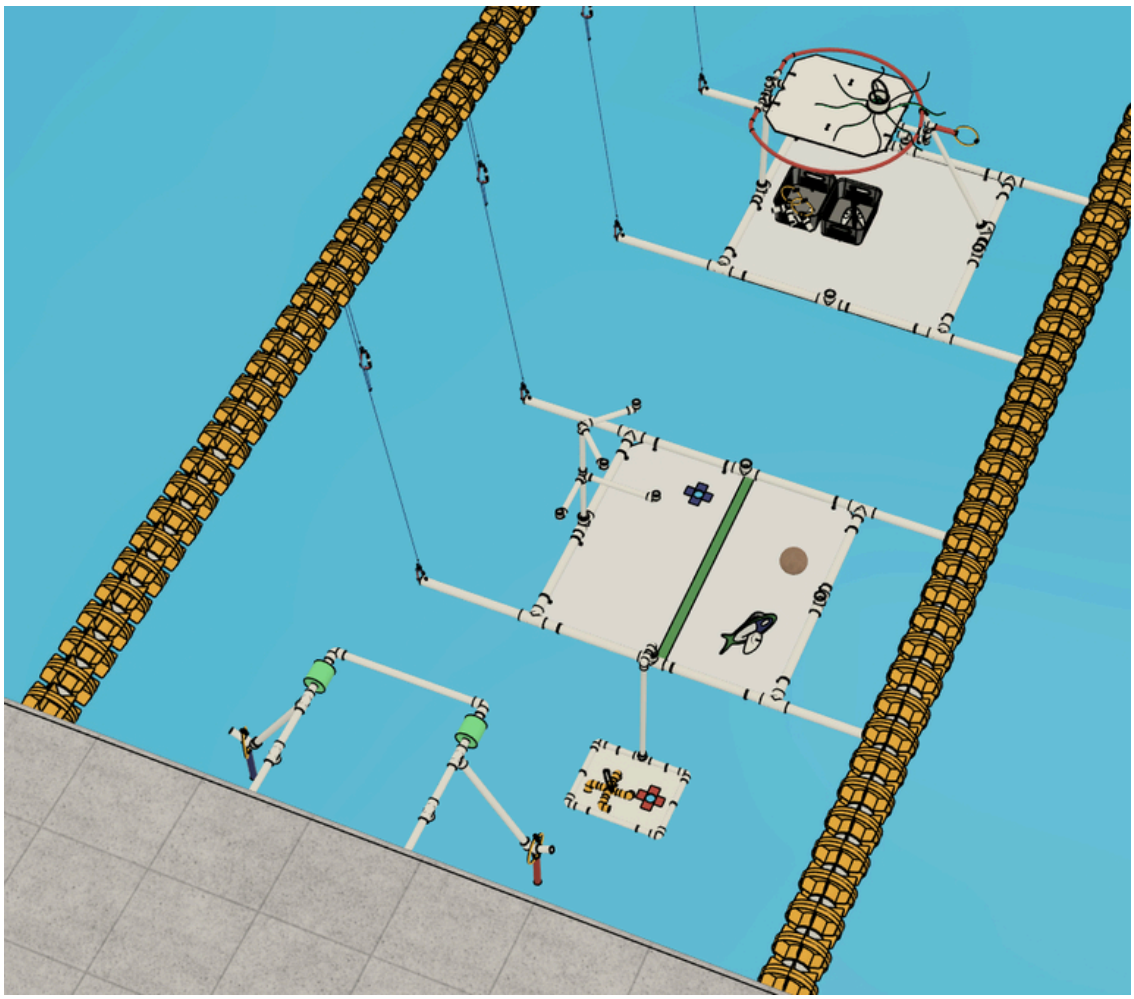
2.2 Mission Course

The Mission Course 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

Course Layout

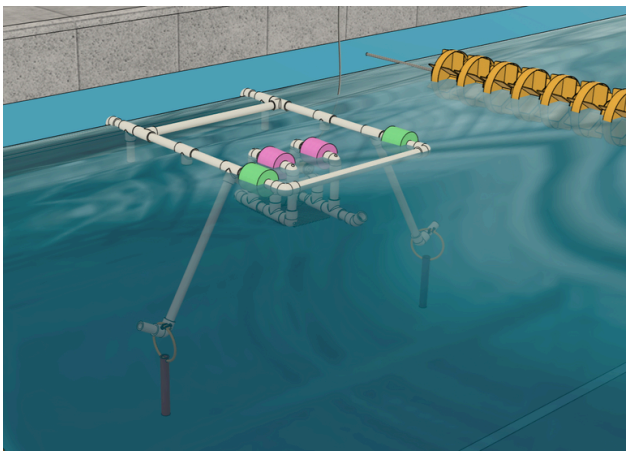
The Mission Course consists of a surface vehicle located next to the pool wall, two task frames that will be suspended 5-6 feet below the water surface, and a smaller task frame suspended below the front frame.

