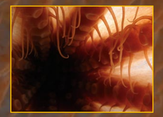
Arms – *One of the best known features of octopuses is that they have eight arms. The inner surface of each arm is lined with a row of suction cups that can be used to seize prey, or hold onto substrate and help the octopus move across the seafloor. A characteristic of this genus of octopuses is the two "cirri," or muscular, finger-like appendages branching off each sucker.*

Octopus – ***Cirroteuthis muelleri's*** *body is the size of a football. A fairly slow swimmer, it uses both the webbing between its arms and its large, flapping fins to move. Whether the octopus also swims using "jet propulsion" is still debated. The large ear-like fins are a primitive characteristic for cephalopods (octopus and squid), and makes this octopus different from others. With the webbed arms stretched out to the side, the animal can be more than three feet wide.*



Black hole that is the mouth – *If you are an ocean animal and see this view then watch out, you are about to be eaten! This seemingly endless black hole is the octopuses' mouth. Scientists use submersibles to see what the octopus looks like because octopuses are fragile and easily damaged when brought up in trawls. Learning about their behavior is difficult and not much is known about this animal's feeding biology.*

CIRROTEUTHIS MUELLERI

Cirroteuthis muelleri, a finned, cirrate octopus is known to be fairly common in the Arctic around Greenland and is found in both the North Atlantic and North Pacific Oceans. With the large, ear-like fins, these octopuses are commonly called "Dumbo." This specimen was found 2,410 meters deep during the 2005 "Hidden Ocean" cruise, a NOAA-sponsored expedition to the Arctic Ocean in support of the Census of Marine Life. (See *oceanexplorer.noaa.gov/explorations/05arctic/welcome.html*) Image copyright 2005 by Kevin Raskoff.

NOAA OFFICE OF OCEAN EXPLORATION

Field Season Highlights

oceanexplorer.noaa.gov

EXPLORE

2005 AND EARLY 2006 FIELD SEASON HIGHLIGHTS

NOAA's Office of Ocean Exploration funds and equips teams of multidisciplinary scientist-explorers on ocean expeditions in support of national and NOAA goals and objectives. Our 2005 field season, and early expeditions in 2006, continued our record of pathfinding ocean missions of discovery that raise basic new questions about our largely unknown ocean, for further investigation and research.

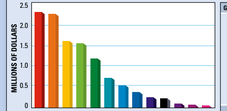
Vision: A society in which citizens make informed decisions about ocean issues because they are inspired by the wonder and mysteries of the ocean and understand the ocean's importance to all life on Earth.

Mission: To support NOAA and national objectives by exploring our largely unknown ocean in all its dimensions for the purpose of discovery and the advancement of knowledge.

Goals: (1) Mapping and describing the physical, biological, geological, chemical and archaeological aspects of the ocean; (2) Understanding ocean dynamics in new places and at new levels to describe the ocean's complex interactions; (3) Developing new technologies, sensors and systems to better meet exploration objectives; and (4) Conveying to the public how and why unlocking the secrets of the ocean will benefit current and future generations.

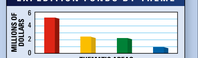
Fiscal Year 2005 Business Report

DISTRIBUTION OF THE 2005 EXPEDITION FUNDS BY REGION



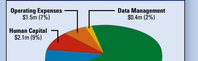
GEOGRAPHICAL REGIONS	TOTAL	PROJECTS
WESTERN PACIFIC	$2,332,000	6
ARCTIC	$2,273,000	4
MID-ATLANTIC OCEAN	$1,545,000	3
EASTERN PACIFIC	$1,532,000	9
SOUTH ATLANTIC BIGHT	$1,192,000	3
GULF OF MEXICO	$674,000	4
MEDITERRANEAN SEA	$500,000	1
NEW ENGLAND	$338,000	5
CARIBBEAN	$215,000	1
ANTARCTIC	$191,000	1
GULF OF ALASKA	$67,000	1
MID-ATLANTIC STATES	$58,000	1
GREAT LAKES	$34,000	1
TOTAL	$10,951,000	40

