
OCEAN EXPLORATION ADVISORY BOARD MEETING | OCTOBER 1-2, 2015
OCEAN EXPLORATION TRUST
NAUTILUS

RECOMMENDATIONS FOR A NATIONAL PROGRAM

2001 | President's Panel on Ocean Exploration

2003 | National Research Council Report

2004 | President's Commistion on Ocean Policy

2004 | Final Recommendations of the Interagency Ocean Policy Task Force

2012 | Decadal Review of the Ocean Exploration Program

2013 | Ocean Exploration 2020: A National Forum

A NATIONAL PROGRAM SHOULD INCLUDE:

- The identification of **clear priorities by the exploration community**
- The creation of an extensive and dynamic **network of partnerships**
- **Private sector investments in technology** that exceed public sector investments
- Communication tools capable of **engaging ocean explorers with the public**
- **Citizens that are engaged** actively in ocean exploration
- **Data** from expeditions that are **readily and rapidly available**

NOAA Ship

Okeanos Explorer

Exploration Vessel

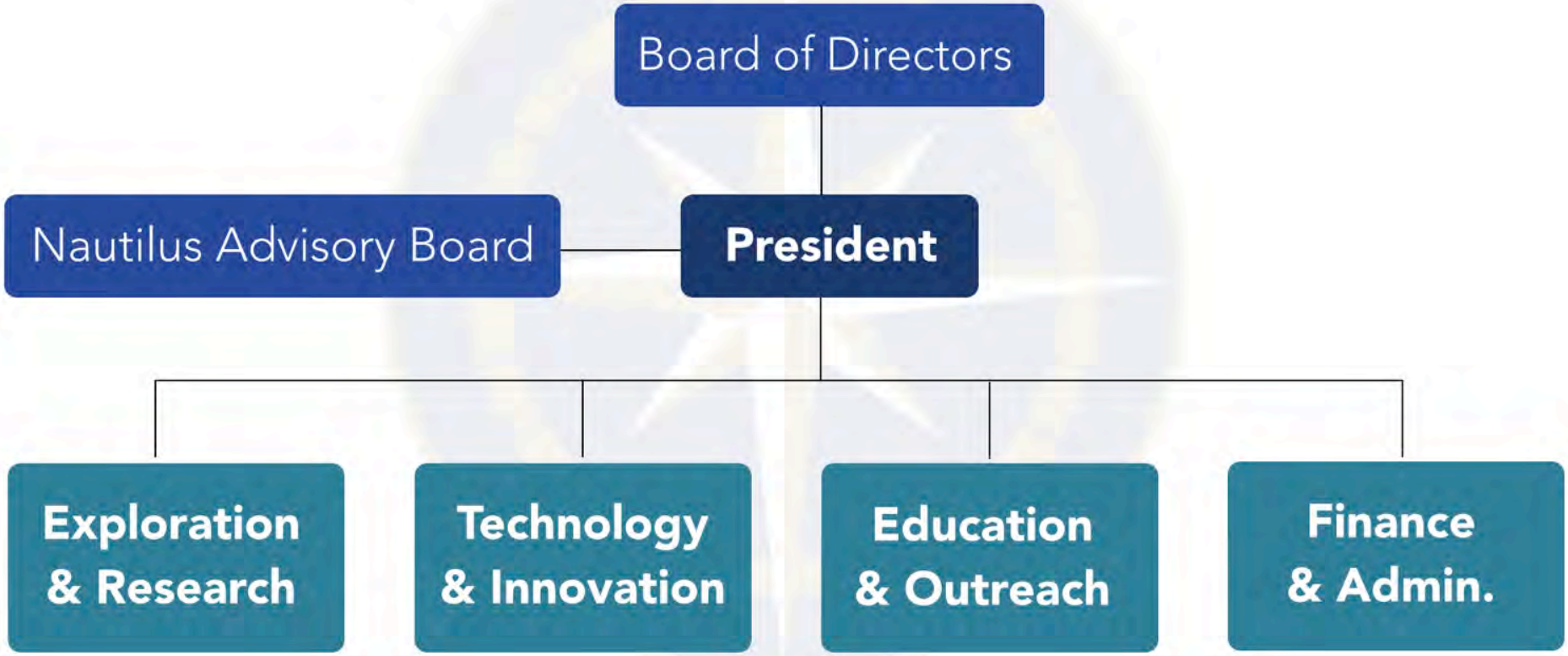
Nautilus

OCEAN EXPLORATION TRUST

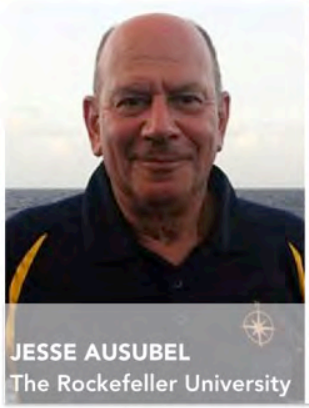
MISSION

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

OET'S ORGANIZATIONAL STRUCTURE

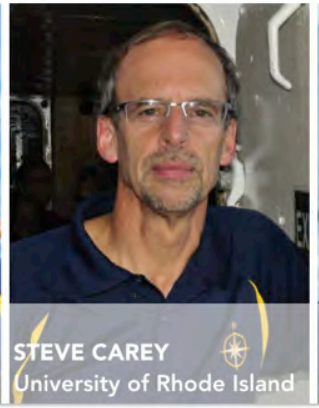


NAUTILUS ADVISORY BOARD



JESSE AUSUBEL
The Rockefeller University

RUTH BLAKE
Yale University



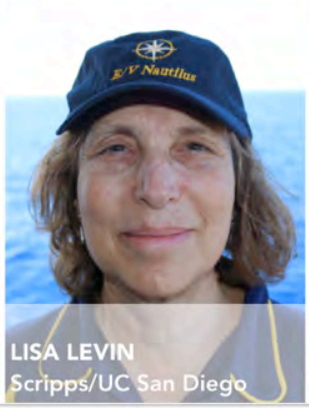
STEVE CAREY
University of Rhode Island

CHUCK FISHER
Penn State University

PETER GIRGUIS
Harvard University

STEVE HAMMOND
NOAA OER/PMEL

JEFF KARSON
Syracuse University



LISA LEVIN
Scripps/UC San Diego

LARRY MAYER
University of NH

MARY MILLER
Exploratorium

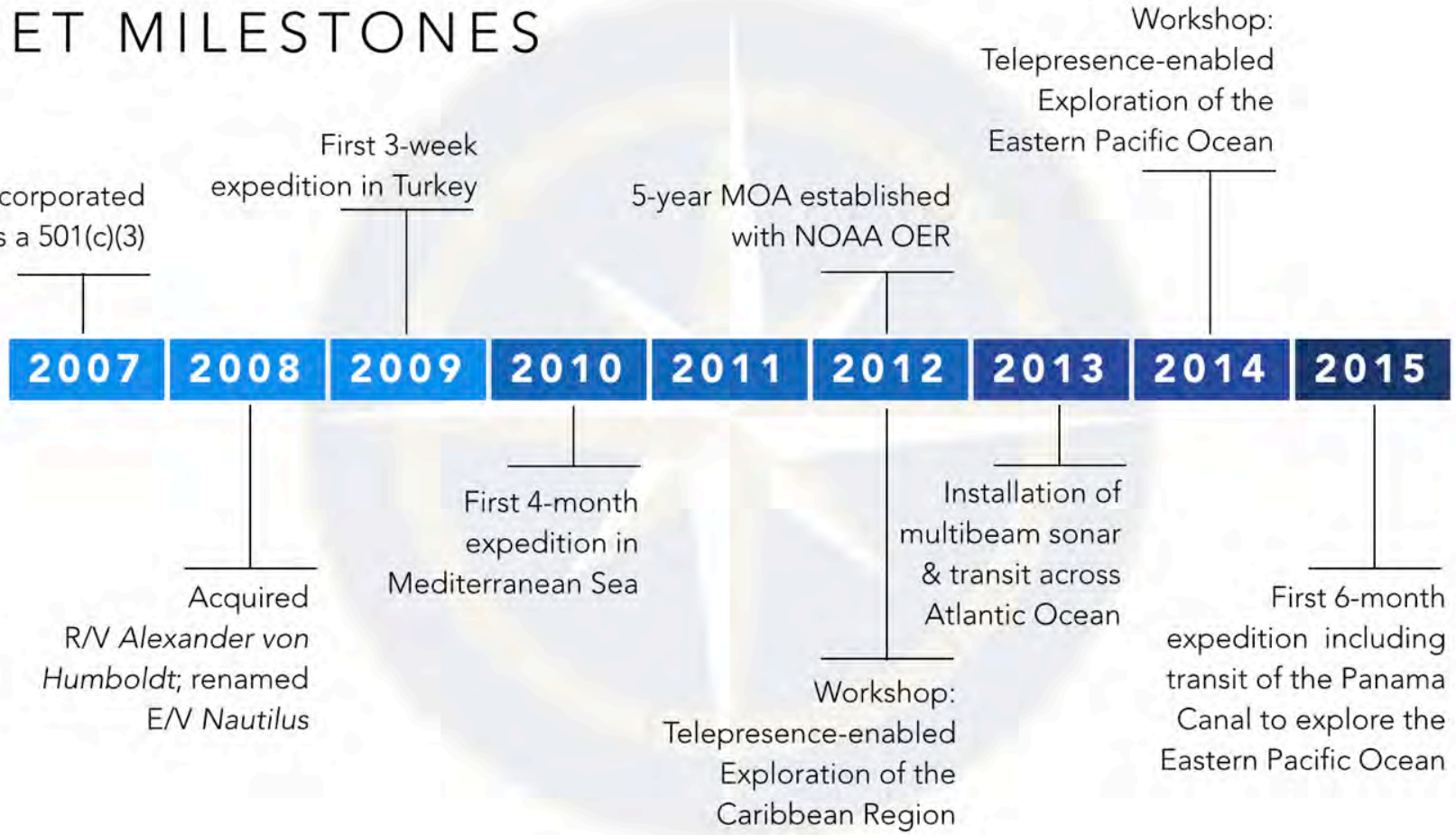
MIKE MOTTL
University of Hawaii

KERRY-ANN ROYES
YMCA of Broward County

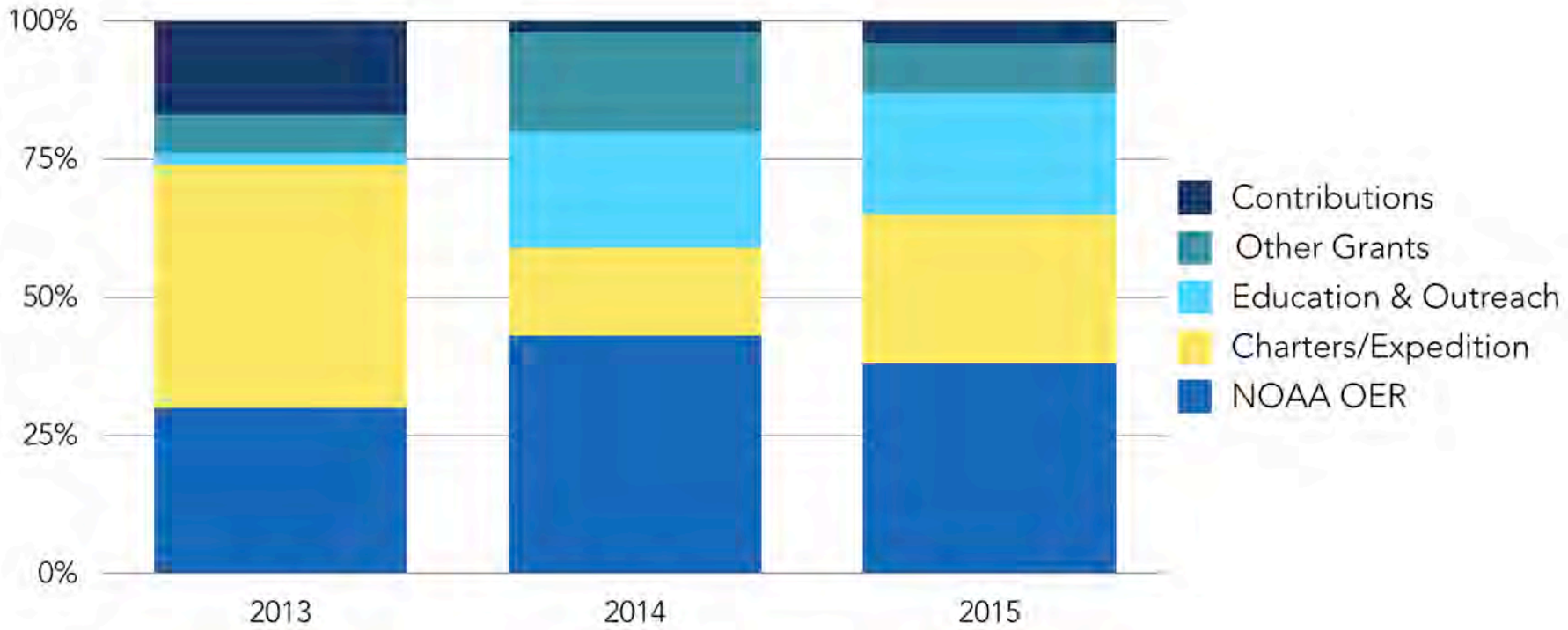
CORPS OF EXPLORATION

798 since 2009

OET MILESTONES



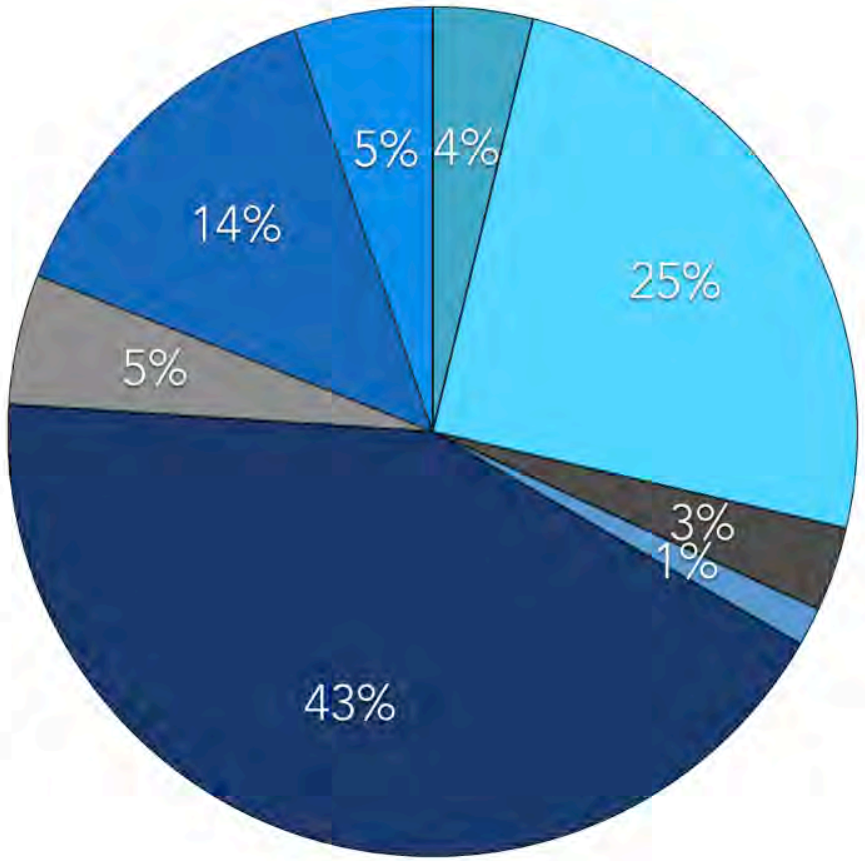
SOURCES OF REVENUE



OET PARTNERSHIPS

- Museum/Aquarium
- K-12 School
- Out-of-School Program
- Media
- Academic
- Industry
- Government
- NGO

Since 2009, **342** organizations have been represented in OET programs, both aboard *Nautilus* and ashore.



NAUTILUS EXPLORATION PROGRAM

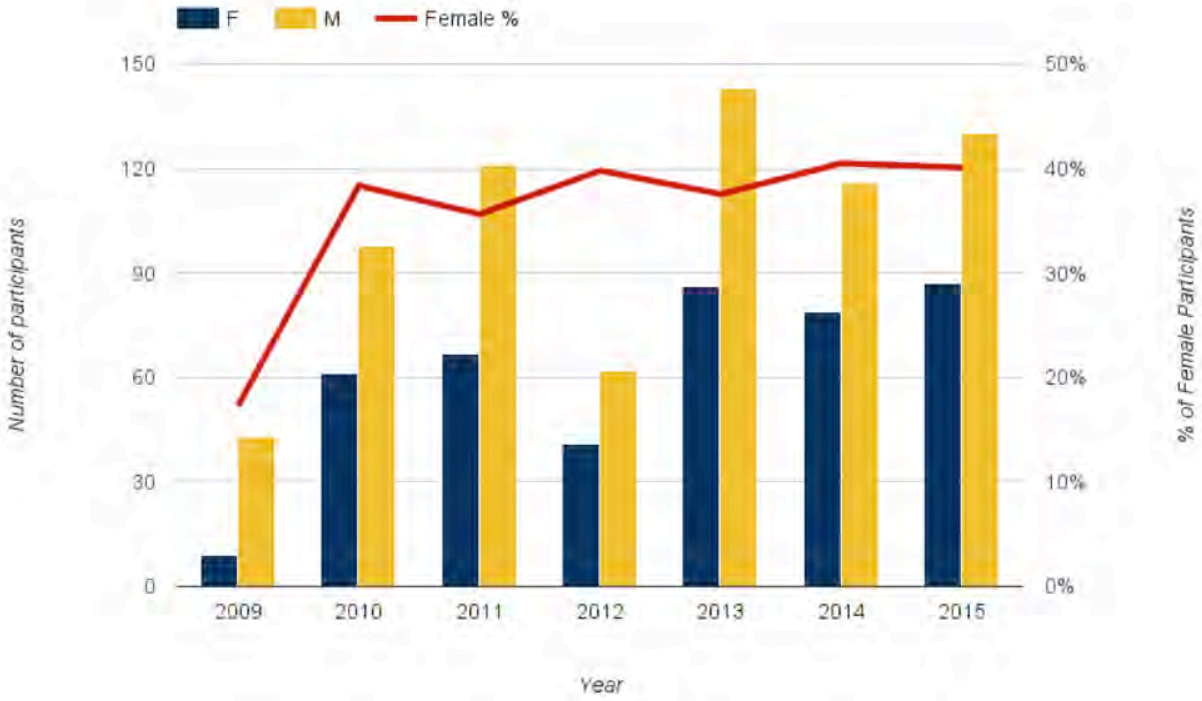
Since 2009, **798** people

from **40** U.S. states…

…and **46** countries have sailed aboard *Nautilus*.

NAUTILUS EXPLORATION PROGRAM

The number of female participants has increased from 17% in 2010 to 40% in 2015.



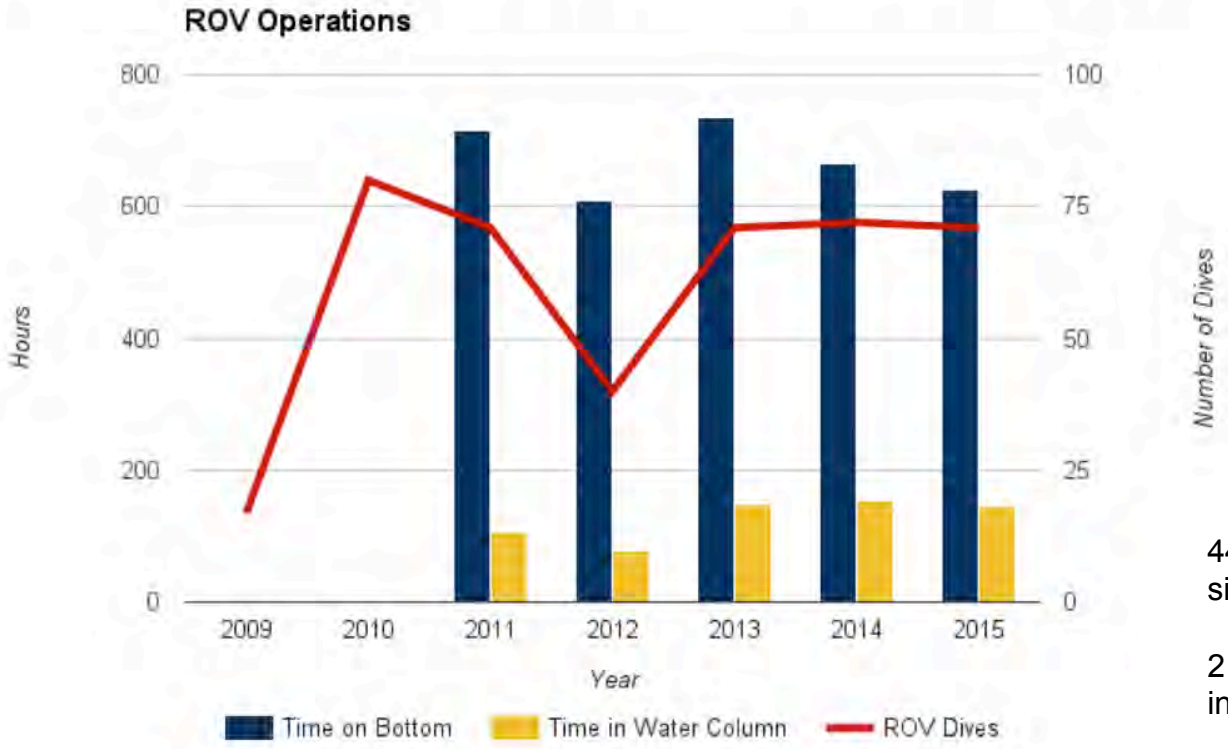
NAUTILUS EXPLORATION PROGRAM

Nautilus has explored in the waters of **24** countries

Bahamas, Belize, British Virgin Islands, Canada, Cayman Islands, Cyprus, Dominica, Ecuador, France, Greece, Grenada, Haiti, Israel, Italy, Jamaica, Montserrat, Portugal, Puerto Rico, Spain, Syria, Trinidad & Tobago, Turkey, Ukraine

NAUTILUS EXPLORATION PROGRAM

While exploring those waters, ~80% of our ROV time has been spent on the seafloor

