



## **SeaPerch: Launch, Recovery, & Discovery**

### **Launch, Recovery, & Discovery**

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

Similar to recent years, two classes with two differing mission requirements will occur this season. The two classes are Captain's Class and Admiral's Class. Participating teams must choose either Captain's Class or Admiral's Class to participate in. Vehicle design rules for each class are provided in the Greater Philadelphia SeaPerch Challenge SeaPerch Design Rules document found at <http://phillynavalstem.com>

The mission course for this season is still under development and testing. The theme, "SeaPerch Launch, Recovery, and Discovery" will be a combination of the ocean exploration components of the International Competition for this season and a unique rocket challenge specific to the Greater Philadelphia SeaPerch Challenge! SeaPerch Launch, Recovery, & Discovery gives teams the opportunity to learn more about air systems, ballistic trajectories, pipes & valves, and more.

### **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 follow-on events unless these requirements are fulfilled.

Only two team members are permitted at the Compliance stations.

### **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 there to build your ROV's 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 pressurize the SeaPerch for the rocket launch (see Mission Overview section of this document for more details). The second person can also deploy the ROV in the pool, remove it, and any other objects from the pool.

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

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

- The vehicle **MAY NOT** be dragged via the tether.
- 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.

### **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.

## **Overall Scoring**

### **Individual Events**

Each event will be scored in accordance with its published 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, Oral Presentation, Vehicle Performance, and Make a Splash. Vehicle Performance awards are a combined score of both pool rounds (Obstacle and Mission courses).

First overall winners from each rank (Admiral & Captain) will receive an invitation to represent the Greater Philadelphia SeaPerch Region at the International Competition.

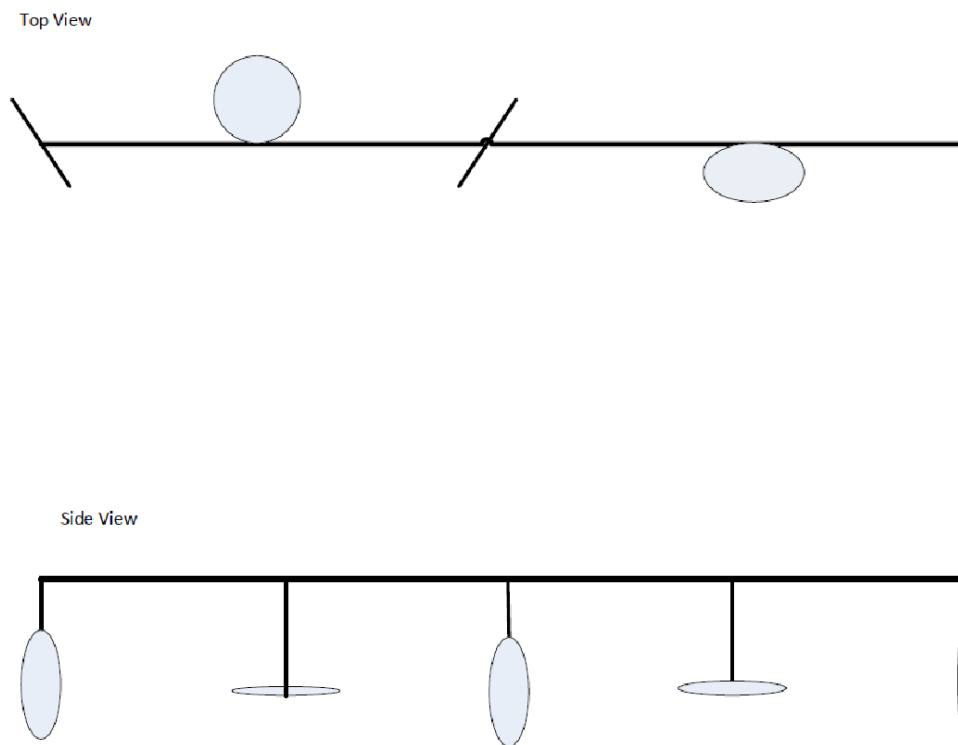
### Breaking Ties

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 diagram below.



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.
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.
11. Components of the SeaPerch designed for the Mission Course may be removed prior to competing in the Obstacle Course.

### **Mission Course Overview**

**Scenario:** The U.S. Navy has been tasked to create a multi-mission ROV platform. The ROV must be able to launch rockets used to signal the U.S. Navy Fleet. Additionally, the ROV must be able to explore the sea floor, recover lost rockets, and show an ability to launch rockets accurately to avoid interference with naval vessels, marine life, and other hazards. The Navy is searching for the best company to complete the mission. The SeaPerch (ROV) must complete the task to secure a Navy contract.

