2012 E/V Nautilus Cruise Overview

Institute for Exploration, Ocean Exploration Trust & URI Center for Ocean Exploration

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Overview of Purpose

This document is a collection of information gathered from various sources about the upcoming E/V Nautilus 2012 expedition season off the coasts of Turkey and Cyprus. It is intended as a source of vetted and edited material for disseminating publicly.

It is a living document and will be updated regularly when significant changes and updates are required. If you are unsure about it’s currency, please contact the author for the latest version.

Please be aware that all the information contained in this document is fluid leading up to, and during, the 2012 expedition season.
Contents

1. 2012 Nautilus Expedition Overview
   Nautilus Cruise Itinerary
   Nautilus Expedition Summary
   Nautilus Expedition Quick Facts
   Nautilus Exploration Program Overview

2. NA021 | Southern Black Sea
   Background and Objectives

3. NA022 | Anaximander Mountains
   Background and Objectives

4. NA023 | Eratosthenes Seamount
   Background and Objectives

5. NA024 | Southeast Aegean Sea
   Background and Objectives

6. Equipment, Technology & Communications
   E/V Nautilus
   Shipboard Exploration Vehicles
   Shore-Based Centers
   Web-Based Communications

7. Education Programs
   Shipboard Programs
   Shore-Based Programs

8. Looking Forward: The 2013 Expedition Season
   2013 Season Overview
   Workshop on Telepresence-Enabled Exploration of the Caribbean Sea

9. Key Expedition Links and Contacts
1. **2012 Nautilus Expedition Overview**

**Cruise Dates**  
7 July – 4 September 2012 (subject to change)

**Cruise Numbers**  
NA021-NA024

**Areas of Exploration**  
Black Sea, Aegean Sea, and Mediterranean Sea

**Countries of Operation**  
Turkey and Cyprus

**Total Days**  
60+

**Number of Participants**  
120+
## 2012 Nautilus Cruise Itinerary

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<thead>
<tr>
<th>Dates</th>
<th>Activity</th>
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<tr>
<td>Jun 23 – Jun 329</td>
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<td>Jul 7 – Jul 23</td>
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<td>Southern Black Sea, Turkey</td>
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<td>Jul 26 - Aug 9</td>
<td>NAO22</td>
<td>Anaximander Mountains, Turkey</td>
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<td>Aug 10 – Aug 11</td>
<td>Port Stop</td>
<td>Marmaris, Turkey</td>
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<td>Aug 12</td>
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<td>Aug 13 – Aug 26</td>
<td>NAO23</td>
<td>Eratosthenes Seamount, Cyprus</td>
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<td>Aug 27 – Aug 28</td>
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<td>Aug 29 – Sept 4</td>
<td>NAO24</td>
<td>SE Aegean Sea/Bodrum, Turkey</td>
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<tr>
<td>Sep 5 – Sep 7</td>
<td>Demobilization</td>
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2012 *Nautilus* Expedition Summary

During July and August of 2012, Exploration Vessel *Nautilus* will explore the Black Sea, Aegean Sea and Mediterranean Sea off the coasts of Turkey and Cyprus. Our rotating Corps of Exploration aboard *Nautilus* will be mapping the geological, biological, archaeological and chemical aspects of these regions to depths of approximately 2000 meters. During the expedition, we will be sharing our discoveries live on the web via telepresence technology, putting the unexplored ocean directly in your hands.

The 2012 expedition consists of four separate cruise legs and will begin off the northern coast of Turkey in the Southern Black Sea. Our second leg brings *Nautilus* south to the submerged Anaximander Mountains off the southern coast of Turkey in the Mediterranean Sea. After a brief port stop, our third leg will explore the Eratosthenes Seamount off the southern coast of Cyprus and then head north to conduct mapping operations in the Southeast Aegean Sea near Bodrum, Turkey.

*E/V Nautilus* is a 211-foot research vessel equipped with state-of-the-art exploration and telepresence technology. Our primary remotely operated vehicles (ROVs) on board, named *Hercules* and *Argus*, will be used to view the seafloor with high definition video, take environmental measurements and collect geological and biological samples. Our two secondary exploration tools, the towfish named *Diana* and *Echo*, will be utilizing side-scan and subbottom sonar technology to explore the seafloor and seek out compelling targets for closer investigation and study.

Dr. Robert Ballard and Dr. Katherine Croff Bell of the Ocean Exploration Trust will lead the expedition, which includes a rotating team of more than 100 scientists, engineers and educators as they explore these poorly understood regions of the world's oceans. Our operations aboard *Nautilus* will be conducted by a team of engineers from the Institute for Exploration based at the Mystic Aquarium in Connecticut. All of the video and data that we collect will be transmitted via satellite to the Inner Space Center, located at the University of Rhode Island Graduate School of Oceanography, where Dr. Ballard is a professor of oceanography. From this “mission control,” our live feeds will be broadcast on the web so that anyone in the world can be a part of the exploration as it happens.

You can follow the expedition live at [www.nautilislive.org](http://www.nautilislive.org) starting on July 7, 2012.

The 2012 *Nautilus* Exploration Program is sponsored by the National Oceanic and Atmospheric Administration (NOAA), Ocean Exploration Trust, Bechtel Corporation, Sea Research Foundation, National Geographic Society, Office of Naval Research, and the University of Rhode Island.
2012 Nautilus Expedition Quick Facts

Cruise Dates 7 July – 4 September 2012 (subject to change)
Cruise Numbers NA021-NA024
Total Days 62+ days of exploration
Number of Participants 120+
Areas of Exploration Black Sea, Aegean Sea, and Mediterranean Sea
Countries of Operation Turkey and Cyprus
Science Subject Areas Archaeology, Biology, Chemistry, Engineering, Geology, Geography, Maritime History, Technology

Principal Investigators
Dr. Robert Ballard, Ocean Exploration Trust
Dr. Katherine Croff Bell, Ocean Exploration Trust

Chief Scientists
Dr. Michael Brennan, Univ. of Rhode Island (NA020/23)
Dr. Timothy Shank, Woods Hole Oceanographic (NA021)
Dr. Lawrence Mayer, Univ. of New Hampshire (NA022)

Expedition Leaders
Dr. Katherine Croff Bell, Ocean Exploration Trust
Dr. Michael Brennan, Univ. of Rhode Island
Dr. Nicole Raineault, Univ. of Rhode Island

Expedition Partners
Ocean Exploration Trust (OET), the Institute for Exploration (IFE) & the URI Center for Exploration

Expedition Sponsors
National Oceanic and Atmospheric Administration (NOAA), Ocean Exploration Trust, Bechtel Corporation, Sea Research Foundation, National Geographic Society, Office of Naval Research, and University of Rhode Island

Exploration Vessel Nautilus
Length 64.23 meters (211 feet)
Tonnage 1249 gross, 374 net
Endurance 40 days
Range 24,000 kilometers (13,000 nautical miles)
Berthing 48 persons (17 crew; 31 science/operations)
Flag St Vincent and the Grenadines
Home port Bodrum, Turkey

