

BOX 5 | The NOAA Ship *Okeanos Explorer*: New Ways For Exploring the Ocean

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BACKGROUND

Since its inception in 2001 in response to the report of the President's Panel on Ocean Exploration (McNutt et al., 2000), the Ocean Exploration Program of NOAA's Office of Ocean Exploration and Research (OER) has made exciting discoveries across all fields of oceanography. Some of the most spectacular discoveries have been related to seamounts, specifically the "North Atlantic Stepping Stones" expedition off the coast of New England (<http://oceanexplorer.noaa.gov/explorations/05stepstones>) and the "Ring of Fire" expedition in the Pacific Ocean (<http://oceanexplorer.noaa.gov/explorations/06fire>).

OER now is in the final stages of field-testing *Okeanos Explorer* (known as "EX"; Figure 1), a dedicated ship for exploration of the world ocean. EX's mission will be to systematically explore unknown ocean areas and phenomena using a state-of-the-art 30-kHz multibeam mapping system (Figure 2, top), a dual-body remotely operated vehicle (ROV) that is depth-rated to 6000 m

and outfitted with high-definition video cameras and a suite of standard oceanographic sensors. The objective will be to search for and characterize physical, chemical, and biological anomalies on the seafloor and in the water column (Figure 2, bottom) in order to establish a foundation for future research. These early tests have already generated new information on previously unknown seamounts off the US West Coast and Hawai'i.

TELEPRESENCE OPERATIONS

A truly unique capability of EX is its "telepresence" system, which uses broadband satellite technology, allowing scientists to lead expeditions from shore-based Internet 2-enabled "Exploration Command Centers." These command centers are equipped with plasma screens that can receive high-definition video and



Figure 1. NOAA ship *Okeanos Explorer*, dedicated to world ocean exploration. NOAA photo

SHIP SPECIFICATIONS

Length: 224 ft
Breadth: 43 ft
Draft: 17 ft
Full Load Displacement: 2312 lt
Lightship Displacement: 1616 lt
Speed: 10 kts
Range: 9600 nm
Endurance: 40 days
Call Letters: WTDH
Commissioned Officers: 6
Licensed Engineers: 3
Crew: 18
Mission Personnel: 19
Launched: October 28, 1988
Transferred to NOAA: September 10, 2004
Commissioned: August 13, 2008
Builder: VT Halter Marine, Inc., Moss Point, MS

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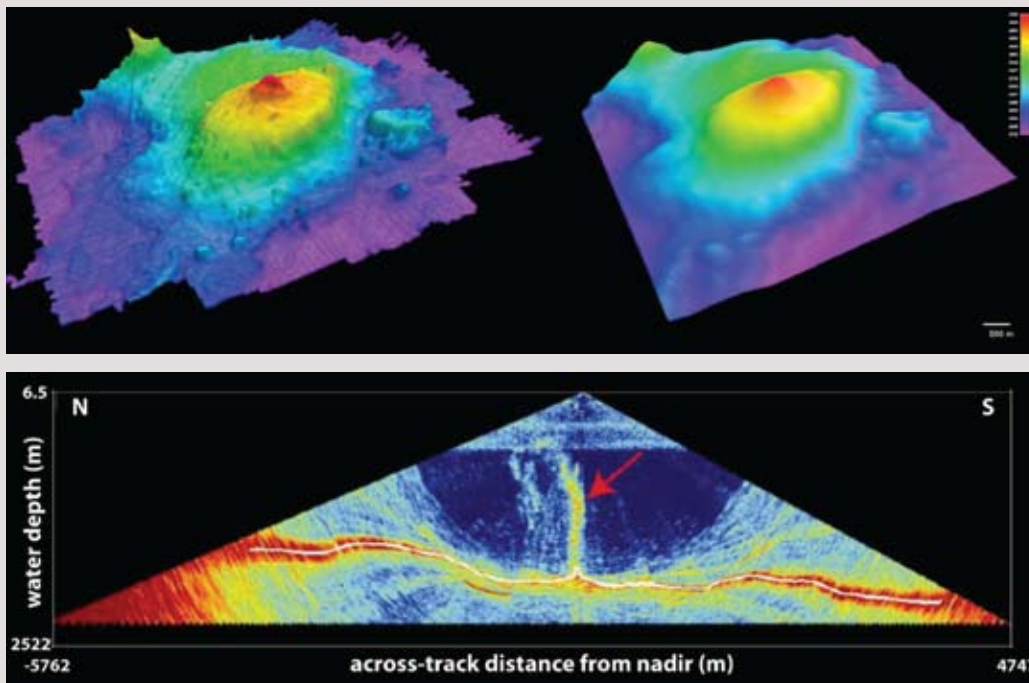


Figure 2. (Top) A small seamount mapped with (right) a conventional 12-kHz swath sonar and the same seamount mapped with (left) *Okeanos Explorer's* 30-kHz Kongsberg EM302 system. The EM302 data are resolved to a 20-m bin size. The range of depths in the illustration are from about 1700 m to 2700 m. (Bottom) Screen capture of a single ping cycle of the ship's 30-kHz system showing what appears to be an approximately 1400-m presumed methane plume (arrow) rising from a depression on the southern scarp of the Mendocino Fracture Zone (Gardner et al., 2009).

other data streams, as well as a voice over IP audio communications system. Scientists on shore will be able to view all of the information being collected and to provide specific instructions to ROV pilots, survey technicians, and other technical personnel on the ship.

Another unique characteristic of the EX mission is that all the data collected will be quality assured and made available (often in near-real time) to anyone who wants to use them. The teams guiding the expeditions thus will be working on behalf of the entire oceanographic community.

SEAMOUNTS AND OKEANOS EXPLORER'S EXPEDITIONS

Okeanos Explorer expedition planning will be done by means of workshops that include both the United States and the international oceanographic communities. Among the first anticipated areas to be explored when EX becomes operational in spring 2010 is the newly designated Marianas Trench Marine National Monument, which is characterized by dozens of unexplored seamounts and hundreds of volcanic cones, and Indonesia, where there is a strong likelihood of discovering high biological and geological diversity, including submarine volcanoes. Subsequent expeditions will likely explore portions of the largely unknown Pacific Remote Islands Marine National Monument, a region notable for a 2000-km-long chain of extinct,

mostly submerged volcanoes.

Information pertaining to all future expeditions will appear on the OER Web site (<http://oceanexplorer.noaa.gov>). Given that nearly half of the more than 40 proposed ideas for EX's initial expeditions involve seamounts, it is clear that they will continue to be one of the highest priorities for EX's voyages of discovery for years to come.

ACKNOWLEDGMENTS

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REFERENCES

- Gardner, J., M. Malik, and S. Walker. 2009. Plume 1400 meters high discovered at the seafloor off the northern California margin. *Eos, Transactions, American Geophysical Union* 90(32):275.
- McNutt, M., V. Alexander, J. Ausubel, R. Ballard, T. Chance, P. Douglas, S. Earle, J. Estes, D. Fornari, A. Gordon, and others. 2000. *Discovering the Earth's Final Frontier: A US Strategy For Ocean Exploration*. US Department of Commerce, National Oceanic and Atmospheric Administration, 77 pp. Available online at: http://explore.noaa.gov/media/http/pubs/pres_panel_rpt.pdf (accessed December 10, 2009).