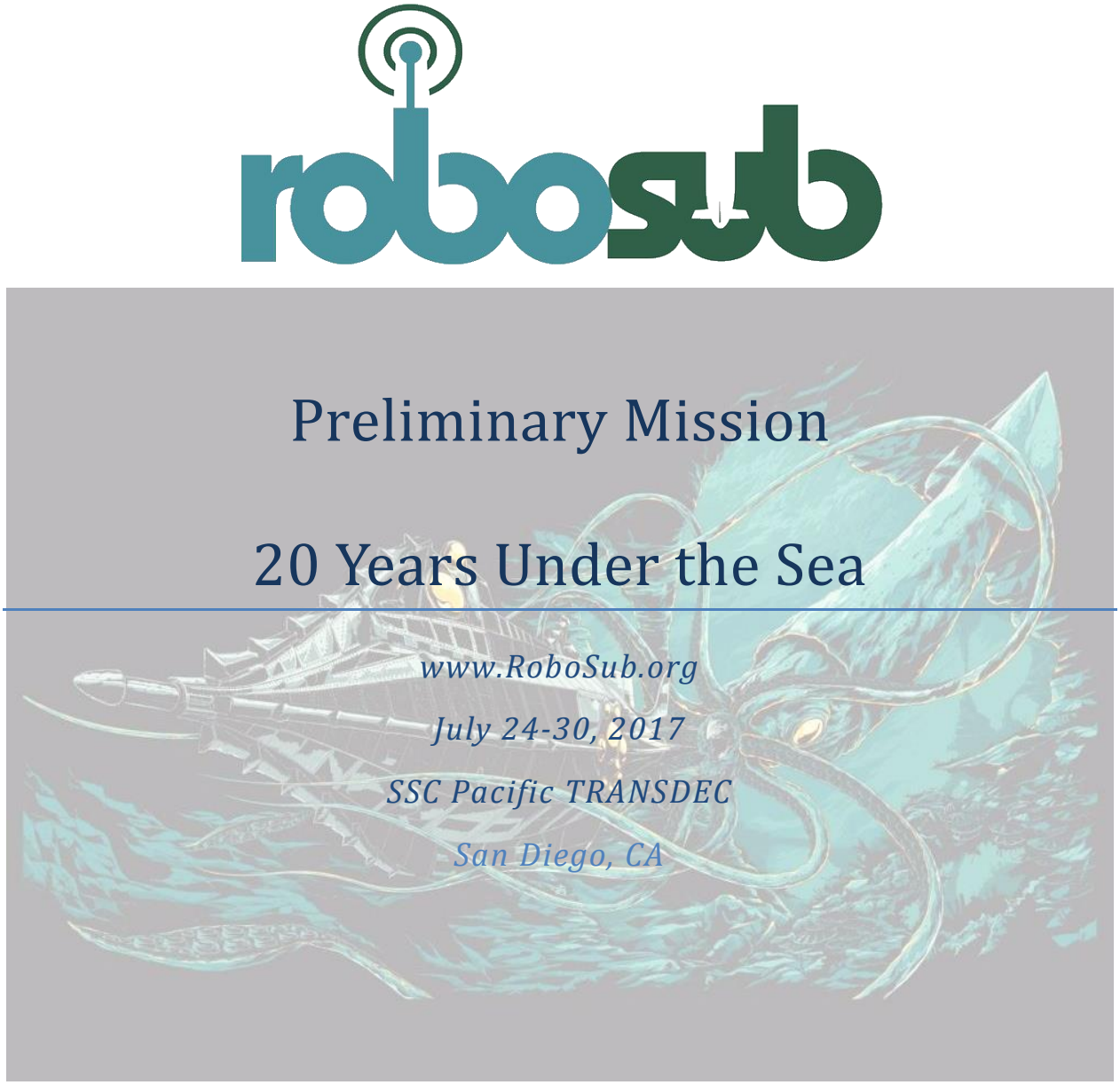


Preliminary Mission

20 Years Under the Sea

www.RoboSub.org

July 24-30, 2017

SSC Pacific TRANSDEC

San Diego, CA

AUVSIfoundation
ASSOCIATION FOR UNMANNED VEHICLE SYSTEMS INTERNATIONAL

DEPARTMENT OF THE NAVY ONR Science & Technology

1. Competition Points of Contact

We are releasing this preliminary mission description for comment by the teams. Please direct your comments and questions to the RoboSub forum on Robonation. Teams are encouraged to participate in the community and to help guide the final mission for the competition. Discussion of the rules will be open for a period of time. After which, these mission tasks will be finalized and released.

