Seeing What You Cannot See – RADAR

4th graders and up

Materials:
•one shoebox per team (Shoe stores usually give these away to teachers.)
•wooden skewers (minimum 1 per team)
•16 penny nail (one per team)
•centimeter grid paper (1 per team)
•data record sheet (1 per team)
•metric ruler (1 per team)
•one common object for each shoebox (bowl, large rock, etc.)
•minimum of one computer with a spreadsheet program (e.g. Excel)

Scientific Background
The students will imitate mapping the ocean floor using the basic concepts of radar. Explain what radar is and how it works.

Mentor Preparation:

1. Collect one shoebox for each team. Tape or glue a copy of the Bathymetry grid on top of the box. Place a common object, like a bowl or a rectangular plastic container, inside the box. Keep the object simple. More complex objects require precise measurements. I suggest taping the object to the base of the shoebox. This will prevent the object from sliding around when the box is moved***. (see figure 1 and figure 2)***
2. Lead a class discussion on how scientists map the ocean floor using radar. Tell them they are going to do an activity that will help them understand how this is done.

Student Procedure:

1. Divide the class into teams of 3-5 students.
2. Give each team a shoebox (see mentor preparation #1), 16 penny nail, wooden skewer, metric ruler, and a record sheet.
3. Demonstrate the procedure for poking holes at the intersections of the grid on top of the box using the 16 penny nail.
4. Demonstrate the procedure for using the wooden skewer to probe for the object. Remind them to stop when they touch the object, then measure the distance from the top of the box to the end of the stick. The students need to record this measurement on the correct spot on their data sheet. Be sure to remind them to measure in centimeters. Have them repeat this process until they have recorded all the measurements. (see figure 3 and figure 4)
5. When the students have completed this portion of the activity, they need to access a computer that has a spreadsheet program (eg Excel). Have the students follow the procedure for entering data in the database. Have them create different graphs using the data. If they use Excel, the “surface” graph provides the best graphic of the hidden object***. (see figure 5 and figure 6)***

6. F. Have the students open the box and compare the results of the graph with the real object.

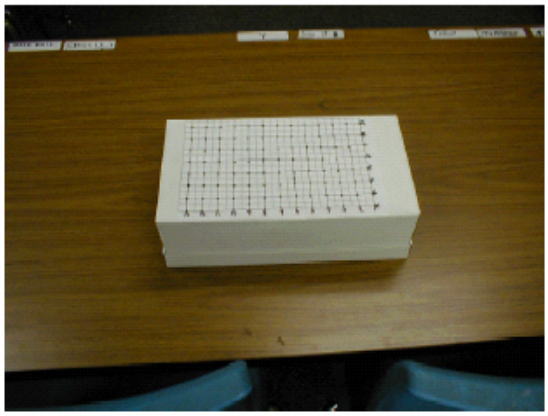


Figure 2

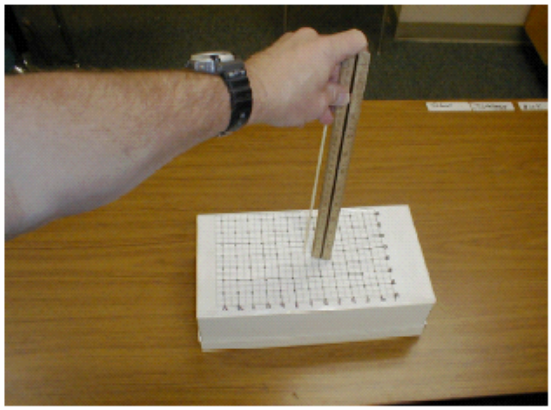


Figure 4

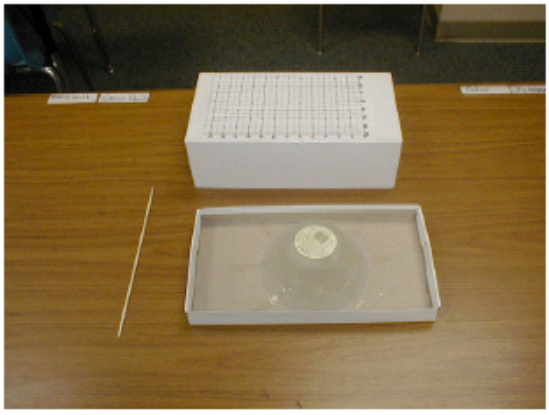


Figure 1

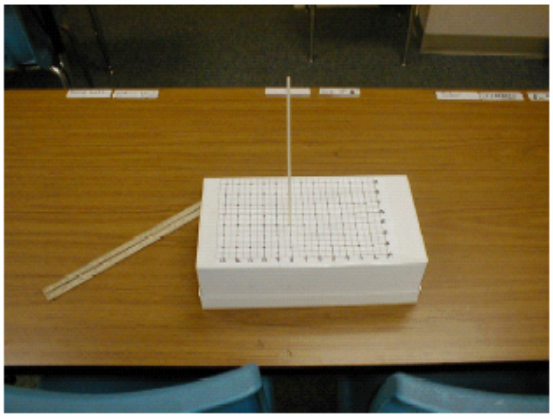


Figure 3

	a	b	c	d	e	f	g	h
1	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
2	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
3	15.6	15.6	16.5	17.5	16.8	16.5	15.6	15.6
4	15.7	17.2	19	20	20	18.4	16.5	15.6
5	16.5	18.8	21.7	21.8	21.8	21.1	18	15.7
6	17.7	19.5	21.7	21.7	21.7	21.8	19	16.5
7	17.5	20	22	21.8	21.8	21.8	19	16.5
8	17	18.5	21.2	21.8	21.8	20.5	17.5	15.6
9	16	17.5	18.3	19.3	19	17.5	16.6	15.6
10	15.6	16	16.5	17	16.7	16.2	15.6	15.6
11	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
12	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
13	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6

