

NOAA Teacher at Sea Program

NOAA Hydrographic Survey

Activity Title: NOAA Research Cruise

Subject (Focus/Topic): Hydrographic Surveying

Grade Level: Grades 6-9

Average Learning Time: Approximately five to ten 50 minute class periods. The more research that is conducted on the ship the longer it may take.

Lesson Summary (Overview/Purpose): The students will be able to present to the class their research on the *Rainier* Hydrographic survey ship using whichever type of media they choose. The students will also be able to create a hydrographic sonar chart of a shipwreck using

Overall Concept (Big Idea/Essential Question): These activities are designed to help the students become more familiar with hydrography and its importance to mariners.

Specific Concepts (Key Concepts):

- Hydrographic surveying is the science of measuring and describing features on the sea floor.
- It is helpful to have for safe marine transportation, information about water depth, the shape of the sea floor and coastline, the location of possible obstructions, and other physical features of water bodies.
- Mariners use *nautical charts*, not maps, in order to document these hazards.

Focus Questions (Specific Questions):

- What is a hydrographic survey?
- Why are hydrographic surveys important?
- What are some important aspects of a research ship?
- What is a nautical chart?
- How does sonar work?

Objectives/Learning Goals:

- Students will be able to research and present information about the hydrographic research ship the *Rainier* using any media of their choice.
- Students will be able to take depth “soundings” of their shoebox topography and record their depths on their nautical chart.
- Students will color code their depths of their sounding boxes on graph paper like the sonar does during a hydrographic survey.
- Students will demonstrate basic chart skills as they practice using Institute of Navigation resources and then create their own chart from their sounding boxes.

- Students will demonstrate good presentation skills as they share their research and sounding boxes with their classmates.

Background Information:

According to the Office of Coast Survey, “hydrography is the science that deals with the measurement and description of the physical features of bodies of water and their littoral land areas. Special emphasis is usually placed on the elements that affect safe navigation and the publication of such information in a suitable form for use in navigation.” This publication is usually in the form of nautical charts so that dangers to navigation are displayed and the mariner knows of their location. Hydrographic surveying helps aid in making these charts show the most accurate and recent information. Some of the charts that the ship has on board can be over 100 years old! This is why it is so important that these ship and their crews are out using sonar to map the sea floor. It may be a slow process, but its worth it for the safety of the ships, their cargo and crew.

Common Misconceptions/Preconceptions: Most students and even adult’s think that the visual aids that mariners use are called “maps”. However, they are actually called charts. Students may also have the misconception that we know a lot about the sea floor thanks to satellites and other technology. However, there are always new dangers to navigation that need to be documented and shared with mariners.

Materials:

- Shoebox
- Toy ship or object that can resemble a shipwreck
- Wooden skewers
- Markers
- Playdough, clay, plaster of paris (depends on what the instructor wants the students to use)
- Graph paper

Technical Requirements:

- Computers for students to use when researching their ship.
- Projector to present information to the class or for students to present their projects.

Teacher Preparation:

The teacher will need to make sure that they have an understanding of hydrographic surveying and nautical charts. The websites listed below are a good place to start for background information. The teacher will also need to let the students know that they will need a shoebox ahead of time so that each student has one. If some students have extras then they can be shared with other students in the classroom.

Keywords:

Hydrography, hydrographic surveying, NOAA, nautical chart, beacon, *Rainier*, depth sounding

Pre-assessment Strategy/Anticipatory Set:

Have students list everything they know about ships. Go over this list with the students and discuss what they came up with. Next, have students list everything they know about a hydrography ship. More than likely, the students will be somewhat stumped. Ask the students to break down the word *hydrography* and look for familiar words within it. Students may then find the word *hydro* and *graphy*. Talk about the meanings or have students look it up. Following this discussion inform the students that they will be starting their own adventure as they research a hydrography ship and what it does, learn how to use nautical charts like the ones on the ship, and finally they will “paint the sea floor” like real hydrographers using sounding boxes.