Technical Director:
David Novick: dknovic@sandia.gov

Competition Questions (registration, travel, hotel or team deliverables):
Competitions@AUVSIFoundation.org

2. Reminder

The official source for all information concerning rules, interpretations, and information updates for the International Autonomous Underwater Vehicle Competition (RoboSub) is the World Wide Web home page: www.RoboSub.org. On the main site, you can find information regarding eligibility, registration (the form and fees), websites, social media, journal paper requirements, team presentations & videos and much, much more.

3. Theme

This year's theme is based on Jules Verne's *20,000 Leagues Under the Sea* (as well as the 1954 Disney movie of the same name).

4. Mission

The fundamental goal of the mission is for an AUV to demonstrate its autonomy by fulfilling the role of the Nautilus from *20,000 Leagues Under the Sea*. Orange guide markers will help direct the vehicle to the beginning tasks. Two pingers will guide the AUV to the remaining two tasks. The vehicle will have to Disable a ship (touch buoys), Navigate a channel (pass over an obstacle), Cultivate pearls (drop a marker), Battle a giant squid (fire torpedoes), and Collect and Classify marine samples (retrieve objects, surface, move/release the object).

5. Competition Overview

5.1. Venue

The competition will be held at the SSC Pacific TRANSDEC facility. The facility's large size allows us to divide the venue into four sections, and run full missions in **every** section. During the semi-finals, one half of the venue (the competition side, two full sections) will be devoted to the semi-final runs. The other half of the venue (practice side, two full sections) will be devoted to teams wishing to continue to polish their algorithms. For the finals, the course will be expanded to include both sections of the competition side. The mission will take place in 16ft (4.9m) of water.

5.2. Weight and Size Constraints

For the RoboSub competition, each entry must fit within a six-foot long, by three-foot wide, by three-foot high "box" (1.83m x 0.91m x 0.91m). Table 1 shows the bonuses and penalty points associated with a vehicle's weight in air:

Table 1: Vehicle weight in air with Bonus or Penalties points

	Bonus	Penalty
AUV Weight > 125 lbs (AUV Weight > 56.7 kg)	**N/A**	**Disqualified**
125 lbs ≥ AUV Weight > 84 (56.7 kg ≥ AUV Weight > 38)	**N/A**	**Loss of** **250 + 5*(lb – 125)** **250 +11*(kg – 56.7)**
84 lbs ≥ AUV Weight > 48.5 (38 kg ≥ AUV Weight > 22)	**Bonus of** **2*(84 – lb)** **4.4*(38 – kg)**	**N/A**
AUV Weight ≤ 48.5 lbs (AUV Weight ≤ 22 kg)	**Bonus of** **80 + (48.5 – lb)**	**N/A**

5.3. Pingers

The pingers will be Benthos ALP-365. The Benthos ALP-365 is user selectable from 25 to 40 kHz in 0.5 kHz increments. They will only be set to an integer frequency (25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39 or 40).

6. Competition Tasks

The Launch Point, Gate, Path Markers, Disable Ship, Navigate Pass, Cultivate Pearls, Battle Squid and Collect & Classify samples will be placed such that no three elements are long a line.

