

Not attempting to answer questions on expeditions will result in point deductions on course workbook (**two or more blank answers** will result in a deduction of 2-4 points; a 5 point deduction will be assessed if **more than five answers** are left blank).

Objectives: (1) Students will experience life on an oceanographic ship during a seafloor mapping survey of the region between the Golden Gate, Alcatraz Island, and Angel Island. Students will learn the scientific methods that are used to produce images of the seafloor and the features that cover it and begin to interpret the meaning of these features.

Remember to take notes as the questions in this worksheet only provide an outline!

1. Introduction - Welcome To Our Expedition on the Bay!

Many techniques are used to study the seafloor; sometimes images of the seafloor are created other time the seafloor is sampled directly, however each technique has its strong and weak points, both together they are used to map the seafloor.

What are the primary objectives of this survey:

(1) _____

(2) _____

(3) _____

2. The Idea - What was the Inspiration for this Study?

Why might it be important to study large rocks on the bottom of the bay?

3. Boarding the Ship

Where are we joining the ship? _____

What is the name of the research vessel on which we will conduct our work?

Who owns and operates this vessel? _____

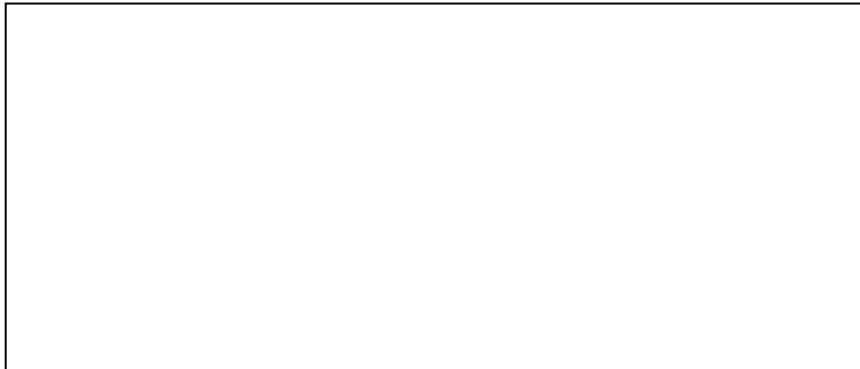
4. Tour of the Ship

What do you think of your stateroom, the galley and the science lab (not quite Princess or Carnival Cruise lines)?

5. On the Fantail or Back Deck - Viewing the Equipment

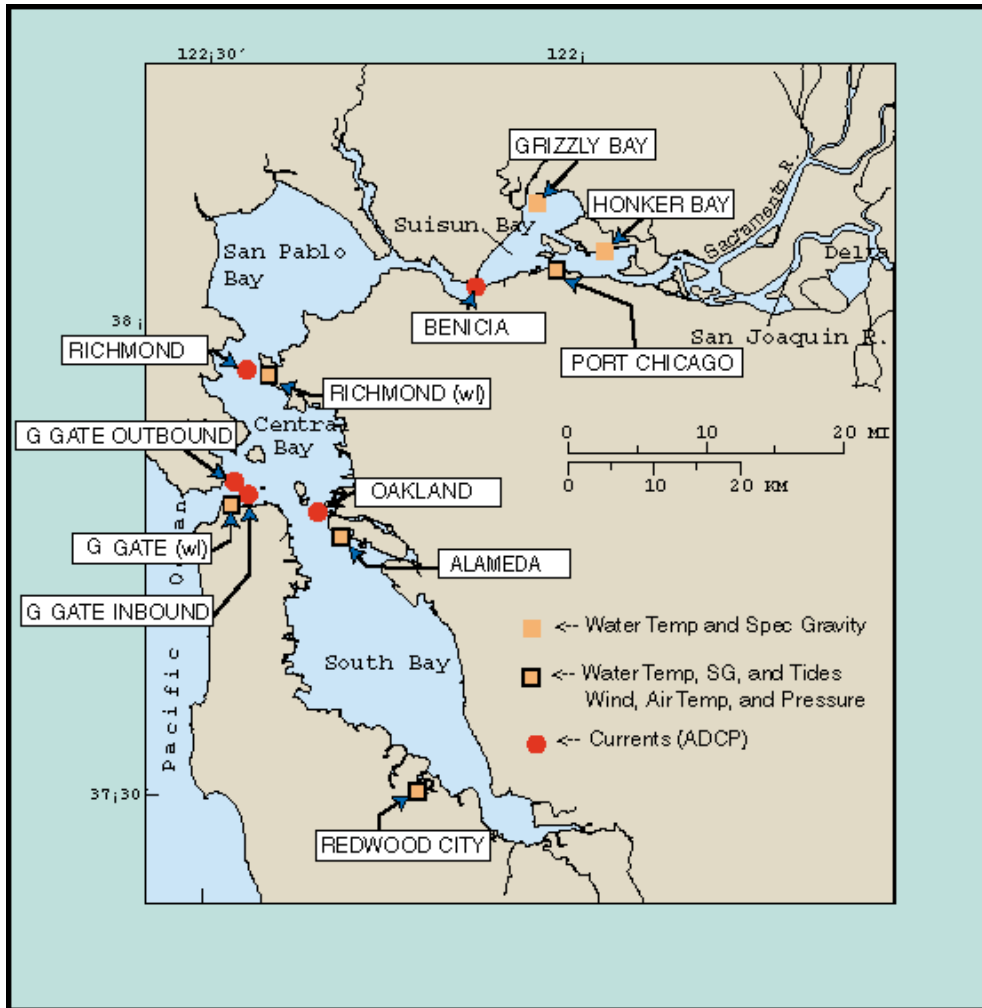
What type of sonar system will you be using on this voyage? _____

