# Nautical Chart Challenge

For as long as anyone in his family could remember, Francis Beaufort wanted to make scientific observations from the deck of a ship. In 1789 at the age of fourteen, he set sail as a sort of officer-in-training aboard the Vansittart, an East India Company tradesman bound for China and the Indies. A central goal of the Vansittart's journey was to survey the Gaspar Strait, where sister ships of the East India Company had been lost on dangerous and poorly charted shoals.

The Vansittart found the shoals...by running hard aground, and taking on water so rapidly that the crew was forced to abandon ship on a tiny reef in the Java Sea. The waters were filled with pirates, so the crew threw thirteen treasure chests overboard, hoping to return later to reclaim them. But when they eventually made their way back aboard two British ships, Malay pirates had burned and pillaged the Vansittart and the crew managed to recover only three of the treasure chests.

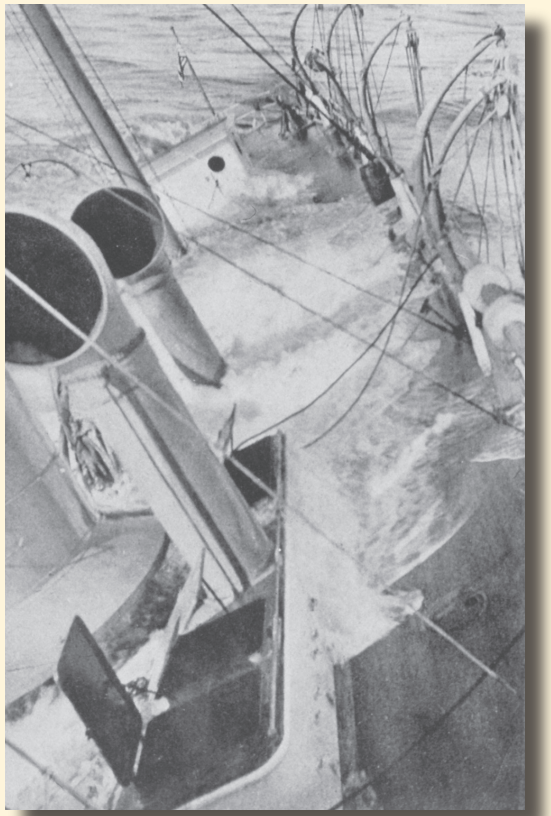
~ based on *Defining the Wind: The Beaufort Scale, and How a 19th-Century Admiral Turned Science Into Poetry* by Scott Huler, 2004

## What You Will Do

**Discover some of the ways a nautical chart can help a mariner safely navigate in unfamiliar coastal waters**

*The sinking of the* Vansittart *provided dramatic evidence of the value of an accurate nautical chart, and Francis Beaufort later became one of history's premier hydrographers. Today, NOAA's Office of Coast Survey produces accurate nautical charts and many other navigational aids that help mariners navigate safely in and out of U.S. ports and along the U.S. coastline as far as 200 nautical miles from shore. How important is ocean navigation? You may be surprised to know that even in the "space age," over 98% of the nation's cargo is carried by waterborne transportation.*

*Here's a chance to try your hand at coastal navigation using a modern nautical chart. Watch out for shoals!*



Wreck of U.S. Revenue Cutter *TAHOMA* which struck an uncharted pinnacle rock off Agattu Island, western Aleutians, September 20, 1914. Courtesy NOAA Ship Collection

## What You Will Need

❒ "Segment of NOAA Nautical Chart 11445, Bahia Honda Key to Sugarloaf Key"

## How to Do It

1. Before beginning your cruise, you need to know a few things about nautical charts. Most charts contain A LOT of information, including lights, buoys, wrecks, information about the sea bottom, shoreline features, water depth, and much more. These features are often very close together, so charts use many symbols and abbreviations. A complete list of these symbols is available in a booklet known as "Chart No. 1," which can be downloaded from *http://nauticalcharts.noaa.gov/mcd/chart1/chart1hr.htm* (the file containing the entire publication is 85 Mb, but smaller files containing specific kinds of information are also available). Here are a few basics:

- The compass rose is a tool provided on all nautical charts to simplify the process of measuring directions. On the sample chart, the compass rose is near the upper center of the chart. The most commonly used reference point for direction on nautical charts is Earth's geographic north pole ("true north").

- Depths on nautical charts are shown as many small numbers scattered over water areas. Depths indicated by these numbers are expressed in feet, fathoms (one fathom is equal to six feet), or meters. Contour lines (called "depth curves") connect points of equal depth, typically 6, 12, 18, 30, 60 and multiples of 60 feet. It's important to remember that depths shown on charts are average depths, so the actual depth at a given location may be less than that shown on the chart.

