NAME ________________________________ DATE_____________________

PARTNER(S) __________________________

EXPLORING LANDFORMS AND SEAFORMS

Forms on dry land are relatively easy to see and chart. We can recognize hills, rivers, mountains, and plains. Do you think the same landforms exist on the ocean floor? Why or why not?

Since the ocean floor is under water, how could we determine what it looks like?

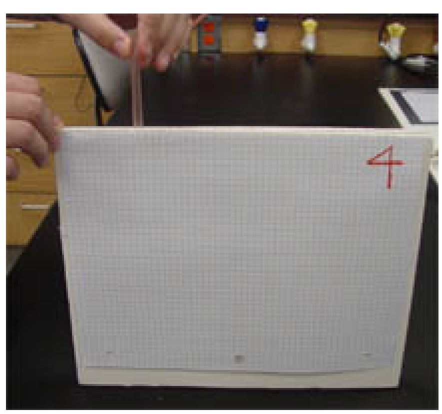
Let's Explore!

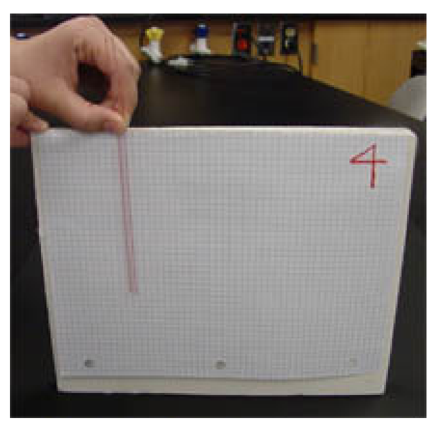
Activity 1: Ups and Downs of the Ocean Floor

Since we can't go out on a boat to measure the ocean depths ourselves, let's simulate the measurement. In the room there are 5 white models made from foamboard. You will not be able to see anything from the front or back but each of these represents a segment of the ocean floor. The "floor" is sandwiched between two pieces of foamboard. The tops of the models represent the sea surface. The models are numbered 1 to 5 but the numbers do not represent the order of the ocean floor segments.

1. Obtain one of the models and tape a piece of graph paper to the side of the model **with the label**. Be sure the top of the paper is level with the top of the model. Label the graph paper with the model number.

2. Starting at one end of the model, insert a drinking straw between the two outer foamboards until you "hit bottom". Pinch the straw at the point that represents the sea surface and withdraw the straw. Lay the straw against the graph paper in the same





position so that the point on the straw that represents the sea surface (pinched part) is at the top of the graph paper. Make a mark on the graph paper at the bottom of the straw. This marks the sea bottom.

3. Insert the straw about 1 cm from the original position and make and mark the depth measurement as you did before. Continue moving the straw and measuring until you have sampled all of the sea floor on your model. Carefully remove the graph paper.

4. Repeat steps 1-3 with another model. When finished do the same for the remaining models.

5. These models represent seafloor from one continental shore to another across an ocean. Lay out the five sheets of graph paper and try to assemble them so that they form a continuous sea floor. Tape the graphs together when you are satisfied. Compare your sea floors with other groups to see if they correspond.

   What model number sequence produced a continuous sea floor?

   __________ __________ __________ __________ __________

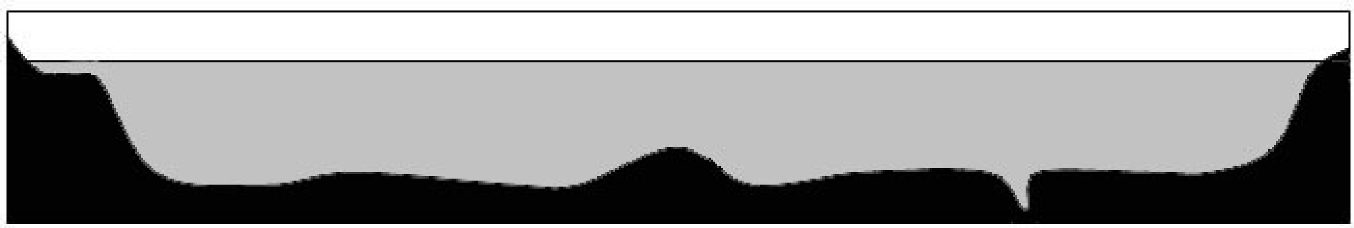
   What features can you detect on the sea floor?

   What processes might have formed the features you see?

6. Some of the ocean features can be thousands of meters below the sea surface. Remember that a meter is about 10% larger than a yard. Is it practical to drop a line to the sea floor bottom to measure? Why or why not?

