

# RANGER product demonstration prop building instructions

Regional competitions may build product demonstration props out of materials other than PVC pipe. Your regional coordinator will inform you of any changes to materials for your regional competition.

NOTE: Look for a regional information document posted on your [regional website](#). This document will list any changes to the product demonstration props.

Companies should be aware that tolerances in lengths of cut pipe and length of pipe inserted into joints can change the overall dimensions of product demonstration tasks. Except where noted, companies should expect tolerances in all product demonstration props and should build their ROVs and tools accordingly. In no case should the dimensions given in this document for a product demonstration prop be used to calibrate a measuring device.

Online links and Home Depot part numbers are given for certain construction items. However, some Home Depot stores may not carry the listed items or Home Depot may not be available in your area. MATE recommends checking other local hardware stores or online sources, such as those listed below, for the required component.

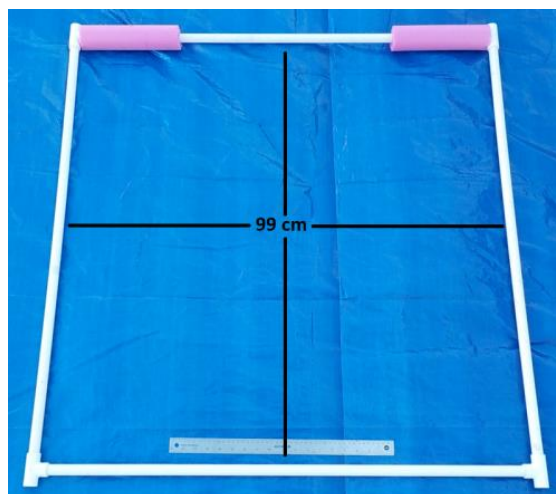
<https://www.pvcfittingsonline.com/>

<https://pvcpipesupplies.com/pvc-fittings/schedule-40-pvc-fittings/>

CAD files will be available soon for all product demonstration props. [SolidWorks Student Edition](#) is free for MATE competitors. The [eDrawings Viewer](#) is a free download that allows the Solidworks files to be viewed dynamically.

See last page for update notes (if any).

## General



The 1-meter square. Companies must launch and return through a 1-meter square area on the surface, side of the pool.

## Task 1: OOI Coastal Pioneer Array

### Task 1.1 Release the multi-function node



The ½-inch PVC framework for the multi-function node. Two ¾-inch to ½-inch reducing tees will hold the acoustic release pin.



The acoustic release pin on the multi-function node is constructed from ½-inch PVC pipe.



The multi-function nodes' recovery float is constructed from 2-inch PVC pipe. Flotation inside the pipe will cause the recovery float to rise when the acoustic release pin is pulled. The [rope](#) should be approximately half the depth of the pool so that when released, it will be “stuck” in mid-water. Note the notch, the 1/4-inch hole, at the bottom of the recovery float (there is a notch on both sides) that will fit over the release pin.



The multi-function node is created from a [plastic milk crate](#). The ½-inch PVC framework is screwed into the top of the milk crate. A 12 cm length of 3-inch pipe is screwed into the side of the milk crate to hold the recovery float. A [brick](#) provides weight for the multi-function node.

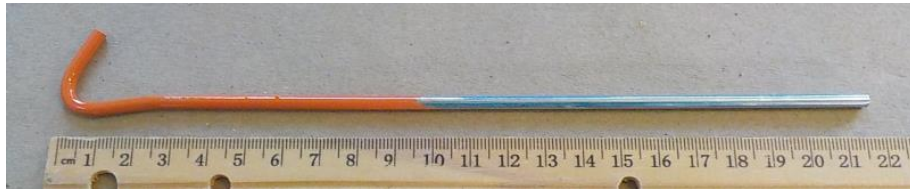


Two screws secure the 3-inch pipe in place. A length of ½-inch PVC pipe inside the milk crate helps to hold the float release pin in place. The pin goes through a loop in the recovery float's rope, through a hole in the milk crate and into two holes drilled in the ½-inch pipe.





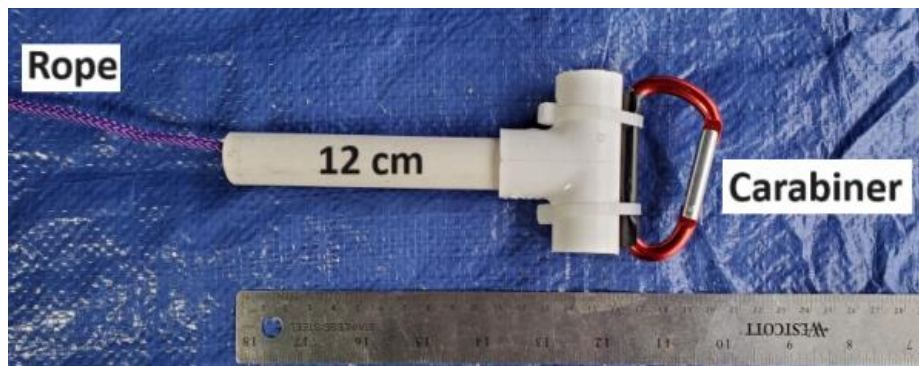
Left: The pin holding the recovery float. The recovery float rope is stored inside the float, above the pin. The pin passes through a loop in the rope, holding the rope in place until the pin is removed. Right: Two notches drilled into the bottom of the recovery float hold the pin in place.



The recovery float [pin](#).



The multi-function node with the acoustic release pin holding the recovery float in place.



The MATE ROV Competition provided recovery line.

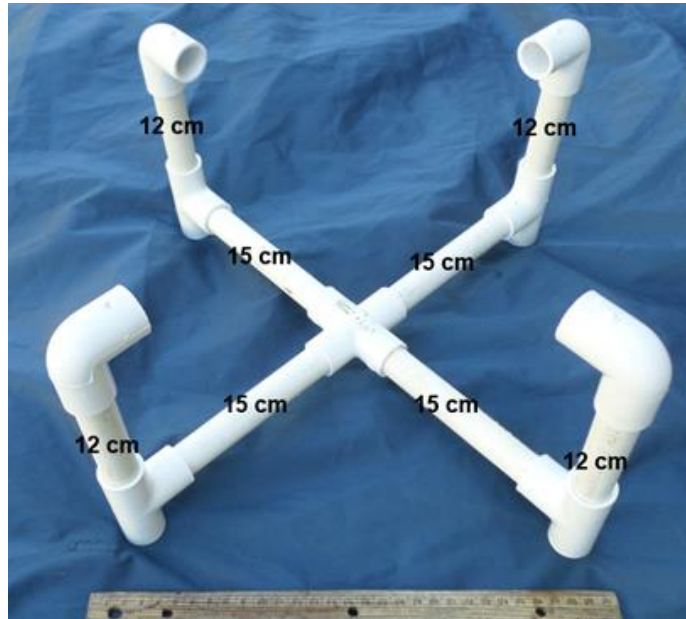
Design note: The MATE ROV Competition provided recovery line is taken from one of the mooring connectors from the 2023 missions.



