



# Preliminary Mission and Scoring

## A Pirate's Life for Thee

[www.RoboSub.org](http://www.RoboSub.org)



July 25-31, 2016

SSC Pacific TRANSDEC

San Diego, CA



## 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 Community](#) (“RoboSub 2016” on Google+). 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:

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### Competition Questions (registration, travel, hotel or team deliverables):

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## 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](http://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

Avast ye land lubbers! Me moniker be Jolly Dave. Th’ 19<sup>th</sup> century saw th’ down turn o’ buccaneering pirates. Shiver me timbers. Th’ 19<sup>th</sup> RoboSub competition gonna smartly raise the jolly roger ‘n embrace our inner scurvy pirate. Don’t be a bilge rat, register fer th’ competition, or be forced to walk th’ plank and give Davey Jones our regards.

## 4. MISSION

The fundamental goal of the mission is for an AUV to demonstrate its autonomy by fulfilling this undertaking as a buccaneering pirate. 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 scuttle a ship (touch buoys), navigate a channel (pass over an obstacle), weigh anchor (drop a marker), set course (fire torpedoes), and bury a treasure (retrieve an object, surface, move/release the object).

## 5. COMPETITION OVERVIEW

### 5.1.Venue

The competition will be held at the SSC Pacific TRANSDEC facility. The large area allows us to divide the area into sections. The mission will take place in 16ft (4.9m) of water. This year, to accommodate the growing number of teams, we will divide the venue into four sections, and will be running full missions in **every** section. During the semi-finals, one half (the competition side, two full sections) will be devoted to the semi-final runs. The other half (practice side, two full sections) will be devoted to teams wishing to continue to polish their algorithms.

### 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 penalties associated with a vehicle’s weight in air

Table 1: Vehicle weight in air with Bonus or Penalties		
	Bonus	Penalty
AUV Weight > 125 lbs (AUV Weight > 56.7 kg)	N/A	<b>Disqualified</b>
125 lbs ≥ AUV Weight > 84 (56.7 kg ≥ AUV Weight > 38)	N/A	<b>Loss of</b> <b>250 + 5*(lb – 125)</b> <b>250 + 11*(kg – 56.7)</b>
84 lbs ≥ AUV Weight > 48.5 (38 kg ≥ AUV Weight > 22)	<b>Bonus of</b> <b>2*(84 – lb)</b> <b>4.4*(38 – kg)</b>	N/A
AUV Weight ≤ 48.5 lbs (AUV Weight ≤ 22 kg)	<b>Bonus of</b> <b>80 + (48.5 – lb)</b>	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, Scuttle Ship, Navigate Channel, Weigh Anchor, Set Course and Bury Treasure will be placed such that no three elements are long a line.

