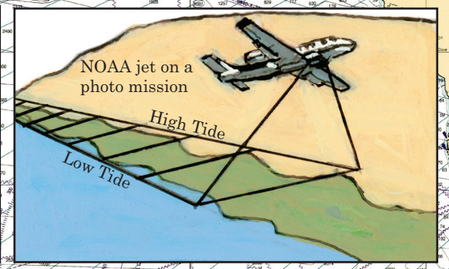
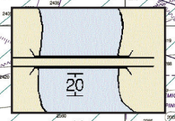
Nautical Chart of the Southwest Coast

Learn more about nautical charts at http://www.nauticalcharts.noaa.gov. Produced by NOAA's Office of Coast Survey

NOAA cartographers draw the coastline by referring to aerial photographs taken from a jet. Images are taken at high and low tide to represent the tidal range of the shoreline on the chart.



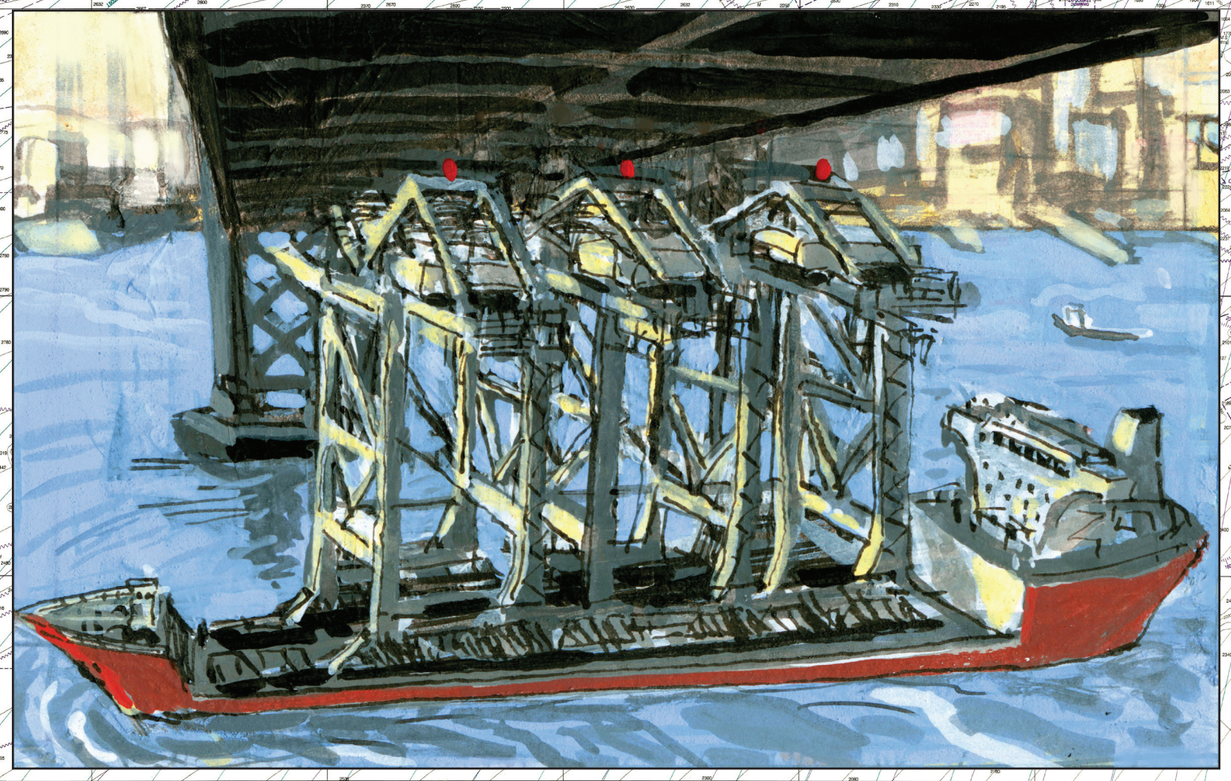
Ship captains must know the vertical clearance: how much room there is between the top of their ship and the bridges and power lines they pass under while navigating. Some ships carry very tall cargo like cranes or are piled high with hundreds of containers. Occasionally, ships break off antennae when passing under bridges. Mariners must also know how much room there is between the keel of their ship and the seafloor; sometimes it is merely inches! That is why the Office of the Coast Survey need the times and heights of high and low tides.



The bridge has a vertical clearance of 20 feet.

California Sea Otter Game Refuge

A sea otter refuge runs the length of California's Big Sur coast. In the rocky islands, small coves, and kelp beds, otters eat, swim, groom themselves, or snooze in the sun. Trapping or hunting birds and animals is prohibited in this area.



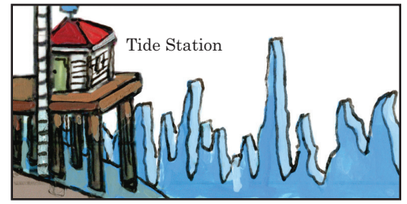
Big, sharp submerged rocks can rip open the hulls of ships.

A dangerous underwater rock of uncertain depth

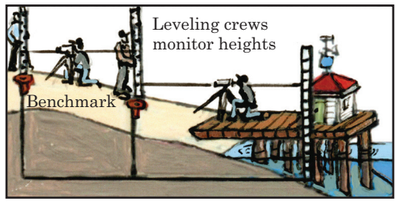
A rock that rises out of the water

More than 200 tide stations stand along the nation's shoreline. Inside the stations tide gauges measure the rise and fall of the sea. A NOAA gauge in San Francisco has recorded the tide for more than 150 years.

All charts give information on water levels. But how can you calculate the height of endlessly moving water? Oceanographers compute the average high- and low-water levels measured in an area over 19-year periods called tidal epochs. The averages remove anamolies like big storms, so steady water levels can be established.



Moving water levels are measured in between bronze discs on the ground called tidal benchmarks. They are like the markings on a football field. You can only measure a touchdown run if the markings don't move and are the right distance apart. That is why NOAA checks the distance between benchmarks for any movement.



Cartographers use the information collected from tide gauges and benchmarks to create tidal datums. They record these different water-level averages on the charts. To clear bridges and overhead cables, mariners refer to Mean High Water (MHW) To avoid underwater obstructions mariners, refer to Mean Lower Low Water (MLLW).