Exploration Vehicles
ROV Hercules, ROV Argus, Towfish Diana, Towfish Echo

Nautilus Live Communications
Main Website http://www.nautiluslive.org
Facebook http://www.facebook.com/Nautiluslive
Twitter http://twitter.com/EVNautilus
YouTube http://www.youtube.com/EVNautilus

Version 1.9 July 17, 2012
**Nautilus Exploration Program Overview**

**Nautilus Exploration Program Mission**

We are an international Corps of Exploration consisting of marine scientists, engineers, communicators, educators and students. Our primary objective is to explore the ocean seeking out new discoveries in the fields of geology, biology, maritime history, archaeology, and chemistry while pushing the boundaries of engineering, technology, education and communications. We aim to share our story and our science with explorers around the world via live telepresence from aboard Exploration Vessel *Nautilus*. Our Corps of Exploration aspires to serve as role models for the next generation of explorers, scientists, engineers and educators. We promise to bring our audience only cutting edge exploration, live from the bottom of the ocean as we explore landscapes that have never been explored before.

**Our Objectives**

- *To explore areas of the ocean that have never been explored before, seeking out new discoveries in the fields of geology, biology, maritime history, archaeology, and chemistry*
- *To conduct all scientific research to the highest international academic standard*
- *To push the boundaries of ocean engineering, technology, education and communications*
- *To share our expeditions with explorers around the world via live telepresence*
- *To serve as role models for the next generation of explorers*
- *To spread the excitement of ocean exploration and turn everyday viewers into explorers*

**About the Nautilus Exploration Program**

The *Nautilus* Exploration Program was founded in 2008 by Dr. Robert Ballard and is a joint ocean exploration initiative of the Ocean Exploration Trust, the Institute for Exploration and the URI Center for Ocean Exploration. This international program centers on scientific exploration of the seafloor launched from aboard the Exploration Vessel *Nautilus*, a 64-meter research vessel currently based in Istanbul, Turkey. In addition to conducting pure scientific research, the *Nautilus* Exploration Program offers ocean telepresence to explorers on shore via live video, audio and data feeds from the ship. The Program also includes an education component that brings educators and students on *E/V Nautilus* expeditions.
2. **NA021 | Southern Black Sea**

<table>
<thead>
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<th>7-23 July 2012</th>
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| Chief Scientist| Dr. Michael Brennan  
University of Rhode Island |
| Expedition Leader | Dr. Katherine Croff Bell  
Ocean Exploration Trust |
| Chief of Operations | Brennan Phillips  
Institute for Exploration |
| Principal Investigators | Dr. Robert Ballard & Dr. Katherine Croff Bell  
Ocean Exploration Trust |
| Area of Exploration | Southern Black Sea |
| Country of Operation | Turkey |
| Total Operations Days | 15+ |
| Number of Participants | 45+ |

**Vehicles, Sensors, and Other Equipment**  
ROV *Hercules*, ROV *Argus*, Sidescan Towfish *Echo*, Sidescan Towfish *Diana*
Background and Objectives – NA021 | Southern Black Sea

Description

In 2011, we returned to the Turkish coast of the Black Sea for the first time since 2007 and continued to document and explore the transition zone between the oxygenated surface waters and the anoxic bottom waters between 100-300 meter depths. During our 2012 expedition, chief scientist Dr. Michael Brennan and our team will continue to acoustically document and map the submarine landscape along the northern Turkish coast off the modern cities of Eregli and Sinop. We will use the side-scan sonar towfish, Diana, to expand the areas we mapped last year and include a new area east of the Sinop peninsula. We will dive on areas of interest located with sonar with Hercules and Argus and will also take geological samples with Hercules. A variety of analyses will be conducted on sediment cores, including microbiology, benthic worm counts, sediment mineral characterization, and geochemistry.

Objectives

- Collect push cores in the oxic, suboxic, and anoxic water layers for analysis
- Conduct high-resolution imaging of Eregli E wreck site to document further trawl damage and changes to site since 2011
- Continue side-scan sonar mapping of shelf areas off Eregli and Sinop, Turkey
- Recover a set of redox experiments left in place at the Sinop D shipwreck site in 2007
- Identify additional targets and areas of interest located with sonar

Background

The Black Sea is a unique ocean basin, in which the bottom waters below 150 meters have become anoxic due to the shallow and narrow outflow at the Bosporus strait. The surface waters are of low salinity and less dense due to the influx of river waters from Europe, while the bottom waters are dense and have a higher salinity from the influx of Mediterranean seawater, further stratifying the sea. The dynamics at the interface between these layers at around 150-meter depth are still poorly understood. This interface responds to events the same way the interface between the air and sea does, in the form of waves. These internal waves, or density currents between the two layers of different density water, can move anoxic bottom waters up onto the continental shelf like waves across a beach.

Such waves of anoxic water would be deadly to benthic organisms on the shelf, such as fish, crabs, mollusks, and worms. Because of this, we have observed a lack of biology in the suboxic zone. However, our work on microbiology and meiofauna (small biology, such as worms) shows some biological activity in the sediments, but which does decrease with decreased oxygen levels. The chemistry of the water changes between these layers as well, with the disappearance of dissolved oxygen comes the onset of hydrogen sulfide, which is created by the bacterial decomposition of organic matter.
This area of the southern Black Sea was also a trade route in ancient times, as seafarers would travel along the coast after exiting the Bosporus. The modern cities off of whose coasts we are working, Eregli and Sinop, were built over the ancient cities of Heraclea Pontica and Sinope, and highly active ports. During the course of our work along the Turkish Black Sea coast since 1999, we have found 13 shipwrecks while mapping the seabed, ranging from the 4th century B.C. to the 19th century A.D., some in states of good preservation due to the lack of wood-boring organisms in the anoxic water layer. Part of our efforts here are to assess the preservation potential of the Black Sea for archaeological sites based on the chemical, biological, and physical properties of this unique basin.

**Importance**

The transitional area between the oxic and anoxic water layers is poorly understood and presents an important region for microbiological, sediment, and chemical research. Additionally, the dynamics and hypothesized presence of internal waves likely increase the preservation of shipwrecks and other submerged cultural sites.

