



UNIVERSITY OF MARYLAND
MAY 31 - JUNE 1, 2024

HANDBOOK

Version 1 (September 2023)

Introduction

Welcome to the International SeaPerch Challenge!

This Team Handbook contains information that teams need to compete at the International SeaPerch Challenge. It includes task descriptions, rules and requirements, and other guidance and specifications. Teams are encouraged to read this document for a thorough understanding of what is necessary to compete effectively.

These instructions apply specifically to participation in the 2024 International SeaPerch Challenge. Please check with your local regional competition coordinator for rules and required submissions related to that event which may differ from the International SeaPerch Challenge.

Why compete in the International SeaPerch Challenge? The annual International SeaPerch Challenge is an invitation-only event open to teams that excel at registered regional competitions and earn a slot to compete in the season's culminating event.

On land, teams show off their engineering skills through technical papers and presentations. In the pool, they navigate their SeaPerch remotely operated vehicle (ROV) through a series of obstacles inspired by the real world that test maneuverability, control, and utility. Each season has a new theme and a new set of competition tasks, challenging teams to expand on their original vehicle design.

Beyond the friendly rivalry, all competitions bring students together from different schools, states, and countries to form a supportive community.

Why robotics competitions? The goals of the RoboNation student competitions are to provide opportunities for students to experience real-world engineering challenges and to develop the skills needed to solve those challenges. The objective is to produce the people who will push the envelope in the future. Competitors gain an appreciation for the tradeoffs inherent in any system design and the lessons learned in transitioning from a working bench prototype to operating reliably in the real world.



The International SeaPerch Challenge is hosted by RoboNation. We are pleased to announce an exciting partnership with NOAA Ocean Exploration and the Ocean Exploration Cooperative Institute (OECI) for the 2024 season theme of deep-sea exploration.

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2024 International SeaPerch Challenge

<https://seaperch.org/>

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SECTION 1: Competition Overview

2024 International SeaPerch Challenge

<https://seaperch.org/>

1.1. Dates & Venue

The 2024 International SeaPerch Challenge will be conducted 31 May – 1 June 2024 at the University of Maryland in College Park, Maryland, USA. This will be a 1.5-day event, taking place on Friday, 31 May in the afternoon and a full day on Saturday, 1 June.

1.2. 2024 Theme

The 2024 theme is Deep-Sea Exploration with an emphasis on hydrothermal vents. First discovered in 1977 near the Galápagos Islands off the coast of Ecuador, hydrothermal vents are a critical area of ocean exploration. ROVs are necessary to aid researchers in exploring the harsh environments that surround hydrothermal vents where extreme temperatures and pressures, toxic chemicals, and reduced visibility are the norm.

The seafloor surrounding hydrothermal vents is a dense oasis of life, teeming with microorganisms such as bacteria and archaea that use the chemical-rich fluids as a source of energy (chemosynthesis) much like plants use sunlight and carbon dioxide (photosynthesis) in the surface ocean and on land. These microbes are the basis of a food web that includes remarkable life forms such as tubeworms, shrimp, clams, fish, crabs, and octopods. The 2024 International SeaPerch Challenge was inspired by the wealth of information that can be gathered by exploring these deep-sea geysers.

1.3. Competition & On-Site Elements

The 2024 International SeaPerch Challenge includes pre-event online submissions as well as on-site events.

1.3.1. Pre-Event Submissions

Technical Design Report (Required)

A Technical Design Report (TDR) succinctly describes your unique SeaPerch ROV and the engineering design process, providing insight into the iterative design process and allowing for data analysis that supports the final ROV design.

Meet the Team (Required)

We want to get to know you! Share your team or school's logo, an overview of what your team is all about, and social media information so we can share it with the SeaPerch community. This is your chance to introduce us to your team and team's personality.

Real-World Innovation Poster (Optional)

This event challenges teams to explore real-world applications for underwater ROVs. Teams are invited to identify a real-world issue and design a SeaPerch ROV to address the issue. To present their project, teams will create a virtual poster. These posters may include anything from a conceptual design to a full project conducted in the real world.

Community Outreach Project (Optional)

Whether you volunteer your time in your community, or your team finds a way to connect and offer support online, we want to hear about it.

1.3.2. On-site Elements

Pool Courses (Required)

- **Obstacle Course:** The Obstacle Course tests high-speed maneuverability and requires the SeaPerch ROV to navigate the course as quickly as possible.
- **Mission Course:** The Mission Course incorporates a mission that teams must complete with their SeaPerch ROV related to Deep-Sea Exploration.

On-site Team Presentations by Invitation (Optional – Not Scored)

Presentations are a great opportunity for teams to share their SeaPerch experience and practice their academic presentation skills. During registration, teams interested in presenting can submit a short abstract that gives a high-level overview of what their presentation would cover.

1.4. Season Schedule/Timeline

Date	Event
November 27, 2023	Wild Card Registration opens
January 8, 2024	Wild Card Registration closes
February 16, 2024	Deadline to host an international regional competition whose advancing teams will require a Visa to attend the International Challenge
April 15, 2024	Deadline to host a regional competition whose advancing teams <u>do not</u> require a Visa to attend the International Challenge
February 16 – April 26, 2024	Team Registration Open: Payment of fees and submission of waivers Pre-Event Submissions: <ul style="list-style-type: none"> • Technical Design Report (Required) • Meet the Team (Required) • Real World Innovation Poster (Optional) • Community & Outreach (Optional) • Presentation Abstract (Optional) Spectator Registration Open
April 26, 2024	Deadline for payment of fees; required and optional submissions due; cancellation deadline; completion of chaperone background checks
May 31 – June 1, 2024	2024 International SeaPerch Challenge In-Person Event

1.5. Eligibility & Qualification

1.5.1. Age level eligibility

The annual International SeaPerch Challenge is an invitation-only event open to student teams from anywhere in the world that have been awarded a slot by winning at an approved regional competition or by earning a Wild Card space. Elementary School, Middle School, and High School students are eligible to compete.

1.5.2. Qualifying at Regional Competitions

SeaPerch regional competitions are planned, hosted, and executed by local SeaPerch advocates, mentors, and regional coordinators around the world. These events range from local exposition events to approved regional

competitions that allocate qualifying spaces for top teams to compete at the annual International SeaPerch Challenge.

Each registered regional competition is allocated a set number of qualifier spaces for their winning teams to attend the International SeaPerch Challenge. Compete and win in one of these events to move on to the international event. Requirements and tasks for regional events vary and may differ from the International SeaPerch Challenge. For specifics about the event closest to you, contact the event host by checking the list of registered regional competitions on the 2024 season page.

Competition hosts are required to supply their winning teams' information to RoboNation no later than three (3) days after their event. Once confirmed by RoboNation, coaches of these winning teams will receive an email with instructions to register their teams. Registration will open February 16, 2024, and teams will be required to complete all steps of the registration process by April 26, 2024. For more information, see Section 1.6.

Intent to Host a Regional Competition

Before invitations to the 2024 International SeaPerch Challenge are allotted, regional competition hosts must submit their Intent to Host here by October 25, 2023: [2024 SeaPerch Regional Competition - Intent to Host Form](#). Invitations to accepted regional qualifiers will be allocated in November and a list of accepted regional events will be posted on the website. *Submission of the Intent to Host form does not guarantee that invitations to the International SeaPerch Challenge will be given.*

All international regional competitions whose teams will require a visa to attend the International SeaPerch Challenge must be completed by February 16, 2024. All other competitions whose teams will not require a visa to attend the International SeaPerch Challenge must be completed by April 15, 2024. All up-to-date information will be available on the SeaPerch website: [2024 SeaPerch Season](#).

1.5.3. Qualifying as a Wild Card Team

Teams without access to a regional competition can apply for a Wild Card invitation to compete at the annual International SeaPerch Challenge.

To be considered for a Wild Card space, teams may submit a short application that includes a brief overview of their SeaPerch ROV design along with a short statement about what participation at the International Challenge means to them. Application questions should be answered in student team members' own words. The application fee of \$10 is non-refundable.

The Wild Card application will open November 27, 2023 and will close on January 8, 2024. Teams that have been awarded an invitation will be notified on February 2, 2024.

1.6. Team Registration

1.6.1. Competition Classes

The 2024 International SeaPerch Challenge will include three (3) competition classes.

Middle School Stock Class:

- Teams include students in 8th grade and below
- The total cost of modifications to the final ROV must be \$25 or less

- Frame built using only PVC, CPVC, PEX pipe and fittings. Any size pipes and pipe fittings may be used. Pipes and pipe fittings may be modified using hand and power tools, but may not be machined using CNC or other automated process.
- Must only use simple on/off switches for thruster controls
- May use PWM, microcontrollers, or other devices for non-thruster controls
- May use a fixed or variable resistor to reduce voltage

High School Stock Class:

- Teams include students in 9th grade and above
- The total cost of modifications to the final ROV must be \$25 or less
- Frame built using only PVC, CPVC, PEX pipe and fittings. Any size pipes and pipe fittings may be used. Pipes and pipe fittings may be modified using hand and power tools, but may not be machined using CNC or other automated process.
- Must only use simple on/off switches for thruster controls
- May use PWM, microcontrollers, or other devices for non-thruster controls
- May use a fixed or variable resistor to reduce voltage

Open Class:

- The cost of modifications may exceed \$25
- Frame may include 3D printed or additive manufactured parts as well as other materials, and may be made using CNC machinery or other automated process.
- May include more than 3 thrusters (i.e., motor and propeller assembly)
- May use power conditioning or pulse-width modulation (PWM) controls for thruster controls

1.6.2. Registration Components

All teams who receive an invitation to compete at the 2024 International SeaPerch Challenge will be required to register by April 26, 2024. Registration will open February 16, 2024. Please refer to [Appendix A: Registration Template for 2024 International SeaPerch Challenge](#) to review the information that is needed to complete the registration process. Teams are encouraged to start registration as soon as possible after receiving instructions as it is a multi-step process; the registration deadline of April 26, 2024 is firm.

PLEASE NOTE: Teams competing in regional competitions that are held in April will have a shortened timeframe to complete registration to attend the 2024 International SeaPerch Challenge. Unfortunately, we will be unable to grant deadline extensions under these circumstances due to judging and venue timelines.

1.6.3. Registration Fees

To complete the International SeaPerch Challenge registration, teams must pay the registration fees and register each competitor. Teams are limited to 12 students and 4 chaperones.