7. Based on the names of the features below, try to label the sections of the sea floor on the diagram below. This diagram should correspond to the seafloor you uncovered and spans from one coast to another across an ocean. The gray represents ocean and the black is solid surface.

trench	abyssal plain	continental shelf
mid-ocean ridge	continental rise	continental slope



Activity 2: RADAR or SONAR – Using Energy for Ranging

If determining depth or height with a long object is not practical, how else could we measure the depth of the ocean or the height of a land surface from space?

Scientists have known that radio waves or sound (acoustical) waves will bounce off an object and be reflected back toward the source. All waves travel at the same speed through the same medium such as air or water (speed of light for radio waves, speed of sound for acoustical waves). Because of this, the length of time the waves take to travel to and from an object can be related to the distance from the wave source to the object.

Suppose you bounced radio waves off two objects, A and B. If it takes 15 seconds for the waves to return from object A and 8 seconds from object B, which is closer and why?

Earth scientists use radio waves to determine the distance to an object it is called **radar** (an acronym for "**ra**dio **d**etection **a**nd **r**anging"); when acoustical waves are used the process is termed **sonar** ("**so**und **n**avigation **a**nd **r**anging).

We can do this on a smaller scale using a device that emits and detects radio waves. If we attach the emitter/detector to a recording device such as a graphing calculator or computer with appropriate software we can store and display our data.

Let’s Try It!

1. Get a TI-CBR (calculator-based ranger), a TI-83 or TI-83+ graphing calculator, and a long connecting cable.

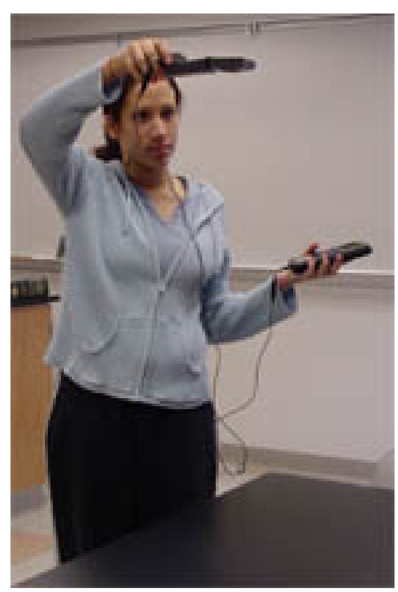
2. Connect the CBR to the calculator using the cable. Turn on the calculator. Press the **PRGM** button. If you see Ranger listed skip to the next step. If you have a TI-83+ check the menu under the APPS button. If Ranger is not one of the listed programs call the instructor to show you the simple way to load the Ranger program.

3. The radio waves are emitted and detected from beneath the metal screen section of the CBR. You will be running the CBR along a surface suspended above a “mystery terrain” (which may be behind a screen). The CBR will collect data for 10 seconds. Practice carefully running the CBR over the surface from left to right so that you traverse the desired distance in about 10 seconds (and the screened section is completely beyond the track surface and over the hidden terrain if appropriate).

   Sketch the terrain that you will be scanning in the box below.

4. When you are ready to collect data be sure the PGRM screen is showing on the calculator. Select the Ranger program (if it is not selected) and hit **ENTER** and **ENTER** again. When you see the Texas Instrument Ranger screen press **ENTER**. Select **1:SETUP/SAMPLE** and hit **ENTER**. The settings on the screen should be:

Realtime:	No
Time (s)	10
Display	Dist
Begin on	{Enter}
Smoothing	None
Units	Feet



If these are correct, use the up arrow to place the cursor next to **START NOW** and press **ENTER**. Position the CBR over one end of the surface. Holding the calculator and the CBR, press **ENTER** and start moving the CBR over the surface at a constant height from the floor. The calculator will display the word **Transferring...** during this process. When the clicking stops, the CBR has finished collecting data. The finished graph of distance versus time will be displayed. The x-axis represents the distance over which you move the CBR.

If you do not like the graph, you can repeat the sample by hitting **ENTER** and selecting **5:REPEAT SAMPLE**. Check with the instructor to be sure the graph is correct and sketch the graph on the next page.

Sketch the resulting graph here:

5. Does the graph generated by the CBR and calculator match the terrain sketch? Explain.

6. Now, let's think about the results before you make conclusions about the terrain. Remember that the CBR measures time for the radio signal to go and return. A long time will be plotted as a high distance value. Would a peak on the calculator graph represent a high or low point on the actual terrain?

What could you do to have the graph match the terrain?