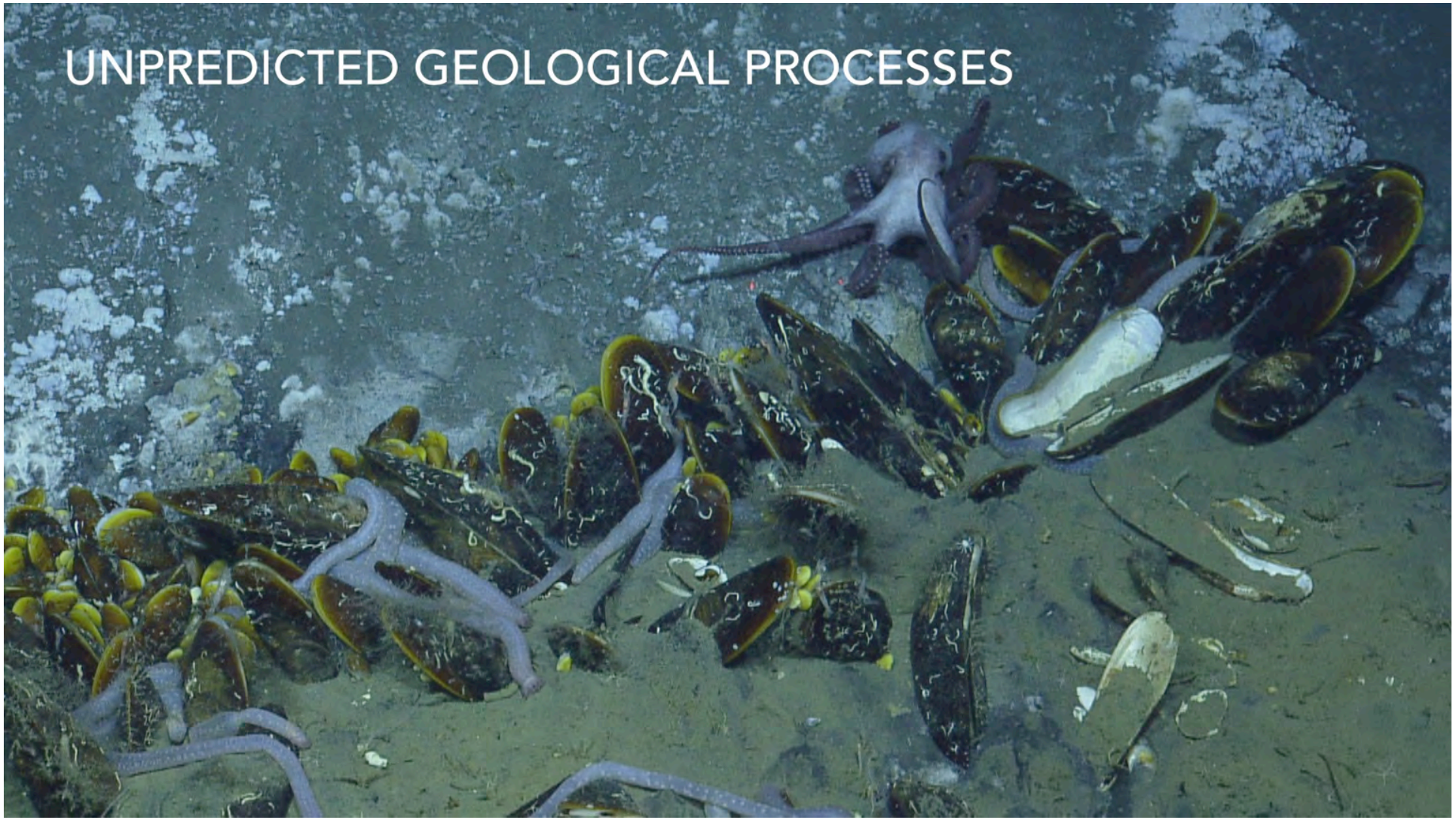


449 ROV Hercules since 2009

217 days = total time in water

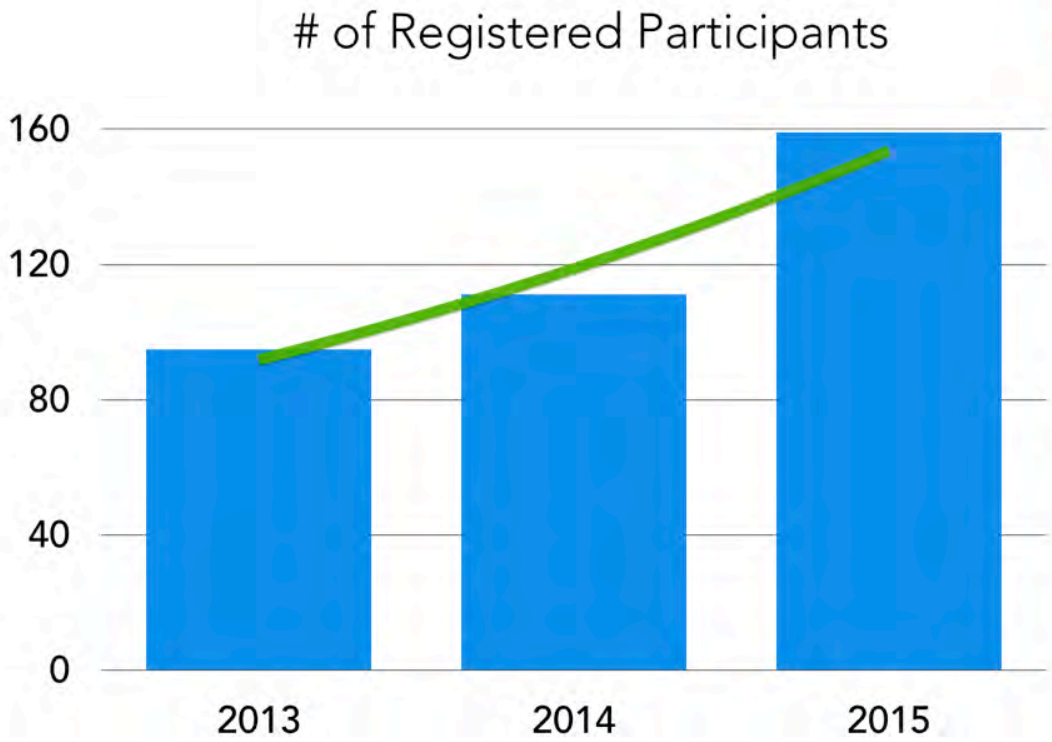
SCIENTIFIC & PROGRAM HIGHLIGHTS

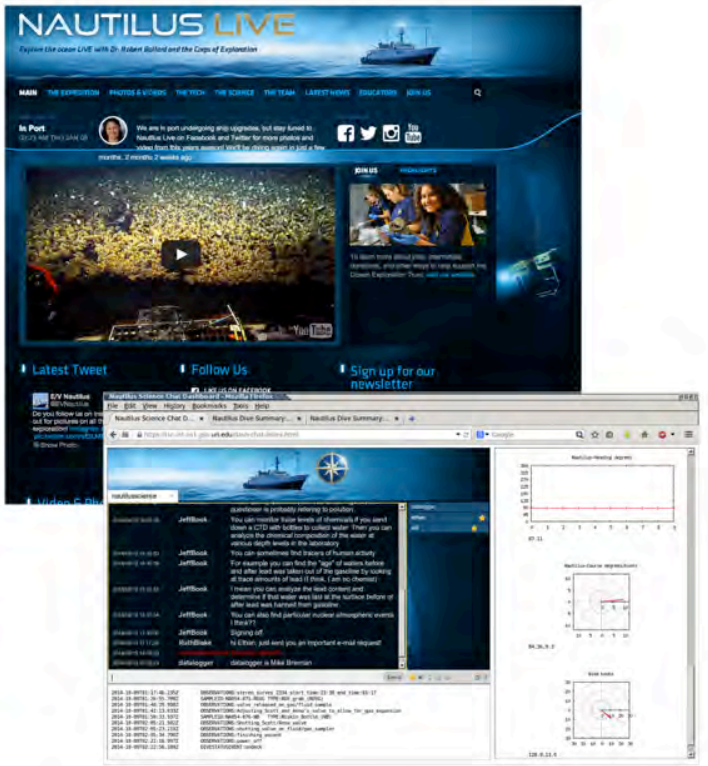

45 SHIPWRECKS FROM ANCIENT GREEK TO MODERN


UNPREDICTED GEOLOGICAL PROCESSES

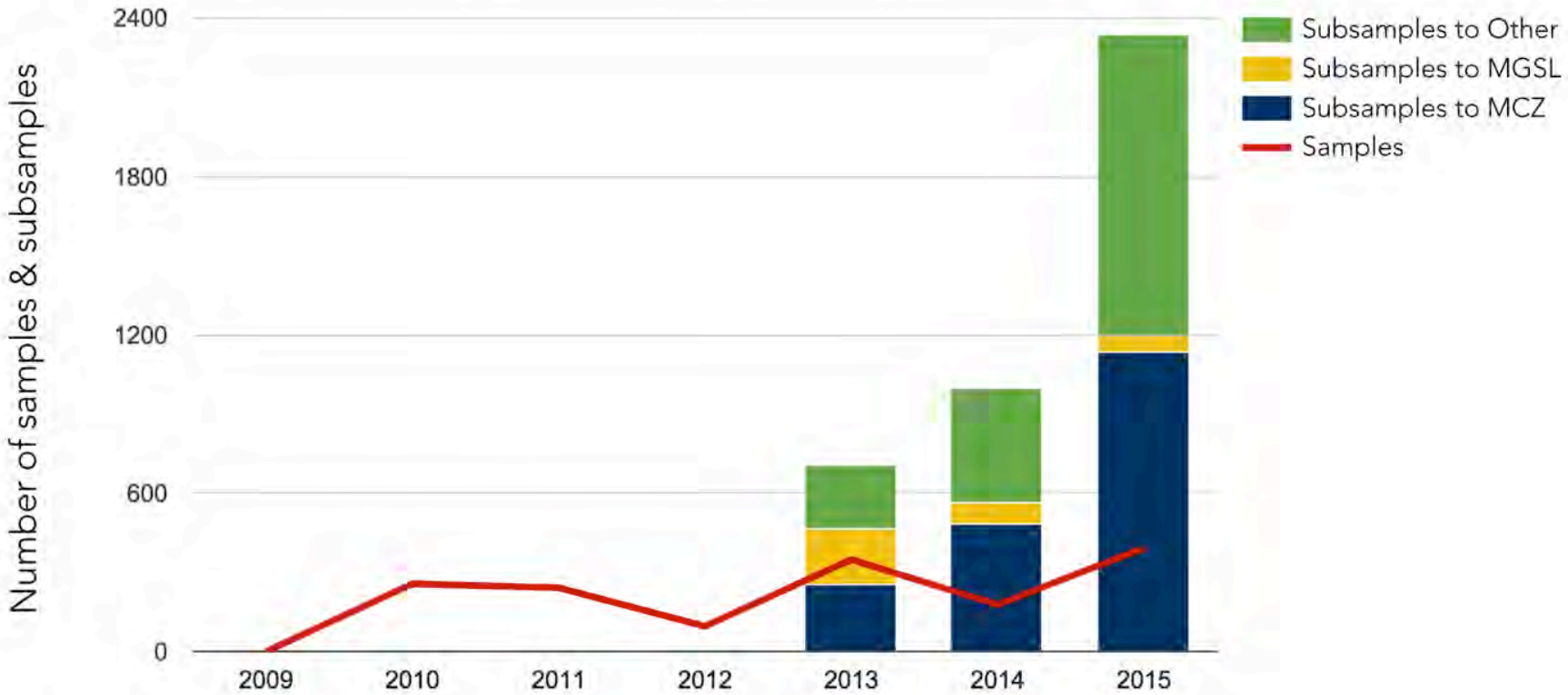

3 NEW SPECIES OF SPONGE, WORM, & FISH
Chondrocladia robertballardi

SCIENTISTS ASHORE PROGRAM



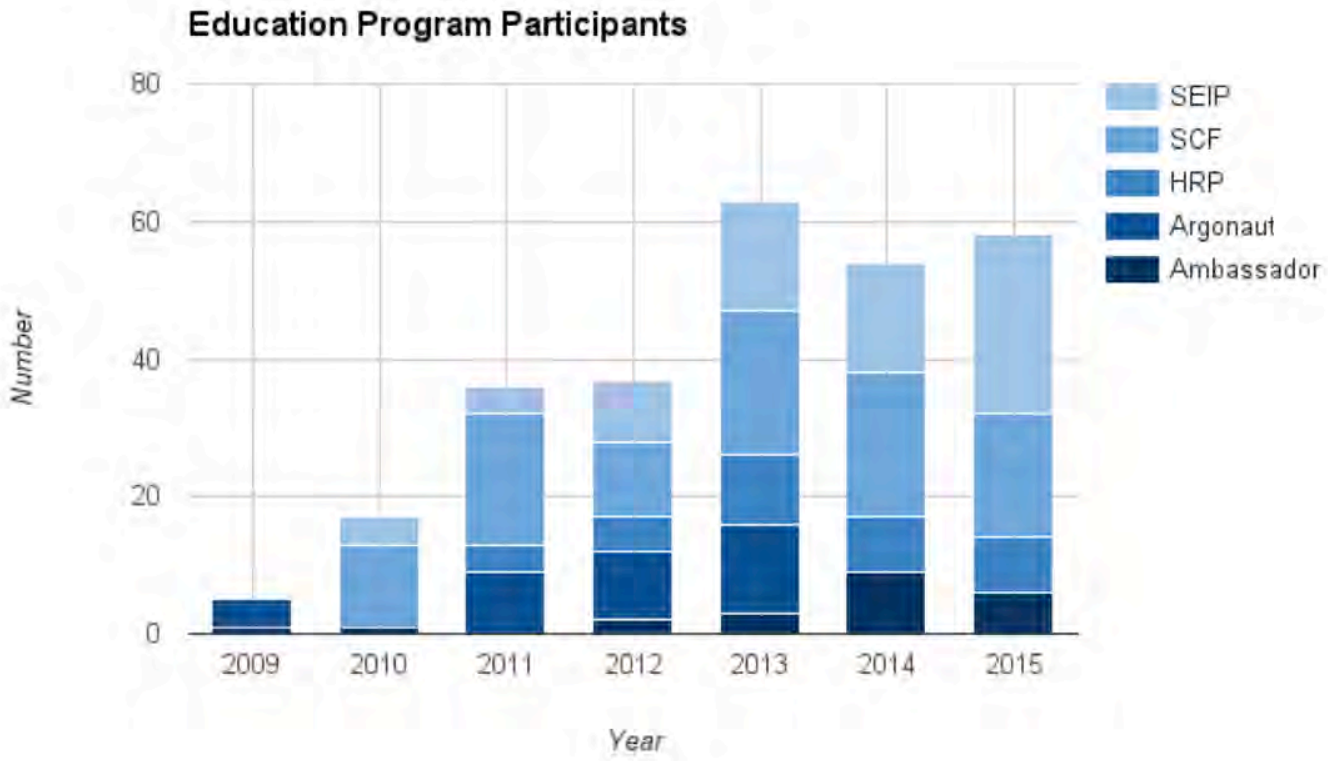


2,225 SAMPLES ARE ARCHIVED AT PARTNER REPOSITORIES



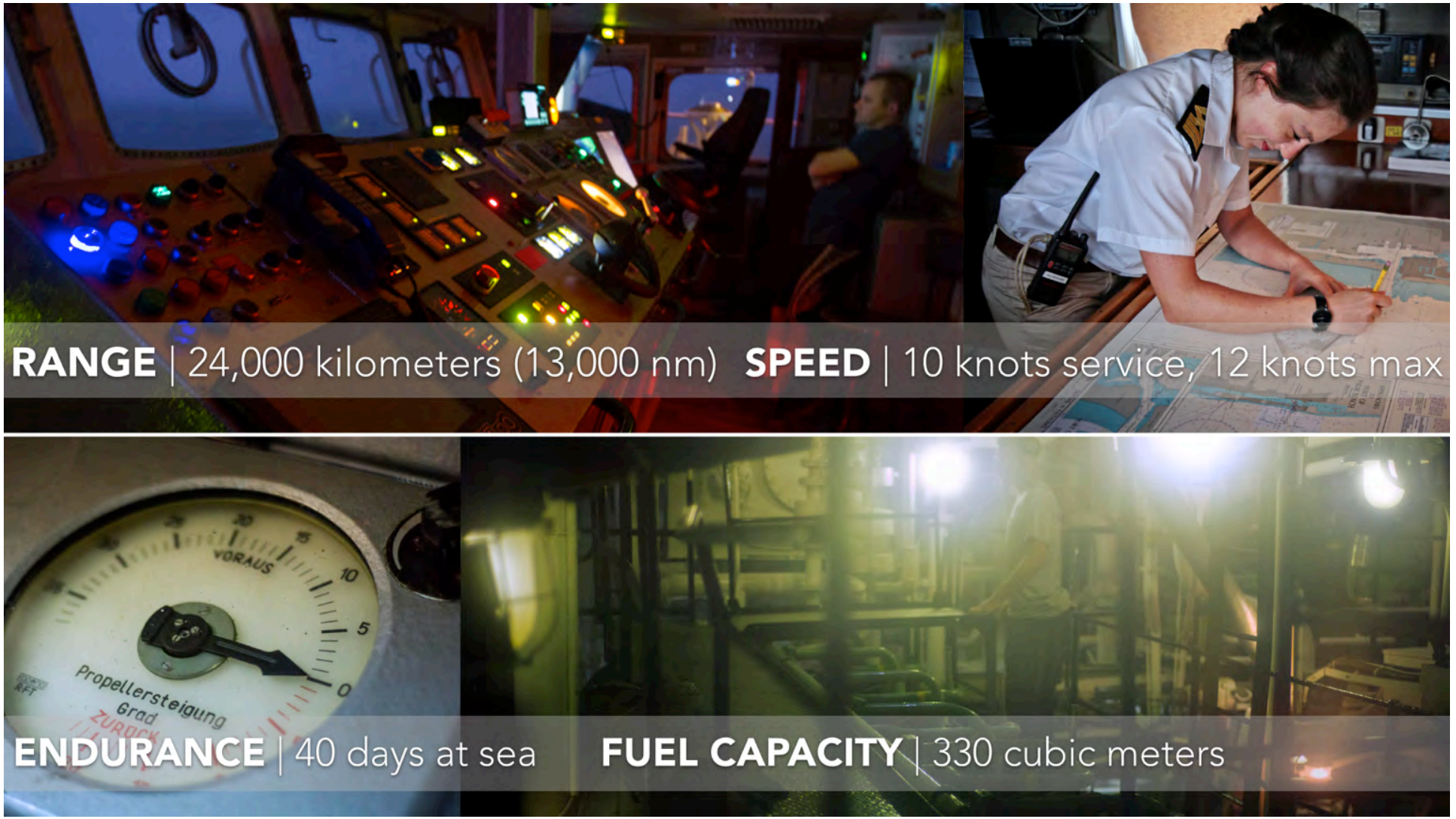

Life Onboard *Nautilus*
• Anaximander Underwater Mountain Range
• Three four-hour watches while running ops
• Completely full ship
• Language
100+ SCIENTIFIC PUBLICATIONS, PRESENTATIONS & THESES

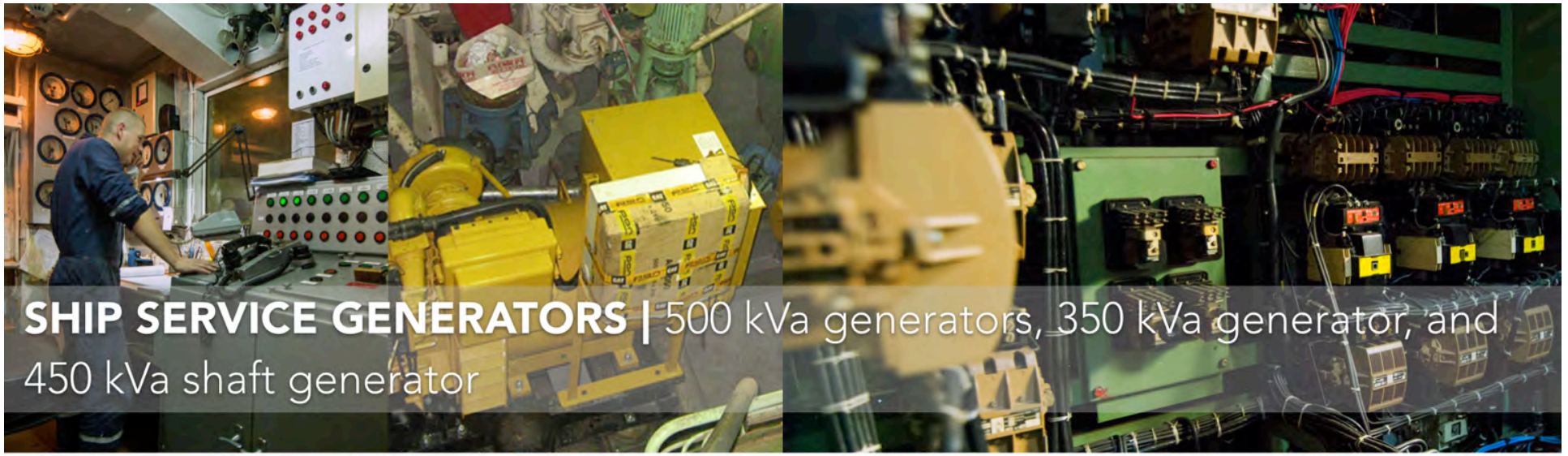
AT SEA PROGRAMS FOR STUDENTS & EDUCATORS



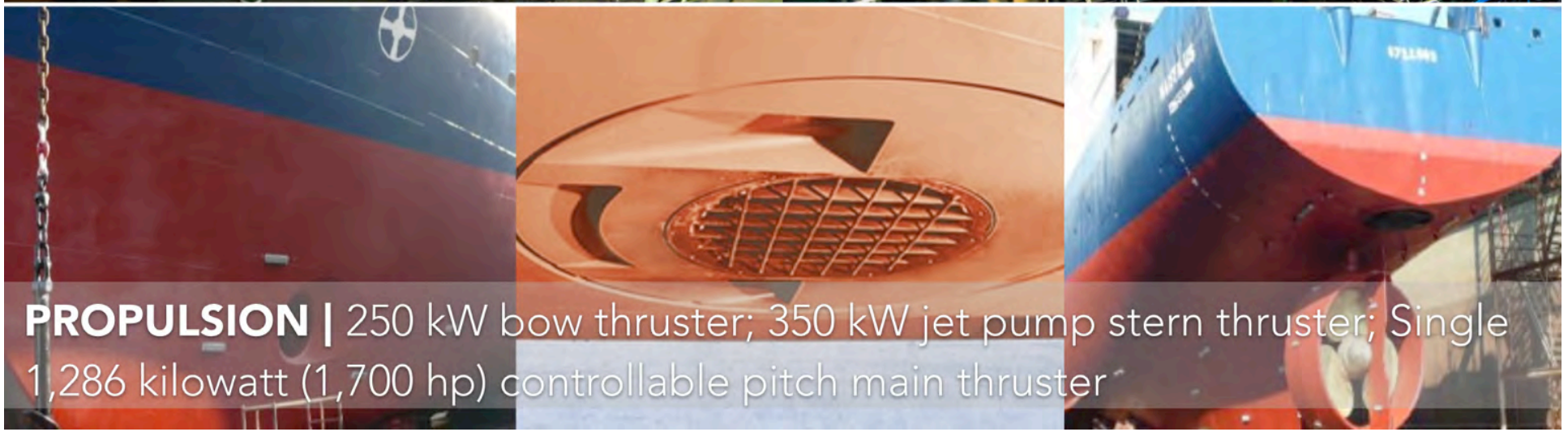
E/V Nautilus | 64 meters

COMPLEMENT | 17 crew; 31 science & operations


RANGE | 24,000 kilometers (13,000 nm)
SPEED | 10 knots service, 12 knots max
VORAUS
Propellersteigung
Grad
ENDURANCE | 40 days at sea
FUEL CAPACITY | 330 cubic meters



SHIP SERVICE GENERATORS | 500 kVa generators, 350 kVa generator, and 450 kVa shaft generator



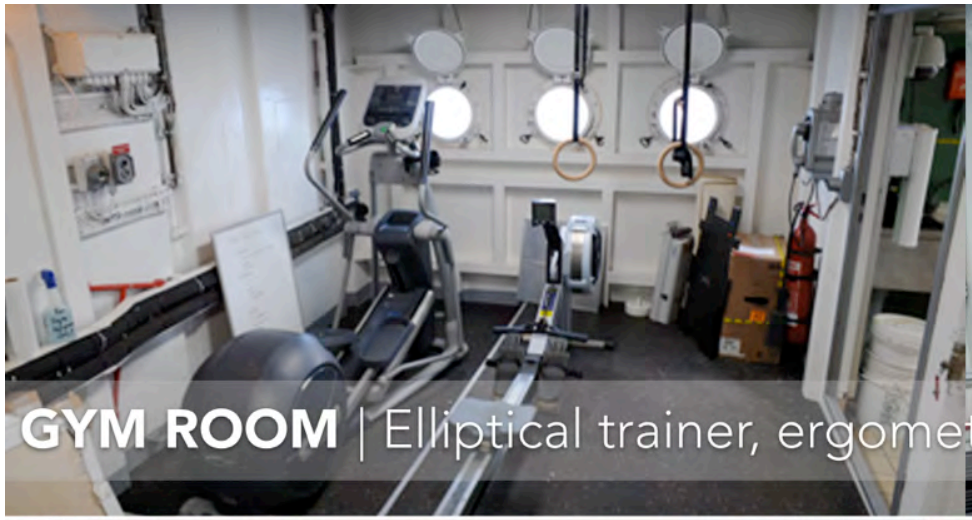
PROPULSION | 250 kW bow thruster; 350 kW jet pump stern thruster; Single 1,286 kilowatt (1,700 hp) controllable pitch main thruster

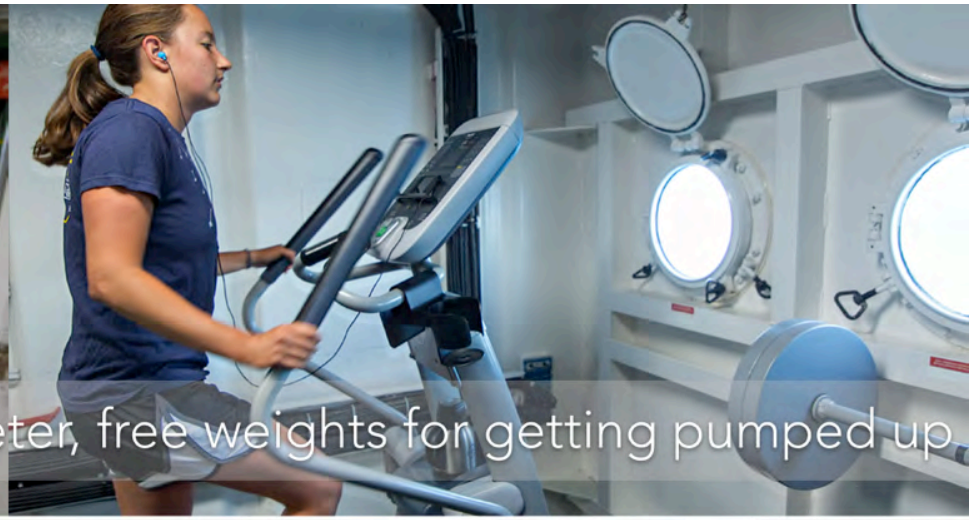
GALLEY | Two cooks and one steward feed 48 people 3 meals per day

MESS | Seating for 32 people, 3 meals per day, with 24-hour snack bar

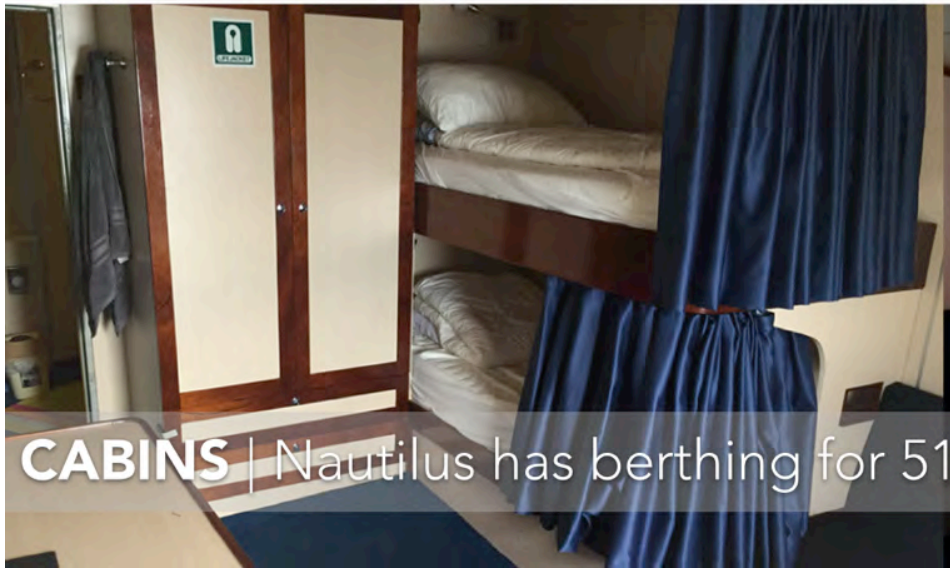
LOUNGE | Comfortable seating, monitors for ROV dive, or presentations; intercom for communications with other spaces on ship and shore; telephone

SOCIAL DECK | Social area for meals and leisure time, equipped with wifi.