**Expected Outcomes**

- Continued acoustic mapping of coastal submarine landscape between 100-400 meters depth
- Documentation of the area east of Sinop where bottom trawl fishing is prohibited
- Recovery of sediment cores and redox experiments
- Identification of geological and archaeological features on the seafloor from sonar targets
3. NA022 | Anaximander Mountains

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<td>Dr. Timothy Shank</td>
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<td>Woods Hole Oceanographic Institution</td>
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<td>Dr. Michael Brennan</td>
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<td>University of Rhode Island</td>
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<td>Chief of Operations</td>
<td>Brennan Phillips</td>
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<td>Institute for Exploration</td>
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<td>Dr. Robert Ballard &amp; Dr. Katherine Croff Bell</td>
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<tr>
<td>Number of Participants</td>
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**Vehicles, Sensors, and Other Equipment**

ROV Hercules, ROV Argus, Sidescan Towfish Echo, Sidescan Towfish Diana
Background and Objectives – NA022 | Anaximander Mountains

Description

*Nautilus* carried out ROV and side-scan surveys of the Anaxagoras and Anaximenes seamounts September 21-28, 2010 (NA010). Exploration of three mud volcanoes, Kazan, Amsterdam, and Thessaloniki, between 1300-2000 m depth, revealed new chemosynthetic cold-seep communities (Shank et al., 2011). The mud volcano fauna consisted mainly of siboglinid tubeworms (Lamellibrachia sp.), amphipods, brachyuran crabs, echinoid sea urchins, mussels, and clams (Shank et al., 2011). By contrast the main megafauna on the seamounts was comprised of cold-water octocorals and scleractinian corals (Shank et al., 2010). The northern side of the Kazan mud volcano, located on Anaxagoras, was actively seeping. In the Kazan and Amsterdam areas seabed scarring, hypothesized to be caused by beaked whale feeding was observed (Shank et al., 2011).

In 2012 E/V *Nautilus* will return to the Anaximander seamounts to further explore active and formerly active seep sites located in 2010. In 2010 new chemosynthetic seep communities were visually surveyed. The goal this year is to take physical samples to identify organisms to the species level and complete DNA analysis. Sampling around seep sites will provide information on the extent of colonization, quantity, type, and diversity of species. Comparison between the actively venting communities and formerly active sites can provide new information on the biological succession at these mud volcanoes. Ancillary information including temperature probes of the sites and salinity will aid in identification of environments including brine pools, which are associated with some mud volcanoes. Mapping of the site with a Blue View multibeam will add valuable information about the relationship between vent fauna and local topography. Sediment samples including of carbonate crusts and brecciated muds, will allow identification of infaunal organisms and sediment provenance. Finally, side-scan surveys may be used to locate new mud volcanoes on the seamounts.

Objectives

- Collect biological samples at known active and inactive vents
- Collect push cores and carbonate crusts for biological and geological information
- Systematic visual (video) surveys of active and inactive vents to quantify benthic macro epifaunal abundances
- Collect ancillary data at sample sites (temperature probe, salinity)
- Bathymetric survey of vents where biological samples are taken
- Time permitting, side-scan surveys of the seamounts to locate new mud volcanoes

Background

The Anaximander Mountains are located in a very complex tectonic setting between the Hellenic subduction zone and the Cyprus arc in the eastern Mediterranean Sea. The seafloor in this region records the active seismic history of compression, extension, and strike-slip motion (Zitter et al., 2003). As the African plate moves north towards the Eurasian plate, the area in between accommodates for the relative motion of these plates. The Anaximander mountains are actually three mountains: Anaximander, the northeast-southwest trending western-most mountain with a
summit at 1250 m depth, Anaxemenes, also NE-SW trending, but shallower peak at 680 m depth, and Anaxagoras, the eastern-most mountain, which is rougher, with many faults running through it, and a much flatter summit at 930 m depth (Zitter et al., 2003). The origin of the mountains is complex. Data suggests that the Anaximander and Anaximenes mountains have a core of rocks from the southern Turkish microplate, possibly from the Taurus Mountains in southern Turkey, although the mountains also contain blocks of completely different age, composition, and deformation stage (Zitter et al., 2003). Gas hydrates are commonly associated with these mud volcanoes (Lykousis et al., 2009). The seismic activity in the region releases deep, thermogenically produced, or shallower, bacterially produced methane gases trapped in sediment via mud volcanoes and cold seeps (Kopf, 1998; Olu-Le Roy et al., 2004). The mud volcanoes are mounds, typically around 100 m tall (though they may be smaller) and go through periods of activity and inactivity (Olu-Le Roy et al., 2004).

Mud volcano activity can be gauged by examining the surface sediments and macro benthic biology. Surface sediment near active volcanoes is usually a grey brecciated mud, whereas inactive sites have carbonate crusts up to several 10's of cm thick, formed by methane-consuming bacteria (Olu-Le Roy et al., 2004). The first colonizers of an active methane seep are the bacteria. Bivalves follow, supported either by the methane seep (chemoautotrophs) or the bacteria. Sea urchins, tubeworms, crabs, and other fauna further contribute to the biodiversity of these sites, in this otherwise biologically barren area. Corals are common at shallow sites and can survive when the vent is no longer active, whereas original inhabitants, including bivalves die-off, leaving large middens. The communities at the Mediterranean mud volcanoes are believed to be different from those found in the Atlantic, due to isolation following the Messinian crisis (Danovaro et al., 2010).

**Importance**

The mud volcanoes support diverse and abundant populations of organisms, rarely found in the Mediterranean Sea. Sampling efforts will aid in our understanding of the diversity and succession of marine life at these seeps. Combined, the maps, samples, visual surveys, and ancillary data will increase our knowledge of association between environmental variables and the location of different communities. Broader coverage by side-scan sonar will contribute to our understanding of mud volcano and potential gas-hydrate locations, a novel and largely unexplored source of energy.

**Expected Outcomes**

- Identify and quantify macrobenthic infaunal and epifaunal species at active and inactive vent sites
- Relate visual survey of biological and geological features to high resolution bathymetric data at active vent site
- Determine temperature and salinity associated with sample sites
- Locate new mud volcanoes with side-scan sonar surveys
4. NA023 | Eratosthenes Seamount

Cruise dates 13 - 26 August 2012

Chief Scientist Dr. Lawrence Mayer
University of New Hampshire

Expedition Leader Dr. Katherine Croff Bell
Ocean Exploration Trust

Chief of Operations Brennan Phillips
Institute for Exploration

Principal Investigators Dr. Robert Ballard & Dr. Katherine Croff Bell
Ocean Exploration Trust

Scientific Observer TBD

Area of Exploration Eratosthenes Seamount
Country of Operation Cyprus

Total Operations Days 14+
Number of Participants 40+

Vehicles, Sensors, and Other Equipment
ROV Hercules, ROV Argus, Sidescan Towfish Echo, Sidescan Towfish Diana
Background and Objectives – NA023 | Eratosthenes Seamount

Description

During the summer of 2010, *Nautilus* conducted an ocean exploration expedition to Eratosthenes Seamount (ESM), Cyprus. ESM is an 120 km x 80 km, elliptically shaped seamount that stands 2000 m proud above the surrounding Eratosthenes Abyssal Plain, reaching a depth of approximately 690 m at its shoalest. The expedition explored and mapped portions of the seamount with a tandem remotely operated vehicle (ROV) system ROV Argus and ROV Hercules. The primary motivations for exploration of ESM in 2010 were to explore the previously described "pockmarks" on the summit of the seamount and understand their relationship to fluid escape, to explore the impact of active subduction of a continental fragment, and to document biodiversity at ESM, in particular the reported presence of scleractinian corals. The 2010 expedition made a number of notable discoveries using the Argus/Hercules systems reflecting a range of geologic and tectonic processes (karst topography, cold seeps, extensional and compressional faulting, slickensides, accretion and m’elange formation), biological phenomena (methane-based chemosynthetic vent communities associated with seeping and seafloor structures associated beaked whale feeding behavior), and human history (discarded amphorae and wrecks). As outlined below, these discoveries form the framework of planning for the 2012 expedition.