**For SeaPerch Operators:** A controlled demonstration showing mastery of surface and undersea travel, undersea recovery operations, and launch and recovery operations will be conducted to down select on who will win the Navy contract. You have been selected to lead the operation of your prototype vehicle in this demonstration due to your skills in navigating and manipulating the SeaPerch ROV. Your SeaPerch will be equipped with a mission package, such as probes or manipulators as you determine necessary as well as a rocket launch mechanism.

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.

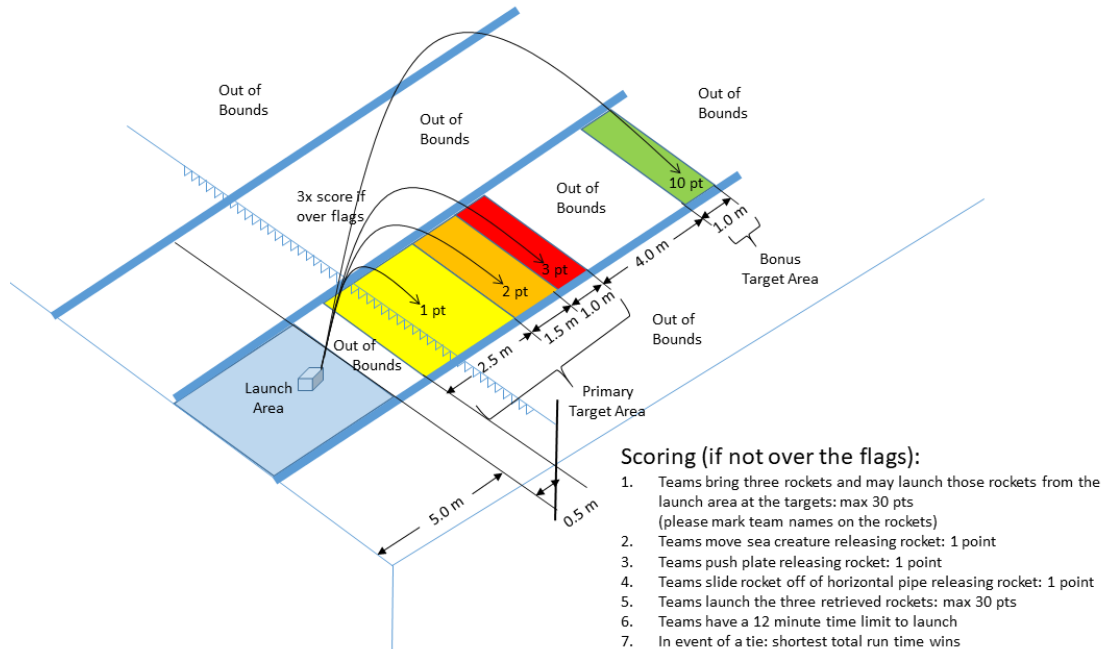
The qualities of a successful SeaPerch should be:

- Accurate, reliable, and waterproofed rocket launching mechanism to take place at the water surface
- Maneuverability to allow for underwater rocket recovery efforts
- Ability to manipulate underwater hazards to release and retrieve rockets effectively
- Speed to retrieve and reset rockets into the launch tube for repeated launching
- Ability of the rocket launching mechanism to reach an effective height and distance

The course features representative challenges from this year's international mission, which has an **Ocean Exploration** theme. The challenges in this course require all the SeaPerch features and pilot skills needed to compete in the international mission. The challenges included in "SeaPerch: Launch, Recovery, & Discovery" are:

### **Team Action**

1. Race to launch rockets accurately towards the target areas (see image below for target area layout).
  - a. Only one launch per rocket. Teams cannot retrieve a launched rocket and relaunch it for additional points.
  - b. Teams must launch their rockets within the designated launch area which will run from the pool edge to the location of the flags hanging over the lanes (2.5 meters x 5 meters). Teams are not permitted to launch outside of the launch area.
  - c. Teams are permitted to bring 3 rockets from their supplied kits (or equivalent rockets with the same form, fit, and function) to launch at the designated target areas. Teams should write their team names on the rockets so we can properly identify which rockets belong to which teams during the competition event in the case of misfires into other lanes' targets.
  - d. Bonus points will be awarded for hitting the target area and clearing your rocket over the flags suspended above the pool area. The flags will be located at a distance of 5 meters from the pool edge and a distance of 8 feet above the pool deck. Clearing the flags will act as a point multiplier (3x multiplier) for teams hitting a target area.
  - e. Teams launching rockets that land outside of the scoring areas will score no points for those launches.
  - f. Teams may elect to target the primary target area or the bonus target area which represents a higher risk / higher reward target.
  - g. Teams may return their ROVs poolside to re-pressurize their launch mechanisms and load rockets. Bicycle pumps will be available for teams to utilize at each lane, but teams may elect to use their own bicycle pumps. Motorized air compressors will not be permitted.



