Telepresence Technology and Applications on UNOLS Ships

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GSO

THE UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL OF OCEANOGRAPHY

Inner Space center

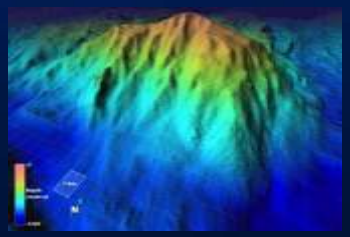
Telepresence–Enabled Ocean Research and Exploration:

- Background –

  Ships/ROVs - NOAA Ship *Okeanos Explorer* and E/V *Nautilus*
  Deep Discoverer and *Hercules*
  Shore Facilities - Inner Space Center and ECCs
  Education and Outreach – Exploration Now, Unknown Ocean

- Pilot Project –ROV *Jason* (NDSF) and R/V *Atlantis*

- Future Plans for Telepresence with UNOLS Facilities


EXPLORE

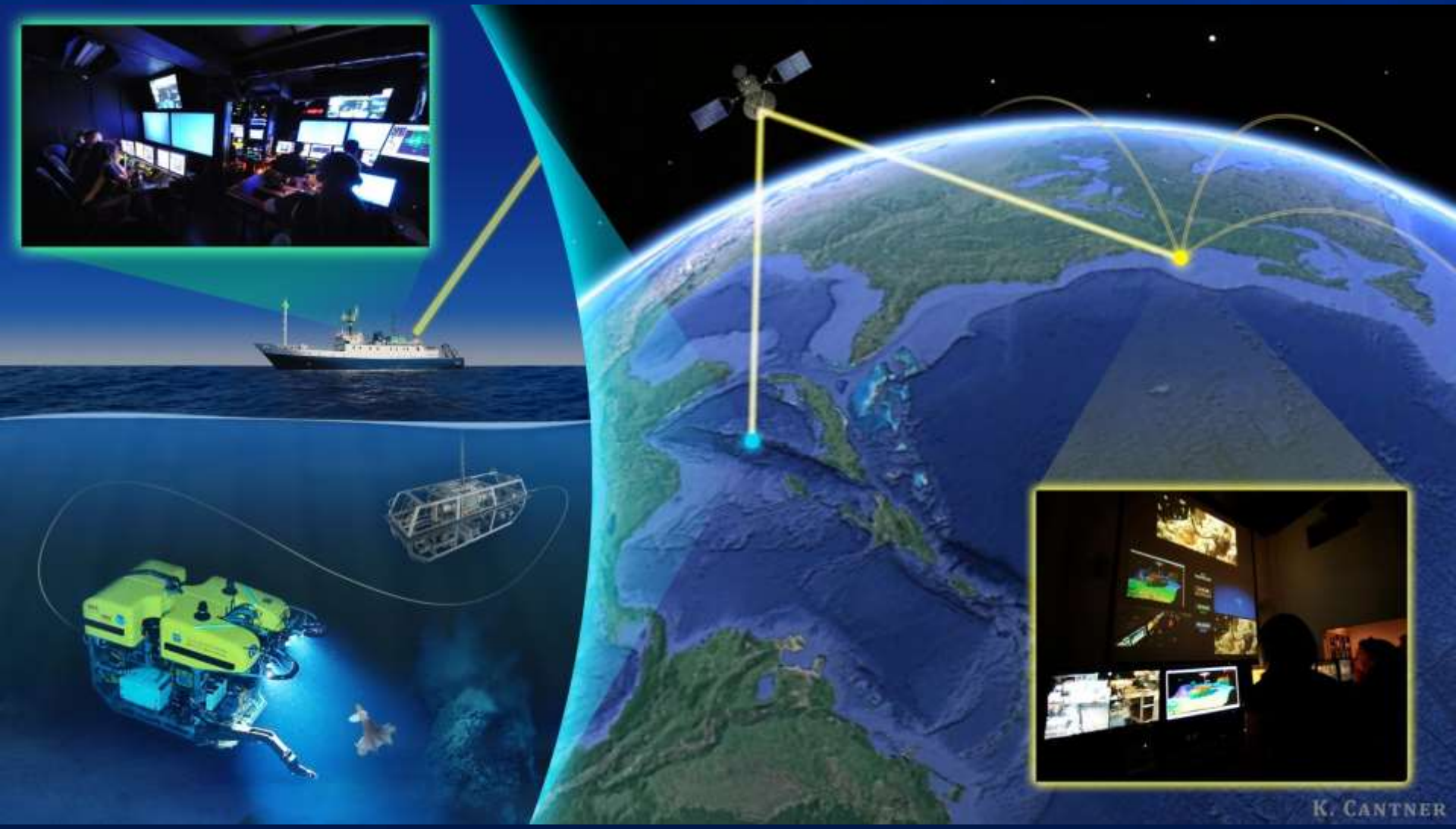
OCEAN EXPLORATION TRUST

NOAA Ship *Okeanos Explorer*

E/V *Nautilus*

ROV *Deep Discoverer*

ROV *Hercules*



Ship-to-Shore Telepresence

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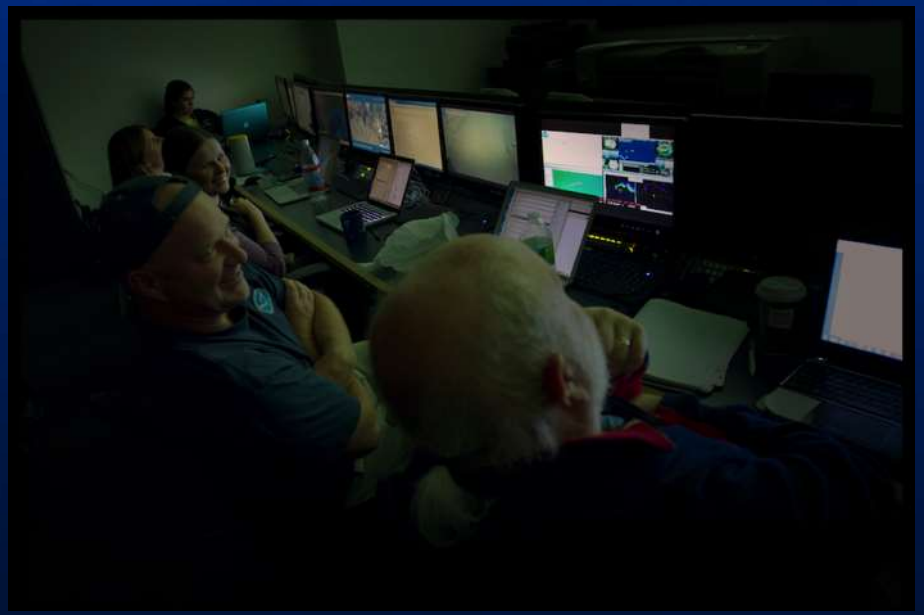
Mission Control



