

2011 Greater Philadelphia Sea Perch Challenge

Ocean Oil Disaster: Cap the Well, Save the Sea

Background

The Sea Perch program introduces pre-college students to the wonders of underwater robotics. Part of the Office of Naval Research's initiative, "Recruiting the Next Generation of Naval Architects," this program teaches students how to build an underwater robot (called a Sea Perch), how to build a propulsion system, how to develop a controller, and how to investigate weight and buoyancy. This endeavor is one of many projects funded by the Office of Naval Research (ONR) as part of its National Naval Responsibility Initiative. The initiative focuses on bringing academia, government and industry to work together to ensure that the talent needed to design the Navy's next generation of ships and submarines will be there when needed. To visit the MIT Sea Perch website please visit <http://web.mit.edu/seagrant/edu/seaperch/WhySP.html>.

So how did it end up in Philadelphia?

The Delaware Valley Section of the American Society of Naval Engineers (ASNE) and the Philadelphia Naval Surface Warfare Center (NSWC) brought the Sea Perch program to Philadelphia and Drexel University. ONR funds the kits that ASNE and NSWC provide for the competition. In 2005, SeaPerch outreach included a few local schools, and the educational value of SeaPerch was quickly realized. The first Greater Philadelphia Sea Perch Challenge competition was held at Drexel University on Saturday, Jun 3, 2006 and included about 20 schools. In both the 4th and 5th SeaPerch Challenge, approximately 40 schools participated in the challenge. The program has continued to evolve and has become a model for the national Sea Perch initiative www.SeaPerch.org.

Eligibility

The Greater Philadelphia Sea Perch Challenge is open to middle school and high schools in the PA-NJ-DE region. The goal is to increase student interest in robotics, science, mathematics, engineering and technology and to introduce students to naval engineering.

The Structure of the Event

The event is structured to give students an overall experience in the engineering process. The first category, **Vehicle Performance**, is a test of how well the students did in designing and building their ROV. The second category, **Team Presentation**, is a test of how well the students can convey their engineering ideas and market their ROV. The third category, **Design Notebook**, is a test of the students organizational and documentation capabilities. The fourth category, **Spirit & Sportsmanship** is a test of the students' capabilities to recognize and encourage better solutions and engineering.

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Competition Categories & Judging

There will be separate competitions and awards for High Schools and Middle Schools. Each team is judged in each of the four weighted competition categories:

- Vehicle Performance
 - Awards: First Place, Second Place, and Third Place
- Team Presentation
 - Awards: First Place, Second Place, and Third Place
- Design Notebook (due 2 weeks prior to competition day)
 - Awards: First Place, Second Place, and Third Place
- Team Spirit & Sportsmanship
 - Awards: First Place, Second Place, and Third Place

Panels of external judges from industry, government agencies and higher education will evaluate the competition. Each category will have its own separate panel of judges. Each team will be given a score for each event and each category will have three awards.

Overall Greater Philadelphia SeaPerch Winner

Each team will receive a score for each of the four competition categories listed below, these scores will be added together to determine the overall Greater Philadelphia Sea Perch Challenge Champion. There will be one award for Middle School and one award for High School.

ASNE Engineering Process Award

This award goes to the SeaPerch team that best utilizes sound engineering principles and approach for assessing SeaPerch design variations and incorporating those changes into the final design. There will be one award for Middle School and one award for High School.

All awards will be announced at the end of the competition

General Rules

1. The Tether:

Throughout the competition, the vehicles must move only under their own power. Specifically, a team member pulling on the tether during the competition rounds is expressly prohibited and will be grounds for immediate disqualification.

2. Modifications to the Sea Perch Kit:

Teams are encouraged to think outside of the box and can spend up to \$20.00 to make design modifications. Adding additional thrusters is not allowed and only the motors that come with the kit can be used. Everything else in the kit can be used at your own discretion. All purchases must have a receipt of purchase and that receipt must be included in the Design Notebook. Proof of price from a comparative item (from the

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internet) can be used in lieu of a receipt. Teams are permitted to change the shape and configuration of the sea perch.

Hooks and attachments may be added/removed depending on the round. Extra batteries may be purchased or used from other kits and will not be included in your \$20 budget.

3. *Competition Day*

- All team members must wear shoes with rubber soles to the competition
- Each robot will be inspected and qualified by a judge prior to competition
- Only 2 team members are allowed on the pool deck during competition
- Nothing other than the sea perch vehicle should be put into the pools
- In the event that a vehicle is inadvertently interfered with during a trial or a malfunction of a vehicle's parts (i.e. the motor) that is beyond the design and construction put together by the team, the panel of judges will have the authority to allow the team time to fix their vehicle and allow them to complete later in the round. These malfunctions will be evaluated on a case by case basis.

Vehicle Performance

Many times underwater vehicles are used to retrieve things from the sea floor, or the floor of a harbor or port. The ability to perform a required task on the sea floor depends on the vehicle's ability to view, maneuver, grasp or manipulate objects, and to also lift or carry objects to and from a destination. If the object is too heavy, or it unbalances the craft, or the craft cannot get control of the object, the vehicle cannot successfully perform its mission.

ROVs are often called upon to perform tasks that are too dangerous for humans to do. In these situations, the loss of an ROV is considered acceptable, but still a financial loss. Completing the mission without the loss of the ROV is considered a very successful mission.

Round 1: Maneuvering the Obstacle Course

The first requirement of an underwater remotely operated vehicle is that it 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.

This event will consist of a submerged obstacle course involving large 24-inch diameter rings, oriented in any direction, through which the vehicles must travel. Teams must navigate the obstacle course, surface, then re-submerge and return through the course to the end. Consideration of optimal maneuverability, control and speed should be given when constructing your SeaPerch (motor placement and orientation, tether attachment, buoyancy and ballast, etc) and control box. Scores for this round will be based on the fastest time for successfully navigating the obstacle course.