GYM ROOM | Elliptical trainer, ergometer, free weights for getting pumped up.



CABINS | Nautilus has berthing for 51, but lifeboat capacity is limited to 48.

DECK EQUIPMENT

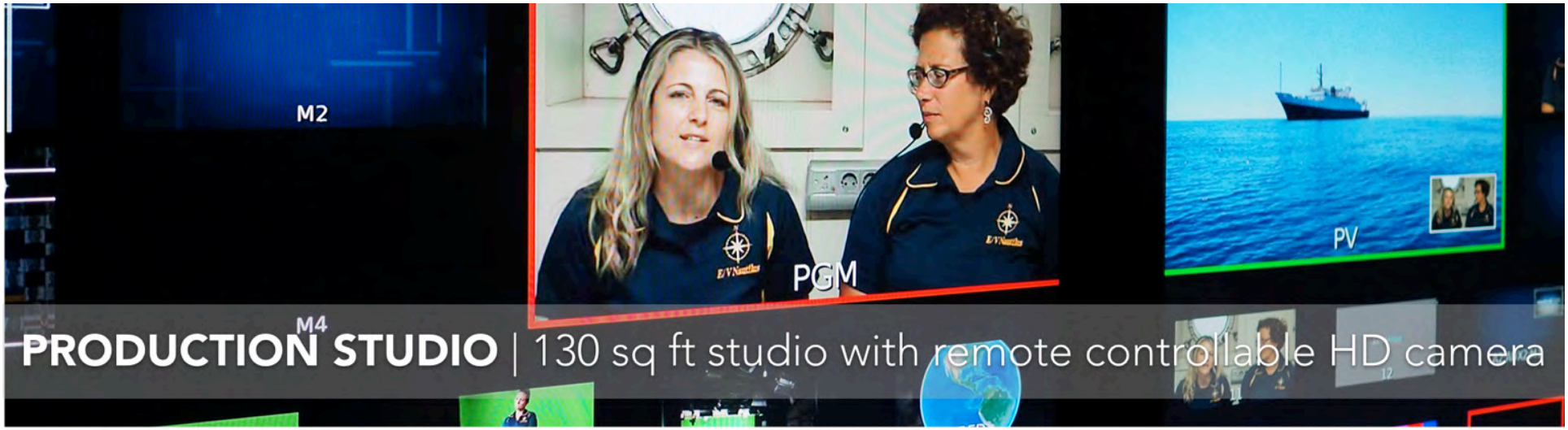
ROV HANGAR | 258.3 sq ft ROV Hangar with 110/60 Hz and 220/50 Hz power

WORKSHOP | Complete set of hand tools, cordless tools, electrical and fiber optic test equipment, mill-drill combination machine, as well as storage for spares and other equipment

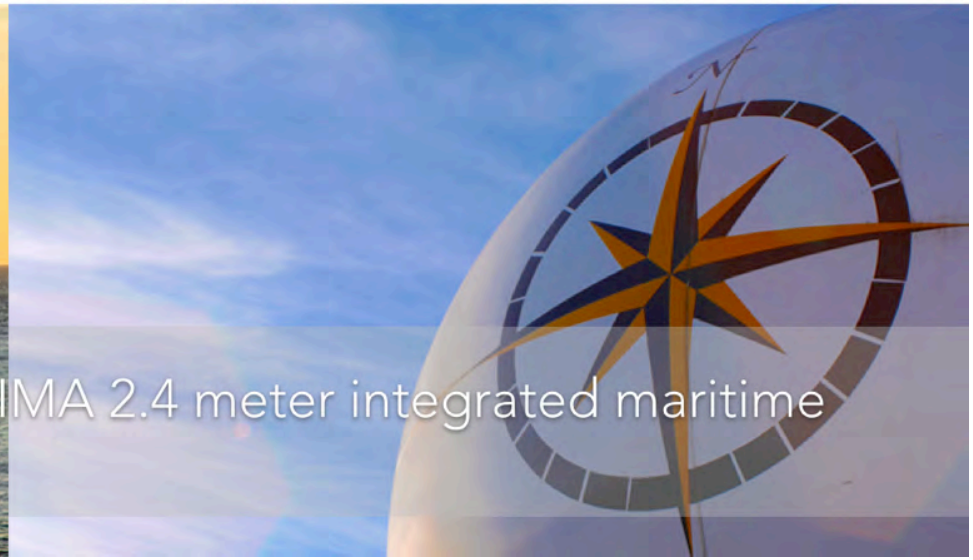
COMMAND CENTER | 301.4 sq ft Command Center with nine workstations

WET LAB | -80°C freezer, scientific freezer/fridge, misc scientific equipment


DATA PROCESSING & VISUALIZATION LAB | 480 sq ft lab with 7 workstations
Quartz Composer
RACK ROOM | 185 square feet; Two Omneon Mediadecks



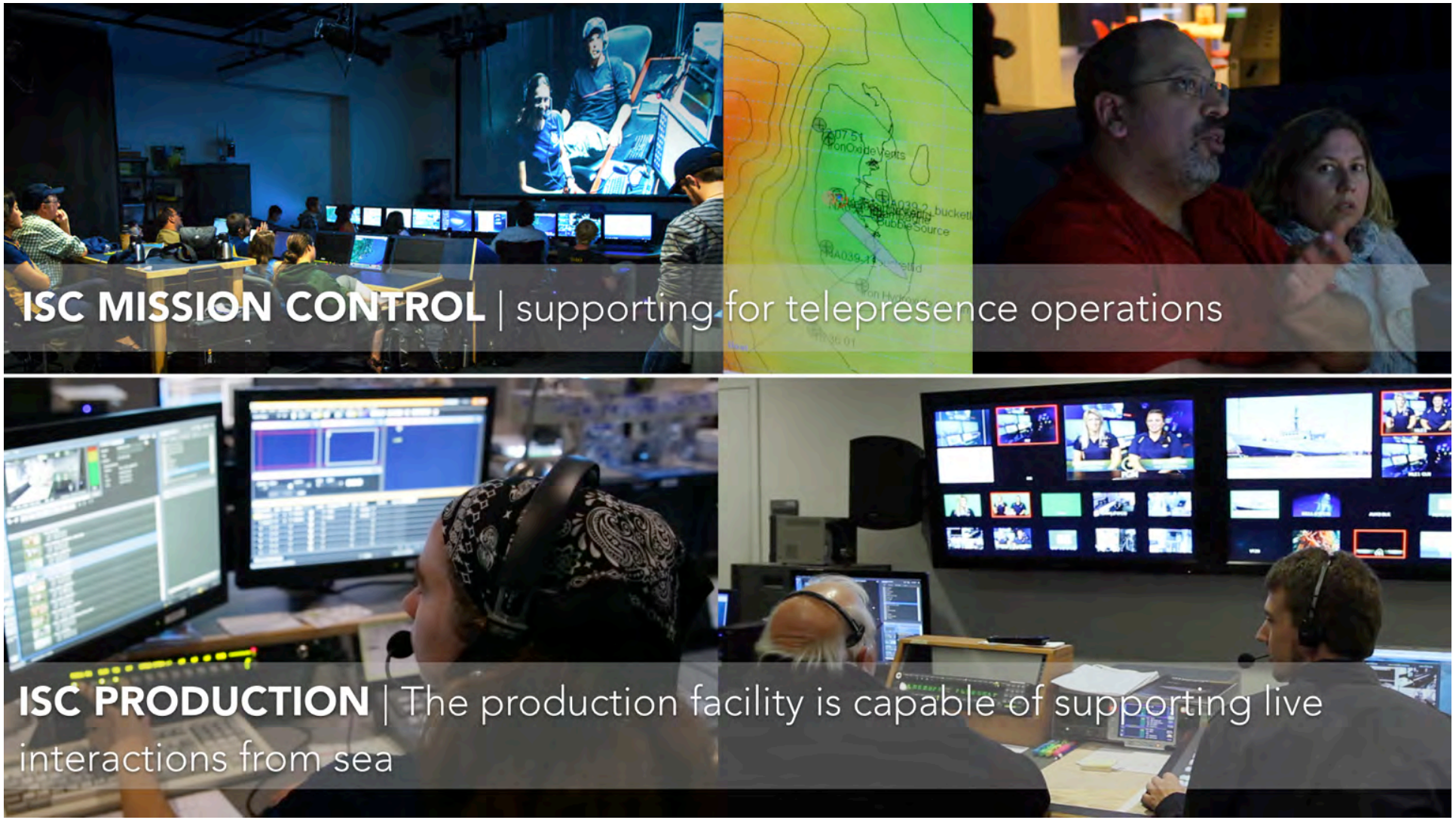
PRODUCTION STUDIO | 130 sq ft studio with remote controllable HD camera

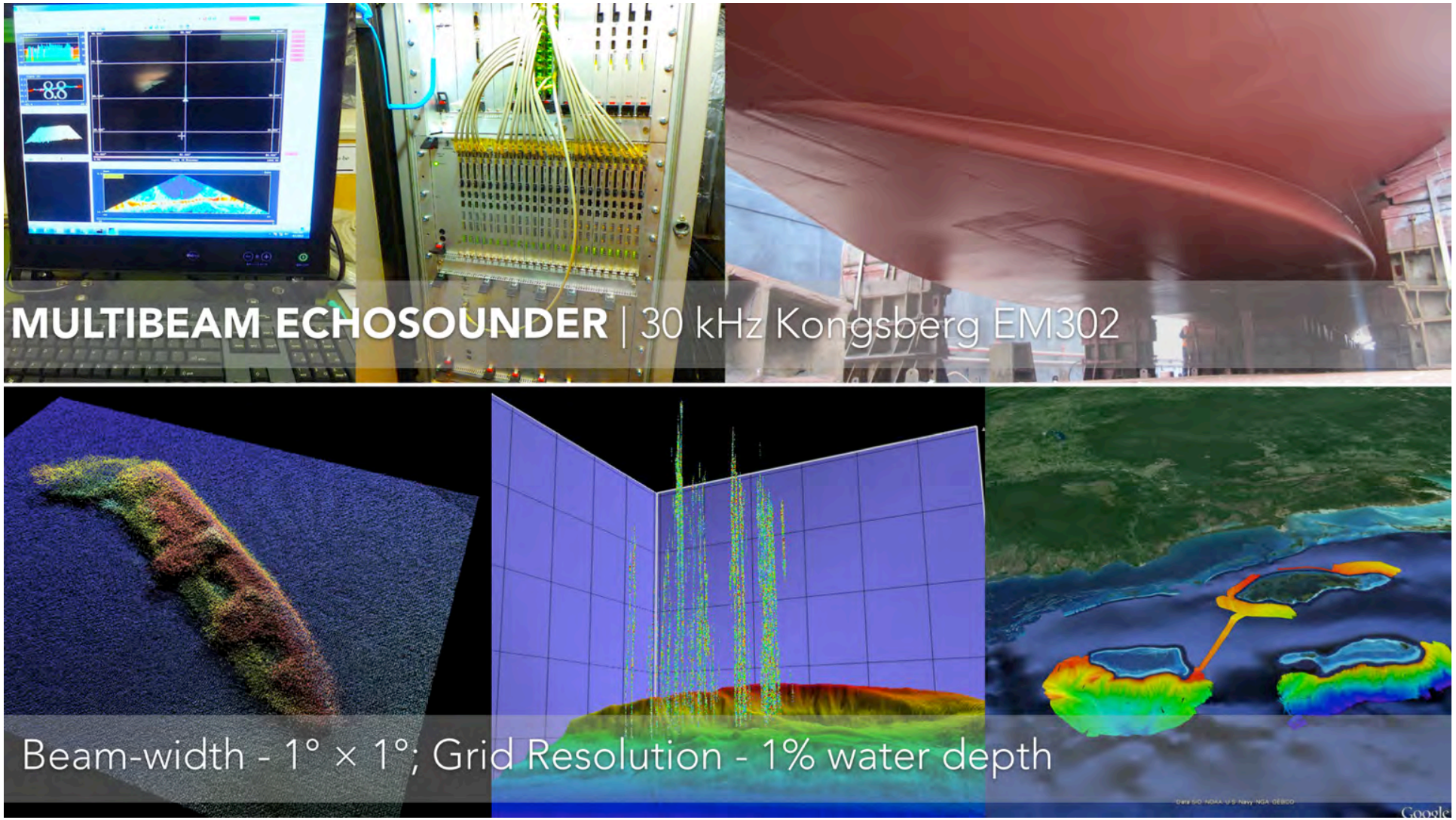


SATELLITE ANTENNA | Sea Tek 9711 IMA 2.4 meter integrated maritime tracking antenna

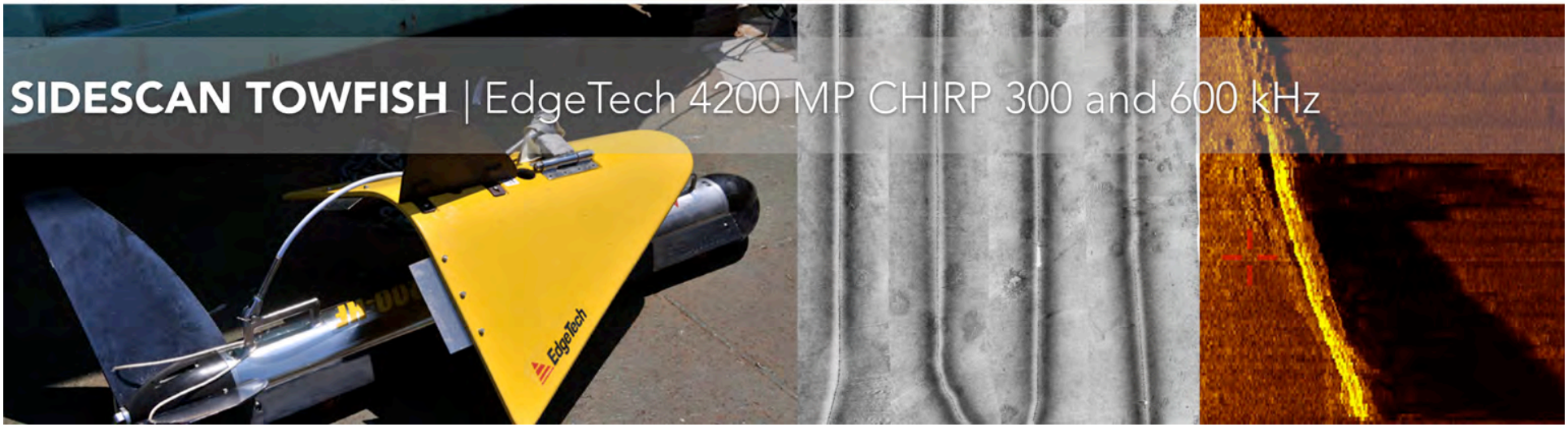
TOPSIDE VIDEO CAMERAS | HD cameras in Command Center, Fantail, ROV Hangar, & Wet Lab

INTERCOM | Ship-wide RTS Telex intercom system with integrated handheld UHF radios for communications


ISC MISSION CONTROL | supporting for telepresence operations
ISC PRODUCTION | The production facility is capable of supporting live interactions from sea

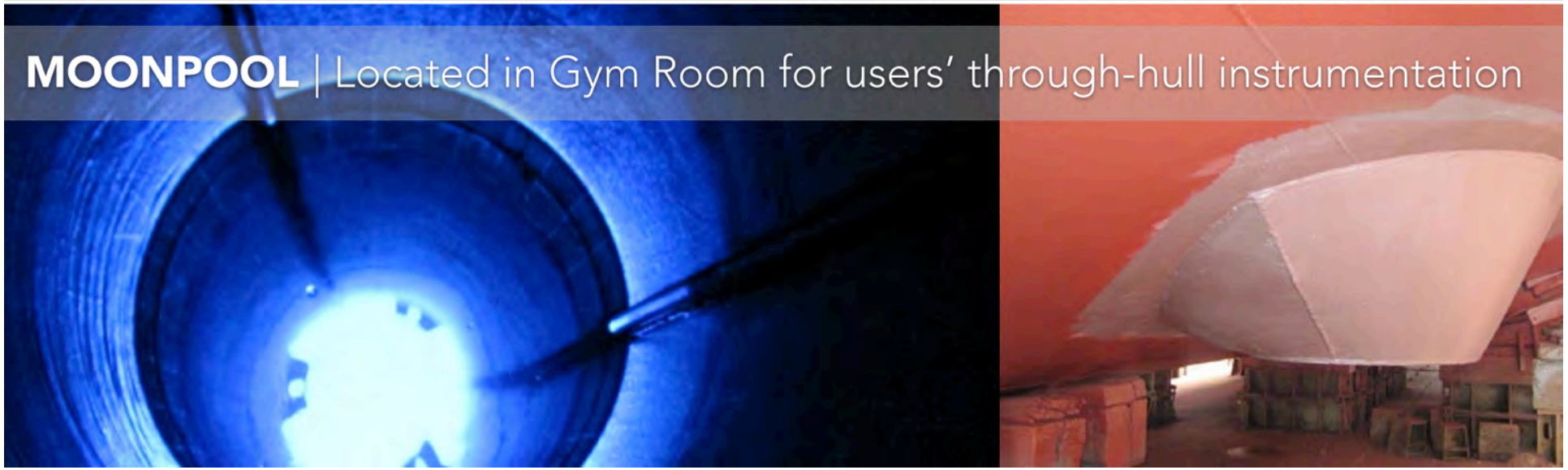

MULTIBEAM ECHOSOUNDER | 30 kHz Kongsberg EM302
Beam-width - 1° × 1°; Grid Resolution - 1% water depth
Google

SUB-BOTTOM PROFILER & ECHOSOUNDER | Knudsen 3260

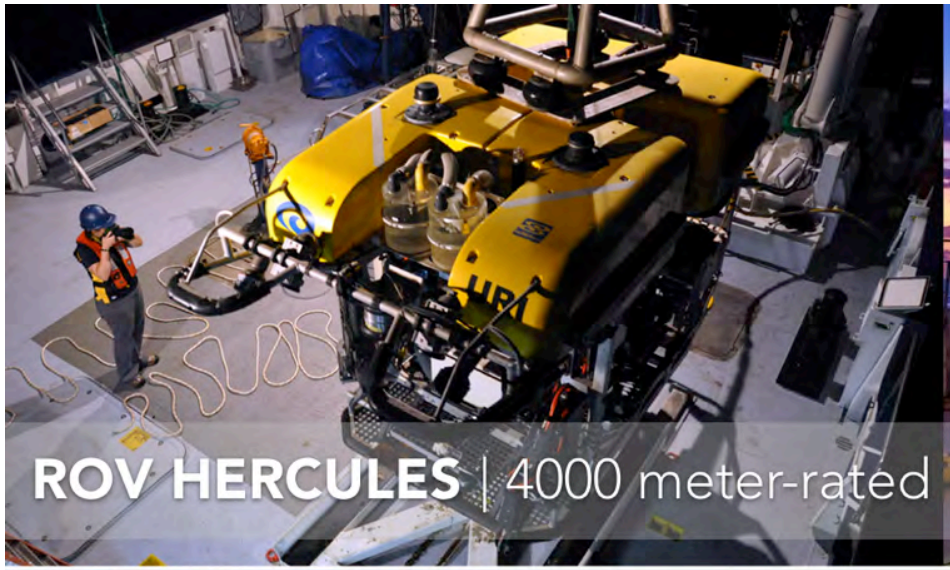


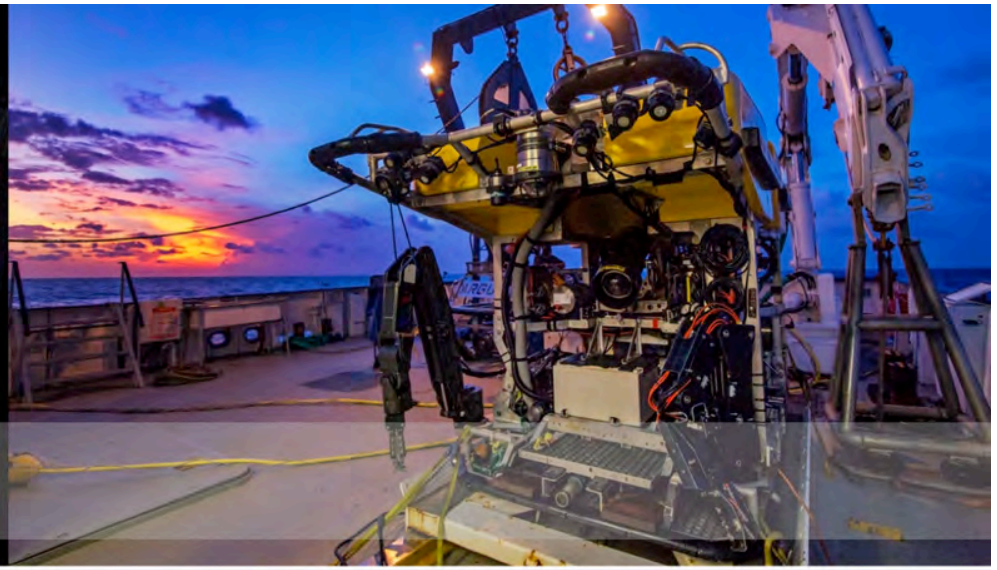
SIDESCAN TOWFISH | EdgeTech 4200 MP CHIRP 300 and 600 kHz

