

NOAA Ship *Okeanos Explorer*: 2018 Field Season Overview

October 2017 - September 2018



Ocean Exploration
and Research



NOAA Ship *Okeanos Explorer* at sea.

Introduction

From October 2017 to September 2018, NOAA Ship *Okeanos Explorer* will return to the Atlantic Ocean and conduct a series of expeditions to continue exploration of the deep waters of the U.S. Gulf of Mexico and North Atlantic. A multidisciplinary team of scientists, technicians, and engineers – both on board the ship and on shore – will conduct undersea mapping and remotely operated vehicle (ROV) explorations of the geological, biological, archaeological, and chemical features of these vast areas.

The team will investigate the Gulf of Mexico, Mid- and South Atlantic Bight, Northeast U.S./Canada transboundary area, and a priority mapping area in international waters south of Bermuda. The Atlantic expeditions are all part of the Atlantic Seafloor Partnership for Integrated Research and Exploration (ASPIRE) campaign - an umbrella for a subset of deepwater field activities that support the [Galway Statement on Atlantic Ocean Cooperation](#). NOAA is proud to be partnering with Canada and the European Union to conduct work in support of the Galway Statement. The Galway Statement is an initiative between the U.S., Canada, and the European Union to advance knowledge of the Atlantic Ocean leading to improved stewardship and understanding. Operations in all areas will be designed to complement previous and planned work.

Expeditions will also include two technology demonstrations to test novel approaches or emerging technologies for ocean science, strengthening the use of the *Okeanos Explorer* as a platform for technology advancement and testing.

Throughout the year, telepresence technology will allow you to follow discoveries via the [NOAA Ocean Explorer website](#), putting the unexplored ocean directly into your hands.

NOAA is seeking scientists and managers interested in actively participating during some or all of the 2018 expeditions. For details on opportunities to get involved, please visit [this page](#). If you are interested in providing input into expedition planning or participating as a scientist or student, please contact the Expeditions Science Advisor, Dr. Scott France at france@louisiana.edu.

Eastern Pacific Mapping and Transition to the Atlantic

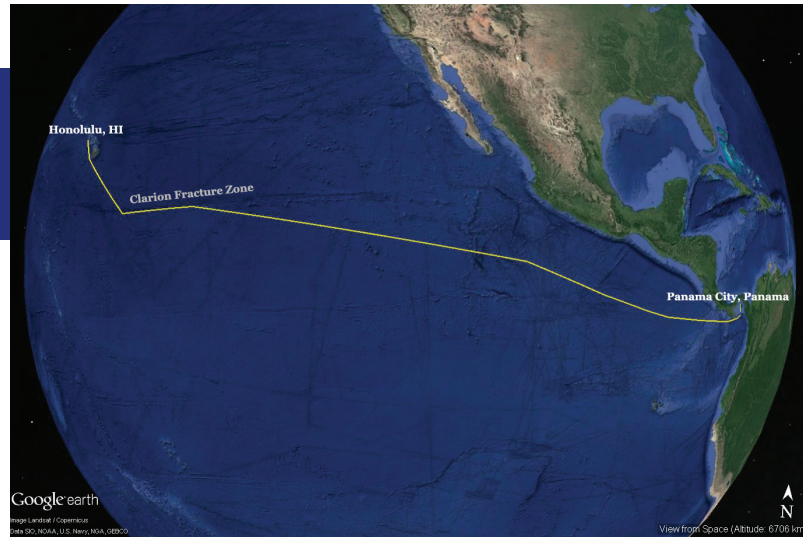
In late 2017, the *Okeanos Explorer* will transit from the Pacific Ocean to the Gulf of Mexico and ultimately the Atlantic Ocean - while mapping as much as possible along the way. From mid-October to November, the ship will transit about 5,000 nautical miles from Hawaii to Panama while mapping key unexplored areas along the Clarion Fracture Zone.

The Clarion-Clipperton Fracture Zone is a major geological feature of interest in the eastern Pacific and is a global hotspot of polymetallic nodule formations of potential interest to many nations. Mapping this region will provide insights into plate tectonics along a major oceanic fracture zone and baseline information to support further exploration and habitat characterization. The cruise track will transit through the center of the large oxygen minimum zone (OMZ) found in the eastern Pacific. A new nitrogen sensor technology will be tested as part of CTD casts conducted outside and inside the OMZ.

