

Bathymetric Mapping Research Cruise

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Background

As with any kind of traveling, it is very important to have a good map of your destination. This is true especially if your destination is the ocean floor.

Before sending down manned or un-manned vehicles scientists need to have a good idea about the features and conditions they are likely to encounter at their sites. Not knowing what obstacles or hazards are at depth could result in the loss of human life or equipment (which can sometimes cost millions of dollars). All research expeditions need to be carefully planned and a good map is always a good place to start.

Humans have been collecting ocean depth data since ~85 B.C. The first comprehensive maps of the ocean topography were compiled in 1959. Since then, technology and the use of satellites have meant that we can map more of the ocean floor more accurately than we ever have before.

Ship time used to do deep water research is very expensive so it is important to gather as much data as possible in the shortest period of time. Researchers plan their cruises very carefully to get as data as they possible can. Employing the right vessel can be just as important as planning the cruise.

Vessels like the R/V *Pelican* are used extensively to do oceanographic research. LUMCON is a member of the Universities National Oceanographic Laboratory System (UNOLS - <http://www.unols.org>) and the R/V *Pelican* is a designated UNOLS vessel.

The R/V *Pelican* evolved from a research vessel concept developed by a group of scientists from universities throughout the Gulf coast. She has four laboratories and is capable of taking 16 scientists to sea for periods up to three weeks at a time. R/V *Pelican* is based at LUMCON's DeFelice Marine Center in Cocodrie, LA.

The R/V *Pelican* has successfully conducted scientific trawling, large box core sampling, thirty foot piston cores, shallow seismic surveys, current meter array and benthic boundary array deployment and recovery. Plankton sampling, hydrographic casts with CTD-rosette systems and underway sampling with towed water sampling systems have also been successfully conducted.



Materials

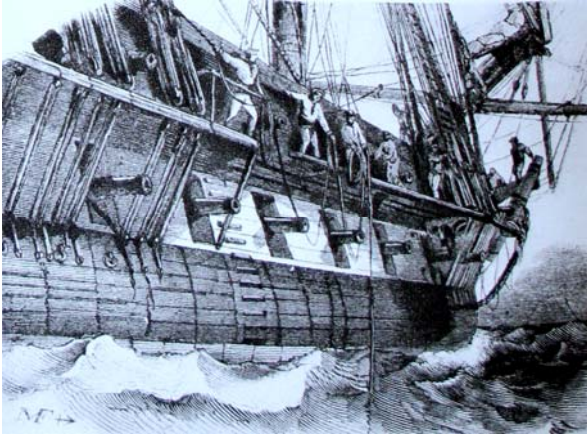
- Sea floor model (1/group)
- Box to fit around each model (1/group)
- Paper grid to fit on the top of each box
- 1 dowel/group marked off in centimeters
- One set of cruise scenarios
- Bowl or hat to pull scenarios from
 - Timers
- Research cruise log book (1/student or group)
 - pencils

Overview

This activity will simulate what an actual research cruise might be like. Students will use models of the ocean floor to gather bathymetric (underwater topography) data. Through the simulated cruise students will gain experience with . . .

- Collecting accurate data
- Keeping records of data collected
- Team building and decision making
- Ocean exploration technologies and research methods
- How to make a contour map

Finding Depth with Sounding



Finding depth using a weighted line.

Depth sounding refers to the act of measuring the depth of a body of water. In the past this was done very simply by lowering a weighted line into the water until the weight hit bottom. It was not until the early 1900s that researchers started using sound to measure the depth of the ocean. Echo sounding sends a pulse of sound to the ocean floor. By measuring how long it takes the sound to come back we can calculate the depth of the ocean floor. The use of echo sounding technology greatly advanced our knowledge of the ocean floor and plate tectonics. We could now map a larger area of the ocean floor in less time.