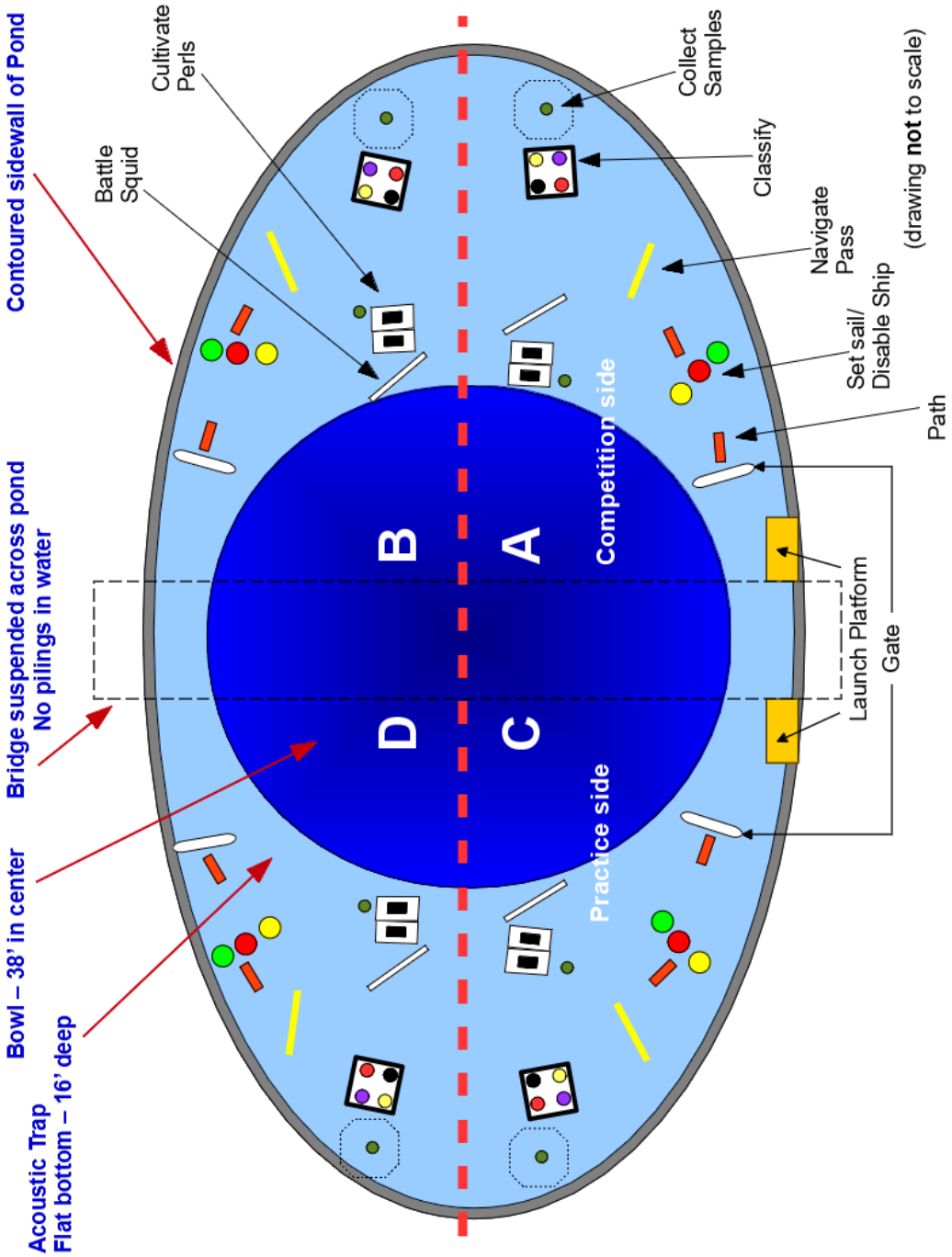


Figure 1: Overview of course layout

6.1.Path Marker

The path markers are 4 feet (1.2m) long by 6 inches (15cm) wide. The path will be covered in **BLAZE ORANGE** colored Duct Tape. Each path marker will be placed directly after the current task, and point to the next task. There will be one positioned at the gate that points to the Disable Ship (buoy) task. Positioned near the Disable Ship task, the next path segment will point to the Navigate Pass task. Those two path markers will be the only path segments available which can be used to visually direct the vehicle.

6.2.Set Sail/Disable Ship (Buoy)

There will be two 8" (20 cm) diameter solid color Polyform A-0 buoys. One will be **Red**, the other will be **Green**. The third object will be a corrugated plastic cutout similar in size to the buoys (**Question: Color? Shape?**). The cutout will be moored to the floor, and directly above the cutout, on the surface of the water, will be the silhouette of a ship. Points are awarded for touching any buoy. Additional points are awarded for touching the **Red** then **Green** buoy. Extra points are also awarded for also touching the yellow "buoy" moving the ship on the surface.