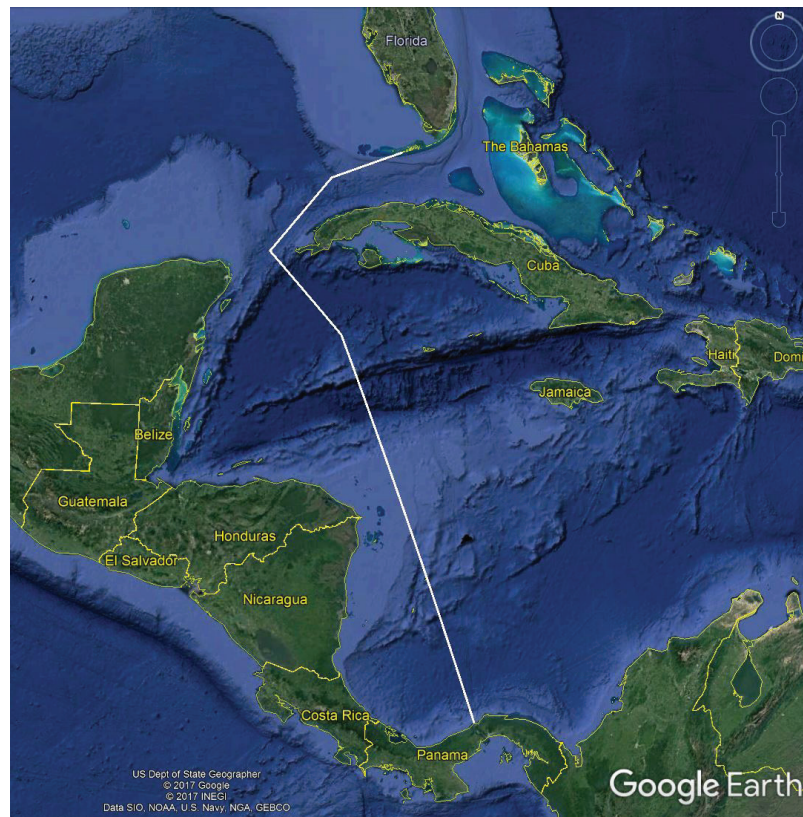
Once the ship reaches Panama, it will transit through the Panama Canal into the Caribbean Sea and conduct an eight-day cruise to Key West, Florida. This cruise will include exploratory transit mapping through the Caribbean and Gulf of Mexico.

Planned expedition dates and activities include:

October 16 - November 11, 2017: Telepresence mapping and CTD rosette casts starting in Honolulu, Hawaii, and ending in Panama City, Panama.



Map showing the approximate planned transit path for the *Okeanos Explorer* from Honolulu, Hawaii, to Panama City, Panama (yellow line).



Map showing the approximate planned transit path for the *Okeanos Explorer* from Panama to Florida (white line).

November 15 - 22, 2017: Mapping starting in Panama City, Panama, and ending in Key West, Florida.

Gulf of Mexico

From November 2017 to May 2018, the *Okeanos Explorer* will return to the Gulf of Mexico for three expeditions. This work will be in partnership with [NOAA's Deep Sea Coral Research and Technology Program](#) and the [Office of National Marine Sanctuaries](#). The expeditions will consist of more than 60 days at sea combined with both ROV and mapping operations as well as dedicated time for testing and demonstrating emerging technologies from the *Okeanos Explorer*.

Work conducted in the Gulf of Mexico will also support the [Southeast Deep Coral Initiative](#) - an interagency initiative to coordinate the research efforts of several NOAA line offices as well as other federal partners such as the U.S. Geological Survey and Bureau of Ocean Energy Management. At-sea operations will focus on unmapped areas, deep-sea coral and chemosynthetic communities, and submerged cultural heritage sites.

Planned expedition dates and activities include:

November 29 - December 21, 2017: ROV and mapping starting in Key West, Florida, and ending in Pascagoula, Mississippi.

March 17 - 19, 2018: Sea trials and ship shakedown starting in Pascagoula, Mississippi, and ending in Galveston, Texas.

March 23 - April 5, 2018: Mapping and emerging technology testing/demonstration starting in Galveston, Texas, and ending in Pascagoula, Mississippi.

April 11 - May 3, 2018: ROV and mapping starting in Pascagoula, Mississippi and ending in Key West, Florida.