- The general rule for coastal navigation is "red, right, returning." This means that red markers, lights, or buoys should be on the right side of a vessel when coming into port. There are many exceptions to this general rule, though, so it is essential to have a chart that shows the arrangement of markers for a specific part of the coast.

- In shallow water, markers are often flat "signs" fastened to wood or metal stakes. Red markers are usually triangular, and green markers are square. These markers are shown on a chart by red triangles and green squares, and usually have a number that also is shown on the chart.

- Buoys are shown on nautical charts by diamond-shaped symbols and a small open circle that indicates the location of the buoy.

- Red buoys are printed in magenta and often have the letter "R" nearby.

- Green buoys are printed in green with the letter "G" nearby.

- A number in quotation marks is the number painted on the buoy's structure.

- Lighted buoys are indicated by a magenta disk printed over the small circle that marks the buoy's position.

- The shape of unlighted buoys is normally shown by a letter. "C' indicates a "can" buoy whose top has a cylindrical shape

- "N" indicates a "nun" buoy whose top is shaped like a cone with the pointed end cut off (this is called a "truncated" cone).

- Lights on nautical charts are all shown by a magenta symbol that looks like an exclamation point and a black dot indicating the light's position. Notes alongside these symbols describe the color of the light and how it flashes. Some commonly used abbreviations are:
  - Q: A light flashing at a rate of not less than 60 flashes per minute
  - R: A red light.
  - G: A green light
  - If no color is indicated for a light, it is understood to be a white light.

- Numbers next to the symbol for a light show the height of the light.

- If numbers are inside quotation marks, this number is painted onto the light structure.

- Numbers followed by the letter "M" show the approximate range of visibility of the light in miles.

For example:

Q R 16ft "6" 9M

indicates a red light, 16 ft high, flashing at a rate of not less than 60 flashes per minute ("quick flashing"), with the number "6" painted on the structure, with a visibility of about 9 miles

2. Now it's time to take the Chart Challenge! We will use part of NOAA Nautical Chart 11445, which includes the Florida Keys from Bahia Honda Key to Sugarloaf Key. Suppose you are the captain of a 24-foot fishing boat, and are taking some friends around the Keys. As the captain of a vessel, it is very important to know how much water is under your boat (underkeel clearance). This can vary depending on how much cargo you are carrying (or in this case, how many friends are aboard). Let's say that your boat draws 2 feet, which is another way of saying that the bottom (keel) of your boat is two feet below the surface. So, you'll need to subtract two feet from the depths indicated on the chart to find your underkeel clearance.

a. You and your friends board your boat at the dock in Doctors Arm Bay on Big Pine Key (to the right of the compass rose). What kind of markers show the location of this dock?

b. After casting off from the dock, you steer southeast into Bogie Channel. What is the maximum depth shown on the chart for the Channel?

c. As you pass through Spanish Harbor, you notice a low bridge ahead. The highest point on your boat is 10 feet above the water. Can you pass beneath the bridge?

d. You continue heading southeast until your depth sounder shows a depth of 10 feet. What does the chart show is probably on the bottom in this area?

e. Your friends are interested in snorkeling, so you decide to take them to the buoyed snorkeling area to the south of Newfound Harbor Keys, which is part of NOAA's Florida Keys National Marine Sanctuary. Looking at the chart, you see that there are several shallow coral heads marked "Co" that are not marked with buoys. What is the water depth over these coral heads?

f. Since the water over the coral heads is very shallow, you want to steer a course that will avoid them. How could you use your depth sounder to help steer clear of these dangers?

g. As you travel toward the snorkeling area, one of your friends notices the vegetation on the islands to the north. According to the chart, what kind of vegetation is this?

h. According to the chart, the snorkeling area is marked by buoys labeled "A," "B," "C," and "D." What is the color and shape of these buoys?

i. After snorkeling, you decide to visit Ramrod Key. One of your friends says that he can see open water between Hopkins Island and Cook Island. Would this be a good way to go to Ramrod Key?

j. After looking at the chart, you decide to go to the southwest of Munson Island to enter Newfound Harbor Channel. What light could you use to be sure you avoid the shallow area to the southwest of Munson Island? How tall is this light?

k. After passing Munson Island, you notice four markers that showing the location of Newfound Harbor Channel. What are the color, shape, and numbers of these

markers, and how would you use them to stay in the Channel?

l. As you enter Newfound Harbor, you notice three green markers and a red marker leading into a marina. What is the water depth near these markers?

