

DISCUSSION

This colored shaded-relief bathymetry map of Hueneme Canyon and vicinity in southern California was generated from bathymetry collected by California State University, Monterey Bay (CSUMB), by the U.S. Geological Survey (USGS), and by Fugro Pelagos for the U.S. Army Corps of Engineers (USACE) Joint Lidar Bathymetry Technical Center of Expertise (jLbE). Most of the offshore area was mapped by CSUMB in the summers of 2006 and 2007, using a 244-kHz Ricon 8101 multibeam echosounder. The far northern part of the offshore area was mapped by the USGS in 2006, using a 117-kHz SEA (APOL) LIDAR SWATHplus+M phase-differencing sidescan sonar. The nearshore bathymetry and coastal topography were mapped for USACE by Fugro Pelagos in 2009, using the SHOALS-1000T bathymetric-lidar and Leica AL60 topographic-lidar systems. All these mapping missions combined to collect bathymetry from the 0-m isobath to beyond the 3-nautical-mile limit of California's State Waters.

During the CSUMB mapping missions, an Applanix positioning and motion compensation system (POS/MV) was used to accurately position the vessel during data collection, and it also accounted for vessel motion such as heave, pitch, and roll (position accuracy: ± 2 m, pitch, roll, and heading accuracy: $\pm 0.02^\circ$; heave accuracy: $\pm 5\%$, 5 cm). NavCom 2000 GPS receiver (CNV data) were used to account for tidal-cycle fluctuations, and sound-velocity profiles were collected with an Applied Microsystems (AM) SVPLUS sound velocimeter. Soundings were corrected for vessel motion using the Applanix POS/MV data, for variations in water-column sound velocity using the AM SVPLUS data, and for variations in water height (tides) using vertical-position data from the CNV receiver. Final XYZ soundings and bathymetric-surface models were referenced to the World Geodetic System of 1984 (WGS 1984) relative to the North American Vertical Datum of 1988 (NAVD 1988).

On 15 May 2006, during the USGS main mission, GPS data and measurements of vessel motion (heave, pitch, and roll) were combined in a CodaOctopus F180 attitude-and-position system to produce a high-precision vessel-attitude packet. This packet was transmitted to the acquisition software in real time and combined with instantaneous sound-velocity measurements at the transducer head before each ping. The returned samples were projected to the seafloor using a ray-tracing algorithm that works with previously measured sound-velocity profiles. Statistical filters were applied to the raw samples that discriminate the seafloor returns (soundings) from unintended targets in the water column. The original soundings were referenced to the WGS 1984 latitude to the MLW (Mean Lower Low Water) tidal datum, but, through postprocessing using NOAA's VDatum tool, the soundings were transformed to NAVD 1983. Finally, the soundings were converted into 2-m-resolution bathymetric-surface-model grids.

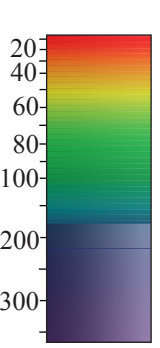
During the Ganga Peltica mapping mission that was completed as part of the National Coastal Mapping Program of USACE, the Leica ALS60 topographic-lidar and the SHOALS-1000T bathymetric-lidar systems were mounted on aircraft that flew survey lines in an altitude range of 300 to 400 m (bathymetry) and 300 to 1,200 m (topography), at speeds between 135 and 185 knots. The ALS60 system collected data at a maximum pulse rate of 200 kHz, and the SHOALS system collected data at 1 kHz. Information on aircraft position, velocity, and acceleration were collected using the Novatel and POS AV410 systems (SHOALS) and the Novatel system (ALS60). Aircraft position and velocity were processed using POSPro software, and the results were converted to ground level coordinates (2D position) using the POSPro software. Various commercial and proprietary software packages were used to clean the data, to convert all valid data from intensity to orthometric heights, and to export the data as a series of first-return topography and bathymetry ASCII files. Final grids were provided in geographic coordinates referenced to the NAD83.

Once all the bathymetry-surface models were transformed to a common projection and datum, the files were merged into one overall 2-m-resolution bathymetric-surface model. An illumination having an azimuth of 300° and from 45° above the horizon was then applied to the surface to create shaded-relief imagery. Also, a modified "rainbow" color ramp was applied to the bathymetry data, using reds and oranges to represent shallower depths, and dark blues and purples to represent greater depths. This colored bathymetry surface was draped over the shaded-relief imagery at 60 percent transparency to create this colored shaded-relief map. Bathymetric data were generated from a modified 2-m-resolution bathymetric surface where a smooth arithmetic mean convolution function applied a weight of one-half to each cell in a 3-pixel by 3-pixel matrix was applied iteratively to the surface 100 times.

The onshore-area image was generated by applying the same illumination to the topographic-lidar data, as well as to publicly available, 3-m-resolution, interferometric synthetic aperture radar (IFSAR) data, available from NOAA Coastal Service Center's Digital Coast, at <http://csc-s-maps-q.csc.noaa.gov/dataviewer/viewer.html> (last accessed April 5, 2011).