In 2012, *E/V Nautilus* return to Eratosthenes Seamount to further document these various geological, ecological, and archaeological discoveries made during the 2010 cruise. An unexpected discovery in 2010 was the presence of chemosynthetic vent communities apparently confined to depths between 900 and 1000 m along wide regions of the southeastern flanks of the seamount. We plan to use the Argus/Hercules system to expand on several of these discoveries through sidescan sonar and near-bottom high-definition video investigation of several areas of interest. The new areas of exploration include tracing the porous outcrop associated with venting communities along both the eastern and western flanks of the seamount beginning at the known vent sites discovered in 2010 in order to understand the lateral extent of these communities. During these dives with Hercules, we will be sampling vent fluids, temperatures surrounding the cold seepages, and collection of vent fauna. Additionally, we will revisit a near vertical outcrop of limestone along the northern wall of the major east-west fault in the center of the seamount and scan the outcrop with a forward-looking laser line scanner, stereo cameras, and a Blue View multibeam.

Objectives

- Collection of vent fluids at cold seep sites for geochemical analysis
- Determine extent of the vent communities centered around the porous carbonate outcrop at 900 - 1000 m depth along the SE to NE flanks of the seamount
- Continuation of side scan operations across the summit of Eratosthenes to explore for undocumented wrecks
- Further exploration of the northern end of ESM to better understand accretion of continental material
- Texture map to centimeter scale the exposed vertical limestone outcrop located at approximately 465716.472, 3730428.454 (UTM 30N)
Background

Eratosthenes Seamount (ESM) is located in the Eastern Mediterranean Sea, approximately halfway between the island of Cyprus to its north and the Nile Cone to its south. This large (120 km length by 80 km width) elliptical seamount is a fragmented continental fragment rifted from the northern margin of the African plate in the early Mesozoic Era. The morphology and petrology of ESM represents its history of submarine and subaerial geologic exposure. Initial deposits of shallow-water carbonates were later superimposed by deeperwater pelagic carbonates after the carbonate platform subsided in the early Cretaceous. Later tectonic uplift initially resulting from the Red Sea rifting episode during the Miocene exposed the peak of Eratosthenes Seamount above sea level during the Messinian salinity crisis (6.5-5.3 Ma). During its geologically brief subaerial exposure, the seamount underwent severe erosion and chemical weathering that formed the present day morphology that includes a flat top perforated with karst geomorphology. The flanks of ESM are dominated by gravity-controlled slides, slumps, and other mass wasting processes. Rapid sea level rise associated with the Atlantic Ocean refilling the Mediterranean Basin during the Messinian desiccation crisis submerged the ESM to its present day bathyal depths. One of the largest submarine geologic features in the Eastern Mediterranean, ESM rises over 2,000 m above the encompassing Eratosthenes Abyssal Plain, where its flat peak reaches a minimum depth of 690 m.

The current tectonic setting of the seamount is unusual in that it represents a continental fragment undergoing active subduction as the African plate descends beneath the Eurasian plate at the Cyprus trench. Subduction is speculated to be causing both uplifting of the Eratosthenes Seamount and faulting related to crustal flexure as the less dense continental crust resists underthrusting at the trench. The northern margin of Eratosthenes Seamount is under compression, caused by the overthrusting of the Eurasian margin. The mid- and southern-regions of the seamount are undergoing tension due to crustal flexure induced by subduction, creating a sequence of parallel east-west trending normal faults separated with offsets up to 250 m.

Importance

Eratosthenes Seamount lies directly under major ancient shipping routes and most likely contains numerous shipwrecks of historic significance. Geologically, the fluid release located along the SE flank of the seamount may provide novel insight into fluid flow associated with, accretion and crustal flexure. Eratosthenes is a rare example of a continental fragment undergoing incipient subduction and knowing these lateral extents of fluid seepages could provide insight into the role of fluid discharge during subduction. The slickenlines and their specific orientation found along the steep inner wall of the major East-West fault may contain important clues into the tectonic history of Eratosthenes, in particular new insights into accretion.

Expected Outcomes

• Identification of geological and archaeological features on the seafloor from sonar targets
• Determine extent of the outcrop and vent communities on the eastern flank of the seamount
• Sample vent fluids to understand the chemistry supporting the chemosynthetic communities
• Determine orientation of fault movement via analysis of slickenline striations
• Relate video to multibeam sonar data to better understand the karst and tectonic features.
5. NA024 | Southeast Aegean Sea

**Cruise dates** 29 - 4 September 2012

**Chief Scientist** Dr. Michael Brennan
University of Rhode Island

Dr. Katherine Croff Bell
Ocean Exploration Trust

**Expedition Leader** Dr. Nicole Raineault
University of Rhode Island

**Chief of Operations** Brennan Phillips
Institute for Exploration

**Principal Investigators** Dr. Robert Ballard & Dr. Katherine Croff Bell
Ocean Exploration Trust

**Scientific Observer** TBD

**Area of Exploration** Southeast Aegean Sea

**Country of Operation** Turkey

**Total Operations Days** 4

**Number of Participants** 30+

**Vehicles, Sensors, and Other Equipment**
ROV *Hercules*, ROV *Argus*, Sidescan Towfish *Echo*, Sidescan Towfish *Diana*
Background and Objectives – NA024 | Southeast Aegean Sea

Description

Our work in the southeastern Aegean Sea since 2008 has focused on the documentation of trawl damage to the seafloor off the Bodrum and Datça peninsulas, general mapping of the seafloor, and subsequent identification of sonar targets, which have included carbonate crusts from methane seeps, rock ridges and outcrops, slope failures, and numerous shipwrecks. After four years of work, we have compiled a large data set of side-scan sonar mapping of the coastal deep water (50-600 m) off these two peninsulas. Six ancient wrecks were located off the Bodrum peninsula, 20 off Knidos at the western end of the Datça peninsula, and another four south of Marmaris in 2010. These wrecks are all damaged by bottom trawl fishing to varying degrees, ranging from no damage (Yalikavak II inside a harbor) to ones containing few intact artifacts with broken sherds scattered across the seafloor by weighted nets (Marmaris D). This damage demonstrates where fishermen have been operating. They appear to be respecting some trawl restrictions, such as the 2.5 km prohibited zone off the coast, while illegally trawling in others, such as parallel to submarine cables.

Despite the large area we have mapped with side-scan sonar over the past four years, gaps in coverage remain, especially in the area south of Knidos. In 2012, we will continue to work toward a comprehensive documentation of this area south of the Datça peninsula. Each of the shipwrecks located here was documented with high-resolution imaging systems on Hercules, including stereo cameras for photomosaicking, multibeam sonar for microbathymetry, and structured light lasers, but some wrecks were not mapped with all three systems. We will return to these sites this year to complete these imaging data sets.