An aggregation of methane ice worms inhabiting a white methane hydrate in the Gulf of Mexico. Studies suggest that these worms eat chemoautotrophic bacteria that are living off of chemicals in the hydrate. *Image courtesy of NOAA Office of Ocean Exploration and Research.*

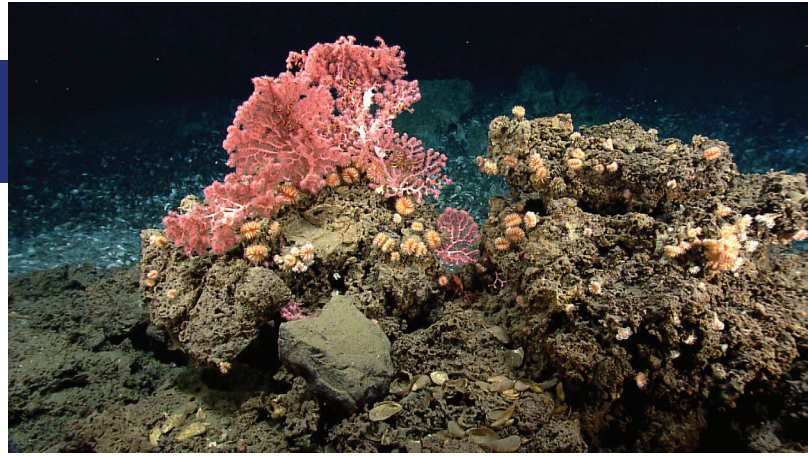
U.S. Mid- and South Atlantic Bight

From May to June 2018, the *Okeanos Explorer* will operate offshore of the U.S. South-Atlantic and Mid-Atlantic coast for a combined 32 days at sea. This region has extensive yet poorly explored deep-sea coral habitats that are of high interest to federal and state agencies with research and management responsibilities.

At-sea operations will include collecting bathymetric data of the Blake Plateau region and exploring and characterizing deep-sea coral and sponge habitats, gas seeps, chemosynthetic communities, and continental slope canyons. At-sea teams will also deploy optical sensors for validation of Visible Infrared Imaging Radiometer Suite (VIIRS) satellite data with opportunistic mapping and CTD operations. Explorations in this region will improve deep-sea coral habitat suitability models and geohazards models, as well as international efforts to better understand nearshore-offshore connectivity and biogeographic patterns across the Atlantic.

The Mid- and South Atlantic Bight expeditions will be closely coordinated with partners, resource managers, and will collaborate with ongoing [interagency](#) and [NOAA efforts](#) in the regions. As part of ASPIRE, NOAA and partners will leverage the significant contributions from the Atlantic Canyons Undersea Mapping Expeditions (ACUMEN) campaign, a series of expeditions aboard NOAA Ships *Henry B. Bigelow*, *Ferdinand R. Hassler*, and *Okeanos Explorer* from 2011 - 2014, and use this opportunity to fill data gaps and to conduct ROV dives on a number of targets identified during the ACUMEN campaign.

Planned expedition dates and activities include:



The southeast coast of the U.S. is home to a diversity of habitats that include deep-sea coral and sponge communities and chemosynthetic communities around methane seeps. From May to June 2018, NOAA will explore the extent of these habitats and seek to identify new ones. *Image courtesy of NOAA Office of Ocean Exploration and Research.*

May 9 - 18, 2018: VIIRS sensor validation, mapping, and CTD rosette casts starting in Key West, Florida, and ending in Mayport, Florida.

May 23 - June 1, 2018: Mapping starting in Mayport, Florida, and ending in Charleston, South Carolina.

June 6 - 27, 2018: ROV and mapping starting in Charleston, South Carolina, and ending in Norfolk, Virginia.

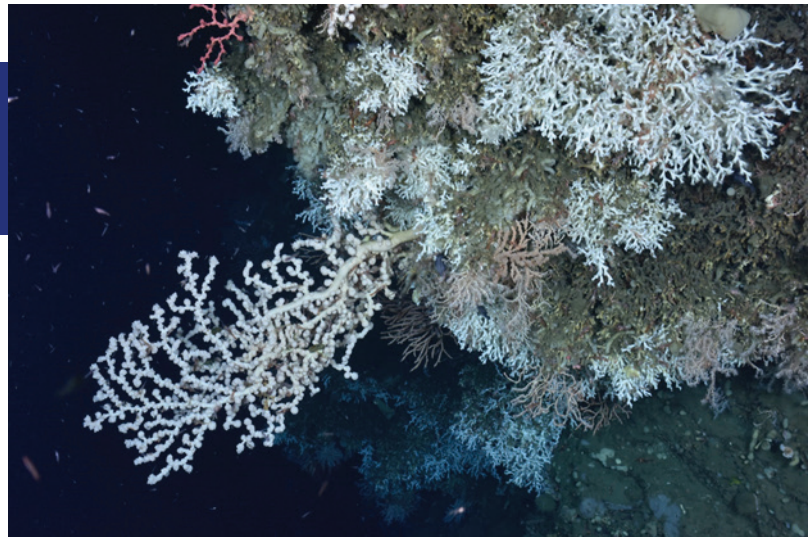
Exploration in Support of the Galway Statement

Exploration efforts in support of ASPIRE and the Galway Statement will continue from July to September 2018, extending east to international waters south of Bermuda and north to deep waters off the coast of New England and Atlantic Canada.

