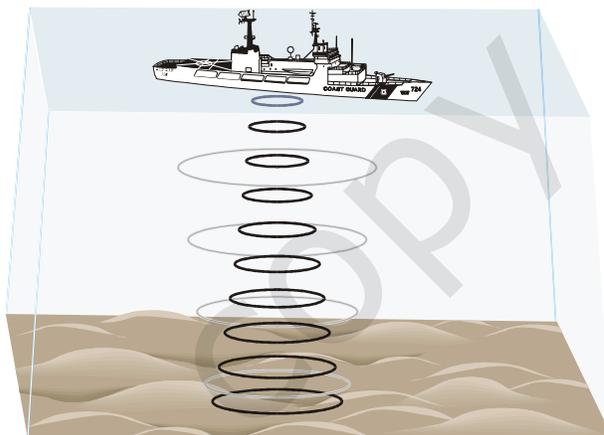


Mapping the Ocean Floor

Oceanographers, marine geologists, and archeologists use echo sounders to investigate objects below the surfaces of bodies of water. An echo sounder consists of a transducer that sends out and receives sound waves. A signal is sent out and bounces back from a submerged surface. Scientists use the speed of sound in water and the time it takes for the signal to bounce back to calculate the depth of the object. The deeper the object, the longer it takes for the sound to return. A map of the ocean floor is made by sending out a series of “pings” in a grid pattern and recording the depths. Echo sounders use different frequencies to map different things on the ocean floor.



Sonar, which is short for *sound navigation ranging*, is the name given to this echo sounding system. It was invented during World War I to detect submarines. The Vernier Motion Detector works in a similar manner. In this activity, you will use a Motion Detector to map objects on a simulated ocean floor.

OBJECTIVES

In this experiment, you will

- Use a Motion Detector to measure distances.
- Map simulated ocean floors.

MATERIALS

computer
Vernier computer interface
LoggerPro
Vernier Motion Detector

1 m board
masking tape
2 or more boxes

PRE-LAB QUESTIONS

1. What else can you think of that measures distance by sending out a sound signal?

2. What factors make it difficult to study the ocean floor directly?

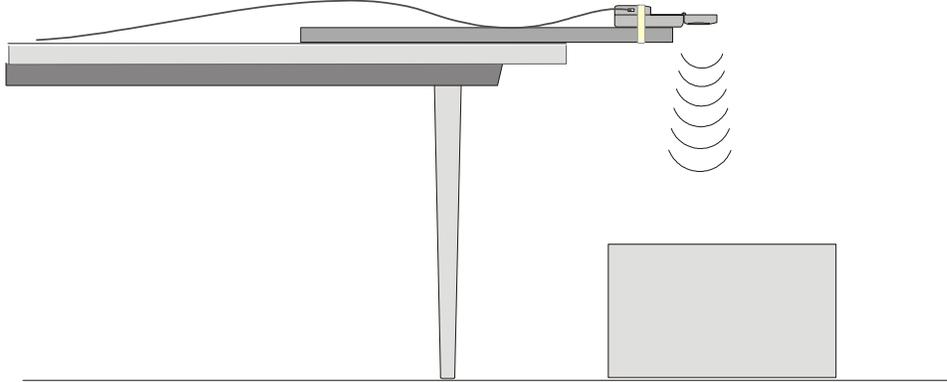


Figure 1

PROCEDURE

Part I Ocean Floor 1

1. Prepare the Motion Detector for data collection.
 - a. Get the board that will act as the support for your Motion Detector.
 - b. Tape or clamp the Motion Detector to one end of the board. Make sure that the round screen of the Motion Detector is not covered and is pointing downward.
 - c. Place the board with the Motion Detector flat on your table as shown in Figure 1.
 - d. Connect the Motion Detector. If your Motion Detector has a sensitivity switch, set it to Normal.
2. Prepare the ocean floor for data collection.
 - a. Place the box on the floor underneath the Motion Detector. **Note:** If your Motion Detector does not have a switch, it must be at least 40 cm from the top of the box.
 - b. Line up the Motion Detector so that when it is moved along the table edge it will pass over the box.
3. Prepare the computer for data collection by opening the file “19 Mapping Ocean Floor” from the *Earth Science with Vernier* folder.
4. Zero the sensor. Click on with the Motion Detector in place.
5. Collect data.
 - a. Move the board to position the Motion Detector to the left of the box.
 - b. Click to begin data collection.
 - c. When you hear clicking, slowly slide the board across the tabletop so that the Motion Detector passes over and past the box.
6. Record the measured distances.
 - a. After data collection stops, use the mouse to select a flat portion of the graph that represents the box.
 - b. Click on the Statistics button, . Record the Mean (average) height of the box in meters.
7. Sketch and label your graph.

Part II Ocean Floor 2

8. Prepare Ocean Floor 2.
 - a. Set up two boxes in the shape of steps. The tallest box must be at least 40 cm from the Motion Detector.
 - b. Repeat Steps 4-7. Be sure to record both distances.

Part III Hidden Ocean Floor

9. Your teacher will have a hidden ocean floor for you to measure. Repeat Steps 4-7 for the concealed object or objects

Graph Sketches

Ocean Floor 1

Ocean Floor 2

Hidden Ocean Floor

DATA

	Box height (m)
Ocean floor 1 single box	
Ocean floor 2 box 1	
Ocean floor 2 box 2	
Hidden ocean floor box 1	
Hidden ocean floor box 2	
Hidden ocean floor box 3 (if detected)	

PROCESSING THE DATA

1. Which was your best result? Why do you think it was better than your other results?
2. How did the shape of your graph compare to the actual object(s) in each case? Explain.
3. What factors might affect the accuracy of real ocean-floor mapping?

EXTENSIONS

1. Try other hidden ocean-floor arrangements.
2. Research the sonar process and compare it to what you did in this activity.

Vernier Lab Safety Instructions Disclaimer

THIS IS AN EVALUATION COPY OF THE VERNIER STUDENT LAB.

This copy does not include:

- **Safety information**
- **Essential instructor background information**
- **Directions for preparing solutions**
- **Important tips for successfully doing these labs**

The complete *Earth Science with Vernier* lab manual includes 33 labs, 6 projects, and essential teacher information. The full lab book is available for purchase at:

<http://www.vernier.com/cmat/esv.html>



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