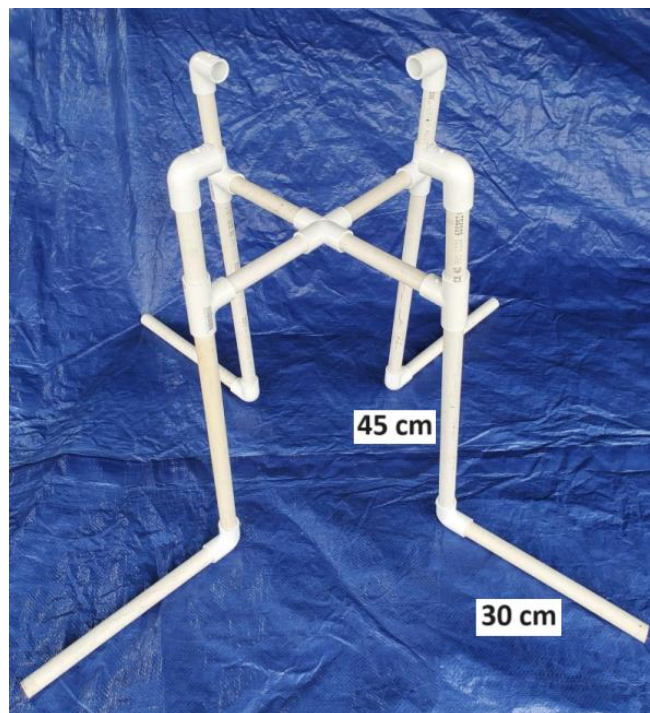
The MATE ROV Competition provided recovery line attached to the #310 U-bolt bale on the multi-function node.

## TASK 2: SMART Cables for Ocean Observing

### Task 2.1 Deploy SMART cable



A waypoint located on the bottom of the seafloor is constructed from ½-inch PVC pipe.

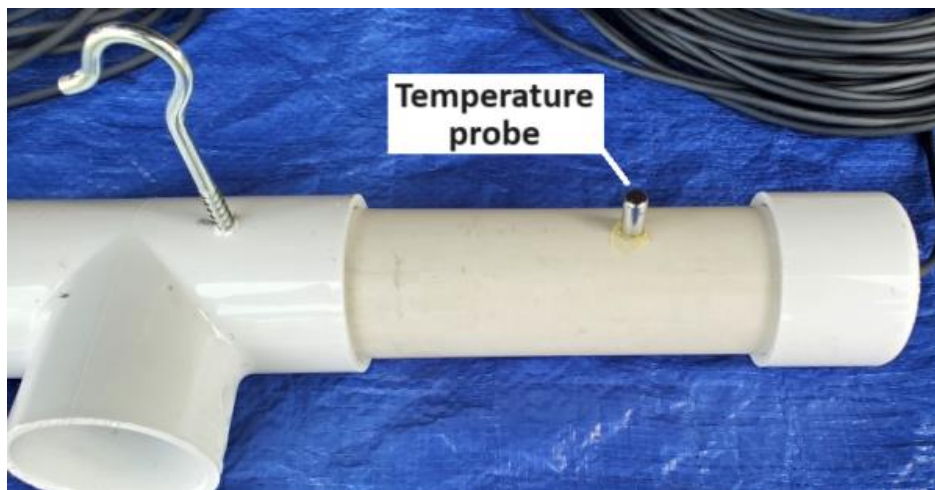


A waypoint located on a seamount. The top of the waypoint is identical to the seafloor waypoint, it is just raised up on “legs.” The four “legs” are constructed from ½-inch PVC pipe and raise the waypoint up 50 cm above the bottom of the pool.





The SMART cable repeater is constructed from 1 ½-inch PVC pipe, a tee, and two end caps. A #6 screw hook acts as a carrying mechanism for the SMART cable repeater. The cable on both ends should be long enough to reach the furthest waypoint and back to the surface, side of the pool.



The MATE ROV Competition temperature sensor probe emerges from a hole drilled into the pipe. Epoxy/glue holds the temperature probe in place. To construct a simple temperature sensor for the SMART cable repeater, see the [Sensors Presentation](#).





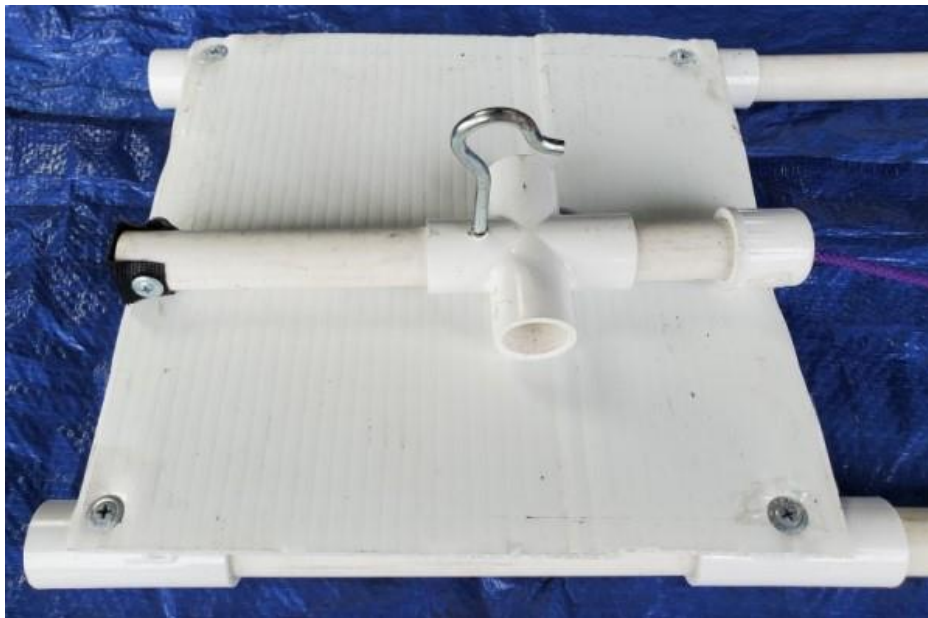
The SMART Cable designated area is a square constructed from PVC pipe painted blue.



