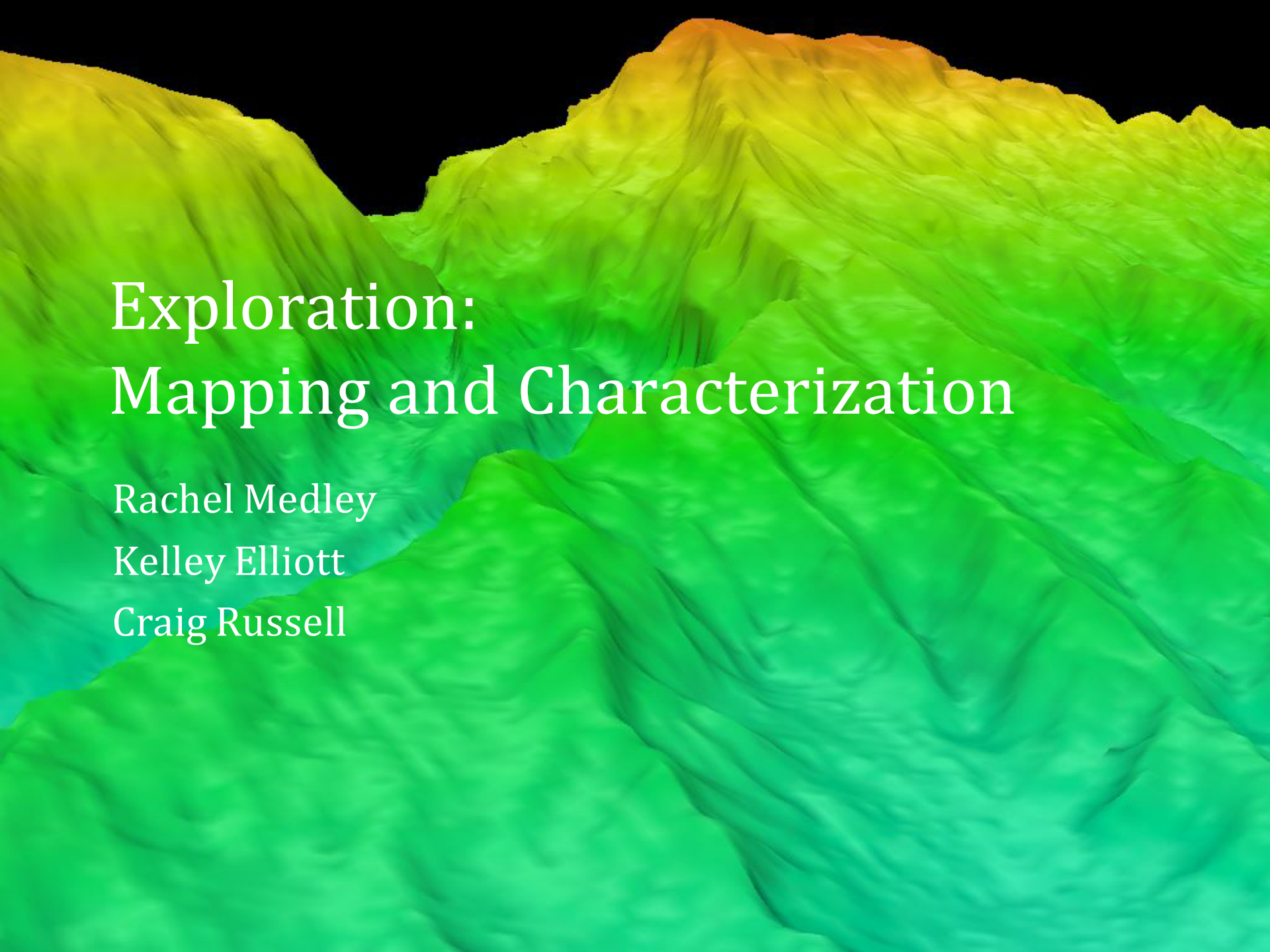
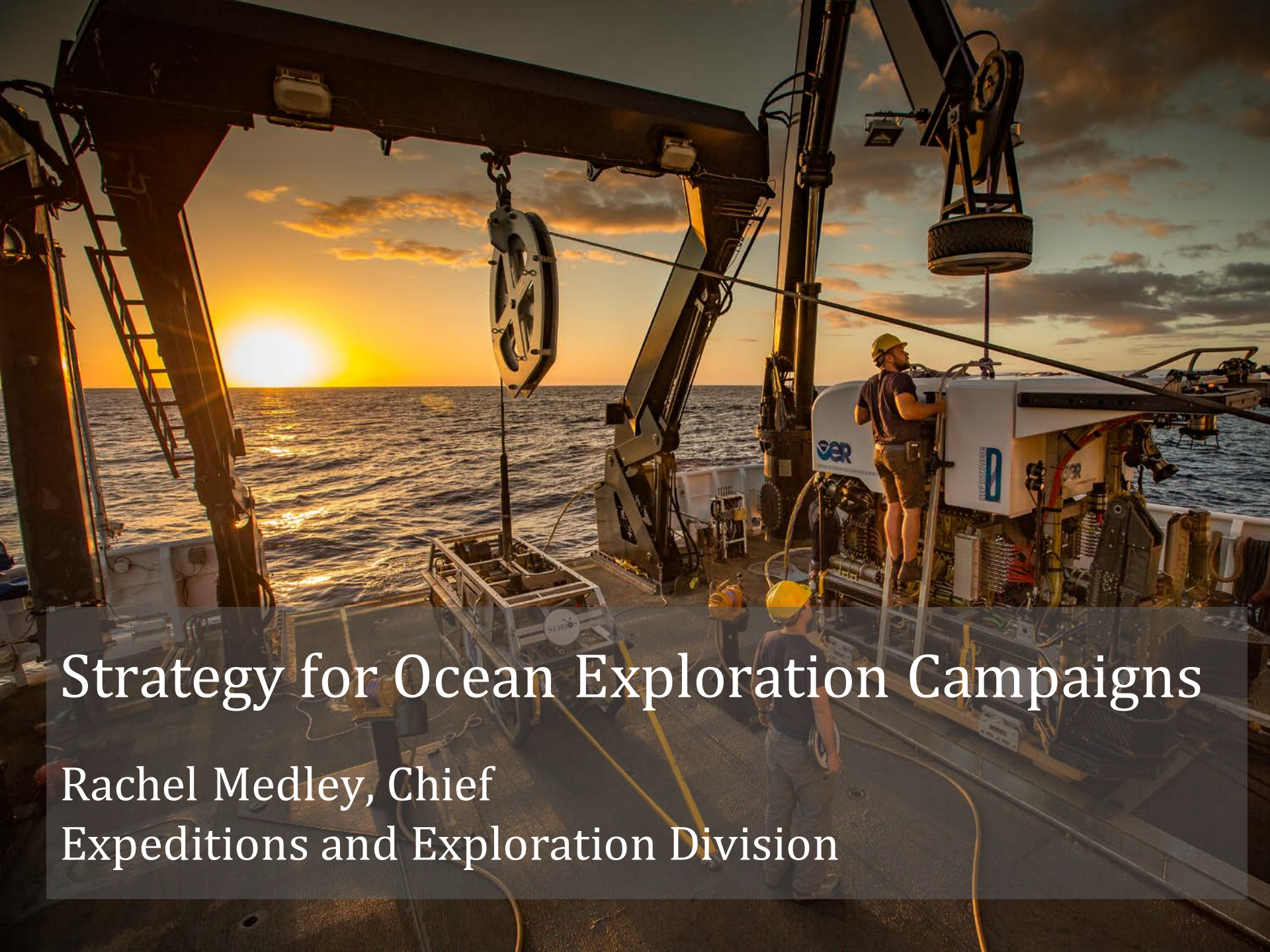


Exploration: Mapping and Characterization

Rachel Medley

Kelley Elliott

Craig Russell



Strategy for Ocean Exploration Campaigns

Rachel Medley, Chief
Expeditions and Exploration Division

Executing on Our Vision: Exploration Campaigns

A series of expeditions over multiple years to a geographic area or theme of **exploration priority** interest

Complementary expeditions using a wide variety of **platforms**, **technologies**, and strategies

Package of **data and information sharing** across platforms serves as foundation of environmental intelligence

Robust **engagement** in education and outreach efforts are integral activities

Partners focus messaging on the breadth of work

ACUMEN

Atlantic Canyons Undersea Mapping Expeditions

Ocean Exploration and Research

CAPSTONE

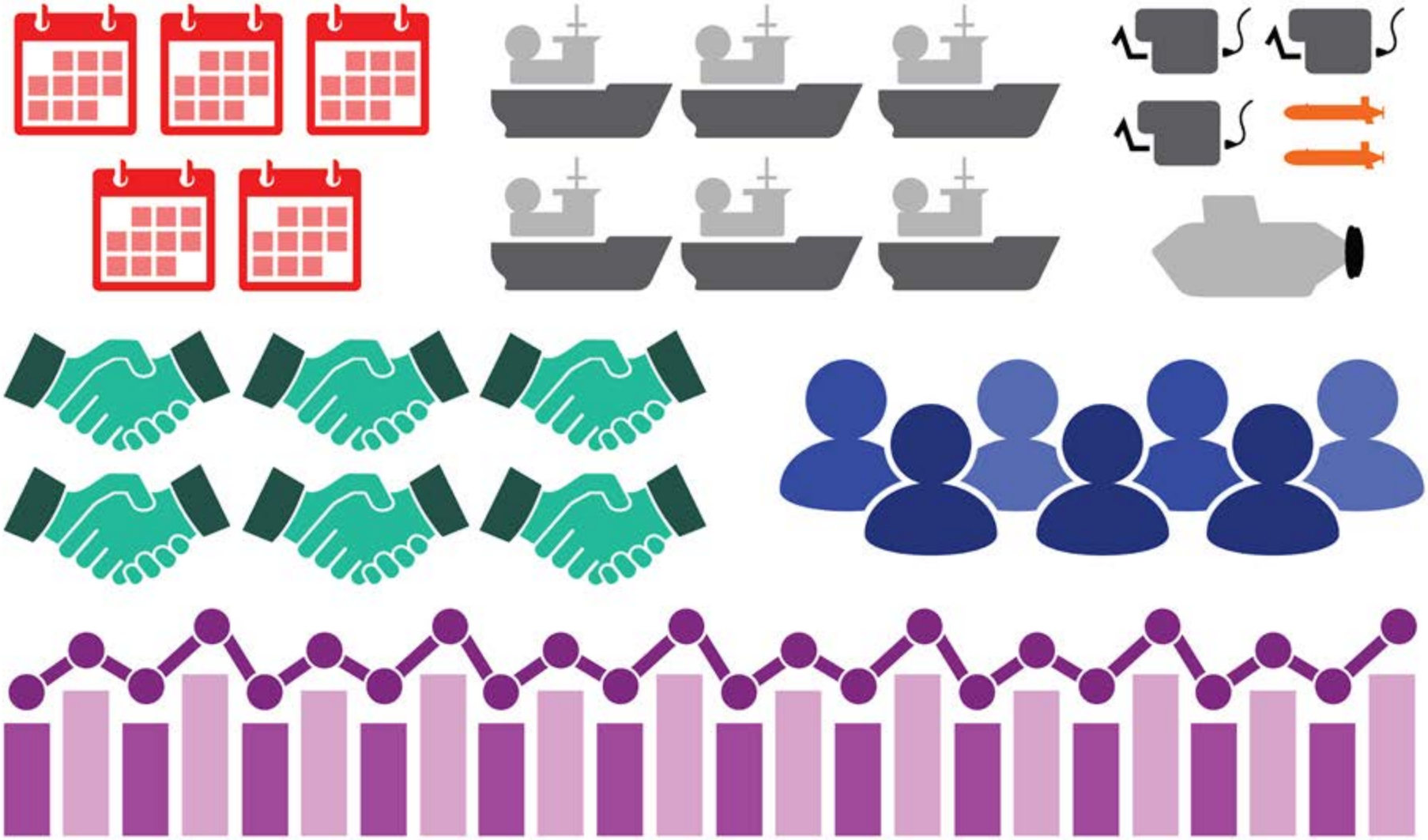
Campaign to Address Pacific Monument Science, Technology, and Ocean Needs

Ocean Exploration and Research

ASPIRE

Ocean Exploration and Research

Atlantic Seafloor Partnership for Integrated Research and Exploration



Nested Approach to Expedition Planning

CAMPAIGN

The highest level is development of a Campaign in an operating region or basin focused on themes, agreements, or interests of key partners that connect multiple expeditions and platforms in support of common goals

COMMUNITY WORKSHOP

Conduct a community workshop to identify exploration priorities, themes, and partners in a region.