Starting in July, a 24-day cruise from Norfolk, Virginia, to Hamilton, Bermuda, will map an area southeast of Bermuda identified as a priority area by the Atlantic Seabed Mapping International Working Group (ASMIWG) at the 4th Annual Galway Trilateral Meeting in April 2017. As part of the Galway initiative, the ASMIWG used a suitability model to identify priority areas in the Atlantic Ocean, factoring in areas of public interest, sensitive marine areas, and areas with marine resource potential. This will be the first U.S.-led mapping effort in support of the ASMIWG.

In August 2018, the *Okeanos Explorer* will head northeast to explore deep waters off the coast of New England and into Canadian waters. Exploration targets are expected to include undersea canyons including minor canyons and inter-canyon areas, slope areas, seamounts, deep-sea coral and sponge habitats, chemosynthetic communities, and unmapped or poorly mapped areas. Data acquired are expected to ground truth and inform deep-sea coral and sponge habitat suitability models and support both the science and management communities.

The 2018 expeditions will conclude with mapping operations and testing and demonstrating



A variety of deep-sea corals found on a ledge in an unnamed “minor” canyon between Heezen and Nygren Canyons, including the stony coral *Lophelia pertusa*, a large white gorgonian *Paragorgia* (bubblegum coral) and a small red *Paragorgia* (upper left), and the gorgonian *Primnoa* (orange, center). Image courtesy of Northern Neighbors: Transboundary Exploration of Deepwater Communities.

emerging technologies from the *Okeanos Explorer* offshore of New England. These operations will be planned to complement previous work in the region, including building on the 2014 and 2017 transboundary collaboration cruises between NOAA and the Department of Fisheries and Oceans Canada and the 2011-2014 ACUMEN campaign.

Planned expedition dates and activities include:

July 12 - August 4, 2018: Mapping starting in Norfolk, Virginia, and ending in Hamilton, Bermuda.

August 11 - September 2, 2018: ROV and mapping starting in Hamilton, Bermuda, and ending in Davisville, Rhode Island.

September 8 - 19, 2018: Mapping and emerging technology demonstration starting and ending in Davisville, Rhode Island.

Fiscal Year 17 OER Federal Funding Opportunity Grants and Cooperative Agreements

This Fiscal year, NOAA's Office of Ocean Exploration and Research selected 9 projects for financial support totaling close to \$3.7 M. All grants have been received and accepted by the selected scientific institutions. The supported projects are detailed below.



Ocean Exploration and Research

Exploration of Biodiversity and Ecosystem Structure on Seamounts in the Western CCZ

Jeffrey Drazen
University of Hawaii at Manoa
Budget: \$746,000
Dates: May 5 - June 5, 2018

The biodiversity and ecosystem structure of the Western of Clarion-Clipperton Fracture Zone (CCZ) seamounts will be contrasted to benthic habitats on the surrounding abyssal seafloor to explore the characteristic biodiversity. This will help to elucidate the seamounts potential as refugia and larval sources for abyssal-plain biota that will be devastated by mining (e.g., nodule dwelling fauna). The field program will involve baseline characterization of key biotic components at the benthic-pelagic interface, specifically demersal zooplankton, epibenthic megafauna, and mobile scavengers. The proposed approach will provide a first look at ecosystems never before explored and ones that will likely face some of the largest anthropogenic disturbances in the deep sea.



