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Seafloor Mapping

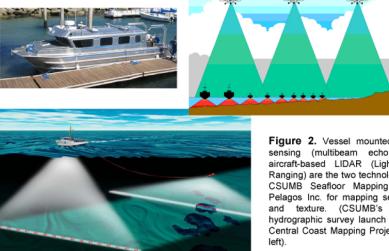


Figure 2. Vessel mounted acoustic remote sensing (multibeam echo sounders) and aircraft-based LIDAR (Light Detection and Ranging) are the two technologies employed by CSUMB Seafloor Mapping Lab and Fugro Pelagos Inc. for seafloor mapping surveys at sea. Top left: CSUMB vessel used in the North Central Coast Mapping Project shown in the Central Coast shown in the figure below. Bottom left: Aerial view of a survey vessel at sea.

Tier 1 & 2 Products

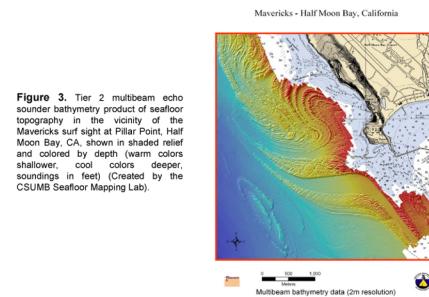


Figure 3. Tier 2 multibeam echo sounder bathymetry map of seafloor topography in the vicinity of the Mavericks surf spot at Pillar Point, Half Moon Bay, CA, shown in shaded relief and colored by depth (warm colors shallower, cool colors deeper, soundings in feet) (Created by the CSUMB Seafloor Mapping Lab).

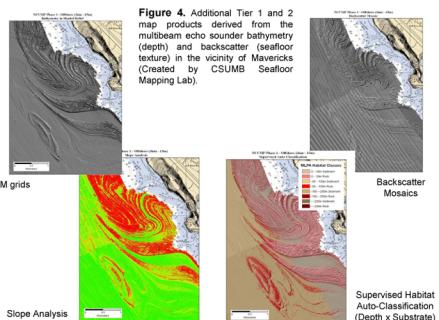


Figure 4. Additional Tier 1 and 2 products derived from the multibeam echo sounder bathymetry (depth) and backscatter (seafloor texture) in the vicinity of Mavericks (Created by CSUMB Seafloor Mapping Lab).

California North Central Coast State Waters Mapping Project

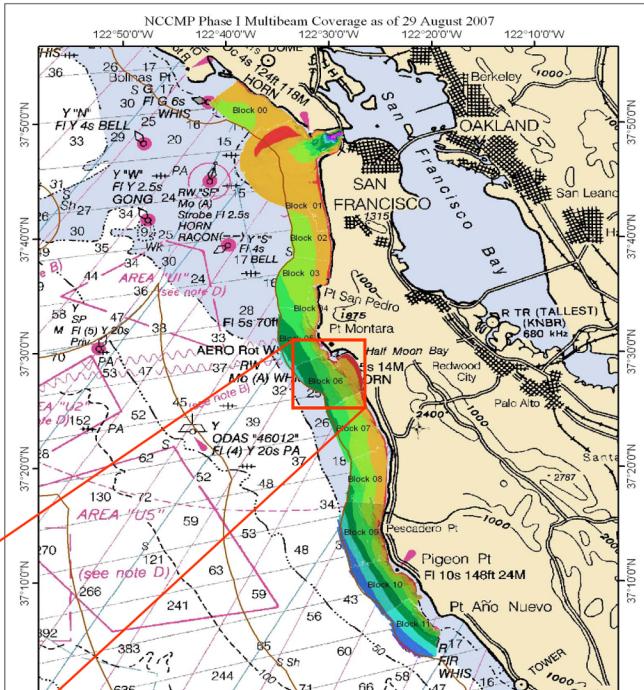


Figure 1. Multibeam echo sounder bathymetry coverage completed as of August 2007 for the North Central Coast Mapping Project Phase I, shown in shaded relief and colored by depth (warm colors shallower, cool colors deeper, soundings in fathoms). (Data acquisition conducted by Fugro Pelagos Inc. and CSUMB Seafloor Mapping Lab).

Sub-bottom Profiling

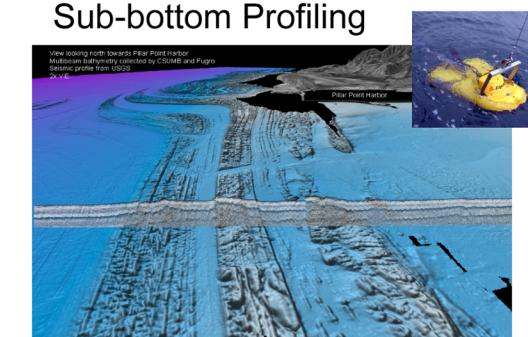


Figure 5. Vertical sub-bottom profile trace showing buried rock and sediment layers superimposed on a perspective view of the multibeam echo sounder bathymetry DEM shown in shaded relief in the vicinity of the Mavericks surf spot at Pillar Point, Half Moon Bay, CA (created by Pete Dartnell, USGS).