CALL FOR INPUT

A "Call for Input" to solicit general mapping, CTD, and ROV dive targets in the operating area from the science and management community.

+

CONSULTATIONS

Expeditions require the Expedition Manager to identify and consult with key partners in the region to understand their priorities, data needs, and interests.

EXPEDITION PARTICIPATION

Any interested scientist, student, or manager with a relevant expertise is invited to join the expedition science and participate in the cruise and cruise planning meetings.

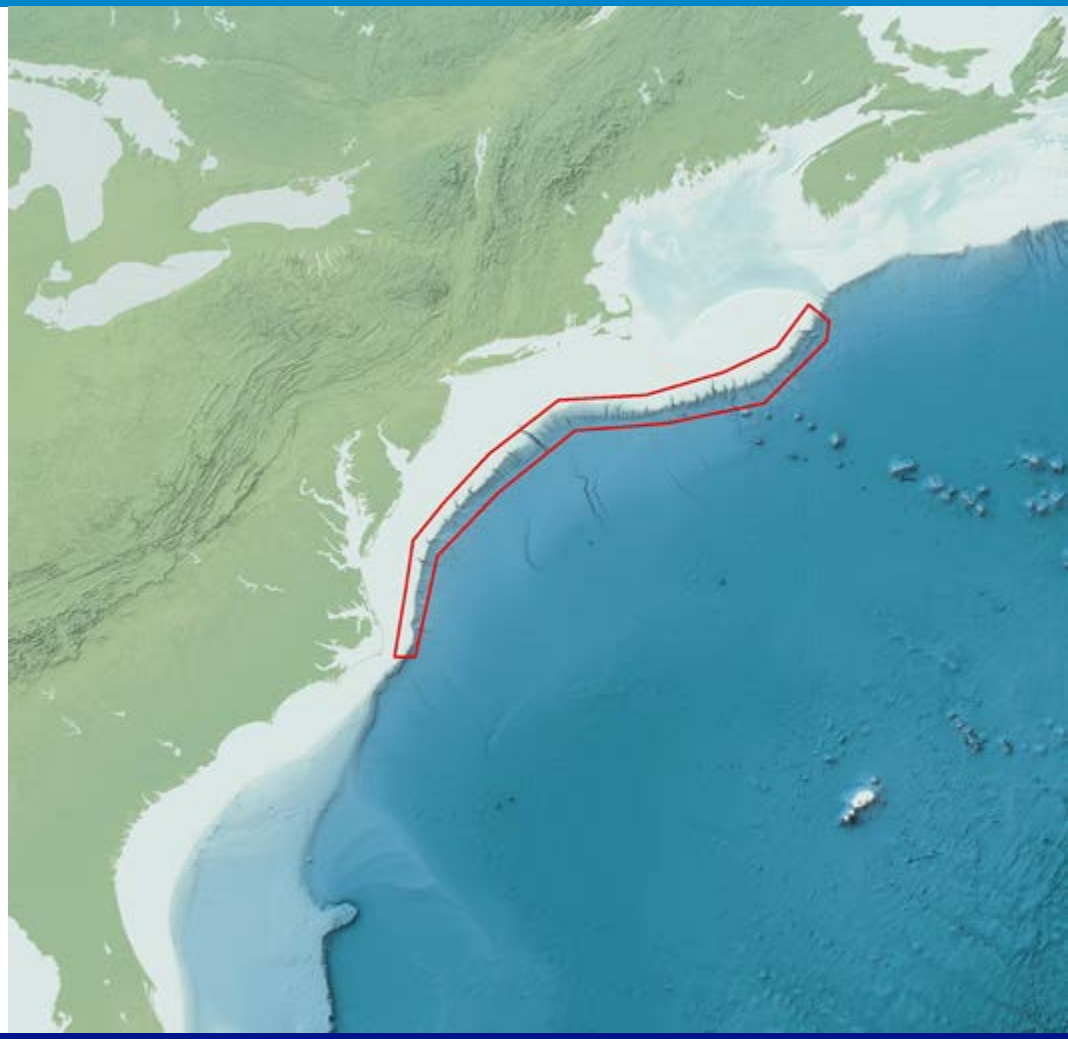
ACUMEN - Results

Atlantic Canyons Undersea Mapping Expeditions

- Mapped canyons from North Carolina to Maine
- Discovered each canyon is a different environment with distinct characteristics
- Revealed 570+ methane seeps along the U.S. East Coast
- Routine transit line bathy acquisition provided a model for data acquisition

13 cruises

45,530 km^2 mapped



CAPSTONE - Results

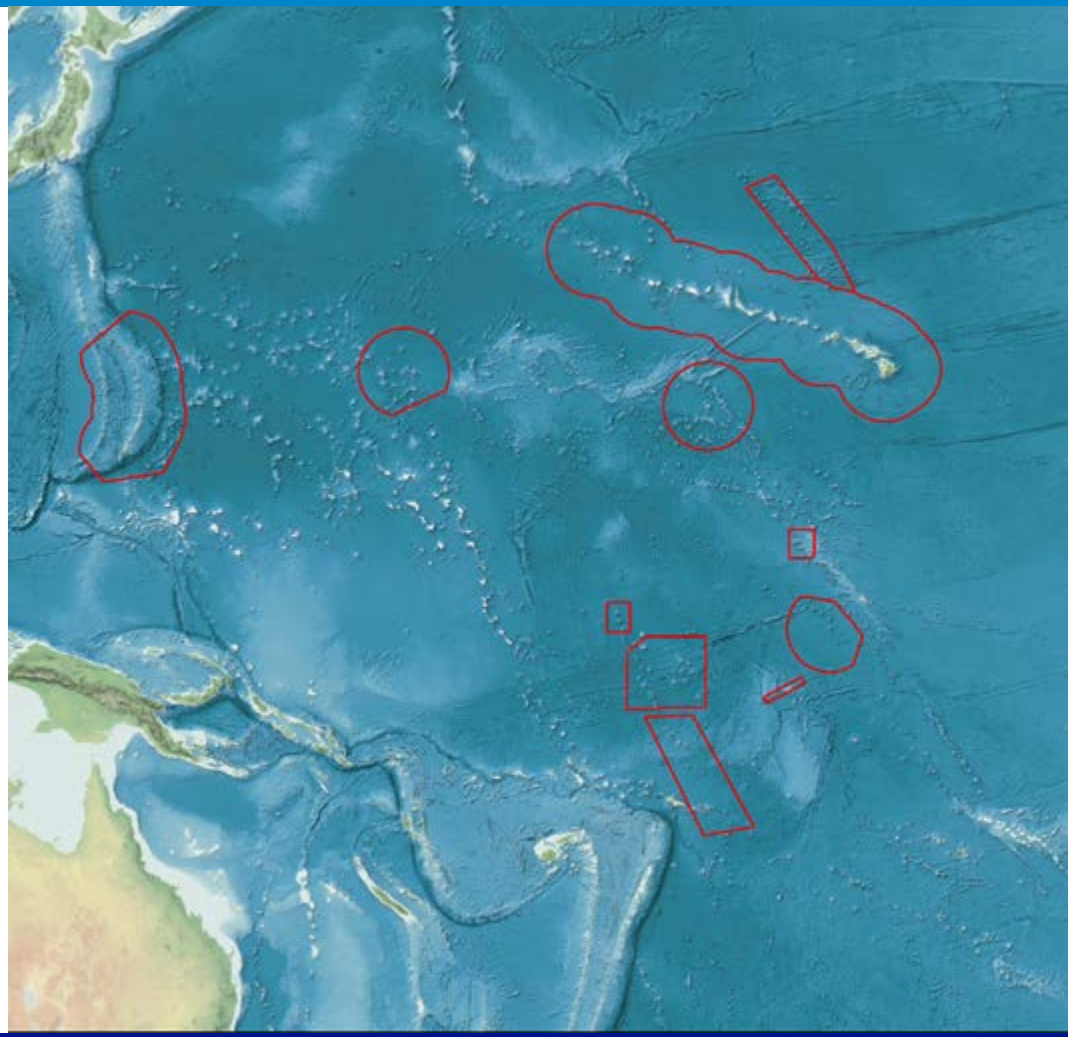
Campaign to Address Pacific monument Science, Technology, and Ocean NEeds

- Exponentially increased understanding of deep sea corals e.g. abundance & distribution
- New lines of scientific inquiry surrounding biogeographic patterns throughout the Pacific
- Discovered dozens of new species
- E/V *Nautilus* now building on initial CAPSTONE expeditions

