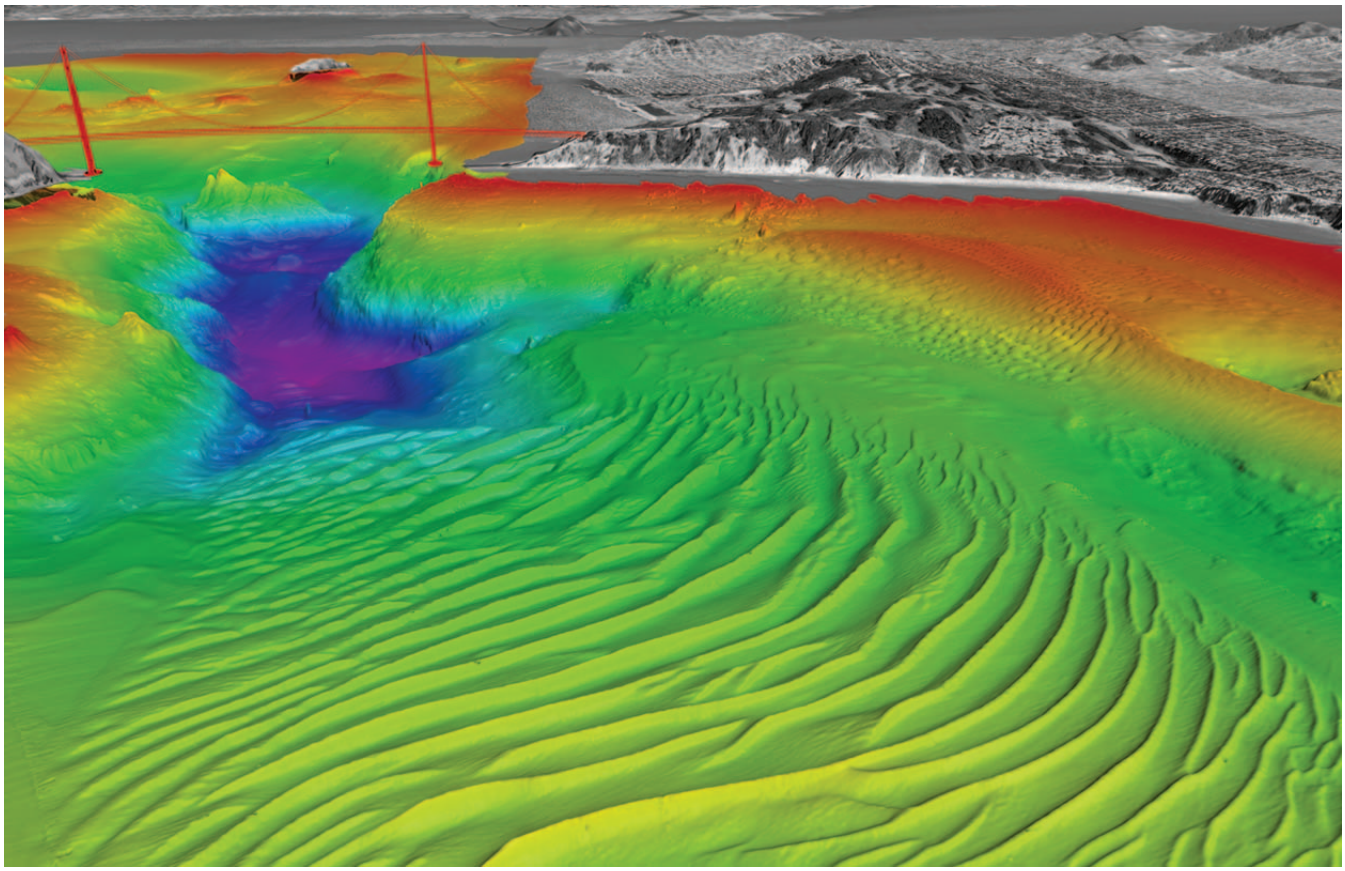
COVER PHOTOGRAPH



COVER PHOTOGRAPH: SAN FRANCISCO BAY, CALIFORNIA, U.S.A.

Perspective view of the giant sand wave field at the mouth of San Francisco Bay, just seaward of the Golden Gate Bridge

The shaded relief bathymetry was created in Fledermaus with a 2-m grid, a 4x vertical exaggeration, sun azimuth of 240 degrees, and a sun angle 66 degrees. The land image was generated by overlaying digital orthophoto quadrangles on U.S. Geological Survey (USGS) digital elevation models, with 2x vertical exaggeration. The Golden Gate Bridge is approximately 2 km long (1.2 mi). The bathymetry inside the bay is from Dartnell and Gardner (1999). Golden Gate Bridge model courtesy of Interactive Visualization Systems.

A field of giant sand waves, among the largest in the world, is located just west of the Golden Gate Bridge, as imaged for the first time during a recent multibeam survey led by the USGS. These waves were formed by abundant sediment and tidal currents that regularly exceed 2.5 m/s. This massive sand wave field covers about 4 km^2 in water depths ranging from 30 m to 106 m. More than 40 distinct sand waves were identified; the waves have an average wavelength of 82 m and an average height of 6 m. The maximum wavelength and height are 220 m and 10 m, respectively. Sand wave crests extend 2 km across the mouth of this energetic tidal inlet, where each tide forces 2 billion m^3 (528 billion gallons) of water under the Golden Gate.

Multiple surveys of a 2.5 km track line through the center of the massive sand wave field were completed in 2004 and 2005, permitting calculation of short- (daily) and long-term (annual) rates of bedform migration and sediment transport. In 2004, 24-hours surveys showed that crests shifted as much as 3 m, whereas over the entire 13-day sampling period average sand wave migration was 1.4 m (11 cm/day). The 2005 surveys indicated that the net migration rate, when averaged over an entire year, is 7 m, or less than 2 cm/day seaward. Strong tidal fluctuations thus cause daily sand wave oscillations that are a significant percentage of annual migration rates, but flow reversals result in a relatively low rate of net sand wave migration annually.

The multibeam bathymetric survey that produced these high resolution images of the mouth of San Francisco Bay was conducted in 2004 and 2005 via collaborative efforts between the U.S. Geological Survey, the Seafloor Mapping Lab at California State University, Monterey Bay, the United States Army Corps of Engineers, San Francisco District, and NOAA's Coastal Observation Technology System Center for Integrative Coastal Observation, Research and Education program. Digital files are available at http://pubs.usgs.gov/sim/2006/2944/. For more information, go to http://walrus.wr.usgs.gov/coastal_processes/. This work will be featured in an upcoming JCR Special Issue: Hanes, D.M. and Barnard, P.L., 2007. Morphological evolution in the San Francisco Bight. *Journal of Coastal Research,* SI 50 (Proceedings of the 9th International Coastal Symposium), Gold Coast, Australia.