- ROV Registration Fee: \$225 USD per team
- Individual Registration Fee: \$75 USD per team member/chaperone

Refund policy

To cancel a registration for the 2024 International SeaPerch Challenge, teams must complete the Cancellation Form. Cancellation requests submitted via email will not be accepted. Click here for the link to the [Cancellation Form](#).

- Full teams who cancel will receive their participant registration fee (\$75) refund. The ROV registration fee (\$250) is nonrefundable.

- Individuals who cancel will receive their participant registration fee (\$75) refund less 10%.
- No refunds after April 26, 2024.

Refunds (if applicable) will be processed as soon as administratively possible and will be based on the original payment method. I.e., payments received by check/bank transfer will be processed as check/bank transfer refunds; payments by credit card will be credited on the original credit card charged.

1.7. Spectator Tickets

Spectator tickets will be required to access team village, pool competition viewing areas, and presentation rooms. Spectators will not have access to the pool deck. Tickets are not required for students under 13 years old. Spectator registration will open February 16, 2024.

1.8. Communications

1.8.1. 2024 International SeaPerch Challenge Website

The official competition website is the [2024 SeaPerch Season](#). This website includes all official documents and a detailed list of the registered Challenge teams. Helpful resources, past competition results, and other engagement opportunities can be found on this website. Information and documents are updated regularly, and it is the team's responsibility to check the website for updates.

1.8.2 Points of Contact

SeaPerch Questions:
seaperch@robonation.org

Registration Questions:
support@robonation.org

Technical Questions:
support@robonation.org

On-Site Logistics/Safety:
events@robonation.org

SECTION 2: Pool Courses

2024 International SeaPerch Challenge

<https://seaperch.org/>

2.1. Pool Course Events Overview

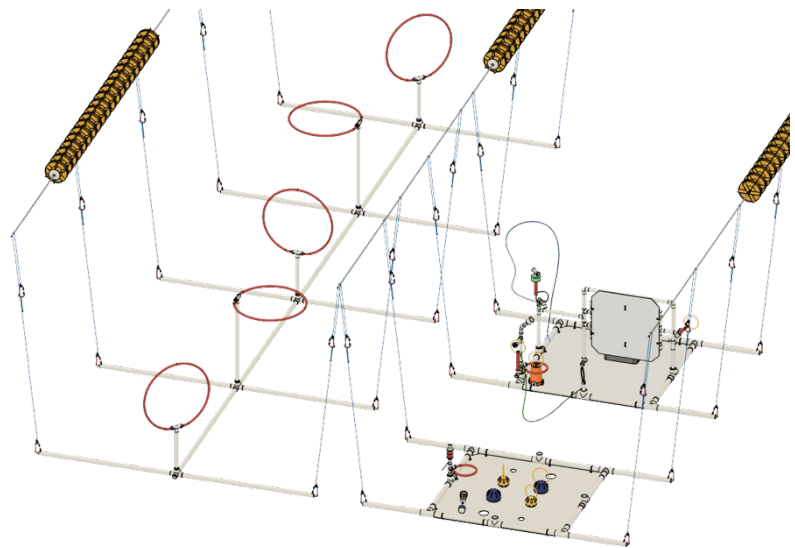
The competition will include two in-pool courses:

- **The Obstacle Course** tests high-speed maneuverability and requires the SeaPerch ROV to navigate the course as quickly as possible.
- **The Mission Course** incorporates a mission that teams must complete related to Deep-Sea Exploration. This course simulates the tasks and environment that an ROV might encounter while exploring the harsh environments that surround hydrothermal vents.

2.2. Lane Setup

Courses will be suspended from the pool's lane dividers with the lower course frames approximately 5-6 feet below the water surface and 5-6 feet from the side of the pool.

The obstacle course and mission course will be arranged beside each other and considered a single competition lane. The pool will include eight (8) competition lanes to accommodate eight (8) teams simultaneously. Competition lanes will be separated by a vacant pool lane (i.e. no course). Each team will have sole use of their assigned competition lane for their allotted time slot.



2.3. Timing

Teams have 20 minutes to complete Pool Course runs. After the course judge verifies the team and provides instructions, a 20-minute course timer will start. Teams are responsible for managing their time and may take as much time as needed for setup and reset within the twenty minutes allocated. When the course timer expires and reaches zero, the team must depart the Pool Course.

Runs will be timed using a run timer. The run timer starts when the run starts and records the official run times. Teams may start subsequent runs immediately after completing a prior run but must receive a start signal from the judge to ensure the run will be scored. Teams may abort runs at any time without completing the course if they are experiencing problems and want to ensure they have enough time for subsequent runs. A run ends when the run time expires, the team has aborted the run, or the team has completed the course (whichever comes first). Guidelines for obstacle course and mission course runs are below.

2.3.1. Obstacle Course Timing

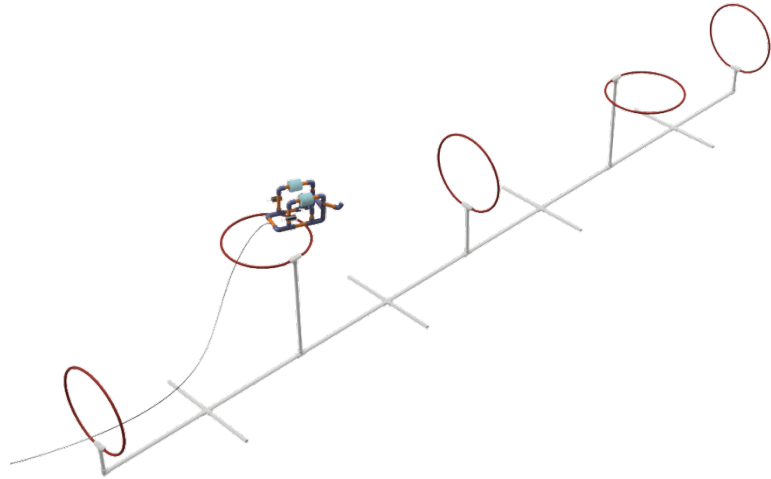
- Teams may attempt up to two (2) runs.
- Each run is limited to four (4) minutes maximum.

2.3.2. Mission Course Timing

- Teams may attempt one (1) run on the mission course.
- The mission course time limit is eight (8) minutes maximum.

2.4. Obstacle Course

The Obstacle Course consists of five 18" hoops oriented at different angles and suspended 5-6 feet below the water surface. *Please note that there is no guarantee of the position of the hoops when the course is deployed in the pool at the International SeaPerch Challenge and may not appear as pictured below.* Operators should not try to memorize actions such as in playing a video game but should instead practice a variety of general high-speed maneuvers.



2.4.1. Navigation Overview

- *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.
- 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.
- The ROV must surface after clearing the hoop furthest from the pool wall. Surfacing is considered complete when any part of the ROV breaks the surface of the water.
- The ROV must re-submerge and head back to the pool wall by passing through each of the five hoops in reverse order.
- *End of run:* The run is complete when the ROV touches the pool wall while surfaced (any part of the ROV breaks the surface of the water). The run will be aborted if the allotted time expires even if the ROV has not completed the course.

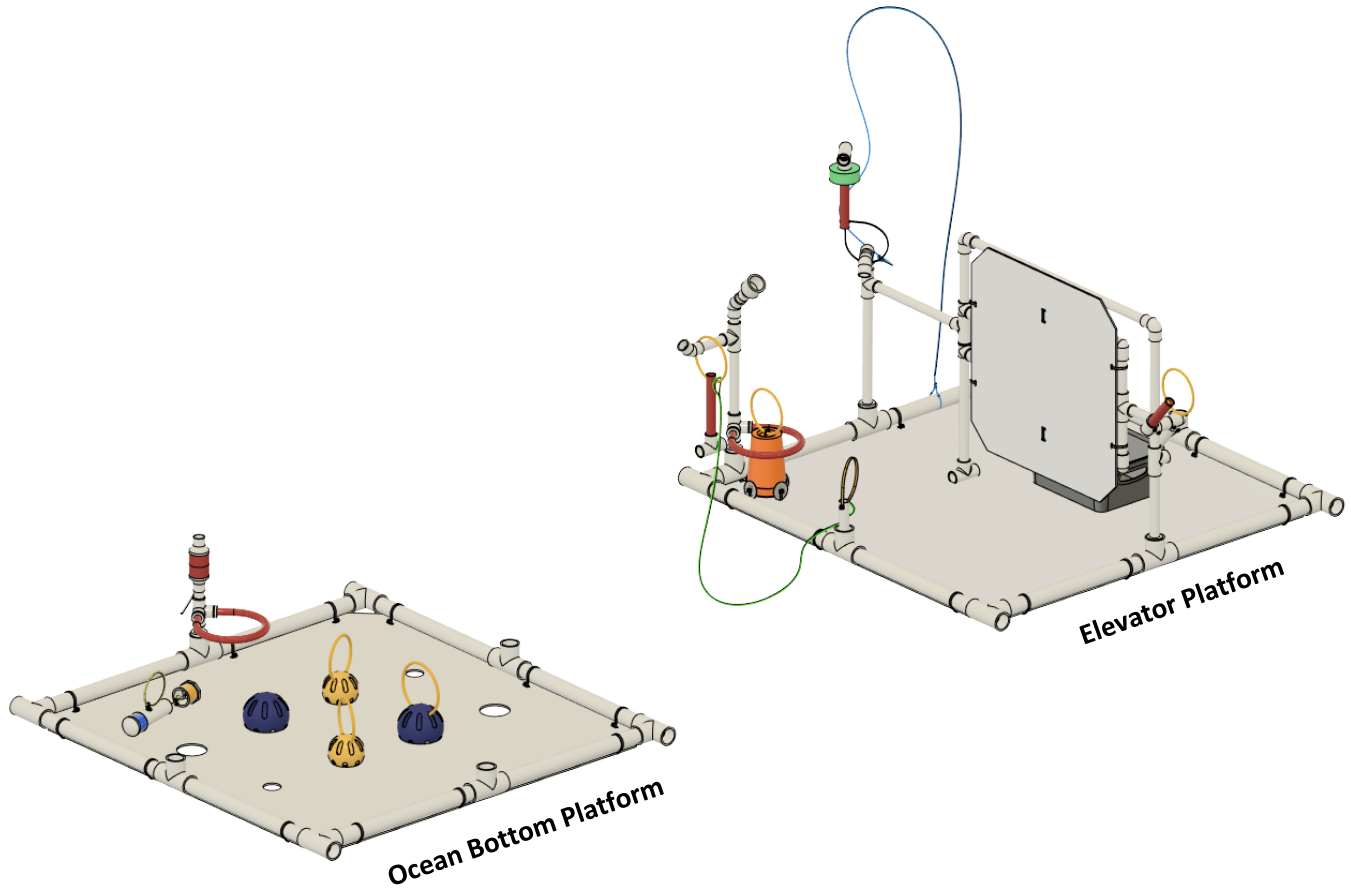
2.4.2. Scoring Overview

Teams are ranked based on time. The obstacle course scoresheet is available in [Appendix B: Scoring Rubrics and Scoresheets](#)