Draw a picture illustrating the operation principles of the sonar system used in your research



Describe how this system works.

6. Preparing to Depart - Marine Conditions



Here is a map showing locations around the bay where the tide is measured.

a) What is the water level in the bay?

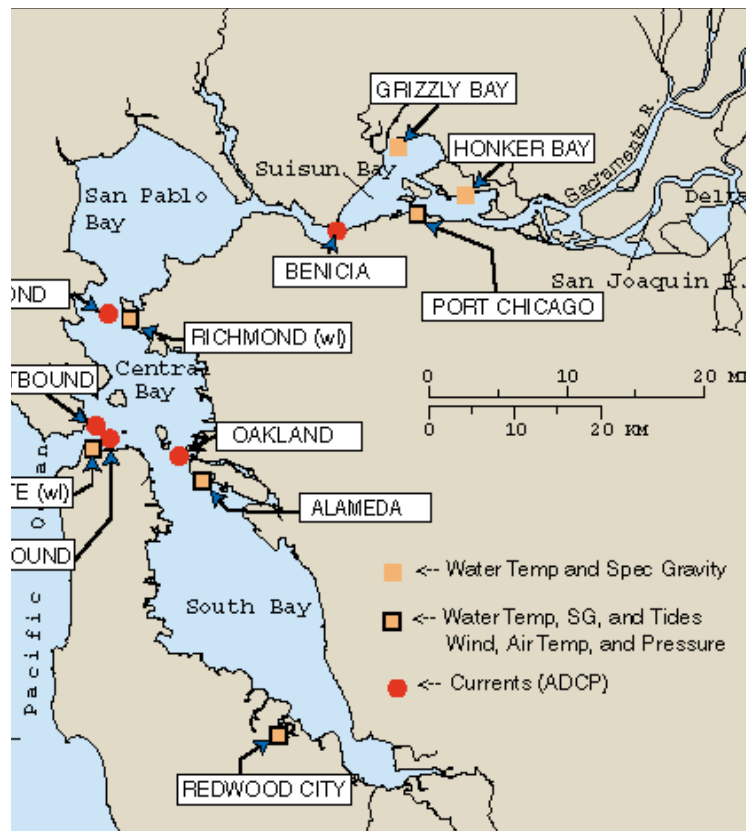
By clicking on "What is the water level in the bay?" - a pop-up window will be activated to show the data at each station around the bay.