ULTRA SHORT BASELINE ROV NAVIGATION | TrackLink 5000MA system

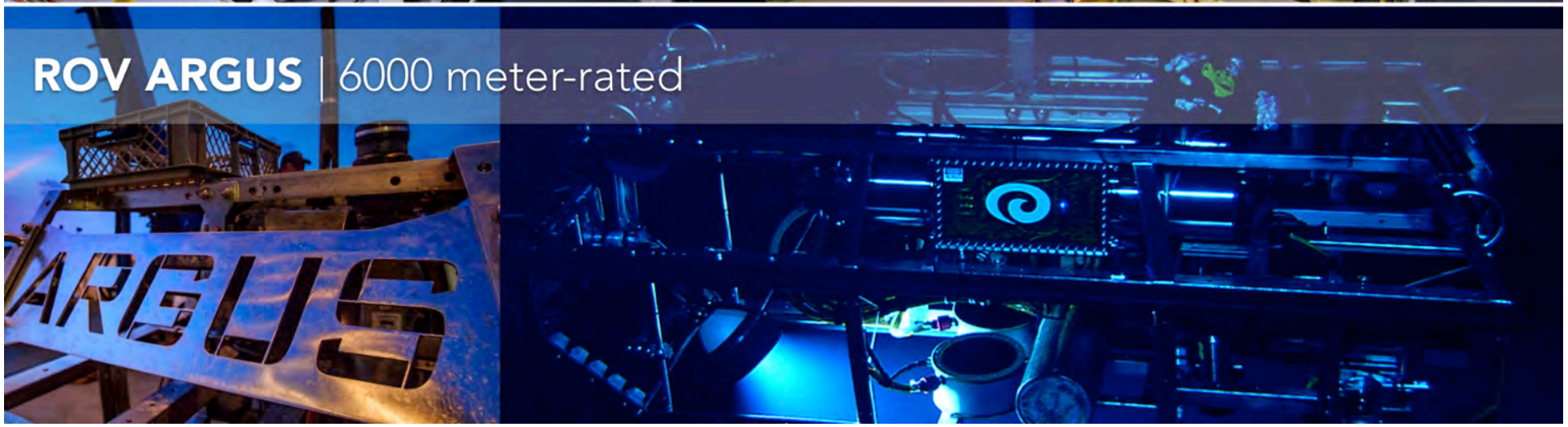


MOONPOOL | Located in Gym Room for users' through-hull instrumentation

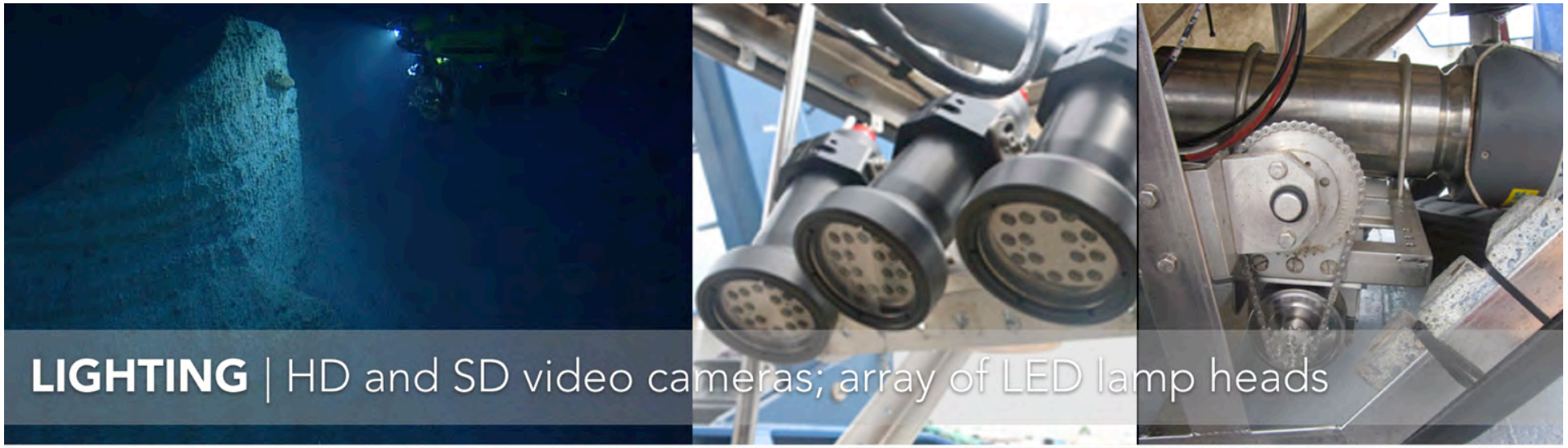


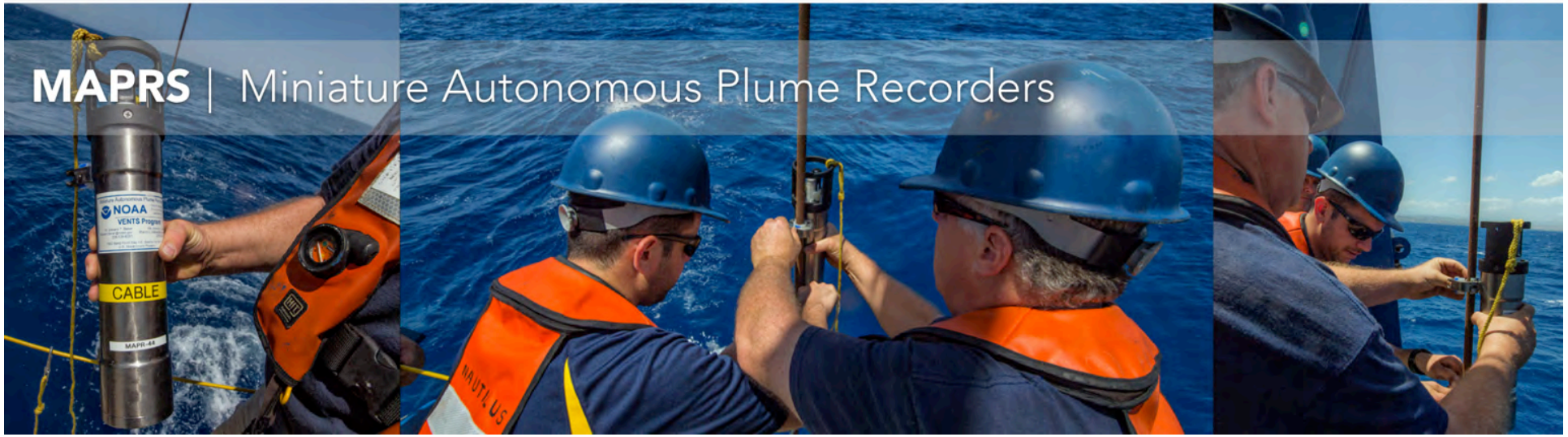


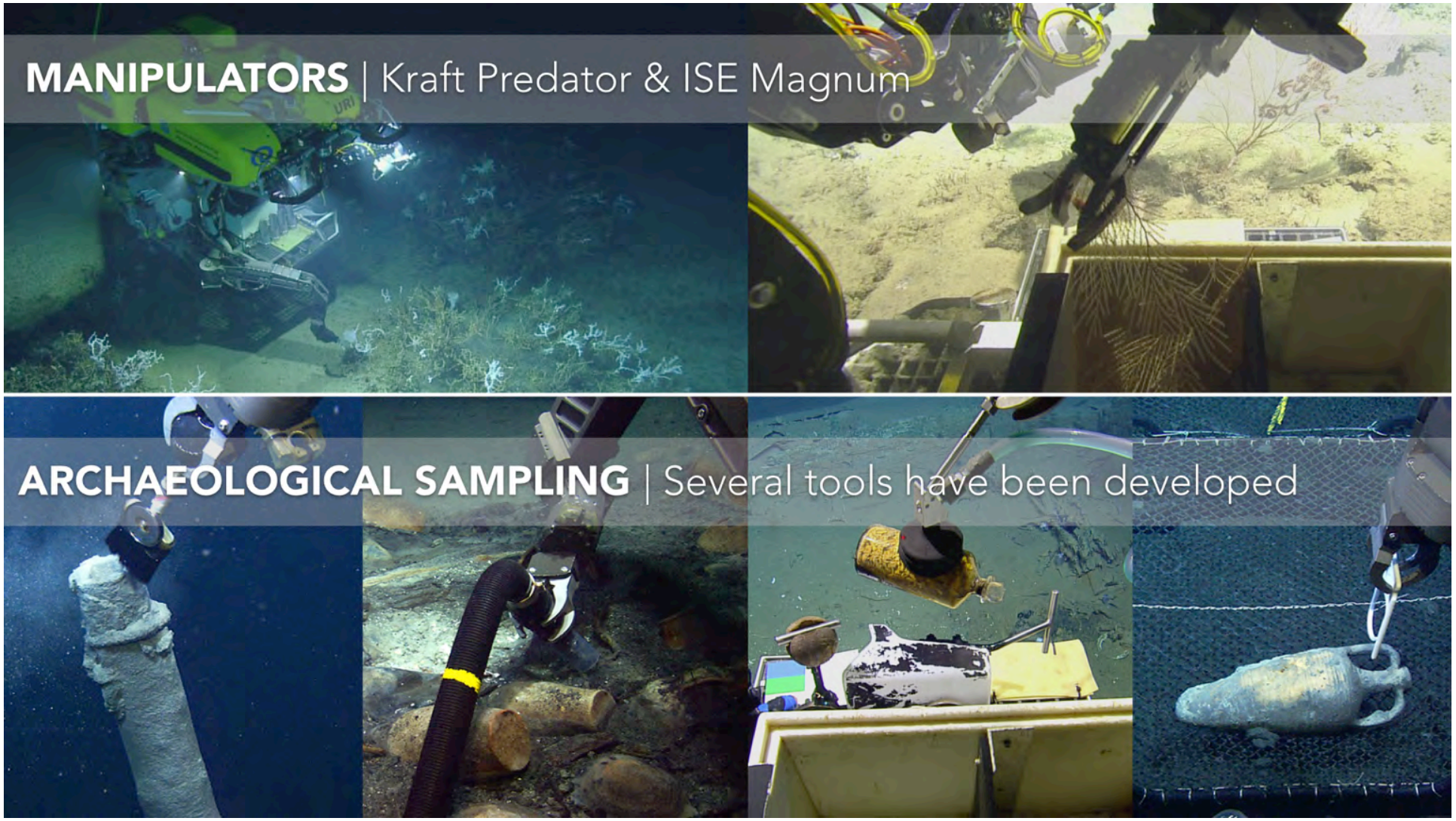
ROV HERCULES | 4000 meter-rated

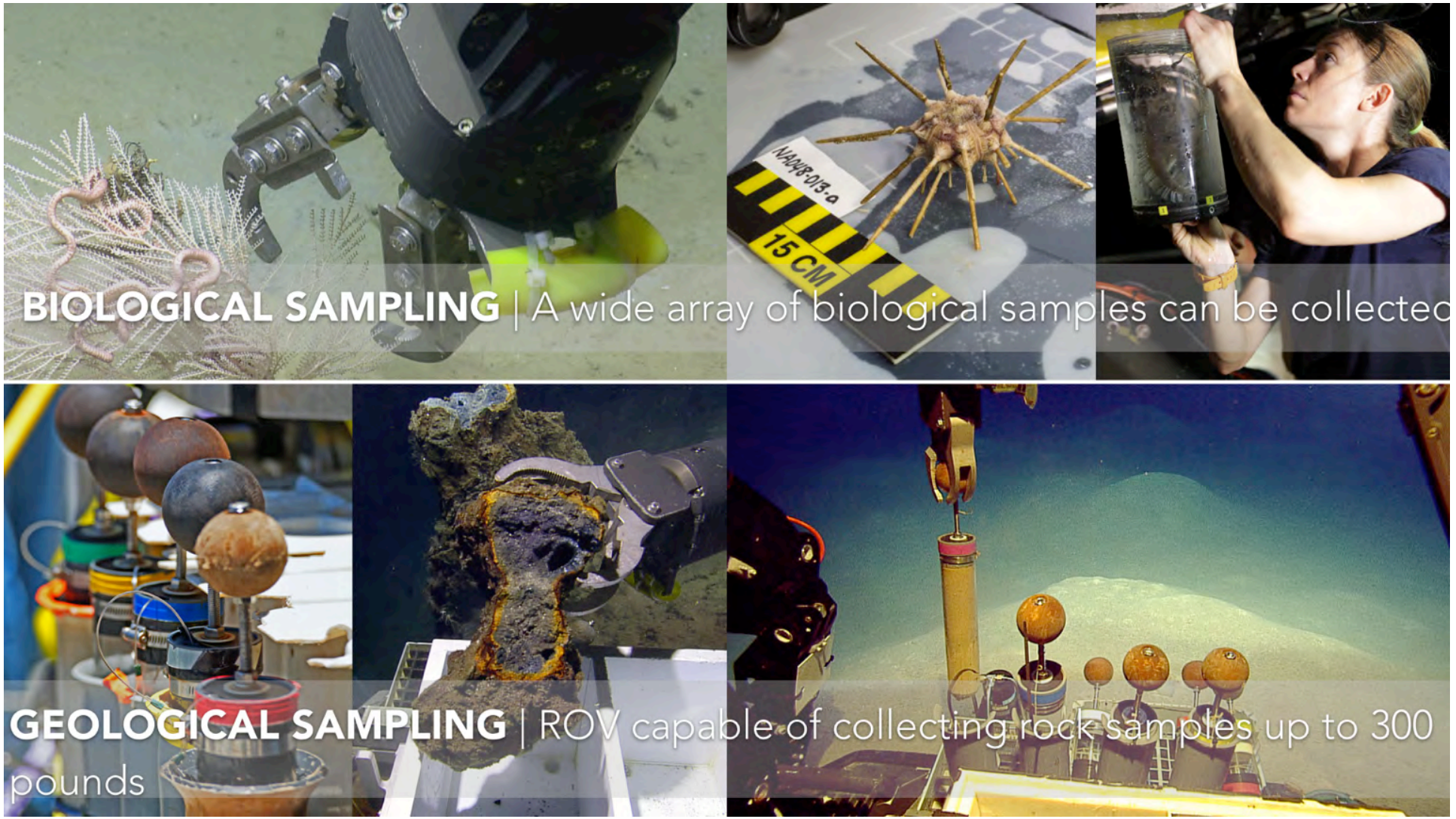


ROV ARGUS | 6000 meter-rated

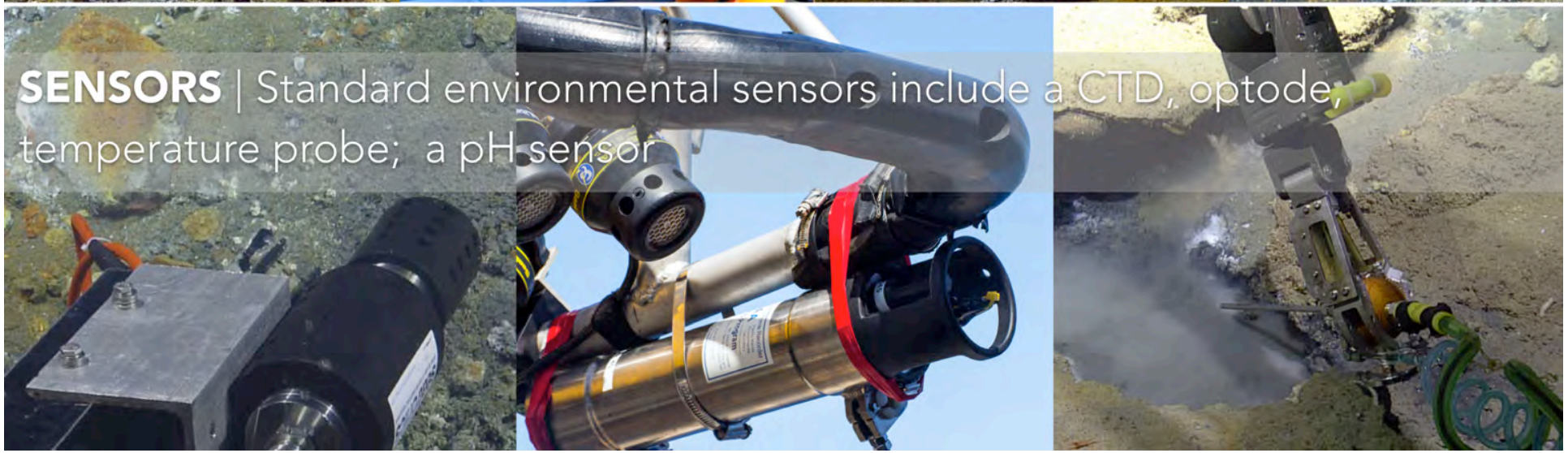

LIGHTING | HD and SD video cameras; array of LED lamp heads

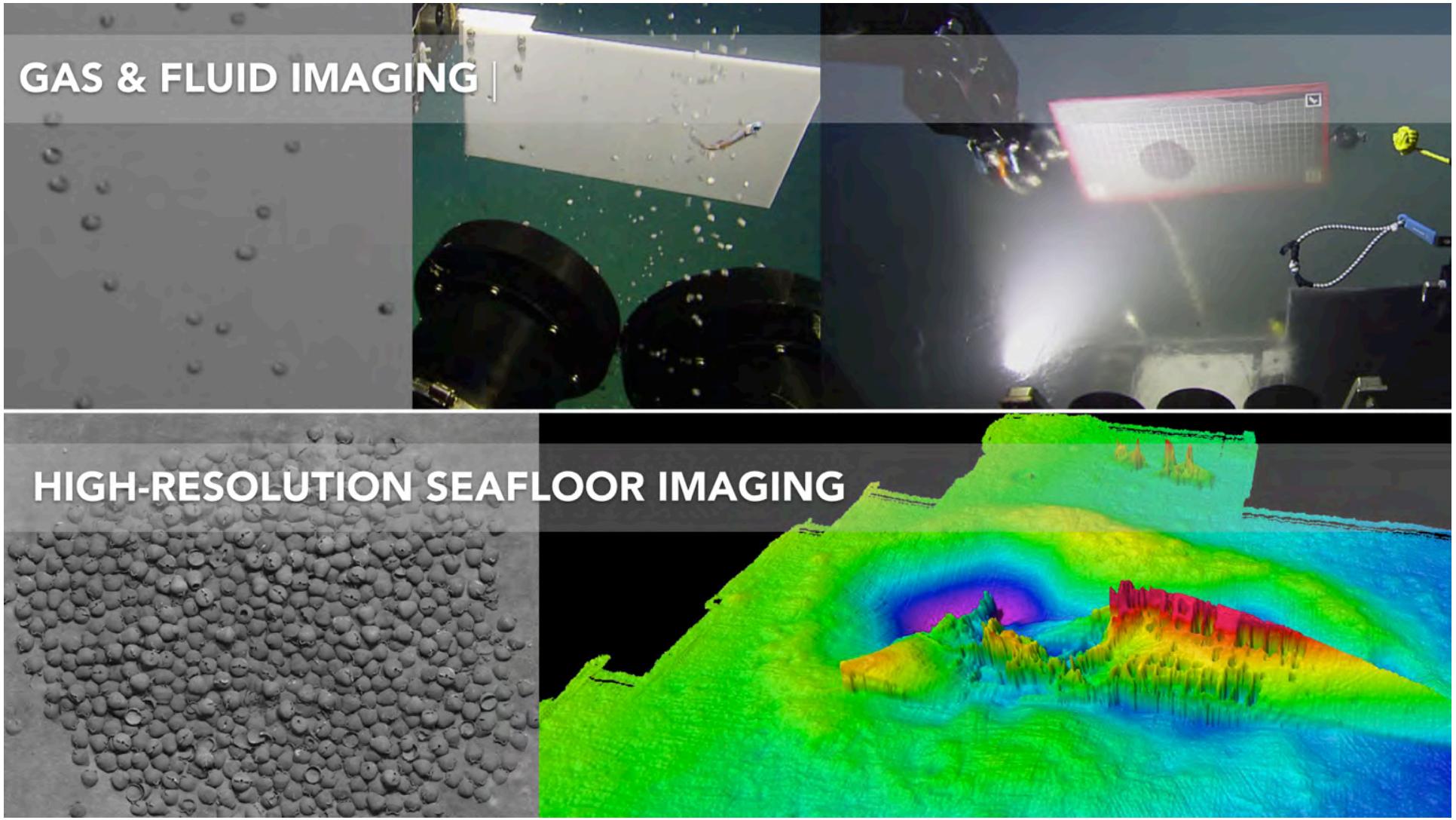

MAPRS | Miniature Autonomous Plume Recorders
NOAA
CABLE


MANIPULATORS | Kraft Predator & ISE Magnum
ARCHAEOLOGICAL SAMPLING | Several tools have been developed


BIOLOGICAL SAMPLING | A wide array of biological samples can be collected
NAMS-013-a
15 CM
GEOLOGICAL SAMPLING | ROV capable of collecting rock samples up to 300 pounds


HERCULES
URI
GAS & FLUID SAMPLING | variety of instruments been used

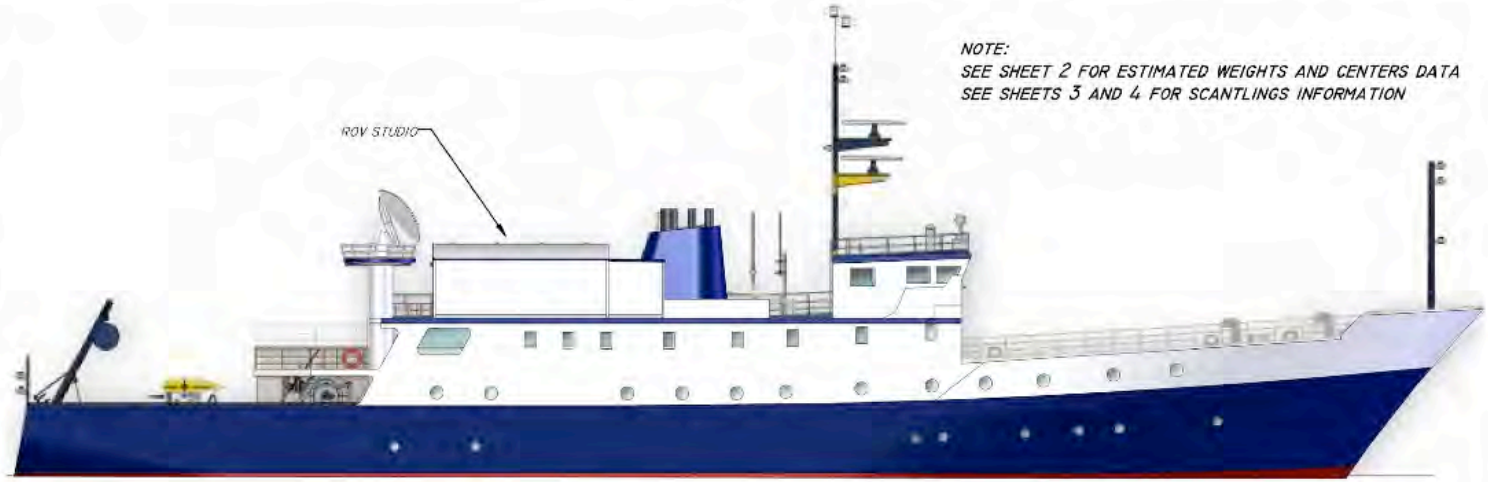

SENSORS | Standard environmental sensors include a CTD, optode, temperature probe; a pH sensor

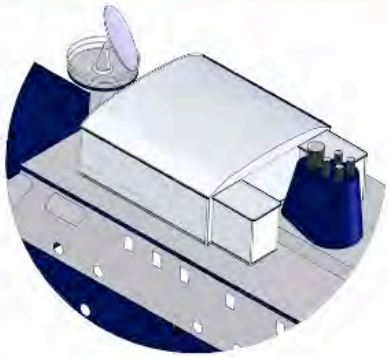

GAS & FLUID IMAGING
HIGH-RESOLUTION SEAFLOOR IMAGING


LASER SPECTROMETER | CO2 and CH4 measurements in situ in deep sea.
LANDERS | Elevators and other platforms are mission configurable

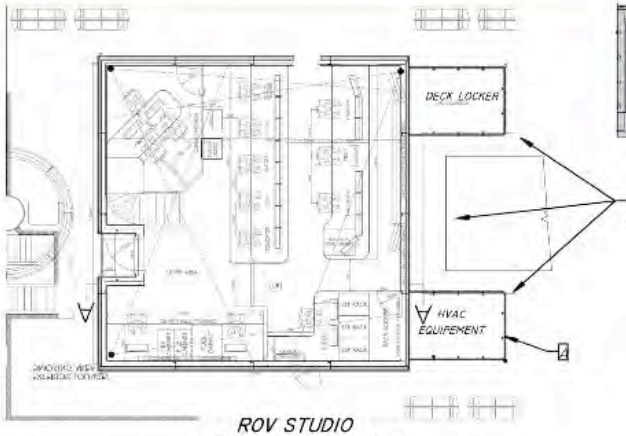

SENTRY | Conducted simultaneous operations with the AUV Sentry in'13
SENTRY
ENGINEERING DESIGN CHALLENGE |

NOTE:
SEE SHEET 2 FOR ESTIMATED WEIGHTS AND CENTERS DATA
SEE SHEETS 3 AND 4 FOR SCANTLINGS INFORMATION

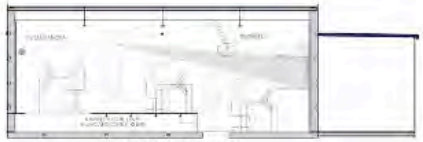




ROV STUDIO
VIEWED FROM STBD FWD



ROV STUDIO
FLOOR PLAN COMPARISON



ROV STUDIO
PROFILE COMPARISON

SYMETRIC BUMP-OUTS CREATE A SOUND WELL IN THIS AREA WHERE HVAC EQUIPEMENT EXHAUST AND NOISE CAN BE SHIELDED FROM REST OF DECK

ITEM	REV.	DESCRIPTION	DATE	APPD.
	B	revised stern and section shapes	4/29/2015	JTW
	A	Added bump-outs at two ends of cabin	4/15/2015	JTW

REVISIONS

BAY DESIGN & ENGINEERING

DRAWN	JTW	04-03-15
CHECKED		
APPROVED		
DESCRIPTION		

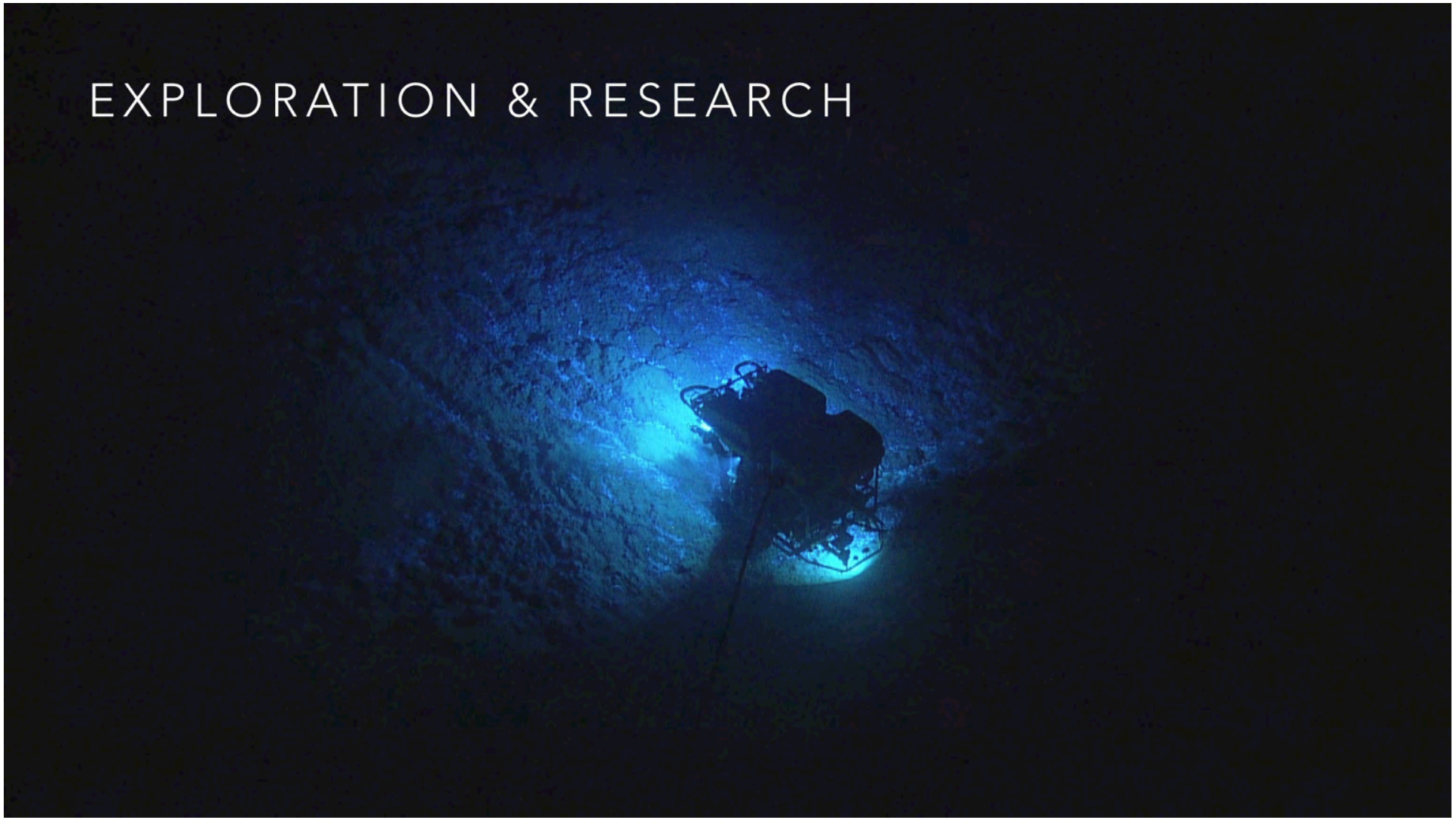
JOB # 150154
ITEM # 80.01

TITLE:
EV NAUTILUS
ROV STUDIO
BSY STRUCTURAL CONCEPT

SIZE B | DWG. NO. 150154-01 | REV. B

CHALLENGES: UNFUNDED CHARGES FOR OET

- The identification of clear priorities by the exploration community
- The creation of an extensive and dynamic network of partnerships
- Private sector investments in technology that exceed public sector investments
- Communication tools capable of engaging ocean explorers with the public
- Citizens that are engaged actively in ocean exploration
- Data from expeditions that are readily and rapidly available