2.5. Mission Course

The Mission Course consists of six tasks across two task frames and will be suspended 5-6 feet below the water surface (see course layout on next page). Tasks are described in detail below and include:

- Task 1: Elevator Preparation
- Task 2: Temperature Sensor
- Task 3: Fluid Sample Collection
- Task 4: Gas Sample Collection
- Task 5: Rock Sample Collection
- Task 6: Prepare for Elevator Recovery



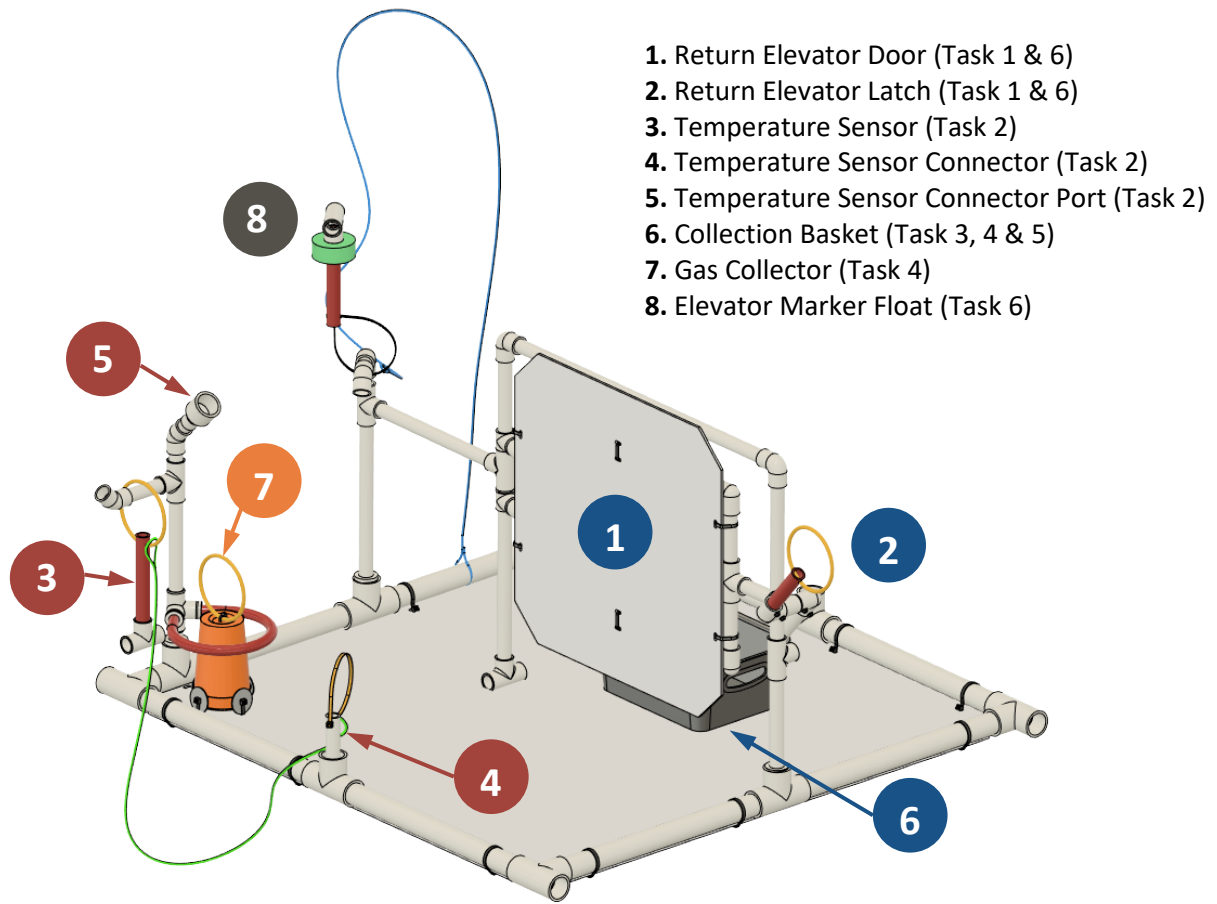
2.5.1. Navigation Overview

- *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.
- Objects falling past the suspended task frame are out of play and the ROV is not allowed to attempt to retrieve them.
- *End of run:* The run is complete when the ROV touches the pool wall while surfaced (any part of the ROV breaks the surface of the water). The run will be aborted if the allotted time expires even if the ROV has not completed the course.

The ROV may transport multiple objects simultaneously. Objects may be moved between platforms for staging without completing the task. (For example, the rock samples can be moved to the return elevator and placed in the basket after completing other tasks.)

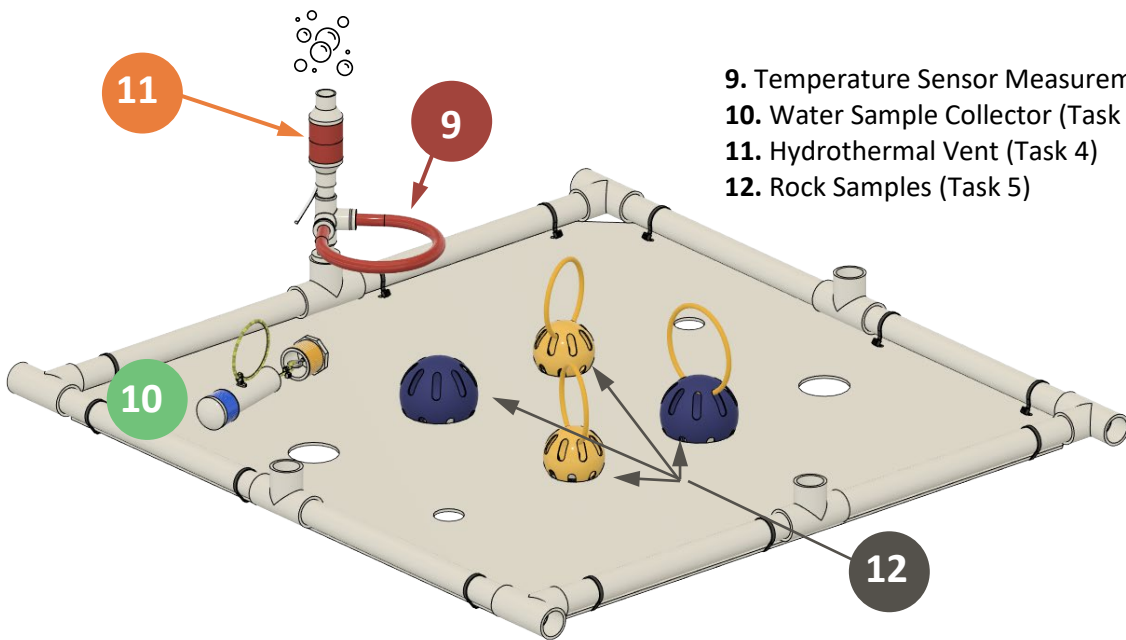
Tasks may be completed in any order with the following exceptions:

- To receive points for opening the elevator door, it must be opened before placing objects in the sample collection basket. If the team fails to open the door, they may still place objects in the basket; however, points will not be awarded for opening the door once an object is placed in the basket.
- Releasing the elevator marker float must be the last task completed. Points will not be awarded for the elevator marker float release if other tasks are completed after its release.



- 1. Return Elevator Door (Task 1 & 6)
- 2. Return Elevator Latch (Task 1 & 6)
- 3. Temperature Sensor (Task 2)
- 4. Temperature Sensor Connector (Task 2)
- 5. Temperature Sensor Connector Port (Task 2)
- 6. Collection Basket (Task 3, 4 & 5)
- 7. Gas Collector (Task 4)
- 8. Elevator Marker Float (Task 6)

Elevator Platform with Task



- 9. Temperature Sensor Measurement Area (Task 2)
- 10. Water Sample Collector (Task 3)
- 11. Hydrothermal Vent (Task 4)
- 12. Rock Samples (Task 5)

Ocean Bottom Platform with Task Elements

2.5.2. 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: Elevator Preparation has a max of 5 points
- Task 2: Temperature Sensor has a max of 30 points
- Task 3: Fluid Collection has a max of 10 points
- Task 4: Gas Collection has a max of 15 points
- Task 5: Rock Collection has a max of 25 points
- Task 6: Elevator Recovery has a max of 15 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

Rubric

The mission course scoring rubric is available in [Appendix B: Scoring Rubrics and Scoresheets](#)

2.5.3. Elevator Preparation (Task 1)

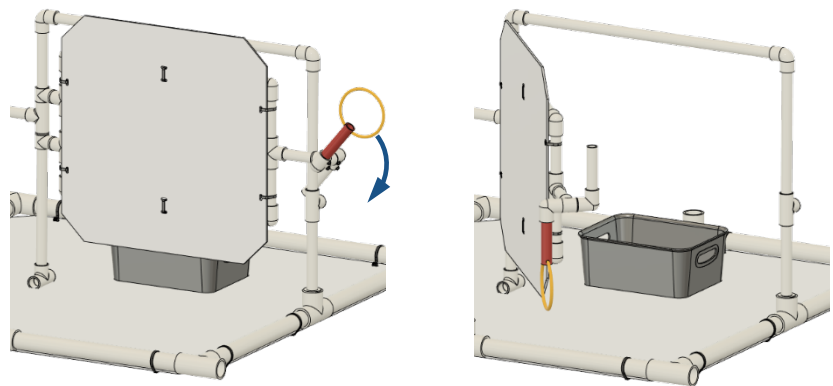
The ROV must move a lever to open a door on the return elevator to expose the collection platform in preparation for sample collection (simulated in the image by a small basket).

Scoring

Teams will receive five (5) points upon successful completion of this task.

Real-World Inspiration

A lander is a mechanical platform used to carry payloads from the bottom of the sea to the researchers on the surface (“underwater elevator”). A lander makes the transit to the surface for an ROV and allows the vehicle to spend more time exploring the seafloor. This task represents preparing the lander to transport samples from the seafloor to the water’s surface.