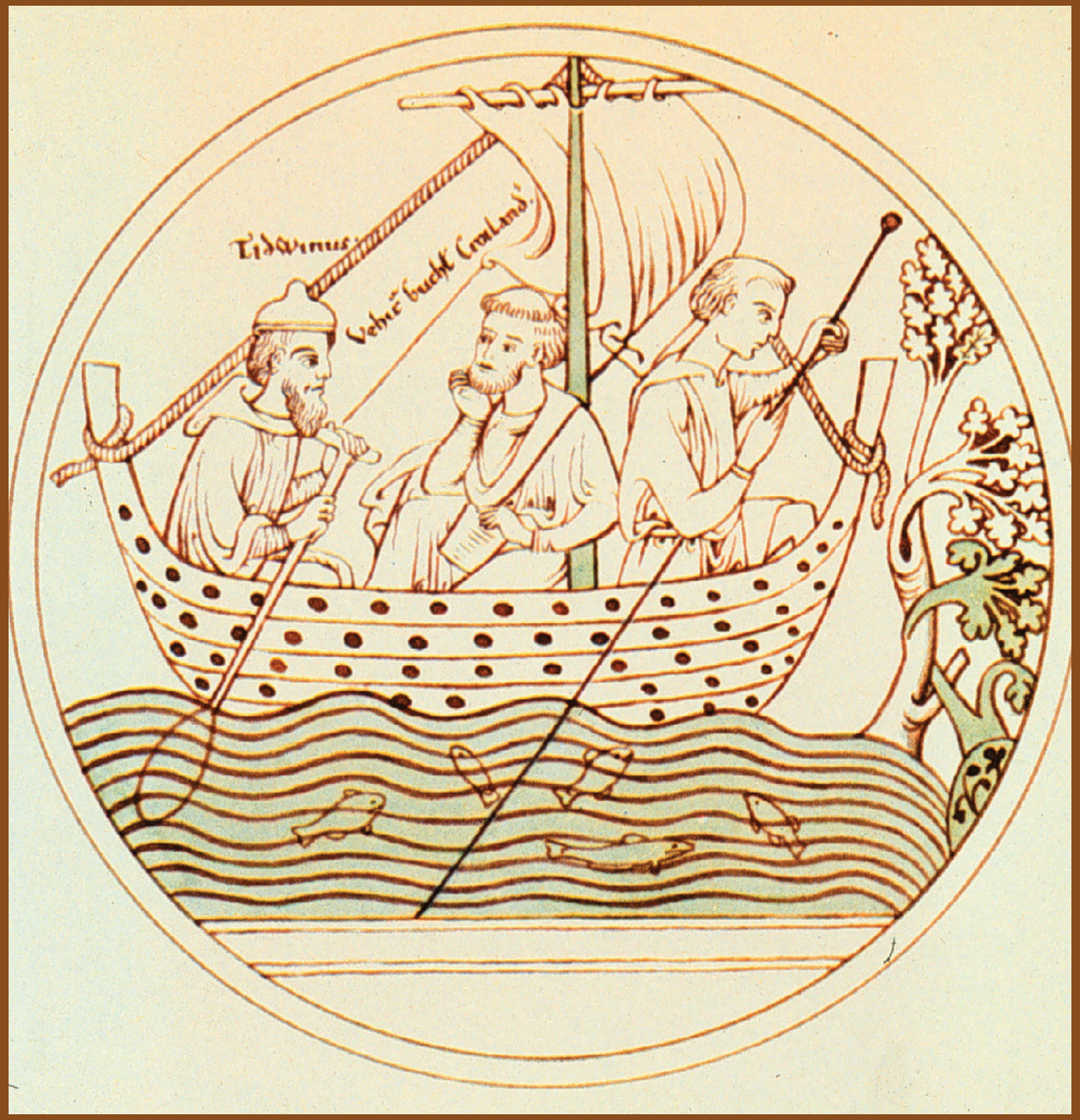
m. You change your mind, and decide to visit Little Torch Key instead. You want to go to a marina that is to the east of the microwave tower on Little Torch Key. Can your vessel pass beneath the bridge between Little Torch and Big Pine Key?

n. Just before you pass beneath the bridge, one of your friends notices something sticking up out of the water. Does the chart show anything in this area?

