Mapping California's Statewide Waters
Status February 2007

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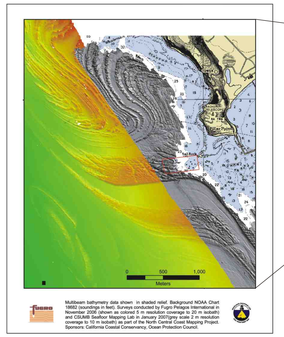
A specialist team comprising academic, industry and government members is underway in a program that will ultimately lead to mapping of all of California's State Waters from MHHW out to the three-nautical-mile boundary.

a. This ground-breaking program is funded by the California State Coastal Conservancy and the California Ocean Protection Council. The program manager is the Monterey Bay Sanctuary Foundation, working in collaboration with NOAA's National Marine Sanctuary Program.

b. The team is lead by the Seafloor Mapping Lab of California State University Monterey Bay, and includes Principle Investigators from

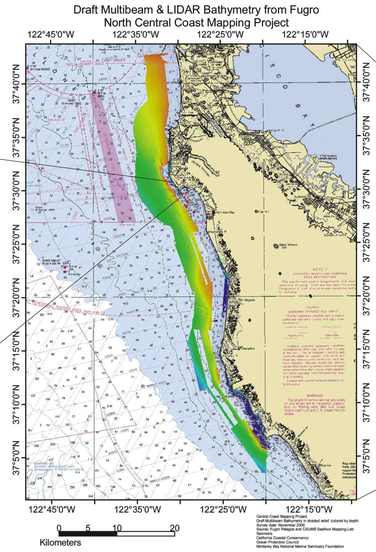
- Fugro Pelagos, Inc
- US Geological Survey's Coastal and Marine Geology Program
- Moss Landing Marine Lab's Center for Habitat Studies

World-Famous Mega-Wave Surfing Site (Red Box)



Multibeam echosounding data and acoustic backscatter data have been collected in the deepwater areas to the 3nm limit. The inshore data coverage is from three days of airborne bathymetric LIDAR operations in November 2006.

Data collection for the intervening mid-depth zone is underway by the Seafloor Mapping Lab of CSUMB. An example of their recent 2007 data is shown for the internationally famous Mavericks surfing area.



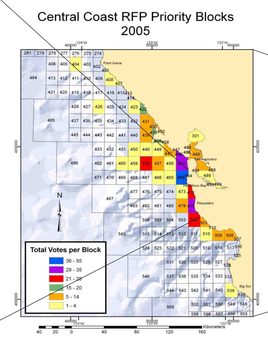
Establishing Survey Priorities

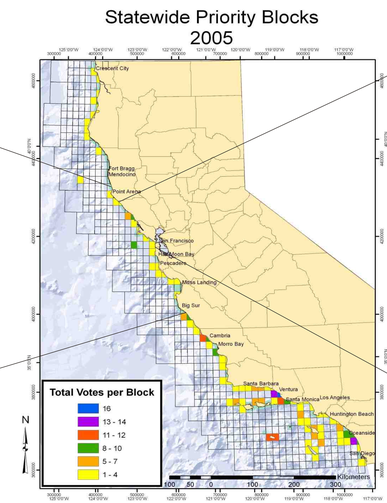
Priorities for seafloor mapping of statewide waters in California were evaluated in a stakeholders' meeting in December 2005. Partial funding allowed starting in a high priority area in 2006. The meeting also consolidated information on existing data sets to reduce potential overlap. This poster shows examples of both data types with emphasis on the latest data coverage achieved in 2006 and 2007.

One of the most important parts of the planning for statewide mapping was to develop general guidelines and standards for mapping data acquisition, processing, interpretation, metadata, data sharing and archiving.

Another was to update and provide an overview of seafloor mapping techniques, capabilities, interpretation, and applications.

Priority-setting exercises were conducted to determine the geographic sequence for future mapping efforts and product generation for state waters (3 nm). See maps below.





The Strategic Planning Workshop was supported by and organized at the request of the California Coastal Conservancy in their capacity as staff to the California Ocean Protection Council. The objective of this planning effort was to develop a prioritized strategic plan for statewide seafloor mapping in California state waters, in consultation with relevant stakeholders, including academic institutions, management agencies, and other mapping data consumers.