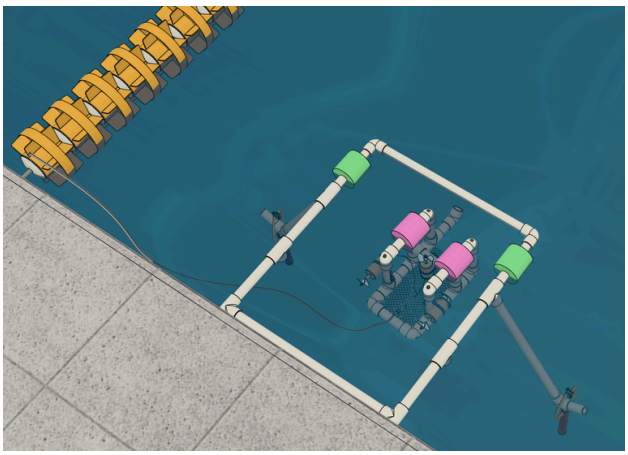


Surface Vehicle

A PVC structure representing a surface vehicle will be placed by the pool wall where team members and judges are positioned. This structure will serve as the start and end point of Mission Course runs.

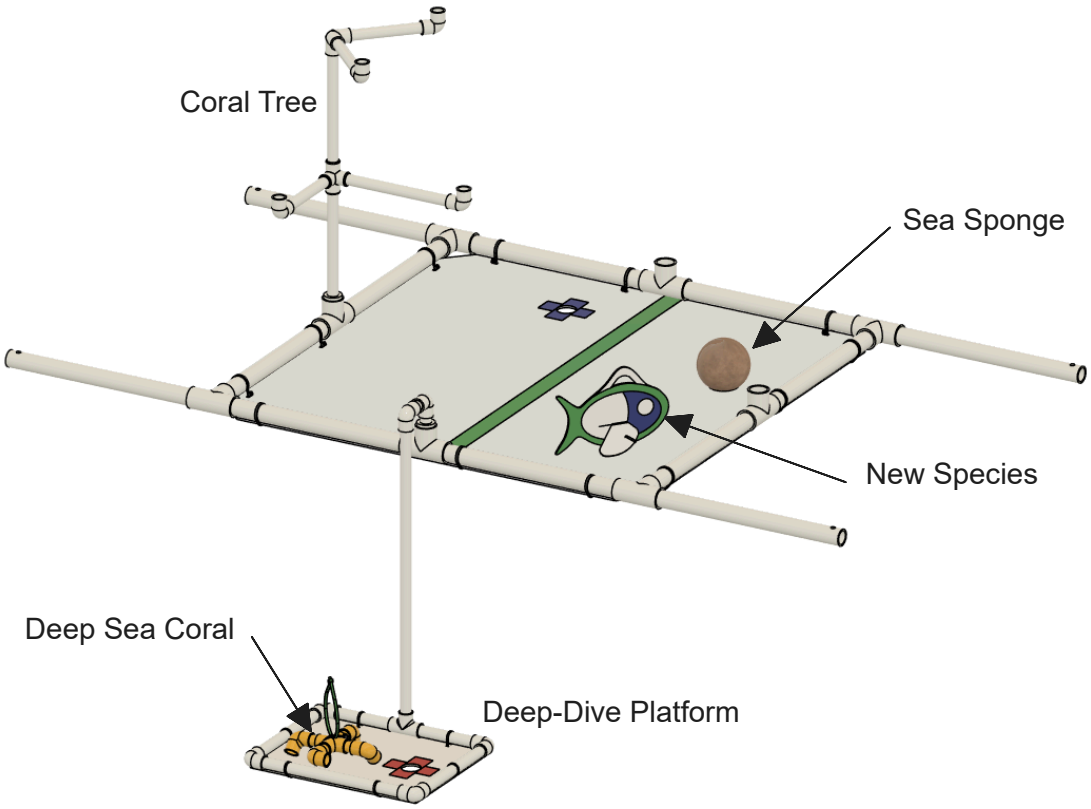
Two sensors (Task 5) will hang below the surface vehicle structure.





Front Platform

The front platform is the platform closest to the pool wall. This platform includes a coral tree (Task 3), seagrass area (Task 2), and the sensing location for Sensor #1 (Task 5).