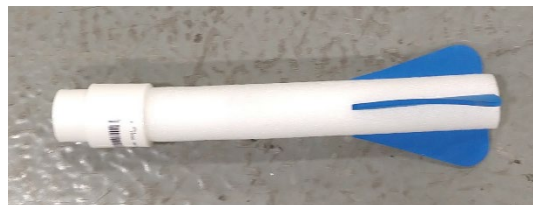
2. After the initial launch, additional rockets may be retrieved from an underwater course (see following images).
  - a. Components of the SeaPerch designed for the rocket launch portion of the Mission Course may be removed prior to interacting with the underwater course.
  - b. Release a rocket trapped under **marine life** by safely relocating the marine life to release the rocket from its grip. (1 point)
  - c. Release a rocket snagged on a **horizontal obstacle** (pole or rod) by sliding it off of the obstacle. (1 point)
  - d. Release a rocket by activating a **push button** to release an underwater rocket storage mechanism (1 point)
  - e. All rockets are buoyant and will float to the surface once released.
  - f. The rockets retrieved underwater may have caps on them to secure to the underwater obstacles.
3. After releasing any or all additional rockets, teams may retrieve the rockets with their SeaPerch ROVs and drive them back to poolside for reloading the launch tubes. Retrieved rockets may be stored poolside at the teams' discretion prior to launching. Using the retrieved rockets, teams will have the opportunity to launch these new rockets at the target area for additional points (as described in Section 1).
4. The maximum time will be published later, but it will likely be between 10 and 15 minutes.



*push button*

*marine life*

*horizontal obstacle*



### Scoring Scenarios:

#### Team A

- Team A brings 3 rockets with their team names properly marked on them.
- At the beginning of the match, their first launch goes out of bounds into the lane of Team B.
- The team returns their ROV poolside and they pressurize their system and load on their second rocket. The second rocket hits the closest target area for 1 point, but does not go over the flags.
- They return poolside and repeat the process and their third rocket makes it over the flags and hits the middle target area for 2 points. Since they went over the flags, that multiplies their points by 3, scoring 6 points. The team now has 7 points in total.
- They go underwater and push off the rocket hanging on the horizontal obstacle and move the marine life to free another rocket. They try the push button, but have some trouble hitting the target with enough force, so they give up and come to the surface. This scores an additional 2 points for 9 points total.

- They use their ROV to push both rockets back to the poolside and then pressurize their system again and load on one of the two rockets they just retrieved. They make an angle adjustment with their launch tube and launch this rocket within the launch area and it hits the outer target area in the primary target area, but it does not go over the flags. This scores 3 points.
- Finally, with a minute to spare, they return and try to launch their last rocket, but they run out of time and the match is over. Team A has scored 12 points in total.

#### Team B

- Team B brings 3 rockets with their team names properly marked on them. They launch their first rocket, but go beyond the launch area boundary when they launch. Although they hit the bonus target for 10 points, since they were outside of the launch area, this will not count.
- Suddenly, a rocket from Team A lands in their lane. They check with the lane judge if they can retrieve it, but they are not permitted to retrieve another team's rocket to launch in their lane for points.
- The team returns their ROV poolside and they pressurize their system and load on their second rocket. They successfully launch in the launch area this time, but fall just short of the bonus target area.
- They return to load their last team rocket, properly launch, and hit the bonus target area. The team has 10 points.
- They quickly dive underwater and free all three rockets, scoring another 3 points. The team now has 13 points.
- Team B tries to push back all 3 rockets at once, but one gets away from them and floats away. They pressurize their system, load on one of the rockets, and launch it. They were aiming for the bonus target area, but instead it falls short and lands in the outer edge of the primary target area for 3 points. The team now has 16 points.
- The team retrieves the rocket that floated away earlier with their ROV and pressurizes their system and loads on the new rocket. They adjust their launch angle for height instead of distance and launch over the flags, but into Team A's scoring area and hits the 1 point target in Team A's lane. This scores no points.
- Finally, they return and load on their last rocket and properly launch it over the flags and hit the 3 point section in their lane. This scores 9 points for a final total of 25 points. They finish a little early and the lane judge marks down their final time in the case of a tie breaker with another team.

### **Wild Card Qualification**

Teams from around the world can apply for Wild Card spaces to compete at the annual International SeaPerch Challenge.

To be considered for a Wild Card space, teams may submit an application including team information, a brief overview of their SeaPerch ROV design, and a short statement about what participation at the International Challenge means to them. We are eager to hear from the students about why they want to compete at the International SeaPerch Challenge. As such, application questions should be answered in student team members' own words.

**Eligibility:** Teams are eligible to apply for Wild Card slots even if they are participating in a regional. However, teams are not eligible to be awarded a Wild Card slot if they win an invitation at a regional. Please note priority will be given to teams who do not have access to a regional competition.



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Wild Card Applications are open! Please use this link to apply: [2023 SeaPerch Wild Card Application](#)

Registration closes on March 10, 2023.