23 cruises

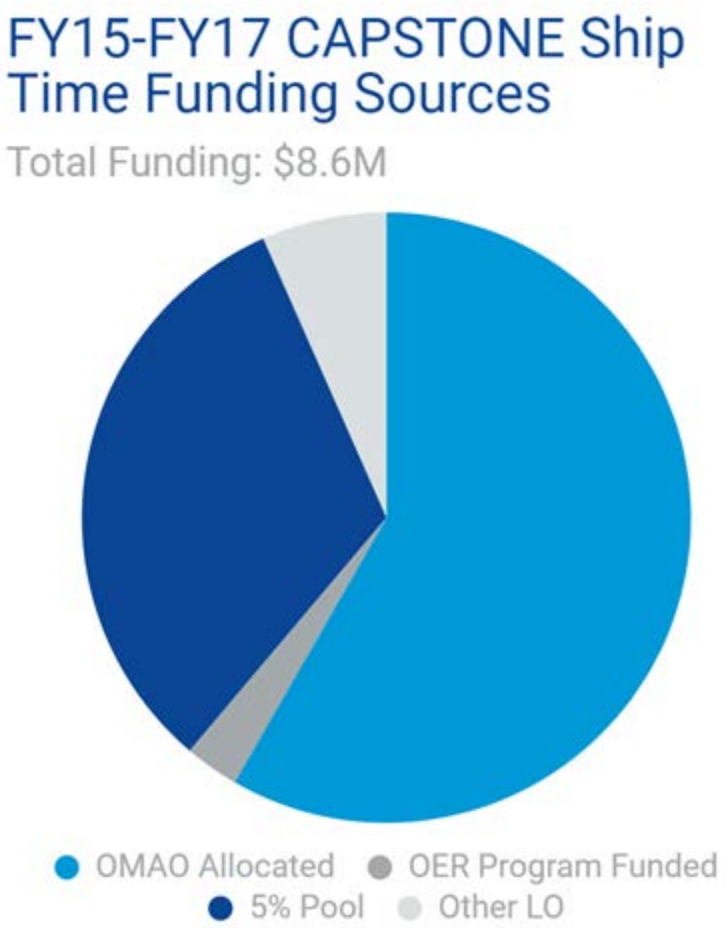
597,230 km^2 mapped

187 vehicle dives



CAPSTONE: Capitalizing on Cross-NOAA Partnerships

- CAPSTONE was the first time NOAA line offices recognized value of ocean exploration in terms of "hard currency:" DAS
- Capitalized on NOAA corporate 5% pool for cross-NOAA projects
- Leveraged variety of mechanisms for DAS needed over three years



Community-based Exploration Priorities

NOAA Ocean Exploration
NOAA Office of Ocean Exploration and Research admin
seasketch
Caitlin Adams

Data Layers | My Plans | Participate

Surveys / Okeanos Explorer 2017 Johnston Atoll & ...

Edit Intro

2017 *Okeanos Explorer* Central Pacific Exploration: Johnston Atoll & Musicians Seamounts

2017 is the third and final year of NOAA's Campaign to Address the Pacific monument Science, Technology, and Ocean NEeds (CAPSTONE) - a major multi-year foundational science effort focused on deepwater areas of U.S marine protected areas in the central and western Pacific. NOAA conducts telepresence-enabled mapping and remotely operated vehicle (ROV) operations in poorly known ocean areas with NOAA Ship *Okeanos Explorer* to support deepwater habitat characterization and spur follow-on investigations.

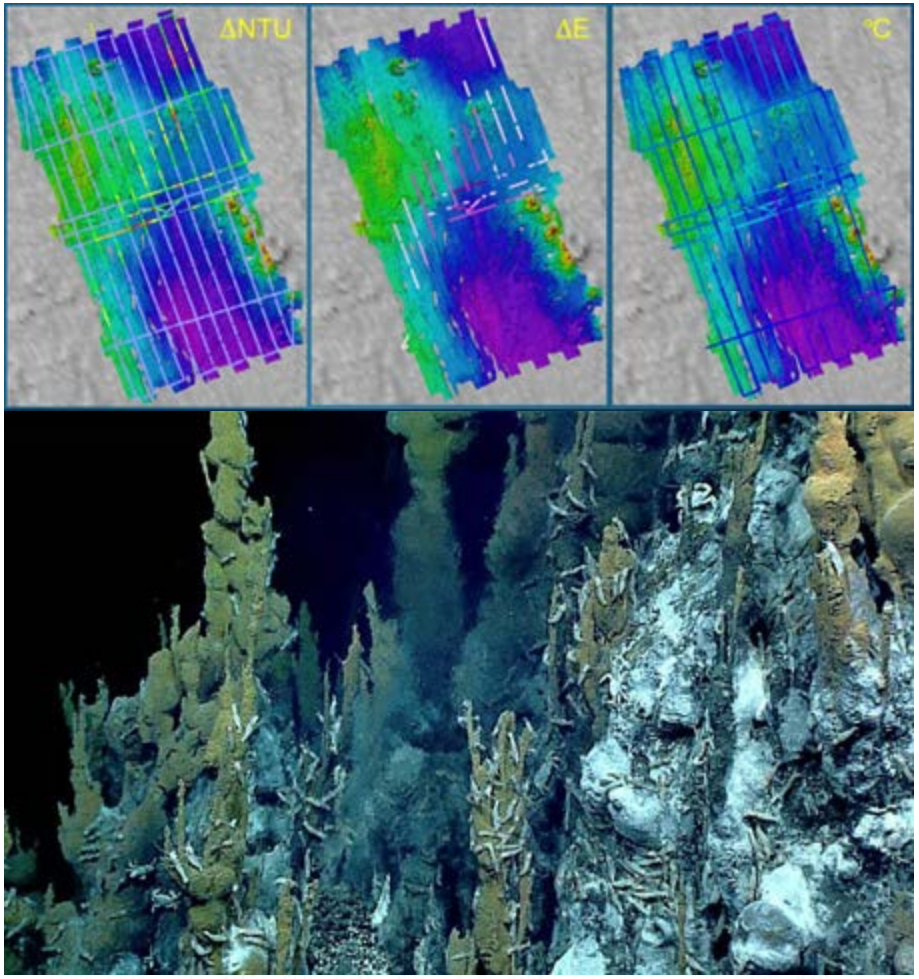
On behalf of NOAA, OER invites members of the ocean science and management community to submit areas and sites for deepwater acoustic seafloor mapping and remotely operated vehicle (ROV) investigation within our summer 2017 operating area. The information received will be used to refine our cruise tracks, and a selection of these targets and areas will be explored during upcoming expeditions. In summer 2017, NOAA intends to investigate and document the diversity and distribution of deep-water environments in and around:

- The Johnston Atoll unit of the Pacific Remote Islands Marine National Monument,
- The Musicians Seamounts north of the Hawaiian archipelago; and
- U.S. and high seas locations crossed during transits to and from specified operating areas and Honolulu, Hawaii.

Pacific Ocean
Pacific Ocean

Esri, HERE, Garmin, NGA, USGS | Powered by Esri and SeaSketch

Collaborating beyond *Okeanos Explorer*



- Leveraged across platforms and projects: NSF, ECS, Falkor, PMEL, HURL, and OER grant funded scientists
- Leveraged data to complement operations
- Collaboratively planned expeditions across deep ocean community capitalizing on concurrent or near-concurrent expeditions on multiple platforms

ASPIRE Outcomes to date

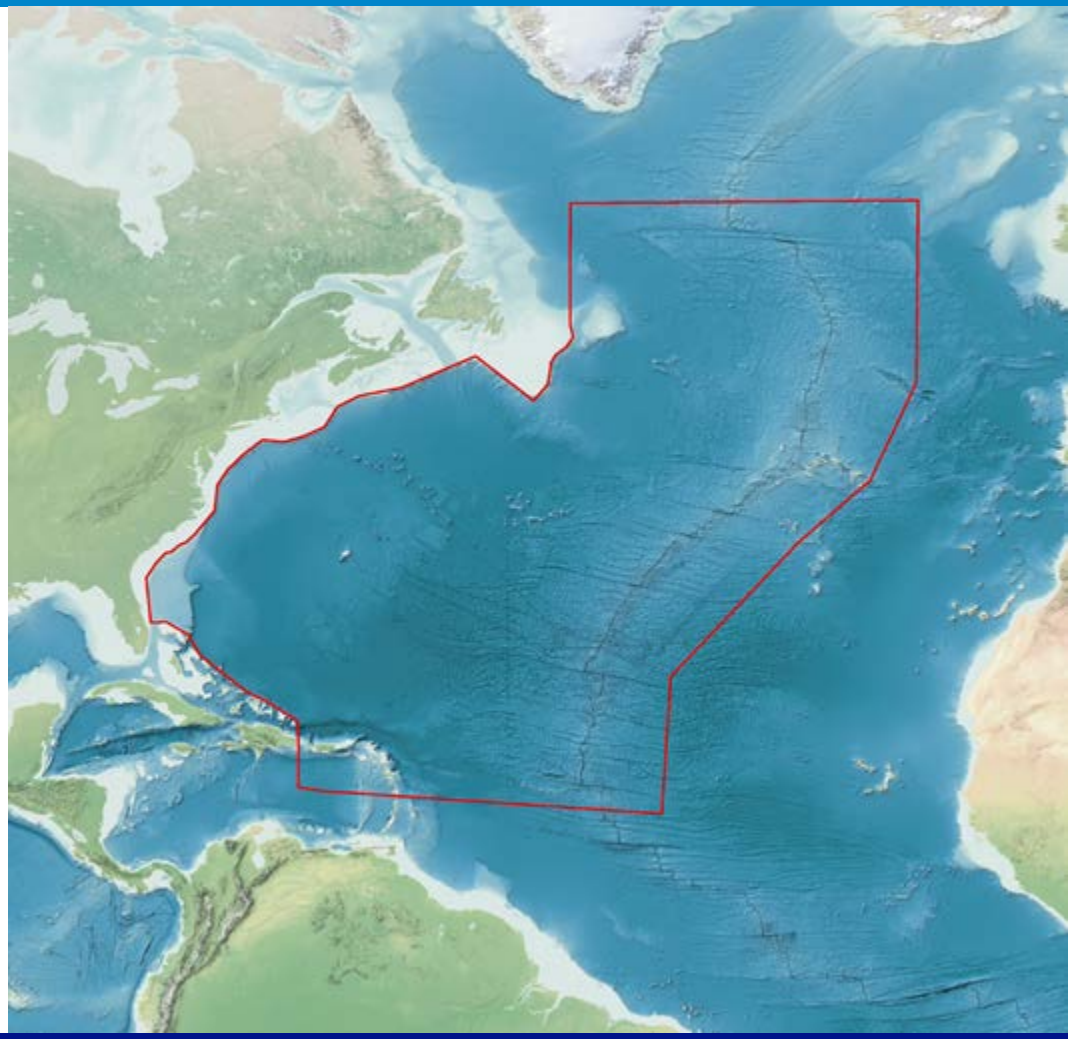
Atlantic Seafloor Partnership for Integrated Research and Exploration

- Extensive, previously unknown, deep sea coral habitats identified and characterized
- First U.S. government-led, focused mapping survey in support of the Atlantic Seabed Mapping International Working Group (ASMIWG)
- Significant contributions to mapping bathy gaps of US East Coast EEZ >200m

20 cruises

244,000+ km^2 mapped

122 vehicle dives



ASPIRE EXPEDITIONS

Mid-Atlantic Ridge ROV and Mapping
Summer 2020
NOAA OER, NOAA Ship *Okeanos Explorer*

Northern Neighbors: Transboundary Exploration of Deepwater Communities
June 2017, June 2019
NOAA NMFS/Dalhousie University, NOAA Ship *Henry B. Bigelow*

US-Canada ROV and Mapping
Summer 2019
NOAA OER/ONMS, NOAA Ship *Okeanos Explorer*

Mid-Atlantic Ridge Mapping
Summer 2020
NOAA OER, NOAA Ship *Okeanos Explorer*

Northeast US Tech Demonstration
July 2019
NOAA OER, NOAA Ship *Okeanos Explorer*

Canada Mapping
Summer 2020
NOAA OER, NOAA Ship *Okeanos Explorer*

Carolina Canyons
August 2016, August 2017
NOAA NMFS, NOAA Ship *Pisces*

Mid-Atlantic Ridge ROV and Mapping
Summer 2020
NOAA OER, NOAA Ship *Okeanos Explorer*