The SMART Cable repeater successfully placed in the designated area.

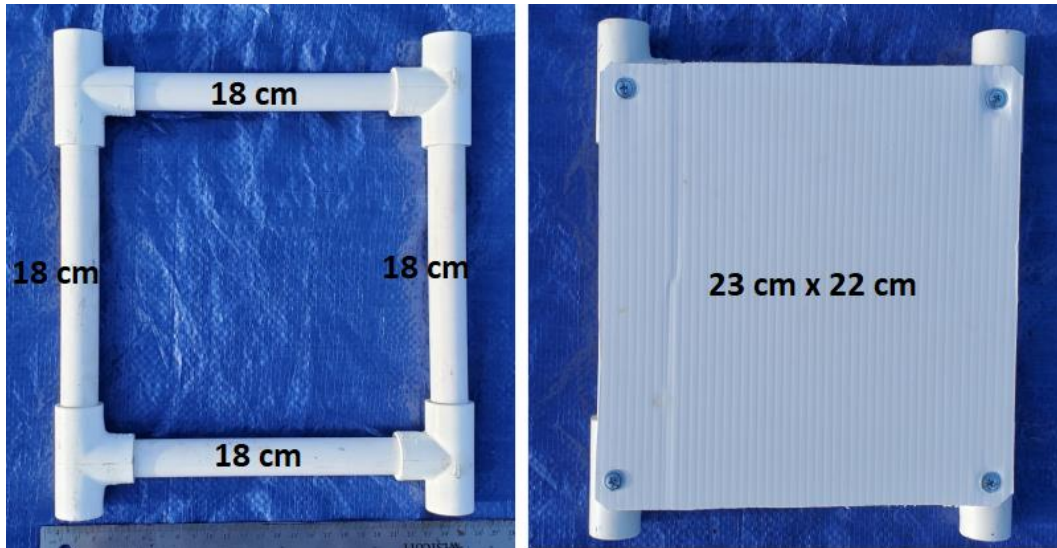


The AUV docking station power connector is constructed from ½-inch PVC pipe. A [#6 screw hook](#) can be used to carry the connector. 4 meters of rope connect the power connector to the AUV docking station. A 6 cm x 2.3 cm rectangle of Velcro hooks covers the open end of the 12 cm length of pipe.



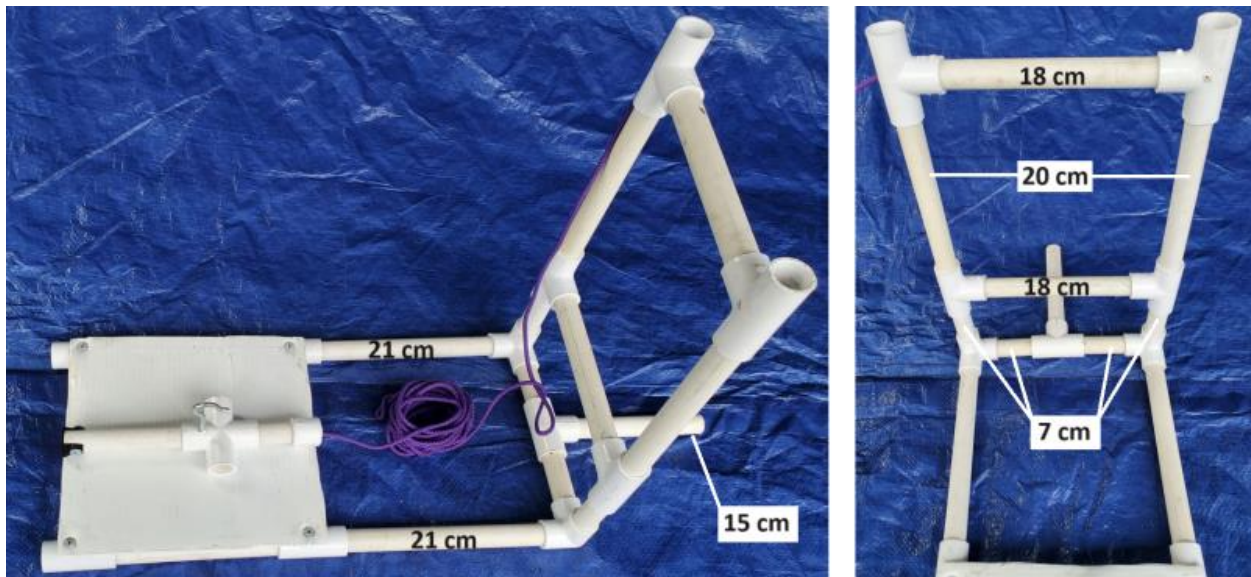
The AUV docking station power connector resting on its platform.





Left: The framework for the AUV docking station power connector platform is constructed from ½-inch PVC pipe. Right: A 23 cm x 22 cm rectangle of corrugated plastic sheeting is attached to the framework.

Design note: The AUV docking station power connector platform is identical to the seagrass platform from the 2023 mission.



The AUV docking station is constructed from ½-inch PVC pipe. The 4 meters of rope are coiled up between the AUV docking station and the AUV docking station connector platform.

