New Approaches for Coastal Observatories

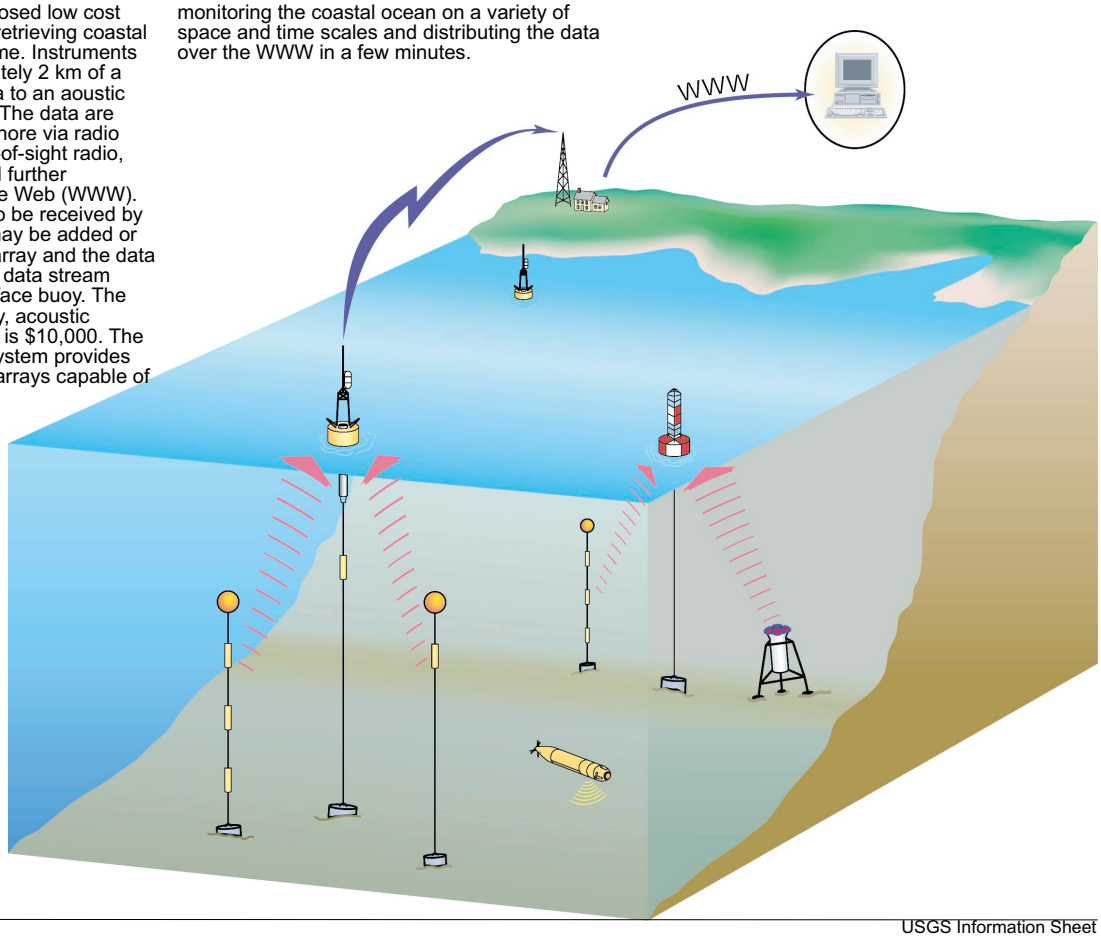
Observations from the coastal ocean are needed in real time for ocean prediction, environmental monitoring and ocean-process studies