Clarion-Clipperton Fracture Zone fauna. *Image courtesy of Amon et al. 2016.*

Aviators Down! The Search for Tuskegee and Free French World War II Aircrafts in Lake Huron

Wayne Lusardi
NOAA/Thunder Bay National Marine Sanctuary
Budget: \$78,000
Dates: May 14 - September 21, 2018
(multiple legs)



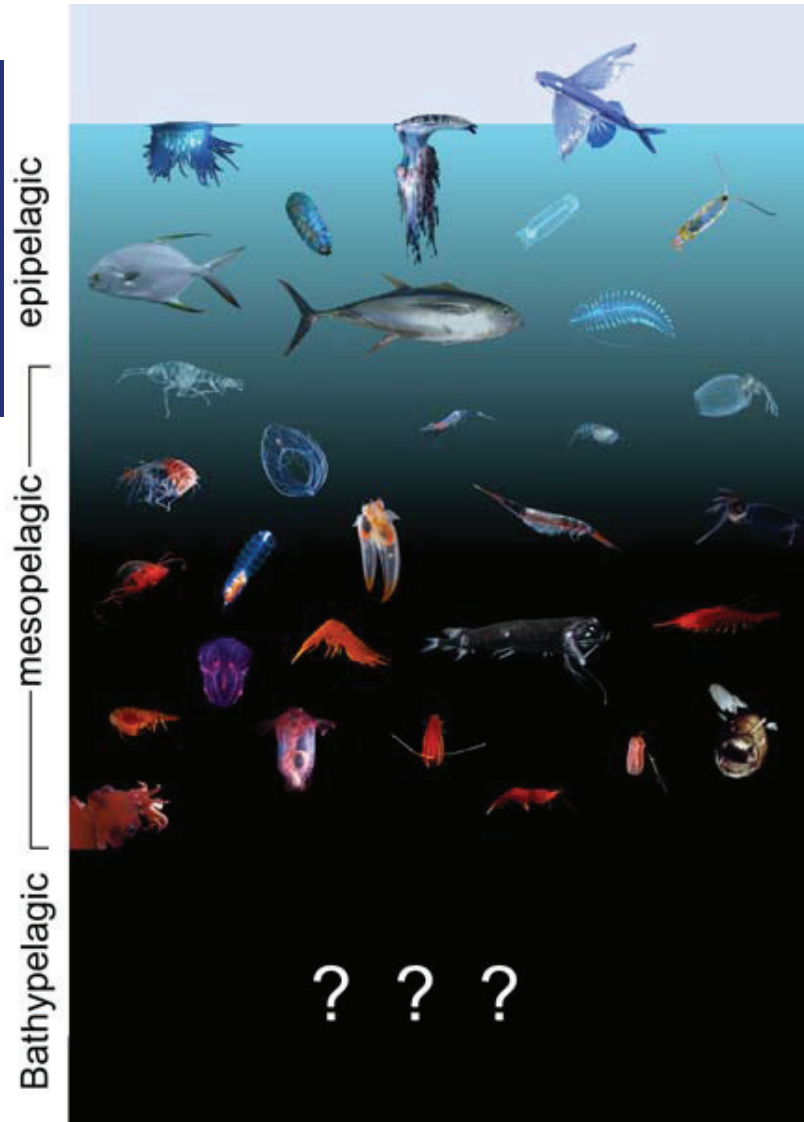
Republic P-47D Thunderbolt. *Image courtesy of Wikimedia.*

Nearly 200 military aircraft were lost in the Great Lakes during World War II. The vast majority of accidents occurred in lower Lake Michigan where Navy aviators attempted to qualify for carrier takeoffs and landings. The Army also lost pilots and aircraft in Lake St. Clair and Lake Huron. Dozens of foreign pilots including French and Norwegian exiles training in North America were also lost over water. Although many of the WWII aircraft wrecked in the Great Lakes have been recovered, the majority have not yet been found. The project goals are: to emphasize the importance of World War II related cultural heritage within and adjacent to Thunder Bay National Marine Sanctuary; to develop archaeological survey methodologies to locate and characterize small, disarticulated aircraft sites; and to create and develop new partnerships between NOAA and other academic and governmental agencies that will facilitate the exploration and characterization of Lake Huron's maritime and aviation heritage.

The Sigsbee Deep Expedition

Sonke Johnsen
Duke University
Budget: \$665,995
Dates: July 1 - 18, 2018

Once one moves below 1000 m into the bathypelagic, a realm that – because no visible sunlight penetrates – is severed from the rest of our planet in critical ways. In particular, because adapting to see the blue downwelling light from the surface is no longer an issue, bathypelagic organisms are now free to become visually sensitive to other portions of the spectrum, such as the violet or red regions, with the light coming from bioluminescent emissions. Pelagic bioluminescence has rarely been studied below 1000 m, due to the difficulty in collecting live animals from these depths. The project proposes to explore the water column below 1000 m in the Sigsbee Deep in the center of the Gulf of Mexico using the *Global Explorer* ROV, the Medusa camera platform, and deep sea trawls. These shipboard studies will include the characterization of visual systems, bioluminescence, and fluorescence, the first using shipboard electroretinography, the latter two using low light imaging and spectroscopy.



