San Francisco to Hawaii, and Back Again

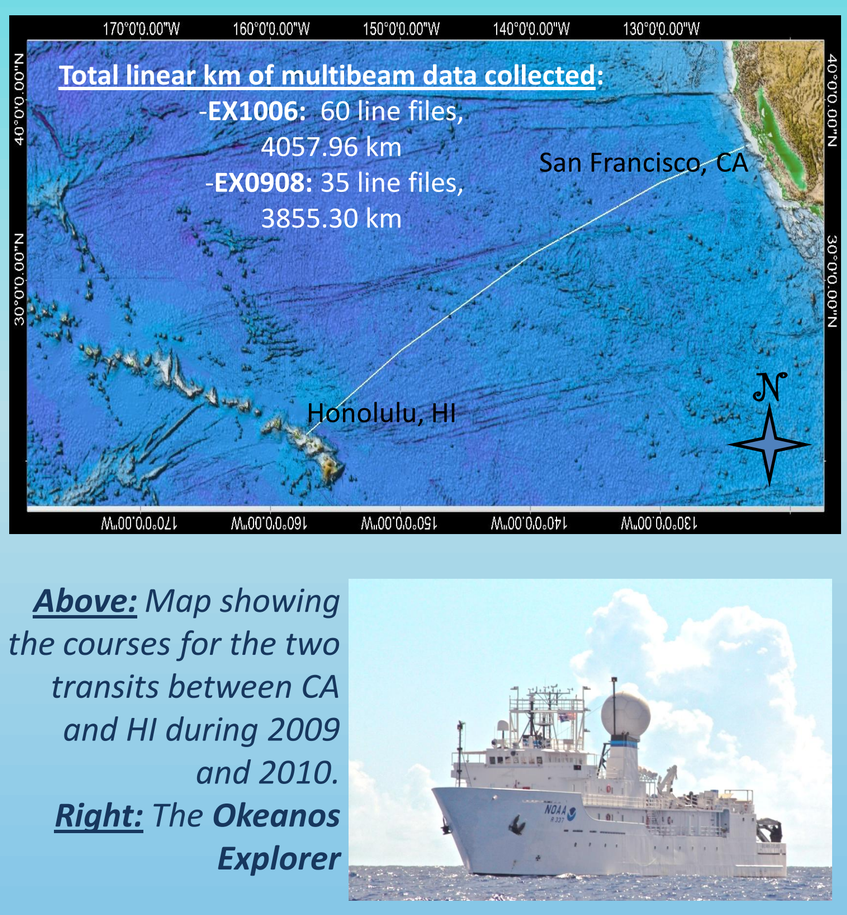
Transit Voyages on the NOAA Ship *Okeanos Explorer*

EX0908: July 29-August 8, 2009 & **EX1006:** October 19-29, 2010

Karma Kissinger, OER Watchstander 2009/2010

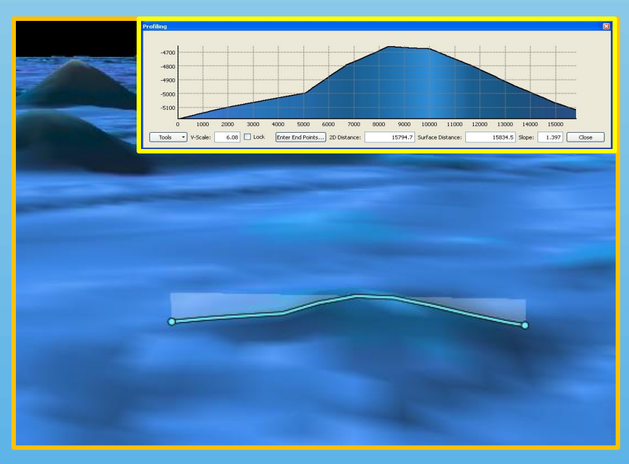
The Sticks and Boxes Model

The *Okeanos Explorer* uses what is known as a **sticks and boxes** approach for ocean exploration. Predetermined, high-priority areas designated for scientific survey represent the "boxes." Transit voyages between boxes incorporate the "sticks" into the model, as the ship moves from one box to another. During 2009 and 2010, the *Okeanos Explorer* conducted two transit cruises between Honolulu, HI and San Francisco, CA. The two voyages were extremely close in proximity to each other, even overlapping in some areas. The *EX1006* transit revealed a larger number of visible features than *EX0908*. At least three potentially new features with heights greater than 1000 meters have been charted from the *EX1006* data.