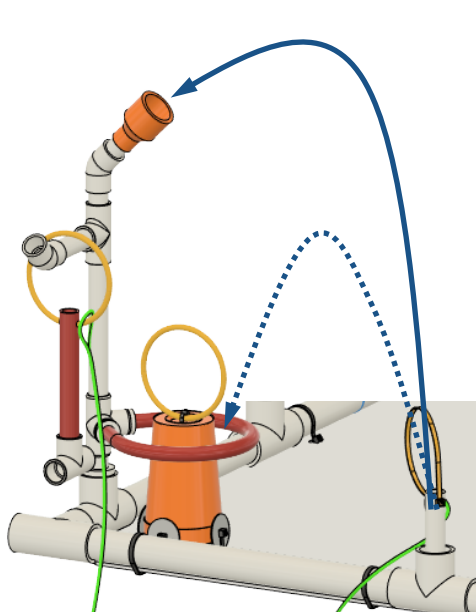


2.5.4. Temperature Sensor (Task 2)

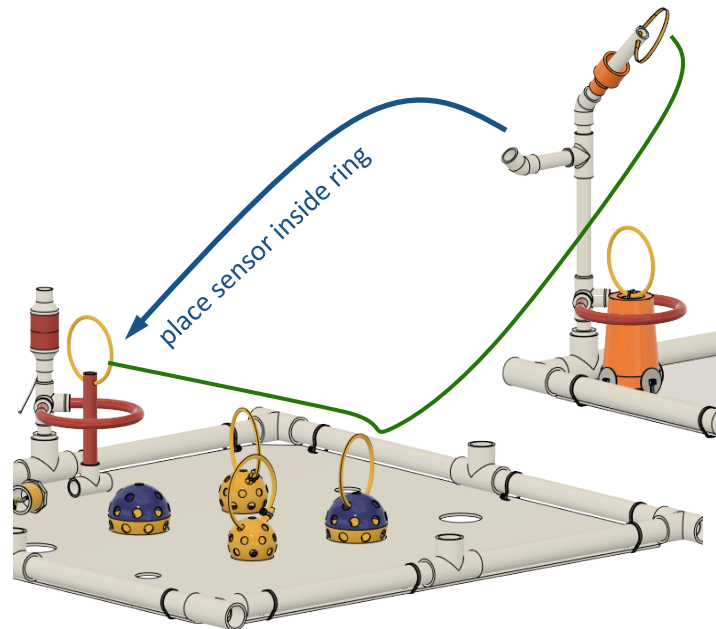
The ROV must retrieve the temperature sensor connector, deposit the temperature sensor connector, and then place the temperature sensor inside the hydrothermal vent ring.

Teams may select one of two options for depositing the temperature sensor connector:

- **Option A:** Plug the connector into the connector port (shown with the blue **solid line** below; higher difficulty)
- **Option B:** If teams are unable to plug the connector into the port, the connector may be placed in the holding ring below it (shown with the blue **dashed line** below; lower difficulty)



Temperature Sensor Connector Placement
Option A (**solid**) – Option B (**dashed**)



Temperature Sensor Placement

At the start of the run, the temperature sensor will be located on the Elevator Platform and must be moved to the temperature sensor measurement area on the Ocean Bottom Platform. The connector port and holding ring are both located on the Elevator Platform.

Scoring

A maximum of 30 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:

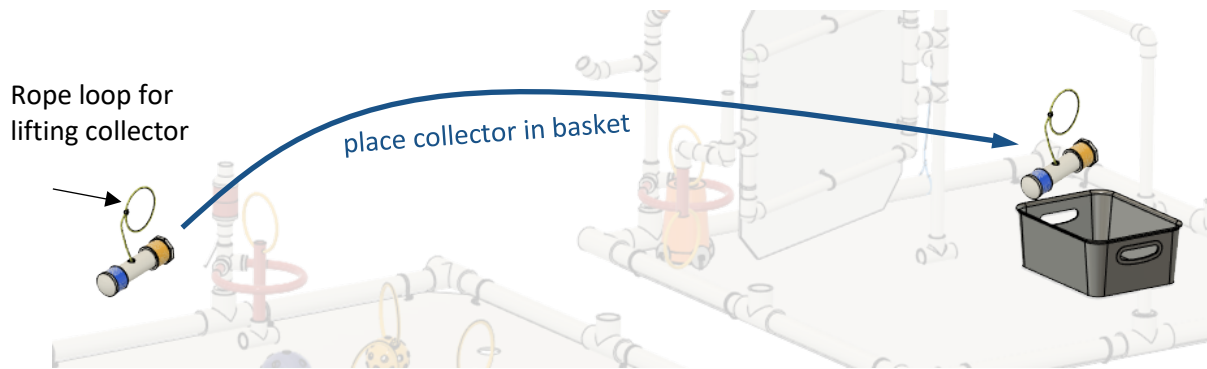
- For retrieving and depositing the temperature sensor connector teams will earn:
 - Twenty (20) points for placing temperature sensor inside the connector port OR
 - Five (5) points for leaving the temperature sensor in the holding ring.
- Teams will receive ten (10) points for placing the temperature sensor inside the hydrothermal vent ring.

Real-World Inspiration

Temperatures near hydrothermal vents can reach up to 750°F (400°C), hot enough to melt some ROV parts. Measuring temperature is essential to helping scientists understand the formation, structure, and evolution of these unique habitats. Biologists use temperature data to learn about the animals' living environments and the range of temperatures they can tolerate. Chemists use it to make sure they are collecting the hottest fluid from a vent as well as to explain the vent's chemical composition deep below the surface.

2.5.5. Fluid Collection (Task 3)

The ROV must close the end cap on the water sample collector by lifting the collector by the attached rope loop. The ROV must then retrieve the water sample collector from the Ocean Bottom Platform and transport it to the storage basket on the Elevator Platform.



Water Sample Collector Closure and Placement

Scoring

A maximum of ten (10) 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. Teams will receive:

- Five (5) points for closing the water sample collector. Points will be earned by lifting the collector by the rope loop even if the caps do not fully close.
- Five (5) points for transporting the water sample collector and placing in the collection basket.

Real-World Inspiration

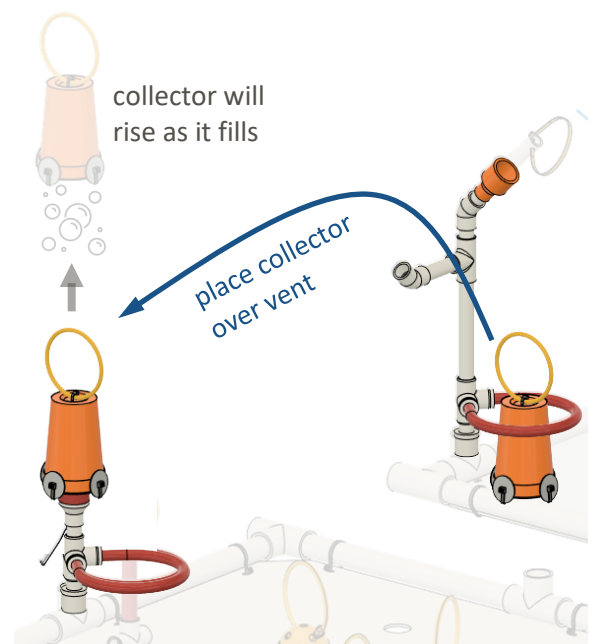
Hydrothermal fluid can contain dissolved sulfur, copper, zinc, gold, iron, helium and other chemicals from deep beneath the ocean floor. When it combines with near-freezing, oxygen-rich seawater, rapid chemical reactions are triggered that cause sulfides and other minerals to precipitate (rapidly transition from dissolved to solid).

The seafloor surrounding hydrothermal vents is a dense oasis of life, teeming with microorganisms such as bacteria and archaea that use the chemical-rich fluids as a source of energy (chemosynthesis) much like plants use sunlight and carbon dioxide (photosynthesis) in the surface ocean and on land. These microbes are the basis of a food web that includes remarkable life forms such as tubeworms, shrimp, clams, fish, crabs, and octopods.

Analyses of the fluids collected by ROVs around hydrothermal vents provide chemical and microbiological data that helps scientists understand the fluid-rock interactions beneath the surface and often leads to the discovery of never seen before species.

2.5.6. Gas Collection (Task 4)

The ROV must retrieve the gas collector from the Elevator Platform and place it over the hydrothermal vent on the Ocean Bottom Platform to collect a gas sample. The hydrothermal vent will be releasing small bubbles that will be visible on the surface of the pool, simulating the presence of a hydrothermal vent below. As the ROV holds the gas collector above the vent, the collector will fill with gas and rise to the surface. The ROV must hold the collector above the vent and may not release the gas collector until it begins to float upward.



Gas Collector Placement

Scoring

A maximum of 15 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. Teams will receive:

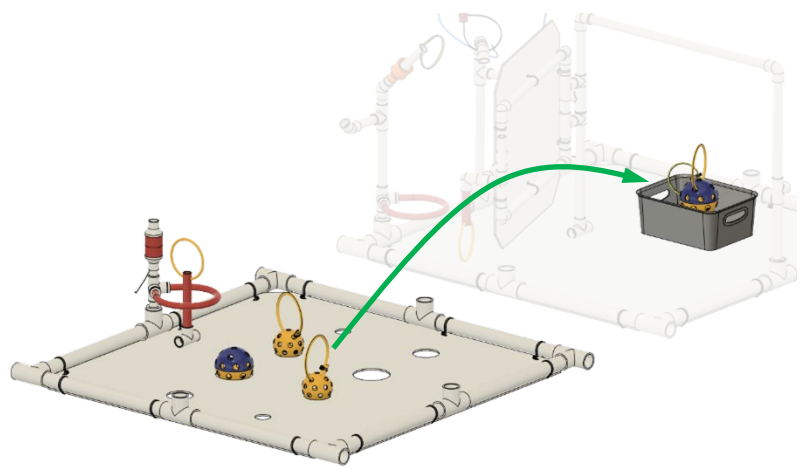
- Five (5) points for removing the gas collector from the ring on the Elevator Platform
- Ten (10) points for filling the collector with gas until the collector fills and floats. Once the collector begins to rise teams will earn the allotted points even if the collector flips and/or sinks.

Real-World Inspiration

Gases collected near hydrothermal vents are analyzed for, among other things, helium and carbon isotopes, which provide valuable information about the age and development of the vents as well as the origins of the gases in the crust and mantle.

2.5.7. Rock Collection (Task 5)

The ROV must retrieve rock samples from the Ocean Bottom Platform and transport them to the collection basket on the Elevator Platform.



