



Outstanding Accomplishments in Research

Ocean Exploration

Research is at the center of all NOAA services. NOAA's Office of Oceanic & Atmospheric Research (OAR) helps improve weather forecasts, and enhances navigation and aviation safety, as well as a variety of coastal services.

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NOAA's program for ocean exploration conducts interdisciplinary expeditions which are resulting in a wide diversity of important discoveries including active submarine volcanoes, unsuspected ecosystems in sometimes extreme environments, living and non-living marine resources, and historical shipwrecks. Following are some recent ocean exploration accomplishments.

Telepresence Technology

NOAA's expedition to the "Lost City" and three subsequent expeditions, set a new precedent in ocean exploration using "telepresence technology". In less than two seconds, images traveled from 640 meters below sea level to the NOAA research vessel *Ronald H. Brown*, across the Atlantic Ocean to the "Inner Space" hub at the University of Rhode Island, and then across the United States to scientists at Science Command Centers around the country.

"Telepresence technology" utilizes high-speed satellite and internet pathways to connect real-time images from the sea floor and from research vessels to Science Command Centers. This new technology allows more intellectual capital to be used for ocean missions by connecting scientists standing watch ashore with the missions at sea. In addition, ocean literacy is advanced when the excitement of ocean discovery in real-time is brought to teachers and students, and indeed to anyone with Internet access. *Okeanos Explorer*, NOAA's new ship for ocean reconnaissance, will use telepresence to share discoveries with audiences ashore.

Deep Slope Ocean Exploration

NOAA joined forces with the Department of the Interior's Minerals Management Service on a series of

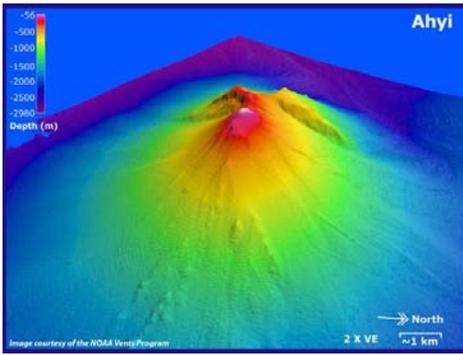
expeditions to explore the deep slope ocean (depths greater than 1,000 meters) to locate, map, and investigate deep water chemosynthetic and coral communities in the Gulf of Mexico, in advance of potential oil and gas exploration and development. The 2006 expedition was conducted aboard the Woods Hole Oceanographic Institution's Research Vessel (R/V) *Atlantis*, the support vessel for the Alvin submersible.

Davidson Seamount Expedition to Ancient Coral Gardens

This expedition of deep coral communities found on the Davidson Seamount off the California coast was conducted aboard the Monterey Bay Aquarium Research Institute's R/V *Western Flyer* and used the Tiburon deep water remotely operated vehicle (ROV). Maps of corals developed during this cruise help protect fragile ecosystems by identifying cable-laying locations where corals will not be harmed, and critical protection areas within marine reserves in central California.



This curious octopus (Benthoctopus sp.) was found at 2,422 meters depth next to an orange stalked crinoid on the Davidson Seamount. Image courtesy of NOAA/MBARI.



Ahji submarine volcano, looking toward the southwest. Depths in this image range from 56 to 2,980 meters. Image is two times vertically exaggerated. Image courtesy of Submarine Ring of Fire 2006 Exploration, NOAA Vents Program

Submarine Ring of Fire

NOAA continued a multi-year series of discovery missions to undersea volcanoes and hydrothermal vents associated with the Submarine Ring of Fire, a large but virtually unexplored province in the Pacific where the Earth's tectonic plates are being forced below the

Earth's crust. Accomplishments include discovery of abundant flows of both gaseous and liquid carbon dioxide (CO₂) from the seafloor, which will provide a natural deep-ocean laboratory for studying ocean sequestration of this greenhouse gas. Regionally, large volumes of CO₂ are affecting the acidity of the water column and the amounts and cycles of CO₂ in seawater. Newly discovered hydrothermal venting is producing mineral deposits likely to contain ore-grade concentrations of precious metals. Because the Mariana Arc hydrothermal fluids are very differ-

ent than those associated with seafloor spreading centers, a large variety of apparently unique ecosystems have been discovered. The biotechnical and pharmaceutical value of these organisms is under study.

Tracking Narwhals in Greenland

NOAA Ocean Exploration sponsored scientists from the University of Washington and the Greenland Institute of Natural Resources to instrument narwhals, a type of whale, with satellite-linked time-depth-temperature recorders to track whale movements, diving behavior, and ocean temperature structure in Baffin Bay. The instruments will collect water column temperature profiles. Baffin Bay is a gateway for the colder fresh polar waters flowing south to the Labrador Shelf into the North Atlantic, ultimately impacting its current. Monitoring changes in this outflow is critical for understanding the impacts of a changing Arctic on thermohaline circulation, also known as the global ocean conveyor belt.

Alaska's Submerged Heritage

A NOAA-sponsored interdisciplinary science team led by Alaska's state archaeologist investigated five significant shipwrecks located in coastal southeast Alaska to begin inventorying and verifying Alaska's more than 4,000 submerged heritage sites. Findings will constitute "snapshots in time" for future studies to better understand changes due to natural and cultural processes, and for scientists to better understand the effects of coldwater deterioration.

PREEMINENT RESEARCH

The ocean, our greatest resource, covers over 70 percent of the Earth's surface. And yet, only a fraction of its secrets are known. With this in mind, NOAA launched a systematic, strategic effort to search and investigate the deepest reaches of our planet's oceans for the purpose of discovery.

NOAA's ocean exploration mission is comprised of four crucial components including mapping the physical, biological, chemical, and archaeological aspects of the ocean; understanding ocean dynamics at new levels to describe the complex interactions of the living ocean; developing new sensors and systems to regain U.S. leadership in ocean technology; and reaching out to the public to communicate how and why unlocking the secrets of the ocean is well worth the commitment of time and resources, and to the benefit current and future generations.

VALUE TO SOCIETY

Ocean exploration benefits NOAA and the Nation by providing a management structure to enable a broad program of exploration of ocean resources across many scientific, cultural, and technological disciplines, and among many participants. Ocean Exploration promotes discovery-based science, collaboration, education and outreach.

Over 95 percent of the underwater world remains unknown and unseen. Exploration may reveal clues to the origin of life on earth, cures for human diseases, answers for the sustainable use of resources, links to our maritime history, and information to protect endangered species.

To Learn More, Visit These Sites:

NOAA's Ocean Explorer: <http://oceanexplorer.noaa.gov/welcome.html>

NOAA's Undersea Research Program: <http://www.nurp.noaa.gov/>

To Work or Study at OAR, Visit These Sites:

NOAA Careers: <http://www.careers.noaa.gov>

Hollings Scholarships: <http://www.orau.gov/noaa/HollingsScholarship/>

Knauss Fellowships: <http://www.seagrant.noaa.gov/knauss/>

Ocean Careers: <http://oceanexplorer.noaa.gov/edu/oceanage/welcome.html>

OAR's mission is to conduct research, develop products, provide scientific understanding and leadership and to conduct outreach towards fostering NOAA's evolving environmental and economic mission.