ISC Mission Control

Sentry AUV Support

Internet2

NOAA HQ, Silver Spring

NOAA NCDDC, Stennis

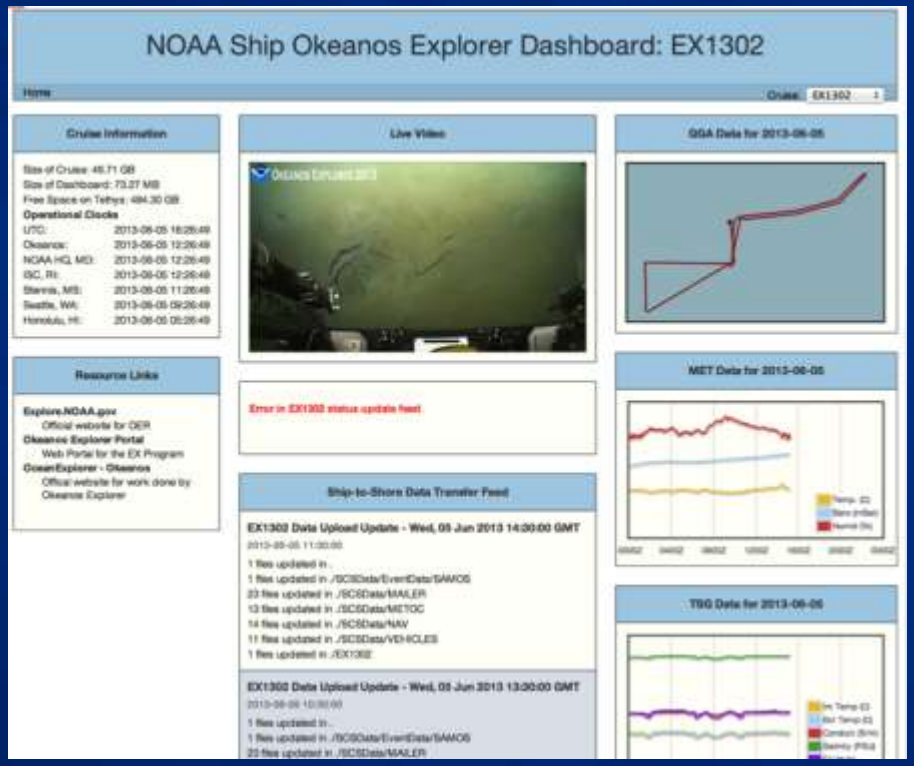
NOAA PMEL, Seattle

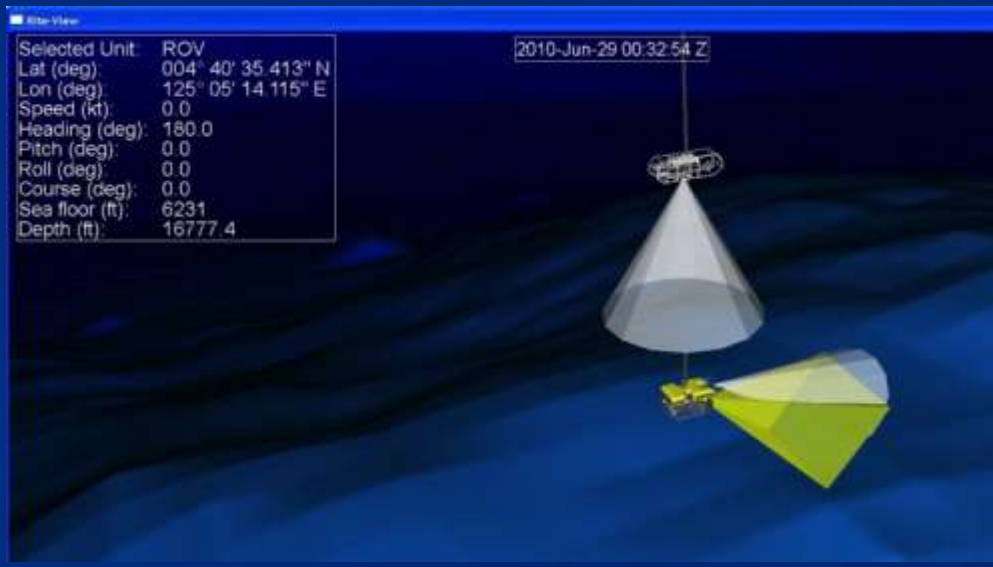
University of New Hampshire

University of Delaware

University of Haifa, Israel

Ocean Exploration Center, Mystic





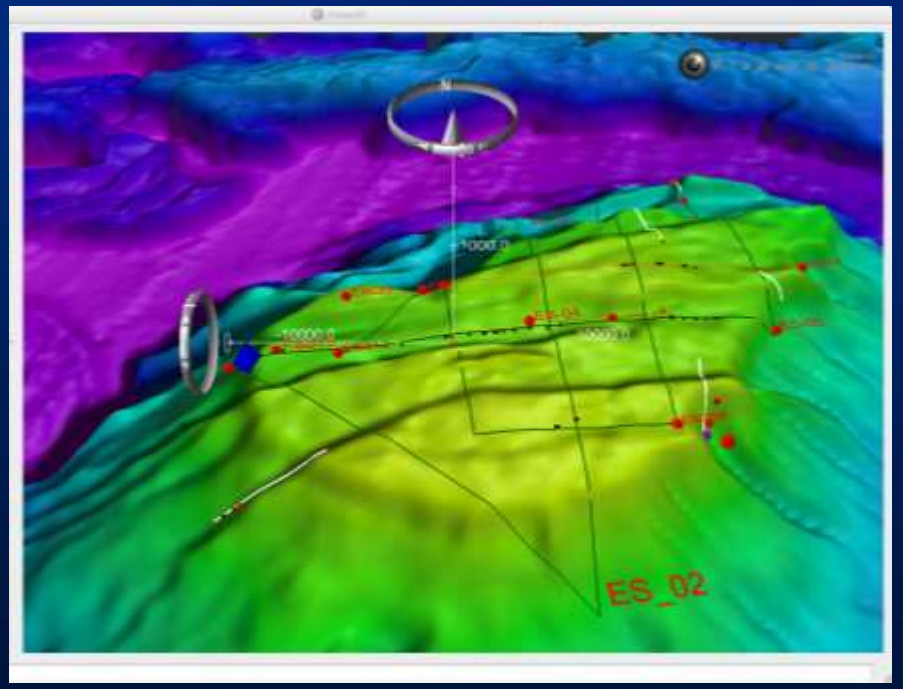
EX is 1250. We are currently conducting ROV operations at a hydrothermal vent site, on "Mount Dent". Operations are being conducted in waters within the Cayman Islands Exclusive Economic Zone. The ship's current heading is 035 degrees, and the location is 18 22.62 N, 81 47.88 W. ROV operations will continue throughout the day.