Objectives

- Continued side-scan sonar mapping south of the Datça peninsula
- Target ID and documentation of new sites located with sonar
- Re-mapping of known sites

Background

Southwestern Turkey is comprised of a series of folds from tectonic stresses that have created E-W trending peninsulas jutting out into the Aegean Sea. These spits of land, such as the Bodrum and Datça peninsulas, acted as shelter from the wind for ancient seafaring vessels, causing harbor sites to be built up along the southern coasts, such as Knidos and Halicarnassus. However, the winds that these promontories provided shelter from also created hazards for seafaring and, combined with storms and a rocky coastline, explains why so many shipwrecks are encountered in this area.
Importance

The Aegean Sea is a shallow sea and rarely gets deep enough to be out of the reach of bottom trawlers. The discovery and characterization of 30 shipwrecks in this region is the first time such a data set has been collected that documents and quantifies the damage of bottom trawl fishing on ancient shipwreck sites. We plan to use this information to advise areas where marine protected areas may be established to help protect both wrecks and juvenile fish species that congregate on wrecks, utilizing them as artificial reefs.

Expected Outcomes

- Identification of archaeological and geological targets from sonar mapping
- Completed comprehensive side-scan sonar coverage south of Datça
- Re-imaging surveys of shipwreck sites
6. Equipment, Technology & Communications

*Exploration Vessel Nautilus* is equipped with some of the latest technological systems, helping to advance the frontiers of ocean exploration. Primary capabilities include science class remotely operated vehicles (ROVs), high-resolution seafloor mapping, and real-time satellite transmission of data.

Systematic exploration consists of a tiered approach of information gathering in geographic regions about which we know little or nothing, but where there is high potential for discovery. The first step involves studying large areas of unknown or poorly known ocean regions using sonar mapping systems. *Nautilus* currently uses side scan sonar systems on two towfish, *Diana* and *Echo*, for seafloor mapping, and is slated to install a hull-mounted multibeam sonar in the winter of 2013. Water column properties may also be surveyed using CTDs and other towed sensor packages to record salinity and temperature at depth.

In the second tier of exploration, resulting data are used to identify areas of further interest to be explored using our ROVs, *Hercules* and *Argus*, owned and operated by the Sea Research Foundation’s Institute for Exploration. The objective is to explore, locate and describe new habitats, geological processes, cultural sites, and unknown phenomena, establishing a rich foundation of information to catalyze further scientific efforts.

As the Corps of Exploration aboard *Nautilus* conduct operations at sea, satellite technology is used to transmit video, sensor and audio data to shore in real time. These high-definition data streams are transmitted via high bandwidth Internet-2 to the expedition’s “mission control” at the Inner Space Center (ISC), located at the University of Rhode Island’s Graduate School of Oceanography. The feed is also transmitted to other shore-based Exploration Command Centers (ECCs) developed in strategic locations around the U.S. and in other parts of the world.

A standard definition version of the live video from the ISC is then transmitted via standard Internet so that scientists, students and the general public can participate in the investigation of the unexplored deep ocean simultaneously with *Nautilus*-based teams via www.nautiluslive.org. These new high-speed, real-time links to shore provide a unique opportunity for the inclusion of participants from diverse communities who may not otherwise be involved in oceanographic exploration, including scientists, engineers and learners of all ages from around the world.
### Exploration Vessel (E/V) Nautilus

| **Length**     | 64.23 meters (211 feet) |
| **Beam**       | 10.5 meters (34.5 feet) |
| **Draft**      | 4.9 meters (14.75 feet) |
| **Tonnage**    | 1249 gross, 374 net    |
| **Main Propulsion** | Single 1286 kw (1700 HP), controllable pitch |
| **Speed**      | 10 knots service, 12 knots maximum |
| **Endurance**  | 40 days                |
| **Range**      | 24,000 kilometers (13,000 nautical miles) |
| **Dynamic Positioning** | 300kW azimuthing jet-pump (stern), 250kW tunnel (bow) |
| **Classification** | Germanischer Lloyd (GL) 100 A5 E1 (Ice Strengthened) |
| **Built**      | 1967, Rostock, E. Germany |
| **Formerly**  | Alexander von Humboldt (East German research vessel) |
| **Berthing**  | 48 persons (17 crew; 31 science/operations) |
| **Flag**       | St Vincent and the Grenadines |
| **Home port** | Bodrum, Turkey |
| **Communication Broadcast** | C-band satellite communications, 18 mbps (HD video) |
| **Call sign** | J8B3605 |
| **Deck Equipment** | A-frame, 6-ton capacity; Knuckle-boom crane, 4.2-ton capacity with 2 extensions; Dynacon 421 oceanographic winch, 8.8-ton capacity with 4300m 0.68” cable; Hatlapa oceanographic winch, 2.1-ton capacity with 3000m 0.322” cable |
Shipboard Exploration Vehicles

Remotely Operated Vehicles (ROVs)

E/V Nautilus has two shipboard remotely operated vehicles (ROVs) named Hercules and Argus that work in tandem. This Hercules and Argus system is a state-of-the-art deep-sea robotic laboratory capable of exploring depths up to 4,000 meters. Each of the ROVs has its own suite of cameras and sensors that receive electrical power from the surface through a fiber-optic cable, which also transmits data and video. Engineers and scientists control the vehicles from a control room aboard Nautilus, with some dives lasting more than three days. The system is a versatile tool capable of supporting a wide range of oceanographic instrumentation and sampling equipment. They have surveyed ancient shipwrecks, discovered hydrothermal vents, and explored habitats in oceans and seas around the world.

ROV Hercules

Since it was first launched in 2003, Hercules has been working in tandem with Argus to explore the geology, biology, archaeology, and chemistry of the deep sea. Hercules is equipped with a high-definition video camera, four HMI lights, two manipulator arms, and a variety of oceanographic sensors and samplers, including a suite of high-resolution mapping tools. Hercules weighs about 5,200 lbs in air and can deliver approx. 150 lbs of samples or tools to and from the seafloor.
ROV Hercules Specifications – Standard Configuration

Depth rating 4,000 meters (13,123 feet)

Air weight 2400 kg (5200 lbs)

Video 1x 3-chip High Definition cameras w/zoom, pan & tilt
      1x Standard Definition pan & tilt camera
      5x Standard Definition cameras
      1x stereo high-resolution still-camera system

Lighting 4x 400W HMI, 2x 250W incandescent

Navigation Tracklink 5000 USBL acoustic position
       RDI acoustic Doppler velocimeter (600 & 1200 kHz)
       Ixsea OCTANS gyro
       DVLNAV navigation software

Manipulators Kraft Predator, ISE Magnum 7-function

Sonars Mesotech 1071 series profiling sonar (300 kHz)
       Imagenex 881A profiling sonar (600 kHz)
       Tritech Super SeaPrince profiling sonar (600 kHz)

Sensors Sea-Bird FastCAT 49 CTD
       Aanderaa optode
       WHOI high-temperature probe

Sampling Tools Suction sampling system: 2x 8-liter acrylic buckets
       “Snuffer” jet-suction excavation system
       Suction-cup artifact recovery tool
       2x sample bays, configurable with sealed biological boxes open-top
       Geologic boxes, various crates and containers
**ROV Argus**

*Argus* was first launched in 2000 as a deep-tow system capable of diving as deep as 6000 meters. *Argus* is now typically used in tandem with *Hercules*, where it hovers several meters above in order to provide a bird’s-eye view of *Hercules* on the seafloor. It is also capable of working as a stand-alone system as a towed-body instrument for large-scale deepwater survey missions. Sidescan sonar looks out on either side of the vehicle up to 400 meters total swath.