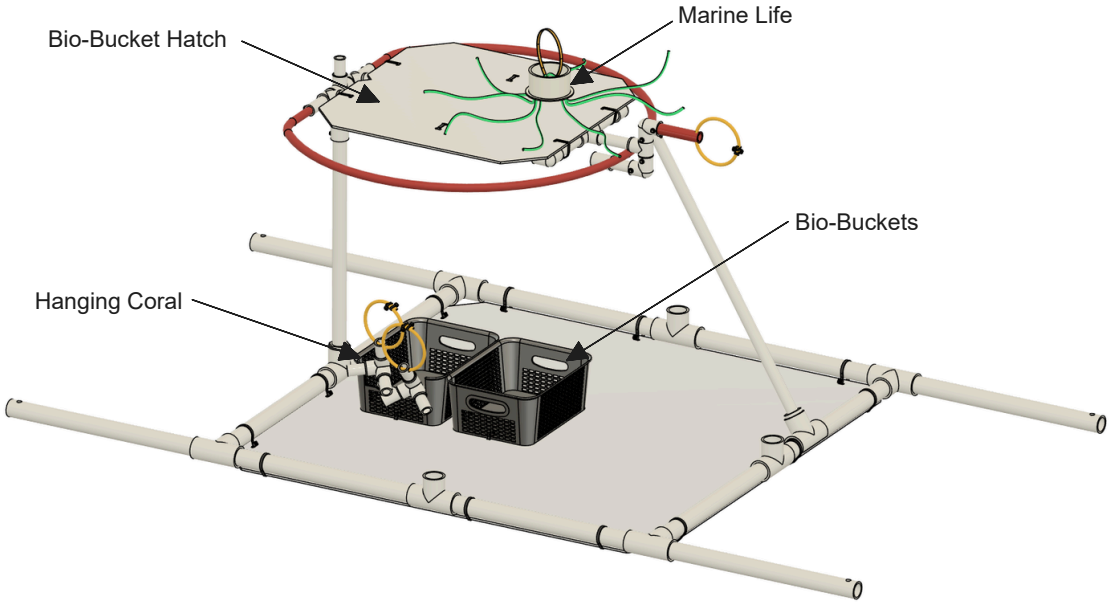
Front Platform

The deep dive platform will hang below the front platform. This platform includes the sensing location for Sensor #2 (Task 5). At the start of the run, deep-sea coral will be positioned on this platform (Task 4).

Back Platform

The back platform includes a closed hatch (Task 1) that can be used to access the bio-bucket (Tasks 2, 3 & 4). One or two bio-buckets may be included in the course and if multiple are available, they may be utilized interchangeably.

At the start of the run, marine life will be positioned on top of the hatch (Task 2).

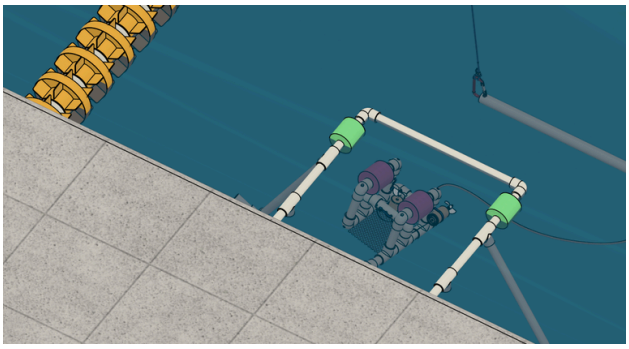


Back Platform

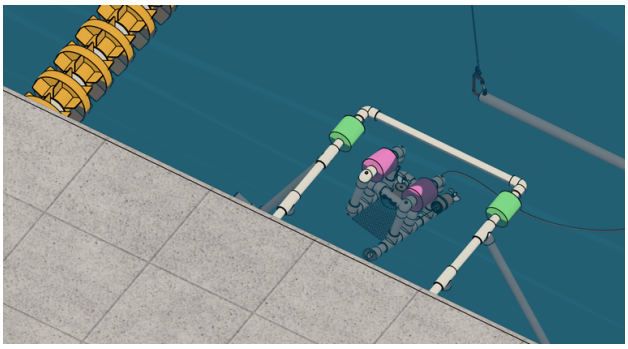
Navigation Overview

- *Start of run:* The ROV must be under its own power and surfaced within the outline of the surface vehicle. Team members are not allowed to touch the ROV after the lane judge begins the countdown to start the run. The tether cable does not have to go through the open area of the surface vehicle. Teams are allowed to position the surface vehicle along the wall within the lane.

- Objects falling past the suspended task frames are out of play and the ROV is not allowed to attempt to retrieve them
- *End of run:* The run is complete with the ROV surfaces (any part of the ROV breaks the surface of the water) within the outline of the surface vehicle located next to the pool wall. The run will end if the allotted time expires even if the ROV has not completed the course.



ROV Not Surfaced



End of Run - ROV Surfaced

The ROV may transport multiple objects simultaneously. Objects may be moved between platforms for staging without completing the task. (For example, the coral samples can be moved to the bin after completing other tasks.)

Tasks may be completed in any order with the following exceptions:

- To receive points for opening the hatch door (Task 1), it must be opened before removing or placing objects in the bio-basket. If a team fails to open the hatch, objects may still be removed from or place in the basket; however, points will not be awarded for opening the hatch.
- To receive points for moving the marine life from the hatch (Task 2), it must be removed from the hatch prior to opening the hatch. If a team fails to move the marine life, the hatch may be opened; however, points will not be awarded for moving the marine life.