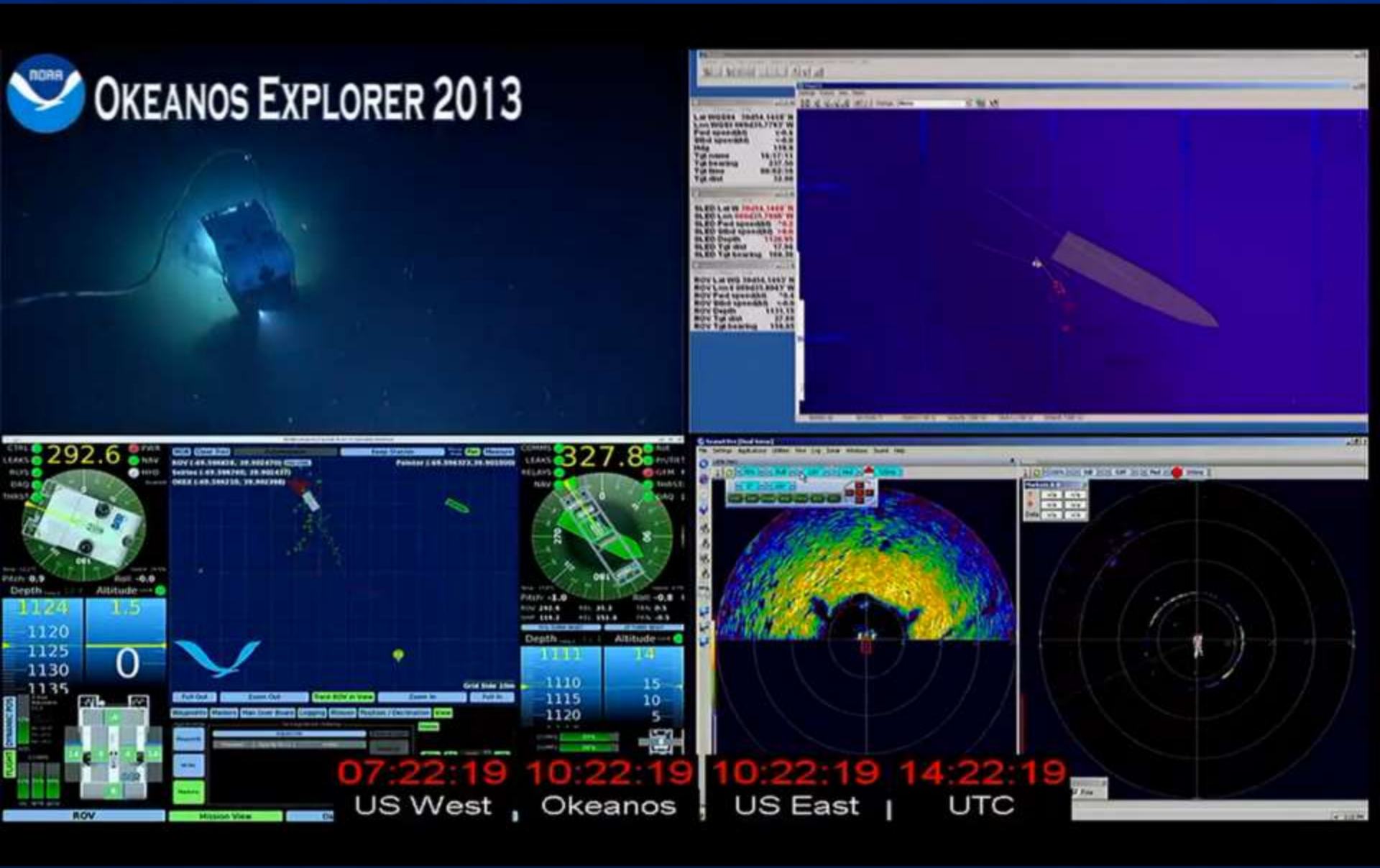
(5:49:39 PM) Bobbie: what ar the white boulders -zoom ?

(5:50:16 PM) Bobbie: ahhhhh ?

(5:50:32 PM) jamesonclarke: limestone?

(5:50:49 PM) mikecheadle: talc?




OKEANOS EXPLORER 2013
07:22:19
US West
10:22:19
Okeanos
10:22:19
US East
14:22:19
UTC


Inner Space center
What's happening now at the Inner Space Center?
E/V Nautilus is linked up LIVE to the Inner Space Center! Watch the live feeds now! Catch what you missed on Exploration Now!
Select a featured video below:
Live Stream
What's an ROV?
About the ISC
Deep Sea Communities
Lost City 2005
NOAA Mid-Cayman Rise Highlights
Nautilus NA017 Highlights
See more awesome clips in our video galleries!
The Inner Space Center, located at the University of Rhode Island's Graduate School of Oceanography, utilizes telepresence technologies to bring oceanographic exploration to the world in real time. Please browse our live video feeds and video gallery to learn more about the projects we support.