DISTRIBUTION OF THE 2005 EXPEDITION FUNDS BY THEME



THEMATIC AREAS	TOTAL	PROJECTS
HABITAT CHARACTERIZATION	$5,254,000	14
MARINE LIFE INVENTORIES	$2,506,000	8
DEEP CORALS	$2,244,000	8
MARINE ARCHAEOLOGY	$947,000	10
TOTAL	$10,951,000	40

FY 2005 BUDGET BY CATEGORY

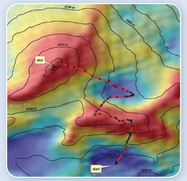


SIGNATURE EXPEDITIONS

Davidson Seamount: Exploring Ancient Coral Gardens *(Jan - Feb, 2006)*

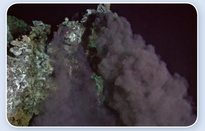
Chief Scientist Andrew DeVogelaere of Monterey Bay National Marine Sanctuary, led a team to the largely unexplored Davidson Seamount off California, on the Research Vessel (R/V) *Western Flyer* and used the remotely-operated vehicle (ROV) *Tiburon* and an array of scientific instruments.

Achievements: *With coral maps developed from this cruise, studies will be more efficient, managers can focus activities such as cable laying, where corals are not expected, and critical protection areas can be identified when marine reserves, including no-take areas, are selected in central California.*



Map of two peaks on Davidson Seamount, with the underwater robot's dive track shown in red and dots along the track indicating significant events. Researchers can now search for information about events in a database. *Credit: NOAA/MBARI 2006.*

Galápagos: Where Ridge Meets Hotspot *(Dec 2005 - Jan 2006)*



Newly found black chimney smoker, formed by metals deposited when hot water cools. *Credit: UCSB, Univ. S. Carolina, NOAA, WHOI.*

A science team, funded by NOAA and the National Science Foundation, and led by Chief Scientist Rachel Haymon from the University of California at Santa Barbara, sailed on the Research Vessel *Thompson* to survey a 400 km-long section of the Galápagos Spreading Center above the mantle plume and hotspot that created the Galápagos Islands. They surveyed an area completely unexplored for hydrothermal vents, and scientists sought to uncover hydrothermal, chemical, geological and biological responses to magma supply and crustal thickness.

Achievements: *Scientists found and imaged black smoker chimneys for the first time in this area, and they studied associated communities of marine animals. Findings are expected to advance our basic understanding of undersea volcanoes and hotspots.*

Life on the Edge, and Florida Coast Deep Corals *(Oct - Nov, 2005)*

Despite poor weather, scientists operated in waters off the East Coast to explore continental slope coral ecosystems. Principal Investigator Steve Ross, from the University of North Carolina at Wilmington, on assignment to U.S. Geological Survey (USGS), and Co-Principal Investigator Martha Nizinski from NOAA Fisheries Service, led an international team of scientists operating from the R/V *Seward Johnson*, and using the manned submersible *Johnson-Sea-Link (JSL)*.

The JSL submersible offers a panoramic view of the underwater world, 400 meters deep. *Credit: Art Howard.*

Sandra Brooke from the Oregon Institute of Marine Biology, and John Reed from Harbor Branch Oceanographic Institution led investigators on the continuation mission to document and study the habitat and biodiversity of deep-water coral sites off the coast of Florida.

USGS's Cheryl Morrision photographs Lophelia coral. *Credit: Bob Schwartz.*

Achievements: *Both missions recorded observations, collected samples, and used molecular tools to study deep-sea coral biodiversity and population genetics. Scientists collected soft corals that form growth rings at regular intervals with potential for data about the ocean and climates. Previously unidentified coral and crustaceans were discovered and chemicals produced by deep-sea snails were collected for analysis. Findings will add to our understanding of deep-sea coral communities so we may better understand and manage these important resources.*

Operation Deep Scope *(Aug - Sept, 2005)*

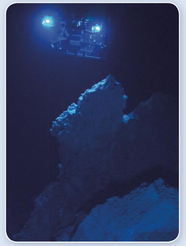
A 3-foot fluorescent chain cat shark, more than 1,800 feet deep. *Credit: Deep Scope 2005 Science Team.*

This mission looked into the Gulf of Mexico with "new eyes," deploying the unobtrusive "Eye in the Sea" camera to conduct observations of animals in their natural habitats and without the use of bright lights. The expedition used new tools with the *Johnson Sea Link* submersible to study polarization and fluorescence in the deep-sea environment, and to collect live species for vision studies in shipboard labs. Tamara Frank of Harbor Branch Oceanographic Institution, and Co-Principal Investigator Edith Widder of Ocean Research and Conservation Association, led the science team.