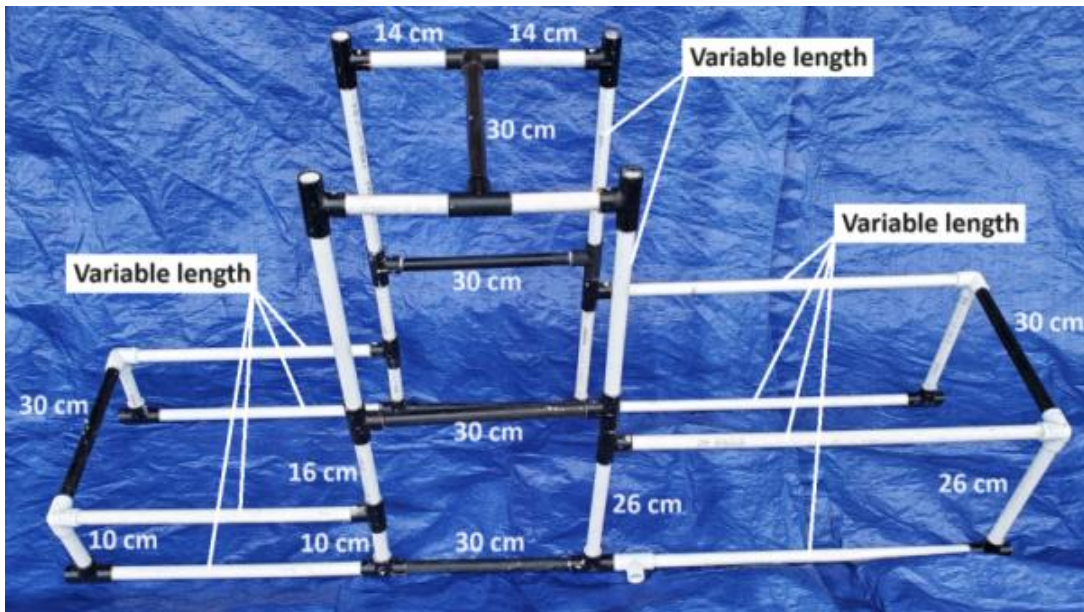




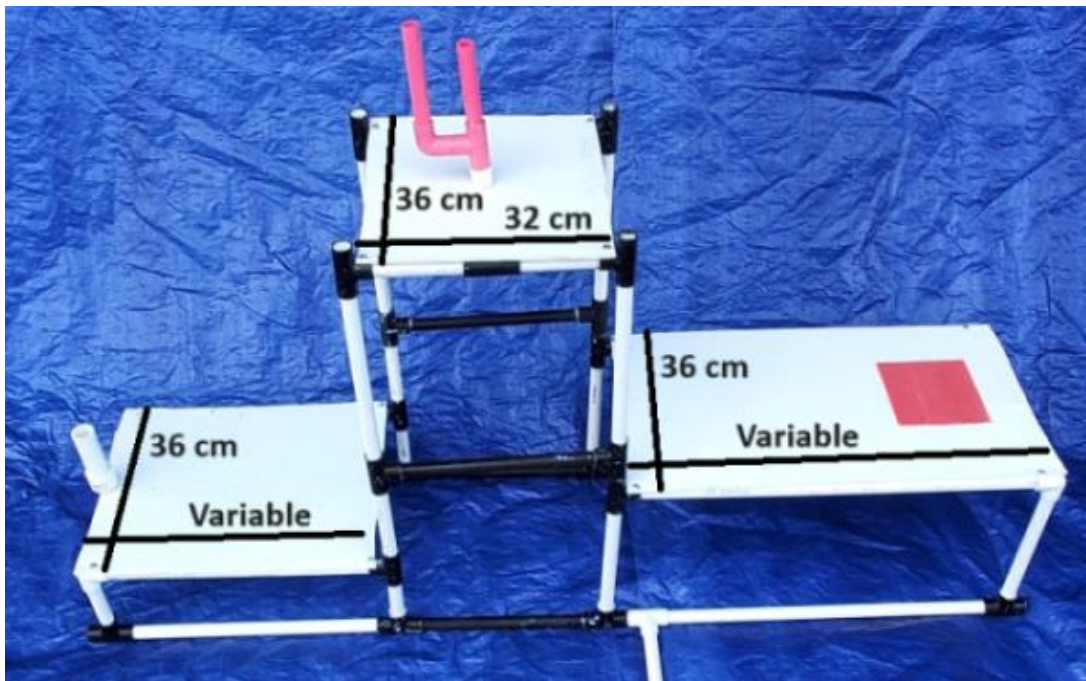
The power connector inserted into the SMART repeater.