science for a changing world



Collaborating Institutions

CSUMB Seafloor Mapping Lab
Fugro Pelagos Inc.
US Geological Survey
Moss Landing Marine Labs Center for Habitat Studies
California Geological Survey



Poster Prepared by
Rikk Kvitek – California State University, Monterey Bay Seafloor Mapping Lab (<http://seafloor.csumb.edu>)

Introduction

In 2006, the state of California initiated Phase I of a comprehensive seafloor mapping program designed to ultimately cover the remaining 6000 km² of unmapped state waters (3 nm – shore). This collaborative effort involving industry (Fugro Pelagos Incorporated, university (California State University, Monterey Bay and Moss Landing Marine Labs) and research agencies (U.S. Geological Survey and California Geological Survey) is supported by the California Ocean Protection Council, the State Coastal Conservancy, the California Department of Fish and Game, and NOAA National Marine Sanctuary Program. The five partnering institutions are now nearing the completion of the Phase I coverage from Stinson Beach to Ano Nuevo (Figure 1). Here we summarize the intended applications, coverage to-date, methods used, and products created.

Purpose

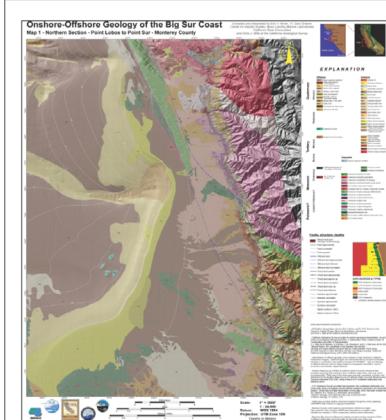
The purpose of this mapping campaign is to create a high-resolution base map of all seafloor habitats and geological features within the California's 3 nautical mile state waters boundary. Although the first phase of the campaign has been driven largely by the need to support the state's Marine Life Protection Initiative (MLPA) by aiding in the selection and design of Marine Protected Areas (MPAs) along the Central California Coast, the state-wide base map being created will enable unprecedented seafloor classification and change detection studies required to address a variety of coastal ocean management issues including:

- Coastal Erosion, sediment transport and beach loss
- Development and implementation of true Ecosystem Based Management
- Protection of Critical Habitats, Marine Mammals and Endangered Species
- Variability and Stability of Essential Fish Habitats
- Monitoring of Marine Protected Areas
- Tidal Fluctuation, Tsunami and Tsunami Hazards
- Maintenance and safety monitoring of Oil, Gas and Telecommunication Facilities
- Location and removal of Seafloor Debris and Derelict Fishing Gear
- Sub-bottom Profiling and Seismic Monitoring of Archaeological Sites
- Managing Offshore Sand and Aggregate Mining
- Maintaining Shipping Channels and Harbor Entrances
- Surveillance for Submarine Threats to Homeland Security

Methods & Products

A variety of state-of-the-art mapping technologies are being employed to create a series of Tiered Map Products.

- Tier 1 – Multibeam Echo Sounder and LIDAR technologies (Figure 2) are being used to create high-resolution 3D digital elevation models (DEM's) and seafloor texture (acoustic backscatter) products (Figures 3 and 4).
- Tier 2 – The DEM grids of the bathymetric sounding data are used to create a variety of algorithmically derivative map products including shade relief, slope analysis and supervised substrate classifications (Figures 3 and 4).
- Sub-bottom profiling – Acoustic sub-bottom profilers are used to image and quantify the thickness of seafloor sediment layers (Figure 5).
- Video Groundtruthing – Video cameras are used to verify the results of the acoustic and sub-bottom profiling data (Figure 6).
- California's most skilled and experienced marine geologists are involved in the Tier 1 – 2 map products, video groundtruthing and sub-bottom profiling results to produce a series of detailed, 1:24,000 scale interpreted and classified habitat maps and geological strip charts spanning the terrestrial and marine landscapes within the state's coastal zone (Figure 7).



Tier 3 Products

Figure 7. Example of a Tier 3 1:24,000 scale Onshore-Offshore Geology map product showing the classification of coastal units and faults spanning the land-sea interface along the California coast. (Created by California Geological Survey, Moss Landing Marine Labs Center for Habitat Studies).

Video Groundtruthing

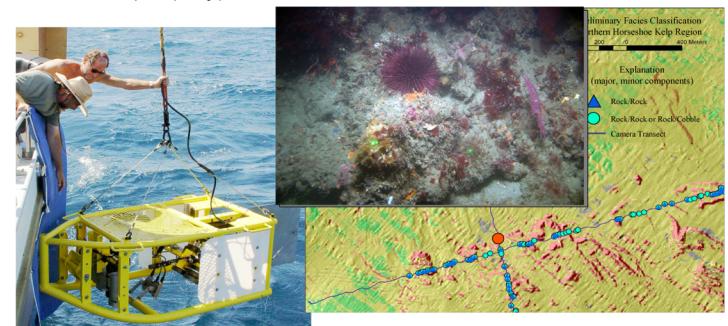


Figure 6. USGS video groundtruthing tow sled being deployed (left), georeferenced video imagery (top right) and concordance of results in GIS superimposed with Tier 2 supervised substrate classification products (lower right).