Explore the ocean, seeking out new discoveries in the fields of geology, biology, maritime history, and archaeology while pushing the boundaries of STEM education and technological innovation.
PRIORITIES

DRIVERS FOR OET’S EXPLORATION PROGRAM

Aligning with NOAA & other sponsor priorities

Federal NOMEC Strategy

Seabed 2030

UN Decade of Ocean Science

Biden/Harris Administration priorities (e.g. 30 by 30, climate change)

Blue Economy & building STEM workforce

STEM Education

Justice, Equity, Diversity & Inclusion

Collaboration
ROV SURVEY & SAMPLING

CAPABILITIES

• ROV Hercules (4000 m), Towsled Argus (6000 m)
• 250 lb payload for samples/equipment
• Mission configurable standard sampling tools
  • 11” push cores (up to 8)
  • 5-L Niskins (up to 6)
  • Suction sampling system (up to 8x 3-L)
• CTD, oxygen optode, temp probe, scanning sonars
• configurable sample boxes & crates
• Flexibility for user-installed technologies/sensors
GUEST TECHNOLOGIES

EXAMPLES: ROV & OVER-THE-SIDE DEPLOYED

- **VISUAL**
  - Still cameras (OSU Sexton, WHOI-MISO Mesocam)
  - NGS Deep Sea drop cameras

- **SELF-LOGGING INSTRUMENTS**
  - MAPR (miniature autonomous plume recorder)
  - Passive acoustics
  - Waverider buoys
  - Argo biogeochemical floats

- **MAPPING**
  - LiDAR
  - NORBIT high-resolution sonar

- **SAMPLING DEVICES**
  - Gastights
  - *In situ* water filtration
  - Mass spectrometer
  - Soft grippers for coral sampling
UNCREWED SYSTEMS

USV DriX (UNH)

HROV NUI (WHOI)

AUV Mesobot (WHOI)
EDUCATION & OUTREACH

SHARING STORIES WITH THE WORLD

- Science & Engineering Internships
- Science Communication Fellowships
- Live ship-to-shore Broadcasts
  (‘Ōlelo Hawai‘i & English)
- K-12 educational resources
  (Spanish & English)
- NautilusLive.org website
- Social media
- Media production
WHO’S ABOARD NAUTILUS?

SCIENCE PARTY = 33 PPL

LEAD SCIENTIST(S) — (1-2 leads) Represents the interests of the broader ocean exploration community and fosters collaboration to ensure broad and inclusive science objectives are met. Author cruise and dive plans. Typically participate on expedition in person.

EXPEDITION LEAD — (1 lead) Coordinates expedition planning and implementation, including integration of plans amongst expedition teams. Keeps all stakeholders informed of progress and evolving plans.

WATCH LEADERS — (3 leads) Subject mater experts that guide ROV operations on behalf of broader community interests. Onboard liaisons with Scientists Ashore.

SCIENCE & OPERATIONS TEAM — ROV pilots, navigators/mappers, video engineers, data loggers, partner vehicle teams, communications & outreach

EDUCATION PROGRAM PARTICIPANTS — Science Communication Fellows, Science & Engineering Internship Program participants, OECI graduate students & interns
WHO’S “ABOARD” NAUTILUS?

Aboard E/V Nautilus

Scientist Ashore via Telepresence
SCIENTIST ASHORE PROGRAM
EXPANDING OPPORTUNITIES FOR PARTICIPATION

• PLANNING
  • Provide input on expedition plans and sampling objectives
  • Scientist Ashore Interest Form
  • Questions? email us at science@oet.org

• DURING EXPEDITIONS
  • Contribute via OET’s Scientist Ashore Portal & text-based chat
  • Assist with dive and sampling objectives
  • Receive daily updates & dive plans (email)

• POST-EXPERDITIONS
  • Open access to samples & data
  • Participate aboard future expeditions
2022 OCEAN EXPLORATION TRUST EXPEDITIONS

SEASON AT A GLANCE

PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT
EXPLORING THE LIL’I’UOKALANI SEAMOUNTS
MAPPING THE US EXCLUSIVE ECONOMIC ZONE (EEZ)
FROM SHORE TO THE ABYSS