Scoring

A maximum of 25 points can be earned on this task. This is a multi-step task and teams will earn points for completing each step of the task. Teams will receive:

- Five (5) points for the successful retrieval of rocks with loops that are placed in basket (3 rocks available)
- Ten (10) points for the successful retrieval of the rock without loop that is placed in basket (1 rock available)

Real-World Inspiration

Rocks and life near hydrothermal vents are intertwined; life thrives on the surfaces of the underlying crust and within the vent chimneys. Samples are cataloged, extensively imaged and described, and then stored in a variety of ways for geochemical and biological analyses by researchers on shore.

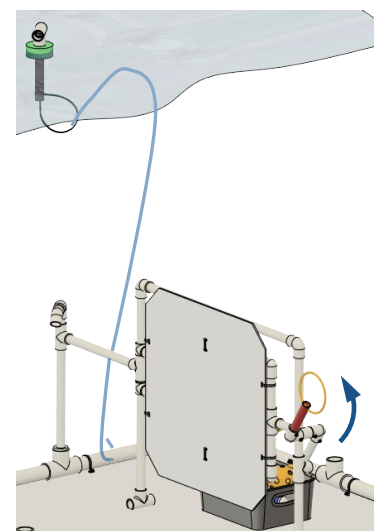
2.5.8. Elevator Recovery (Task 6)

The ROV must close the door and lock the latch on the Sample Return Elevator so that samples are secured during the trip back to the surface. The ROV must then release the elevator marker float to make the sample return elevator visible to and recoverable by the researchers waiting for it on the ship.

Scoring

A maximum of 15 points can be earned on this task. This is a multi-step task and teams will earn points for completing each step of the task. Teams will receive:

- Ten (10) points for closing and latching the elevator door
- Five (5) points for releasing the elevator marker float



Real-World Inspiration

Although the ROV could carry samples back to the ship, it has limited carrying capacity and space. In addition, the ROV receives power from the ship via its tether, so it can stay submerged for days at a time. Instead of recovering the ROV to collect a relatively small number of samples each time, the Sample Return Elevator brings samples to the surface independent of the ROV. Engineers on the ship can then send a new elevator down for additional samples to continue the mission.

2.6. General Pool Event Rules

2.6.1. ROV, Spare Parts, and Adjustments

1. The team must use the same ROV that was presented at compliance for both pool events.
2. Each team must have their own ROV – teams are not allowed to share an ROV.
3. Teams are not allowed to share ROV attachments or devices.
4. Spare parts are allowed; however, spare ROVs are not allowed.
5. Any design or structural modifications made to the ROV after a compliance check requires the team to re-submit the ROV for a compliance check.
6. No parts or materials, except as noted in this section, may be added to or removed from the ROV between pool events. The ROV must compete in both pool events with the same attachments and parts connected. Violations will result in disqualification.
7. Attachments and parts may be *repositioned* (i.e., rotated or swiveled) between the two pool events. Attachments or parts may not be disconnected and relocated; they must remain connected to the same point on the ROV when they are repositioned.
8. The ROV may be worked on or adjusted during competition. This may include adjusting buoyancy by adding or removing buoyancy materials or adding materials like tape or cable ties necessary to secure parts. However, the run timer will continue.
9. Replacement of failed or damaged parts is permitted. Teams replacing failed or damaged parts must re-submit their ROV for a compliance check conducted by staff at the Triage or ROV Poolside First Aid Station.
10. Passing compliance checks does not guarantee the right to compete. Lead judges in the competition area have the final say on safety and compliance issues and may require teams that have already passed the compliance check to fix issues prior to competing.

2.6.2. Auxiliary Equipment, Batteries, and Power Supplies

1. 12-volt direct current (VDC) power connections for the standard SeaPerch power cable alligator clips will be supplied for each competition lane. This power connection is for the ROV only; no auxiliary equipment may be connected to this power connection.
2. Teams may provide their own battery for the ROV.
3. Teams may provide an additional battery for auxiliary equipment such as cameras, advanced controllers, and electromechanical ROV attachments.
4. Team supplied batteries must not be larger than 6.5" long x 3" wide x 4" high and must be 12 VDC maximum with a 9-amp hour maximum rating.
5. Teams may not bring anything to the pool deck that requires 110-volt or any other alternating current (AC) power. Laptop computers are allowed if they are battery powered and do not need to be plugged into 110-volt power.

2.6.3. Diver Assistance and ROV Tether Handling

1. The ROV must move only under its own power. The tether may not be pulled to expedite the ROV's navigation of the course.

2. If the ROV or tether becomes tangled on the course structure or is otherwise unable to move on its own power, a team member must notify the judge that they would like to try to free the ROV by pulling on the tether. Under this circumstance teams may gently pull on the tether; however, the run timer will continue. If the ROV is pulled by the tether, the ROV must be returned to the location that it was moved from before it may continue competing.
3. The team may ask the judge for diver assistance. If diver assistance is requested the judge will pause the run timer. The judge will restart the run timer when the diver arrives at the lane and begins assisting. There is no longer a two-minute diver assistance penalty. If the ROV is moved, it must be returned to the location that it was moved from before it may continue competing.

2.6.4. On Deck

1. Prior arrangements are required for waivers to any of the following rules to accommodate students' special needs. Any special accommodations must be made in advance of the starting date of the International SeaPerch Challenge by contacting seaperch@robonation.org.
2. All team members and spectators are expected to be respectful of other competitors, spectators, volunteers, judges, and staff.
3. Instructions from judges, volunteers, and event staff must be followed at all times on the pool deck. Those not complying with instructions from judges, volunteers, or event staff will be asked to leave the pool area and may risk disqualification of their team from the event.
4. Pool passes are required to enter the pool area.
5. A maximum of six (6) pool passes will be issued for each team. Any team with more than six members in the pool area without special accommodations risks disqualification from the event.
6. Only four (4) student team members are allowed at the competition lane. Only two (2) team members are allowed at the active course lane. The two (2) team members at the active course are considered the competing team members. The two (2) team members at the inactive course are considered non-competing.
7. Only competing team members are allowed to communicate with the judges.
8. The four team members at the competition lane may switch drivers at any time and as many times as they choose. The lane judge will not stop the timers.
9. The remaining two passes are for pool area spectators and can be used by other students (competing later in either the obstacle or mission course), parents, coaches, teachers, or chaperones.
10. Once a pool event run starts the pool area team spectator may not enter the competition lane.
11. The pool area team spectators must sit or stand behind the designated barrier ribbon.
12. Any student team members who are pool area team spectators may switch with the team members at the competition lane between the pool event runs (obstacle and mission course).
13. All team members must wear shoes with rubber soles while on the pool deck.
14. All team members may help with setup but must exit to their assigned spots before the course run starts. During this set-up period, teams should adjust the ROV's buoyancy and make any other necessary adjustments.

2.6.5. Equipment Failure

1. In the event of equipment failure between pool events, a team will be allowed to work on their ROV at an ROV First Aid Station or at Triage.
 - a. The ROV First Aid Station is intended for *quick repairs* that can be accomplished in 15 minutes or less. The station will not be equipped with electrical power, so soldering is not allowed.
 - b. After successful repairs, the team will reenter the competition queue in the front of the line.
 - c. If repairs are not accomplished within the 15-minute time limit, the team must proceed to the pool check-in station and notify the staff that they require Triage. Teams completing repairs in

Triage will check-in at the pool check-in station and enter the staging area.

2. While competition staff will attempt to accommodate all participants, teams not completing repairs by the last pool event time slots may not be able to compete.
3. If an ROV or equipment malfunctions before attempting the first mission task or passing the first obstacle course hoop, the team may elect to stop their run without incurring a time penalty. The team will be allowed to make repairs as described in item 1 of this section.
4. If an ROV or equipment malfunctions after attempting the first mission task or passing through the first obstacle course hoop, the team may elect to stop their run. The judge will record the current run time and notify the lead judge. The lead judge or technical director will evaluate the issue and decide a course of action. If the team is allowed to make repairs and restart their run, they may incur a time penalty equal to their initial run time at the time they stopped their initial run.

2.6.6. Disputes, Challenges, and Redress Request

1. Sportsmanship is always expected.
2. Team members and advisors are responsible for the conduct of all members and adults accompanying the team. Unsportsmanlike conduct of registered student team members or chaperones is grounds for the disqualification of a team.
3. Teams may not raise questions concerning other competing vehicles or other teams' scores.
4. Only the two competing team members may approach or speak to lane judges. Exceptions to this rule are only allowed if prior arrangements have been made to accommodate special needs.
5. Team members, chaperones, or spectators may not speak to the divers.
6. Team members will verify the time on the scoresheet reflects the time on the stopwatch. If there is a discrepancy, a team member may ask the lane judge for a second opinion. Timing disputes such as a team member claiming the judge did not start or stop the stopwatch at the correct time are not allowable disputes.
7. Disputes should be resolved at the time the alleged grievance occurs. However, if students are not able to articulate the alleged grievance, they may ask to speak to the lead course judge. The lead course judge will provide a redress request card that will allow the student and adult team members to meet with the technical director or lead judge to resolve the dispute. *Decisions of the technical director or lead judge are final, and the same dispute will not be heard again.*
8. If an ROV or the course is inadvertently interfered with during the competition, the competing team members should alert the lane judge and ask for a ruling by the lead judge or technical director. These situations will be addressed on a case-by-case basis.

SECTION 3: Design Documentation

2024 International SeaPerch Challenge

<https://seaperch.org/>

3.1. Overview

The following design documentation is delivered prior to the on-site competition, due at the close of team registration, 11:59 PM EST, April 26, 2024:

- Technical Design Report (Required)
- Meet the Team (Required):
- Real-World Innovation Poster (Optional)
- Community Outreach Project (Optional)
- Presentation Abstract (Optional)

3.2. Required Documentation

3.2.1. Technical Design Report (TDR)

A TDR succinctly describes your unique SeaPerch ROV and the engineering design process, providing insight into the iterative design process and allowing for data analysis that supports the final ROV design.

Overview

The TDR consists of seven mandatory sections and two mandatory appendices. Additional sections may be included; however, all reports must be limited to 5 pages (excluding *References*, *Acknowledgements*, and *Appendices*). Sections and appendices must appear in the order listed below. Reports must be written in English, typed, and submitted in PDF format.

PRO TIP: Teams are encouraged to start and keep an Engineering Notebook at the beginning of their SeaPerch build. Submitting an Engineering Notebook is not required for participation in the 2024 International SeaPerch Challenge but does help form the basis for creating a well-written TDR. Need some inspiration? Visit <https://seaperch.org/resources/design-process/> for a few helpful resources.