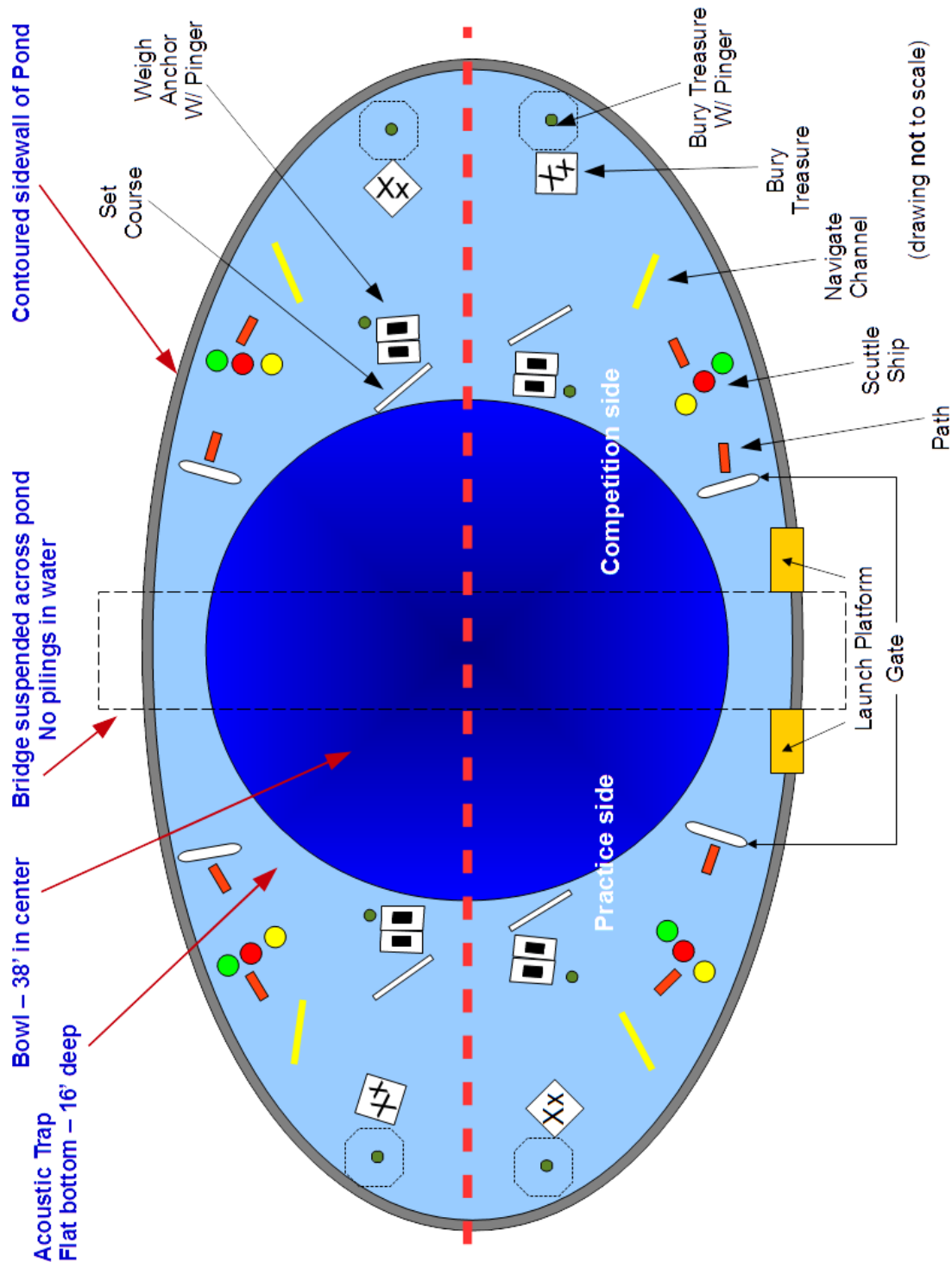


Figure 1: Overview of course layout

### 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 Scuttle Ship (buoy) task. Positioned near the Scuttle Ship task, the next path segment will point to the Navigate Channel task. Those will be the only path segments which can be used to visually direct the vehicle.

### 6.2.Scuttle 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. 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. Additional points are also awarded for dragging the yellow "buoy" downward pulling the ship on the surface underwater.