Introduction

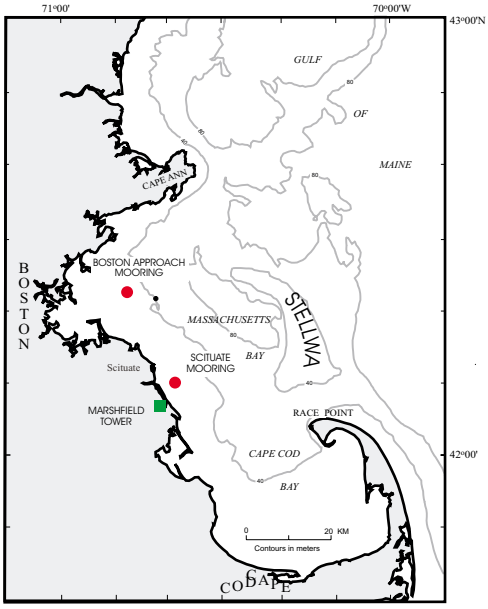
Since the 1960's, long-term observations of ocean properties (currents and temperature for example) have been obtained by mooring instruments in the ocean that record data internally. Although now relatively reliable, data from these instruments are not available until the instrument is retrieved (typically 1-6 months), and damage to an instrument or electronic failure is not known until the instrument is recovered. Limited data is being sent from ocean observing systems to shore via satellite and recently, ocean observatories (such as LEO15 offshore of New Jersey), linked to shore via subsea cable, have been established to provide real-time high-resolution observations at a fixed location. New technologies are now available that have the potential to inexpensively communicate field measurements from many sensors to a user in a few minutes. This technology can fill a niche between internally recording instruments and fixed location, relatively expensive, high data rate observatories. Development of low cost systems has the potential to provide observations from distributed arrays with multiple sensors on a wide variety of spatial scales.

Developing new technologies for coastal observations

Under the National Ocean Partnership Program (NOPP), the Woods Hole Oceanographic Institution and the U.S. Geological Survey, in cooperation with the U.S. Coast Guard, the Massachusetts Water Resources Authority (MWRA), and RD Instruments are developing a low-cost system for retrieving oceanographic data from instruments in the coastal ocean and delivering these data over the World Wide Web. The conceptual approach is to use low cost, low power acoustic transmitters which transmit data from a sensor located on a mooring line or on the bottom in the vicinity of a surface buoy. These individual low-cost transmitters are the key new technology. A relay system on the surface buoy, consisting of an acoustic modem integrated directly with a reliable, medium bandwidth telemetry link, receives the data from the underwater sensor and sends it directly to shore. The system will be demonstrated by transmitting Acoustic Doppler Current Profiler (ADCP) data from two long-term monitoring sites in Massachusetts Bay.

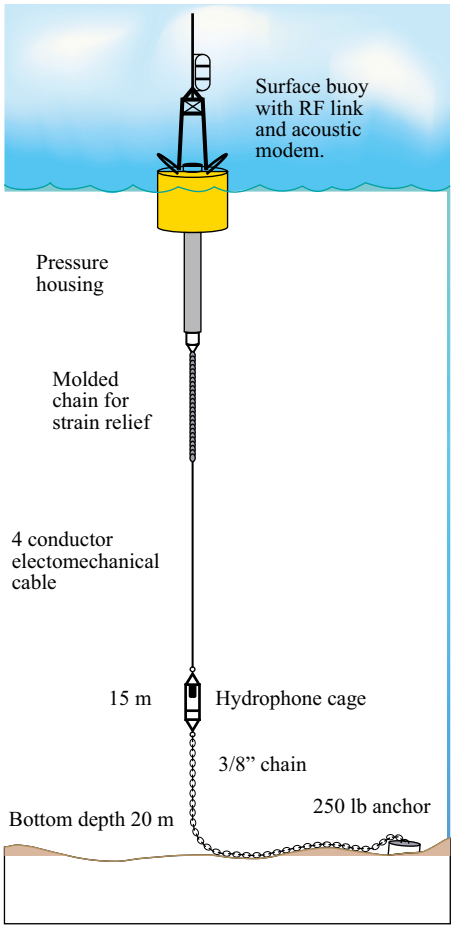


Conceptual picture of the proposed low cost acoustic telemetry system for retrieving coastal time series data in near real time. Instruments are deployed within approximately 2 km of a surface buoy and transmit data to an aoustic modem mounted on the buoy. The data are immediately retransmitted to shore via radio frequency (RF) telemetry (line-of-sight radio, satellite, or cellular phone) and further distributed over the World Wide Web (WWW). In principle, the data could also be received by ships in the vicinity. Sensors may be added or removed from the instrument array and the data are automatically added to the data stream without modification to the surface buoy. The target cost for the surface buoy, acoustic modem, and RF telemetry unit is $10,000. The low-cost telemetry and buoy system provides the potential for instrumented arrays capable of monitoring the coastal ocean on a variety of space and time scales and distributing the data over the WWW in a few minutes.