Scoring

This submission is worth 100 points. Guidelines are available in [Appendix B: Scoring Rubrics and Scoresheets](#).

- *Abstract* – 10 points max
- *Task Overview* – 10 points max
- *Design Approach* – 26 points max
- *Experimental Results* – 14 points max
- *Reflection & Next Steps* – 10 points max
- *Acknowledgements* – 4 points max
- *References* – 8 points max
- *Budget* – 4 points max
- *Writing Skills* – 8 points max
- *Paper format* – 6 points max

Contents

Abstract (1/2 page)

A well-written abstract should concisely explain the key points or essence of your paper and quickly explain to the reader what the paper is about.

Task Overview (1/2 page)

This section should include an overview of the task(s) your ROV will attempt and should discuss the characteristics and features of the tasks that affected the final design. Avoid directly quoting course descriptions or problem statements for real-world applications and instead use your own words to describe what your ROV will/would do within the application.

Design Approach (2 pages)

Given the tasks described in the previous section, describe your team’s strategy and approach to developing a novel SeaPerch design. Novelty may occur at various levels of the design and build process including specific components, collections of components, or even team approaches to the process. Focus attention on the creative aspects of your system and how your team conceived of, refined, and implemented these ideas. Describe your experience in making design decisions and how prospective ideas were considered among the team. Include engineering and scientific terms and concepts to demonstrate the team’s understanding of the challenges of constructing and operating an underwater ROV.

Experimental Results (1 page)

This section should describe various tests accomplished in-water and/or in simulation. What were your results? How did these tests impact your team’s subsequent design(s)? Include images, charts, and figures to demonstrate your results.

Reflection & Next Steps (1 page)

Reflect on this season’s experience. What did you learn? Were there aspects of the project that you particularly enjoyed or that challenged you? How do you think that your new knowledge or experience will assist you in future endeavors? Include a discussion of next steps for the team and/or the team’s ROV.

Acknowledgements (no page limit)

Participating in the competition involves identifying resources and support beyond the efforts of individual team members. This support can take many forms, such as technical advice, labor, equipment, facilities, and monetary contributions. Acknowledging those who have supported your efforts is important.

References (no page limit)

As with any technical publication, original ideas and content not generated by the paper’s authors should be properly cited. While there are many citation styles, the American Psychological Association (APA) style guide should be used. Use in-text citations, where appropriate.

This information may be utilized during compliance checks to determine appropriate competition class and should reflect the total materials cost of your ROV. Parts that are 3D printed will be costed out at \$0.05 per gram.

Component	Vendor	How was component used?	Cost (in USD)
TOTAL COST OF SEAPERCH COMPONENTS			\$

3.2.2. Meet the Team

Connecting with your community is important. We want to get to know you! This is your chance to introduce us to your team and team’s personality.

Overview

Reach out and share your team or school's logo, an overview of what your team is all about, and social media information so we can share it with the SeaPerch community.

Scoring

This is not a scored event. We will include this information on the 2024 International SeaPerch Challenge webpage.

Contents

Teams will be asked to submit the following information:

- Team Name, organization, and location
- Team logo/icon (submitted as PNG image)
- One paragraph (100 words max) team bio/overview
 - *PLEASE NOTE: Team bios will not be edited to correct any spelling and/or grammatical errors before posting, so put your best foot forward and proofread your entry carefully.*
- Image or drawing of the team's SeaPerch ROV design
- Competition Class (i.e., Middle School Stock Class, High School Stock Class, Open Class)
- Overview of SeaPerch Design: Provide a high-level explanation of your SeaPerch design
- Number of years your team has participated in the SeaPerch program (this should include years that you have been involved in building a SeaPerch and/or competed in a SeaPerch competition)
- Number of times your team has competed at the International SeaPerch Challenge including your anticipated participation at the 2024 Challenge (i.e., Put 1 year if this is your 1st year)
- Complete the statement "Our SeaPerch is unique because..."; highlight what you think makes your design innovative
- Complete the statement "Our biggest takeaway this season is..."; focus on your team's experience and what you learned from working together on your design
- Website link*
- Organization's social media link (Facebook, Twitter, Instagram, LinkedIn)*

*Acknowledgement certifying that photographs or videos given as part of this entry only include team members who have submitted a Photographic Release Form signed by a parent/guardian.

3.3. Optional Documentation

3.3.1. Community & Outreach

The Community and Outreach event is an optional component of the 2024 International SeaPerch Challenge. What is giving back and why do we think it is important?

Overview

Giving back can take many forms. Find a good fit between what you are passionate about (or good at) and how that can meet a need in your community. Increase awareness of a topic that you care about. Get others excited about your cause or unite them in support of a common goal.

Scoring

Submissions may be considered for special awards.

Contents

Share your special skills and interests with others who could benefit from them. In the process, you will hone your communication skills, deepen your own understanding and appreciation, and feel a personal sense of pride and accomplishment. You may even inspire others to join you!

STEM-Related Ideas to Give Back

- Serve as a near-peer virtual mentor or tutor to other students who are building SeaPerch ROVs or who need extra help in other STEM areas
- Volunteer to be a student assistant in a robotics or STEM enrichment club at your school
- Help develop an exhibit for a science museum or STEM center
- Create a website for people to learn more about ROVs and their real-world applications
- Volunteer to participate in the clean-up of a local waterway
- Write an article for your local newspaper highlighting your team and how you have made it to this year's International SeaPerch Challenge

General Giving Back Ideas:

- Volunteer at a local animal shelter
- Collect canned/non-perishable goods for donation to a local food bank
- Send cards or letters to nursing home residents
- Contact your local community center and inquire about available volunteer opportunities
- Create a social media post or a team promo video to highlight your effort or get the word out

Community and Outreach efforts should be described in 500 words or less. To capture important details, think about the **5 Ws** as you write, explaining, at a minimum, the **Who, What, When, Where, and Why** of your outreach activity. What inspired you? Why was this important to you? You might also tell us about any future plans you have or share the impact of your efforts.

Submission Instructions:

Teams that choose to participate in this optional give back event and outreach will be asked to submit the following resources. Teams may submit a written statement, team information, or both.

- Description of the team's activity* (one-page max, submitted as PDF)
- Supporting photos or documents (optional with three file uploads max.)
- Supporting reference link to a video, website, article, etc. (optional)

*Acknowledgement certifying that photographs or videos given as part of this entry only include team members who have submitted a Photographic Release Form signed by a parent/guardian.

3.3.2. Real-World Innovation Poster

This event challenges teams to explore real-world applications for underwater ROVs. Teams are invited to identify a real-world issue and design a SeaPerch ROV to address the issue. To present their project, teams will create a virtual poster. These posters may include anything from a conceptual design to a full project conducted in the real world.

Overview

Teams that choose to participate in this optional event must submit a virtual PDF poster. The following rules apply for this poster submission:

- Posters should have dimensions of 4' wide x 3' tall and must be submitted in PDF format.

- Optional templates are provided for teams to use (PowerPoint and Google Slides formats); however, teams are encouraged to create their own templates or modify these to best communicate their respective projects.
- There are no specific requirements for section headers or space allocated for each section.

Scoring

Top scoring posters will receive awards. Submitted posters will also be open for public voting and will be eligible for “Fan Favorites” awards.

Contents

Posters will be rated on the following areas (*see scoring rubric*):

- *Project Overview*: An overview of their project, approach, and findings
- *Background & Rationale*: The team’s motivations for conducting the project
- *Approach*: Justification for the team’s approach to the project
- *Discussion & Reasoning*: Evidence supporting the team’s approach and modifications to their project
- *Next Steps*: Thoughtful consideration of new questions and next steps for the team’s project
- *Use of Graphics*: Use of images, charts, and figures to support the poster’s text
- *Organization*: Content organization
- *Creativity*: The creativity of the project and innovative approach to a real-world issue
- *Overall Quality*: The poster effectively conveys the project and approach

3.4. On-Site Team Presentations

During registration, teams can apply to give a short presentation on their SeaPerch season. These presentations are **not scored**.

Content/Structure

- Presentations will be grouped into sessions including multiple teams across different competition classes. All teams are required to attend the full session to which they are assigned.
- Presentation sessions will be led by a moderator who will ask questions and facilitate discussions following team presentations.
- Networking and open dialogue to share perspective and ask other teams questions during the discussion period in each session is strongly encouraged.
- Presentations will be open to attendance by teams, mentors, and spectators.
- Teams will not have access to AV so no PowerPoint or other multimedia presentations will be allowed; however, props and models are welcome.

Application Process

Teams who are interested in presenting at the 2024 International SeaPerch Challenge will submit their intent along with a one-paragraph abstract outlining what they would like to present during a session when they register for the event. Teams that are invited to present will be notified on May 10th, 2024.

SECTION 4: Awards

2024 International SeaPerch Challenge

<https://seaperch.org/>

4.1. Competition Awards

Awards will be given to top performers in each class as well as those who have demonstrated exemplary skills in special award categories.

Class Champions

Top team in each class (1 per class) (3 total awards)

Competition Events (TDR/Mission/Obstacle)

TDR (1st, 2nd, 3rd for each competition class) (9 awards)

Mission Course (1st, 2nd, 3rd for each competition class) (9 awards)

Obstacle Course (1st, 2nd, 3rd for each competition class) (9 awards)

Real-World Innovation Poster

Top teams in the Real-World Innovation event - First, second, third in each class (9 total awards)

Fan Favorites - middle school and high school teams from public judging (2 total awards)

Community & Outreach

Top teams in the Community and Outreach event – First, second, third (not related to class) (3 total awards)

4.2. Special Awards

Teams may be nominated for Special awards during pre-event submission judging and on-site at the competition. A nomination form will be available on-site for all participants, advisors, volunteers, staff, and spectators to nominate teams for these awards.

Sportsmanship Award

This award recognizes individuals or teams who demonstrate a commitment to fair play, ethical behavior and integrity, and general goodwill towards others. Recipients of this award may be coaches, team members, parents, officials or anyone else that tournament officials or directors feel exhibit these traits.

Resiliency and Grit Award

As the name implies, this award is given to an individual or team who displays the dynamic ability to recover quickly from challenges. Recipients maintain control of a difficult situation and devise new ways to tackle a problem, all while showing courage and resolve or strength of character.

Ingenuity

This award is given for a team's exceptional creativity, either through some aspect of their ROV, or an extraordinary idea beyond the standard build. This award acknowledges and encourages creative thinking and risk-taking; recipients embody the principle of "thinking outside the box" to solve engineering problems.