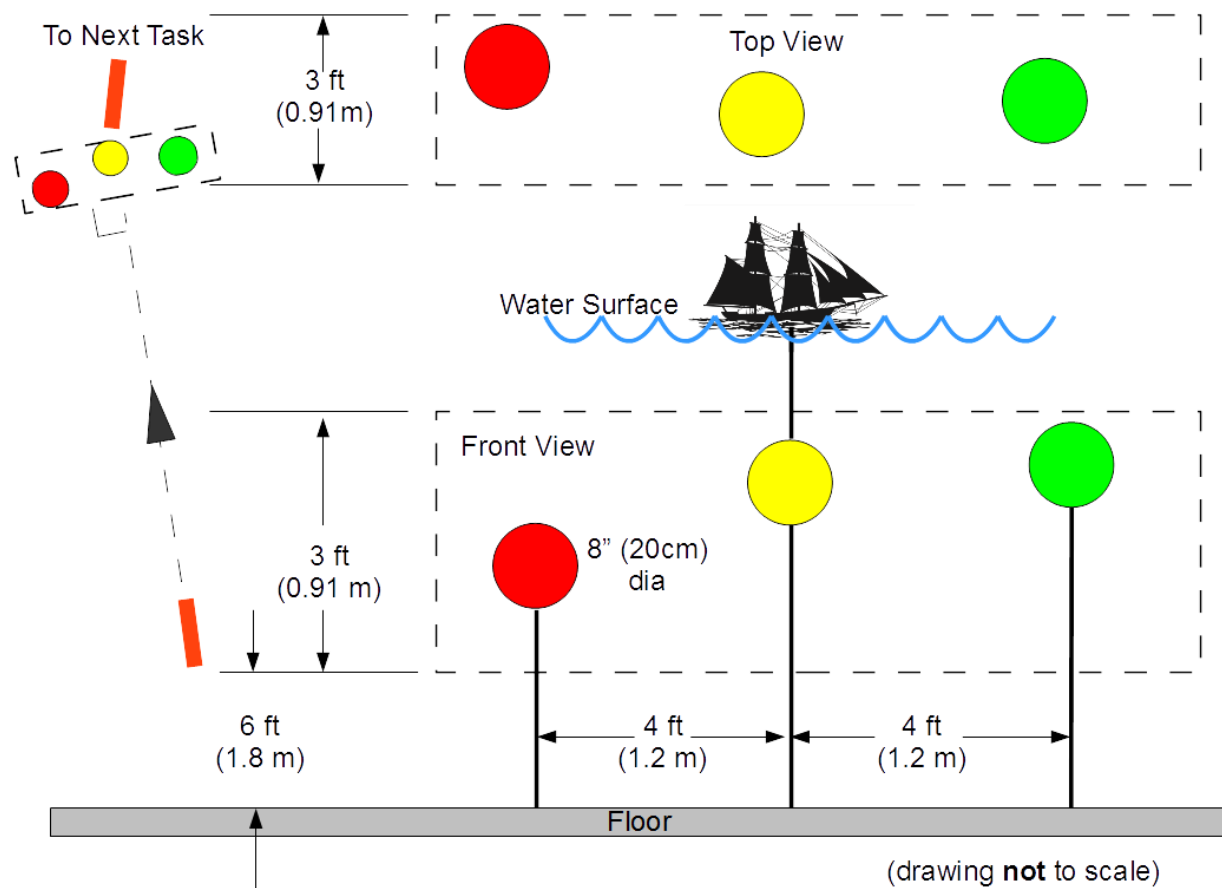
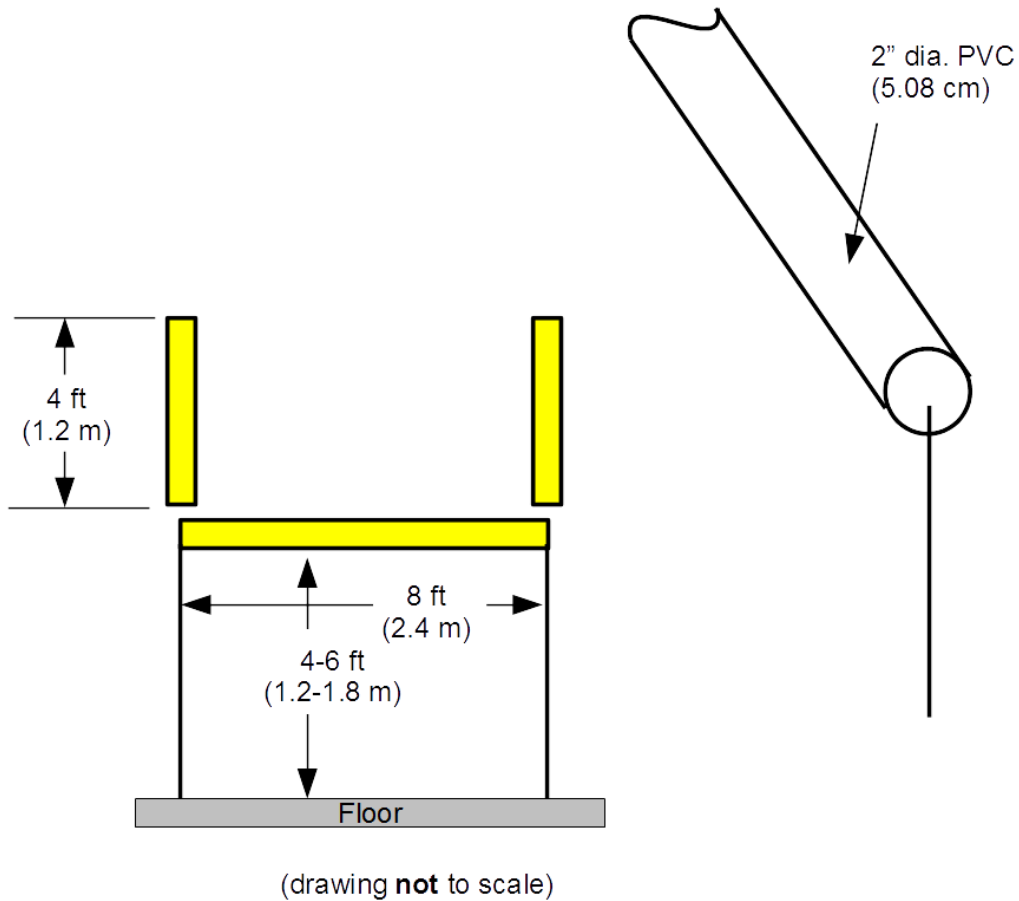


Figure 2: Scuttle Ship

### 6.3.Navigate Channel

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 channel.