Scoring Overview

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

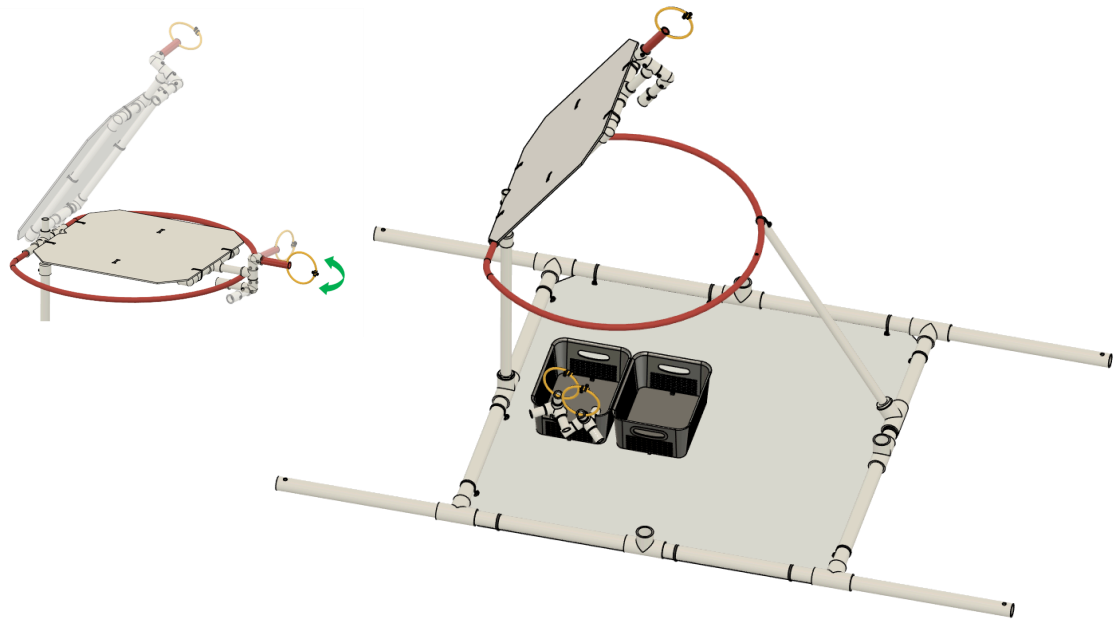
Scoresheet

The mission course scoresheet is available in Appendix B: Competition Scoresheets & Rubrics - Mission Course Scoresheet.

Task 1: Bio-Bucket Access

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 (see Navigation Overview). The hatch may be closed at any time during the run to collect points.

Scoring

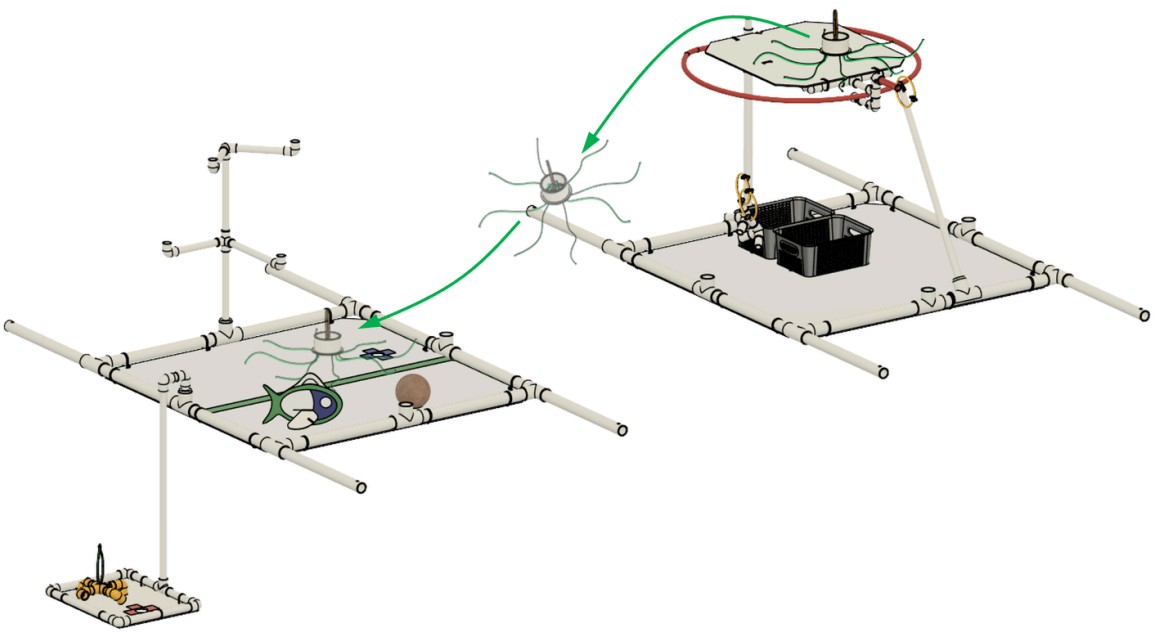
A maximum of 14 points can be earned in this task. This is a multi-step task and teams will earn points for completing each step of the task, including:

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

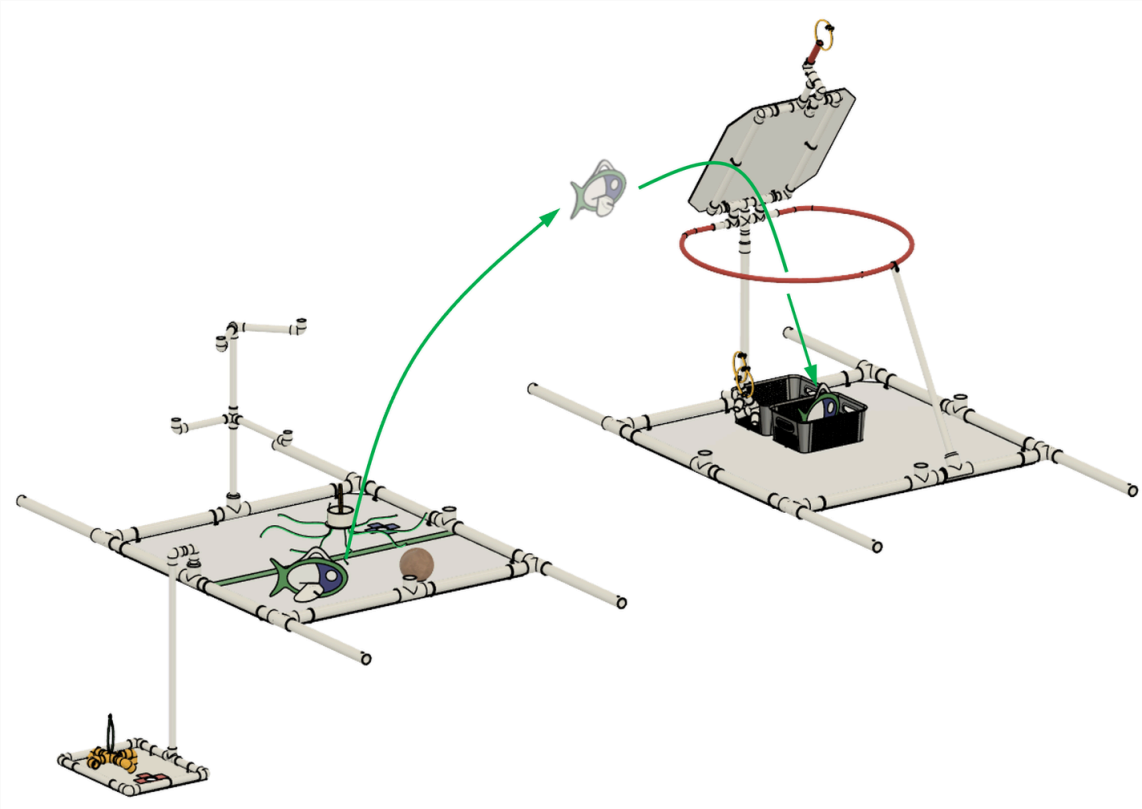
Task 2: Marine Life Management

This task includes multiple actions related to marine life.

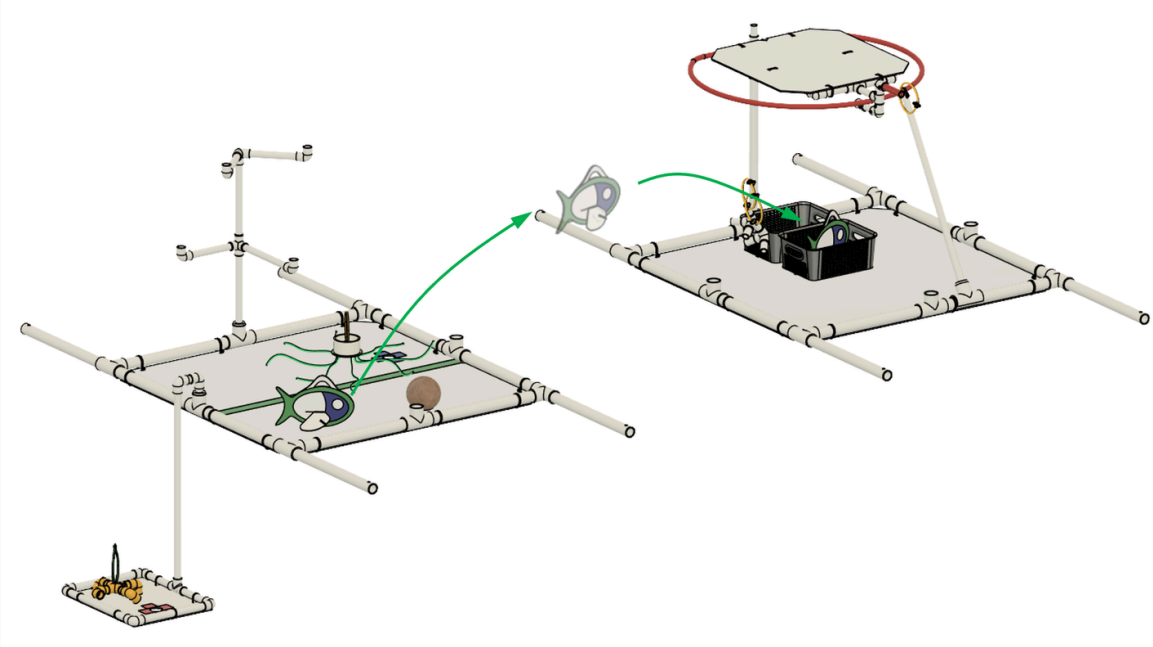
Task 2.1: At the start of the run, marine life will be located on top of the hatch on the back platform. The ROV must move marine life from the top of the hatch to the front platform.