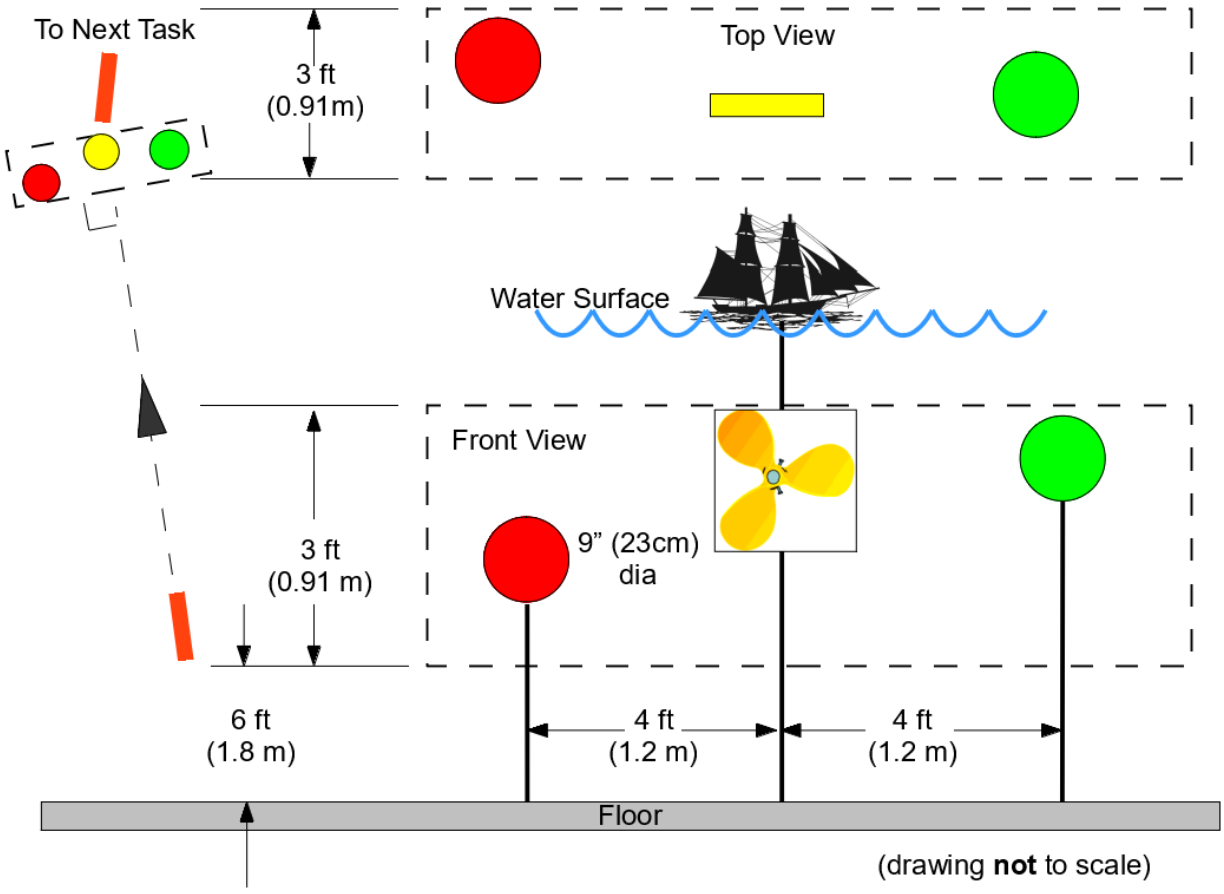
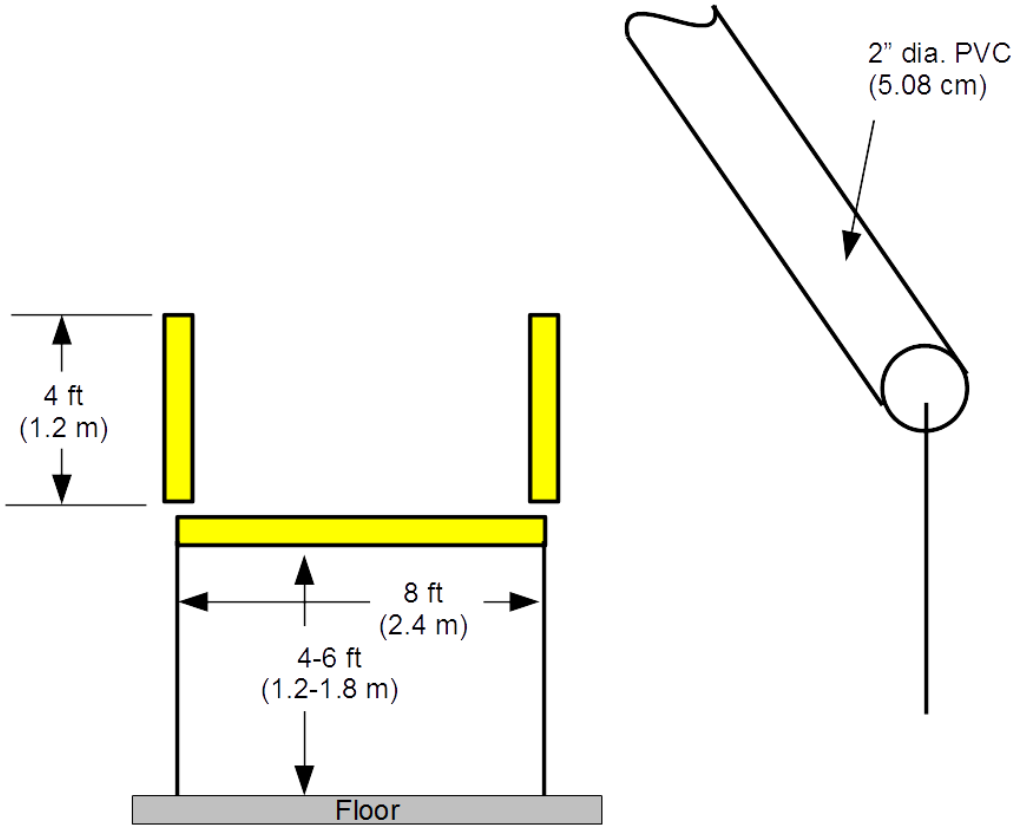