### 6.4. Weigh Anchor (Bins)

This task 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 different anchor silhouette (Question: Color?). One of the two bins will have a cover over the opening. Points are awarded for dropping the markers in the open bin, or on the outer white edge. To obtain maximum points, the vehicle must remove the cover and drop both markers in the bin that was once covered.

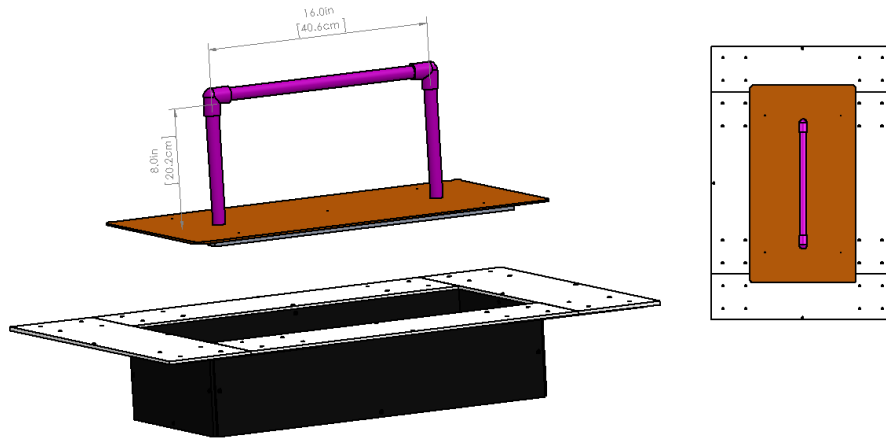


Figure 3: Bin with possible cover.

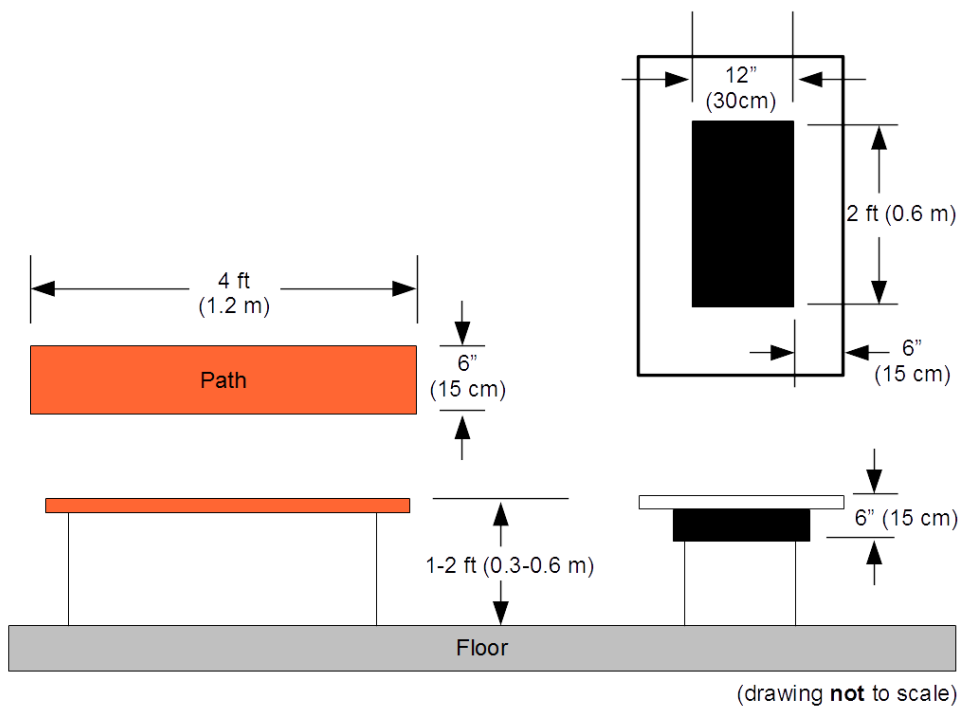


Figure 4: Path marker and bin.