Ocean Explorer
NOAA
OKEANOS explorer
OCEAN EXPLORER
EXPEDITIONS
EDUCATION
ABOUT


NOAA Ship Okeanos Explorer, "America's Ship for Ocean Exploration"
Featured Expedition: Gulf of Mexico 2012 Expedition
Featured Content
Watch video clips from the Okeanos Explorer Gulf of Mexico 2012 Expedition. See how scientists used the tandem remotely operated vehicles (ROV's), Little Hercules and Seirios, to
Okeanos Explorer
Education
Explorations
Sideshows
Video Playlist
Okeanos Explorer Digital Atlas


NATIONAL GEOGRAPHIC
SEA RESEARCH FOUNDATION
NAUTILUS LIVE
Explore the ocean LIVE with Dr. Robert Ballard and his Corps of Explorers aboard E/V Nautilus
STAY CONNECTED
THE MISSION
THE HIGHLIGHTS
THE TECH
THE TEAM
THE LATEST
FOR EDUCATORS
FOR KIDS
Offseason
Data log offline
E/V Nautilus
ROV Hercules
ROV Argus

Inner Space center

Production Control and Studio

Mystic Aquarium – Nautilus Live Theater, CT

Cape Henry Collegiate School, VA

Exploratorium, San Francisco

Scottsdale, AZ Boys &Girls Club

THE UNKNOWN OCEAN

LIVE INTERACTIVE EDUCATIONAL PROGRAMMING UTILIZING
SHIP-TO-SHORE TELEPRESENCE TECHNOLOGY

RESEARCH
PROTECT OUR OCEANS
MYSTIC AQUARIUM

South Carolina
Aquarium

Mystic Aquarium
Unknown Ocean Kiosk

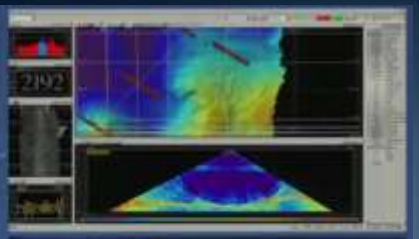
MYSTIC AQUARIUM – NAUTILUS LIVE THEATER

Exploration Command Station

The Unknown Ocean

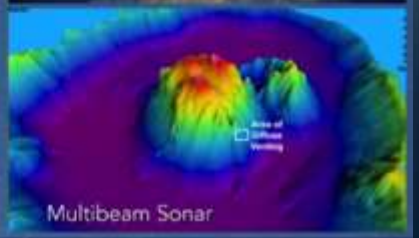
Mapping the Seafloor

Inner Space center



Multibeam Sonar

Seafloor

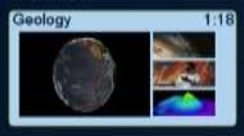


Bathymetry

1:29

CC

Select A Video:



The Unknown Ocean: Exploring Inner Space

Live Feeds from the E/V Nautilus

Inner Space center

Select A Video:

EXPLORATION NOW

A Portal for Discovery

LIVE FROM
INNER SPACE CENTER

LOCATION
NARRAGANSETT, RI

STATUS
PREVIOUSLY RECORDED

E/V NAUTILUS

STS BODRUM

R/V ATLANTIS

STATUS
OFFSEASON

LOCATION
CARIBBEAN SEA

LATEST RECORD
Thank you for being a part of our 2013 season! Follow us on facebook and twitter for updates on 2013 results and plans for 2014, which will take us back to the Gulf of Mexico & Caribbean.
1 month 4 weeks ago

SEA RESEARCH FOUNDATION

Mystic Aquarium – Nautilus Live Theater


AQUARIUM
OF THE PACIFIC


OCEAN EXPLORATION HUB
2013 ROV Shakedown and Field Trials in the U.S. Northeast Canyons: Follow along as the Okeanos Explorer team "shakes down" a new remotely operated vehicle (ROV) capable of diving to depths of 6,000 meters.
2013
LIVE
US West
Okeanos
US East
UTC

the Houston Museum of natural science

Burke Baker
PLANETARIUM


OKEANOS EXPLORER 2010
Live
Live
Live
The Okeanos Explorer is the first vessel in the fleet of the National Oceanic and Atmospheric Administration (NOAA) to be dedicated solely to exploration and discovery missions. It's equipped with a remotely operated vehicle (ROV), sophisticated multibeam sonar technology for mapping the sea floor as deep as 6000 meters (nearly 20,000 feet), and 24-hour satellite telecommunications equipment to beam images in real time from the ship and ROV to destinations on shore. The Okeanos Explorer is primed for making new discoveries with every mission it undertakes. Venture into the vast and largely unknown ocean and follow along with the Okeanos Explorer scientists and crew on their discovery voyages.


exploratorium
the museum of science, art and human perception

Telepresence – Pilot Project for UNOLS:

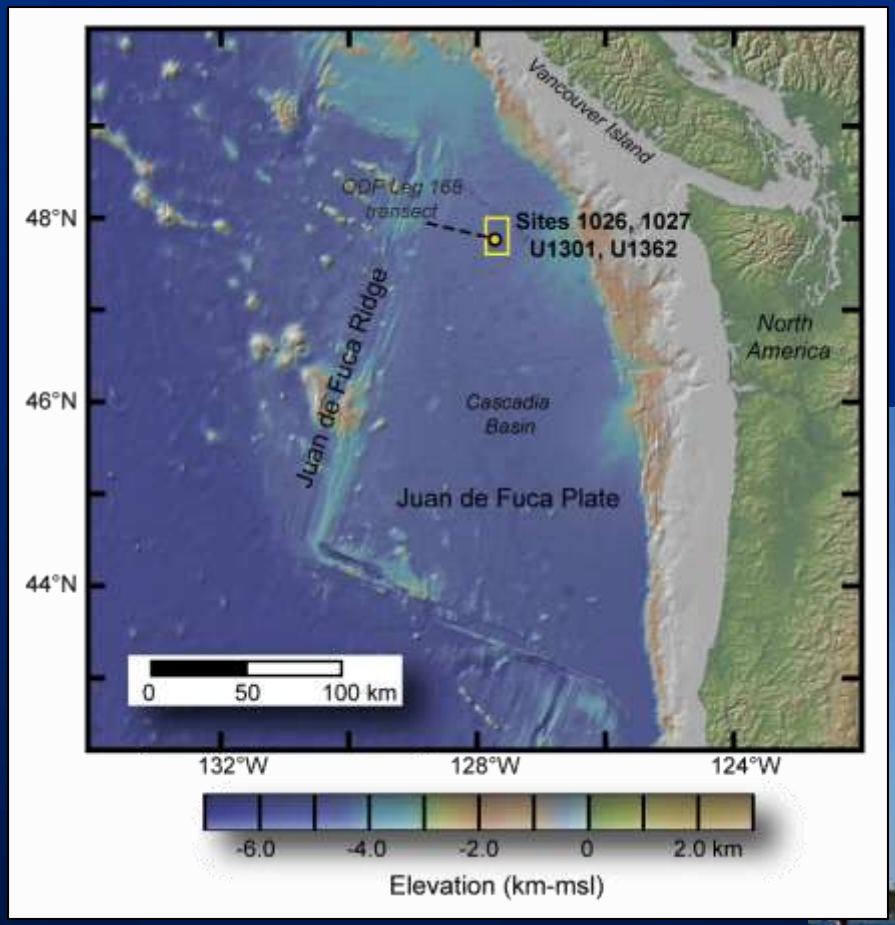
- Project conceived after last UNOLS Council Meeting – sponsored by ONR and NSF
- Targeted funded NSF projects that planned to use the ROV *Jason*
- Focus was on education and outreach, not remote science
- Found willing PI's with existing outreach programs to use *Jason* on the R/V *Atlantis* – July 2013