Above: *Map showing the courses for the two transits between CA and HI during 2009 and 2010.*

Right: *The* ***Okeanos Explorer***



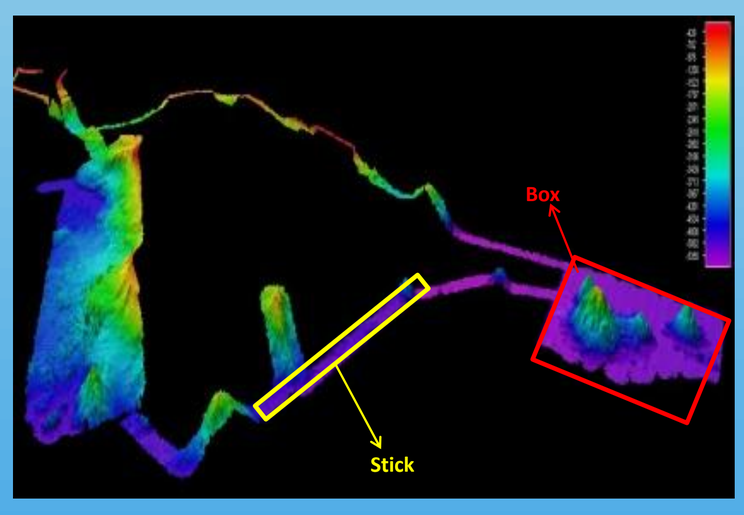
Above: Sandwell and Smith global bathymetry data originally estimated this feature to be ~600 meters high. Profile drawn left to right.

Why Explore In This Way?

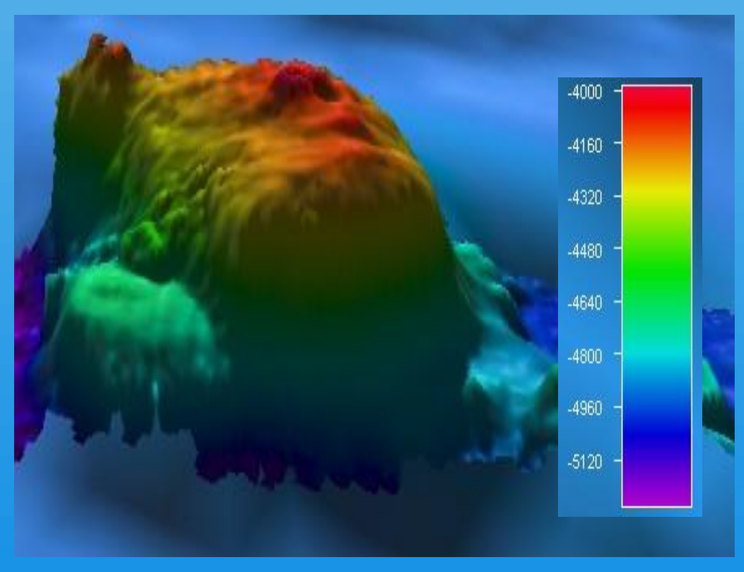
The addition of sticks into the survey model allows for larger, unknown areas of ocean to be surveyed, rather than by just using boxes alone.