### 6.5.Set Course

There will be a vertical square moored to the floor with two different size square openings. Two small openings and two large openings (**Question: Sizes, color, border?**). A total of two torpedoes can be fired from the vehicle. On the face of the square will be a compass rose, with the cardinal directions (**N, S, E, W**). One of the two small squares will be covered. The ship's course will be assigned at the beginning of the day (for example, **NW**). Each small opening and large opening will have each half of the course. Points will be awarded for firing the torpedo through any of the openings. More points will be awarded for firing torpedoes in the correct course heading (**N** and then **W**). Maximum points will be awarded for removing the cover, and firing torpedoes through the small openings in the correct order.

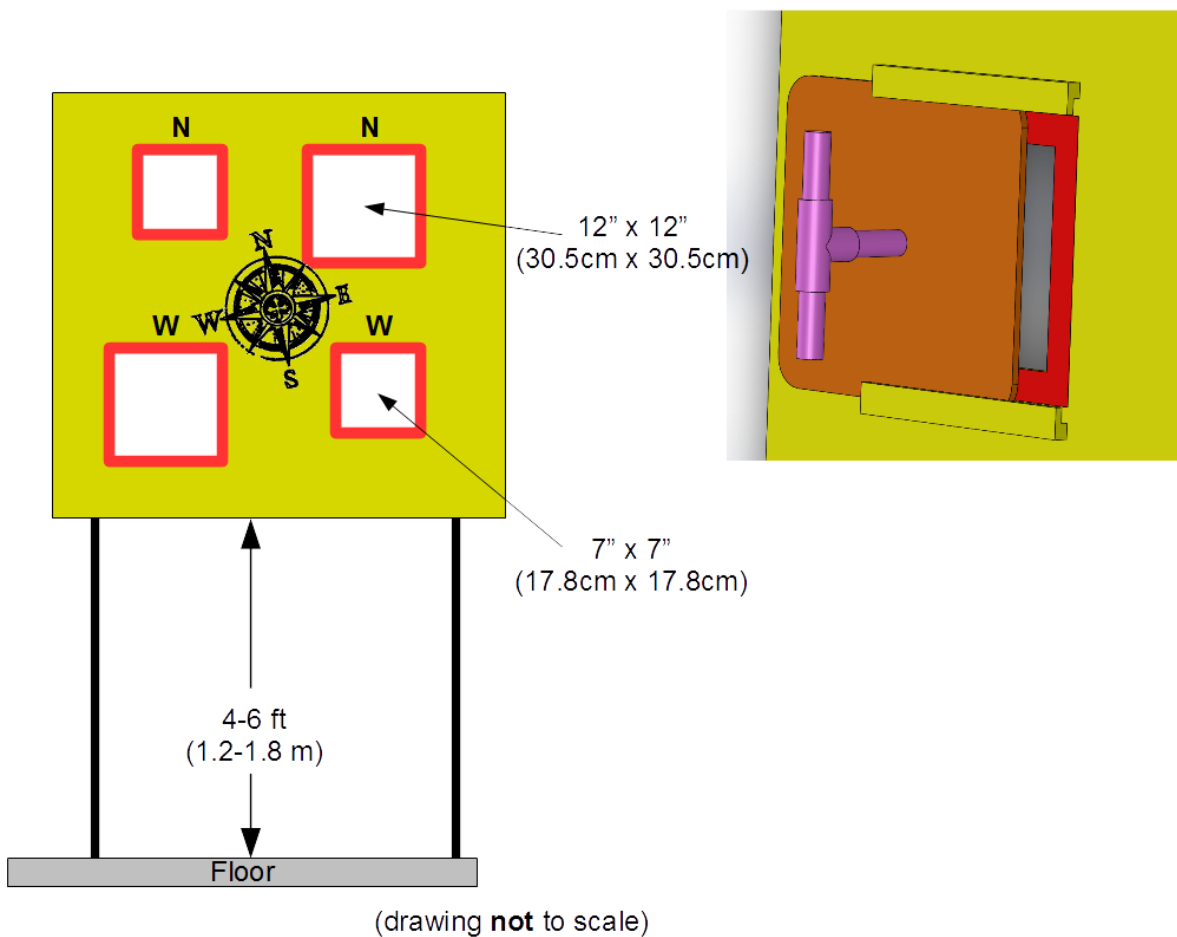


Figure 5: Set course showing possible cover.