Southeast US ROV and Mapping
Fall 2019
NOAA OER/OCS, NOAA Ship *Okeanos Explorer*

DEEP SEARCH
2017-2019
BOEM/USGS/NOAA, Multiple Platforms

US Southeast and Bahama Ridge Mapping
October 2018
NOAA OER/OCS, NOAA Ship *Okeanos Explorer*

Blake Plateau Mapping
Spring 2020
NOAA OER, NOAA Ship *Okeanos Explorer*

ASMIWG Pilot Area Mapping
July 2018
NOAA OER, NOAA Ship *Okeanos Explorer*

Southeast US ROV and Mapping
Summer 2018, Spring 2019
NOAA OER/NMFS/ONMS, NOAA Ship *Okeanos Explorer*

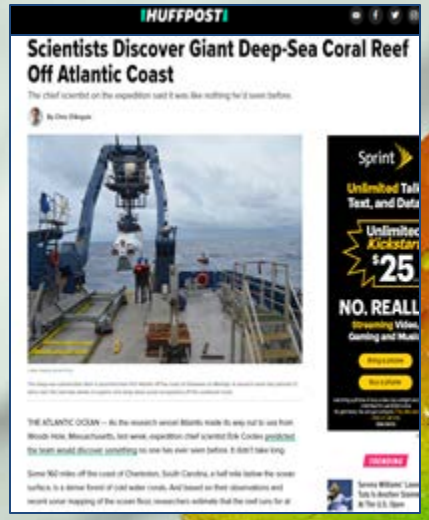
US Caribbean ROV and Mapping
Fall 2018
NOAA OER/OCS, NOAA Ship *Okeanos Explorer*

US Caribbean Tech Demonstration
Spring 2020
NOAA OER/OCS, NOAA Ship *Okeanos Explorer*

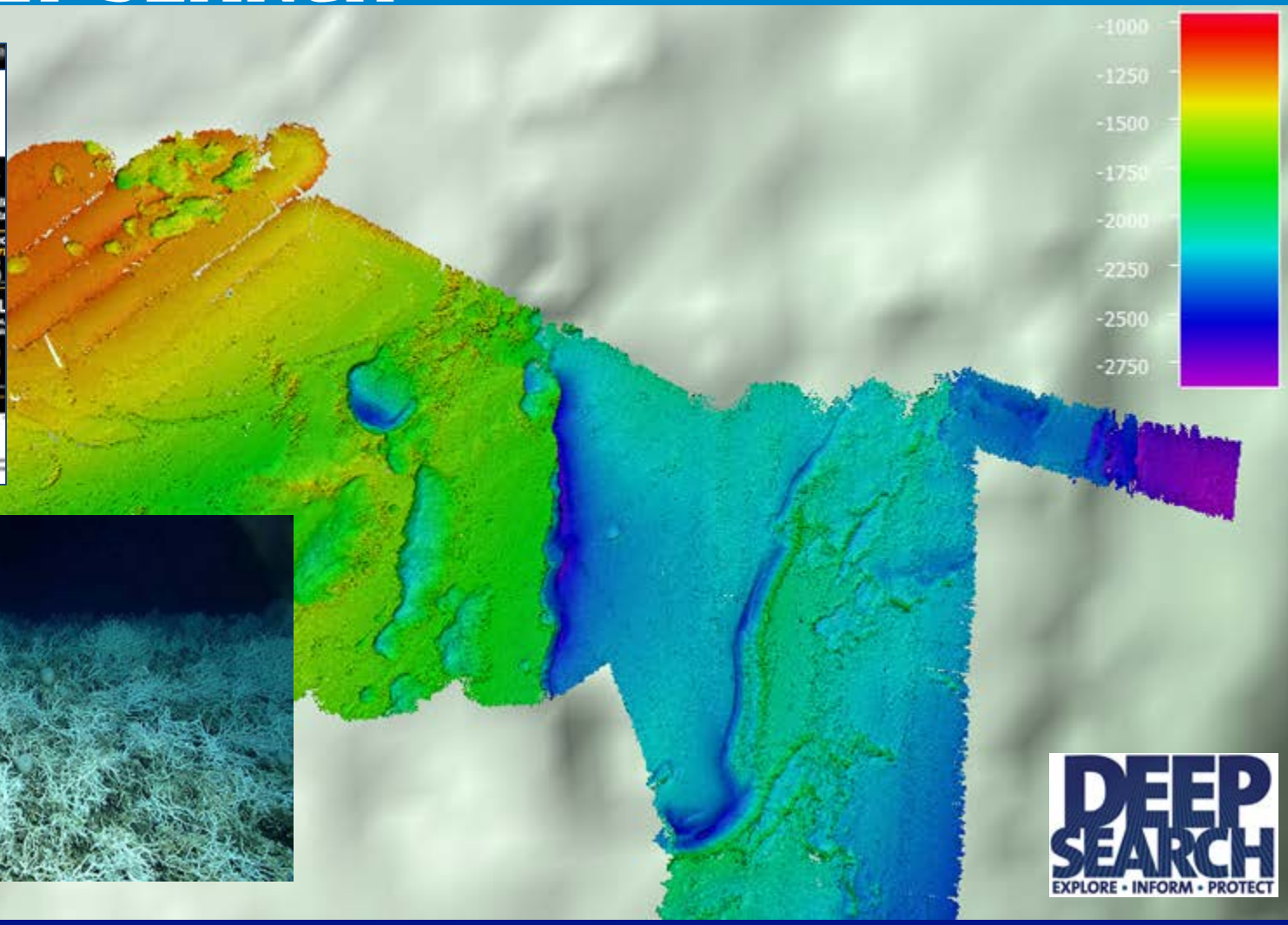
US Caribbean Mapping
Spring 2020
NOAA OER/OCS, NOAA Ship *Okeanos Explorer*

Last updated: October 8, 2019

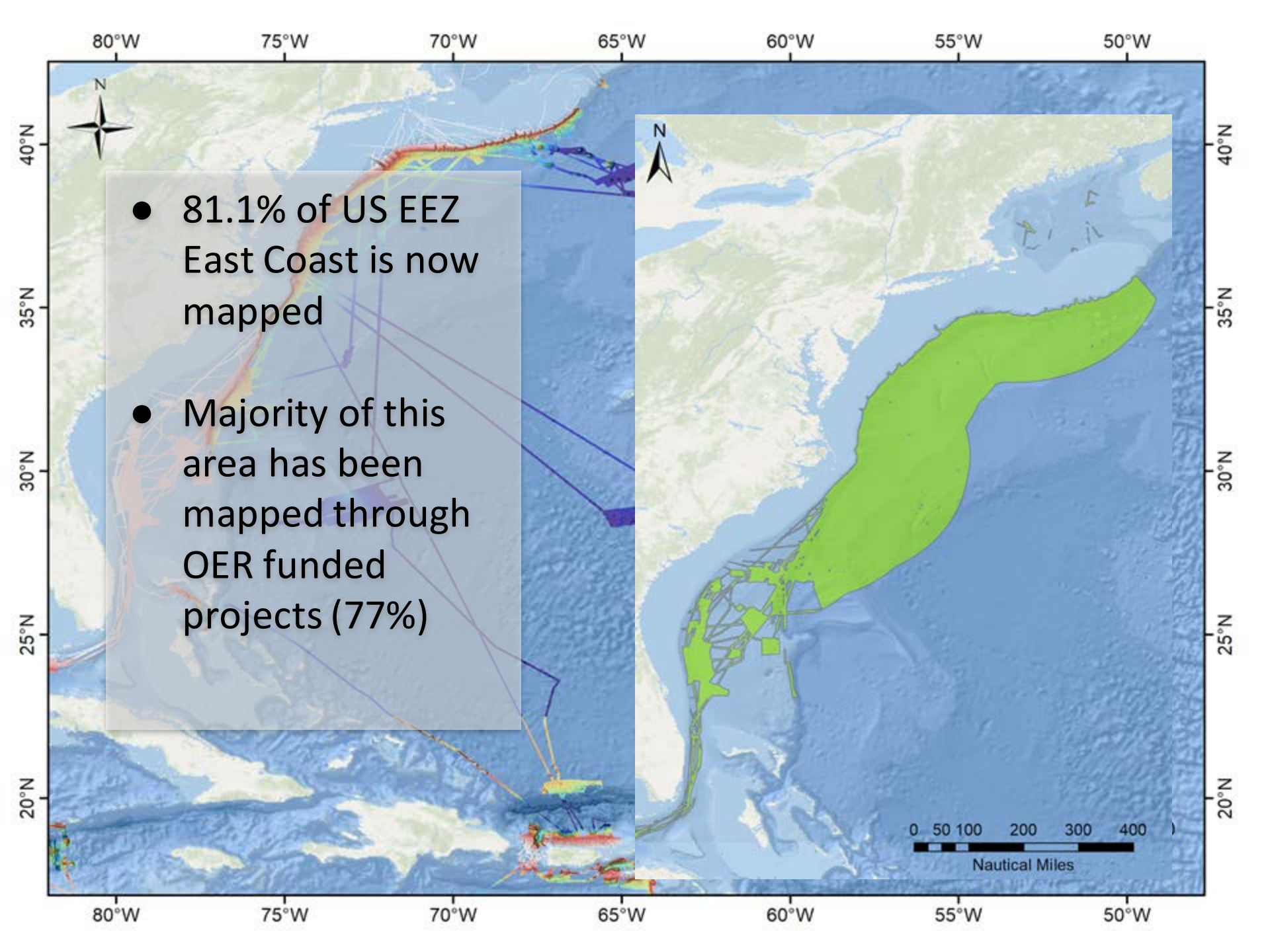
Expanding impacts: *Okeanos Explorer* and DEEP SEARCH