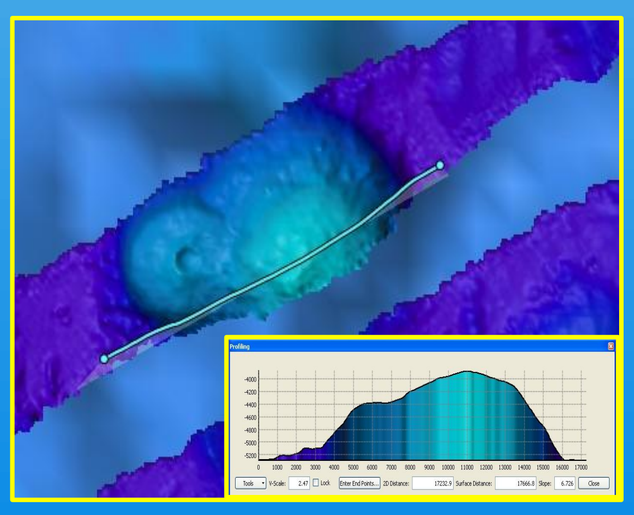
Transit cruises are truly exploratory; increasing the potential to discover exciting new seafloor features, improve overall global bathymetry data, and expand the limits of current ocean exploration.

Right: Screen capture in Fledermaus of a sticks and boxes model used previously to survey around the main Hawaiian Islands during the 2009 field season. *Image credit: NOAA*



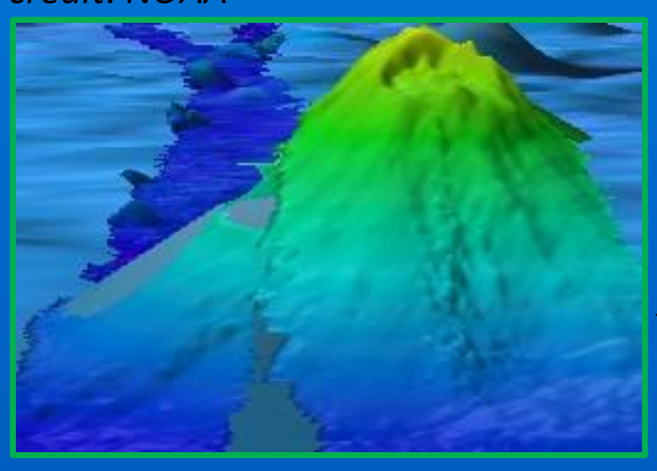
Right: Image from the EX0908 transit showing a seamount estimated to be at least 1100 meters high. Depths on color bar shown in meters. Vertical exaggeration 3. *Image credit: NOAA.*





Above: View of same feature using EM302 data collected during EX1006. New height estimate ~1395 meters . Profile drawn left to right. Vertical exaggeration for both images, 3. *Image credits: NOAA*

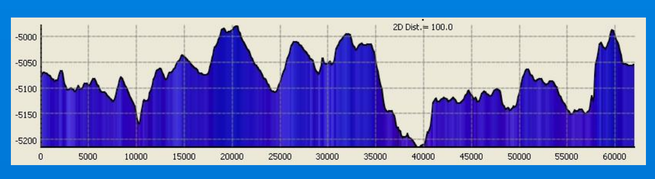
Below: Screen capture of Fledermaus showing **Huddell Seamount**, which was partially mapped during both **EX0908** and **EX1006**. Overlap of ship's track (dark blue) during both cruises can be seen in background. *Image credit: NOAA*