While we have some understanding of the communities and animals in the epipelagic and mesopelagic realms, our understanding of the bathypelagic world is very poor. Image courtesy of NOAA Office of Ocean Exploration and Research.

Submerged Cultural Resource Survey of the Kiska Island National Historic Landmark Maritime Battlefield

Eric Terrill
UCSD-Scripps Institution of Oceanography
Budget: \$629,535
Dates: July 5 - August 3, 2018

Kiska remains one of the best preserved historic battlefields from WWII, being one of only two world-wide where neither previous nor later settlement obscure military developments. The project will explore the waters off Kiska, Alaska to locate and document WWII era submerged cultural resources. This effort builds on existing archaeological and historical data to explore one of the least studied, yet most significant campaigns of WWII. The Aleutian campaign was the only WWII campaign fought on North American soil, and Kiska Island, along with Attu Island to the west, are the only U.S. territories occupied by foreign forces in the last 200 years. two using low light imaging and spectroscopy.



Japanese ship aground at Kiska harbor, Aleutian islands, US Territory of Alaska, on 18 Sep 1943. *Image courtesy of US Navy.*

Peleliu's Forgotten WWII Battlefield

Toni Carrell
Ships of Exploration and Discovery Research
Budget: \$89,969
Dates: July 15 - 27, 2018

The WWII battle for Peleliu is considered of such significance that the entire island was listed on the National Register of Historic Places and as a National Historical Landmark in 1985 and portions were evaluated for National Historical Park status in 1991 and 2003. This project will make a significant contribution to our understanding of the amphibious invasion through the discovery, identification, and recording of sites. Two well known, but rarely integrated, avenues of marine science will be used to characterize, identify, interpret, and analyze the remains. The traditional deployment of a geophysical and remote sensing package (side-scan and magnetometer) coupled with the use of a small ROV and drone, where appropriate, will be complemented by marine biological characterization of the coral reef structures that now host these sites.

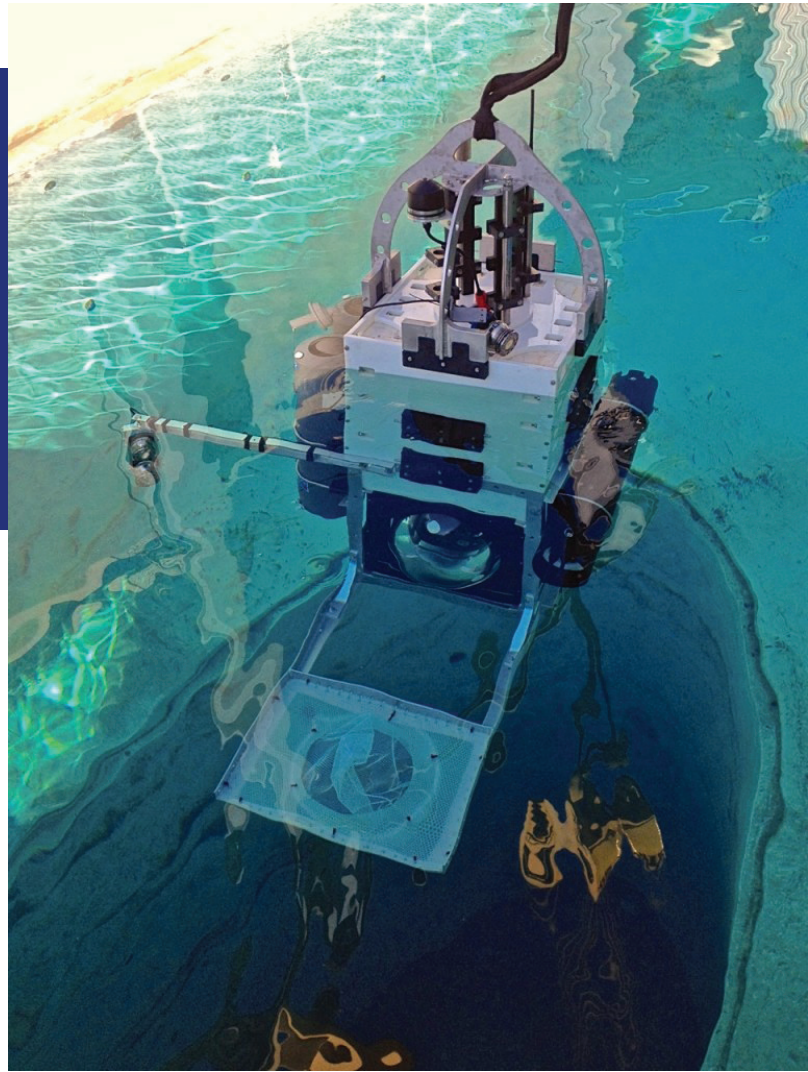


Landing craft carrying Marines approach beaches on Peleliu, September 15, 1944. *Image courtesy of United States Marine Corps.*