HUFFPOST

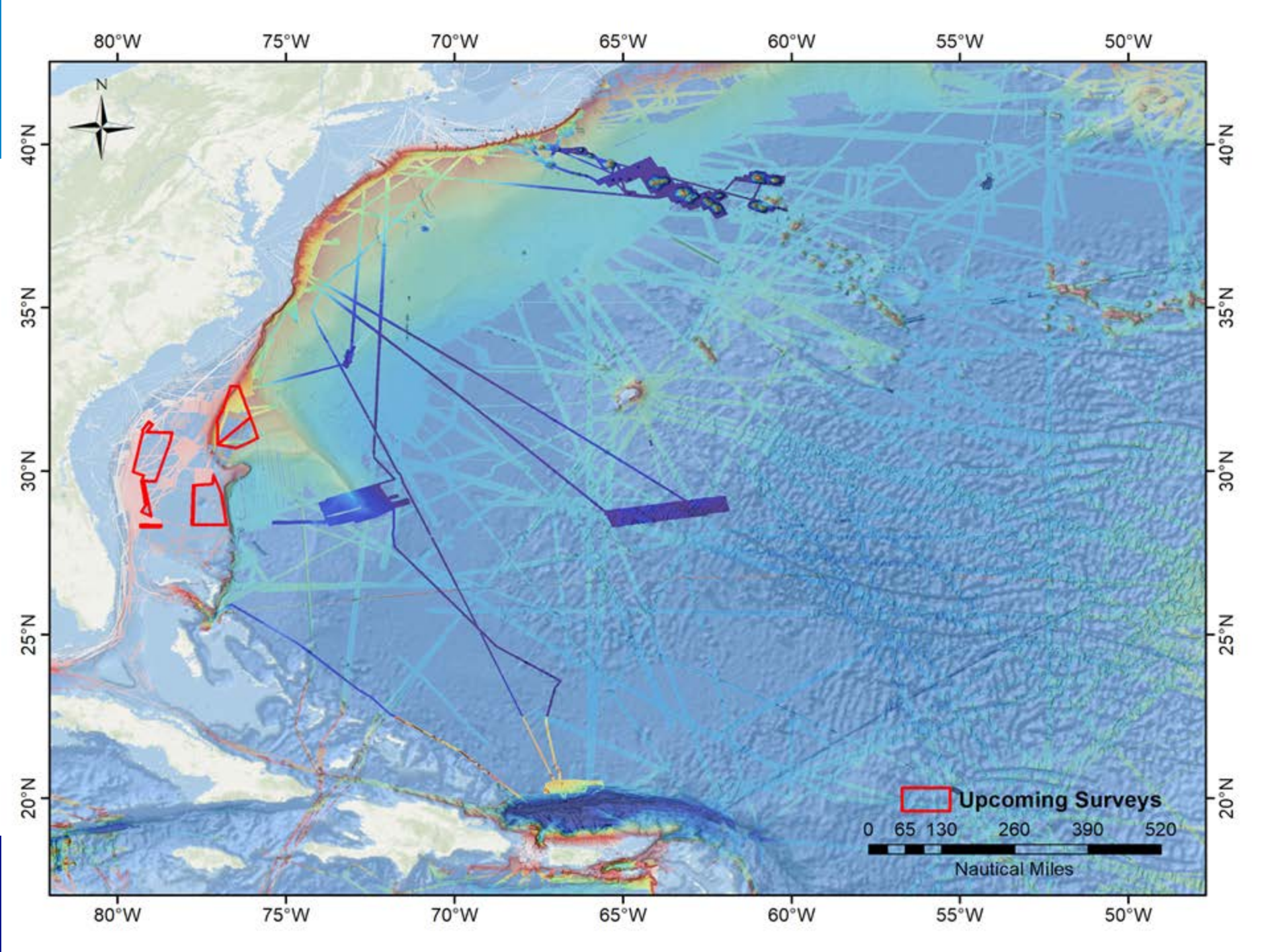
Scientists Discover Giant Deep-Sea Coral Reef Off Atlantic Coast



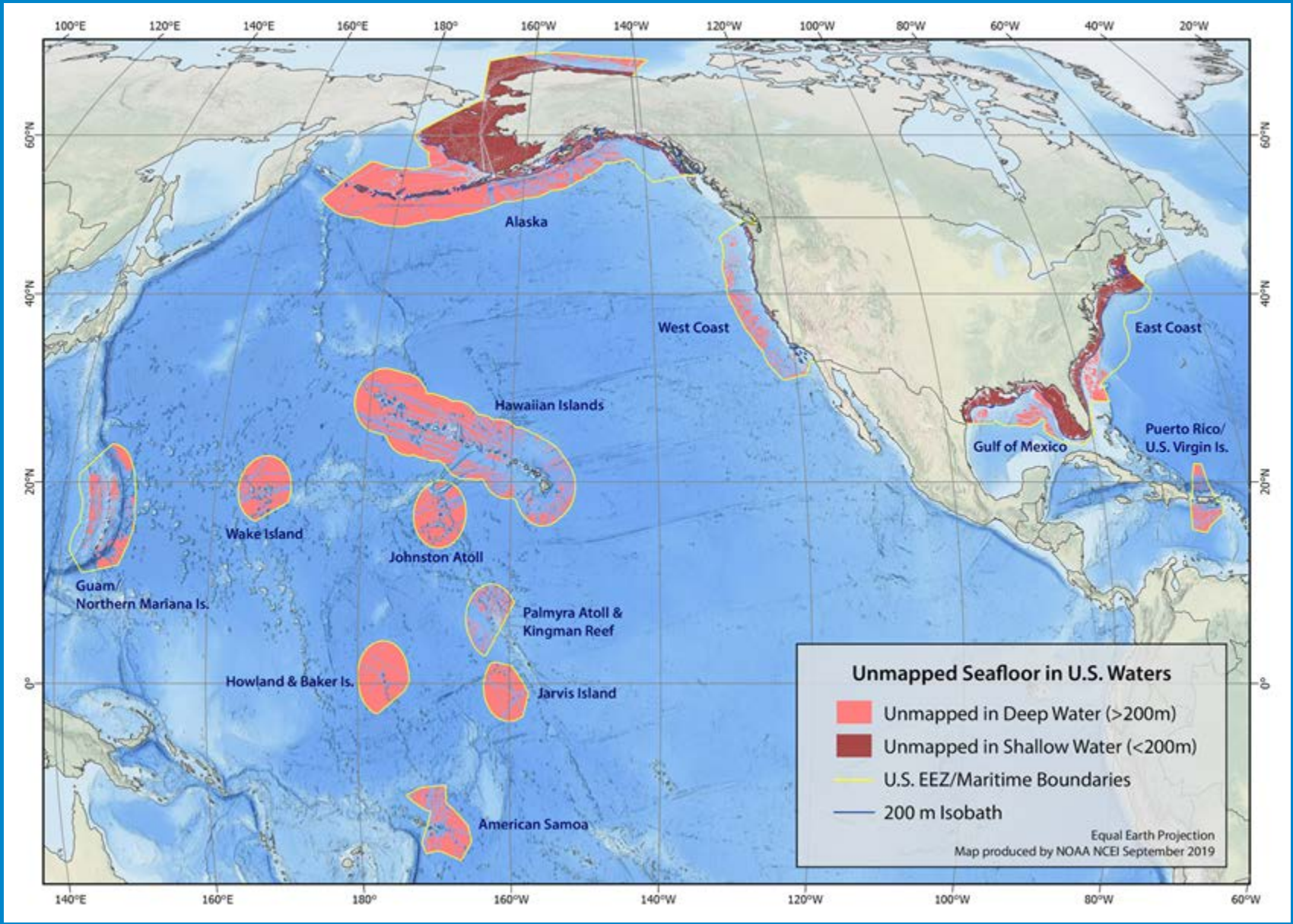
DEEP SEARCH
EXPLORE • INFORM • PROTECT



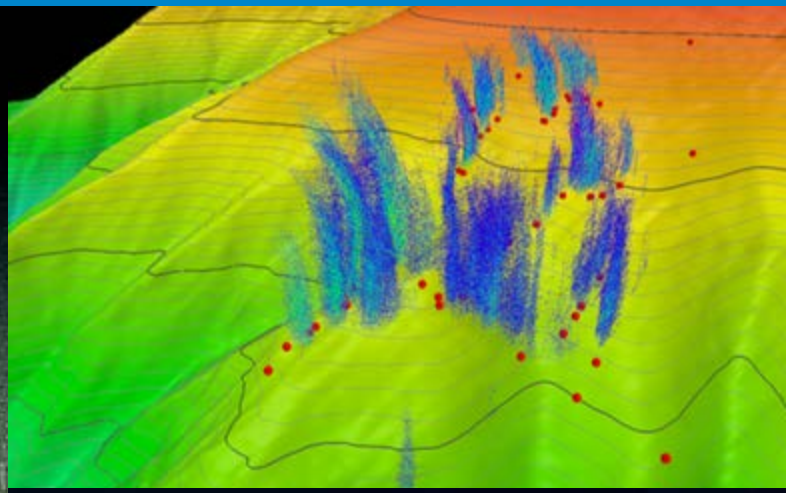
- 81.1% of US EEZ East Coast is now mapped
- Majority of this area has been mapped through OER funded projects (77%)

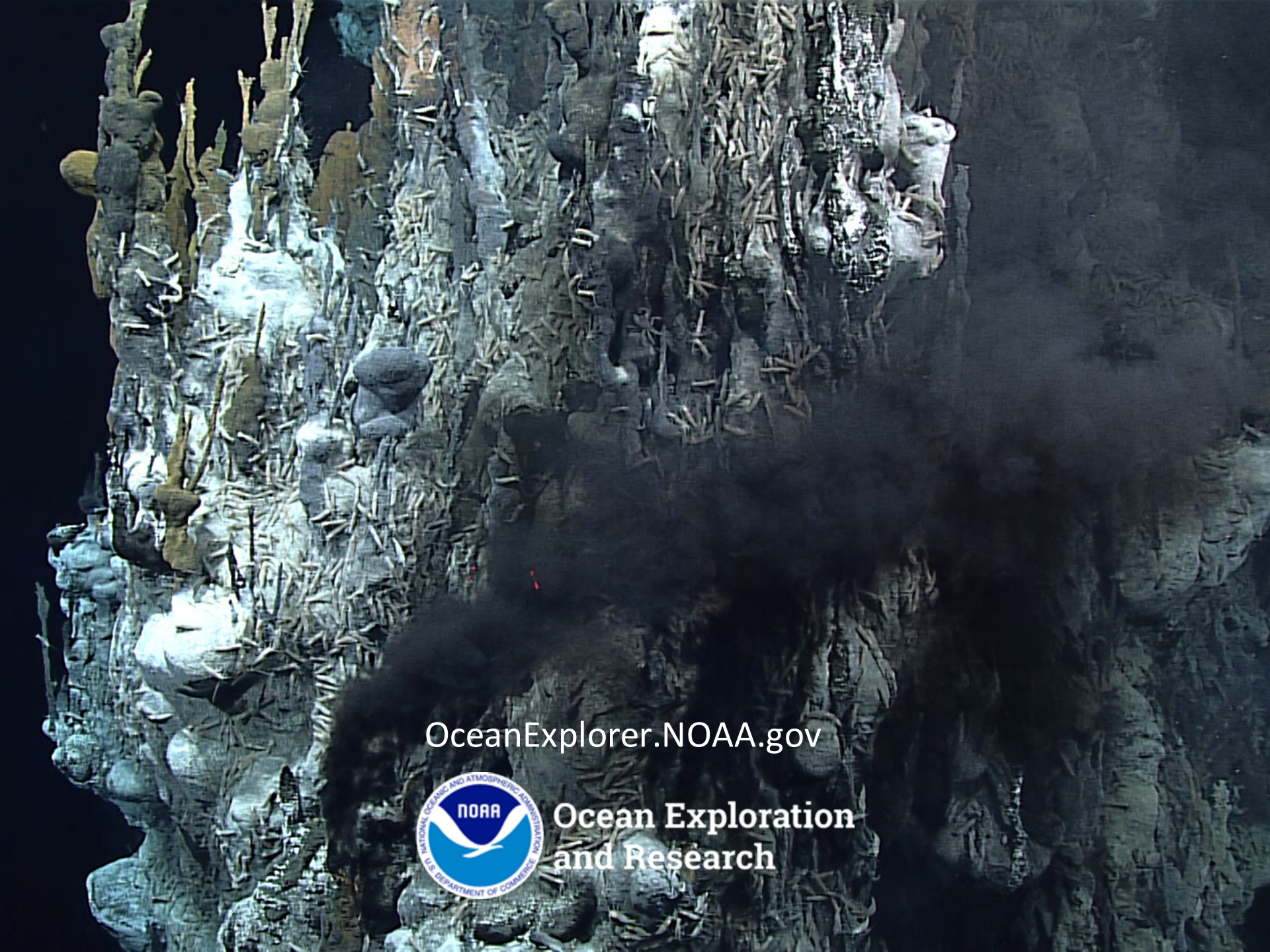

80°W
75°W
70°W
65°W
60°W
55°W
50°W
40°N
35°N
30°N
25°N
20°N
N
Upcoming Surveys
0 65 130 260 390 520
Nautical Miles