### Task 3: From the Red Sea to Tennessee

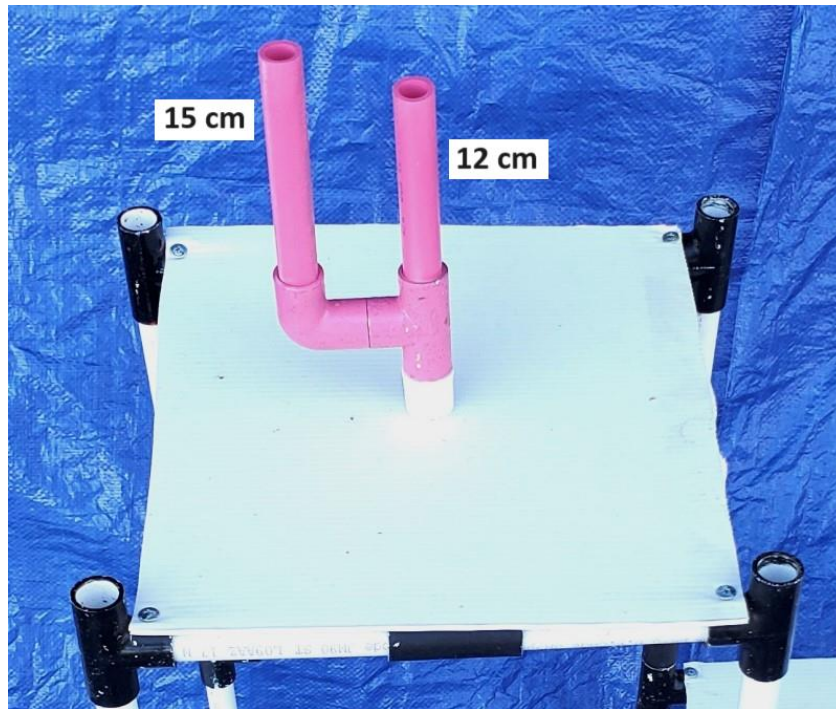
#### SMART Reefs



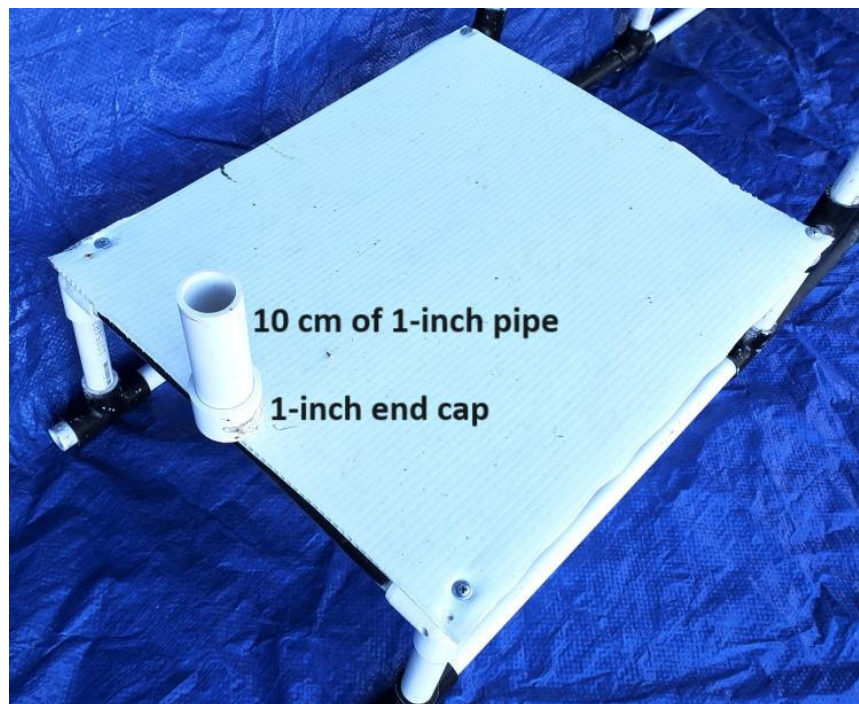
The framework of the coral restoration area is constructed from ½-inch PVC pipe. Variable lengths of PVC pipe will make the coral restoration area between 1 meter and 2.5 meters in length. The height over the coral restoration area is variable as well.



The coral restoration area has three platforms constructed from corrugated plastic sheeting. The length of two platforms will vary with the length of the PVC pipe framework. The middle platform is approximately 32 cm in length. All platforms are 36 cm wide.



The branching coral at the top of the coral restoration area is painted [berry pink](#).



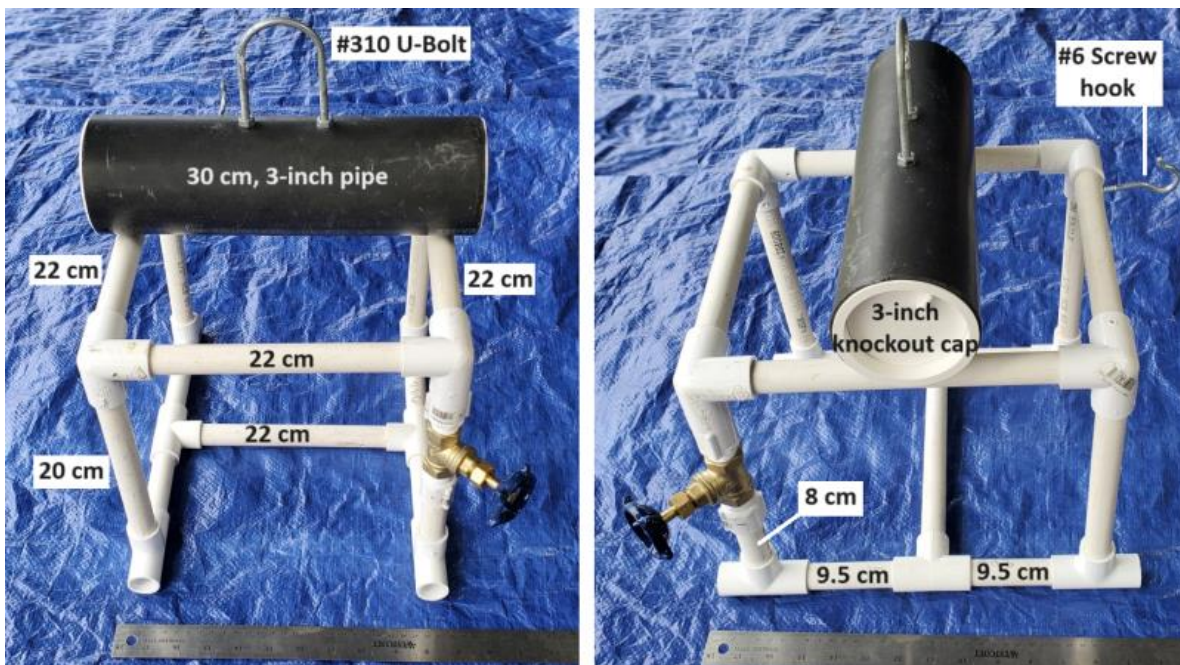
The transplant location for the branching coral is constructed from 10 cm of 1-inch PVC pipe inserted into a 1-inch end cap.





The transplant location for the brain coral is a 15 cm x 15 cm square of [red Velcro](#). Design note: This red Velcro does not have adhesive glue. Place three 14 cm strips of [black Velcro hooks](#) with adhesive onto the corrugated plastic sheeting. Attach three 15 cm strips of red Velcro to this black Velcro.

### Task 3.1 Probiotics



The irrigation system framework is constructed from ½-inch PVC pipe with 3-inch ABS on top. A #310 U-bolt acts as a carrying mechanism for the irrigation system.

Design note: The 3-inch pipe is the 2023 NAVIGATOR/SCOUT heavy lift container with weights removed.

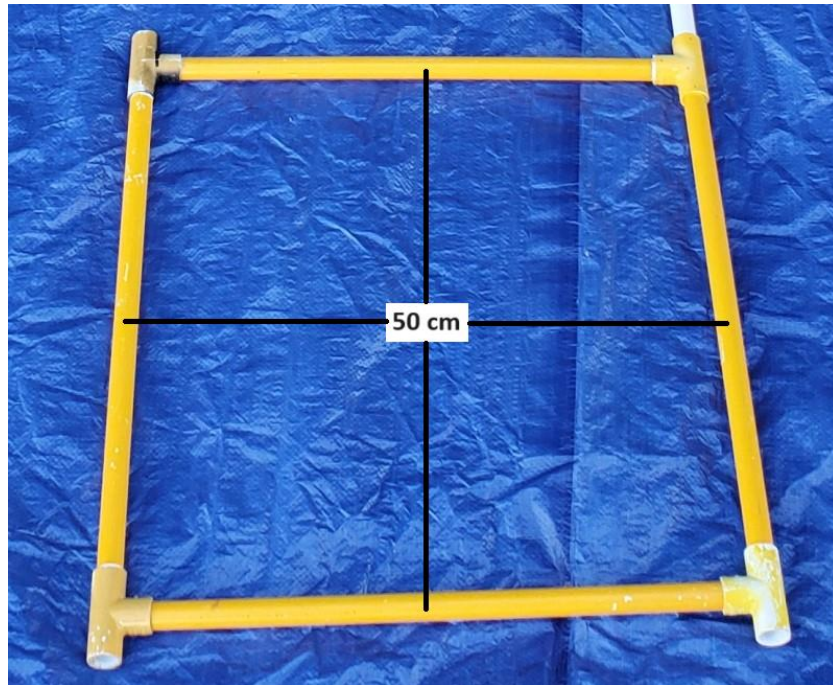


Left: The [1/2-inch brass stop valve](#) has two 1/2-inch male adapters screwed into each side. A [1/2-inch gate valve](#) can be substituted for the 1/2-inch stop valve if desired. Right: A 1/2-inch PVC cross is attached to the handle of the stop valve with a cable tie.