EXPLORATION & RESEARCH

BASIC EXPLORATION Fundamental exploration of the geological, biological, chemical, physical, archaeological and/or historical aspects of an unexplored part of the ocean

APPLIED EXPLORATION Targeted research projects that are undertaken as a charter for a research group, university, government agency, or corporation

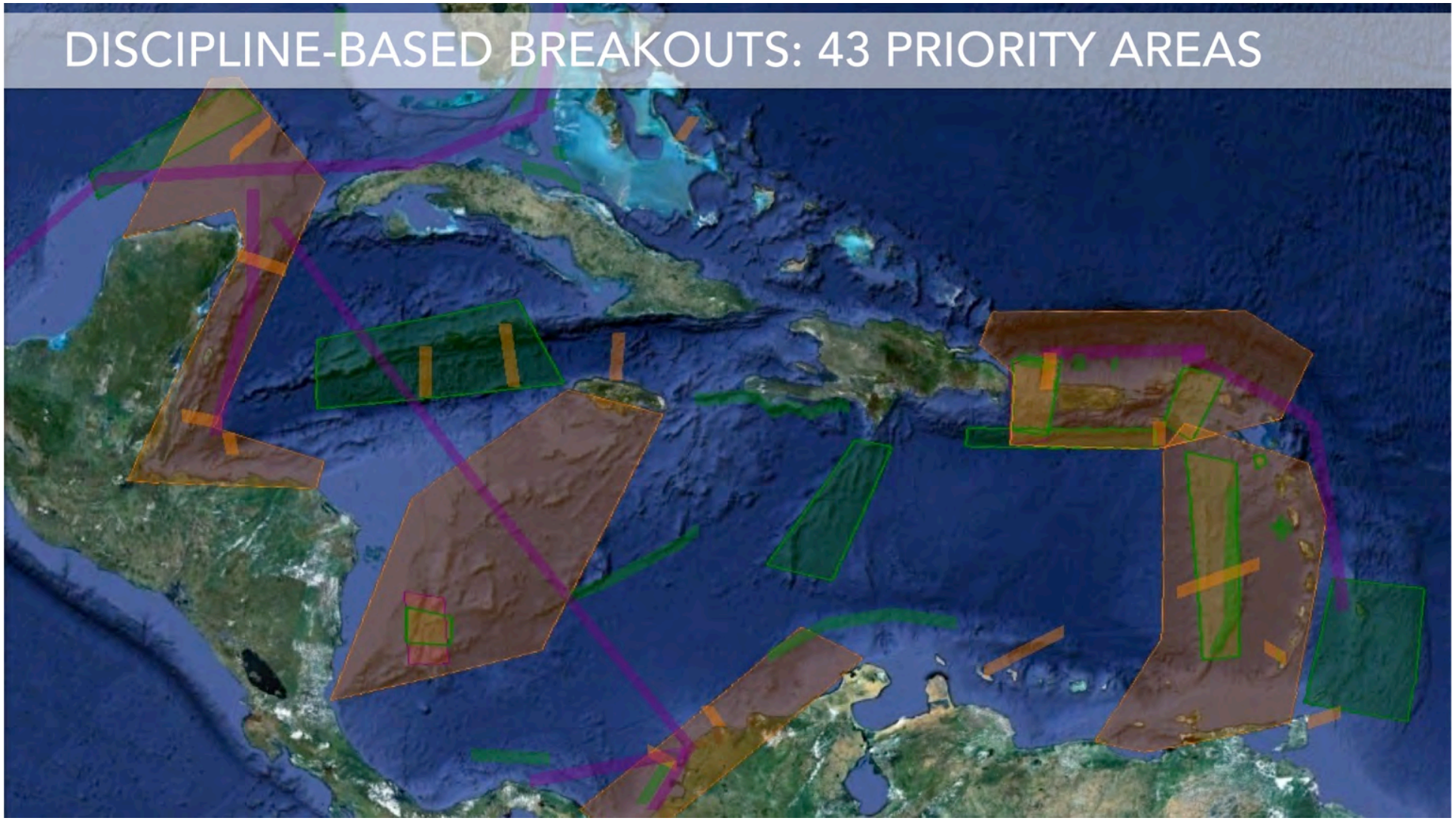
BASIC vs APPLIED EXPLORATION

IDENTIFYING & PRIORITIZING BASIC EXPLORATION TARGETS

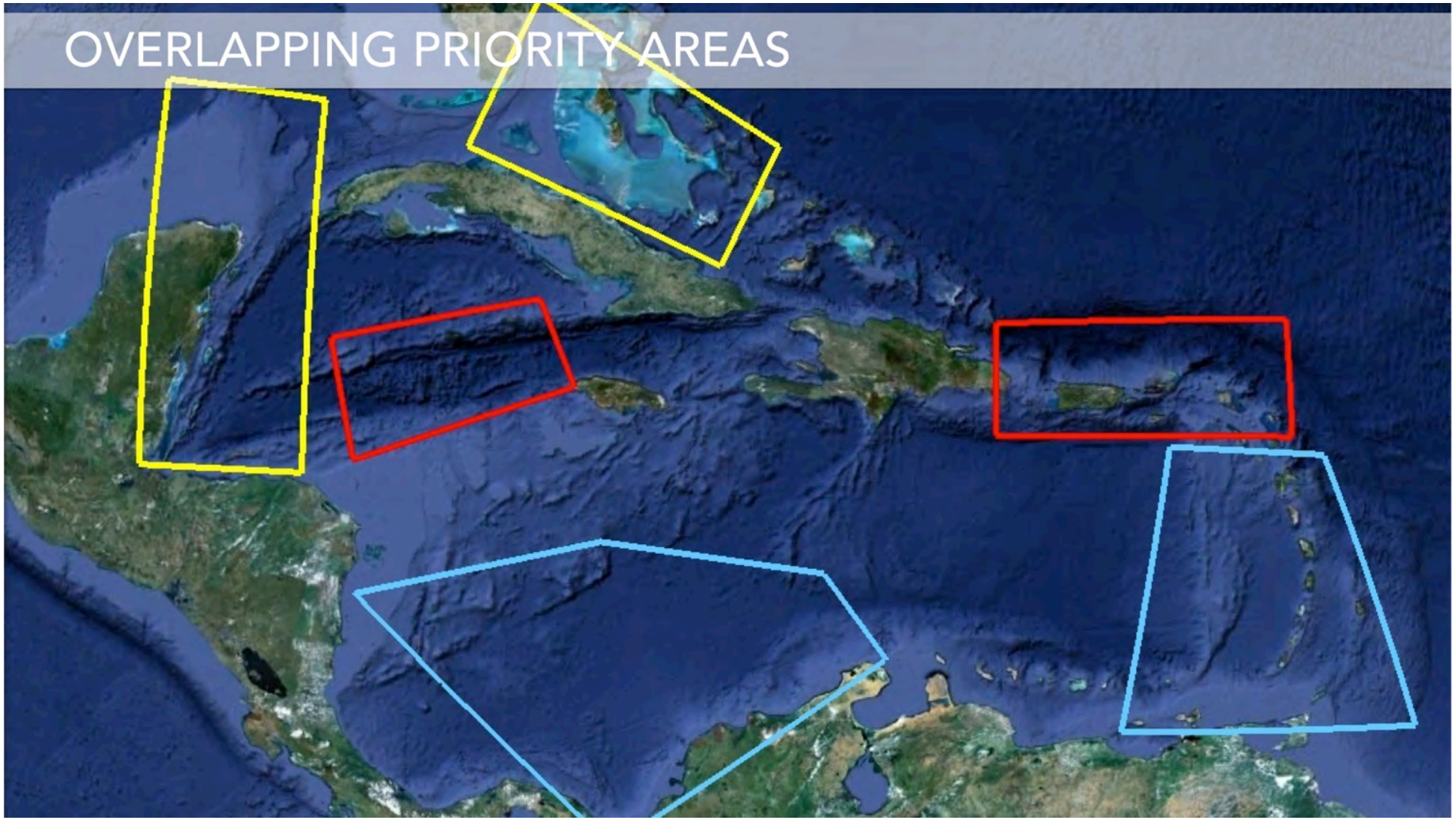
- PRE-WORKSHOP: Call for White Papers
- PRE-WORKSHOP: Invitations to selection of white paper authors
- WORKSHOP: Presentations on telepresence-enabled exploration
- WORKSHOP: Breakout groups based on (1) discipline and (2) region
- POST-WORKSHOP: Public comment period
- POST-WORKSHOP: Follow-up webinar to gather community input on results
- POST-WORKSHOP: Work with NAB to develop field programs

57 WHITE PAPERS SUBMITTED, 37 INVITED

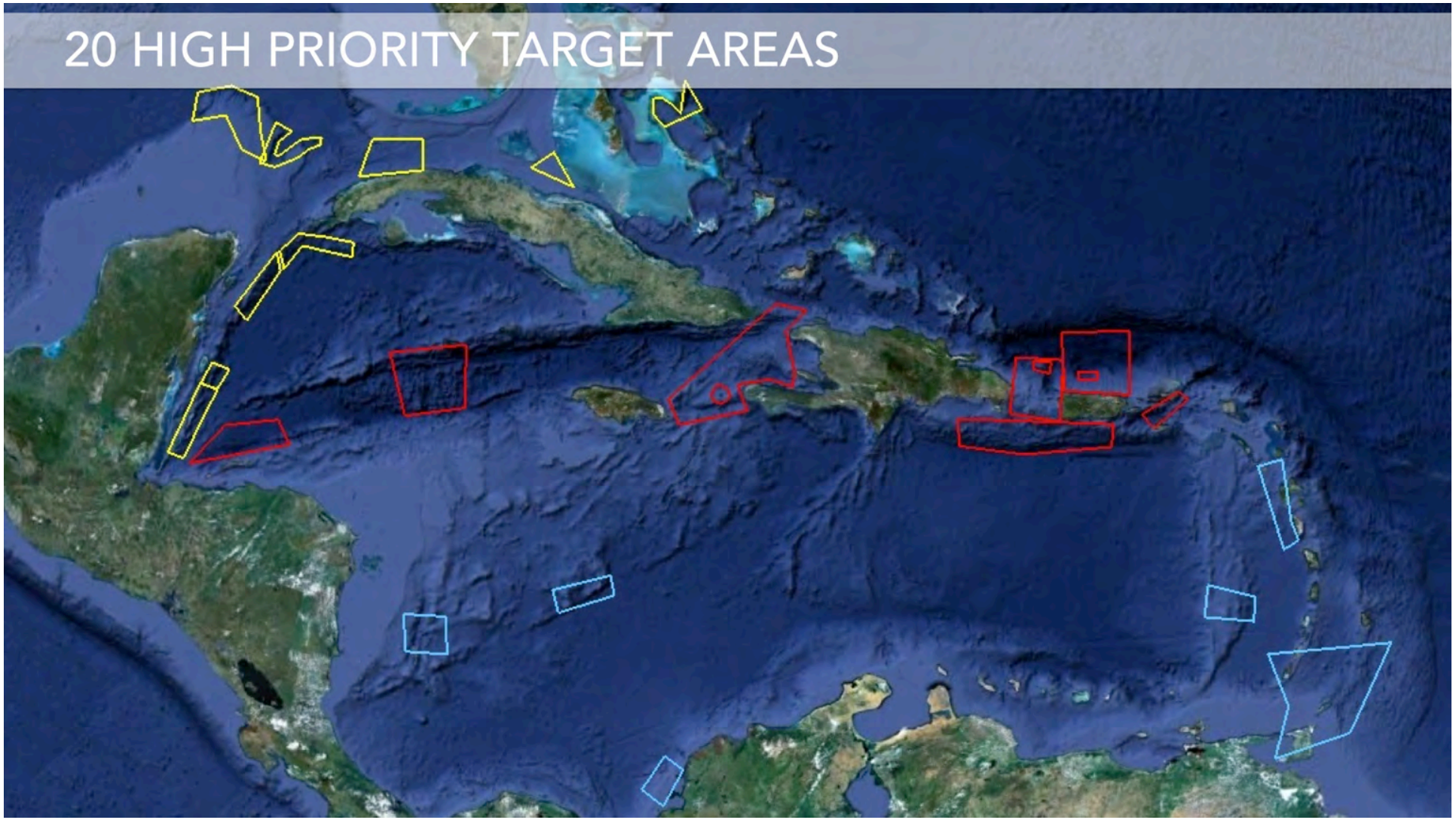
DISCIPLINE-BASED BREAKOUTS: 43 PRIORITY AREAS