Figure 2: Set Sail/Disable Ship

6.3.Navigate Pass

A horizontal section of 2" PVC pipe (**Question: Color?**) will be moored to the floor. Attached to this will be two vertical sections. Points will be awarded for passing over the obstacle. More points will be awarded for navigating with "style" (sliding sideways, backward, upside down) through the pass.



(drawing **not** to scale)

6.4.Cultivate Pearls (Bins)

This tasks consists of two black bins. Each black bin will be surrounded by a 6" (15cm) white border. A total of two markers can be dropped from each vehicle. Inside each bin will be a pearl silhouette (**Question: Silhouette? Color?**). One silhouette will be larger than the other. One of the two bins will have a cover over the opening (**Question: How to remove lid? Color? Giant Clam?**). Instead of a handle, there may be a lever. Pushing down on the lever will open the bin. Points are awarded for dropping the markers in the open bin, or on the outer white edge. To obtain maximum points, the vehicle must move the cover and drop both markers in the bin that was once covered.

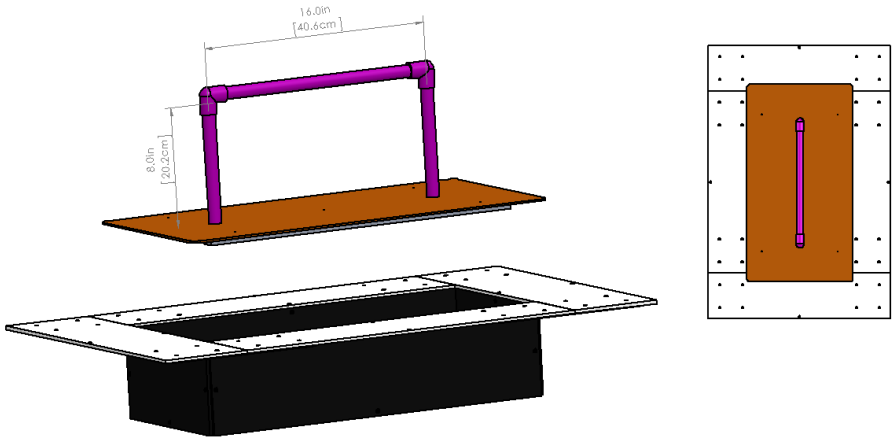


Figure 3: Bin with possible cover.

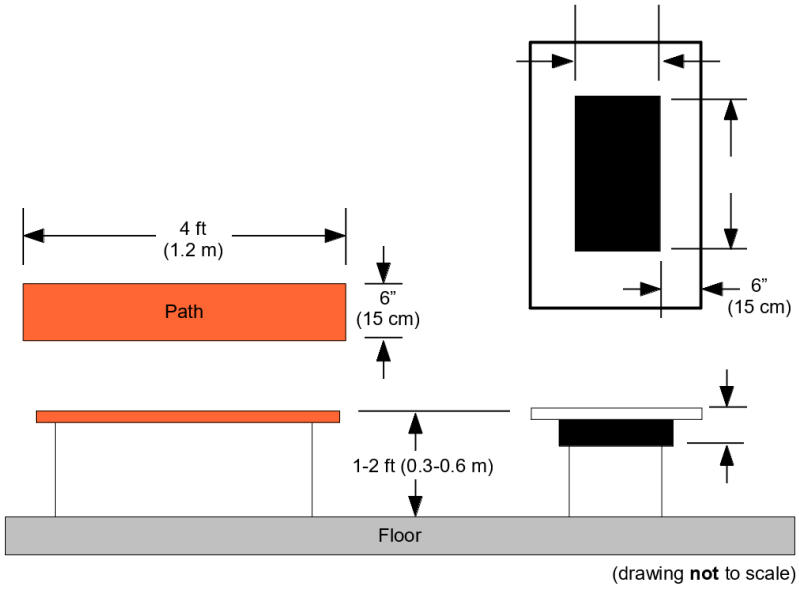


Figure 4: Path marker and bin.