Station	Tide Height (from MLLW)	Is Water Level Rising or Falling?	Winds (Knots & Direction)	Time (PDT)
Alameda				
Golden Gate				

Using the table above, record the tidal height, whether tide is rising or falling, wind speed and direction, and time at the two locations nearest to Pier 32, where our ship is docked

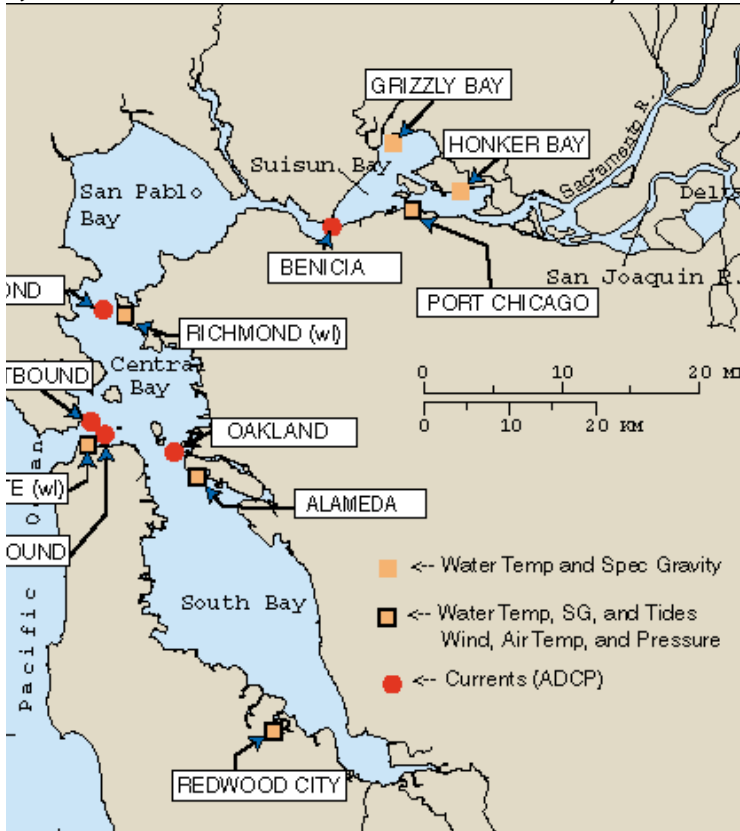
Why do you think that we might want to know the timing and height of the tides before leaving the dock?

b) What is the wind speed and direction? On the map below, draw at least seven arrows, technically called vectors, that show the direction of the wind over the bay area at the present time- make the length of each representative of the wind speed (click on any arrow on the map on your web page to obtain the wind speed at that location - see display at lower right corner of image on web page).



Next, summarize the patterns of the winds

c) What are the directions of currents in the Bay?



Like the diagram for the winds, draw arrows on the map above that represent the direction and speed of the currents, include a scale on your map (like the one on the web page).

d) What is the weather forecast for the region of our study?

Based on the information above, should we depart from the dock?

7. Leaving the Dock

Are you ready to go to sea?

8. The Scientific Meeting

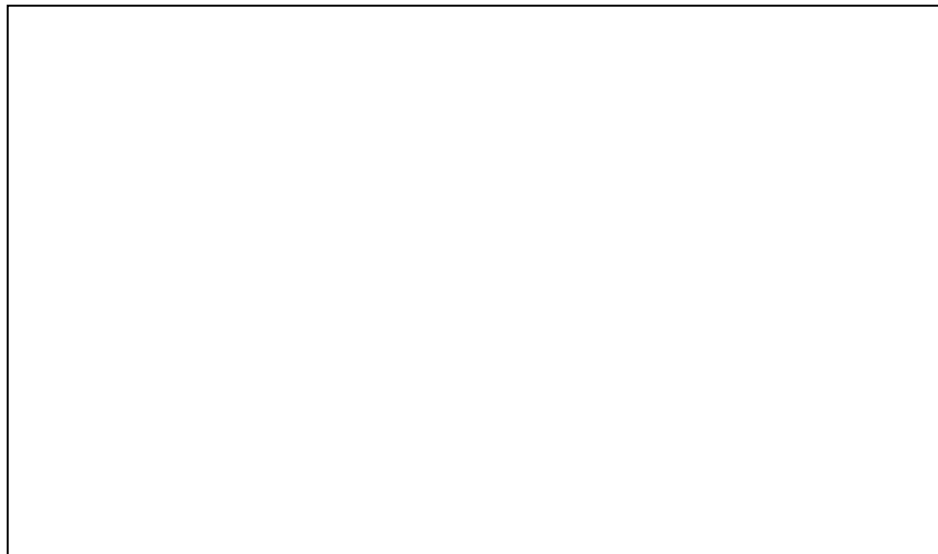
What will be your duties on the voyage?