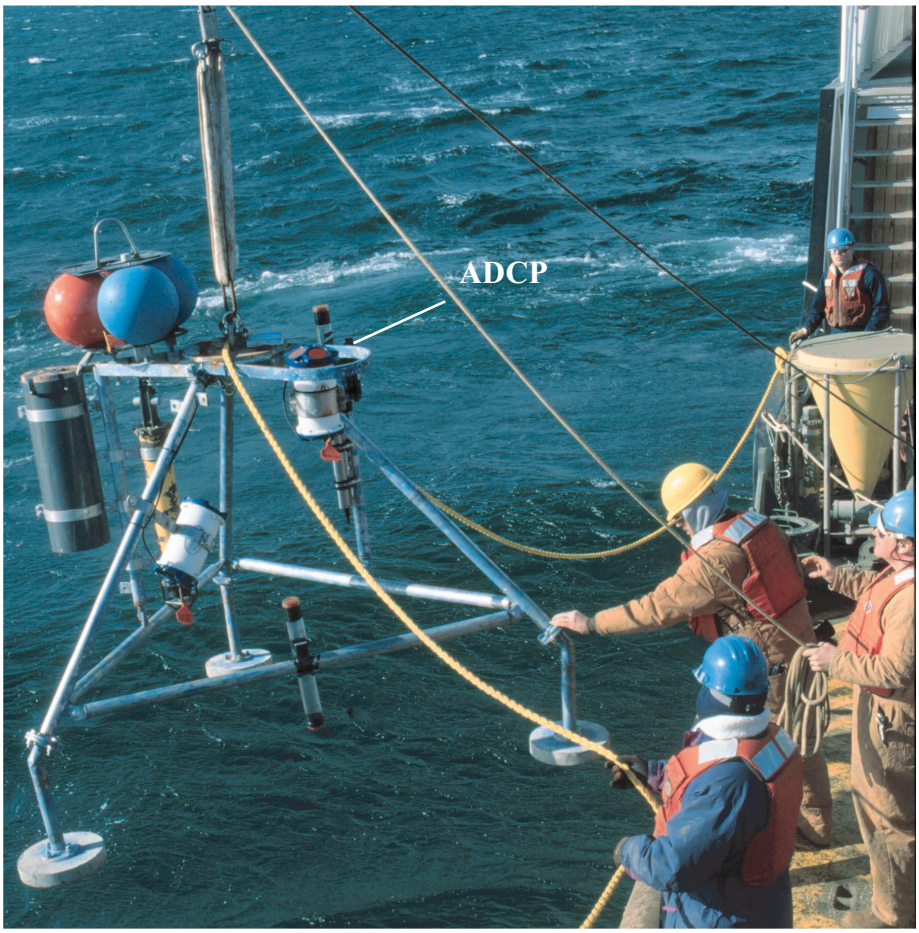


Location of moorings in Massachusetts Bay where the telemetry system will be tested. At the Boston Site, the surface link will be installed on a Coast Guard Navigation Buoy (right). At the Scituate site, the surface link will be on a research buoy (far right). Observations at both sites are part of the long-term USGS-MWRA monitoring program in Massachusetts Bay. The telemetry link will be located on a U.S. Coast Guard Tower in Marshfield.

U.S. Coast Guard Boston Approach 'B' Buoy. The acoustic modem will be suspended beneath the buoy and the radio antenna will be mounted on the top of the buoy tower.



This simple surface mooring combines an acoustic modem and a radio-frequency (RF) modem to link insitu sensors to the shore. The mooring is small and lightweight and can be deployed from a small boat.



Tripod frame being deployed in Massachusetts from the USCG Buoy Tender MARCUS HANNA. The Acoustic Doppler Current Profiler (ADCP) mounted on the tripod frame uses sound to measure the currents from the sea surface to the bottom every two meters. The acoustic telemetry unit developed as part of this project will transmit data from the ADCP to the nearby surface buoy every hour.

National Ocean Partnership Program

Development of this technology is a cooperative project between the U.S. Geological Survey, the Woods Hole Oceanographic Institution, the U.S. Coast Guard, the Massachusetts Water Resources Authority, and RD Instruments. The work is carried out with funding from the National Ocean Partnership Program and the partners.

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