Figure 5

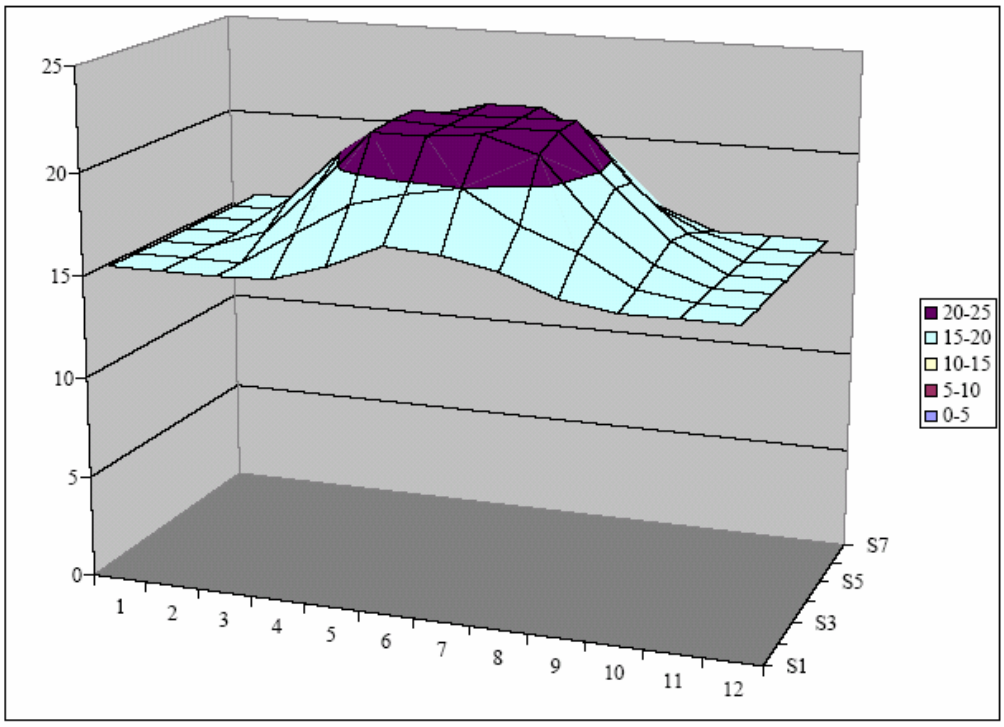
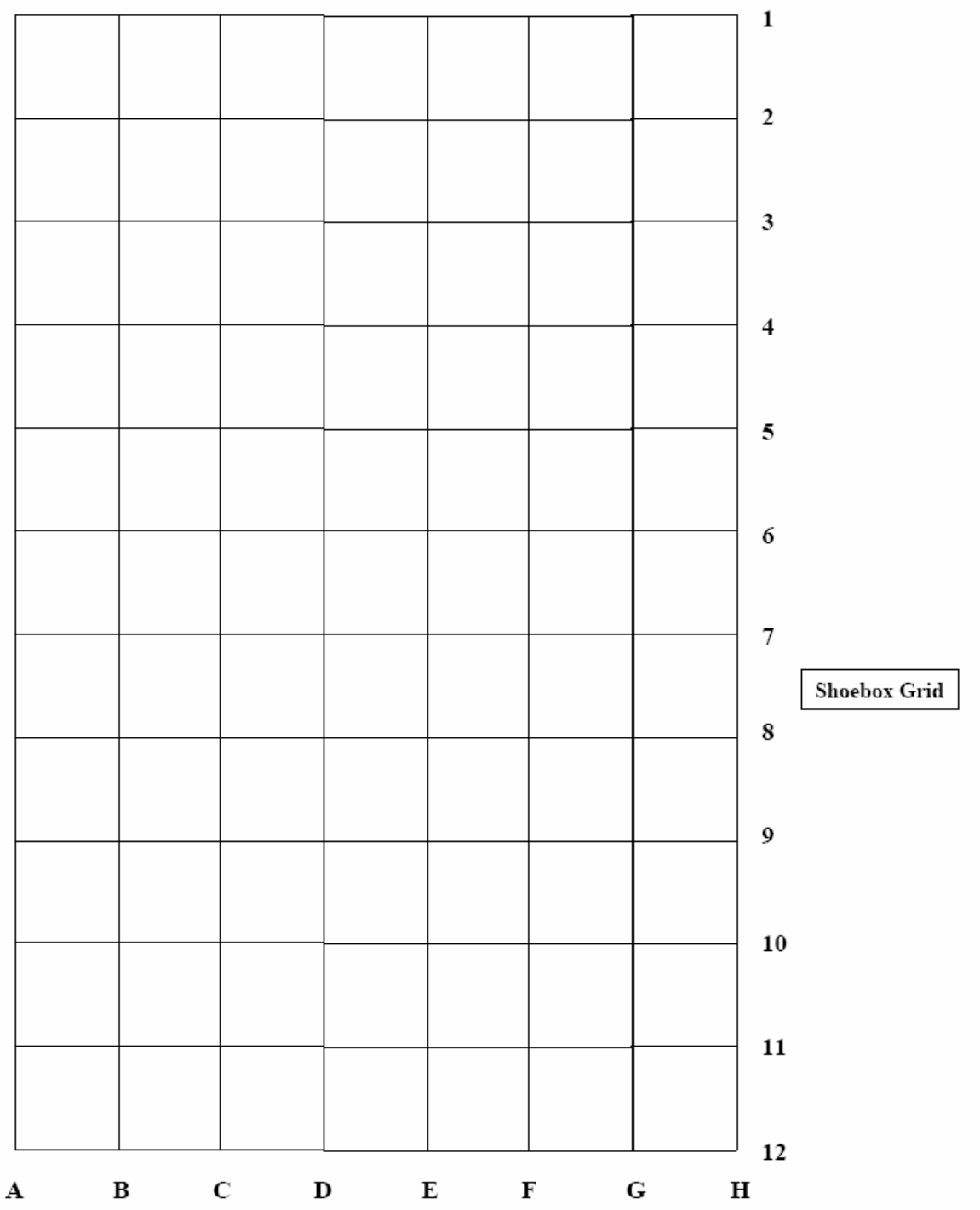