Looking to the Future



Campaign Strategies for Decision Support

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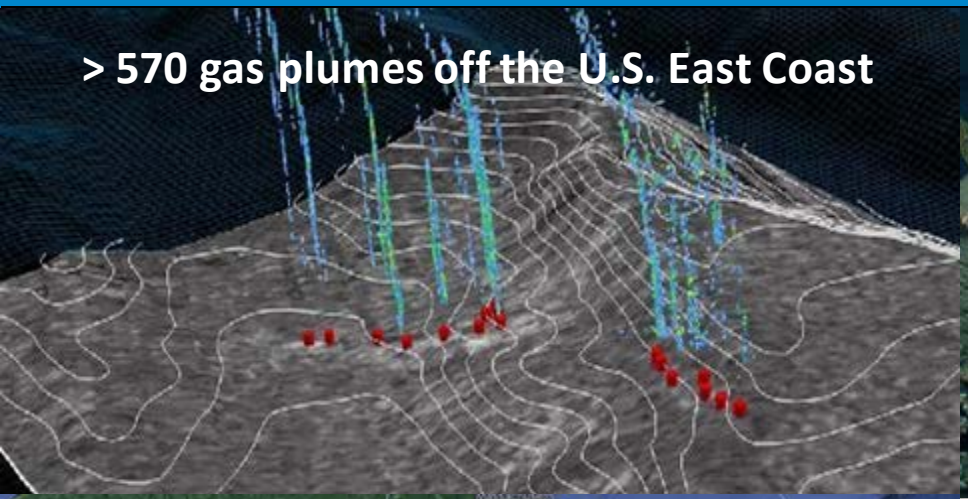
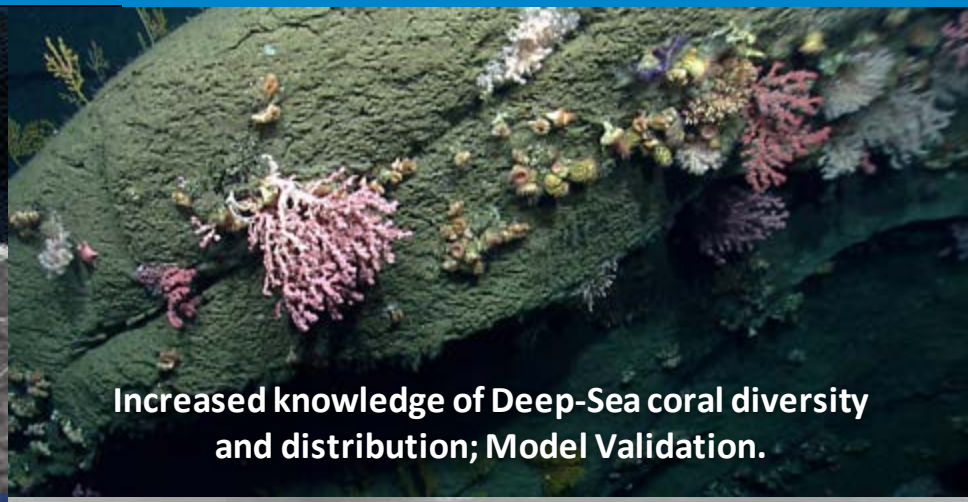
NOAA
Ocean Exploration
and Research