Appendix A: Registration Template

2024 International SeaPerch Challenge

<https://seaperch.org/>

This is not a registration form and is intended **ONLY** to assist in collecting information prior to online registration.

1. ORGANIZATION & CONTACT INFORMATION

TEAM INFORMATION

- Team Name
- Team's School or Organization
- School/Organization Street Address
- City, State, and ZIP, Country

PRIMARY TEAM POINT OF CONTACT

The registered Team Point of Contact will be responsible for all team communications with RoboNation staff concerning registered attendees, housing, technical submissions, and payments. If this Team Point of Contact will also be acting as a Team Chaperone, they must also be registered under Attendee Registration below as a chaperone.

- Name
- Phone
- Email

SECONDARY TEAM POINT OF CONTACT (OPTIONAL)

- Name
- Phone
- Email

TEAM EMERGENCY CONTACT

Please provide the name and phone number of an emergency contact for the team while they attend the SeaPerch Challenge. Preferably, this person should be someone who will NOT be on site at the event.

- Name
- Phone

2. TEAM INFORMATION & DEMOGRAPHICS

Team ID (This ID will be provided with your registration invitation.)

REGION: What region you are representing?

- | | |
|---|---|
| <input type="checkbox"/> New England – ME, NH, VT, MA, RI, CT | <input type="checkbox"/> Plains – MI, IA, MO, ND, SD, NE, KS |
| <input type="checkbox"/> Northeast – NY, NJ, PA, DE | <input type="checkbox"/> Southwest – OK, TX, NM, AZ |
| <input type="checkbox"/> Mid-Atlantic – DC, MD, WV, VA, NC | <input type="checkbox"/> Rocky Mountains – MT, WY, CO, UT, ID |
| <input type="checkbox"/> Great Lakes – OH, MI, IN, IL, WI | <input type="checkbox"/> Western – WA, OR, NV, CA, AK, HI |
| <input type="checkbox"/> Southeast – KY, TN, SC, GA, FL, AL, MS, LA, AR, PR | <input type="checkbox"/> International |

QUALIFICATION: How did your team qualify?

- SeaPerch Regional
- Wild Card

COMPETITION CLASS & ROV REGISTRATION

Select the competition class below that matches your team's ROV specifications.

- Middle School Stock Class
- High School Stock Class
- Open Class

OPTIONAL EVENTS: What optional events will your team participate in?

All teams are expected to submit a Technical Design Report and Meet the Team documentation as part of their registration. Additional awards will be provided in the following optional events.

- Real-World Innovation (Poster)
- Community & Outreach
- No Optional Event

PRESENTATIONS: Would your team be interested in presenting at the event? Selected teams will be notified in May if selected for a presentation slot.

- Yes No

TEAM DEMOGRAPHICS

Provide the number of students and educators/mentors engaged with the team. This may include students and educators/mentors that are not registered participants but who worked with the team during the season. This number will not affect the cost of your registration. Registered participant numbers will be entered later.

of Students: _____

of Educators/Mentors: _____

GENDER	Students	Mentors/ Educators
Male		
Female		
Non-Binary		
Prefer Not to Answer		

ETHNICITY	Students	Mentors/ Educators
Asian		
Black/African American		
Hispanic/Latino		
Native Hawaiian/ Pacific Islander		
White		
Other		
Prefer Not to Respond		

Specify Other Ethnicity: _____

GRADE	K	1	2	3	4	5	6	7	8	9	10	11	12
Students													

GRADUATES: How many students will graduate high school in 2024? _____

3. REGISTRATION FEE DETAILS

PARTICIPANT REGISTRATION: Please note that teams are limited to 12 students and 4 chaperones.

- How many **students** are you registering?
- How many **chaperones** are you registering?

ROV FEE: \$250 per team

PARTICIPANT FEE: \$75 per student/chaperone

Includes registration fee, t-shirt, lunch, and on-site access to Team Village and presentations

4. CHAPERONE INFORMATION

Please collect this information for each chaperone.

- **Title** (ex. Mr., Ms., Dr.) & **Name** (First & Last)
- **ROLE: Which of the following best describes your role?**
 - Educator (K – 5)
 - Educator (6 – 8)
 - Educator (9 – 12)
 - Educator (Undergraduate)
 - Parent
 - Community Org. Mentor/Volunteer
 - Industry Volunteer
 - DoD Mentor/Volunteer
 - School Administrator
 - School Counselor
- **Mobile Phone**
- **Special Needs** (special needs, allergies, dietary restrictions or ADA accommodations required)
- **Signed Documents** (Information will be available closer to the event.)
- **Email**
- **T-Shirt Size**

- Signed Liability Waiver
- Signed Youth Protection Policy Acknowledgement Form

Background Check Submission Verification: All chaperones of teams with registered minors must submit a request for a background check. Information will be available closer to the event.

5. STUDENT INFORMATION

Please collect this information for each student.

- **Name** (First & Last)
- **Email** (Please provide the email address of a parent/guardian for students under age 13.)
- **T-Shirt Size**
- **Special Needs** (special needs, allergies, dietary restrictions or ADA accommodations required)
- **Signed Liability Waiver** (Information will be available closer to the event.)

6. SUBMISSION: TECHNICAL DESIGN REPORT

PDF Upload: Technical Design Report

7. SUBMISSION: MEET THE TEAM

Complete the following information (for more detailed instructions see Section 3: Design Documentation):

- Team logo/icon (PNG or JPG upload)
- Team bio/overview (100 words max)
- Image or drawing of the team's SeaPerch ROV design (PNG or JPG upload)
- Overview of ROV Design: High-level explanation of your SeaPerch design
- Number of years your team has participated in the SeaPerch program
- Number of times your team has competed at the International SeaPerch Challenge (including 2024)
- Complete the statement "Our SeaPerch is unique because..."
- Complete the statement "Our biggest takeaway this season is..."
- Website link* (optional)
- Organization's social media link (Facebook, Twitter, Instagram, LinkedIn)* (optional)
- *Photo Release acknowledgement

8. SUBMISSION: REAL-WORLD INNOVATION (OPTIONAL)

PDF Upload: Digital Poster

9. SUBMISSION: COMMUNITY & OUTREACH (OPTIONAL)

PDF Upload: Written statement (with photos and videos as applicable) submitted as a one-page PDF.

- *Photo Release acknowledgement

10. SUBMISSION: PRESENTATION ABSTRACT (OPTIONAL)

PDF Upload

11. ADD-ONS: SPECTATORS & EXTRA T-SHIRTS (OPTIONAL)

Add-ons are purchased separately from the team's registration and will be accessible at the **RoboNation Shop**.

- **SPECTATOR TICKETS**
- **ADDITIONAL T-SHIRTS** (Available for pick-up on-site or shipped direct to recipient)

Appendix B: Pool Course Scoresheet – Mission Course

2024 International SeaPerch Challenge

<https://seaperch.org/>

TOTAL SCORE: _____

Score is not official until verified by master scorekeeper

JUDGE NAME _____ LANE #/TIME: _____ REVIEW INITIALS _____ <small>Team member to initial after verifying times</small>		TEAM NUMBER _____ TEAM _____ ORG./SCHOOL _____ CLASS/DIVISION _____	
Task Description & Scoring Guidelines			Points Earned
TASK 1: Elevator Preparation - Open elevator hatch: 5 points <input type="checkbox"/>			Max. 5 points
TASK 2: Temperature Sensor - A: Plug connector into connector port: 20 points <input type="checkbox"/> - B: Alternate – Leave connector in holding ring: 5 points <input type="checkbox"/> Only A or B can be completed - Place sensor in hydrothermal vent ring: 10 points <input type="checkbox"/>			Max. 30 points
TASK 3: Fluid Collection - Lift and close collector: 5 points <input type="checkbox"/> - Transport collector and place in basket: 5 points <input type="checkbox"/>			Max. 10 points
TASK 4: Gas Collection - Remove collector from ring: 5 points <input type="checkbox"/> - Fill collector with gas: 10 points <input type="checkbox"/>			Max. 15 points
TASK 5: Rock Collection - Retrieve rocks with loops and place in basket: 5 points each <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> - Retrieve rock without loop and place in basket: 10 points <input type="checkbox"/>			Max. 25 points
TASK 6: Prepare for Elevator Recovery - Close and latch Elevator Hatch: 10 points <input type="checkbox"/> - Release Elevator Marker Float: 5 points <input type="checkbox"/>			Max. 15 points
Finish Time: <i>(Enter actual stopwatch time)</i> <div style="text-align: right;"> _____ : _____ : _____ (M) (S) (1/100) </div>			
Bonus points based on adjusted finish time. <i>Bonus points are awarded only if all tasks are completed.</i>		Finish time is less than: 6 min: 5 points 4 min: 10 points	Max. 10 points

Notes: _____

Appendix B: Pool Course Scoresheet – Obstacle Course

2024 International SeaPerch Challenge

<https://seaperch.org/>

JUDGE NAME _____ LANE #/TIME: _____ REVIEW INITIALS _____ <small>Team member to initial after verifying times</small>	TEAM NUMBER _____ TEAM _____ ORG./SCHOOL _____ CLASS/DIVISION _____
<h2>Run 1</h2> <p><input type="checkbox"/> Course completed</p> <p>Finish Time: <i>(Enter actual stopwatch time)</i></p> <p>_____ : _____ : _____ (M) (S) (1/100)</p>	<h2>Run 2</h2> <p><input type="checkbox"/> Course completed</p> <p>Finish Time: <i>(Enter actual stopwatch time)</i></p> <p>_____ : _____ : _____ (M) (S) (1/100)</p>
	<h2>Best Time:</h2> <p>_____ : _____ : _____ (M) (S) (1/100)</p>

Notes: _____

Appendix B: Technical Design Report Scoring Rubric

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Scoring Guidelines:
Missing Components (0 points) Requirements missing does not meet minimum requirements.
BASIC (2 points) Meets <u>basic</u> requirements. Average. (60-75%)
SATISFACTORY (3 points) Meets all requirements with additional content. (85%) Above Average.
ROBUST (4 points) Exceeds requirements with additional content, material, formatting. Superior (95%)

TOTAL SCORE:

TEAM: _____

JUDGE: _____

1. Abstract	0	1	2	3	4	Points
Limited to ½ page	Exceeds page limit.		Within page limit.			
Report summarization	Does not summarize main points of the report.		Includes a basic overview of the report.		Includes a robust overview of the report.	
Unique ROV design and/or design process	No discussion of ROV design or process.		Basic overview of design and/or process with some focus on unique traits.		Robust discussion of unique design and process.	