Lesson Procedure:

It is best to start off with students conducting research about the ship and hydrographic surveying before they start on the charts and sounding boxes. This will provide a better base of background knowledge. Once the students have an understanding of how the ship works and how important hydrography is then the students will start the next step of learning what a nautical chart is, how to read one, and how important it is to know where the dangers to navigation lie. Finally, after the students have shown that they understand how to use a nautical chart will they begin making their sounding boxes. The details for students constructing their boxes and taking depth measurements are below. The students will then put together a presentation for their classmates about their own nautical chart and all of their research information that they have collected during the course of this project.

Assessment and Evaluation: Scoring Rubric made on Rubistar.com

Oral Presentation Rubric : Hydrographic Survey Presentation

Teacher
Name:

Student Name:

CATEGORY	6	4	2	1
Enthusiasm	Facial expressions and body language generate a strong interest and enthusiasm about the topic in others.	Facial expressions and body language sometimes generate a strong interest and enthusiasm about the topic in others.	Facial expressions and body language are used to try to generate enthusiasm, but seem somewhat faked.	Very little use of facial expressions or body language. Did not generate much interest in topic being presented.

Listens to Other Presentations	Listens intently. Does not make distracting noises or movements.	Listens intently but has one distracting noise or movement.	Sometimes does not appear to be listening but is not distracting.	Sometimes does not appear to be listening and has distracting noises or movements.
Speaks Clearly	Speaks clearly and distinctly all (100-95%) the time, and mispronounces no words.	Speaks clearly and distinctly all (100-95%) the time, but mispronounces one word.	Speaks clearly and distinctly most (94-85%) of the time. Mispronounces no more than one word.	Often mumbles or can not be understood OR mispronounces more than one word.
Stays on Topic	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
Posture and Eye Contact	Stands up straight, looks relaxed and confident. Establishes eye contact with everyone in the room during the presentation.	Stands up straight and establishes eye contact with everyone in the room during the presentation.	Sometimes stands up straight and establishes eye contact.	Slouches and/or does not look at people during the presentation.
Content	Shows a full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.
Volume	Volume is loud enough to be heard by all audience members throughout the presentation.	Volume is loud enough to be heard by all audience members at least 90% of the time.	Volume is loud enough to be heard by all audience members at least 80% of the time.	Volume often too soft to be heard by all audience members.

Originality	Product shows a large amount of original thought. Ideas are creative and inventive.	Product shows some original thought. Work shows new ideas and insights.	Uses other people's ideas (giving them credit), but there is little evidence of original thinking.	Uses other people's ideas, but does not give them credit.
Sounding Box	The sounding box is complete and shows the shipwreck along with where the soundings were made.	The sounding box is mostly complete. There could have been a few more soundings made in order to be more accurate.	The sounding box is somewhat complete. There could have been more topography within the box and more soundings made.	The sounding box is not complete. There are not different levels of topography, there is no ship, or not enough soundings were made to make a complete chart.
Nautical Chart Survey	The nautical chart survey is complete with varying colors and numbers for depths.	The nautical chart survey is mostly complete with varying colors and most have numbers for depths.	The nautical chart survey is somewhat complete. Some of the colors and depth numbers are not correct.	The nautical chart survey is not complete. It is missing varying colors and numbers for depths.
Nautical Chart Tasks	The nautical chart has everything that was required such as scale, key, compass, title, beacons, and island.	The nautical chart has almost everything that was required. One item was missing from the chart.	The nautical chart is missing a couple of required items.	The nautical chart has numerous requirements missing.
Neatness	The nautical chart is neat, easy to read and understand.	The nautical chart is mostly neat, easy to read and understand.	The nautical chart is somewhat neat, easy to read and understand.	The nautical chart is not neat, or easy to read and understand.
Listens to Other Presentations	Listens intently. Does not make distracting noises or movements.	Listens intently but has one distracting noise or movement.	Sometimes does not appear to be listening but is not distracting.	Sometimes does not appear to be listening and has distracting noises or movements.