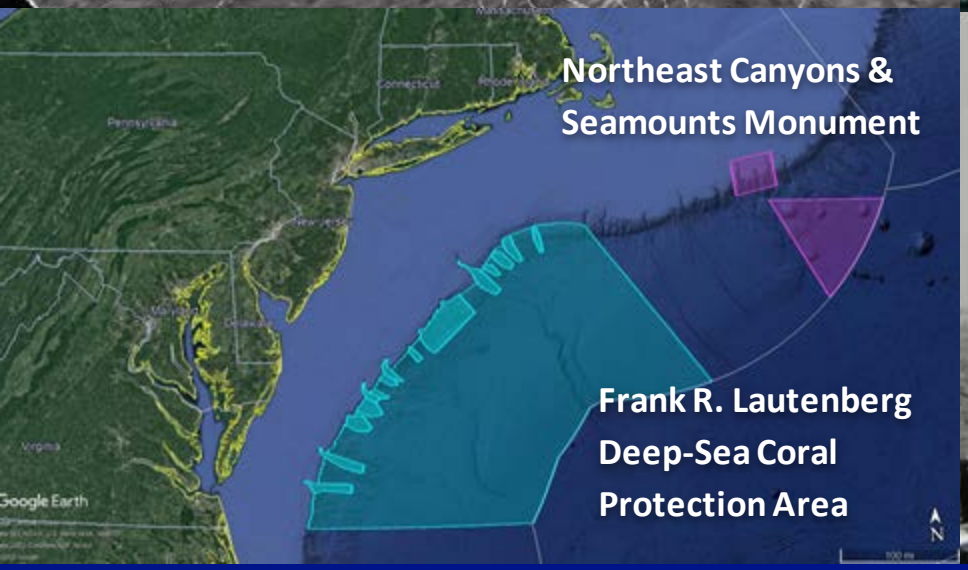
Exploration Results for Management

Kelley Elliott
Expeditions and Exploration Division

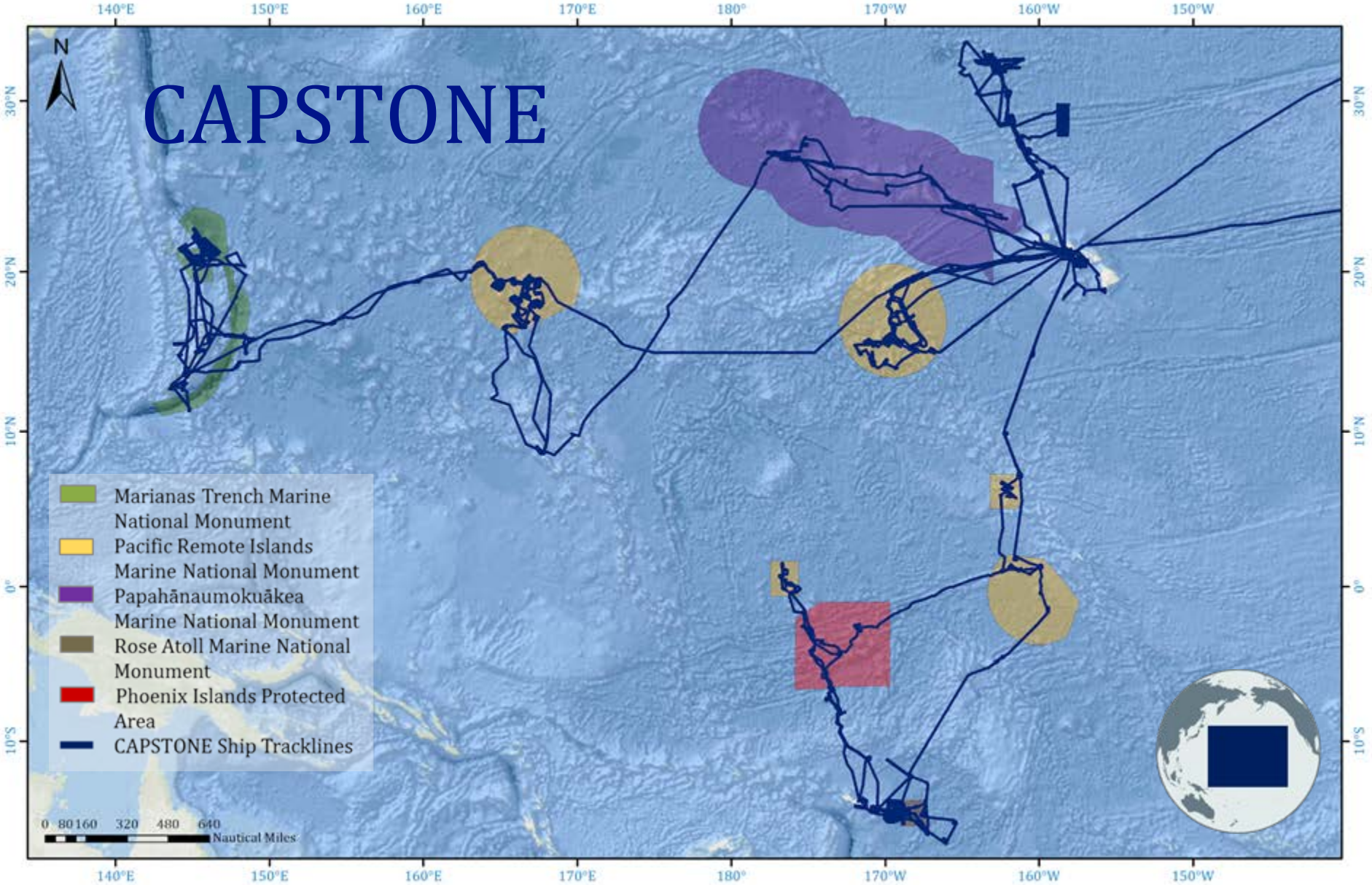
Northeast Canyons Management Highlights



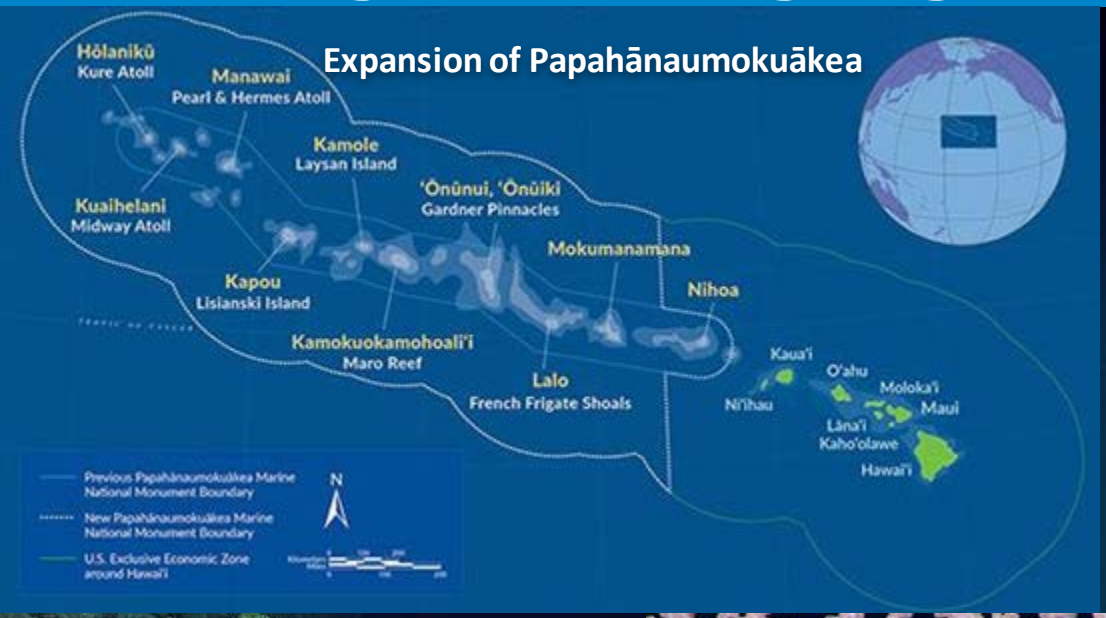


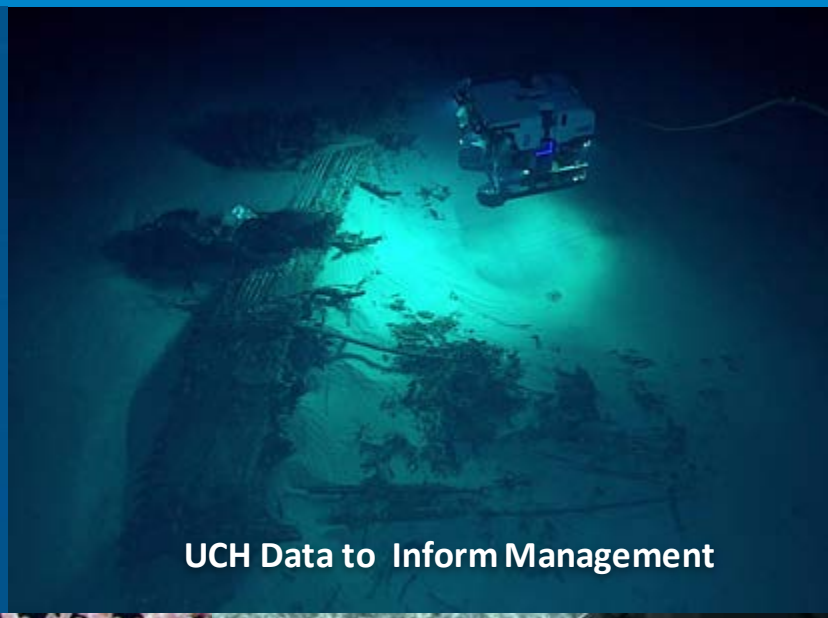


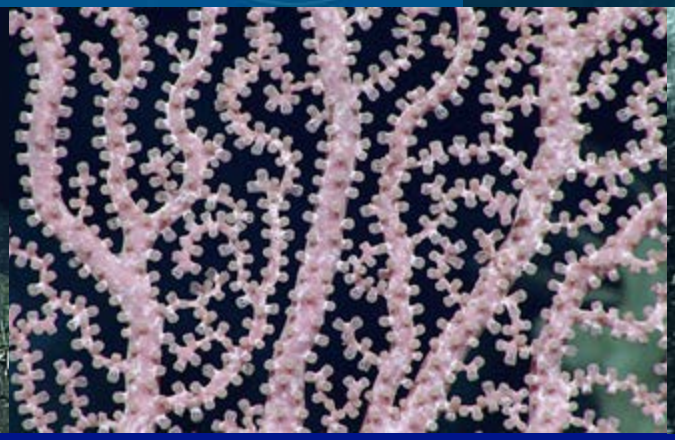
CAPSTONE


N
140°E
150°E
160°E
170°E
180°
170°W
160°W
150°W
30°N
20°N
10°N
0°
10°S
Marianas Trench Marine National Monument
Pacific Remote Islands Marine National Monument
Papahānaumokuākea Marine National Monument
Rose Atoll Marine National Monument
Phoenix Islands Protected Area
CAPSTONE Ship Tracklines
0 80 160 320 480 640
Nautical Miles

CAPSTONE Results: Management Highlights

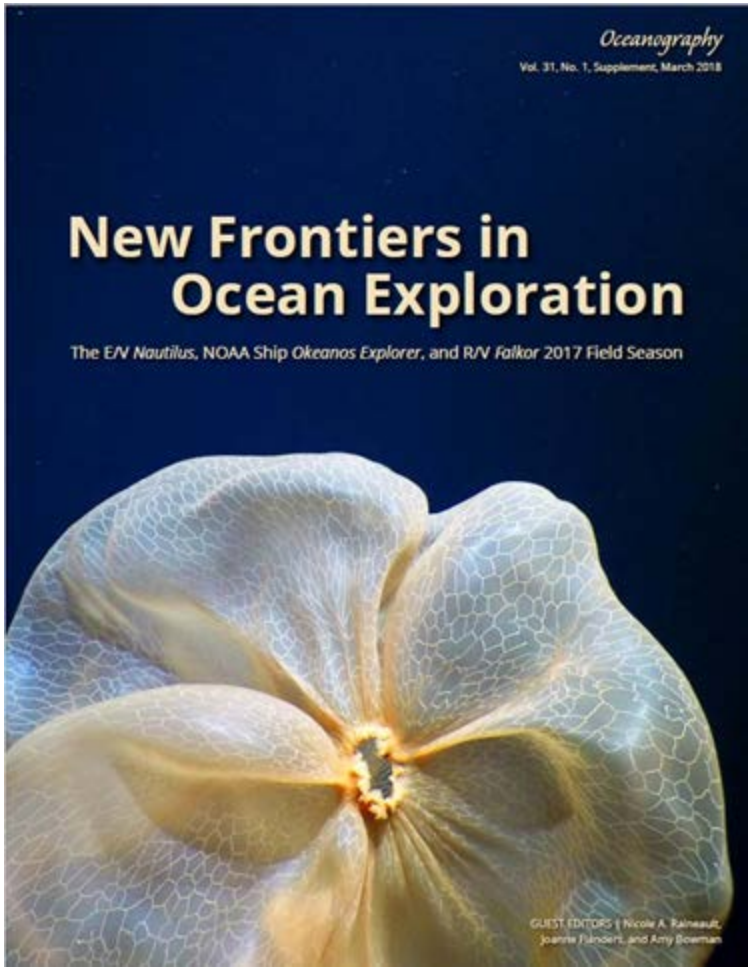




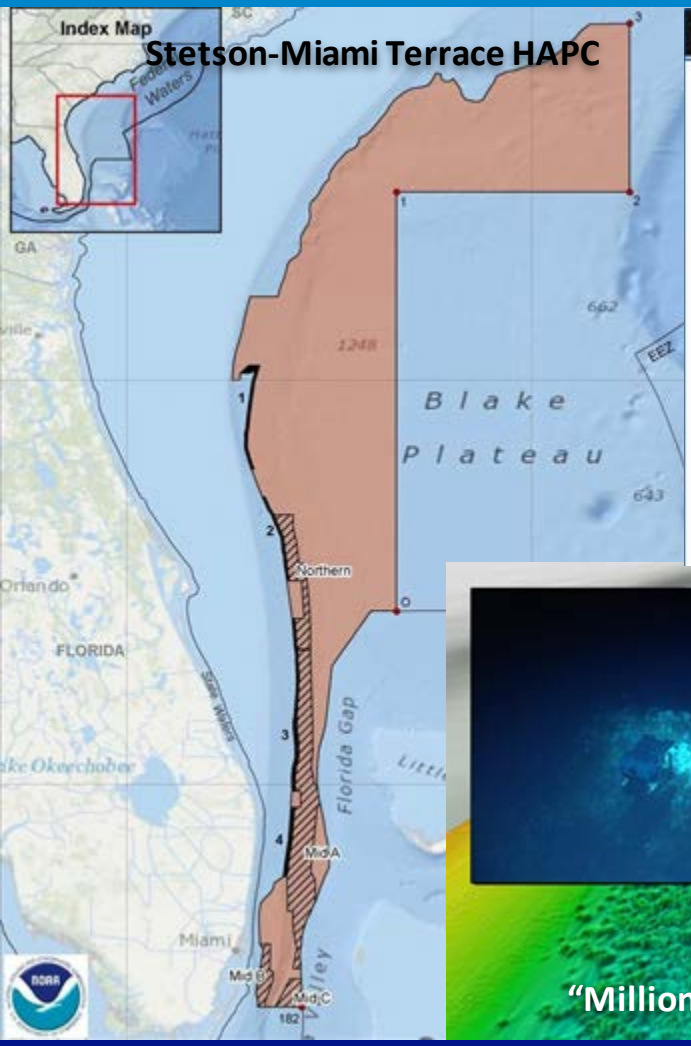


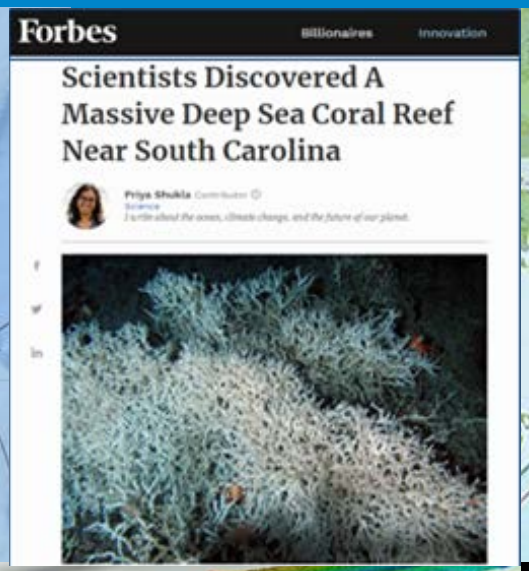
CAPSTONE Science Products

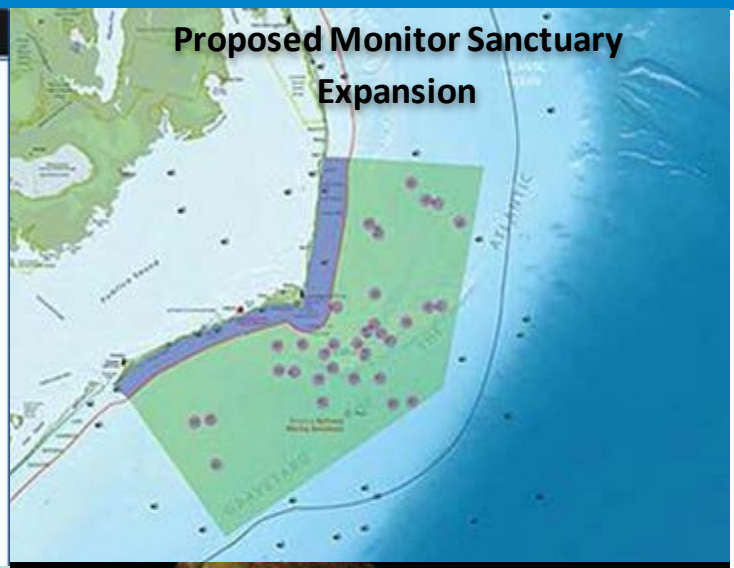
- Oceanography supplement
- Ocean Sciences session
- Frontiers in Marine Sciences research topic
- Deep-Sea Animal Guide
- DSCRTP database Annotations
- Cruise reports
- A foundation of public data