  Doug Toomey, Anne Trehu, Dean Livelybrooks
  Cascadia Initiative – Ocean Bottom Seismometers

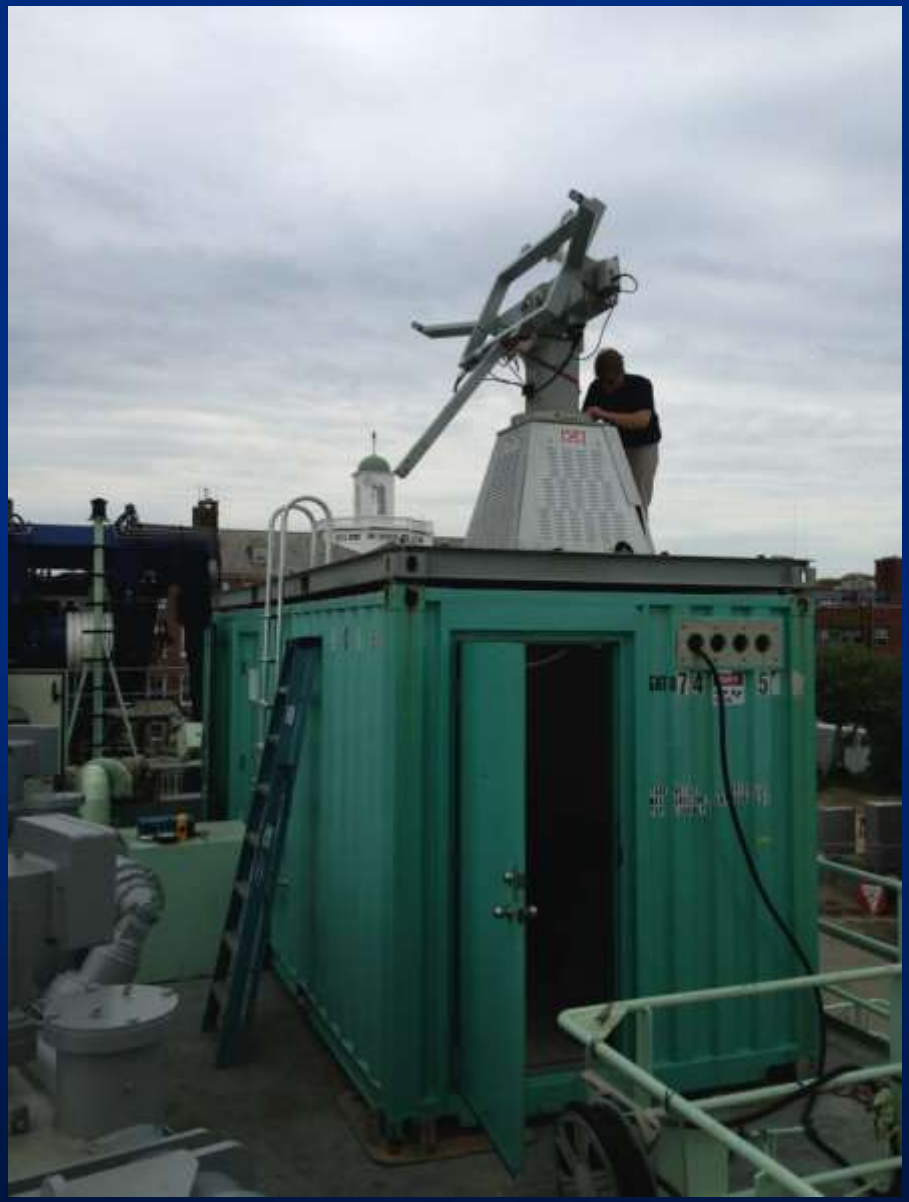
  Andrew Fisher, Eastern Flank of Juan de Fuca Ridge –
  Hydrogeology, Geochemistry, Microbiology at CORK sites

- Conducted science communication training for the educational teams onboard to support live ship-to-shore interactions and video broadcasts about the research