Website…

http://seafloor.csumb.edu/StrategicMappingWorkshop.htm

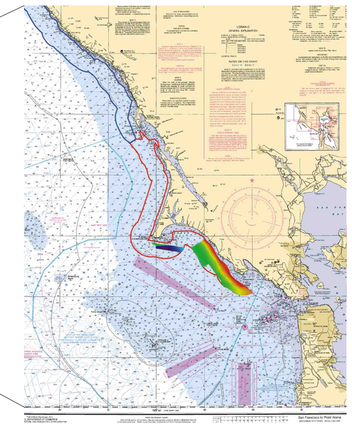
Data Standards

The recommended quality standard for the statewide data is International Hydrographic Organization Order 1 or better. Collecting data to high standard is essential to establish a basis for detection of changes by subsequent surveying. NOAA uses IHO standards in their navigation charting responsibility.

An essential part of achieving high data standards includes using the best available geodetic positioning technology for both vertical and horizontal locations.

Using the latest MBES systems, such as the Reson 7125, these standards can be met and exceeded. This system was utilized for the November 2006 mapping in waters deeper than 20m.

Finally, all acknowledged the critical importance of having all data meet FGDC metadata standards.



Three Levels of Statewide Seafloor Mapping Data Products

Following acquisition of the MBES and bathymetric LIDAR data, a three-tiered data processing scheme was recommended:

i. Cleaned bathymetry XYZ data and backscatter mosaics are the basic level of processing of the raw data sets

ii. Manipulations of the above data into DEMs, shaded-relief, contours, or slope maps are examples of the next level. This includes any data product that can be derived using automated processing to present different perspectives on the survey data.

iii. Detailed seafloor characteristics require interpretation and human analyses. An example might be seafloor classification schemes.

All data should be in georeferenced digital GIS-compatible format, along with associated metadata. These also apply to the corresponding groundtruth data sets.

Seaworthy Survey Vessel

On-Board Data Acquisition Lab

Laboratory Module, Golden Gate Bridge

Farallon Islands

Survey Engineer

Data Type Priorities

Stakeholders' unanimous opinion was that 100% bathymetric coverage is essential. This implies **multibeam echosounding**. Since this technology allows simultaneous collection of acoustic backscatter data for only the costs of data storage and processing, there was common support for collecting and mosaicking seafloor acoustic imagery.

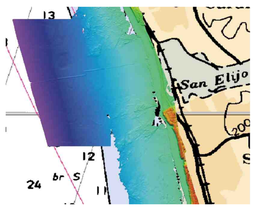
Here is an example of **seafloor acoustic imagery** draped over bathymetry. Note the detailed information about the distribution of different rocks and sediments.

SeaBat Sonar

POS M/V 320

AML Smart SV

For the difficult-to-cover nearshore shallow areas, **airborne bathymetric LIDAR** was endorsed. This technology also provides the shoreline and onshore topography, all integrated with the bathymetry, plus digital orthophoto coverage. These data are merged with MBES bathymetry to yield a continuous offshore-onshore data set, as shown in the figure below:



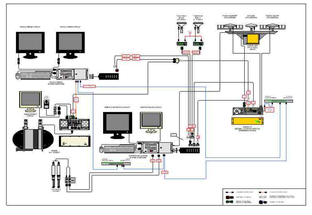
Another key data type identified was **seismic reflection profiling**, which gives information about the thickness and nature of seafloor materials. While this was deemed highly desirable, it was recommended that profiling coverage is not needed everywhere, and can be defined once the surficial mapping (above) is available for planning seismic surveying.

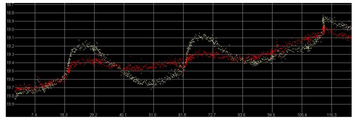
Groundtruth Data are essential for the program, and should be acquired in a nearly synoptic schedule. The recommended groundtruth data types included seafloor samples and underwater video transects.

Bathymetric LIDAR System

Digital Orthophoto
Draped Over LIDAR Topography

Typical Integrated MBES System Configuration
Design by Fugro Pelagos



- All data precisely stamped on UTC epoch
- Zero latency acquisition
- Simplified patch test procedures and processing
- Improved sounding accuracy
- Larger weather window
- Reduced turn time

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