not maneuvering through the hatch.

**Scoring**

A maximum of 24 points can be earned in this task. This is a multi-step task and teams will earn points for completing each step of the task, including:

- Ten (10) points for placing the sea sponge in the bio-bucket
- Three (3) points for maneuvering through the hatch with the sea sponge (these points will only apply if the sea sponge is placed in the bio-bucket)
- Eight (8) points for placing the deep-sea coral sample in the bio-bucket
- Three (3) points for maneuvering through the hatch with the deep-sea coral sample (these points will only apply if the deep-sea coral is placed in the bio-bucket)

**Marine Monitoring (Task 5):**

The ROV must retrieve two sensors from the back platform and place each sensor in the sensing location located on the front platform. Sensor #1 (blue) and Sensor #2 (red) should be placed in the corresponding sensing location on the front platform. This deviates from the International SeaPerch Challenge.

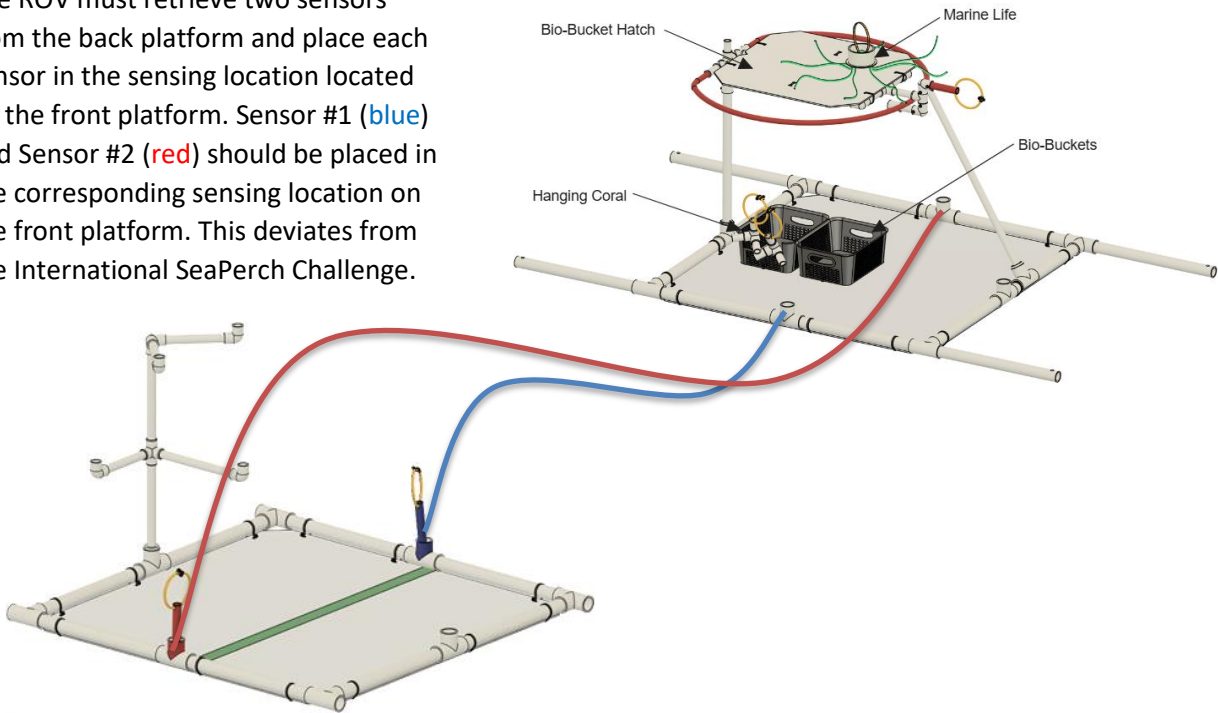


Figure 7: Red line shows path of ROV to relocate the red sensor from the back platform to the front platform. Blue line shows path of the ROV to relocate the blue sensor from the back platform to the front platform.

### Scoring

A maximum of 16 points can be earned in this task. This is a multi-step task and teams will earn points for completing each step of the task, including:

- Six (6) points for placing Sensor #1 (blue) in the sensing location on the front platform
- Ten (10) points for placing Sensor #2 (red) in the sensing location on the deep-dive platform
- Partial points will be earned on this task if the ROV places a sensor on the platform but not in the defined sensing location:
  - Three (3) points for placing a sensor on the front platform (6 total for both sensors)
  - Six (6) points for placing a sensor on the deep-dive platforms (max of 1 sensor)

**Teams are encouraged to learn more about environmental monitoring by checking out what the Nautilus Live exploration team is up to at <https://nautiluslive.org/>**

**Nautilus Live is a partner of the Naval STEM Office and students across the Greater Philadelphia Area and beyond have had the opportunity to engage in live at-sea discussions with the Nautilus**

**research team recently. We'll be in touch with YOUR SCHOOL if we have an opportunity to bring this virtual experience to you in 2025!**