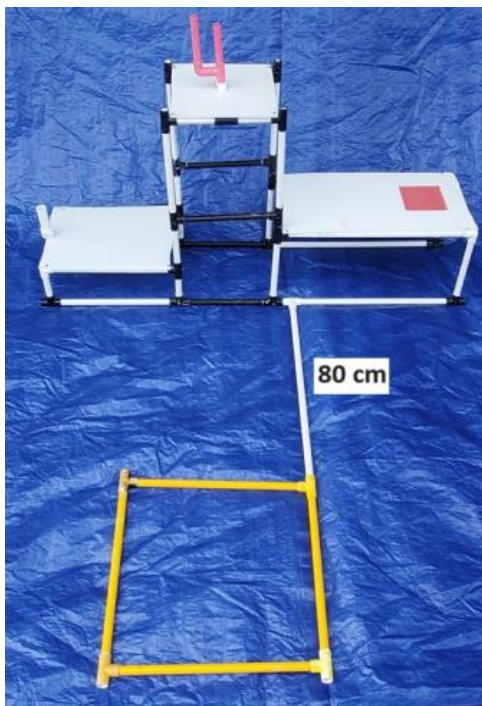


Design note: Loosen the nut underneath the handle to make the handle easier to turn. Once fully loose, use Loctite or glue to secure the nut in place. Photo: [Everbilt 1/2 in. x 1/2 in. FPT Brass Stop Valve 105-003EB - The Home Depot](#)





The irrigation system designated area is constructed from ½-inch PVC pipe painted yellow.

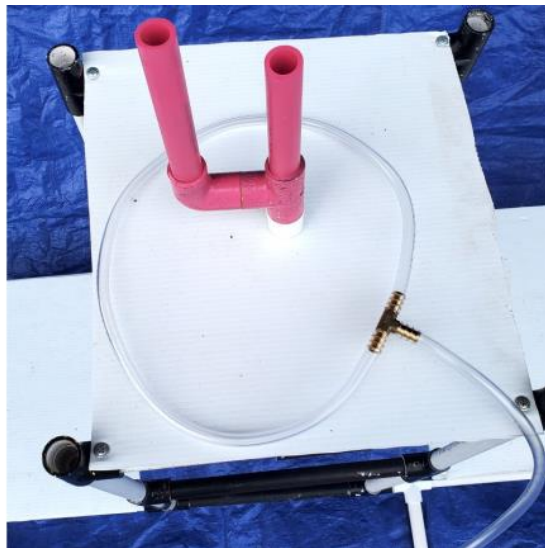


Left: The coral restoration area with the irrigation system designated area attached. Right: The irrigation system successfully deployed in the designated area.



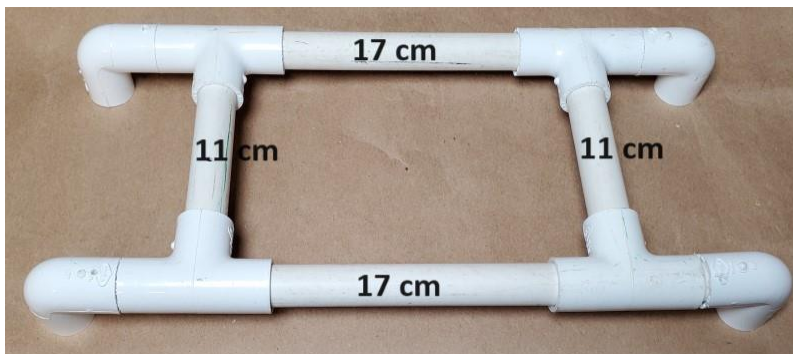


The sprinkler system is constructed from [clear vinyl tubing](#). 75 cm makes the loop that goes over the coral head. The ends are inserted into a [brass tee barb](#).

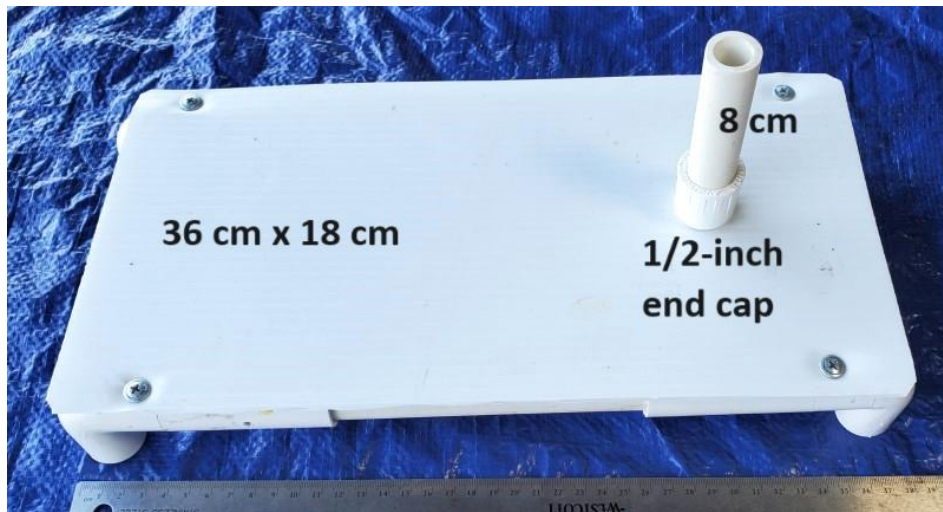


Left: The sprinkler system hanging from a [#6 screw hook](#) inserted into the irrigation system. Right: The sprinkler system successfully deployed over the coral head.