National Deep Submergence Facility



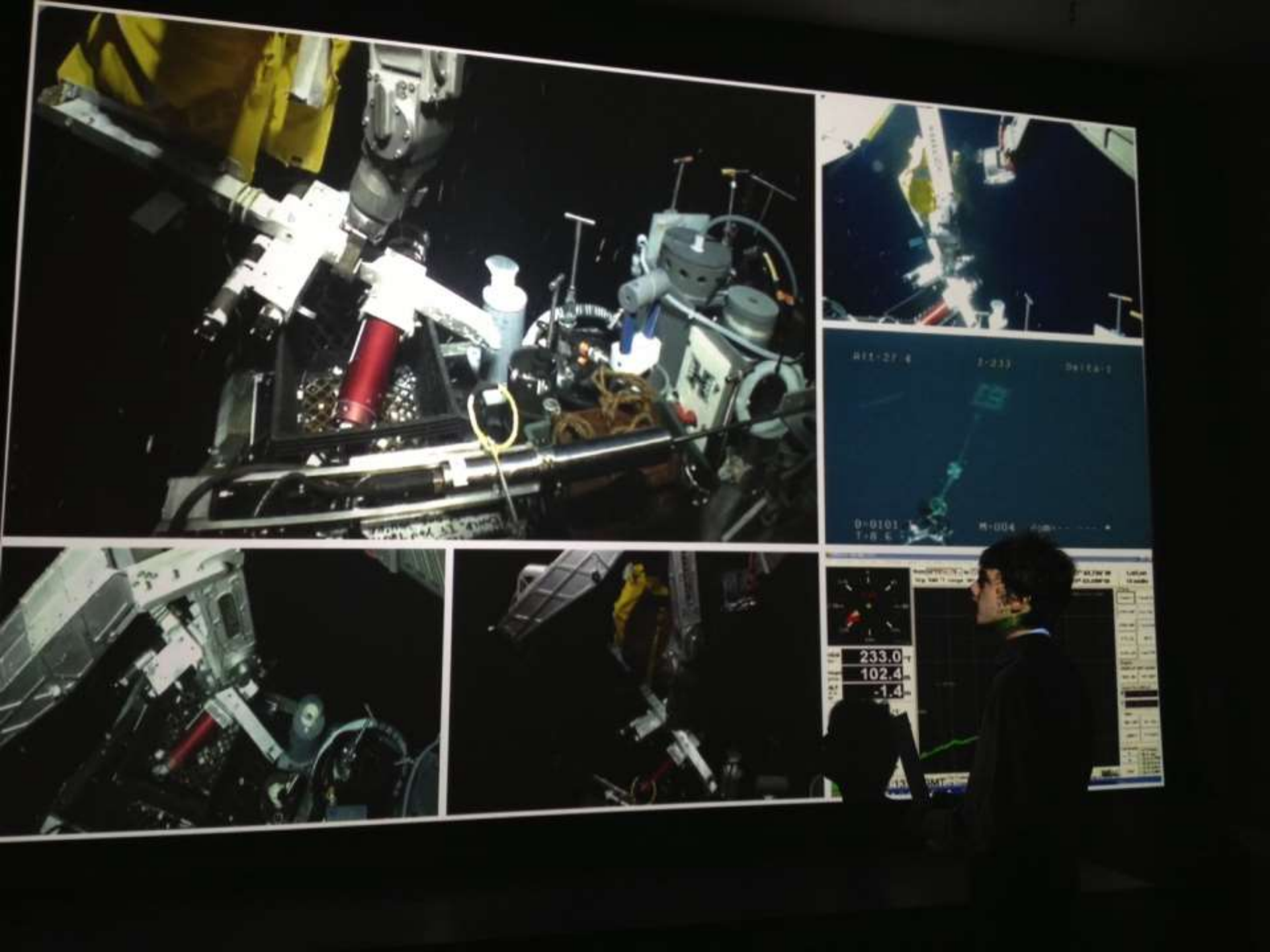
National Deep Submergence Facility




TARE WEIGHT 4185 LBS
MAX GROSS WEIGHT 36060 LBS
TOP LOADINLY

Mobile Telepresence Unit (MTU)


15:22:32
15:22:34
HD


233.0
102.4
-1.4

EXPLORATION NOW

ATLANTIS LIVE

Explore the ocean LIVE with scientists and engineers aboard R/V Atlantis

WATCH LIVE | THE MISSION | THE HIGHLIGHTS | THE TECH | THE TEAM | THE LATEST

Home

THE HIGHLIGHTS

Jason Dive Highlight - Octopus's Garden

It is not uncommon for an octopus to take up residence in or around a CORK. This footage taken by a Jason camera at the bottom of the ocean shows the resident octopus at CORK 1362B.

Meet the Team

Chelsea Catania
researcher

Oceanography
VOL.27, NO.1, SUPPLEMENT | MARCH 2014

New Frontiers in Ocean Exploration

The E/V *Nautilus* 2013 Gulf of Mexico and Caribbean Field Season

GUEST EDITORS | KATHERINE L.C. BELL, MICHAEL L. BRENNAN, AND NICOLE A. RAINEAULT

EXPANDING THE TELEPRESENCE PARADIGM

Live Interactive Programming from R/V *Atlantis* and ROV *Jason*

By Dwight F. Coleman, Dean Livelybrooks, Sharon Katz Cooper, Gregory Mulder, Andrew T. Fisher, Anne M. Tréhu, and Douglas R. Toomey

Since 1981, Robert Ballard has envisioned a concept of ocean exploration with multiple ships collecting video and data from the depths of the world ocean and broadcasting discoveries in real time through ship-to-shore satellite technology. In 1989, the telepresence vision was realized when the first Jason Project broadcasts employed ROV technology developed by the Deep Submergence Laboratory at Woods Hole Oceanographic Institution (WHOI). Those early telepresence-enabled broadcasts delivered live educational programming to vast audiences who could participate in the exploration as it was happening.

The vision expanded in 2003 when the Institute for Exploration developed a new suite of ROV and telepresence technologies as part of a portable system that was installed on ships of opportunity. In 2007, those expeditions began to feature live broadcasts 24 hours a day to audiences on the Internet and at venues such as Mystic Aquarium, all made possible through a prototype version of the Inner Space Center (ISC) at URI GSO. Since 2009, the telepresence paradigm has grown substantially with the development of E/V *Nautilus*, introduction of the NOAA Ship *Okeanos Explorer*, and construction of the permanent ISC. Live broadcasting can now originate from two ships of exploration that have dedicated ROV and telepresence systems installed on board and that conduct field work up to six months each year.

Figure 1 (above). ROV Jason, part of the UNOLS National Deep Submergence Facility operated by Woods Hole Oceanographic Institution. Photo credit: Tom Bolmer, Woods Hole Oceanographic Institution

Beginning in 2013, the telepresence-enabled exploration paradigm expanded yet again to involve more ships, including the Schmidt Ocean Institute's R/V *Falkor*, the University of Washington operated R/V *Thomas G. Thompson*, and the WHOI operated R/V *Atlantis* (the latter two ships are part of the University-National Oceanographic Laboratory System [UNOLS]). Many more live feeds could now be received and distributed through the ISC and used for live video production associated with the Exploration Now program (see page 22). We report here on two specific telepresence-enabled projects conducted during the summer of 2013 on board R/V *Atlantis* that used the *Jason* ROV system (Figure 1). This project represents a milestone in the development and use of telepresence technology for UNOLS platforms, leading to even greater expansion of the telepresence vision for the academic research fleet, with several new ships slated to come on line in the near future.