**Depth rating** 6,000 meters (currently limited to 4,000 meters by cable length)

**Air weight** 1800 kg (4000 lbs)

**Video** 1x High Definition w/ zoom & tilt, 3x SD cameras

**Lighting** 2x 1200W HMI, 2x incandescent

**Sonars** Mesotech 1071 series profiling sonar (600 kHz)
Tritech SeaKing subbottom profiler (20/200 kHz)
Edgetech 4200 HF sidescan sonar (300/500 kHz)
Mapping Systems

Towfish Diana

*Diana* is an Edgetech 4200 HF side-scan sonar towfish that uses dual frequencies with a range of approximately 200 meters on either side. The *Diana* system is capable of being towed to a depth of 2000 meters, but is currently limited by cable length to a working depth of 600 meters. *Diana’s* transducers can also be installed on the Argus towsled, which increases the towing depth to a maximum of 4000 meters.

*Diana* is used to create accurate, high-resolution maps of the seafloor and to identify targets of interest that ROVs *Hercules* and *Argus* may explore in more detail. The primary advantage of this system is the quality of data that is produced.

<table>
<thead>
<tr>
<th>Depth rating</th>
<th>2,000 meters (currently limited to 600 meters by cable length)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonar</td>
<td>Edgetech 4200 sidescan sonar (300/500 kHz)</td>
</tr>
</tbody>
</table>

Towfish Echo

*Echo* is a five-channel Benthos deep-tow side-scan sonar system rated to 3,000 meters water depth. *Echo’s* operating frequencies are 100 and 400 kHz, which cover a total swath width up to 1,000 meters. *Echo* is also equipped with a Chirp 2-7 kHz subbottom profiler that permits identification of subseafloor features.

Towfish *Echo*, like *Diana*, is used to create accurate, high-resolution maps of the seafloor and to identify targets of interest that ROVs *Hercules* and *Argus* may explore in more detail.

<table>
<thead>
<tr>
<th>Depth rating</th>
<th>3,000 meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonar</td>
<td>Benthos SIS-1500 sidescan sonar (100/400 kHz)</td>
</tr>
<tr>
<td></td>
<td>Subbottom sonar (3-7 kHz)</td>
</tr>
<tr>
<td>Sensors</td>
<td>Falmouth Scientific CTD</td>
</tr>
</tbody>
</table>
Shore-Based Centers

Telepresence Systems

Telepresence technology enables real-time participation in ocean exploration expeditions from shore. *Nautilus* is equipped with a satellite dish that allows us to send data and video back to our “mission control” at the Inner Space Center in real-time while our Corps of Exploration is investigating the seafloor. The application of telepresence technology for ship-based work is extremely efficient as it permits unlimited access to personnel on shore, transcending schedules, expertise, skills, and abilities of traditional shipboard teams.

Telepresence also enables the development of partnerships between geographically dispersed groups who otherwise might not have the opportunity to collaborate due to cost or logistics, and ultimately allows for the most efficient use of all resources, as access to data and information between ship and shore is immediate and sustained for the duration of an expedition.

| Inner Space Center |

The Inner Space Center (ISC) at the University of Rhode Island Graduate School of Oceanography serves as the shore-based telepresence hub or “mission control” for multiple ships of exploration, including *E/V Nautilus*. The ISC facility is connected to Internet2, which permits high bandwidth streams of video, audio, and data to flow from the ship to shore where it is captured, displayed and disseminated in real time. The Inner Space Center also hosts teams of scientists and engineers at the facility during operations, so they can communicate with their counterparts at sea and monitor the expedition in real time.
Exploration Command Centers

The JASON Project Exploration Command Centers (ECCs) combine telepresence technology with a program of live exploration content and live interactions with scientists and engineers designed to engage and excite audiences of all kinds. The system allows ECC sites to receive and display three to four high-quality live streams, which are delivered via either Internet1 or Internet2. ECCs can schedule exclusive live interactions with the Nautilus Corps of Exploration and have access to a constantly updated “video on demand” library of news updates, dive highlights, science background segments, and team interviews.

ECCs can be configured and used in two standard styles: theater or exhibit. Venues with an auditorium space may opt to install a “theater-style” ECC to provide the Nautilus Live experience in a show format. Replicating the successful program currently used at Mystic Aquarium, these twenty-five minute long shows are a mix of pre-produced video segments and live feeds from the ship, hosted by a live presenter. The program includes all of the required media assets, interpreter training, and daily updates from the Nautilus Live production team. Exhibit-style ECC installations are available for venues that prefer a less structured experience for their visitors. HDTVs display 3 screens of live video and audio from E/V Nautilus. Computers or touch screens allow visitors to send text questions and dive deeper into expedition resources, while graphics and content resources are also available.

Nautilus Live Theater

The Nautilus Live Theater is our premier Exploration Command Center (ECC) venue, located in the state-of-the-art theater space at Mystic Aquarium in Mystic, Connecticut. Visitors can learn about the Nautilus expedition and join Dr. Robert Ballard’s Corps of Exploration aboard Nautilus through live feeds and interactions. The Nautilus Live Theater is located in the Ocean Exploration Center at Mystic Aquarium, home of the new Titanic - 12,450 Feet Below exhibit.

During the Nautilus expedition, the Nautilus Live Theater provides aquarium visitors with live video and two-way ship-to-shore communications. During daily theater shows, an expedition presenter guides audiences through video segments, expedition maps, recent dive highlights, current live feeds and live interactions with the Corps of Exploration aboard Nautilus. When Nautilus is not at sea, the Nautilus Live Theater showcases highlights from the most recent Nautilus expedition.
Web-Based Communications

Nautilus Live Website

The Nautilus Live website (http://www.nautiluslive.org) provides web access to live video feeds coming from the ROVs and shipboard cameras on Nautilus to the Inner Space Center. The website provides a fuller picture of Nautilus exploration by surrounding the live feeds with supplemental information about the expedition, including live news updates and audio commentary from the Corps of Exploration. The site also displays the status of operations, including a location map, and a constantly updating display of the notes that are being recorded by the science team. Blogs, photos and highlight videos are updated on the site multiple times per day during operations. The Nautilus Live website has had approximately 250,000 viewers each year (2010-2011) and reached over 170 countries around the world.