Achievements: *New techniques and systems were advanced to allow scientists to use unobtrusive methods to better discover new species and learn more about the natural behavior of animals. Scientists also conducted SCUBA dives to study how some animals use transparency in a mid-water environment to hide from predators. Some animals were brought up in light-tight boxes to learn more about how their eyes operate in the deep and dark ocean. Scientists obtained a video of the fluorescent cat-shark, and discovered ultra-violet vision in a deep-sea crab, both of which made national news.*

The Lost City 2005 *(July - Aug, 2005)*

This precedent-setting ocean expedition used "telepresence technology," high-speed satellite and Internet pathways, to connect Robert Ballard at sea on the NOAA ship *Ronald H. Brown* in the mid-Atlantic ocean, with Chief Scientist Debbie Kelley who led the science of the mission though she was at the University of Washington, nearly 5,000 miles from the research vessel. Kelley and other scientists were in a science command center at the University of Washington connected to Ballard in real time through the "Inner Space" Center at the University of Rhode Island.



IFE ROV Hercules approaches a ghostly, white, carbonate spire in the Lost City Hydrothermal Field, about 2,500 feet below the surface of the Atlantic Ocean. *Credit: IFE, URI-IAO, Univ. of Wash. Lost City science party, and NOAA.*

Achievements: *With scientists ashore at the University of Washington, and others on call, more intellectual capital was applied to the mission. Past missions have been limited by ship-to-shore communications capacity, the finite number of berthing spaces on research vessels and by competing obligations which sometimes precluded top scientists from going to sea. Also, scientists at the UNH/NOAA CCOM Joint Hydrographic Institute, received streams of data from the ship's multibeam sonar, and overnight turned it into 3D maps of the ocean floor to help scientists at sea plan the next day's missions.*

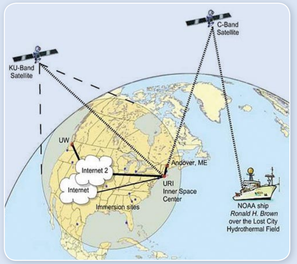
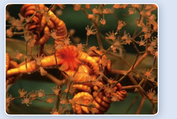


Diagram showing how video and data was sent between the ship and shore sites. *Credit: Todd Viola, Phil Scheuer, Immersion Presents.*

Using "telepresence technology," Robert Ballard on the NOAA ship Ronald H. Brown sent real-time images from the mid-Atlantic seafloor to scientists and students ashore nearly 5,000 away. *Credit:* NOAA photo.

North Atlantic Stepping Stones *(Aug - Sept, 2005)*

This mission targeted North Atlantic seamounts, to determine if they function as 'stepping stones' allowing hard substrate organisms to expand their ranges across ocean basins. The team worked from NOAA ship *Ronald H. Brown*, using IFE's Hercules/Argus remotely-operated-vehicle system. Co-Principal Investigators Tim Shank from Woods Hole Oceanographic Institution, Peter Auster from the University of Connecticut and NOAA, and Les Watling from the University of Maine, led a multidisciplinary team.

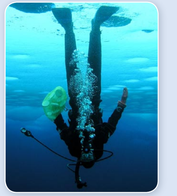


Deep-sea coral Metallogorgia, close-up with a basket star. *Credit: DASS Science Team, IFE, URI-IAO, NOAA.*

Achievements: *The mission exceeded expectations and included dives on 10 seamounts; extensive collection of multibeam data; collection of nearly 350 samples of corals, sponges and associated fauna; documentation of the habitat and foraging behavior of dozens of fish species; and collection of extensive seamount imagery.*

The Hidden Ocean, Arctic *(June - July, 2005)*

Led by Chief Scientists Rolf Gradinger from the University of Alaska (Fairbanks), an international team of scientists from the U.S., Canada, China and Russia sailed on the icebreaker *USCGC Healy* to explore Canada Basin, one of the deepest parts of the Arctic Ocean. With divers, photographic platforms, a remotely operated vehicle, ice corers, nets and trawls, scientists studied the abundance and diversity of life from sea-ice surface to thousands of meters deep on the seafloor.