### Task 3.2 Coral Restoration

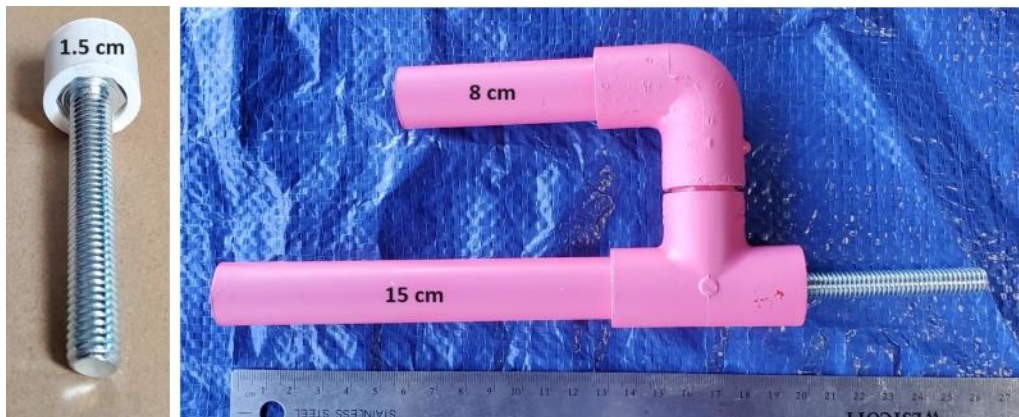


The coral restoration nursery framework is constructed from ½-inch PVC pipe.



The coral restoration nursery.

### Branching coral



The branching coral is constructed out of 1/2-inch PVC pipe. A [3/8-inch, 2 1/2-inch hex bolt](#) is gently hammered into a 1.5 cm length of 1/2-inch pipe.





Left: The brain coral is constructed from a [plastic bowl](#). A 30 cm length of [rope](#) is used a carrying mechanism for the brain coral. Four 2 cm x 2 cm Velcro loops around the bottom edge will secure the brain coral in the coral restoration area. The bowl is 14 cm in diameter and 5.5 cm tall. Right: A large [Mexican Beach Pebble](#) rock is secured to the inside of the brain coral with Velcro to provide weight.



The coral nursery with brain coral and branching coral.





Left: The branching coral transplanted into the coral restoration area. Right: The brain coral transplanted into the coral restoration area.

### Tennessee Lakes and Rivers

#### Task 3.4 Determine the location of sturgeon spawning grounds



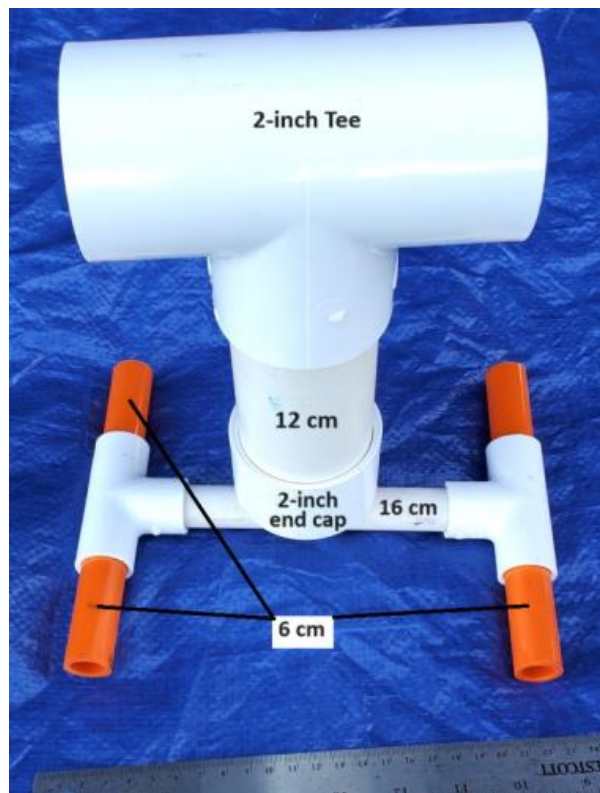
Left: Acoustic receiver front view constructed from 1/2-inch PVC pipe. Right: Acoustic receiver side view.

#### Design Note:

- The acoustic receiver is the camera from the 2023 task. A 3/4-inch to 1/2-inch reducer tee replaces the 1-inch to 1/2-inch reducer tee on the 2023 mission prop.
- Colors will vary between the three acoustic receivers at each station.

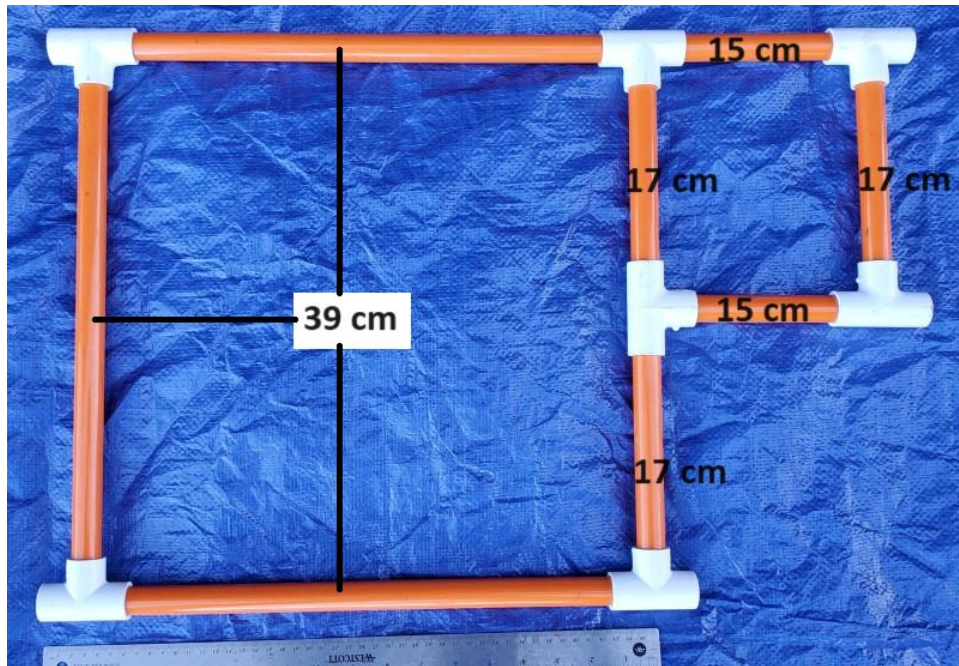


Photo: Three acoustic receivers with different colors (orange, blue and purple)



The Acoustic Doppler Current Profiler (ADCP) is constructed from 2-inch PVC pipe with a ½-inch PVC base.