Nautilus Live Social Media

The Corps of Exploration aboard Nautilus and at the Inner Space Center at the University of Rhode Island keep in touch with Nautilus Live viewers through a dedicated Facebook page, Twitter feed and YouTube channel.

Facebook  http://www.facebook.com/nautiluslive
Twitter    http://twitter.com/EVNautilus
YouTube    http://www.youtube.com/EVNautilus
7. Education Programs

The E/V Nautilus field season offers students and educators many opportunities to get involved, both directly and indirectly, in ocean exploration. Live-access exposure to actual shipboard research activities where exciting discoveries are made can be a key contributor to engaging educators, students and families in learning about science, technology, engineering and mathematics (STEM) subjects. In addition to its role as a platform for innovation in technology and ocean exploration, Nautilus and the Nautilus Exploration Program provide a platform for developing an array of education and outreach programs to engage and inspire people of all ages.

Nautilus offers a broad spectrum of shipboard and shore-based educational programs to engage learners of all ages and levels. The Sea Research Foundation’s JASON Project and Immersion Learning programs offer curricula and professional development that bring real science and exploration to educators and students in grades K-12. The Ocean Exploration Trust’s Honors Research Program immerses honors-level high school juniors and seniors in oceanographic science and engineering; and the Trust’s Science and Engineering Internship Program trains undergraduate and graduate students in the at-sea environment. The Ocean Exploration Trust also brings formal and informal educators aboard Nautilus during the field season as Educators at Sea. Finally, the educators and students on Nautilus share ocean exploration with a global audience via the Nautilus Live website, which engages thousands of people across the globe through real-time exploration aboard Nautilus.

Nautilus educational programs are developed and executed in partnership with several organizations, including the Bechtel Corporation, Ocean Exploration Trust (OET), Sea Research Foundation (SRF), National Geographic Society (NGS), and University of Rhode Island Graduate School of Oceanography.
Shipboard Programs

Honors Research Program

The Ocean Exploration Trust's Honors Research Program (HRP) brings a small group of honors-level high school students to the University of Rhode Island's Graduate School of Oceanography for several weeks during the summer. HRP students work with scientists and engineers to learn about oceanography and the scientific research process. After completing a research project on shore based on data collected by Nautilus, HRP students travel to the ship to work with the Corps of Exploration and stand watch as Data Loggers, alongside Nautilus scientists and engineers.

The Honors Research Program will be bring 6 high school students onboard Nautilus during the 2012 expedition season.

Science and Engineering Internship Program

The Ocean Exploration Trust's Science and Engineering Internship Program aims to train undergraduate and graduate students studying ocean science and engineering in the at-sea environment. Science Interns spend their time on Nautilus working with a wide array of scientists, learning how to make scientific observations and process digital data and physical samples. Engineering Interns work with the engineering team, learning how to maintain and operated the remotely operated vehicles Hercules and Argus. All Interns participate in education and outreach activities and gain at-sea leadership skills.

The Science and Engineering Internship Program will be bring 8 students aboard Nautilus during the 2012 expedition season:

Maggie Craig and Tara Willis will be our Nautilus Engineering Interns this year. They will spend their time on board learning about the Hercules and Argus ROV systems and standing watches as Argus pilots. Maggie is a junior in Ocean Engineering at the University of Rhode Island and will be on the Southern Black Sea and Anaximander Mountains cruise legs. Tara is an undergraduate at Long Beach Community College studying Electrical Engineering and will be on the Anaximander Mountains, Eratosthenes Seamount, and Southeast Aegean Sea cruise legs.

Jeff Emerson, Sandra Schleier, Lindsay McKenna and Kelsey Cornwell will serve as our Nautilus Science Interns. They will stand watches as Data Loggers and process both digital data and physical samples. Jeff is an undergraduate studying archaeology and chemistry at Luther College and he will be on the Southern Black Sea cruise leg. He will be working with Dr. Michael Brennan in order to utilize data collected for his senior project. Sandra and Lindsay will both be on the Anaximander Mountains cruise leg. Sandra is an undergraduate studying marine biology at the University of Puerto Rico and Lindsay is a graduate student studying seafloor mapping at the University of New Hampshire. Kelsey is an undergraduate in classical and medieval studies and anthropology at Bates College. He will be on the Eratosthenes Seamount and Southeast Aegean Sea cruise legs.

Danielle Vaughan and Sarah Bizzoco will be our Video Engineering Interns. They will stand watches assisting with video production. Danielle will be on the Anaximander Mountains cruise leg and

Version 1.9   July 17, 2012
Sarah will be on the Eratosthenes Seamount and Southeast Aegean Sea cruise legs. Both Danielle and Sarah are studying Electronic Media Production at Middle Tennessee State University with veteran *Nautilus* Video Engineer Dr. Mary Nichols.

**Educator at Sea Program**

The Ocean Exploration Trust’s Educator at Sea (EAS) Program immerses formal and informal educators in the *Nautilus* Corps of Exploration and empowers them to bring ocean exploration to a global audience via the Nautilus Live website. Educators at Sea share accounts of ocean science, expedition operations and daily life with audiences through live audio commentary, blogs, photographs, and question-and-answer sessions from aboard the ship. They also assist the video engineers on board to stream engaging live coverage of the expedition. Through participation in live interactions with student groups and public audiences educators additionally engage people of all ages in real-time exploration. Educators at Sea also bring their expedition experience back to their own classrooms and school districts in the form of engaging lesson plans and activities centered around their time at sea on *Nautilus*.

The Educator at Sea Program will be bring 11 educators onboard *Nautilus* during the 2012 expedition season. Prior to the *Nautilus* expedition, our selected educators participate in an intensive multi-day training workshop at the University of Rhode Island from June 25-28, 2012. During this training our Educators at Sea prepare for shipboard responsibilities by attending sessions hosted by scientists, engineers and communicators to learn about the *Nautilus* expedition’s mission, science and technologies. The Educator at Sea Program is sponsored in major part by the Bechtel Corporation.

*Our 2012 Educators at Sea*

Cory Culbertson, Engineering & Technology Teacher  
University High School & Illinois State University, Normal, IL

Sam Garson, Science Department Chair  
Mount Rainier High School, Des Moines, WA

Susie Hill, Education Specialist & Programs Manager  
Nauticus Museum, Norfolk, VA

Steven Hosking, Director of Technology  
The Williams School, New London, CT

Bonnie Keller, Science Teacher  
Lanier Middle School, Fairfax, VA

Eric Lewis, Teacher on Special Assignment & High School Support  
San Francisco Unified School District, San Francisco, CA
Juan Pinto, Technology & Spanish Teacher
Energized for STEM Academy Inc. MS West, Houston, TX

Jason Pittman, Science Focus Teacher
Hollin Meadows Science and Math Focus School, Alexandria, VA

Tom Rodgers, Science Teacher & Science Department Chair
Cape Henry Collegiate School, Virginia Beach, VA

Noelle Turner, Science Teacher
Bearden High School, Knoxville, TN

Krystal Waltman, Science Teacher
Southwest Schools, Houston, TX

Alternate Educator at Sea 2012
Sharon Harder, Science Teacher
Whittle Springs Middle School, Knoxville, TN
Shore-Based Programs

The JASON Project

The JASON Project is an independent 501(c)(3) operated in partnership with National Geographic Society and Sea Research Foundation, Inc. Named for the mythological Greek explorer, JASON is a nationally acclaimed, exploration-based program that links students everywhere – inside the classroom and out – to real science and scientists through technology intensive, inquiry-based curricula.