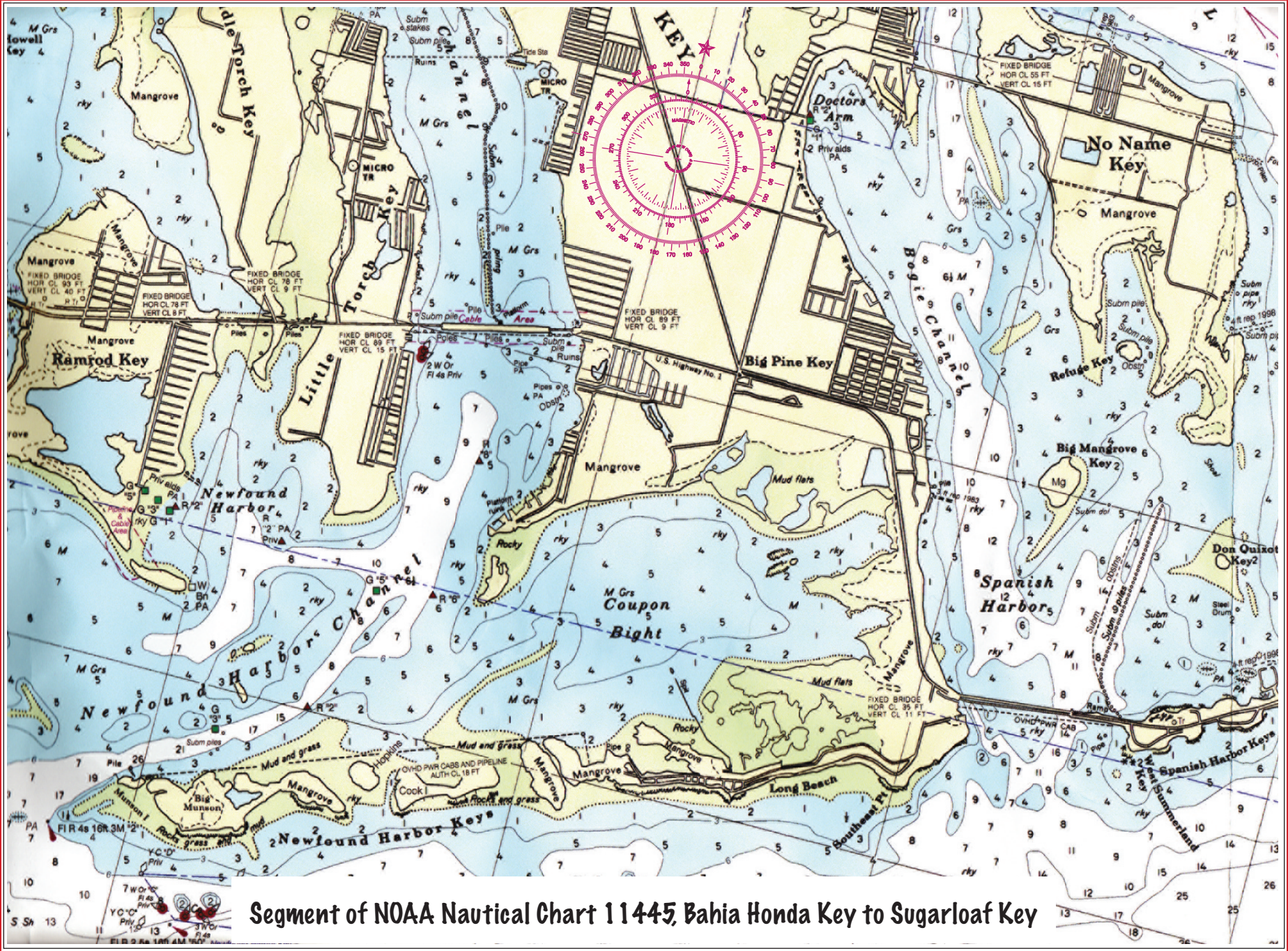
o. After you pass under the bridge, you notice a large marina on the west side of Big Pine Key. Are there any obstacles between your vessel and this marina?

## Want to Do More?

For more about nautical charts and how to use them, see "Plot Your Course" at *http://oceanservice.noaa.gov/education/classroom/lessons/18_marinenav_plotcourse.pdf*; part of the NOAA's National Ocean Service Discovery Classroom.



St. Brendan striking out into the Atlantic - about 6th Century A.D. St. Brendan checking depths with his sounding pole. Courtesy NOAA.




Segment of NOAA Nautical Chart 11445, Bahia Honda Key to Sugarloaf Key

# Don't Peek...

## Until you have answered ALL of the Chart Challenge questions!

### Answers to the Chart Challenge

a. A red triangle numbered "2" and a green square numbered "1"
b. 12 feet
c. Yes, because the vertical clearance beneath the bridge is 11 feet
d. rocks ("rky")
e. one to three feet
f. You could use the depth sounder to follow the 12-foot depth contour line, which will keep you away from the coral heads.
g. Mangroves
h. The buoys are yellow "cans" that have a cylindrical shape.
i. No, because the chart shows depths of less than one foot between these islands.
j. The flashing red light which has the number "2" painted on the structure, and is 16 ft tall and visible for about three miles.
k. There are two square green markers numbered "3" and "5" and two triangular red markers numbered "2" and "6". You would steer your vessel so that the red markers are to the right of the vessel and the green markers are to the left.
l. one to two feet
m. You can pass beneath the west end of the bridge because the vertical clearance is 15 feet, but the clearance is only nine feet under the east end of the bridge.
n. The chart shows three poles on the south side of the bridge.
o. The chart shows submerged pilings to the west of Big Pine Key.