



SeaPerch Class Pack

Project Preparation

Congratulations on receiving your SeaPerch Class Pack! We are excited for you to dive in!

This guide is designed to make your SeaPerch program run smoothly. You'll find materials lists, classroom-setup guidance, build-management tips, and best practices so you and your students have the best experience.

Each Class Pack contains everything needed to build 5 SeaPerch ROVs. While designed for 15 students (three per ROV), we recommend no more than five students per ROV.

The Class Pack ships in three boxes. We encourage you to take the time to make sure you received all items and inspect for any damage that may have occurred during shipping. You should receive one box which contains the ROV Frame Pack, Controller Pack, Thruster Pack, and Other Parts. The other two boxes will contain the tool kits and the batteries and chargers. Refer to the insert card provided for complete Class Pack contents.

We want you to be successful in your SeaPerch program. Be sure to check out training opportunities at seaperch.org/training for the latest information.

For lesson plans on steps to build the SeaPerch ROV, visit seaperch.org/resources/build/.





GENERAL PREPARATION

- The Class Pack is organized by the ROV systems: frame system, controller system, and thruster system to help manage the classroom build.
- Check the condition of each tool frequently to make sure they are fully functional.
- Using the collapsible storage bins:
 - The box labeled "Other Parts" contains five collapsible storage bins. Use one storage bin for each group.
 - Initial Setup
 - Place the following items that are included in the Other Parts box in each bin:
 - Safety glasses (one per student) (15 total) – needed for each session.
 - Disposable gloves (two for each student) (30 gloves total) – needed for each session.
 - Solder tubes (one per group) – needed for the controller and thruster systems sessions.
 - SeaPerch rulers (one per group) – needed for each session.
 - Permanent markers (one per group) – needed for each session.
 - Before the first build session, place the required parts for that day's activity into each of the bins.
 - Use a removable label like a luggage tag to identify each group's bin.
 - Daily Use
 - Assign one bin to each ROV team. The students will use this bin to store their ROV and any associated parts throughout the program.
 - At the start of each session, instruct the teams to retrieve their assigned bin.
 - At the end of each session, have the teams return their bin with all of their materials to the designated storage area.



TEACHER TIP

Set a storage location for the project. Leaving the components in the shipping boxes will help keep the components organized until needed for each build session. The collapsible bins are provided to store the materials for each team during the project.



GENERAL PREPARATION (cont.)

Sections referred to in this guide are references to the 2021 edition of the *SeaPerch Build Manual*.

- Prepare the room for a safe and successful build. **The Tool Usage, Skills, and Safety** section, **Preparing for a Safe, Successful Build** subsection provides excellent information regarding creating a workable and safe environment for the project.
- Set up tools for adequate availability. There are different options for leaders depending on the availability of the tools:
 - Evenly distribute tools to each group. Teams are responsible for caring for their tools.
 - Store tools at a designated location to check out for equal access. Teams are responsible for checking out and returning tools. Leaders can check on the tools easily for regular maintenance.
 - Set up task stations with the tools needed for each task. Examples are a drilling station, a cutting station, and a soldering area where team members go to perform those tasks. Leaders can easily check for tool maintenance and monitor use.
- Set any rechargeable tools and ROV batteries on chargers. Review the **Tool Usage, Skills, and Safety** section - **12 Volt Lead Acid Battery** subsection before charging the ROV batteries.
- Review and print documents from the SeaPerch lessons and resources to assist leaders and students throughout the project.
- Have a copy of the *SeaPerch Build Manual* available for each team. Each Class Pack includes five printed *SeaPerch Build Manuals*.
- Review the **Tool Usage, Skills, and Safety** section for critical safety information. Some program leaders use this as an introduction to tools and safety and then cover safety of specific tools student use before each session.
- If your group is planning to use the ROV they build to compete in a Regional SeaPerch Challenge, it is helpful to align the ROV design with the upcoming competition tasks. See <https://seaperch.org/competition/> and navigate to the latest year's season page for specific information.
 - It is helpful to determine what modifications are necessary to accomplish the mission course tasks.
 - The teams should decide what ROV competition class they want to compete in and make sure they build the appropriate ROV for that competition class.
 - Connect with the Regional host to determine if they use the courses and rules used at the International SeaPerch Challenge.



CONTROLLER SYSTEM

For this system, students will be assembling the power cord, soldering components onto the printed circuit board (PCB), and fully assembling the controller.

- The Controller Pack contains five packages, each with all the components needed to assemble a complete controller. The Controller Pack also contains a bag of spare parts labeled Other Parts. These spare parts can be used to replace components damaged during assembly. If not needed for that purpose they can be used to create three full controllers (without power cables) and two controller boards.
- Follow the instructions in **Section 1: Controller Assembly**. Each section in the *SeaPerch Build Manual* starts with a picture and list of the tools and components needed. Determine how you will distribute the tools.
- Make sure the appropriate number of safety glasses, solder tubes, SeaPerch rulers, and permanent markers are in each bin (see Using the collapsible storage bins in the General Preparation section above).
- Soldering irons used in this session get extremely hot and can cause severe burns if not used carefully and properly. Present a lesson on the safe use of soldering irons before allowing the students access to them. The soldering iron stands can get hot enough to cause burns. Leaders often overlook this when discussing soldering iron safety. Make sure your safety lesson includes not touching the soldering iron stand until it has completely cooled.