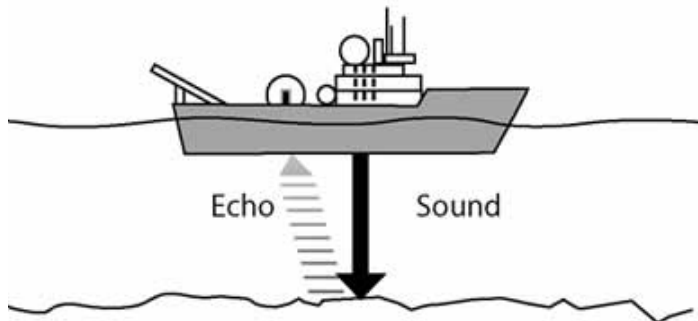
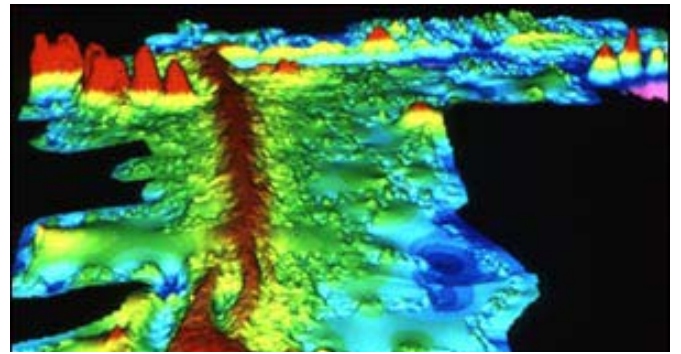


Diagram of how echo sounding is done.



With today's technology the maps of the ocean floor are getting very good. We now have a better understanding of the bathymetry of the ocean floor.

Ocean Floor Models

Ocean floor models can be made using a wide variety of materials. For this activity the models were made using sand molds and plaster of paris. Models can also be made using Styrofoam, modeling clay, or wooden blocks. If you plan on having your students make their own models have them research the following ocean floor features.

- Abyssal plain
- Abyssal hill
- Trench

- Seamount
- Guyot
- Continental shelf
- Continental slope
- Continental rise

Make sure that you give the students a standardized size for their models. You'll want the models to fit inside a box for the mapping cruise simulation.

Preparing for the “cruise”

Since one of the objects of the simulation is for students to create maps from the data they gather you'll want to switch the models around from group to group. No group should “map” their own model.

To keep students from seeing the models they are using place each model in a box. Boxes of a standard size can be used (be sure to tell students what size their models need to be) or you can make a box yourself using cake boards and duct tape.

Before class fit each model into the boxes. Cut out the bottom of the box so that the box can simply be slid over the model to make this step less time

consuming. Cover the top of the box with a opaque piece of paper (like package wrapping paper) with a grid drawn on it. The grid can be made using any increment you deem appropriate. Keep in mind that the smaller the increment the more resolution their maps will have.

You'll also want to print out a copy of the Cruise Scenarios (1 or 2 copies) and the research cruise log books (1/student).



The Simulation

Once you have the models in the boxes and the grids on the top you are ready to start the simulation. For an extension of this activity you can have students complete the “research funding proposal” and “research project budget”.

Explain to the students that they have a total of 5 days to accomplish the task for mapping their portion of the ocean floor (their models).

Each day will have the total length of 4 minutes (2 minutes of day & 2 minutes of night). Time can be kept by one time keeper (you) or students can be given timers to keep track of the time themselves.

Have the students select a scenario card from the “Pre Cruise” pile. This will give the students an idea of the kinds of things that can occur before the vessel even leaves the dock.

Start the simulation by starting the time. After a couple of minutes start handing out scenario cards. These cards are designed to teach students about the things that can occur during a cruise.

Students should collect data starting at A1 continuing down and back up to the top in column B. Tell them they should follow a “mowing the lawn” pattern.

Example Simulation Timeline

Pre Cruise: Students pick a “pre cruise” scenario card. Those that can start early should get started.

Minute 1: Every group (*except those that could start early*) should wait to start. This is the time it takes to reach the site they will be mapping. Students can make “adjustments” to their equipment to help them collect data more efficiently.

Minute 2: Every group can begin to collect their depth data. Remind them that they should be entering data into their log book with notes about anything that may be important to know later. If teams are broken up into day shift and night shift it is time to switch. If your groups are small everyone should have a task.

Minute 3: If you choose you can start handing out scenario cards.

Minute 4: Students should continue to collect data unless they have gotten a scenario card that prevents them. END OF DAY 1.

Minute 5: (Shift change) Have the student continue collecting data, pass out more scenario cards.

Minute 6: Same.

Minute 7: Same.

Minute 8: Same. END OF DAY 2.

REPEAT THE SAME UNTIL THE END OF Minute 19.

Minute 20: All groups should stop. This is the time it takes to make it back to the dock.

Post Simulation Activity:

At the end of the simulation students can graph their data and make contour maps.

See how many groups can identify the model they were mapping from the contour maps they make.

There are questions on the last page of their log book. These can be used as final reports for their research project.