HAWAIIAN ISLANDS
OCEI TECHNOLOGY INTEGRATION
MAPPING THE US EEZ

PACIFIC REMOTE ISLAND MARINE NATIONAL MONUMENT
EXPLORING KINGMAN REEF & PALMYRA ATOLL
EXPLORATION & MAPPING AT JOHNSTON ATOLL
MAPPING THE US EEZ
2022 OCEAN EXPLORATION TRUST EXPEDITIONS

SEASON AT A GLANCE

Mobilization

Shakedown

- NA137: Kingman/Palmyra (PRIMNM)
- NA138: Lu'uaehiikiikekumu (PMNM)
- NA139: OEIC Technology (HI)
- NA140: Johnston Atoll Mapping (PRIMNM)
- NA141: Johnston Atoll ROV (PRIMNM)
- NA142: NWHI Mapping (PMNM)
- NA143-NA147: PMNM Mapping & Nat Geo Expeditions
Kingman Reef & Palmyra Atoll

NA137 | 14 March - 4 April (22 days)

Lead Scientists: Steve Auscavitch (Boston University)  
Dwight Coleman (University of Rhode Island)  
Adam Soule (University of Rhode Island)  
Katie Kelley (University of Rhode Island)

Expedition objectives:
- 12-13 dives between 200-3500m aimed at biological & geological characterization
- Gap-fill mapping for dive site selection
Kingman Reef & Palmyra Atoll

NA137 | 14 March - 4 April

Sampling and observation objectives:

- Rock collections for crust for ferromanganese crust geochemistry and seamount age dating.
- Collect biology that represent possible new species, records, or associations that contribute to biogeographic knowledge of the area.
- Identifying dense and diverse biological communities, including deep-water sponges and corals.
- Collecting water samples to profile eDNA associated with benthic communities.
Luʻuaehaahikiikekumu at Liliʻuokalani Ridge

NA138 | 7 April - 1 May (24 days)

Lead Scientists: Beth Orcutt (Bigelow Laboratory for Ocean Sciences)  
Chris Kelley (University of Hawaiʻi-emeritus)  
Randy Kosaki (NOAA PMNM)

The ‘Ōlelo Hawaiʻi expedition name Luʻuaehaahikiikekumu represents the journey to and the work looking at the source and foundation of the oceans and islands through ROV dives.

Goals:
- Document the biological diversity of unexplored seamounts within the Papahānaumokuākea Marine National Monument (PMNM), particularly for deep-sea corals, sponges and fishes
- Collect rock samples for determining the origin and age of the seamounts
- Determine the microbial ecosystem services and mineral content of minerals crusts that form on the rocks of the seamounts
Luʻuaeaahikiikekumu at Liliʻuokalani Ridge

NA138 | 7 April - 1 May (24 days)

Specific Objectives:

- Conduct ROV surveys and additional multibeam sonar mapping of the Liliʻuokalani seamounts located in the northern part of the poorly explored expansion area of the PMNM.

- Collect basaltic rock samples from each of the seamounts for geochemical dating analyses to determine their age and process by which they formed and examine why a fork exists in this seamount trail.

- Determine if these seamounts support extensive, high density coral and sponge communities similar to those discovered on the Hawaiian Ridge or the Voyager Seamounts farther south. Also determine if several of these seamounts support commercially valuable fisheries species.

- Collect specimens, particularly of corals, sponges, and their associates, that may be new records for the central Pacific or new species to science.

- Collect samples of basalt and attached ferromanganese crusts to examine mineral content and microbial ecosystem services.

- Collect water samples for eDNA analysis.
OECI Tech Challenge

NA139 | 6 - 22 May (16 days)

Lead Scientists: Robert Ballard (OET)
Larry Mayer (UNH)
Dana Yoerger (WHOI)
Andy Bowen (WHOI)

Goals:
Building on 2021 at-sea trials, this expedition will continue to test and demonstrate operational capabilities that have three autonomous vehicles:

- communicating with each other while they are simultaneously deployed
- being re-tasked based on information gained from a partner vehicle
- demonstrating further advances in tele-operations with operators back on shore.
Johnston Atoll

NA141 | 20 June - July 14 (24 days)

Lead Scientists: TBC

ROV cruise at Johnston Atoll in the Pacific Remote Islands Marine National Monument. Preceding by an expedition to map priority areas of interest.

