

DISCUSSION

This colored shaded-relief bathymetry map of the Offshore of San Francisco map area in northern California was generated from bathymetry data collected by California State University, Monterey Bay (CSUMB) and by Fugro Pelagos (fig. 1). Most of the area was mapped by CSUMB in 2004, 2005, 2007, and 2008, a small offshore portion near the southern boundary of the map area was mapped by Fugro Pelagos in 2006. Both used a combination of 400-kHz Reson 7125 and 244-kHz Reson 8101 multibeam echosounders. These mapping missions combined to collect bathymetry data from about the 10-m isobath to beyond the 3-nautical-mile limit of California's State Waters. A large portion of this map area was re-mapped in 2009, however the older bathymetry data are used in this map due to co-registered, acoustic backscatter data (see sheet 3).

During the mapping missions, an Applanix POS MV (Position and Orientation System for Marine Vessels) was used to accurately position the vessels 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, ±0.02°; heave accuracy, ±5%, or 5 cm). To account for tidal-cycle fluctuations, CSUMB used NavCom 2030 GPS receiver (CNAV) data, and Fugro Pelagos used KGPS data (GPS data with real-time kinematic correction); in addition, sound-velocity profiles were collected with an Applied Microsystems (AM) SVPlus sound velocity. 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 KGPS receivers.

Processed soundings from the different mapping missions were exported from the acquisition or processing software as XYZ files and bathymetric surfaces. All the surfaces were merged into one overall 2-m-resolution bathymetric-surface model and clipped to the boundary of the map area. An illumination having an azimuth of 300° and from 45° above the horizon was then applied to the bathymetric surface to create the shaded-relief imagery. In addition, a modified "rainbow" color ramp was applied to the bathymetry data, using reds and oranges to represent shallower depths, 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. Gray areas on map area are gaps in data.

Bathymetric contours were generated at 10-m intervals from the merged 2-m-resolution bathymetric surface. The most continuous contour segments were preserved; smaller segments and isolated island polygons were excluded from the final output. Contours were smoothed using a polynomial approximation with exponential kernel algorithm and a tolerance value of 60 m.

The onshore area imagery was generated by applying an illumination (azimuth of 300° and from 45° above the horizon) to topographic-lidar data collected by Earth Eye in 2010 for San Francisco State University and the U.S. Geological Survey.

EXPLANATION

- Depth (in meters) and illumination (bright areas are illuminated, facing false sun; dark areas are in shadow, facing away from false sun)
- Shallow
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100
- 110
- Deep
- 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 near shoreline not mapped owing to insufficient high-resolution seafloor mapping data; 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
- Bathymetric contour (in meters)—Derived from modified 10-m-resolution bathymetry grid. Contour interval: 10 m

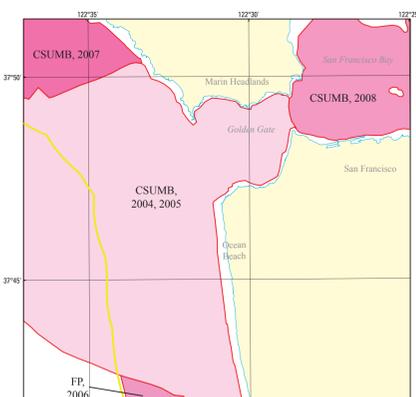
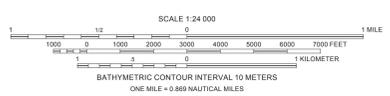


Figure 1. Map showing areas of multibeam-echosounder surveys (pink shading) and onshore topographic-lidar surveys (yellow shading). Also shown are data-collecting agencies (CSUMB, California State University, Monterey Bay; Seafloor Mapping Lab, FP, Fugro Pelagos) and dates of surveys if known.

Onshore elevation data collected by Earth Eye in 2010 for San Francisco State University and the U.S. Geological Survey. California's State Waters limit from NOAA Office of Coast Survey. Universal Transverse Mercator projection, Zone 10N
NOT INTENDED FOR NAVIGATIONAL USE



Shaded-relief bathymetry by Peter Dartnell, 2013 (data collected by California State University, Monterey Bay, Seafloor Mapping Lab in 2004-2008 and by Fugro Pelagos in 2006). Bathymetric contours by Mercedes E. Eray, 2012
GIS database and digital cartography by Nadine E. Galdon
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Colored Shaded-Relief Bathymetry, Offshore of San Francisco Map Area, California

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