Available online at www.jason.org, JASON’s next-generation curricula place 4th – 10th grade students in challenging, real-world situations where they are connected with – and mentored by – leading STEM professionals. These connections are delivered through:

- Rigorous digital and print units aligned to state, national and international standards and assessments;
- Live and near-live interactions with scientists and researchers from the curricula and around the world;
- Interactive online simulations, games, videos and social media; and
- Hands-on labs and field assignments that constitute up to 50 percent of classroom time.

Unlike traditional textbooks with a 7-10 year shelf-life, all materials are housed in a robust online platform that is easily updated, ensuring that all content is “evergreen” and reflects the latest scientific and technical breakthroughs. Each five-to-nine week unit may be used as core curricula or as enrichment.

Meanwhile, comprehensive professional development for educators increases their knowledge of STEM content and provides instructional strategies for delivering hands-on, interdisciplinary science. At national conferences, and one- or multi-day workshops and seminars, educators use JASON curricula to practice inquiry-based learning, technology integration, and differentiated instruction. JASON also provides educators with free online tools for alignments, assessments, student assignments, lesson plans, and classroom management.

Today JASON reaches 1.5 million students a year, and general audiences of over six million through content distributed by partner organizations such as National Geographic, museums, aquariums, and government agencies. Its programs are used in every U.S. state, and internationally including Australia, Canada, Japan, Korea, Mexico, and the United Kingdom.
Argonaut Program

Through the JASON Project’s Argonaut Program, students and teachers participate in an international competition to become National Argonauts each year. These individuals work in the field with scientists and see what it’s really like to have a STEM career. Since 1990, JASON has fielded over 450 student Argonauts, many who have gone on to pursue degrees and careers in science. National Argonauts participate in scientific research with peers and scientists, and return to their communities as mentors and role models.

Immersion Learning

The JASON Project’s Immersion Learning program brings ocean adventures and discoveries to elementary and middle school students in classrooms, after-school settings, and other learning arenas. By exposing students to scientific expeditions through live webcasts, hands-on activities, and interactive multimedia resources, Immersion Learning ignites their interest in discovery and learning. Immersion endeavors to improve the science literacy skills of program participants, as well as their career awareness and job readiness in the fields of science, technology, engineering, and math (STEM).
8. 2013 Expedition Season

2013 Season Overview

We expect to conduct a full field season in the Caribbean region starting in the summer of 2013. The Ocean Exploration Trust, which operates E/V Nautilus, will be holding a workshop on telepresence-enabled exploration of the Caribbean Sea in Fall 2012 to determine specific areas for study. Our Corps of Exploration is looking forward to bringing Nautilus and its capabilities to new parts of the world, forming new partnerships, and learning even more about our underexplored ocean.

Upon completion of the 2013 season, E/V Nautilus will be heading into dry dock for numerous upgrades, including the installation of a new hull-mounted multibeam sonar system during the winter of 2013/14. This new technology will improve our capability to study truly unexplored regions of the deep ocean.

Workshop on Telepresence-Enabled Exploration of the Caribbean Sea

The Ocean Exploration Trust has announces a regional conference in Fall 2012 to enable stakeholders interested in exploration of the Caribbean Sea region to discuss which specific areas are the most promising for making new discoveries and for developing collaborative region-wide research programs based upon these discoveries.

The workshop builds upon a workshop hosted by the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean Exploration and Research (OER) in May 2011, at the University of Rhode Island Graduate School of Oceanography. That workshop focused on the Atlantic Ocean, Caribbean Sea and Gulf of Mexico. Fifty scientists, archaeologists and agency representatives reviewed a series of white papers that had been solicited to define the biggest priorities for exploration in these regions, with 12 papers submitted for work in the Gulf of Mexico and 11 in the Caribbean Sea. Some of the papers extended or built upon existing primarily research, and some of the papers laid out a more general program to survey unexplored terrain.

The 2012 workshop and resulting plan will support the mandate to strengthen our understanding of the Caribbean Sea through the use of mapping, deep submergence, and telepresence technology. The document will be used by the Nautilus Exploration Program to develop field programs during the 2013 field season period that Nautilus is operating in the region. The planning document will provide valuable input to NOAA OER as it prepares for field programs on the NOAA Ship Okeanos Explorer, which will be operating in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea for the foreseeable future. Having two ships of exploration in the region will be key to successful implementation of the planning document but we also anticipate that other research platforms, perhaps from regional countries, can be enlisted to undertake exploration programs based on the plan.
In addition to identifying key priority areas for exploration, the planning process will include further development of the "Doctors on Call" model of engaging a broad range of scientific expertise through live satellite-based interaction with the ships of exploration. We also plan to include education and outreach programs in the plan for this region. This telepresence capability will enable us to work with partner countries to foster real-time interaction by their research communities and stakeholders, and open opportunities for engaging the next generation of regional scientists. Because of the possibility for live access to field programs, we expect that they will generate broader public support for and interest in exploration of the Caribbean Seas and ocean exploration in general.

This workshop is made possible by support from the Richard Lounsberry Foundation.

**Workshop Details**

**Location**  
University of Miami Rosenstiel School of Marine Science (RSMAS)  
Miami, Florida, USA

**Timeline**
- May 31: Target Area White Paper Form due
- July 31: Selections made, invitation letters distributed
- Aug 15: Acceptance of invitation due

**More Information**

http://oceanexplorationtrust.com/2012workshop.htm
9. Key Expedition Links and Contacts

Expedition Communications

Nautilus Live
http://www.nautiluslive.org

Nautilus Live on Facebook
http://www.facebook.com/nautiluslive

Nautilus Live on Twitter
http://twitter.com/EVNautilus

Nautilus Live on YouTube
http://www.youtube.com/EVNautilus

Additional Publications and Materials

http://www.tos.org/oceanography/archive/25-1_supplement.html

“New Frontiers in Ocean Exploration: The E/V Nautilus 2010 Field Season”
http://www.tos.org/oceanography/archive/24-1_supp.html

Partner Organizations

Ocean Exploration Trust
http://oceanexplorationtrust.org

Sea Research Foundation (Institute for Exploration, Mystic Aquarium, The JASON Project and Immersion Learning)
http://www.searesearch.org

Inner Space Center – University of Rhode Island
http://isc.gso.uri.edu

Graduate School of Oceanography – University of Rhode Island
http://www.gso.uri.edu

NOAA Office of Ocean Exploration and Research
http://explore.noaa.gov

National Geographic Society
http://www.nationalgeographic.com
Expedition Contacts

Primary Communications & Press Contact

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