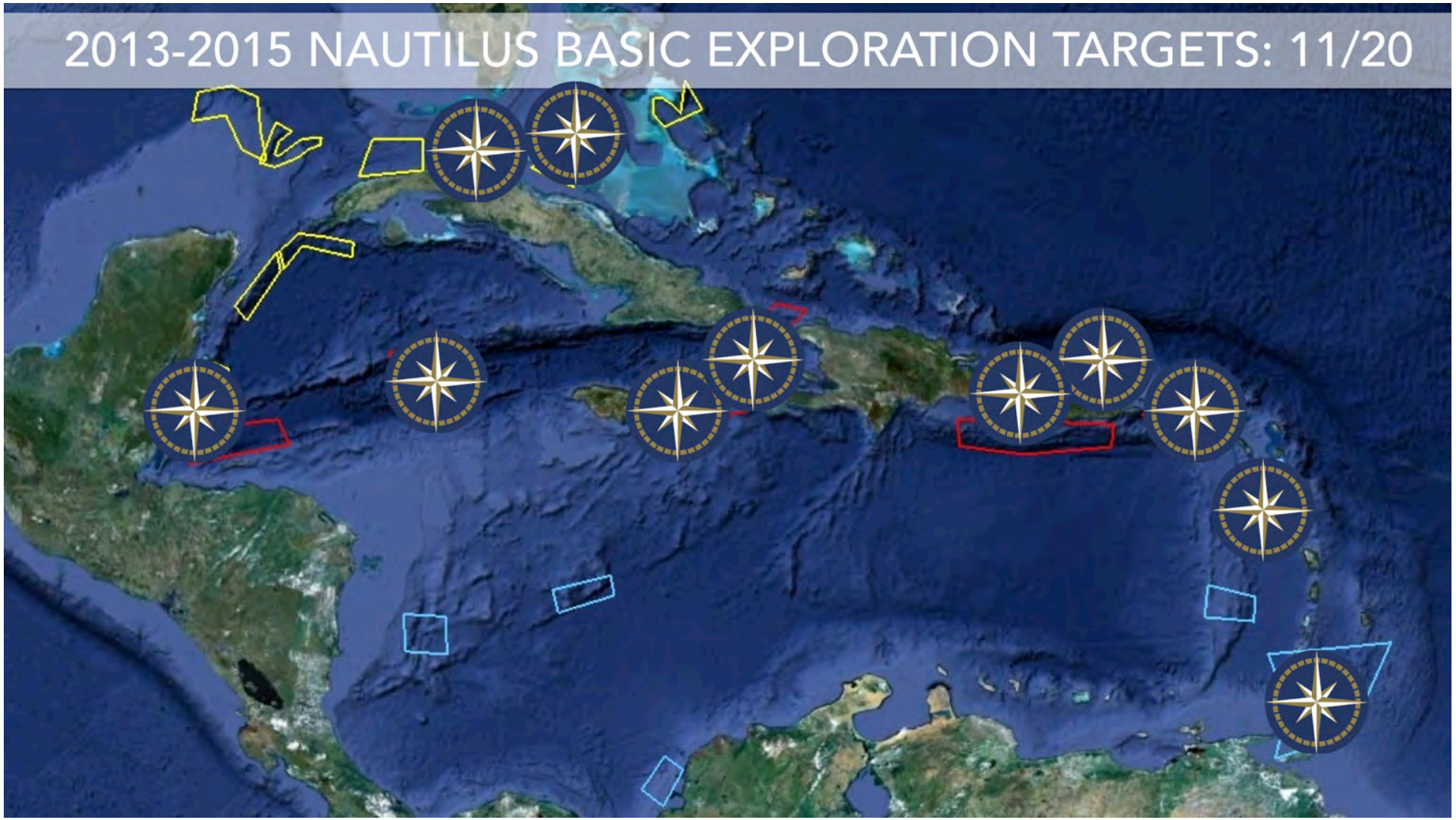


OVERLAPPING PRIORITY AREAS



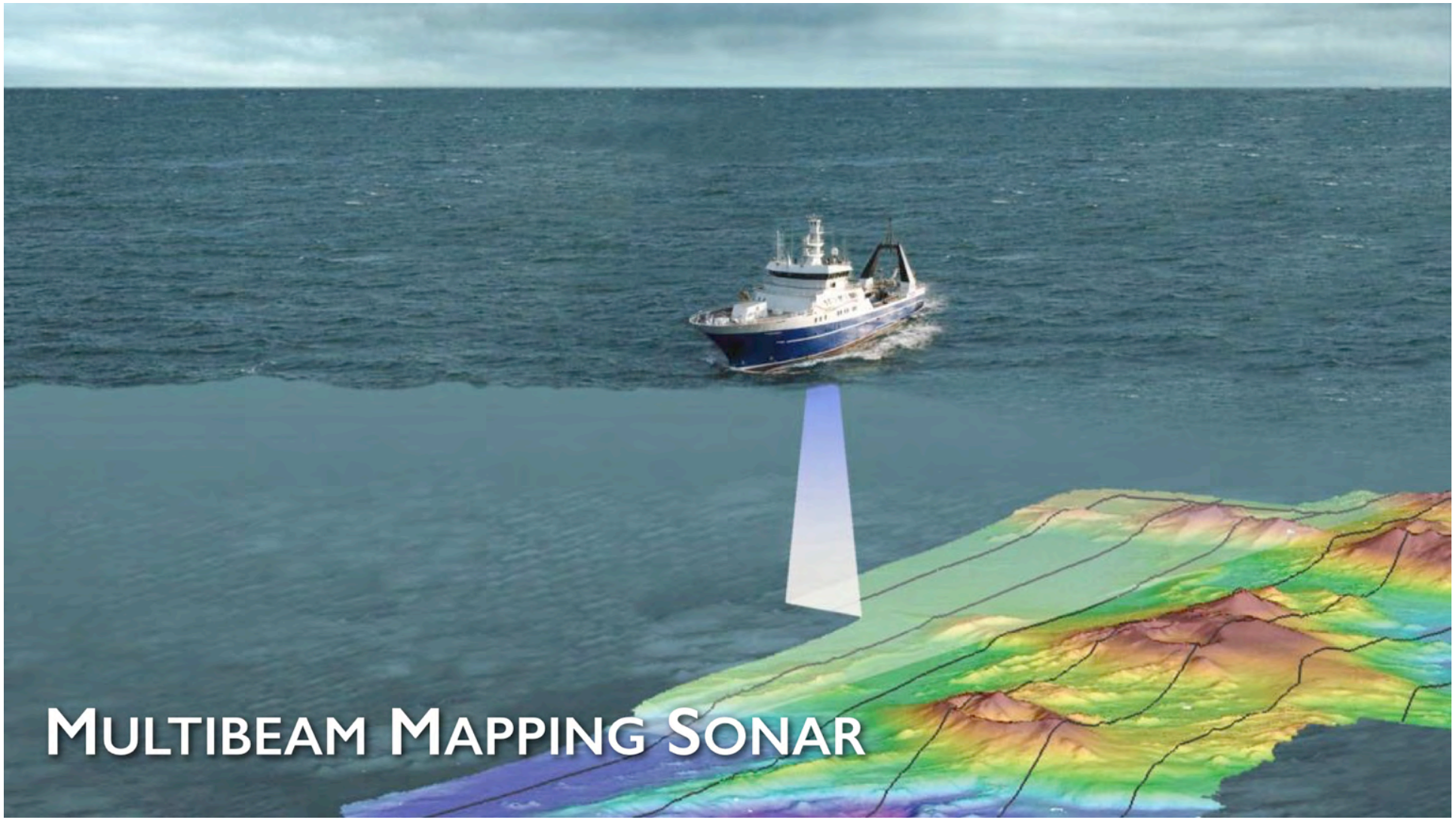
20 HIGH PRIORITY TARGET AREAS

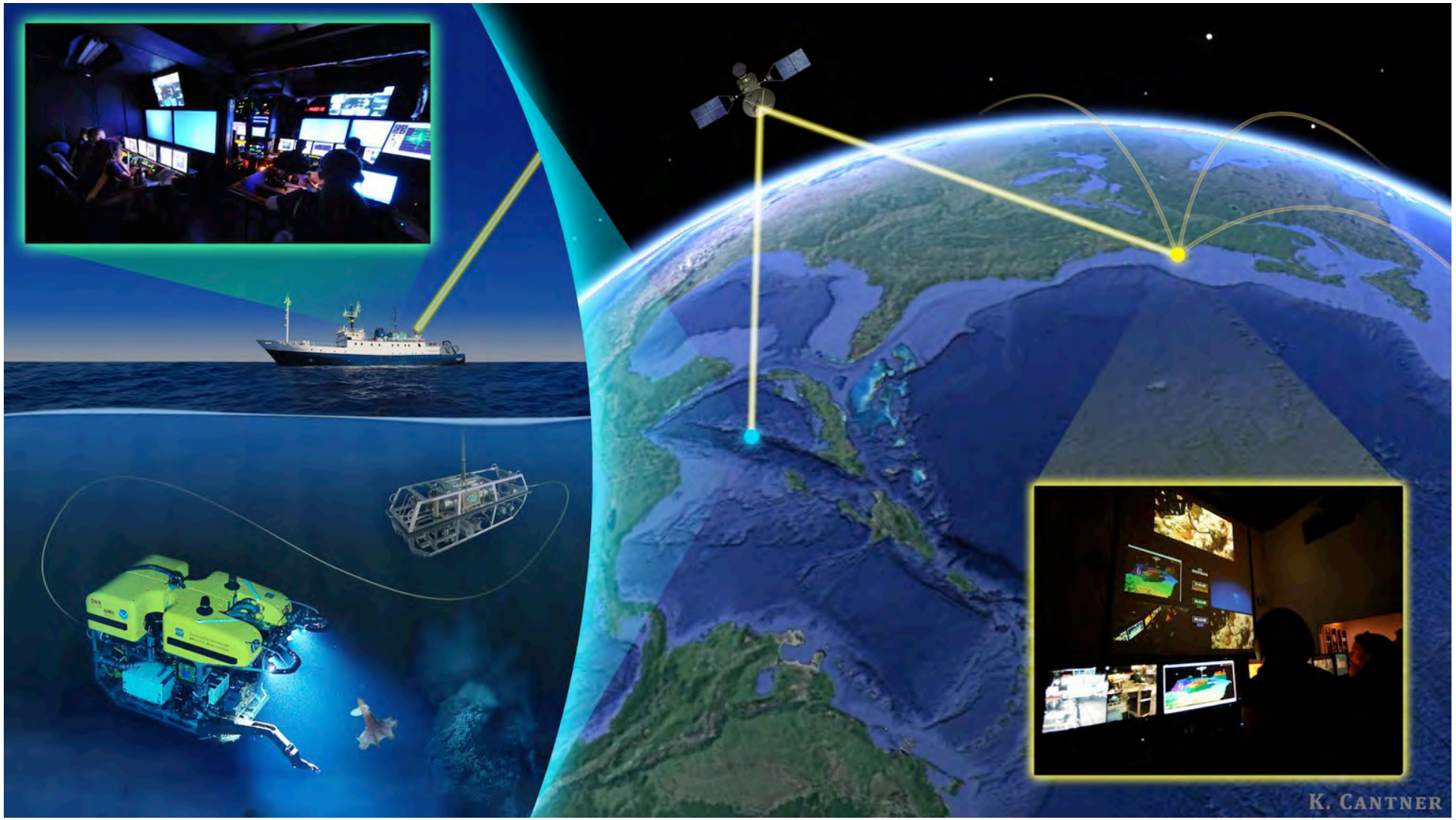


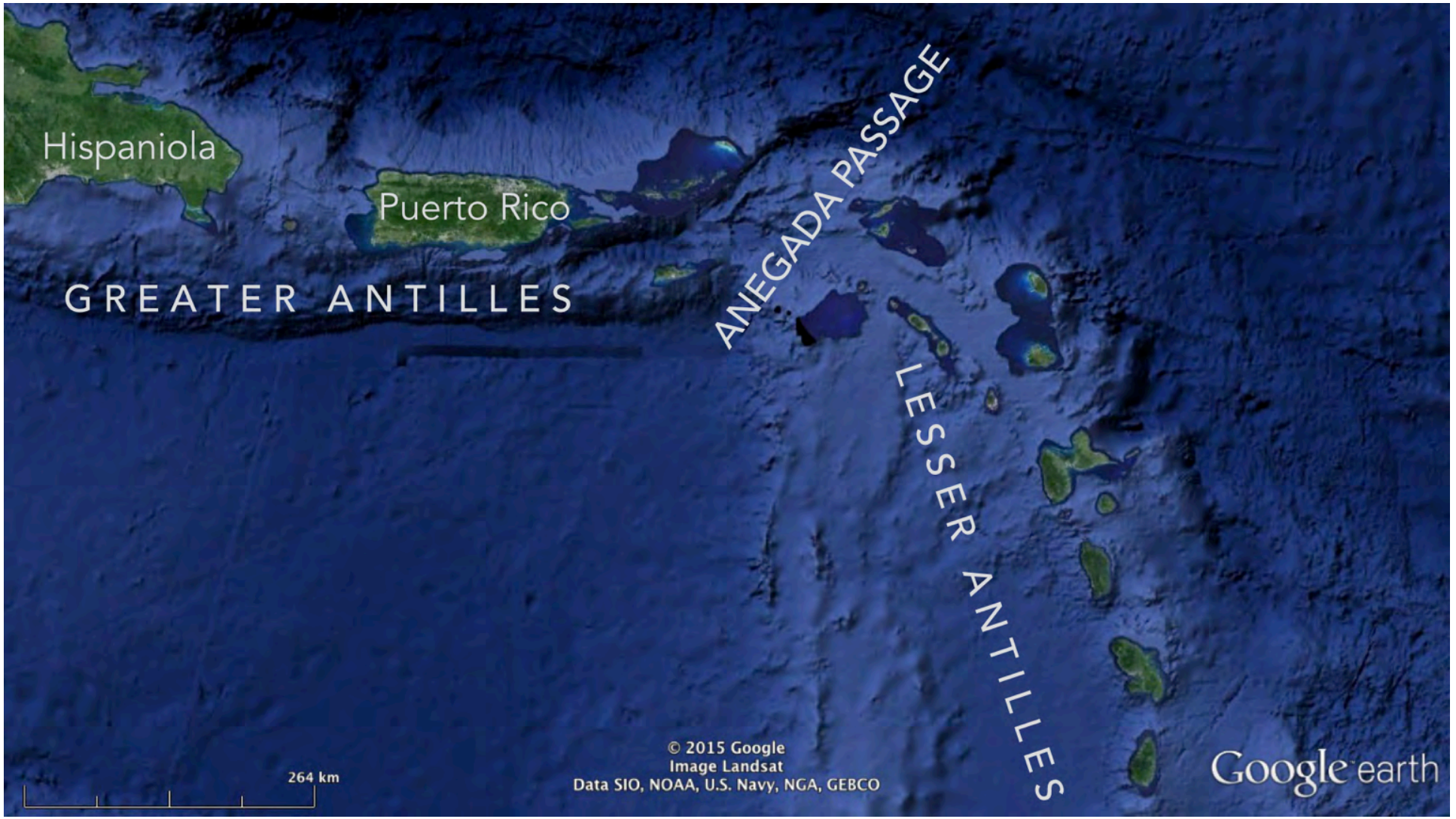

2013-2015 NAUTILUS BASIC EXPLORATION TARGETS: 11/20

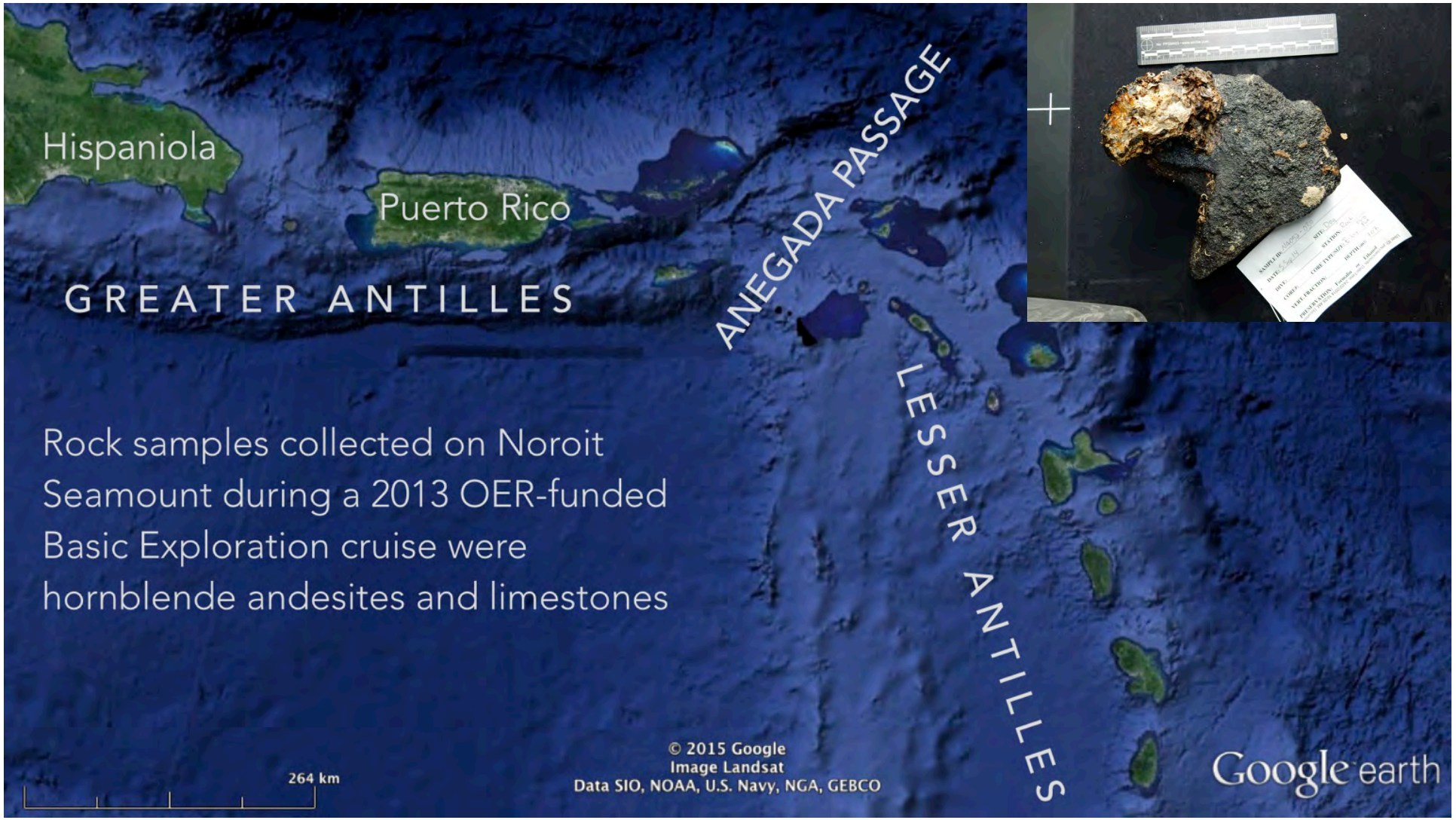

2014 EASTERN PACIFIC WORKSHOP
77 White Papers from 13 countries
35 Key Questions
50 Priority Areas
33 High Priority Target Areas

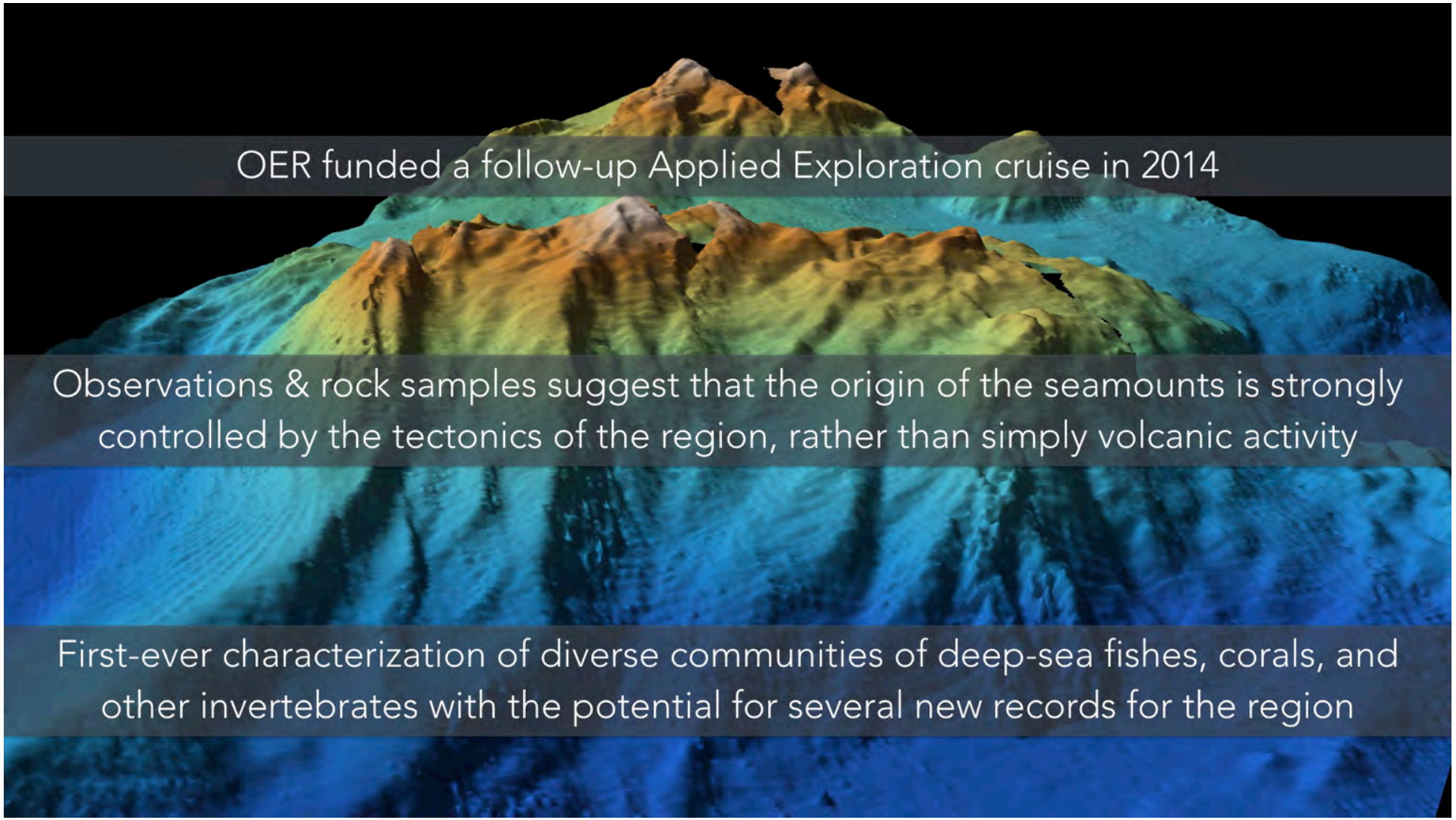

Image Landsat
2015-2017 BASIC EXPLORATION
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth


MULTIBEAM MAPPING SONAR


K. Cantner

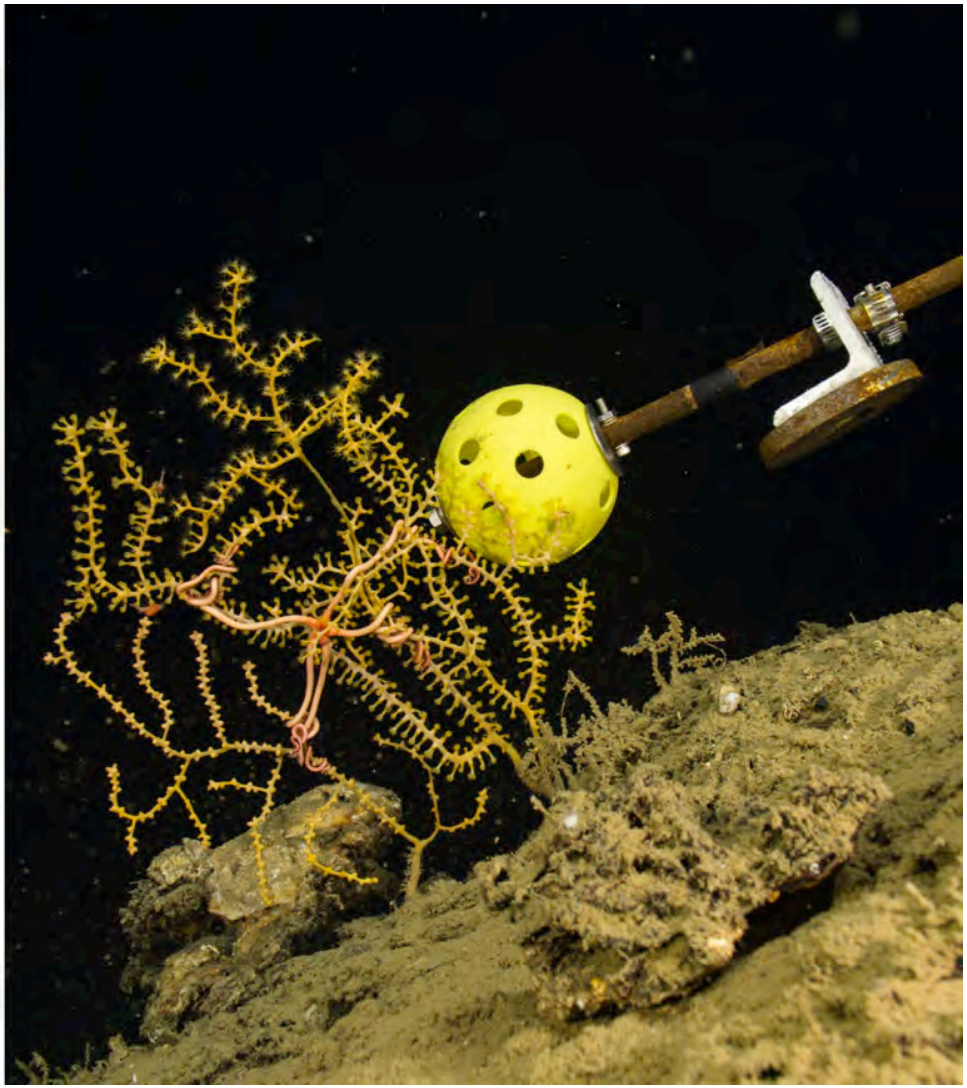

Hispaniola
Puerto Rico
GREATER ANTILLES
ANEGADA PASSAGE
LESSER ANTILLES
264 km
© 2015 Google
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth


Hispaniola
Puerto Rico
GREATER ANTILLES
ANEGADA PASSAGE
LESSER ANTILLES
Rock samples collected on Noroit Seamount during a 2013 OER-funded Basic Exploration cruise were hornblende andesites and limestones
264 km
© 2015 Google
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth


OER funded a follow-up Applied Exploration cruise in 2014
Observations & rock samples suggest that the origin of the seamounts is strongly controlled by the tectonics of the region, rather than simply volcanic activity
First-ever characterization of diverse communities of deep-sea fishes, corals, and other invertebrates with the potential for several new records for the region

APPLIED EXPLORATION

- Funded by external organizations for targeted research and/or educational outreach
- Supplement OET's revenue to keep Basic Exploration costs low
- Provides additional content for our educational offerings; OET's educational programs are required




We didn't go with you guys for the outreach and data management, but now having seen how good that was it will seem missing without it.
So I thought it was great, and I'm advocating we try to build on this cruise by following it up with another next year.
--Chip Breier, GISR Lead Scientist

CHALLENGES

- Limited funding limits community participation in Exploration Workshops.
- We have thus far not been able to coordinate response to the community-driven Exploration Workshops with *Okeanos Explorer.*
- As we move west farther from the continental United States, Applied Exploration funding will become more scarce.


DATA MANAGEMENT & DISSEMINATION

DATA MANAGEMENT & STAFF

Shore Staff

- Director of Science Operations
- Data Engineering (x2)
- Partnering Archival Institutions
  - Inner Space Center (URI)
  - GSO-Marine Geological Sampling Lab
  - Harvard Museum of Comparative Zoology
  - NCEI

At Sea Staff

- Science/Data Managers
- Data Managers in Training
- Science Interns/Data Loggers
- Data Engineer

DATA MANAGEMENT & DISSEMINATION

WHAT WE DO

- Collect interdisciplinary oceanographic datasets
  - QA/QC of data & metadata creation
  - Basic processing of data & repacking for rapid analysis
- Disseminate
  - Near real-time sharing of basic data vis Science Dashboard
  - Post-cruise digital data requests & provide information about partnering institutions

DATA MANAGEMENT & DISSEMINATION

WHAT WE DO

- Archive using widely accepted formats
  - Video & digital data repository at URI's Inner Space Center
  - Physical samples curated & metadata generated on board ship
- Implement, develop, and maintain technical infrastructure on ship and shore
  - Full ship network and systems support from cable terminations to software engineering
  - Shore-side network and systems support fro servers to software engineering
  - End-user support for internal OET, ship staff, and external users

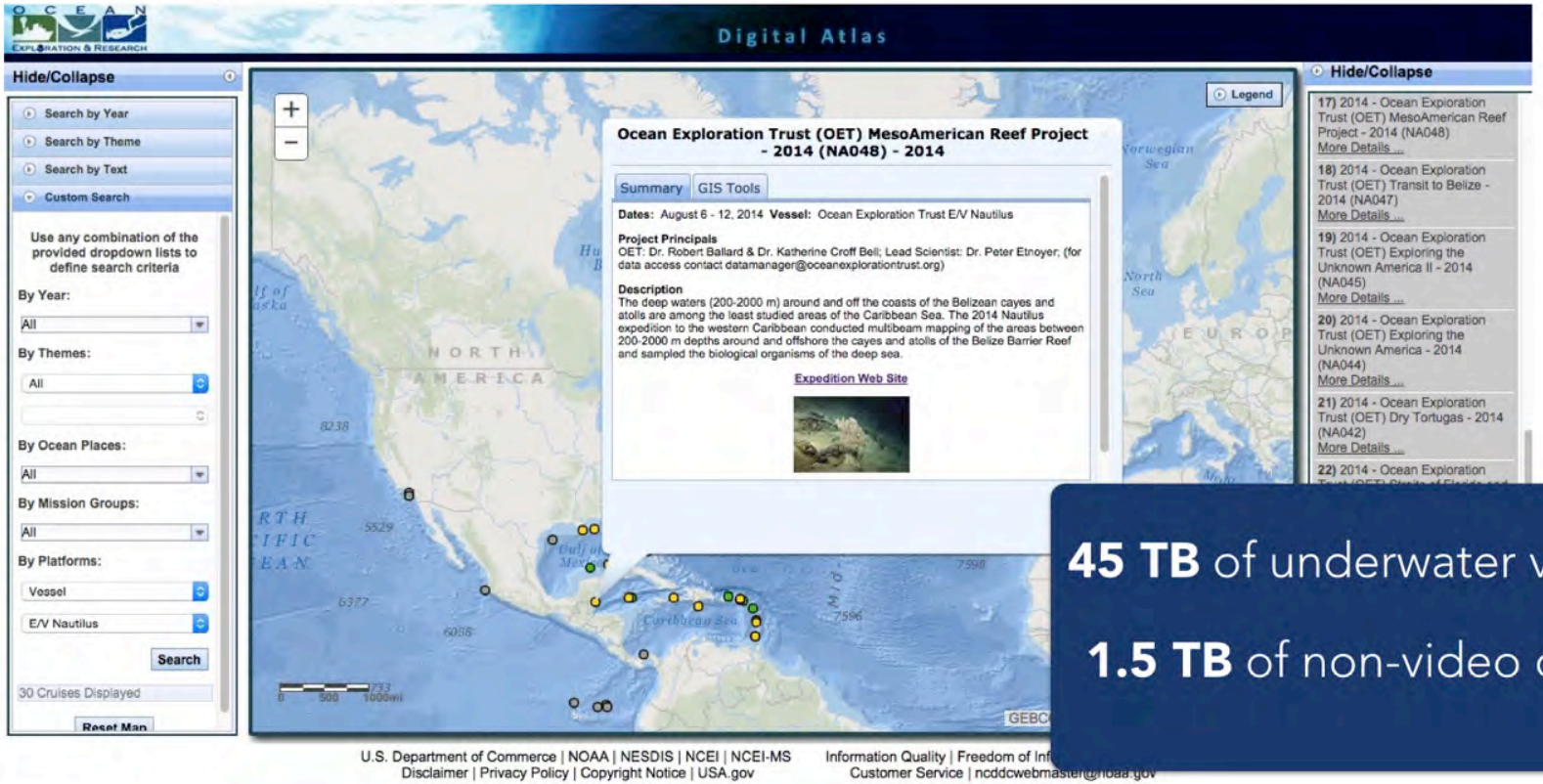
DATA MANAGEMENT & DISSEMINATION

WHY WE DO IT

- Critical to OET's mission & commitment to the community
- Creating a legacy of exploration for future explorers (e.g., archiving data publicly for future research & discovery)
- Learning environment and training the next generation of STEM workers
  - Data Managers & Interns gain hands-on training
  - Opportunity to learn beyond the ship
- Expanding the science team (Scientists Ashore) & impact of our discoveries
  - Shipboard science team ~3-6 can be infinitely extended to scientists on shore