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.



ROV maneuvers through hatch with the new species.



ROV places new species in bio-bucket without maneuvering through the hatch.

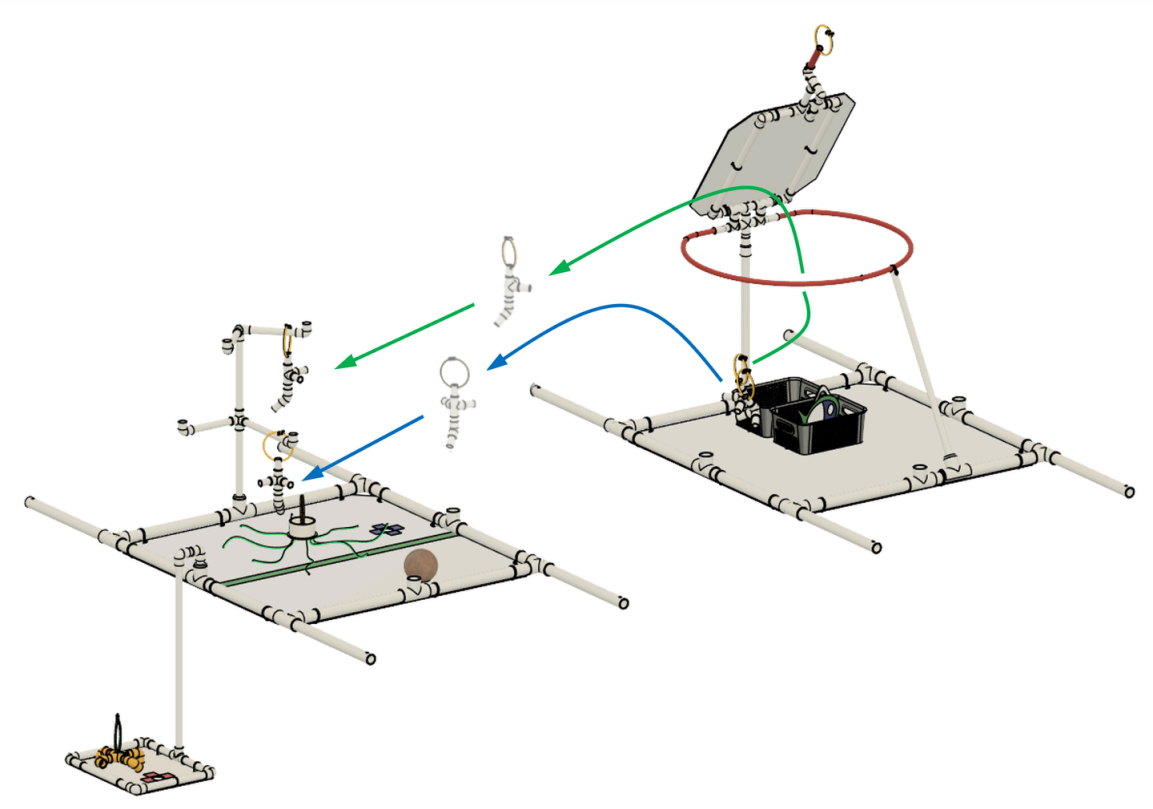
Scoring

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)

Task 3: Coral Restoration

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.



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.

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:

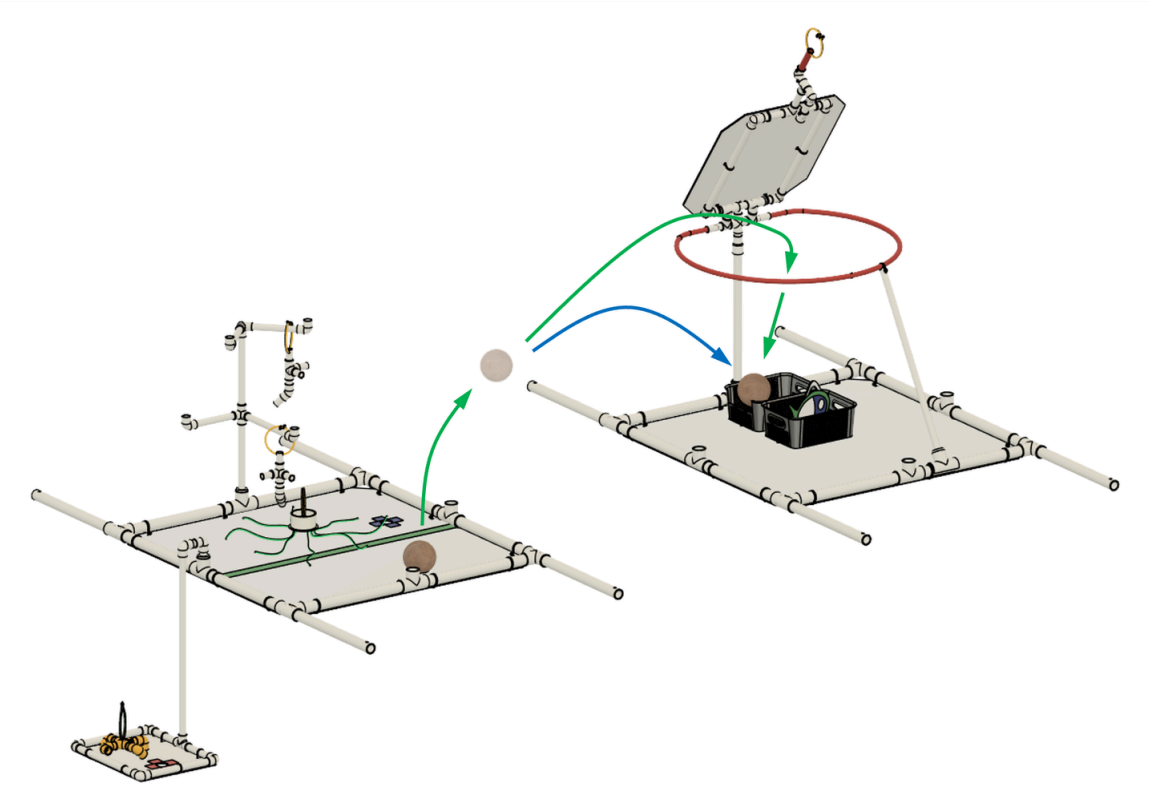
- Three (3) points points for maneuvering through the hatch with each coral sample (6 points total)
- Six (6) points for hanging each coral sample on the coral tree (12 points total)
- Three (3) points for hanging both coral samples on different branches of the coral tree