National Science Education Standard(s) Addressed:

- Content Standard A – Science as Inquiry
 - Ability necessary to do scientific inquiry
- Content Standard D – Earth and Space Science
 - Structure of the Earth system
- Content Standard E – Science and Technology

- Abilities of technological design
- Content Standard G – History and Nature of Science
- Nature of science

Additional Resources:

<http://northlandpreparatoryacademy.wikispaces.com/>
http://en.wikipedia.org/wiki/Hydrographic_survey
<http://oceanservice.noaa.gov/navigation/hydro/#3>
http://oceanservice.noaa.gov/education/lessons/plot_course.html
http://www.nauticalcharts.noaa.gov/staff/education_activities.htm
<http://www.usc.edu/org/seagrant/Education/IELessons/Unit1/Lesson1/U1L1A.html>

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Created: October 2011

Hydrographic Surveying and Charting

For this project you will first need to go through the Power Point presentations about hydrographic surveying. This will give you an overview of what it is, the process of collecting data, the history, and why it is so important. You will be using the information you have collected about the NOAA hydrographic research ship Rainier to make a presentation that includes a “sounding” box, nautical chart, and a summary of everything you have learned while Mrs. Heins has been at sea. Be ready to present your research and information to Mrs. Heins and your classmates on **October 10th** . This gives you two weeks to complete the tasks and it is worth 80 points.

Name _____ Date _____ Period _____

NOAA Hydrographic Research Ship _____

PART I. RESEARCH

1. How did the *Rainier* ship get its name?

2. Where does the *Rainier* do most of its hydrographic surveying?

3. About how long does the *Rainier* sail at sea?

4. Under the *Life at Sea* link, what are four observations that you can make about living at sea?

- 1.
- 2.
- 3.
- 4.

5. When was the boat first commissioned?

6. Where is the boat's homeport?

7. What is the length of the boat?

8. What is the cruising speed of the boat?

9. How many nautical miles can the boat travel in one cruise? About how many days is that?

10. How many miles is a nautical mile?

11. How many gallons of fuel can the boat store?

12. What type of fuel does the boat use?

13. How many gallons of freshwater are stored on the boat?

14. The *Rainier* has two desalinators. What are these and why would they be helpful to a boat that spends many weeks at sea?

15. About how many gallons of water are used a day on the boat?

16. What is the history of surveying the sea floor?

- Pre-1940's

- 1940-1998

- 1998-Present

17. What is True North?

18. What is Magnetic North?

19. What is sonar and how does it work?

20. Why is it so important that hydrographic surveys are conducted along our waterways?

Part II. Vocabulary

Bathymetry -

Nautical Chart -

Hydrography -

Topography -

Contour Line -

Elevation -

Depth -

Sonar -

Presentation

Your presentation will include many elements that you have learned from Mrs. Heins experience at sea on the NOAA hydrographic survey research ship. Here are the elements that you will need in order to have a successful presentation. The scoring rubric is in this packet.

- 1) You will present your hydrographic sounding model shoebox.
- 2) You will present your nautical chart with depth colorings and all other requirements listed.
- 3) You will give an oral presentation of a summary of all the information that you collected on hydrographic surveying and the *Rainier*. This "speech" should be about 3-5 minutes long. You may use any type of media or creative ideas to help you present this material. (Have fun with it!)

Part III. Use a Nautical Chart (From the Institute of Navigation)