Ice diver Shawn Harper "stands" on the ice ceiling above him. *Credit: The Hidden Ocean, Arctic 2005 Exploration, NOAA-OE, Katrin Iken.*

Achievements: *This mission supported the Census of Marine Life in building a baseline of data to evaluate the impacts of quickly changing environmental conditions, including warming and ice melt. Numerous species were seen for the first time in the Amerasian Arctic, and up to 10 of those are believed to be new species.*

A deep red medusa found just off the bottom of the deep sea. *Credit: Kevin Raskoff, California State University, Monterey Bay.*

New Zealand American Submarine Ring of Fire *(April - May, 2005)*

Scientists and explorers from New Zealand and the United States operated from the University of Hawaii's Research Vessel *Ka'imikai-o-Kanaloa* with human-occupied vehicles PISCES IV and V operated by the Hawaii Undersea Research Laboratory, to conduct dives at eight submarine volcanoes, seven of which had never been explored, along the Kermadec Arc north of New Zealand. Bob Embley from NOAA's PMEL, and Alex Malahoff and Gary Massoth, from the Institute of Geological and Nuclear Sciences Ltd in New Zealand, were co-chief scientists on legs of the mission.

Artwork of the manned submersible Pisces IV as it moves over a dense mussel bed through streams of bubbles on a submarine volcano 650 feet deep. *Credit: Terry Kerby.*

Achievements: *Scientists explored largely unknown active and dormant undersea volcanoes on the southern side of the large tectonic plate that far to the north triggered the catastrophic tsunami in December, 2004. The mission added to our basic understanding of undersea volcanoes and Earth processes such as the rare, but potentially very damaging large-scale caldera-forming events that could generate ocean-wide tsunamis. Scientists also gained insights into ore-forming processes associated with subduction zone volcanic action, and they learned more about how degassing events may reduce buoyancy, an event that could pose a hazard to shipping. Scientists also discovered potential new species and extended ranges for known species.*

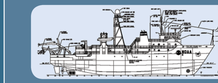
EDUCATION

To raise America's environmental literacy, the Ocean Exploration Program is committed to engaging the broadest possible audiences in near real-time ocean exploration by using telepresence technology to bring the excitement of ocean exploration into classrooms. Educators learn more about NOAA ocean exploration, and they learn how mathematics, science, and technology content associated with exploring the ocean can be used in classrooms where students become virtual members of the exploration team.

There are more than 250 lessons on the Web site for teachers of Grades 5–12, based on National Science Education Standards, connected with ocean expeditions and correlated to Ocean Literacy Essential Principles and Fundamental Concepts. Education Modules were also developed for expeditions and they include lessons, multimedia learning objects, OceanAGE Ocean Career connections and other links and resources specific to expeditions. Join us as we reach out in new ways to enhance ocean literacy among stakeholders of all ages. Explore with us the exciting ocean education opportunities by clicking on "Education" at oceanexplorer.noaa.gov.

DID YOU KNOW?

- Though we depend on the ocean for half our oxygen, for food, medicines, and ocean transportation routes, and to regulate temperature, the ocean is 95 percent unexplored, unseen by human eyes.
- *Okeanos Explorer* will be NOAA's new ship for ocean exploration and after shipyard conversion, it will be ready for ocean expeditions in 2008.



- In addition to our major, or "Signature," expeditions, NOAA's Office of Ocean Exploration supported a number of ocean projects in 2005, including, Sounds of the Southern Ocean, Aquarius Habitat, Galapagos Rift, Vailulu'u, and Hudson River Archaeology, among others. See oceanexplorer.noaa.gov for details.
- More than four million people visited oceanexplorer.noaa.gov in 2005.
- You can try to solve the Ocean Challenge Puzzle, under "For Fun," at oceanexplorer.noaa.gov.

FOR MORE INFORMATION, CONTACT:

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