6.5.Battle a Squid

There will be two separate vertical rectangles moored to the floor, each with two different diameter openings. There will be two small openings and two large openings (**Question: Sizes, color, border?**). One rectangle will be rigidly secured to the floor with PVC pipe (the squid on the right side in the image below). On this rectangle, the small opening will be obscured with floating "seaweed" (not show in image). The seaweed will need to be pushed out of the way in order to shoot through the small opening. The second rectangle (the tentacle on the left side in the image below) will be held in place with just line, and be able to move and sway. A total of two torpedoes can be fired from the vehicle. Points will be awarded for firing the torpedo through any of the openings. Maximum points will be awarded for moving the seaweed cover, and firing torpedoes through both of the small openings.

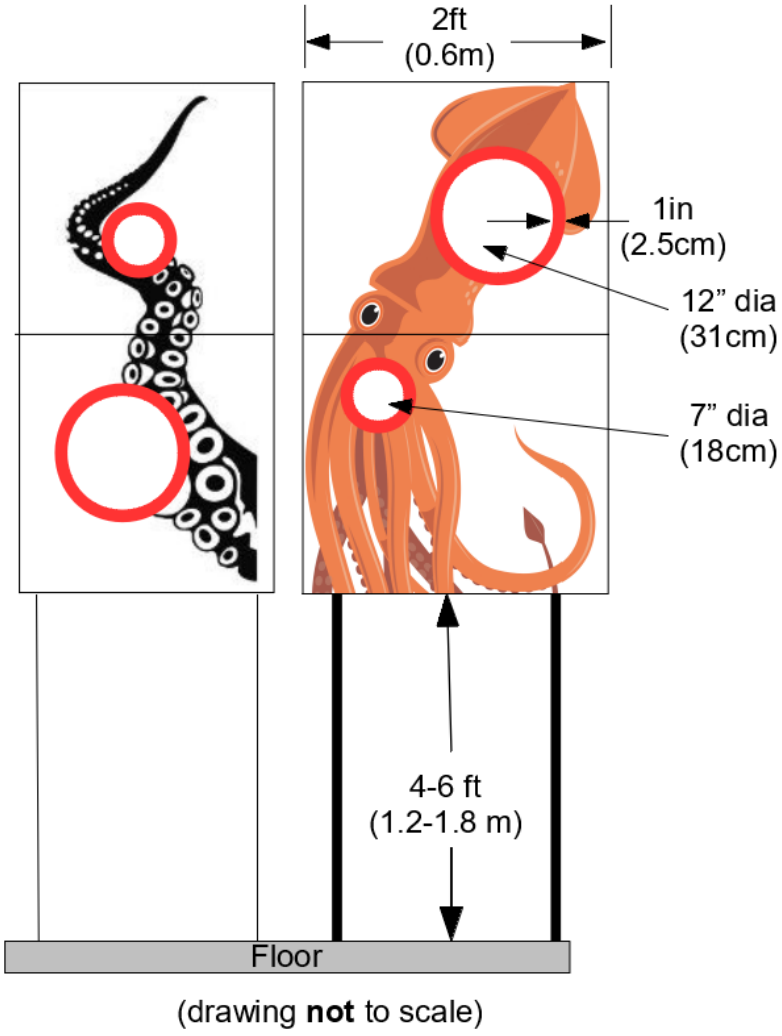


Figure 5: Battle Squid

6.6. Collect & Classify Samples

This task consists of an acoustic pinger located off the floor of the pool. The pingers around the arena in the four sections will be deconflicted. Placed directly above the pinger, on a tower, are four different items (PVC structures). Each item will have a different color, and each item will be increasing more difficult to grab. Floating above the pinger on the surface will be an octagon representing the collection point. In order to obtain full points for the octagon, the vehicle must surface fully inside the octagon.