### 6.6. Bury Treasure

This task consists of an acoustic pinger located off the floor of the pool. The pingers around arena in the four sections will be deconflicted (the method is still to be determined). Placed directly above the pinger, on a tower, are two gold doubloons (PVC structures, **Question: Different sizes, or different colors?**). Floating above the pinger on the surface will be an octagon representing the Island. 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 two "X"s (X marks the spot!) (**Question: Different color "X", same color different sizes, different color and different sizes?**). Points are awarded for picking up an object, surfacing with an object and placing it on the "table". Maximum points are awarded for placing each of the objects near it's associated "X".

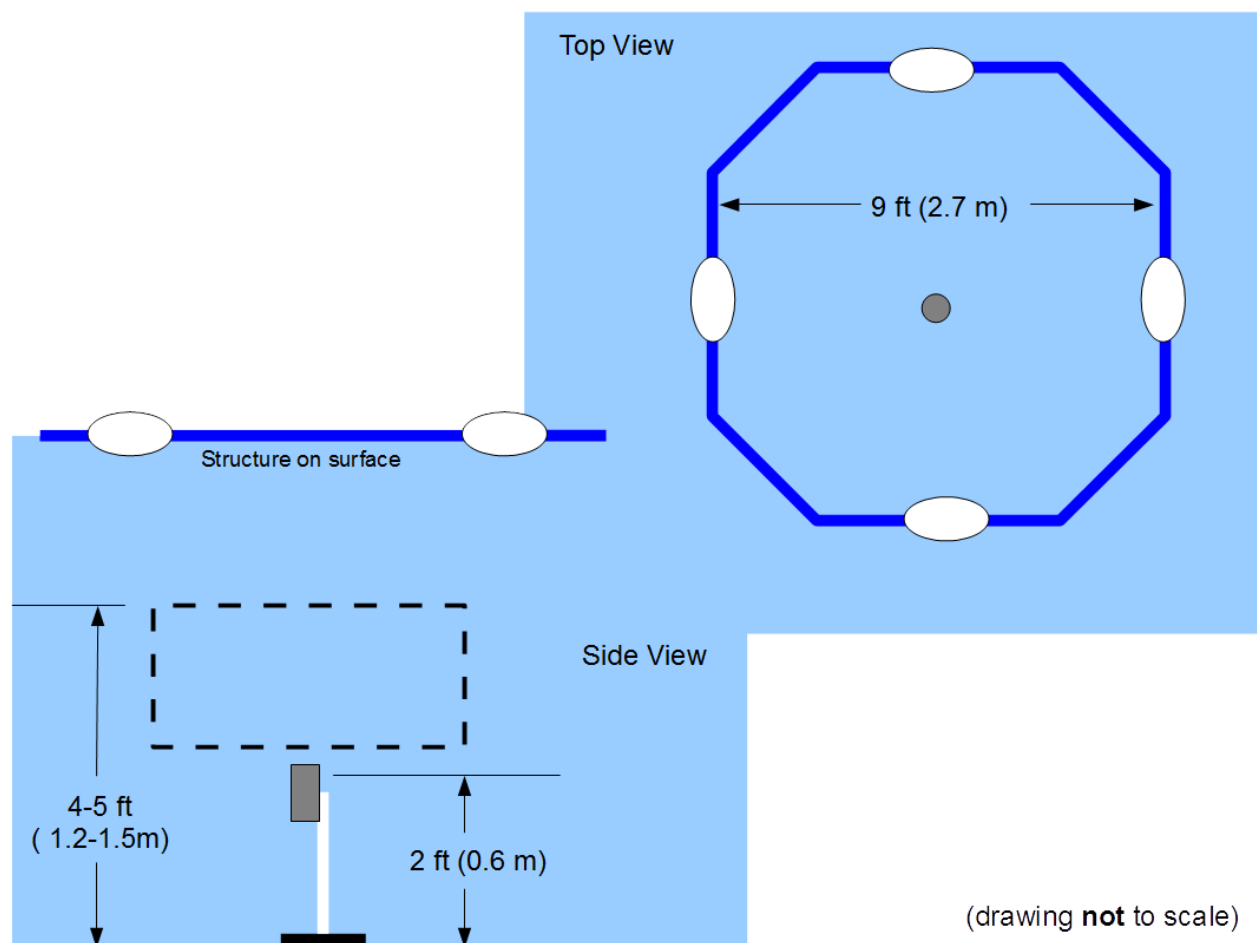


Figure 6: Bury treasure

## 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.

Weigh Anchor / Set Course and Bury Treasure 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 Weigh Anchor / Set Course, or pinger near the Bury Treasure). Extra points will be awarded for 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.