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Round 2: Cap the Well, Save the Sea

In this event, teams will be required to respond to a simulated sea-floor oil well incident similar to the operations performed by ROVs to cap the BP oil well during the Gulf oil spill in 2010. Review of the Cap the Well video on <http://www.youtube.com/watch?v=1fiTjPGbCrs> will provide you an overview of the tasks that must be performed and what is needed on the Sea Perch to successfully complete this event:

1. Stopping the flow of a simulated oil spill
2. Capping the well
3. Collecting the 10 plastic balls, representing spilled oil, floating on the surface of the pool

For this round, the Sea Perch teams must have a rod or hook of some sort fitted to their vehicle in order to retrieve objects from the bottom of the pool. The objects will have a loop by which they can be picked up. A system has to be devised to retrieve the plastic balls to be corralled in a pen on the surface of the pool. Considerations of thruster placement, maneuverability, and camera mounting will be very important in this round. Hook placement and attachment, buoyancy, and ballasting are even more important in this round. Scores for this round will be based on the fastest time to successfully complete all three tasks.

Each team will be required to use an underwater camera to view the mission. Drivers for the middle schools will be permitted to view the Sea Perch on the monitor while being given direction from the other team member on the pool deck. The drivers for the high school teams will be viewing the Sea Perch on the underwater camera monitor behind a screen while receiving direction from their other team member from the pool side.

Team Presentations

Each team will make a maximum 10-minute presentation to a panel of judges on the day of the competition. The team should present as though they are the sales team of the company that designed and built their sea perch. The naval engineering clients, (panel of judges) have a “well capping” mission and they are screening possible companies to determine which sea perch model would be right for them. It is the sales teams’ responsibility to prove to the clients that their product is the best for naval engineering missions. The formal presentation will be followed by an informal 5-minute question, answer, and discussion period. At this time, teams that modified the original Sea Perch design should discuss their modifications. They should discuss the experiments they conducted during their design phase and what modifications came from them. Demonstration of the teams’ knowledge and understanding of the naval engineering principles used in the design and performance of SeaPerch is a key selection criterion that judges will consider. At the conclusion of the question, answer, and discussion period, judges should have a clear understanding of how students implemented their basic knowledge of fluids and propulsion.

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All teams must include the following in their presentation:

- Company Overview
 - Company name, size, demographics
 - Mission/Vision statement with and emphasis on naval engineering.
 - Organization of the company
- Recruiting
- Budget information and implementation
 - Identify additions to the Sea Perch
 - Explain any trade-offs
- Design and Manufacturing Process & Engineering Process
 - Identify the steps taken to achieve the design
 - Design research
 - Identify technical calculations or testing conducted and design priorities
 - Integrated lessons learned
 - Charts/Drawings/Pictures
- Use of computer technology

High School Teams must also:

- Hand out a corporate brochure to the clients which must include:
 - Mission/Vision statement of the company
 - Overview of the types of engineers involved in the process
 - Organizational Chart
- Each member of the sales team must have a resume to distribute

The format for the presentation is open to creative interpretation and teams are encouraged to use technology in their presentations. A PC computer with PowerPoint and multimedia projector will all available. Any additional equipment including computers with special software may be brought in by the team o. If you bring in a Mac book, you must provide the interface for the projector.

A maximum of eight team members will be allowed in the presentation room, plus the advisor. **All** team members present in the room **must participate** in giving the presentation. The presentation may be videotaped by one of the eight representatives in the room and this must be done without causing a disturbance.

A schedule of presentation times will be posted during the competition. Teams are advised to arrive at their designated presentation room 10-minutes prior to their scheduled start time. Teams who are more then 5-minutes late will not be allowed to present.

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Design Notebook

Teams must demonstrate how they implemented the engineering process in their *Teamwork Summary Notebook*.

Design Notebooks should include:

- Cover which includes the following information
 - School
 - School District
 - Team Name
 - Teacher Name and Contact Information
 - Team website (if applicable)
- Title Page
- Table of Contents
- Up to 20 pages that outline the teamwork that went into building the Sea Perch
 - Research of naval and marine engineering
 - Discuss the possible naval scenarios for your Sea Perch
 - Describe how your team demonstrated teamwork
 - Provide concrete examples of how team members worked together and how they helped other team members
 - What challenges did the team face and how did they overcome them?
 - What is the biggest lesson that the team learned?
 - What were the biggest factors of success for the team?
- Team List
- Feel free to include any photos, drawings, organizational charts, or any additional supporting information.
- Experiment worksheets on basic underwater principals
- Receipts for purchased materials.

Notes: Minimum font size is 12 pt and projects should use only 8 ½ " x 11" papers; Submitted electronically two weeks prior to the day of competition, due **April 1, 2011**

IF YOU NEED ASSISTANCE WITH SUBMITTING YOUR NOTEBOOK PLEASE INFORM YOUR MENTOR OR THE COMMITTEE.

Team Spirit & Sportsmanship

Teams are encouraged to show their team spirit during the competition. Judges will watch throughout the competition to determine the teams with the highest levels of team spirit.

Each team will sit together in the bleachers of the pool area. Teams are asked to have a team flag to identify their team to the judges.

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Flag specifications should be:

- Maximum flag pole height is 7 feet
- Maximum flag dimensions are 3x3
- Prominently display the school and team names
- 1 flag per school

Other ways to show school spirit:

- Cheering for teammates during team competition
- Demonstrate sportsmanship by cheering for other schools
- Posters & signs
- Team clothing
- Cheers