Goals:
- Conducting surveys of the density and diversity of benthic habitats of Johnston Atoll including deep-water corals, sponges, and fish habitats
- Acquiring physical and chemical data in support of conservation and exploration goals for remote units of PRIMNM, including dissolved oxygen and eDNA samples
- Collect rock samples to identify mineral crusts and age date the geological features of the region.
2022 Season Overview

- **NA140 | 25 May - 18 June:** ~24 day mapping cruise at Johnston Atoll in PRIMNM funded by NOAA OECI.

- **NA142 | 16 July - 8 August:** ~23 day mapping cruise in PMNM with *Nautilus* multibeam echosounder and University of New Hampshire’s ASV DriX funded by NOAA OECI and Office of Coast Survey.

- **August-October:** mapping in PMNM funded by NOAA OECI.

- **NA137, NA138 & NA141 ROV cruises:** mapping on transit and between dives
NA142 PMNM Nautilus Areas

NA140 Johnston Atoll Nautilus Areas

NA142 PMNM DriX Areas

NA140 & NA142 Mapping Cruises
Open Sample and Data Access

R2R Repository: ID & Locate datasets

- 2016-2021 data
  https://www.rvdata.us/search/vessel/Nautilus

- Direct Data requests to OET for complete cruise archives
  https://nautiluslive.org/science/data-management

Collections: Find & request

- **Biological** voucher specimens & DNA:
  Harvard’s Museum of Comparative Zoology

- **Geological** (rocks & short sediment cores):
  University of Rhode Island’s Graduate School of Oceanography Marine Geological Samples Lab
Scientist Ashore Sample Accommodation

Examples of wet lab sample processing capacity
- Environmental DNA (eDNA)
- Seawater sampling (POM, carbonate chemistry)
- Targeted biological sampling
- Microplastics
- Core sectioning, sediments, and infauna

Sign up as a Scientist Ashore and send sampling requests via the Scientist Ashore Interest Form or via email: science@oet.org
2021 Publications Using E/V Nautilus Data

Coming together—symbiont acquisition and early development in deep-sea bathymodioline mussels
Maximilian Franke, Benedikt Geier, Jörg U. Hammel, Nicole Dubillier, and Nikolaus Leisch
1Max Planck Institute for Marine Microbiology, Moltkestrasse 1, 28359 Bremen, Germany
2Freie Universität Berlin, Institute of Materials Physics, Max-Planck-Straße 1, 14195 Berlin, Germany
3MARE—Zentrum für Marine Umweltwissenschaften, Universität Bremen, Leibniz-Straße 2, 28359 Bremen, Germany

Protistan grazing impacts microbial communities and carbon cycling at deep-sea hydrothermal vents
Sarah K. Hu, Erica L. Herrera, Amy R. Smith, Maria G. Pachiadaki, Virginia P. Edgcomb, Sean P. Sylva, Eric W. Chan, Jeffrey S. Seewald, Christopher R. German, and Julie A. Huber
1Department of Marine Chemistry and Geochimistry, Woods Hole Oceanographic Institution, Woods Hole, MA 02543; 2Department of Biology, Woods Hole Oceanographic Institution, Woods Hole, MA 02543; 3Department of Geology & Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543; and 4School of Earth, Environment, and Marine Sciences, The University of Texas Rio Grande Valley, Edinburg, TX 78539

Publication updates? Send to science@oet.org
Mapping Data Archive & Access

- Raw multibeam and subbottom data – ALL & SEGY
- Processed multibeam data – edited files, grid files, backscatter mosaic, KML, ArcGIS project
- Map products and images for outreach and education

- OET archive and access – data request
- OER Digital Atlas
- 2016+ Rolling Deck to Repository to NCEI
- GMRT and Seabed 2030 >100 km²
- 2021 cruise products to MGDS
Science Portal features:
- Science chat with shipboard scientists
- Live streaming ROV video
- Live vehicle and ship sensor data feeds
- Live webmap
- Follow cruises to access expedition documents and receive daily updates
- Submit input on research interests and site locations

Registration opening soon
What’s Next?

- **February:**
  - Science Portal registration opening soon
  - Sharing Expedition Overviews and starting planning meetings
  - Email `science@oet.org` with input/questions
  - Schedule live ship-to-shore connections with classes, camps, or community events

- **March-October:** Expeditions underway
  - Cruise plan shared prior to expedition
  - Ship reports (Sit Reps) & Dive plans emailed throughout cruises
  - Engage with shipboard scientists through Science Portal

- **October-December:** Expedition reporting
  - Request data & samples
Questions?

science@oet.org