Instrumentation to Assess the Untainted Microbiology of the Deep Ocean Water Column

Douglas Bartlett
UCSD/Scripps Institution of Oceanography
Budget: \$544,601
Dates: August 1 - 22, 2018

A fundamental property of life in the sea is that with increasing depth must come increased adaptation to elevated hydrostatic pressures. The effects of high pressure have been most thoroughly investigated in microorganisms, where it has been found to affect membrane integrity and transport, cytoskeletal assembly and both DNA and protein synthesis. The project aims to: 1) develop technology for the retrieval of deep-sea water samples at *in situ* conditions; and 2) to validate its impact with regards to the accurate characterization of microbial abundance, activity and biodiversity in samples from depths reaching >8,000 m, at the Atacama (Peru-Chile) Trench.

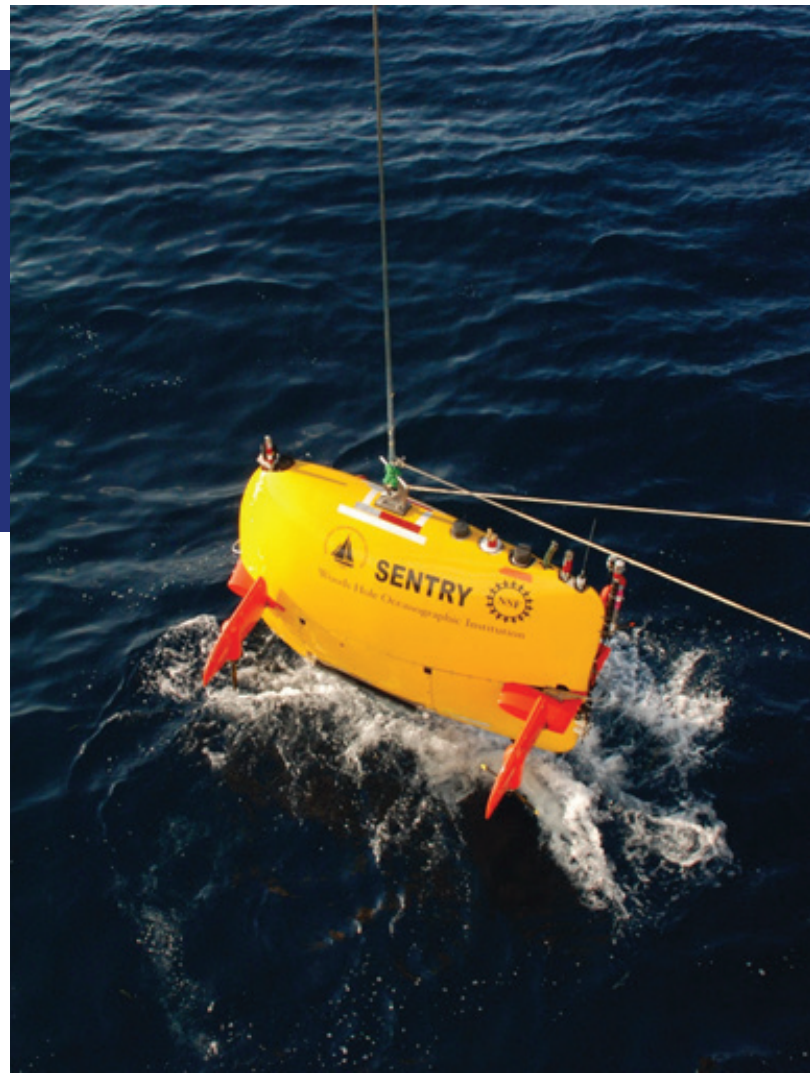


Leggo Lander. Image courtesy of Doug Bartlett.