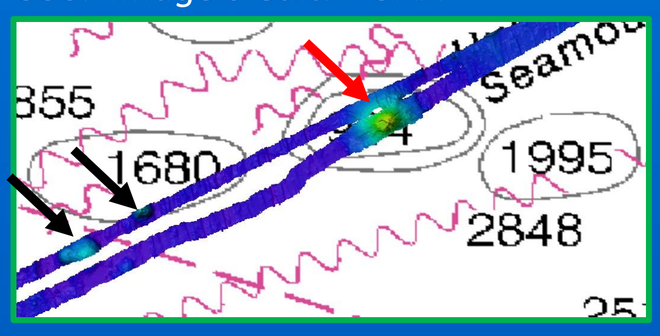
Interesting Features

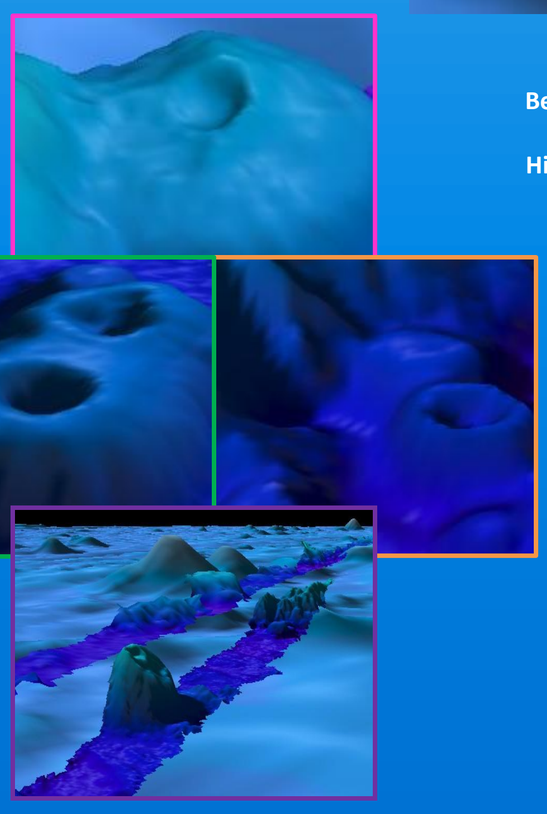
Right: Screen captures in Fledermaus showing features that were observed on the **EX1006** transit from Hawaii to San Francisco. The types of pits and craters shown were noticed to be very prolific in the data gathered on this cruise. *Image credits: NOAA*

Below: A seafloor profile from the **EX0908** data. *Image credit: NOAA*

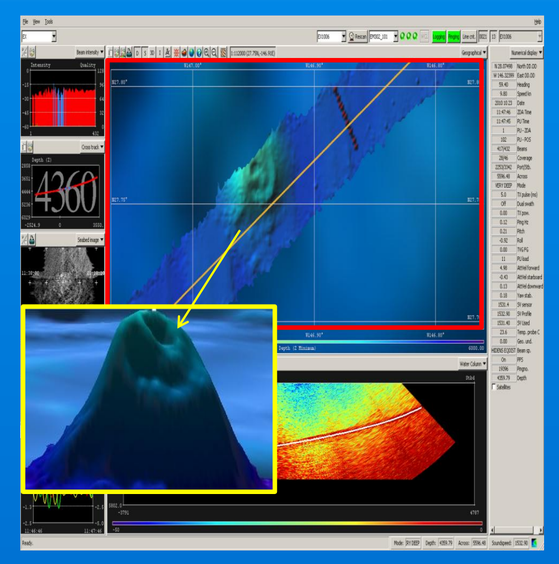


Below: Data collected can be used to improve nautical charts. Huddell Seamount (indicated by red arrow) and two potential discoveries (black arrows) are shown. From NOAA Chart 530. *Image credit: NOAA*





Below, Highlighted in red: Screen capture of Kongsberg SIS software, of what appears to be a collapsed cone. **Highlighted in yellow:** Screen capture from Fledermaus showing 3D image of same cone, after processing EM302 data. *Image credit: NOAA*



Additional Research

Both EX0908 and EX1006 were useful in the acquisition of new bathymetric data for the relatively unexplored Pacific Ocean. In addition to collecting multibeam data, the EX1006 cruise incorporated two "surveys of opportunity" conducted by National Marine Fisheries Service (NMFS) personnel. This research involved measuring plankton diversity and sampling for plastics to better understand the extent of the Pacific Garbage Patch. These additional surveys are yet another way that transit voyages can be used to increase our understanding of the world's oceans.