Figure 6
(Refer to figure 1 to see the real object in the shoebox.)


1
2
3
4
5
6
7
8
9
10
11
12
A
B
C
D
E
F
G
H
Shoebox Grid

Data Record Sheet

Directions: Use the nail and poke holes at every intersection on the top of the shoebox. Use tl wooden skewer as a probe. Put it into each hole and carefully lower it until it touches the bottom of the box or an object. Once it touches an object don't force it any further. Use a met ruler and measure the length of the stick to the nearest millimeter. Record this measurement below. Repeat this procedure for every intersection on the grid.

A – 1 _____mm	A – 2 _____mm	A – 3 _____mm
A – 4 _____mm	A – 5 _____mm	A – 6 _____mm
A – 7 _____mm	A – 8 _____mm	A – 9 _____mm
A – 10 _____mm	A – 11 _____mm	A – 12 _____mm
B – 1 _____mm	B – 2 _____mm	B – 3 _____mm
B – 4 _____mm	B – 5 _____mm	B – 6 _____mm
B – 7 _____mm	B – 8 _____mm	B – 9 _____mm
B – 10 _____mm	B – 11 _____mm	B – 12 _____mm
C – 1 _____mm	C – 2 _____mm	C – 3 _____mm
C – 4 _____mm	C – 5 _____mm	C – 6 _____mm
C – 7 _____mm	C – 8 _____mm	C – 9 _____mm
C – 10 _____mm	C – 11 _____mm	C – 12 _____mm
D – 1 _____mm	D – 2 _____mm	D – 3 _____mm
D – 4 _____mm	D – 5 _____mm	D – 6 _____mm
D – 7 _____mm	D – 8 _____mm	D – 9 _____mm
D – 10 _____mm	D – 11 _____mm	D – 12 _____mm
E – 1 _____mm	E – 2 _____mm	E – 3 _____mm
E – 4 _____mm	E – 5 _____mm	E – 6 _____mm
E – 7 _____mm	E – 8 _____mm	E – 9 _____mm
E – 10 _____mm	E – 11 _____mm	E – 12 _____mm

F – 1 _____mm	F – 2 _____mm	F – 3 _____mm
F – 4 _____mm	F – 5 _____mm	F – 6 _____mm
F – 7 _____mm	F – 8 _____mm	F – 9 _____mm
F – 10 _____mm	F – 11 _____mm	F – 12 _____mm
G – 1 _____mm	G – 2 _____mm	G – 3 _____mm
G – 4 _____mm	G – 5 _____mm	G – 6 _____mm
G – 7 _____mm	G – 8 _____mm	G – 9 _____mm
G – 10 _____mm	G – 11 _____mm	G – 12 _____mm
H – 1 _____mm	H – 2 _____mm	H – 3 _____mm
H – 4 _____mm	H – 5 _____mm	H – 6 _____mm
H – 7 _____mm	H – 8 _____mm	H – 9 _____mm
H – 10 _____mm	H – 11 _____mm	H – 12 _____mm

Directions: Use a computer and enter the data into a spreadsheet program. Create a surface graph using the program. This should give you a picture of the object inside the shoebox. Paste a copy of the graph below.

Acknowledgements: Adapted for Science Days from www.extremeenvironment.com