Worksheet 1 - Nautical Charts

Name: _____ Date: _____

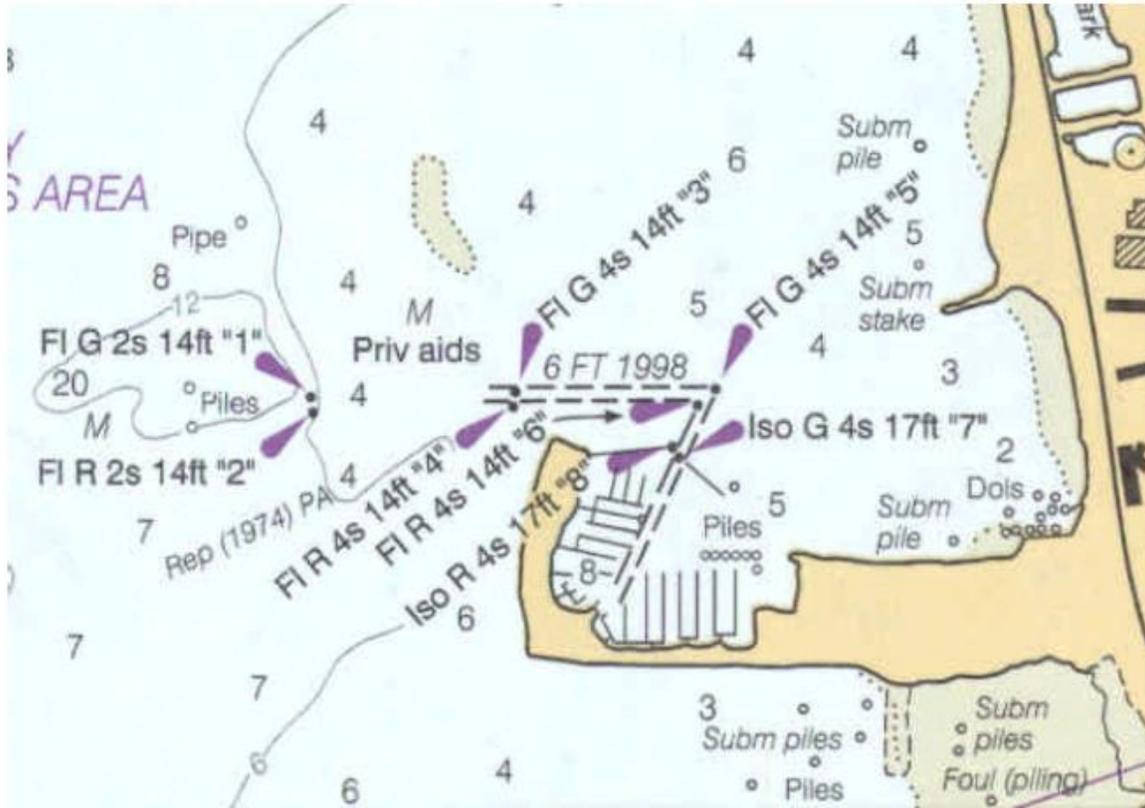


Image: part of an actual nautical chart for the San Francisco Bay.

Question 1: The numbers on the chart above show the depth of the water, in feet. What is the deepest depth of the chart? _____ What is the shallowest depth? _____ Circle those on the nautical chart.

Question 2: All the black dots with the purple (or dark) arrow pointing towards them are beacons. Beacons are like small floating lighthouses. The flash a certain color of light. How many beacons are there? Write the number: _____.

Roads of the Sea

Beacons help sailors figure out where they are and where they should be going. Beacons are like the roads of the sea. If you are traveling to land, a green beacon is like the right side of the road. A red beacon is like the left side of the road. So how do we tell which color the beacons are? Right next to each beacon is a description.

On the map above find the beacon that is FI G 2s 14ft "1." Put an "x" on it with your green pencil. This is actually 5 different things: FI, G, 2s, 14ft and "1." They each tell us something different about the beacon.

What does all this mean?

FI – tells us what type of beacon it is. "FI" stands for flashing, so this is a flashing beacon.

G – tells us what color the beacon is. "G" stand for green, so this beacon flashes green light.

2s –tells us how long between each flash. "2s" stands for 2 seconds, so this beacon

flashes every 2 seconds.

14ft –tells us how high the beacon is. “14ft” stands for 14 feet, so this beacon is 14 feet tall.

“1” – tells us what the beacon is numbered. This is beacon number one.

Question 3: Find the beacon that says Fl R 2s 14ft “2.” Put an “x” on it with your red pencil.

What type of beacon is this? _____ How often does it flash? _____

What color is this beacon? _____ How high is this beacon? _____

What number is this beacon? _____

Question 4: Now find all the green beacons and put an “x” on them with your green pencil.

Now find all the red beacons and put an “x” on them with your red pencil.

How many green beacons are there? _____

How many red beacons are there? _____

Question 5: These beacons form a road in the sea. If you are going to land, or to dock your boat, the green beacons are markers for the left side of the road, and the red beacons are markers for the right side. Looking at the nautical chart above, there is a dotted line that shows the “road” to get into the harbor. Mark this “road” with your purple pencil.

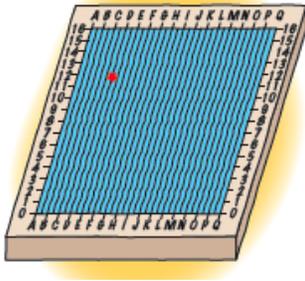
Question 6: There are all kinds of things sailors have to watch for and avoid, like stakes and piles, and pipes. These are usually marked with little circles. Circle all the landmarks that sailors should avoid with your red pencil.