Task 4: Coral Sample Collection

This task includes multiple actions related to collecting coral samples.

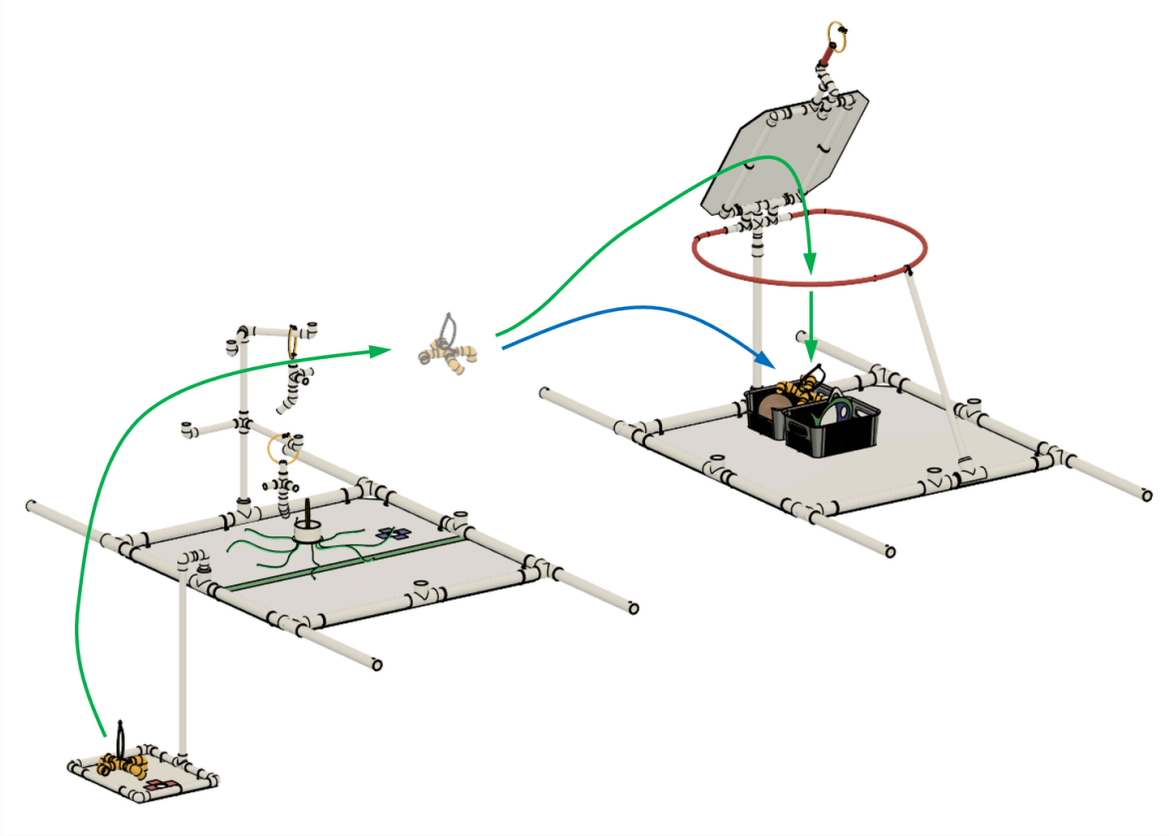
Task 4.1: The ROV must collect the sea sponge from the front platform and place it in one of the bio-bucket on the back platform. The ROV may maneuver through the open hatch for additional points.

> MIT Sea Grant Module: Looking for ideas? Make your own simple and inexpensive soft-robotic grippers that can pick up and put down objects.



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.



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.

