

## **Building A Simple Submarine**

*Submitted by Robert Valtos NSWC Philadelphia*

### **Overview:**

This lab will result in students understanding the principles of how a submarine controls its buoyancy.

**Grades:** 7<sup>th</sup> – 12<sup>th</sup>

**Time:** One 45-minute period.

### **Objective:**

The students will:

- Construct a model of a submarine's ballast system

### **Skills Attained:**

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

### **National Science Content Standards Addressed:**

- Unifying Concepts and Processes
- Science as an Inquiry
- Physical Science
- Science and Technology for grades 9-12

### **Lesson:**

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.

### **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

### **Procedure:**

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.

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

**Assessment:**

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

**References:**

*Build Your Own Underwater Robot and Other Wet Projects*

By Harry Bohm and Vickie Jensen,

Published by Westcoast Words, Vancouver, B.C., Canada

ISBN 0-9681610-0-6

<http://www.westcoastwords.com>