Question 7: Boats come in all different shapes and sizes. Some of them might go 10 meters down in the water. If you were sailing into the harbor, what would be the deepest your boat could be? _____

Part IV. Create a Nautical Chart for Your Shipwreck (Adapted from the NOAA *The Water Writers and NOAA Learning Ocean Science through Ocean Exploration Section 2: Mapping the Ocean Floor: Bathymetry*)

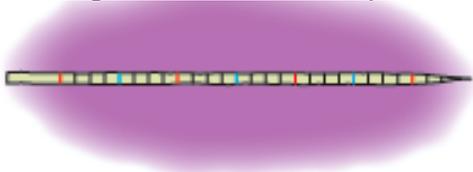
Students will create a bathymetric map of a model underwater feature using a sounding box.

1. Get an empty shoebox with a lid to create your “ship wreck” in.
2. Place a plastic toy ship or any type of object to represent your ship into your shoebox.
3. Use clay, play dough, modeling putty, or plaster of paris to create a varied sea floor topography around your shipwreck.
4. When construction is completed (and dried), tape the shoebox lid on and leave it there for the duration of your project (no cheating by opening it up to look at your wreck!).
5. Tape graph paper to the top of the shoebox so that you have a grid system for your hydrographic chart. (The smaller the grid the more accurate it will be. However, 1cm grid paper should be fine.)
6. Label one side with letters and the other with numbers so you can plot your points.



Grid with letters and numbers on top of the shoebox lid.

7. Have a second piece of graph paper that looks just like the one on your box for you to record your data on. This is the nautical chart that *YOU* will be making for your presentation. The title should include “Sounding Box Plotting Sheet” on it along with anything else you would like to add.
8. Create holes at each intersection along one lines of the grid paper. You may want to use a small nail or thumb tack. Please have adult supervision or help with this part.
9. There are many items that can be used as “soundings” or “pings” for your sonar. These include wooden skewers, pipe cleaners, coffee stirrers, or anything else skinny and sturdy that you can make markings on. I recommend the wooden skewers because you can mark the different depths with different colored markers.
10. Mark your wooden skewer every centimeter with a felt-tip marker. If you have colored markers, you can use different colors to mark each centimeter on your “sounding”. For hydrographic surveying, the different depths have different colors. Reds are shallow, orange, yellow, green, blue, and then purple is the deepest. This makes it easier to tell how deep the skewer is when you take “soundings”.



Centimeter markings on the “sounding” skewer.

11. Gently insert a pipe cleaner or coffee stirrer (“sounding”) into the holes created earlier to determine the depths of your “ocean floor”.
12. Read the “depths” of your skewer (sounding) and record this measurement in the same place on your “Sounding Box Plotting Sheet” that matches the sampling location on your shoebox lid. These numbers will tell me the various depths of the survey on your nautical chart.



13. By recording how deep the “soundings” are you will be able to decipher various heights of the "underwater topography" and your shipwreck.
14. Keep recording “soundings” until you think you have a clear picture of the model seafloor and your shipwreck.
15. In relation to hydrographic surveying, each depth in centimeters should have a different color on your plotting sheet.
16. Remove the lid of shoe box to see if your drawing matches the contour in the shoe box.
17. Save your shoe box ocean floor and plotting sheet to include in your hydrographic survey presentation.

Make your Own Nautical Chart Continued

Step 1: Give your nautical chart a name on the Plotting sheet, such as “Igor’s Island” or “Holly’s Hideaway.”

Step 2: Draw an island somewhere on your chart. Do not make it too big, as you do not want to cover up your shipwreck.

Step 3: Your chart should already have depths on it from your soundings. Make sure you have created a key so that I know which colors correspond with which depth.

Step 4: Draw a compass rose with True North and Magnetic North.

Step 5: Draw a scale within or near the map key. What distance does each square on your grid represent?

Step 5: Draw at least two beacons on your chart and have the description next to them so I know what they are used for. (Use your previous nautical chart activity to help you.)

Step 6: Make sure your chart is neat, readable, and ready to present to the class.