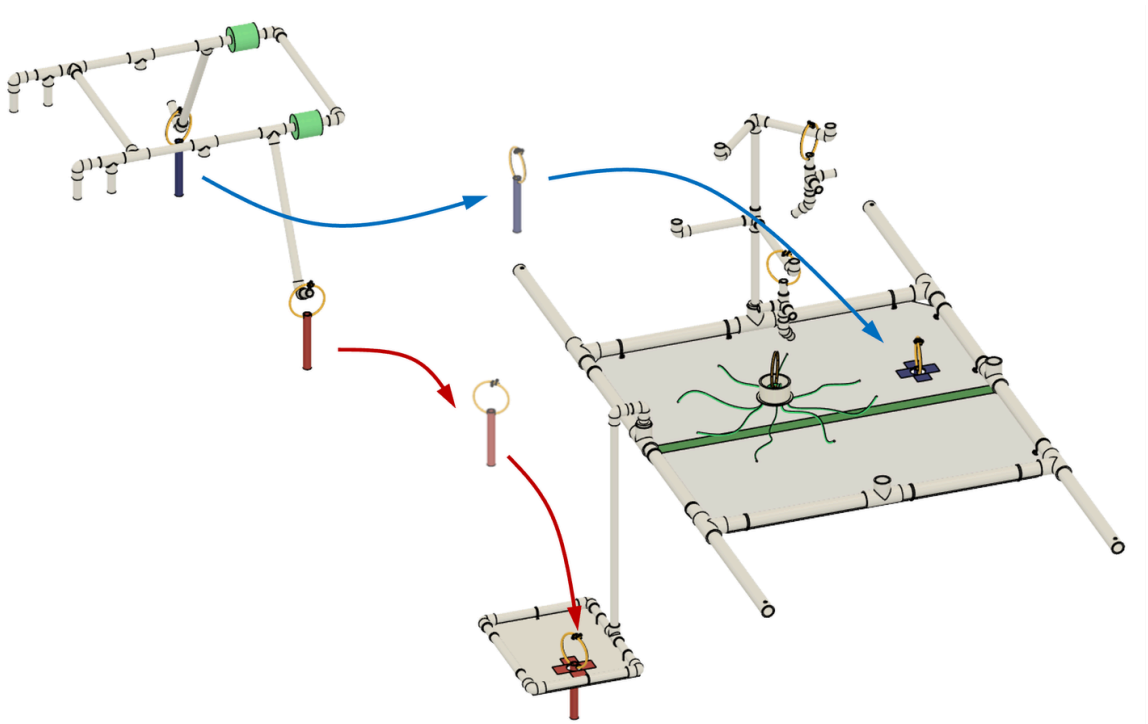
Scoring

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:

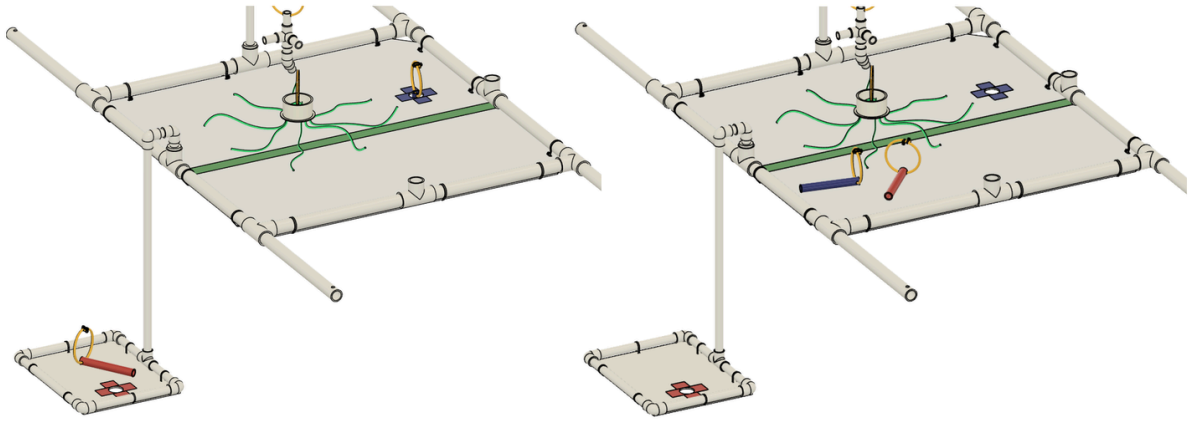
- Ten (10) points for placing the sea sponge in the bio-bucket
- Three (3) points for maneuvering through the hatch with the sea sponge (these points will only apply if the sea sponge is placed in the bio-bucket)
- Eight (8) points for placing the deep-sea coral sample in the bio-bucket
- Three (3) points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

Task 5: Marine Monitoring

The ROV must retrieve two sensors from the surface vehicle and place each sensor in the sensing location located on the front platform and the deep-dive platform. Sensor #1 (**blue**) should be placed in the marked sensing location on the front platform. Sensor #2 (**red**) should be placed in the marked sensing location on the deep-dive platform.



Placement of sensors in their respective sensing location.



(Left) Placement of sensor #1 (blue) in its sensing location with sensor #2 (red) placed on the deep-dive platform. (Right) Placement of both sensors on 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)