Ocean Co-Exploration Through Advanced Human-Robot Interaction

Carl L. Kaiser
Woods Hole Oceanographic Institution
Budget: \$400,016
Dates: TBD

This project seeks to take an important step toward revolutionizing our methods of ocean exploration: to wean us away from expeditionary investigations that rely on large individual research ships, while simultaneously probing deeper into the ocean interior. To move toward global scale exploration of the deep ocean interior will require a move toward innovative uses of collaborative robotics, blending layered autonomy with an increasingly sophisticated use of underwater communications and telepresence to keep the human explorers in the loop but move them to shore. The goals of the project are to: Demonstrate an immediate path to increase the pace of AUV based ocean exploration; demonstrate a path towards rapid reduction of reliance on manned surface vessels and a means to make much more efficient use of manned surface vessels where needed; demonstrate the use of the co-exploration model as an accelerated means of deploying advanced autonomy; and generate a set of tools for co-exploration that can be ported to other AUVs.



Autonomous Underwater Vehicle (AUV) Sentry. Image courtesy of NOAA Office of Ocean Exploration and Research.

3D Seismic Oceanography: The New Frontier in Ocean Water Column Exploration

Leonardo Macelloni
University of Mississippi NCPA
Budget: \$240,723
Dates: N/A

Recent works have shown that marine seismic reflection profiling, a technique commonly used by geophysicists and geologists to image the Earth beneath the seafloor, can produce surprisingly detailed images of thermohaline intrusions, internal waves and small-scale eddies within the entire water column. The discovery of seismic reflections from the water-column and the ability to image large volumes of the ocean at full depth and at high lateral resolution is opening new possibilities for imaging the structure of the ocean with “seismic oceanography”. This project aims to perform the first seismic water-column study using a 3D seismic volume acquired in 900m water depth within the Gulf of Mexico.



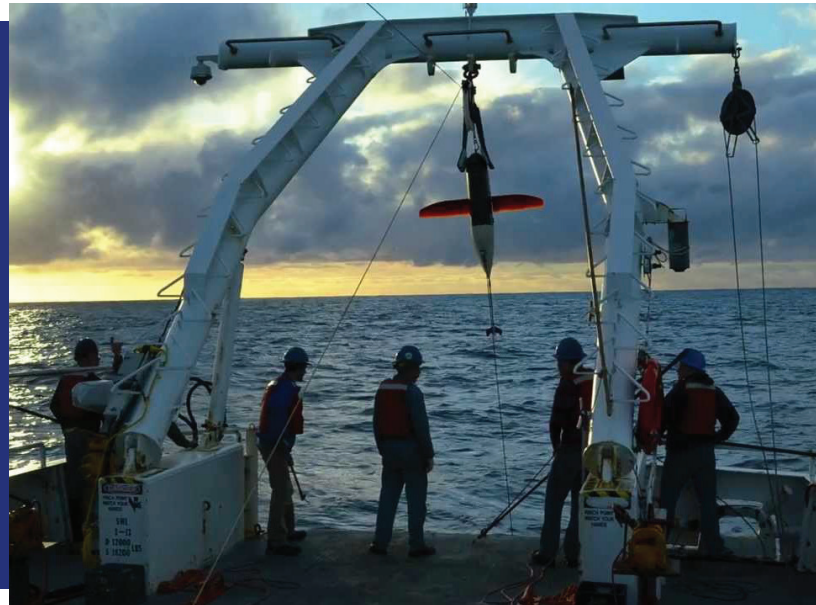
Ship and oil rigs in the Gulf of Mexico. *Image courtesy of Wikimedia.*

Integration of Acoustic Echosounding into the Wire Flyer Profiling Vehicle to Investigate Scattering Layer Distribution and Oxygen Coupling

Christopher Roman
University of Rhode Island
Budget: \$290,621
Dates: TBD

The Wire Flyer is ship towed autonomous profiling vehicle that slides up and down on a standard towed .322 cable using controllable wings for propulsion. The vehicle is able to profile at commanded vertical speeds between 0 and ~2.5 m/sec while being towed between 3-4 knots.

The system can operate over specified depth bands in the water column (e.g. 400- 800 meters) and is not restricted to the upper few hundred meters like other towed undulating systems. This project will integrate a side-looking split-beam multi-frequency echo-sounder into the Wire Flyer towed profiling vehicle for the purpose of providing unprecedented acoustic and environmental sampling resolution of midwater biomass. The motivation for the project is to exploit the high spatial resolution sampling capability of the Wire Flyer vehicle and provide complementary acoustic data in regions of the water column that have been traditionally under sampled.



The Wire Flyer being deployed from the A-Frame. *Image courtesy of Inner Space Center.*