EXPLANATION

Depth (in meters) and illumination (bright areas are illuminated, facing false sun; dark areas are in shadow, facing away from false sun)



Direction of illumination from false sun—Position of false sun is at 300° azimuth, 45° above horizon [arrow included in explanation for illustration purposes only; not shown on map]

Area of “no data”—Areas from shoreline (defined as Mean Higher High Water) out to 10-m water depth not mapped owing to lack of reliable sounding returns to airborne-lidar system caused by sea state (for example, breaking waves or turbidity); areas beyond 3-nautical-mile limit of California’s State Waters were not mapped as part of California Seafloor Mapping Program

— **3-nautical-mile limit of California's State Waters**—Line in southwest corner of map area is limit surrounding Anacapa Island (outside of map area)

—100— **Bathymetric contour (in meters)**—Derived from modified 10-m-resolution bathymetry grids
Contour intervals: 1–100 m water depth, 10 m; >100 m water depth, 50 m

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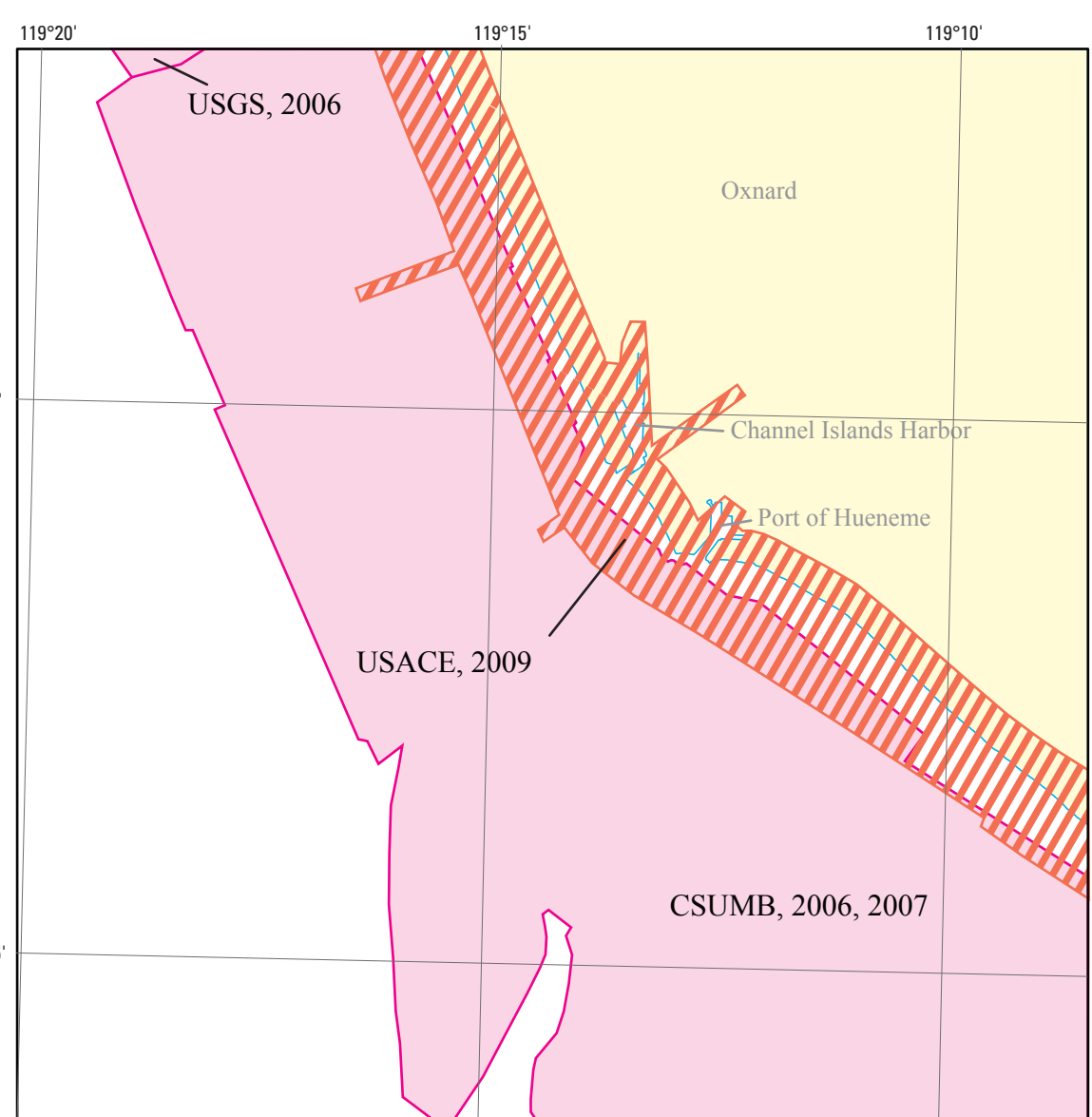


Figure 1. Map showing areas of multibeam-echosounder and bathymetric-sidescan surveys (pink shading), bathymetric- and topographic-lidar surveys (orange diagonal lines), and publicly available interferometric synthetic aperture radar (ifSAR) topography (yellow shading). Also shown are data-collecting agencies (CSUMB, California State University, Monterey Bay, Seafloor Mapping Lab; USACE, U.S. Army Corps of Engineers; USGS, U.S. Geological Survey) and dates of surveys if known.



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Colored Shaded-Relief Bathymetry, Hueneme Canyon and Vicinity, California

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