

Building a Simple Submarine

Grade Level: 7th-12th

Length of Lesson: 45 minutes

Goals:

• Construct a model of a submarine's ballast system

- Develop an understanding of an active ballast system
- Develop skills to devise a ballast system for a SeaPerch ROV

National Science Standards:

- PS2.A: Forces and Motion
- PS3.C: Relationship Between Energy and Force
- ETS1.A: Defining and Delimiting an Engineering Problem

Materials:

- 24 inches of flexible tubing with a 3/8 inch outside diameter
- 16 oz. plastic soda or water bottle with cap
- Approximately 8 oz. of ballast weight
- Electrical tape
- 3/8 inch drill bit and drill
- 5 gallon bucket filled with water

Background

A submarine controls its ballast by allowing water to fill ballast tanks located around the ship. To make a submarine submerge, vent valves at the top of the ballast tanks open, allowing air to escape and water to fill the tanks through holes in the bottom. To make a submarine surface, the vent valves are shut and high pressure air is released into the tanks forcing the water out through the holes in the bottom.

Lesson: LAUNCH

- 1. Drill a 3/8 inch hole in the bottle cap and the bottom of the bottle.
- 2. Tape the ballast weight to the bottom of the bottle.
- 3. Place the flexible tubing in the hole in the cap and insert it about 1 inch.
- 4. Tape the tubing in place.
- 5. Screw the cap onto the top of the bottle.



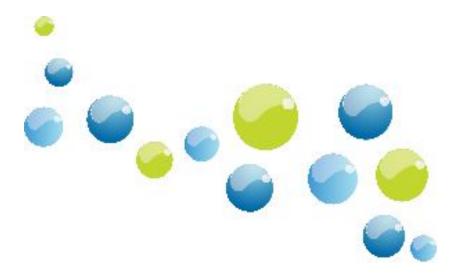
Lesson: INVESTIGATE

- 1. Place the bottle in the 5-gallon bucket and make sure your thumb is over the other end of the tubing.
- 2. Now remove your thumb and watch as the bottle fills with water. You should feel air rushing out of the tubing.
- 3. When the bottle has sunk to the bottom, blow into the tubing and watch the bottle come back to the surface.

Lesson: PRACTICE

Have students analyze the experiment and answer the following questions:

- 1. What did you observe?
- 2. Why do you have to place your thumb over the end of the plastic tubing to keep the bottle afloat?
- 3. How would you be able to put an active ballast system on your ROV?
- 4. What would be the advantages and disadvantages to an active ballast system?



Lesson credits: Harry Bohm and Vickie Jensen, www.westcoastwords.com

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