9. San Francisco Bay-Delta-Estuary

What does the San Francisco Bay mean to you?

10. Navigating to the Survey

Where is our survey located (make a map and describe the location of the survey)?



How will we determine our location at any minute of the voyage?

11. Beginning the Survey

What is the plan for collecting the survey?

12. First Swath of Data

What property of the sonar energy do we measure in multi-beam sonar, which is then used to make our image of the bay floor?

13. Back and Forth and Back and Forth - Building the Mosaic

How is the image of the bay floor converted from a signal swath of data to a mosaic showing the entire survey area?

14. Visualizing the Bay Floor - Processing the Data

Describe each of the following types of maps that can be produced during your analysis using the multi-beam sonar data (make sure that you click on the links in the table to see an example of each type of map)

Contour Map

(Shaded) relief map

Color coded bathymetry and shaded relief map

Oblique perspective of color coded bathymetry and shaded relief map

Multiple oblique perspective views of color coded bathymetry and shaded relief map

15. Interpreting the Image - Research Objective #1

List the water depth to the top of the following submerged rocks:

Harding Rock _____ (meters)

Shag Rock _____ (meters)

Arch Rock _____ (meters)

16. Interpreting the Image - Research Objective #2

Describe how the bay floor at the disposal site near Alcatraz changes over time.

What is the current status of the disposal site? (is it full, half-full or empty)?

17. Interpreting the Image - Research Objective #3



Locate on the above map, each of the features listed below, by encircling the feature with a line and providing a label:

- i. Opening to the Pacific Ocean at the Golden Gate, San Francisco, Alcatraz, Angel Island, and Bay Bridge,
- ii. areas of sediment waves ("bedforms"), which are migrating ridges of mud on the bay floor,
- iii. the flat areas of the bay floor,
- iv. the regions of the rocks that stick out of the bay floor,
- v. the site of the disposed dredged materials, and
- vi. any other features that you can identify

18. Compare Maps

Compare your map to my version

Click individual features to see an expanded version

19. Future Studies

On a previous page, you made a number of interpretations or hypotheses concerning the nature of features on the map of the bay floor.

How would you go about testing each one of your interpretations? What other types of data do you want to collect and where (make stars on the map on the previous page to mark sample locations for your next research project)?

Here is the outcome of your efforts

Take some time to examine the map shown on this page and follow the flyby - you should be able to identify the features.

You begin over top San Francisco, then fly northwards past Alcatraz, then around Angel Island and through Raccoon Strait, back towards Alcatraz and over the three rocks mapped in the survey, and finally westward to the deep water area under the Golden Gate Bridge. (You can replay the flyby over and over again by click on the arrow at the lower left corner of the player)

Next fly over the seafloor on the ocean side of the Golden Gate to examine enormous underwater sand dunes that are formed by the flow of the tide in and out of the Golden Gate. The flyby ends looking southward along Ocean Beach in San Francisco.

20. Scientific Meeting at End of the Cruise

Was the cruise successful?

How will these data be used in the future?

21. Departing the Ship

Thank you for participating in our mapping voyage on the bay.

Here are some of the learning outcomes that I hope that you have obtained over the past 90 minutes:

1. Planning and operation of an oceanographic research vessel.
2. Use of real-time oceanographic data on the WWW
3. An initial understanding of GPS navigation
4. Several methods of seafloor imaging and visualization
5. Interpreting scientific data in two and three dimensions
6. Formulating new scientific hypotheses based on your interpretations of the data
7. A new appreciation for the dynamic system operating in the San Francisco Bay.

1 minute essay - Summarize what you learned in this expedition - Avoid the "I learned a lot about" syndrome - show some insight

Post any questions that you have on the material in the "Exped. 5 - Mapping the Bay - Any Questions?" discussion area.

An answer key is provided for this expedition since the material is covered on Exam #1

In order to receive credit for completing this expedition and have access to answer key,

Go to Desire2Learn Email and send "Bye Don"

- "End Expedition 5" in Subject Line. (VERY IMPORTANT)
- Include "Bye Don" in body of email,
- Include "Completion Word" (see last page of expedition) and write your name in body of e-mail message