DATA MANAGEMENT & DISSEMINATION

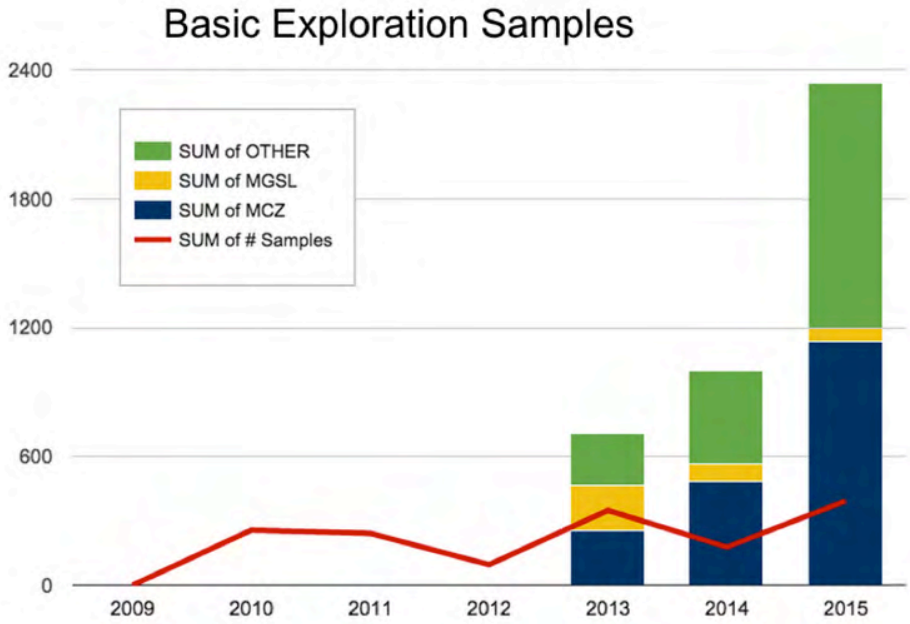
WHAT WE ACHIEVE

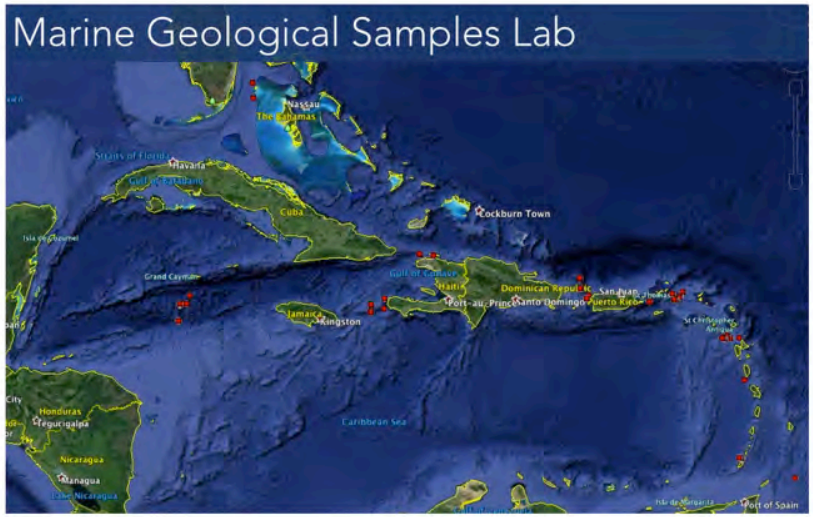


45 TB of underwater video/yr

1.5 TB of non-video data/yr

DATA MANAGEMENT & DISSEMINATION

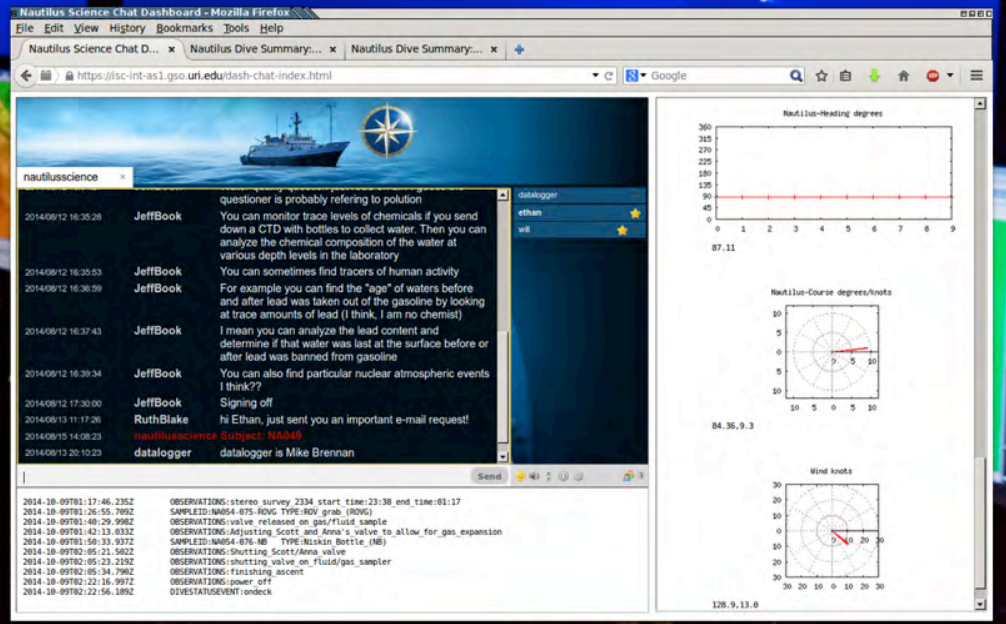




DATA MANAGEMENT & DISSEMINATION

WHAT WE ACHIEVE

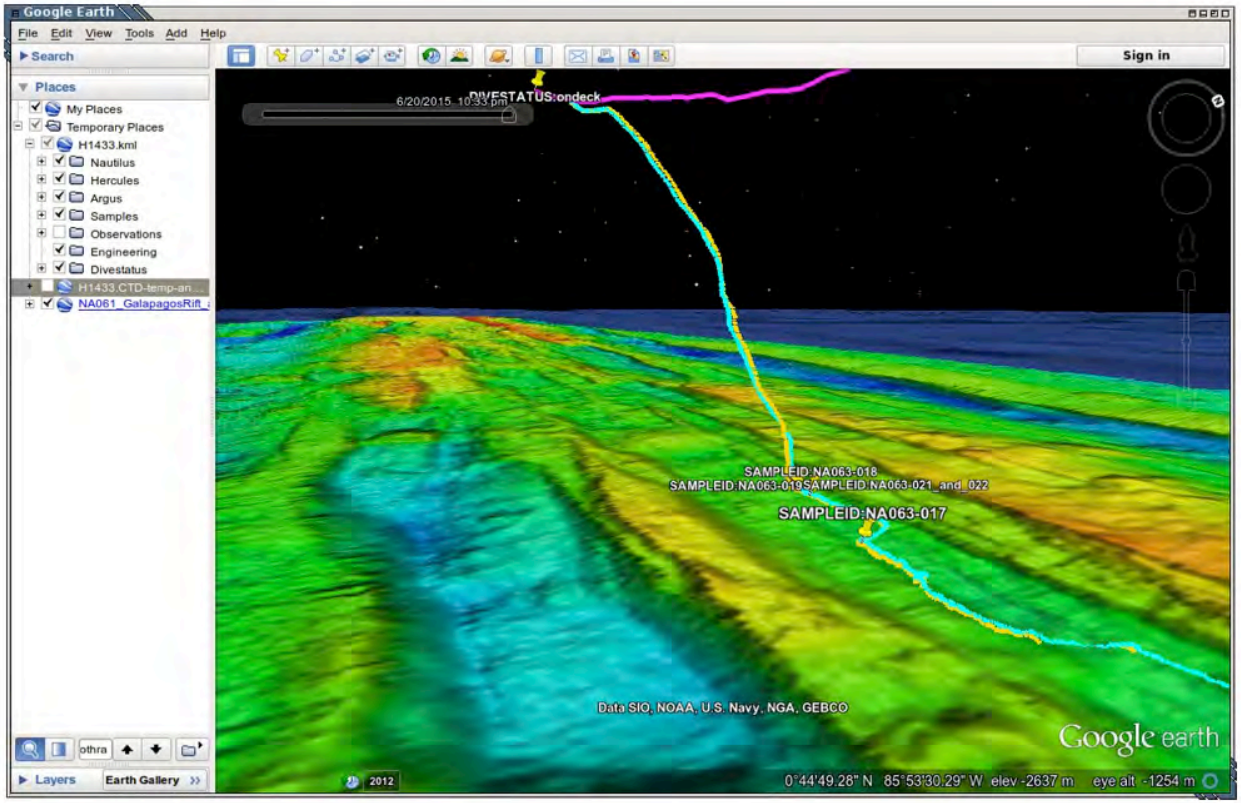
Near real-time data sharing & ocean exploration from anywhere



DATA MANAGEMENT & DISSEMINATION

WHAT WE ACHIEVE

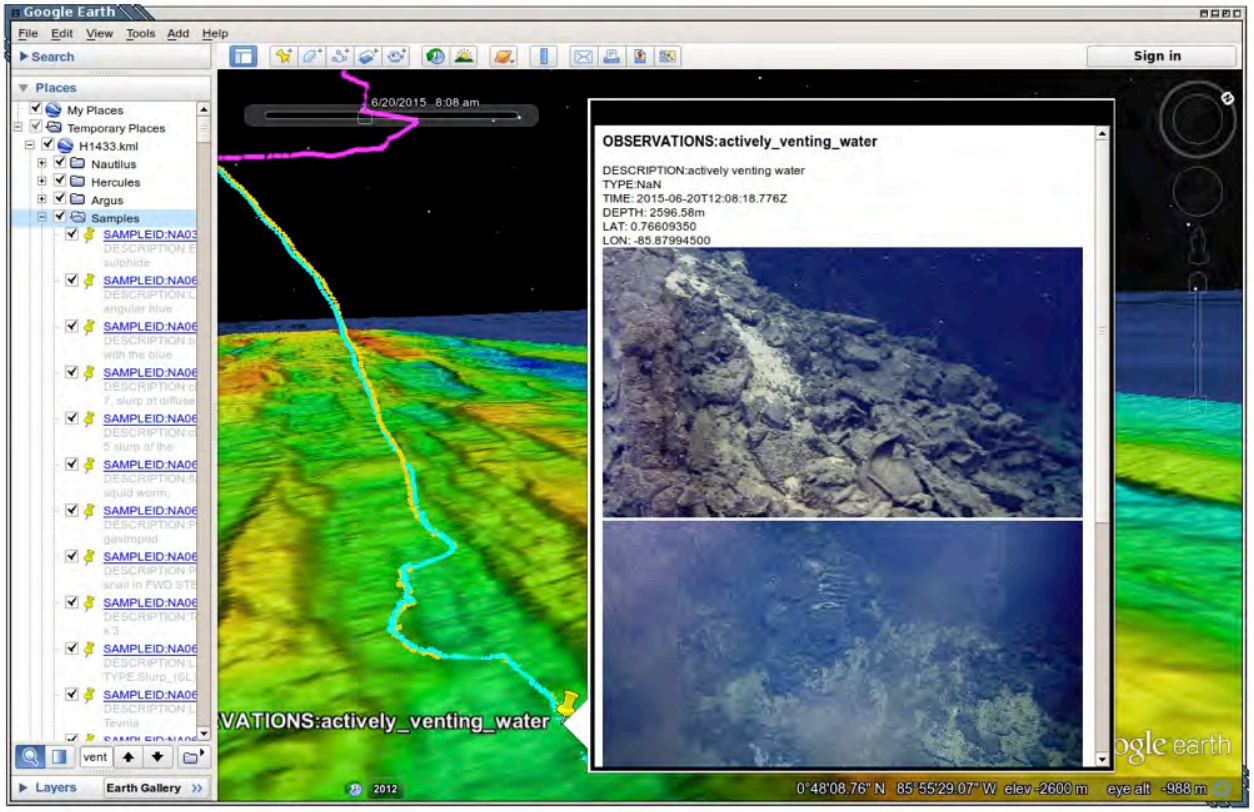
Rapid data analysis & dive replay tools



DATA MANAGEMENT & DISSEMINATION

WHAT WE ACHIEVE

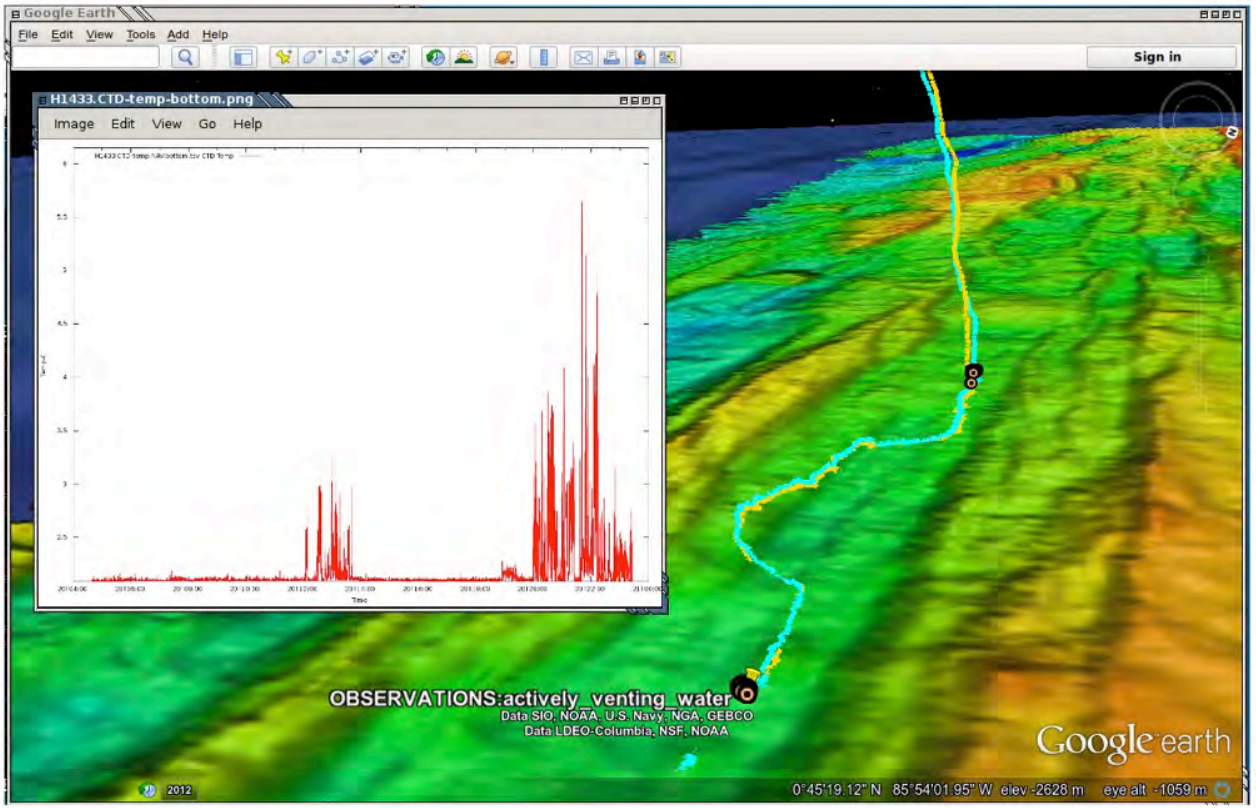
Rapid data analysis & dive replay tools



DATA MANAGEMENT & DISSEMINATION

WHAT WE ACHIEVE

Rapid data analysis & dive replay tools

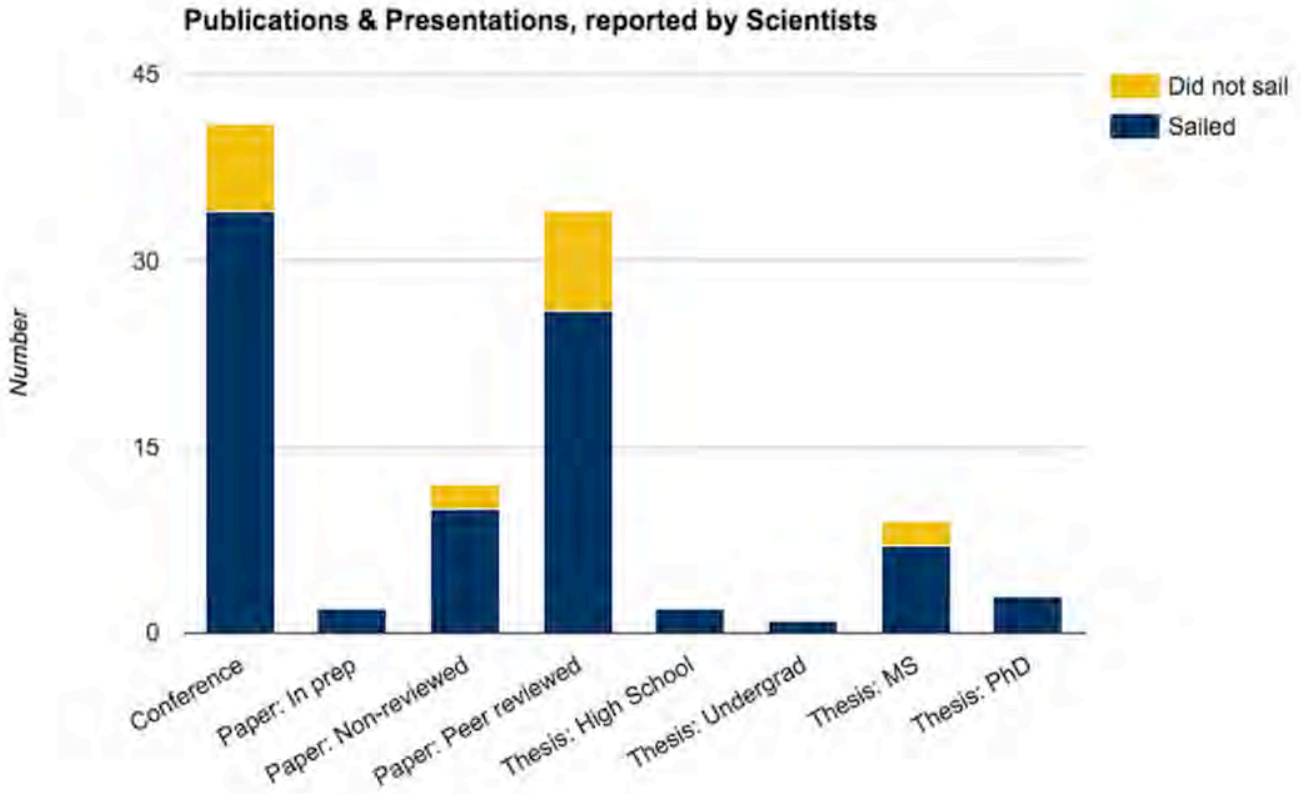


DATA MANAGEMENT & DISSEMINATION

DATA USE

>100 Scientific publications, theses & dissertations, conference abstracts

Follow-up requests & science proposals



CHALLENGES

- Limited number of personnel dedicated to data management & dissemination
- Data mining and use by the public (e.g., citizen science efforts)
- Data archival in NOAA databases
- Video/data accessibility and keeping up with data requests


EDUCATION & OUTREACH
2

EDUCATION & OUTREACH

GOALS

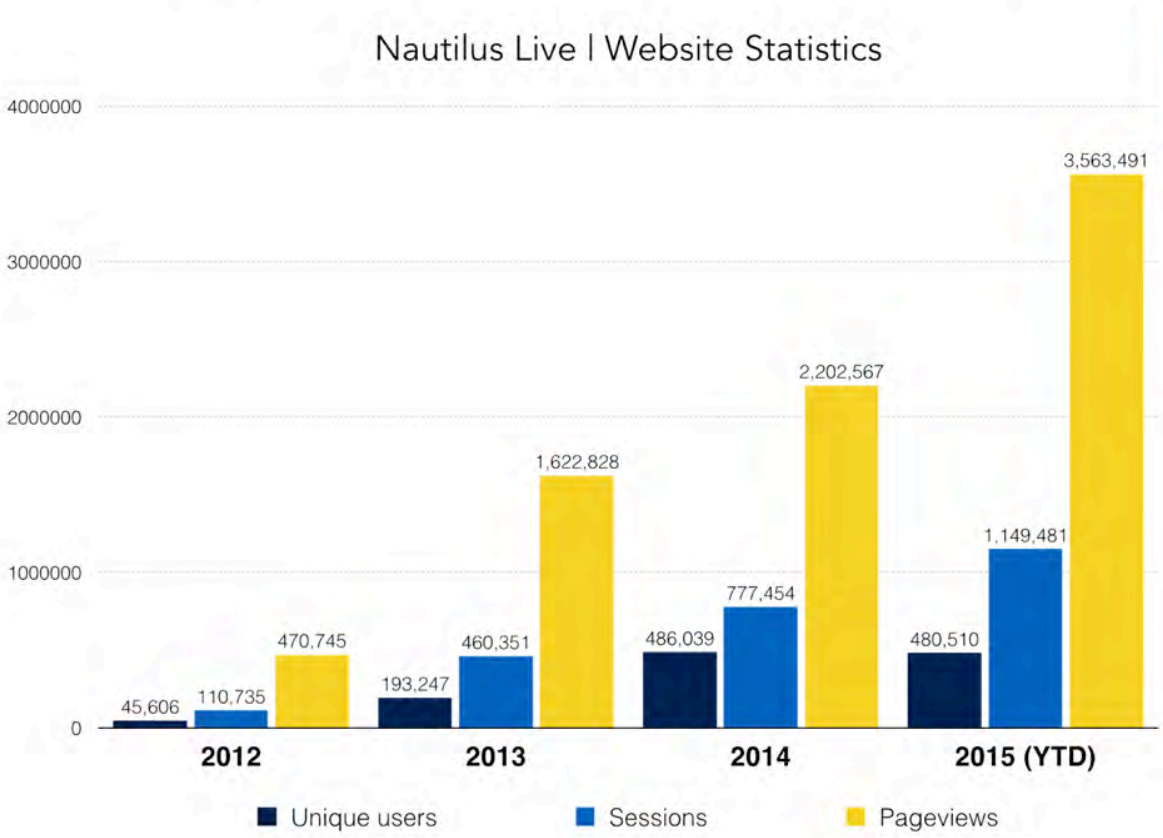
Expose the broader public to ocean exploration & research

Inspire young audiences to be lifelong learners and pursue interests, education, and careers in STEM disciplines

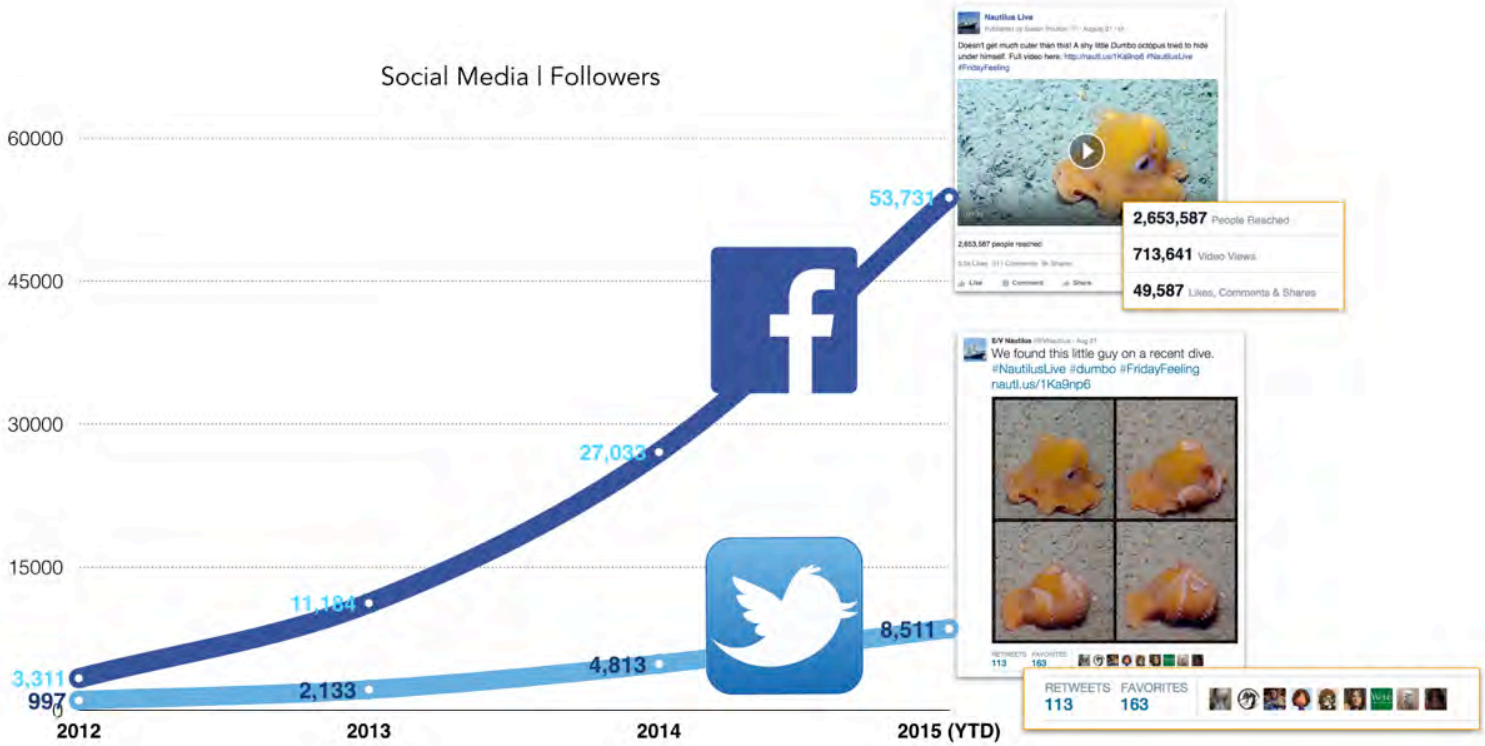
Provide students and educators with engaging learning opportunities and instructional materials. Increase their capacity to use those materials well.

Provide hands-on professional training & vocational skills development for students advancing through stem-focused degrees and careers.

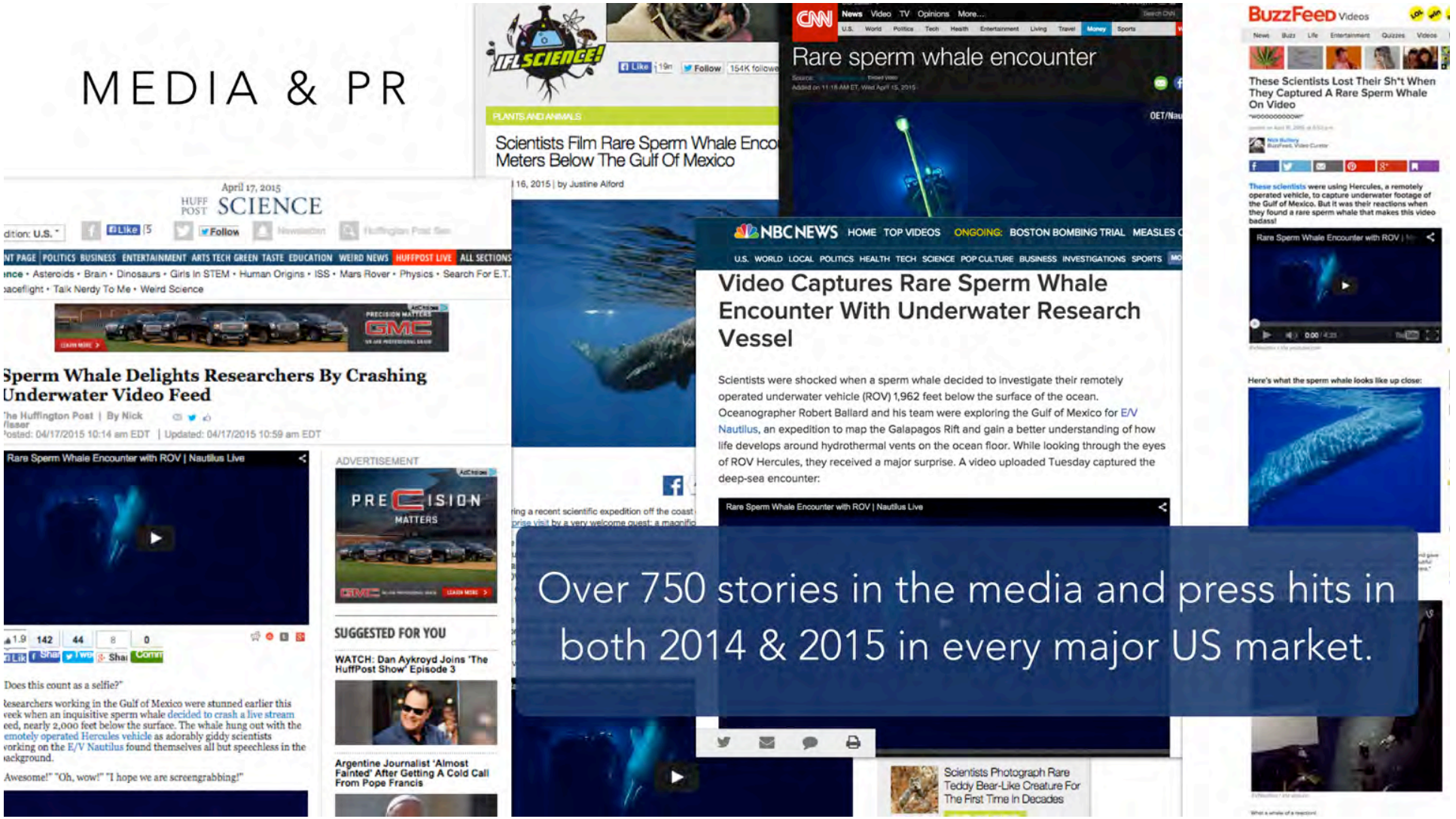
NAUTILUS LIVE WEBSITE & OUTREACH



NAUTILUS LIVE WEBSITE & OUTREACH

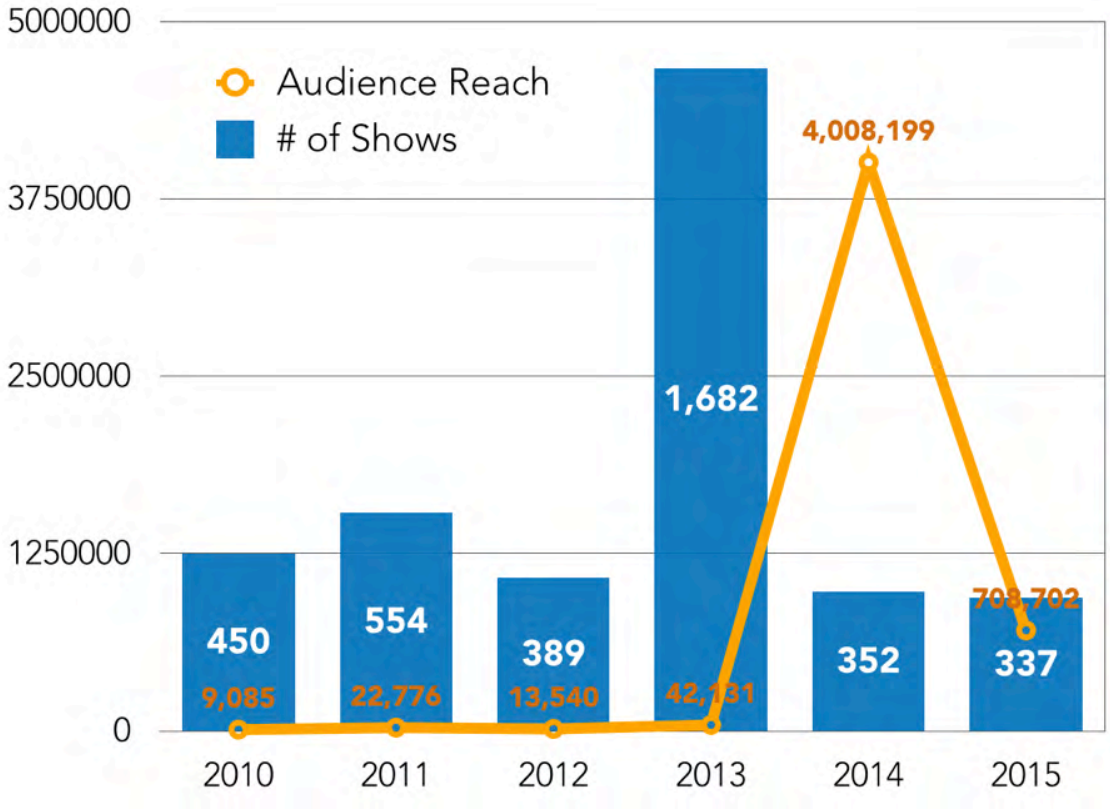


MEDIA & PR



Over 750 stories in the media and press hits in both 2014 & 2015 in every major US market.