Located next to the pinger/tower is a large flat horizontal surface ("table"). On the "table" there will be colored circles (**Question: Size, color?**). Points are awarded for picking up an object from the tower, surfacing with an object and placing the "sample" object on the "table". There are four different "sample" objects to pick up, and four different locations to place them on the table. Maximum points are awarded for placing the same colored sample on its corresponding colored circle.

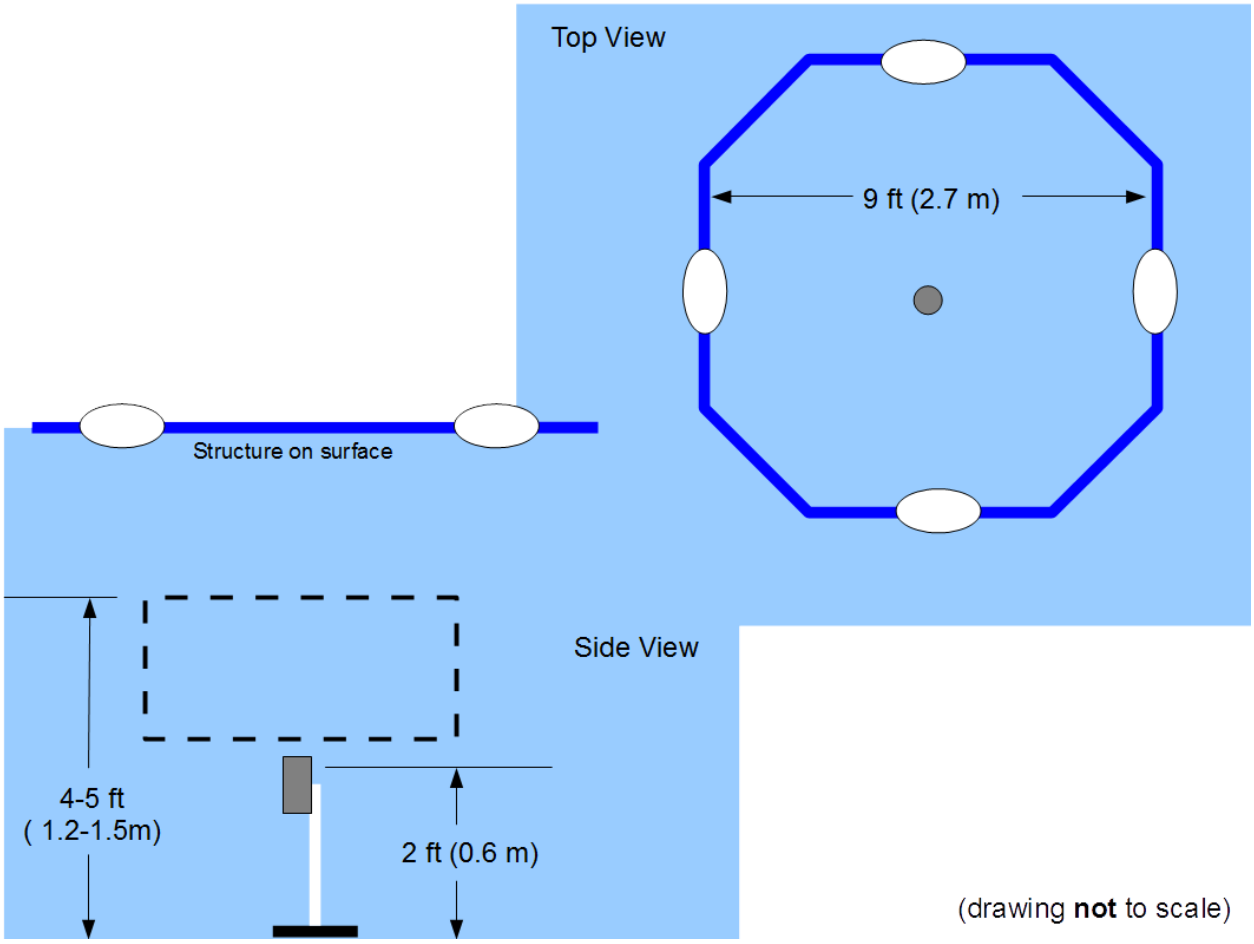


Figure 6: Collect Samples

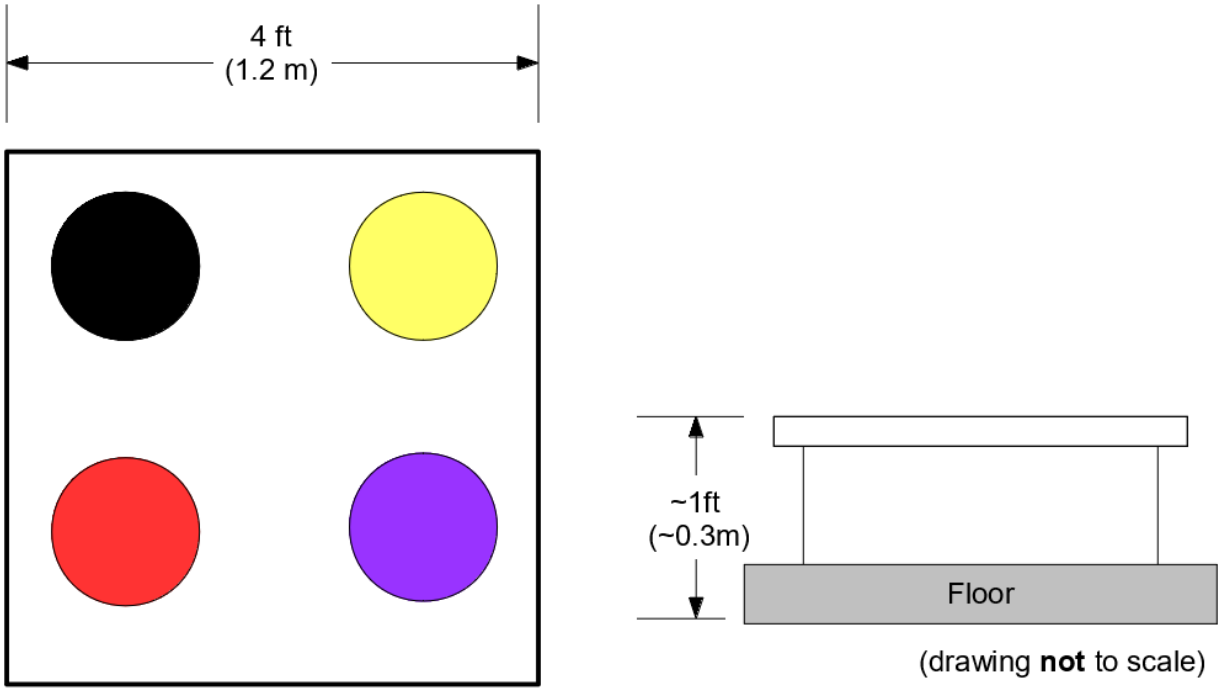


Figure 7: Classify

7. SCORING

Each of the tasks will have a point value associated with it. The tasks can be completed in any order. The recovered object must be attached to the vehicle while the vehicle is surfacing to obtain maximum points for "surfacing with object".

The team captain may stop the run at any time and keep the accumulated points. The team may decide to start another run, in an attempt to accomplish more/different tasks. At the start of a new run, the points accumulated from the previous run are forfeit. The only points which are recorded are from the very last run. (This may change for the finals).

Cultivate Pearls / Battle Squid and Collect & Classify will **only** be marked with a pinger. There will be no path markers that point to either task. A team may request to switch on a specific pinger (pinger near the Cultivate Pearls / Battle Squid, or pinger near the Collect & Classify). Extra points will be awarded for a random pinger selection. A team **must** be able to complete tasks in each section in order to request a random pinger selection.

7.1. Time

We expect each vehicle to have 15 minutes to complete the entire mission (with an additional 5 minutes of dock preparation time). Any vehicle that touches a buoy, passes over the obstacle, places at least one marker in the bin or on the lip (or fires a least one torpedo through the opening) and surfaces within the octagon will receive bonus points proportional to the unused time. Each vehicle must begin the run by passing under a validation gate. At any time during the run, if a vehicle breaches the surface, the run is terminated (See the section "Breaching" for the exception, *'cause there's always one*).

7.2. Breaching

When completing a sequence of tasks, the octagon may not be the last task attempted. In this case, if the vehicle surfaces fully or partially within the octagon it can then submerge to accomplish the remaining tasks.

7.3. Interference

Vehicles that interfere with competition elements may be disqualified at the judges' discretion. "Interference" does not include cases where, in the opinion of the judges, a vehicle is attempting to complete one of the tasks. If a vehicle becomes entangled on a competition element the run will be declared complete. Teams may keep the points earned on that run, or may have the vehicle returned to the launching platform and start another new run. If a new run is begun, all points from the previous run are forfeit.