At the end of each session, instruct the students to put all their ROV components and materials back in their collapsible bin. Store the bins in a designated space.



TEACHER TIP

Make sure the tip nut on the soldering iron is tight prior to plugging in. Should it loosen during use, use pliers to tighten it.



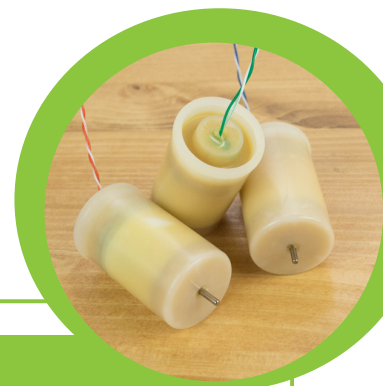


THRUSTER SYSTEM

For this system, students will prepare the tether cable, waterproof the motors, and assemble the propeller assemblies.

- The Thruster Pack contains five bags of the smaller components needed to assemble a complete set of thrusters. The wax rings and tether cable are not in the bagged packages. There are three wax rings which are enough to build five sets of thrusters. The groups will need to share the wax rings. Since the wax is messy it is recommended that the wax rings be divided during the thruster waxing process. If possible, have a separate designated area for thruster waxing. This will help minimize the spread of wax.
- The Thruster Pack also contains a bag of spare parts labeled Other Parts. These spare parts can be used to replace components damaged during assembly. If not needed for that purpose they can be used to create nine full propeller assemblies.
- Follow the instructions in **Section 2: Thruster Assembly** and refer to the lists of tools and components needed.
- Place one thruster parts bag in each collapsible bin. Place one tether cable in each collapsible bin. Decide how you will divide and distribute the wax rings.
- Make sure the appropriate number of safety glasses, solder tubes, SeaPerch rulers, disposable gloves, and permanent markers are in bin (see Using the collapsible storage bins in the General Preparation section above).
- Use materials such as newspapers or butcher paper to cover the tables during the waxing and waterproofing process.

Make assembled controllers and charged batteries available for testing during various stages of thruster construction.



TEACHER TIP

After fully inserting the motors into the thruster housing, visually inspect the exterior for any air pockets. Pay particular attention to the area where the motor shaft exits through the drilled hole and around the motor terminals, as these spots are prone to air gaps that could allow water to enter and potentially short out the motors.



FRAME ASSEMBLY

For the frame assembly, students will decide on their frame design, measure and cut PVC pipe, drill holes in the pipes to mount the motors, and assemble the frame.

The *SeaPerch Build Manual* shows three unique designs that students can build using the components in the kit (see **Section 3: Frame Assembly**).

Some SeaPerch program leaders allow students to design their own frames while some leaders require the students to build one of the three standard designs. Determine in advance how you will approach the frame selection. As mentioned in the General Preparation section above, if your group is planning to use the ROV they build to compete in a Regional SeaPerch Challenge it is helpful to align the ROV design with the upcoming competition tasks. If competing, download and provide copies of the rubrics and challenge instructions for each team. Utilize this as a basis to promote creativity, innovation, and flexibility to adapt the frame iterations in the SeaPerch Build Manual to accomplish the tasks.

The Frame Pack contains five bags of PVC elbows, five bags of PVC tees, and five bags of small cable ties. Large components, like pipes, are not packaged in bags. Place one of each set of packaged parts (elbows, tees, short cable ties) in each of the collapsible bins. Place the following quantities of the loose parts in each of the bins:

- PVC pipes – six in each bin
 - Mesh – one in each bin
 - Pool noodles – two in each bin
 - Long cable ties – six in each bin
- Students should consider the ROV's purpose, buoyancy, size, and shape when selecting a frame design.
 - The students should also consider space requirements and how they will attach any additional components like sensors, cameras, grippers, probes, and collection devices.
 - Follow instructions in **Section 3: Frame Assembly** and refer to the lists of tools and components needed.



TEACHER TIP

Having an area for spare PVC parts is recommended with buckets or tubs for different types of PVC structures such as pipe, elbows, tees and other connectors.



FINAL ASSEMBLY

Students will attach the thrusters to the frame, secure the tether cable and mesh (if used), connect the controller, and test their ROV.

Refer to **Section 4: Final Assembly**, for instructions and for a list of tools and materials needed. Place the materials needed in each collapsible bin if they were not previously placed in the bins.

Ensure the students carefully follow the thruster placement and secure the motors as shown in the **Attaching the Thrusters** subsection.

Refer to the **Buoyancy Adjustment, Ballasting, & Trim Considerations** subsection. Adjusting buoyancy and ballast in the classroom or workspace is helpful and can save time before using the ROVs in a pool.



TEACHER TIP

In addition to completing the procedures in the **Post-Run Cleaning and Maintenance** subsection, inspect the motor shafts between the housing and the propeller for any hair or debris that may be wrapped around them. Use tweezers to carefully remove any obstructions.