The designated area for the ADCP with the sediment area attached. The designated area is constructed from ½-inch PVC pipe.



The sediment sample consists of [Mexican Beach Pebbles](#).

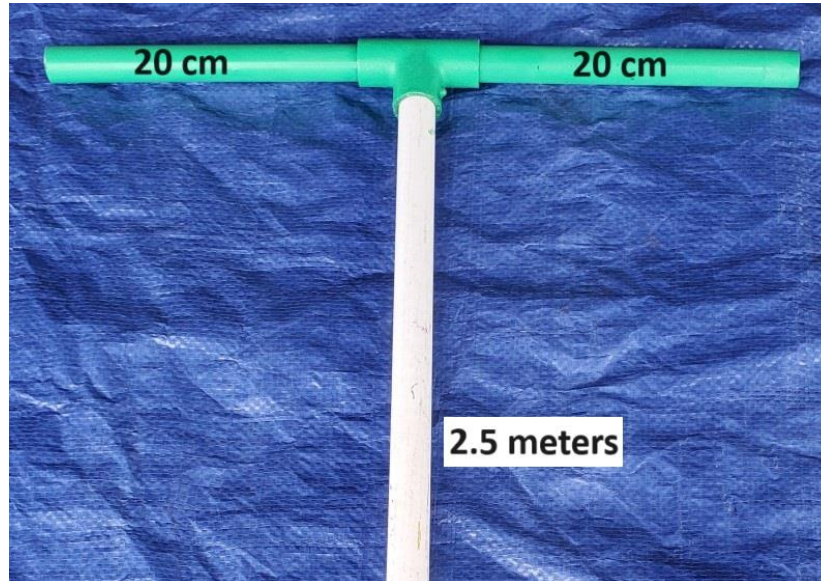




The ADCP deployed in the designated area.

## Task 4: *MATE Floats!*

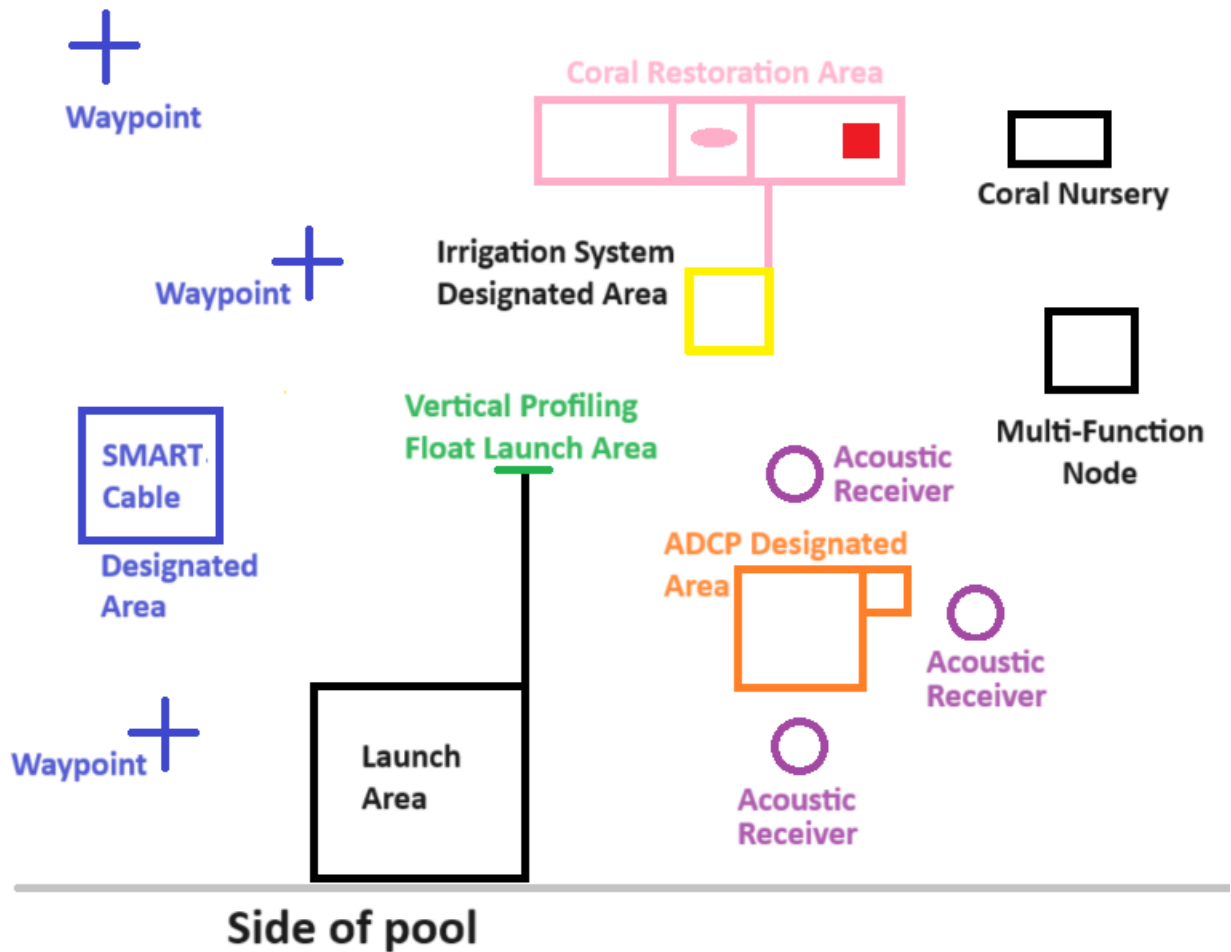
### Task 4.1 Design and construct an operational vertical profiling float



Companies must deploy their vertical profiling floats anywhere beyond the green mark, which is constructed from ½-inch PVC pipe and set 2.5 meters out from the side of the pool. At the World Championship, RANGER class companies will deploy their floats at the edge of the deep end of the pool.

**RANGER class product demonstration set up:**

The following is a possible underwater set up for the RANGER class product demonstration. The set up at regional events and/or the World Championship may vary.





Update Notes:

Updates are highlighted in yellow.

RANGER prop building instructions.

None