Challenges

- Need for more technical support – satellite operations, network engineering, telepresence systems, production logistics, shore

- Funding – can't rely on supplemental funding - need to plan for and budget for telepresence activities through the proposal process

Successes

- Outreach – lots of interest in the scientific activities, conducted more than 100 live interactions with various audiences

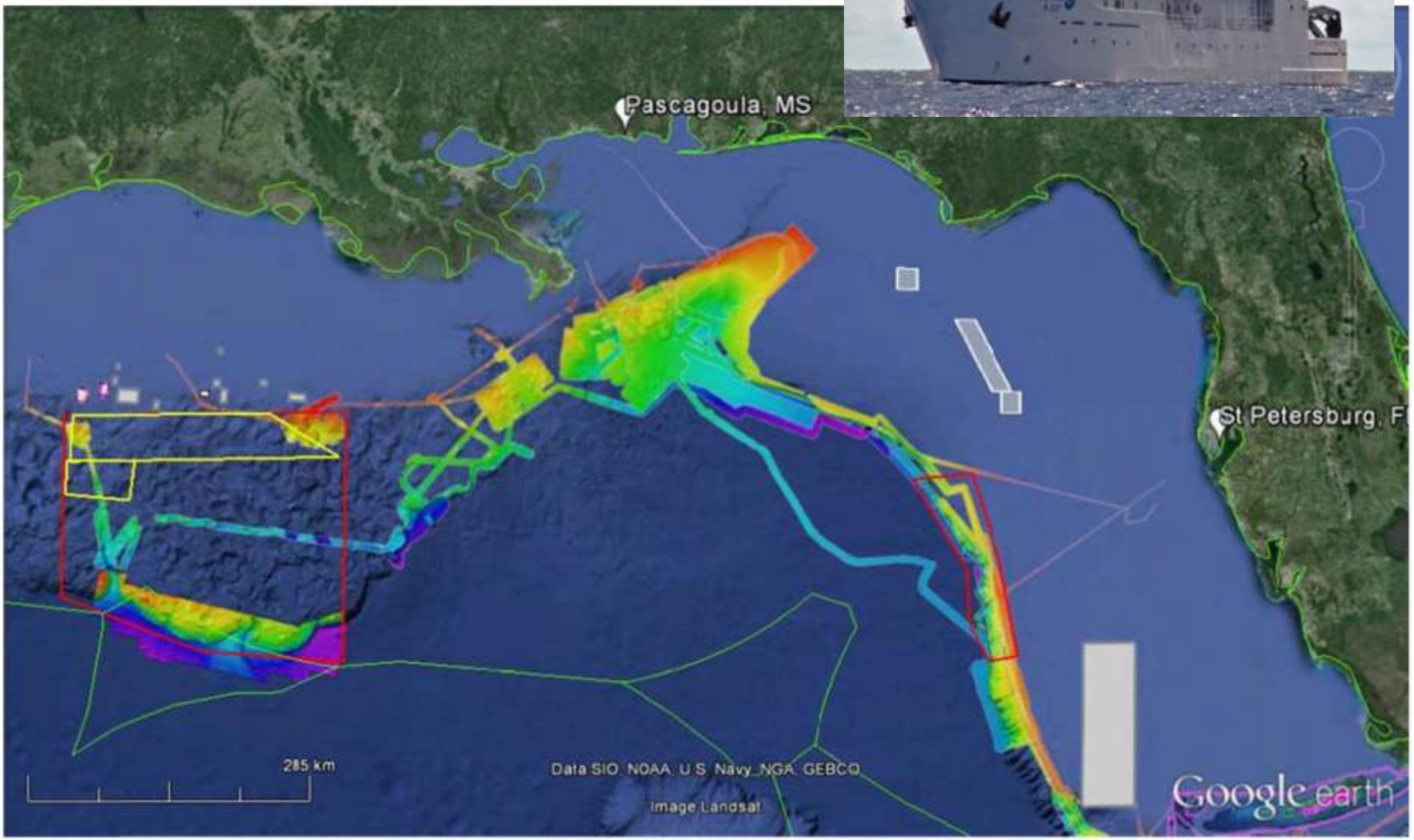
- Data transfers to shore for remote science collaboration

- Bonus – supported Chris Reddy's shore-based participation during Dave Valentine's cruise in October

- Leading to more telepresence-enabled cruise opportunities

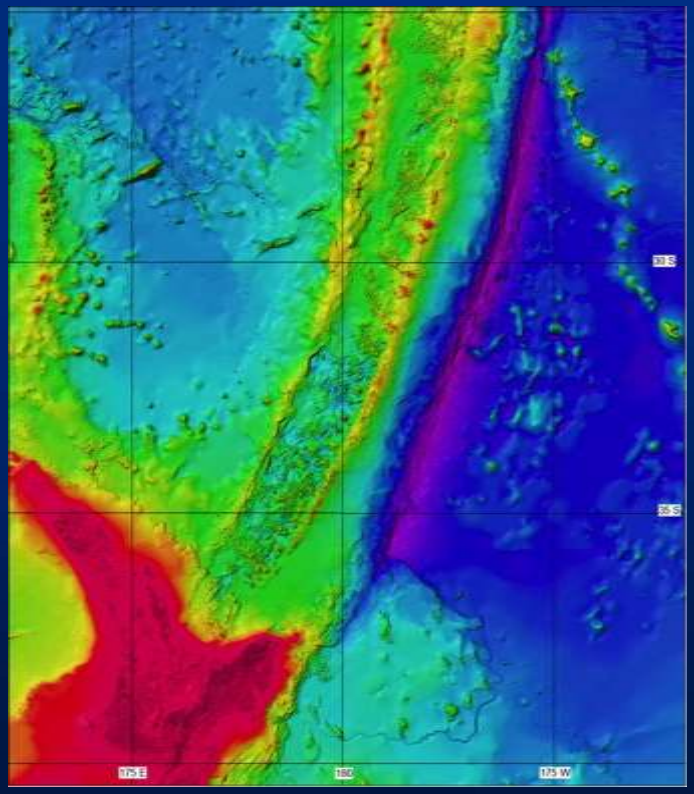
EXPLORE

EX1402 Leg 3 Overview Map



Tim Shank's project:

HADES
HADal Ecosystem Studies



Kermadec Trench, April 10 to May 20, 2014

NAUTILUS EXPLORATION PROGRAM

NSF INSPIRE OCE1344250

TREET: Transforming Remotely-conducted Research through Ethnography, Education, & Rapidly-evolving Technologies

Zara Mirmalek

TREET Participants:

Interdisciplinary Principal Investigators:

Chris German, WHOI

Katy Croff Bell, OET

Zara Mirmalek, Harvard University

Amy Pallant, Concord Consortium

Kanna Rajan, MBARI

Early Career Scientists & Undergraduates

Anna Michel, WHOI

Scott Wankel, WHOI

Masako Tominaga, Michigan State University + students

Eric Mittelstaedt, University of Idaho+ students

Pete Girguis, Harvard University + students

Chris Roman, University of Rhode Island

Expert Mentors

Steve Carey, University of Rhode Island

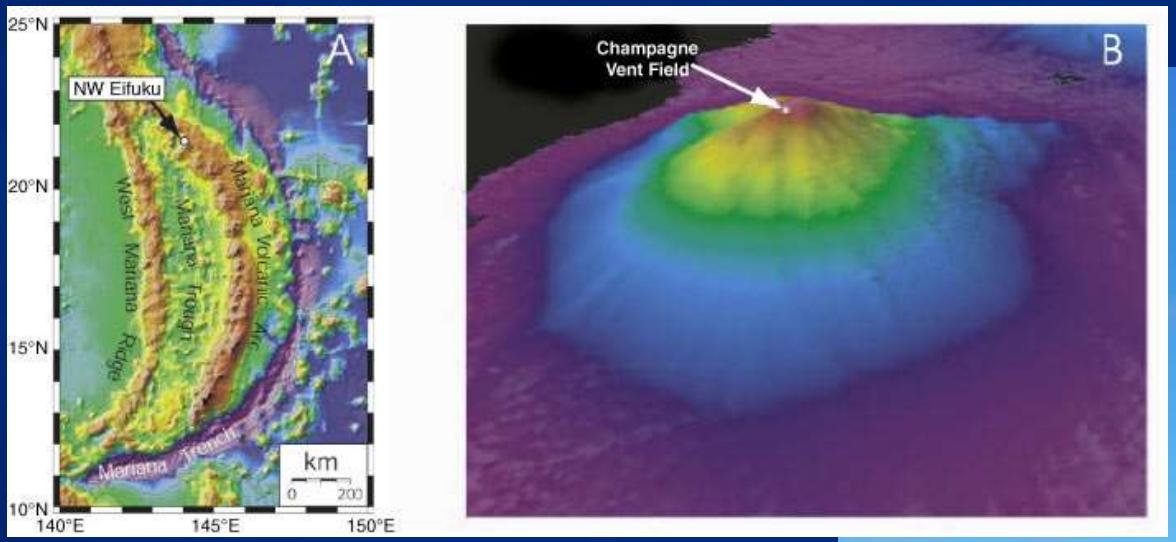
Cindy Van Dover, Duke University

TREET Co-PIs, Early Career Scientists, Expert Mentors, + 8 Undergraduates (not pictured, pending permission to use their images)

TREET Focus & Goals

- To understand and capture the ways in which telepresence-enabled cruises
  - further ocean science and exploration
  - can be advanced with new technologies and social practices
  - allow more access to research environments
- To develop education tools for undergraduate training
- To produce an ethnographically informed study to feed forward in developing new technologies and social process for telepresence communities

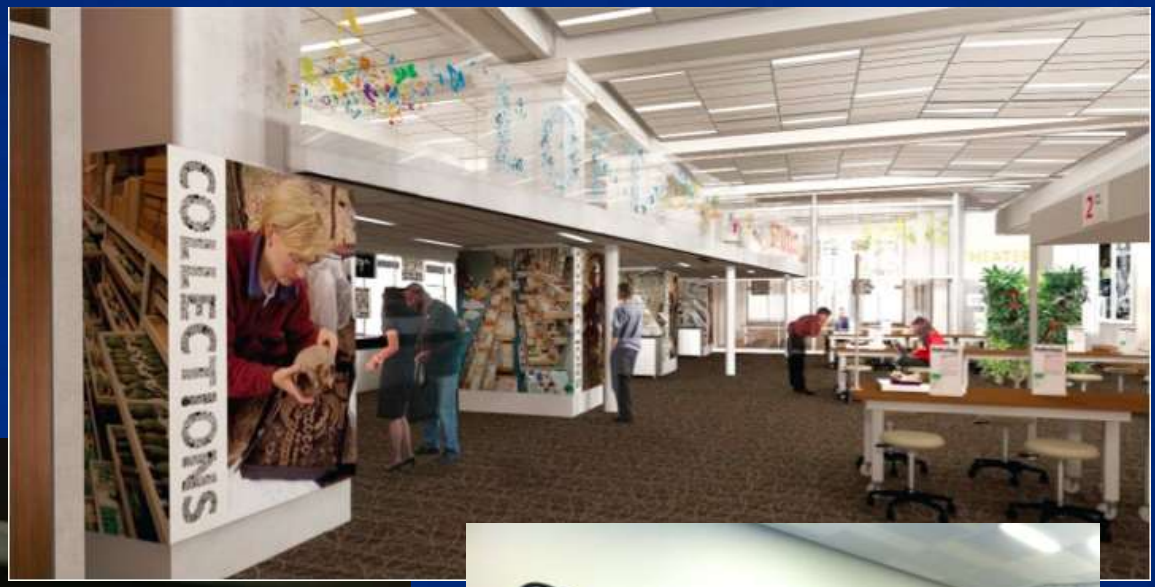
Craig Moyer and Bill Chadwick's project, Nov-Dec, 2014:



R/V *Revelle*

Smithsonian
National Museum of Natural History

Q?rius



NOAA
Science-on-a-Sphere
Education Center

Silver Spring

R/V Sikuliaq

Future RCRV(s)

R/V Neil Armstrong and R/V Sally Ride

THE
UNIVERSITY
OF RHODE ISLAND
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OF OCEANOGRAPHY

R/V Endeavor

JOIDES Resolution