LIVE INTERACTIONS



LIVE INTERACTIONS

2010 - 2015

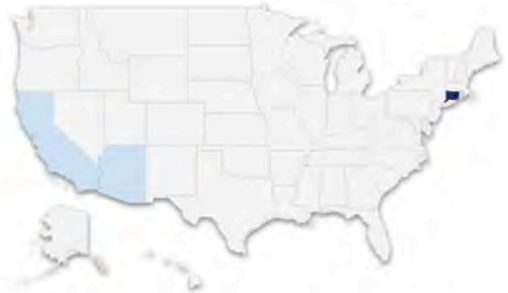
13 | countries connected

3764 | live ship-to-shore interactions (2010 - 2015)

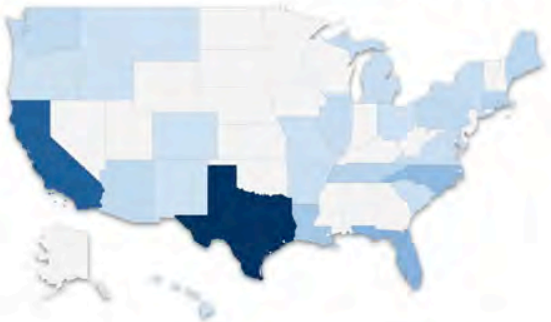
238 | venues & schools connected

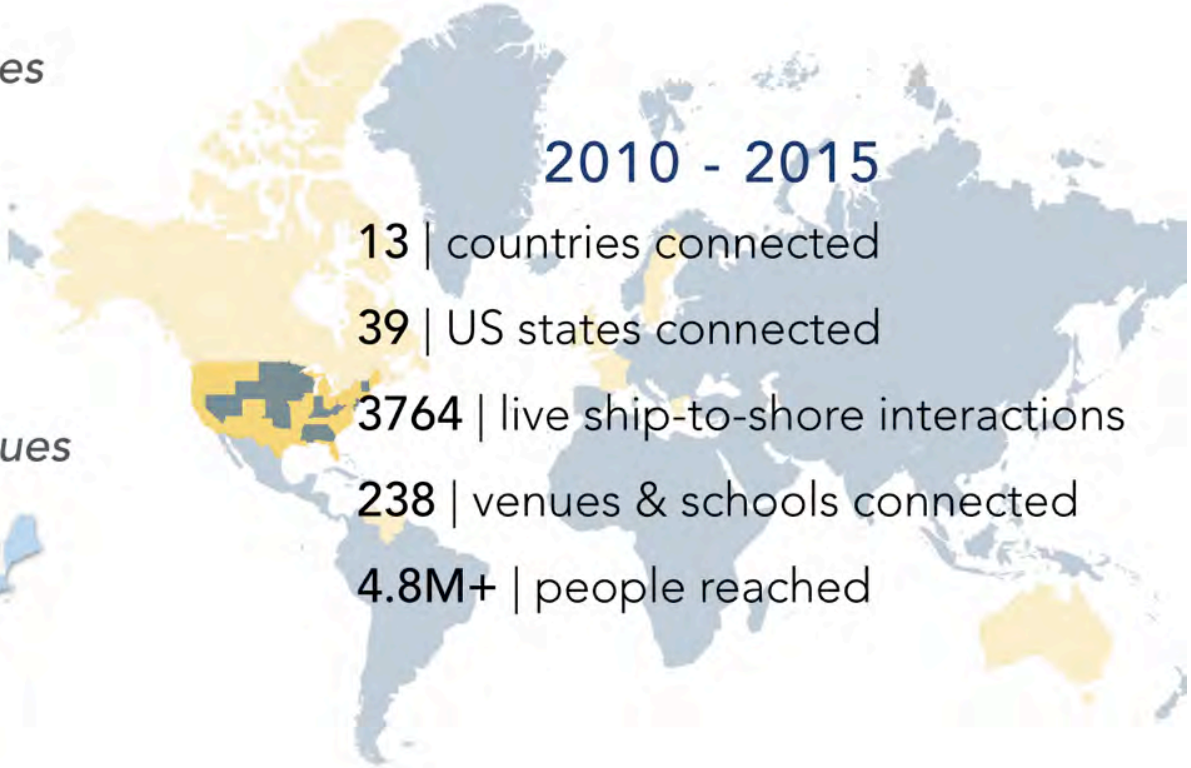
LIVE INTERACTIONS

2010 *4 states & 8 partner venues*



2015 *28 states & 120 venues*





2010 - 2015

13 | countries connected

39 | US states connected

3764 | live ship-to-shore interactions

238 | venues & schools connected

4.8M+ | people reached

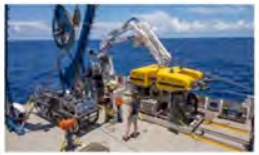
STEM LEARNING MODULES & EDUCATOR WORKSHOPS

STEM LEARNING MODULES: FOUNDATIONAL THEMES

S SCIENCE T TECHNOLOGY E ENGINEERING M MATHEMATICS

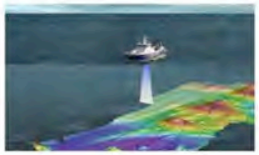
E/V NAUTILUS

S T E M



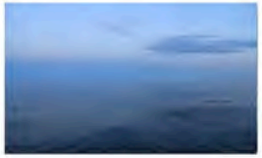
REMOTELY OPERATED VEHICLES

S T E M



SONAR MAPPING

S T E M



OCEANOGRAPHY

S T E M

BIOLOGY OF THE DEEP

S T E M

MARINE GEOLOGY

S T E M

MARINE ARCHAEOLOGY

S T E M

THE CORPS OF EXPLORATION

S T E M

MODEL BEHAVIOR | EDUCATOR

Links to Next Generations Science Standards |

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool or process such that an optimal design can be achieved.

MS-PS1-3: Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Foundational Theme | Oceanography | S T E M

Pacing | 1-2 class periods

Background Needed | Basic knowledge of scientific modeling and graphing

Assessment | Rubric provided

Materials/Resources |

- 4-6 large plastic clear tubs filled with water
- trays of ice
- salt
- several hot pots
- paper fans, straws or small battery operated fans with clips
- various types of cooking oils such as peanut, vegetable, canola, etc.
- plastic stirrers/spoons
- thermometers
- rulers
- timers
- sediments such as sand, gravel, etc.
- laptops and graphing software such as Microsoft Excel (optional)

Overview

In this module, students will be exposed to the importance of developing models to predict behaviors of substances such as oil in a marine environment and will develop a model to test one variable that would influence the behavior of oil molecules when dispersed in water. Students will then use their developed models to make connections to and ask questions about current research addressing these topics. This module could also serve as an introduction to scientific method and measurement.

Background

Oil spills are a major threat to marine ecosystems, costing many millions of dollars to clean up and negatively impact the livelihood of those who depend on the sea for income. In the oceans, there are natural seeps that emit gas and oil into the marine ecosystem yet scientists do not fully understand how this natural gas and oil behaves in the environment. Scientists are studying these natural seeps to predict and model how oil and gas will move through the water column as well as using this as an analogue for oil spills. Scientists are currently working on developing models of oil/hydrocarbon behavior in the water column to accurately inform stakeholders, engineers and scientists how to best manage and mitigate future spills. In this module you will develop a model to test one factor affecting oil behavior in water. Check out http://www.nautiluslive.org/blog/2015/04/13/why-do-bubbles-matter for more information.

Objectives & Learning Outcomes

- Students will understand impacts from hazardous events such as oil spills and actions companies are taking to study the impacts of such events.
- Students will design a model to test a variable in a controlled setting.
- Students will collect and graph data, and use proper scientific measurement techniques.
- Students will communicate their results to an appropriate audience.

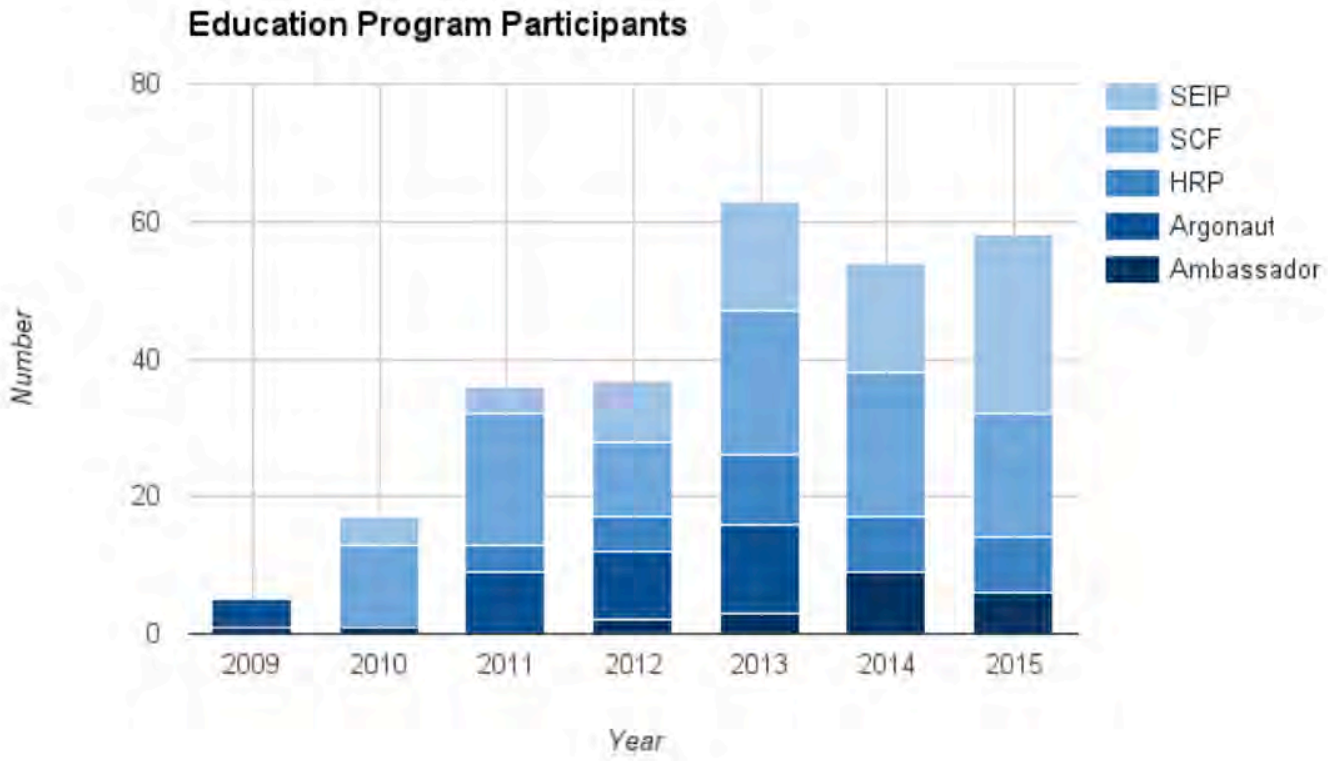
MODEL BEHAVIOR | ASSESSMENT

OBJECTIVE	CRITERIA			
	4 Exemplary	3 Commended	2 Emerging	1 Developing
Knowledge & Understanding |	Student consistently, correctly and thoroughly answers all questions. Uses an abundance of relevant vocabulary and is able to explain relationships within the content using examples. Can apply the content to other topics or real life.	Student is able to consistently answer most questions correctly. Uses an adequate amount of relevant vocabulary. Can explain relationships within the content and can apply content to other topics or real life.	Student is able to answer some questions correctly. Uses some relevant vocabulary. Student does not elaborate on relationships within the content or make connections between the content and real life.	Student is able to answer a few questions correctly. Inconsistently uses relevant vocabulary. Student does not elaborate on relationships within the content or make connections between the content and real life.
Content Organization, Methodology & Analysis |	Student effectively organizes complex ideas, concepts, and information to make important connections and distinctions. This may include detailed, labeled and thorough procedures, data tables, graphs, diagrams and/or analyses.	Student is able to organize ideas, concepts, and information to make connections and distinctions. This may include mostly detailed, labeled and thorough procedures, data tables, graphs, diagrams and/or analyses.	Student attempts to organize ideas, concepts and information to make some connections and distinctions. Student is able to provide basic procedures, data tables, graphs, diagrams and/or analyses.	Student has difficulty organizing ideas, concepts and information to make connections and distinctions. Student is unable to provide basic procedures, data tables, graphs, diagrams and/or analyses.
Self-Directed Learner |	Student is actively engaged in the learning process; consistently contributes to class discussions and asks clarifying questions. Seeks out and shares additional resources with the class or teacher. Advocates for his/her learning needs.	Student is engaged in the learning process. Often contributes to class discussions and asks clarifying questions. Advocates for his/her learning needs.	Student is inconsistently engaged in the learning process. Sometimes contributes to class discussions or asks clarifying questions. Inconsistently advocates for his/her learning needs.	Student is weakly engaged in the learning process. Rarely contributes to class discussions or asks clarifying questions. Rarely advocates for his/her learning needs.
Technological Tools |	Use of digital resources is always appropriate for the task. Willing to learn and use technology for inclusion of charts, graphs, pictures, etc. to amplify the message.	Use of digital resources is appropriate for the task. Willing to use technology for inclusion of charts, graphs, pictures, etc. to amplify the message.	Use of digital resources is sometimes appropriate for the task. Inconsistent use of technology for inclusion of charts, graphs, pictures, etc. to amplify the message.	Use of digital resources is rarely appropriate for the task. Inconsistent use of technology for inclusion of charts, graphs, pictures, etc. to amplify the message.
Collaboration Skills |	Consistently works effectively and respectfully with a diverse group of learners. Actively checks with others for understanding and how he or she may be of help. Student listens when others speak and incorporates or builds off of the ideas of others.	Works effectively and respectfully with a diverse group of learners. Checks with others for understanding and how he or she may be of help. Student listens when others speak.	Sometimes works effectively and respectfully with a diverse group of learners. Sometimes checks with others for understanding and how he or she may be of help. Student listens when others speak.	Has difficulty working effectively and respectfully with a diverse group of learners. Rarely checks with others for understanding and how he or she may be of help. Student may talk over other students or does not listen when others speak.
Total Score:	**Comments:**			

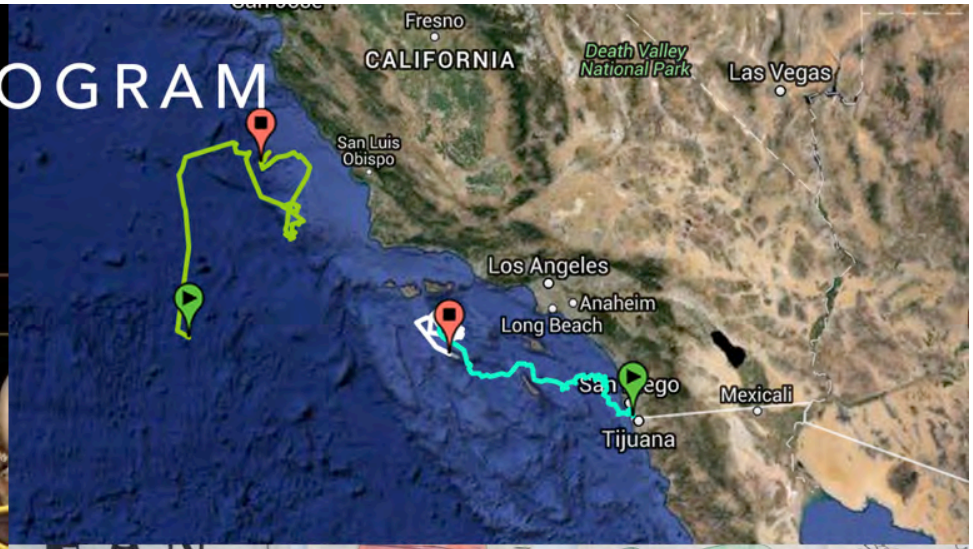
STEM LEARNING MODULES & EDUCATOR WORKSHOPS

- Since June 2015, OET has held **4 STEM workshops in TX, LA, FL, & CT** and another is planned in October in **IL**.
- Estimated student reach through participating teachers to date is **100,000+.**
- Feedback from participants has been extremely positive.

AT SEA PROGRAMS FOR STUDENTS & EDUCATORS



HONORS RESEARCH PROGRAM



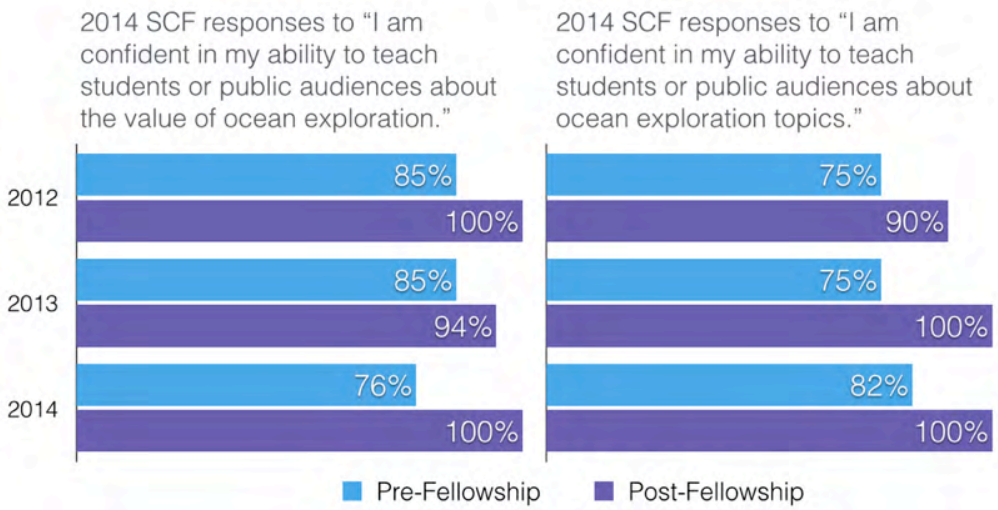
SCIENCE & ENGINEERING INTERNSHIP PROGRAM

2014 SEIP's assessment of the impact of the program on their career plans are that it:

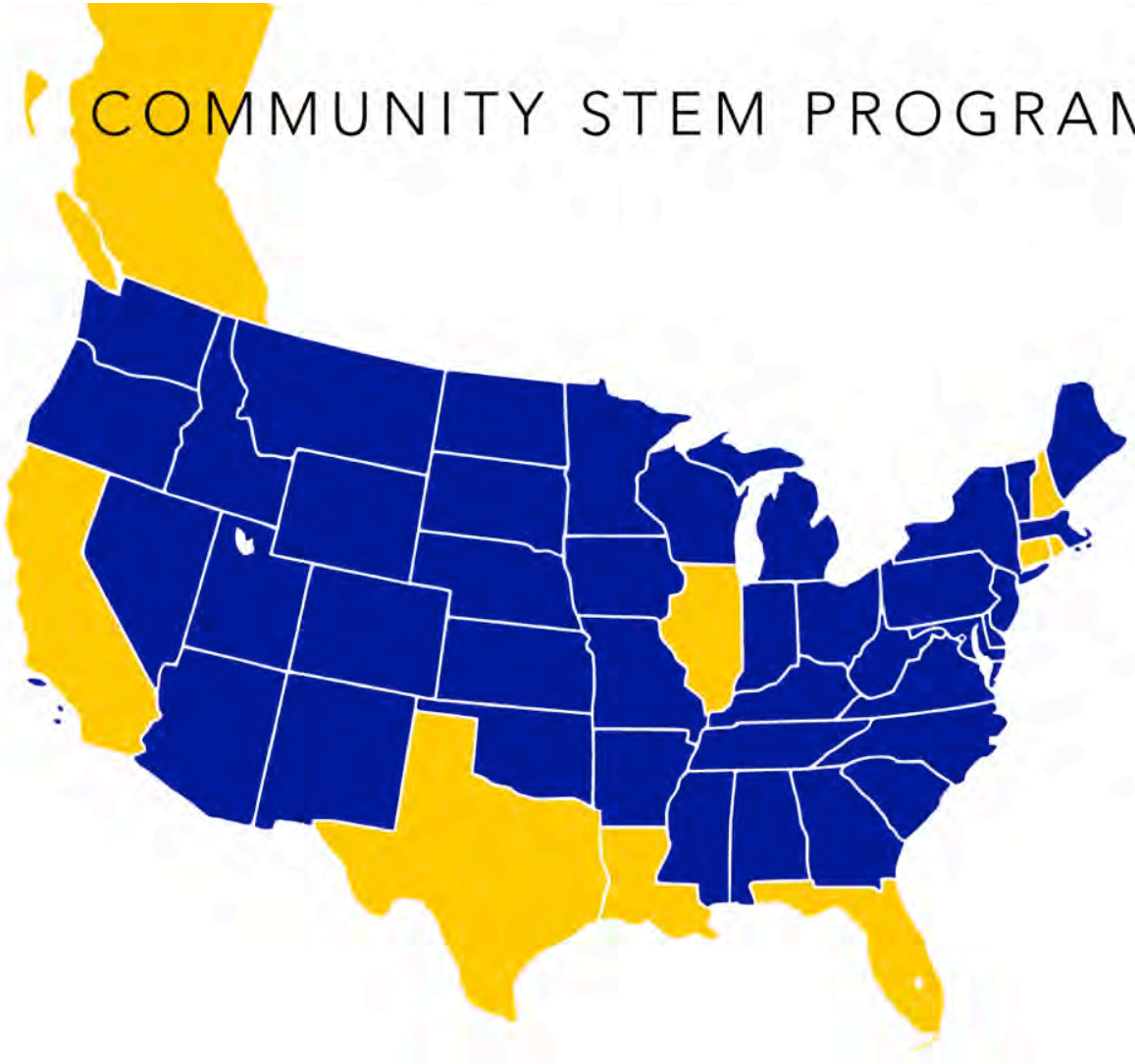
1. Confirmed or reaffirmed career plans
2. Positively influenced career plans
3. Provided professional experience
4. Provided a broader awareness of the interdisciplinary nature of STEM

SCIENCE COMMUNICATION FELLOWSHIP

SCF Evaluation | Professional Confidence



COMMUNITY STEM PROGRAM



SPONSORS/PARTNERS

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CITGO
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Dominion
Ballard Exploration
University of New Hampshire
UC Santa Barbara
Ocean Networks Canada
Florida Panthers Foundation
Lyda Hill Foundation
Phil Stephenson Foundation

2016 & BEYOND

- Wintering over in Canada as guest of Victoria, BC and Ocean Networks Canada while discussing 2016/17 plans to winter over in San Pedro, CA at AltaSea.
- Begin Fabrication of new Command Center with donations from private individuals and ALCOA. Begin wiring installations between new Command Center and the recently renovated Data Lab and Rack Room.
- Work to expand Applied Exploration Program
- Expand scope and reach of OET STEM programs from 11 communities to 20
- Third "60-Minute" program with CBS News
- Explore use of E/V Nautilus in off-season to conduct multi beam operations as well as a dive platform