TOTAL ABSTRACT SCORE (10 POINTS MAX (of 100)):

2. Task Overview	0	1	2	3	4	Points
Limited to ½ page	Exceeds page limit.		Within page limit.			
Overview of the competition tasks	No overview of competition tasks.		Basic overview of obstacle <u>or</u> mission course.		Robust discussion of all tasks for both courses.	
Design approach justification	No discussion of task influence on design.		Basic discussion of how tasks impacted design.		Robust, detailed discussion of design justification.	

TOTAL TASK OVERVIEW SCORE (10 POINTS MAX (of 100)):

3. Design Approach	0	1	2	3	4	Points
Limited to 2 pages	Exceeds page limit.		Within page limit.			
Team's approach to the engineering design process (EDP)	No overview of team approach to EDP.		Basic discussion of team's approach to EDP.		Robust discussion of team's strategy to EDP.	

Design iterations	No discussion of design iterations.		Basic discussion of design iterations.		Robust discussion and analysis of design iterations.	
Conceptual drawings and/or graphics	No drawings or graphics.		Includes graphic(s) with basic context within report.		Includes high-quality graphics with context and labels that enhance the report.	
Final design	No discussion of final design.		Basic discussion of final design features.		Robust discussion of final design features and decisions with supporting reasons.	
Novelty of ROV design or approach	No discussion of design or approach novelty.		Basic discussion of design or approach mentions novelty.		Robust discussion and analysis of novelty of ROV design and approach.	
Scientific and engineering terms	No engineering terms.		Includes 2-4 engineering terms.		Includes 5+ engineering terms in text that include context and enhance the section.	

TOTAL DESIGN APPROACH SCORE (26 POINTS MAX (of 100)): _____

4. Experimental Results	0	1	2	3	4	Points
Limited to 1 page	Exceeds page limit.		Within page limit.			
In-water and/or simulated testing overview	No discussion of testing.		Basic overview and/or discussion of testing conducted.		Robust discussion and analysis of testing models utilized.	
Impact of testing on subsequent designs	No discussion of testing impact on design.		Basic discussion of how multiple designs were impacted by testing.		Robust discussion and thorough analysis of testing impact on multiple design iterations.	
Test results	No test results included.		Basic discussion of test results.		Robust analysis of test results supported by graphs and charts.	

TOTAL EXPERIMENTAL RESULTS SCORE (14 POINTS MAX (of 100)): _____

5. Reflection & Next Steps	0	1	2	3	4	Points
Limited to 1 page	Exceeds page limit.		Within page limit.			
Reflection on the design process	No reflection on the design process.		Basic reflection on the design process.		Robust/thoughtful reflection & analysis of the design process.	
Next Steps	No discussion of next steps.		Basic discussion of next steps for ROV and/or team.		Robust overview of detailed future plans for ROV and team.	

TOTAL REFLECTION & NEXT STEPS SCORE (10 POINTS MAX (of 100)): _____

6. Acknowledgements	0	1	2	3	4	Points
Acknowledgement of support	Not included in report.				Supporters recognized in report.	

TOTAL ACKNOWLEDGEMENTS SCORE (4 POINTS MAX (of 100)):

7. References	0	1	2	3	4	Points
References follow APA format	Does not follow APA format.				Follows APA format.	
Includes references to support report	No references or citations.		2 references are cited in the report text.		At least 4 references are cited in the report text.	

TOTAL REFERENCES SCORE (8 POINTS MAX (of 100)):

8. Budget	0	1	2	3	4	Points
Includes itemized budget	Section not included in report.				Section included in report.	

TOTAL BUDGET SCORE (4 POINTS MAX (of 100)):

10. Writing Skills	0	1	2	3	4	Points
Organization and Readability	Report is inconsistent and difficult to follow. Organization severely impacts readability.		Report is easy to follow with some graphics. Each section includes organized discussion.		Report is concise, cohesive, easy to understand and supported by context and graphics.	
Spelling and Grammar	Significant spelling or grammatical errors (5+)		Several spelling or grammatical errors (2-3)		No spelling or grammatical errors.	

TOTAL WRITING SKILLS SCORE (8 POINTS MAX (of 100)):

11. Paper Format	0		3		6	Points
Follows all formatting guidelines: 5 pages max (excluding sections 6-7 and appendices) Page size: 8.5"x11" Margins ≥ 0.8 in. Times New Roman 12pt Single Spaced Footer with team name and page # on all pages	Does not meet all formatting guidelines. Exceeds 5 pages.		Meets most formatting guidelines.		Meets all formatting guidelines.	

TOTAL PAPER FORMAT SCORE (6 POINTS MAX (of 100)):

Appendix B : Real-World Innovation Scoring Rubric

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Scoring Guidelines:
Missing Components (0 points): Requirements missing
Minimal (1-3 points): Below Average
Good (4-6 points): Above Average
Mastery (7-10 points): Superior

TOTAL SCORE _____

TEAM NUMBER
(if used) _____

TEAM _____

JUDGE _____

	Minimal			Good				Mastery				Points	
Project Overview	The team provides an overview of their project, approach, and findings.												
	0	1	2	3	4	5	6	7	8	9	10		
Background & Rationale	The poster discusses the team's motivations for conducting the project.												
	0	1	2	3	4	5	6	7	8	9	10		
Approach	The team clearly describes and provides justification for their approach to the project.												
	0	1	2	3	4	5	6	7	8	9	10		
Discussion & Reasoning	The team uses evidence to support their approach and modifications to their project.												
	0	1	2	3	4	5	6	7	8	9	10		
Next Steps	The team thoughtfully considers new questions and next steps for their project.												
	0	1	2	3	4	5	6	7	8	9	10		
Use of Graphics	The team uses images, charts, and figures to support the text.												
	0	1	2	3	4	5	6	7	8	9	10		
Organization	The poster's content is organized in a way that makes it easy for the reader to follow.												
	0	1	2	3	4	5	6	7	8	9	10		
Creativity	The project is creative and describes an innovative approach to a real-world issue.												
	0	1	2	3	4	5	6	7	8	9	10		
Overall Quality	The poster effectively conveys the project and approach.												
	0	1	2	3	4	5	6	7	8	9	10		
	TOTAL POINTS (90 POINTS MAX):												

Notes for Team:

Appendix C: ROV Compliance Checklist

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No parts or attachments (except buoyancy material) may be removed or added after the compliance check, but attachments may be repositioned.

Design must follow Competition Classes and Design Rules.

TEAM NUMBER <i>(if used)</i>	_____
TEAM	_____
ORG./SCHOOL	_____
CLASS/DIVISION	_____
JUDGE	_____

Design compliance

Stock and Open Classes

- Requires only one standard power source for propulsion. Battery limited to one 12VDC, 9Ah max battery no larger than standard SeaPerch battery.
- Uses no more than one additional external battery of 12VDC, 9Ah max no larger than standard SeaPerch battery for auxiliary equipment
- Uses only standard SeaPerch kit motors or exact replacement for propulsion

Stock Class Specific

- Maximum of 3 standard motors for propulsion
- ROV meets maximum \$25 (value) budget limit for modifications

Safety

- No exposed live wires on controllers, SeaPerch ROV or tether cable
- No sharp edges or potentially hazardous parts
- Motors are sealed (waterproofed)
- Power cable has insulated covers on alligator clips or terminals

Construction

- No loose parts that could potentially fall off during competition
- Tether cable is secured to ROV

As team captain/coach, I agree to assure that my team will not make modifications to the ROV system after the compliance check.

Team Captain or Coach's Name: _____
Signature: _____

Appendix D: Competition Classes Overview

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The 2024 International SeaPerch Challenge will include three (3) competition classes. These classes are updated from past years so please review the chart below carefully. **Please note, stock classes are limited to PVC, CPVC, and PEX pipe for the ROV frame and may not include 3D printed frames.** Frame parts are any parts that add structural integrity to the frame or connect frame parts together. 3D printed parts may not extend the frame to attach other 3D printed parts. This will be considered a frame part.

Rules	Middle School Stock Class	High School Stock Class	Open Class
BUDGET*			
The total cost of modifications to the final ROV must be \$25 or less	X	X	
The cost of modifications may exceed \$25			X
MATERIALS			
Frame built using <u>only</u> PVC, CPVC, PEX pipe and fittings. Any size pipes and pipe fittings may be used. Pipes and pipe fittings may be modified using hand and power tools, but may not be machined using CNC or other automated process.	X	X	
Frame may include 3D printed or additive manufactured parts as well as other materials, and may be made using CNC machinery or other automated process.			X
Attachments and non-frame parts (i.e., hook, gripper, propeller shroud) may be made from various materials to include 3D printed or additive manufactured parts. For stock classes, the majority of the parts used must be pipes and pipe fittings. Using a single pipe fitting with 3D printed motor mounts is classified as open class.	X	X	X
POWER SUPPLY			
Must design for and utilize a 12-volt power source	X	X	X
May utilize a second power source (no more than 12-volts) to power auxiliary equipment	X	X	X
MOTORS			
All motors must be waterproofed	X	X	X
Must use ONLY stock SeaPerch motors (Jameco Electronics 232022) for propulsion**	X	X	X
Additional non-stock motors may be used for non-propulsion uses	X	X	X
May include more than 3 thrusters (i.e., motor and propeller assembly)			X

Rules	Middle School Stock Class	High School Stock Class	Open Class
CONTROLLERS			
Must only use simple on/off switches for thruster controls	X	X	
May use power conditioning or pulse-width modulation (PWM) controls for thruster controls			X
May use PWM, microcontrollers, or other devices for non-thruster controls	X	X	X
May use a fixed or variable resistor to reduce voltage	X	X	X
STRUCTURE/SIZE			
Must fit through 18" diameter hoop	X	X	X
COMPETITION CRITERIA			
ROV must not be modified after compliance check (except for buoyancy)	X	X	X
The same ROV must be used for both pool events	X	X	X
Team may include a student in 8 th grade or below	X		X
Team may include a student in 9 th grade or above		X	X

*Budget Guidelines include:

- Donated material will be assessed at what the cost would be to procure the material.
- Spare parts and tools are not included in this budget.
- Materials used on earlier prototypes are not included in this budget. Only materials and supplies used on the competition ROV and controllers that are not part of the standard SeaPerch ROV kit should be included.
- Proof of budget compliance must be made available to the judges upon request.
- 3D printed parts will be costed out at \$0.05 per gram.

** Thrusters used for propulsion are thrusters that directly exert force against the water causing the ROV to move in any direction.