ASPIRE Results to Date

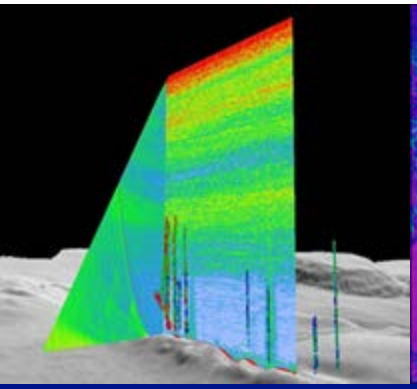
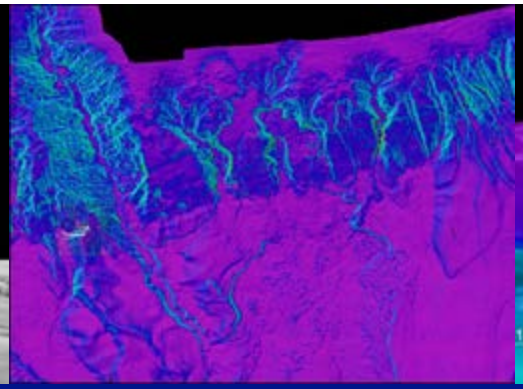
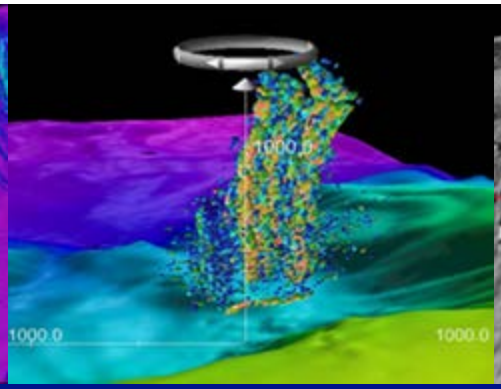


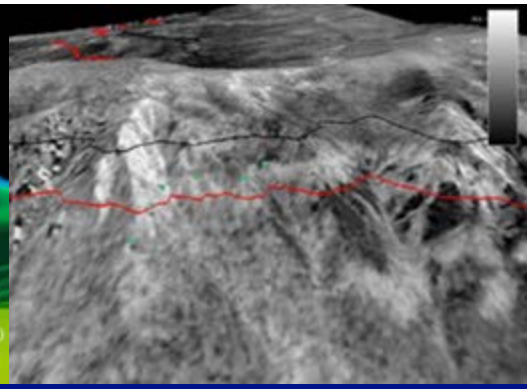




What's Next?

- CAPSTONE and ASPIRE Results Continued…
  - Additional lines of inquiry and analysis
  - Future management decisions and delineations
- Assessment of data & product improvements to enhance future data analysis



How technology can get us to the next level for decision making

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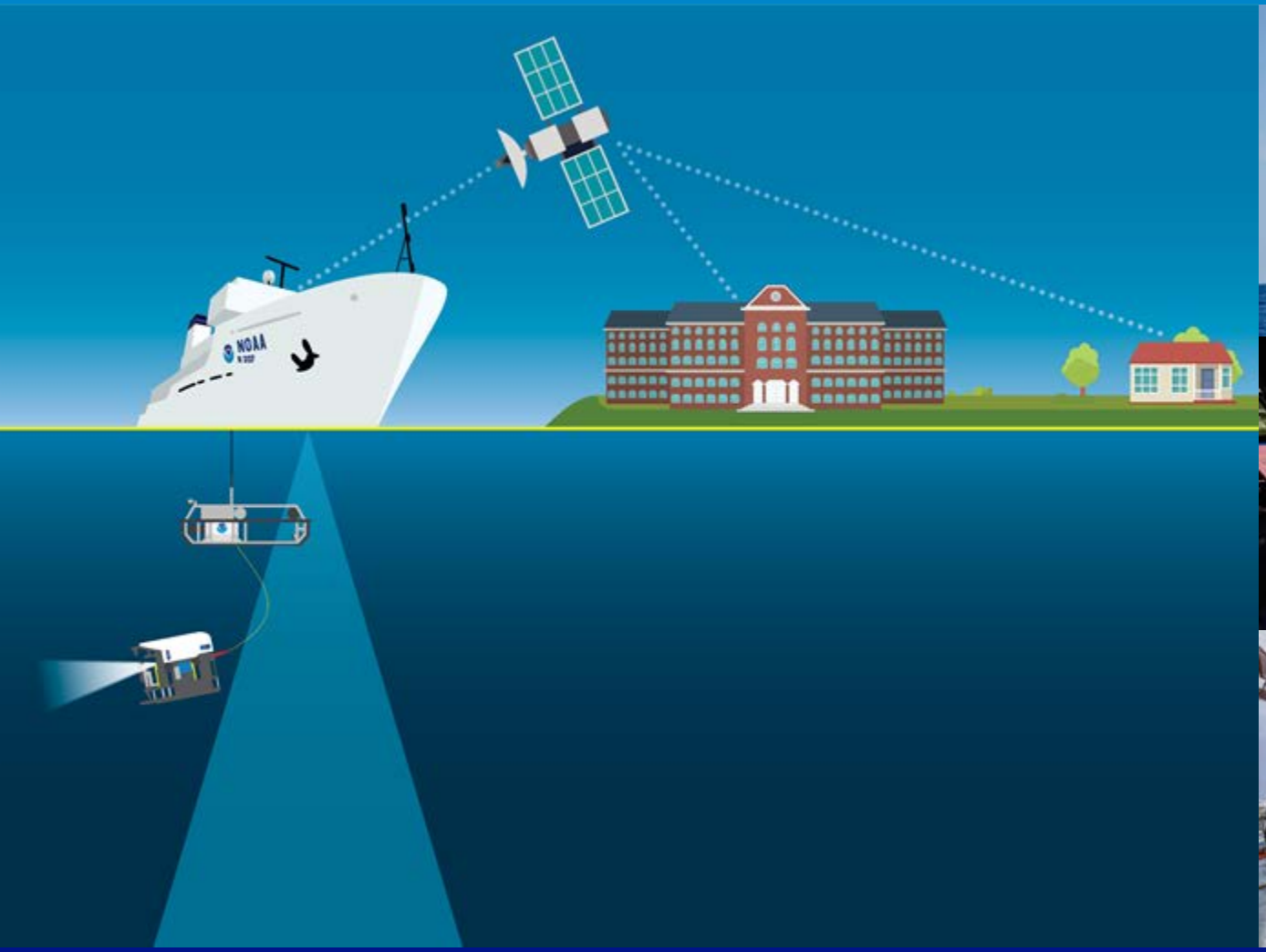
Ocean Exploration
and Research

Innovation for Exploration

Craig Russell
Okeanos Explorer Program Manager

Dedicated Exploration Platform



Telepresence-Enabled Science

Telepresence-Enabled Science

Standard Protocols and Tools

Ocean Networks Canada SeaTube v2
Oceans 2.0

Logged in as Kasey Cantwell | Profile | Help | Logout

Data Preview | Data Search | Plotting Utility | SeaTube | Digital Fishers | Cameras | More | Admin

Videos | Playlists | Dive

Hide Map Hide Video

Dive: EX1811-Dive13
PI: Wagner, Daniel
Area: U.S. Caribbean Sea
Start Date: 13-Nov-2018 10:00:00
End Date: 13-Nov-2018 23:00:00
Dive Plan: This dive will explore an escarpment at 400-535 m depths located northeast off Mona Island inside the Isla de Mona Natural Reserve. This dive will target the potential habitats of deepwater fish species, including snappers and groupers.

Leaflet | Marine Geoscience Data System

Camera #1

Resolution: Low

OKEANOS EXPLORER 2018

Time | Capture Time | To Be Reviewed

Select a Taxonomy... | Type First Three Characters...

Add Attribute

Show Quick Entry

Enter free text here...

Save | Save/Keep Time | Clear

Annotations | Search | Show Filter

Auto-Refresh | 333 / 333

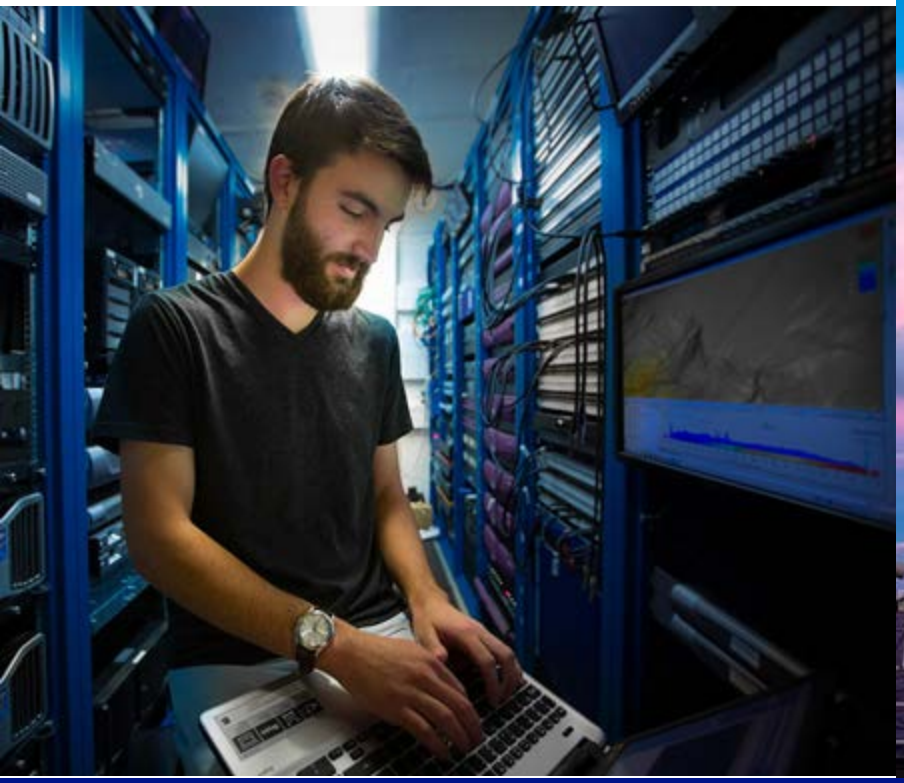
13:04	shiptest	431 m	
13:07	Test2	481 m	
13:15	Callogorgia | ID: 125317 [WORM] x1	566 m	
13:15	Chirostylidae (squat lobsters) | ID: 106732 [WORM]	567 m	
13:16	Ophiuroidea (brittle stars; brittlestars) | ID: 123084 [WORM]	567 m	
13:18	Plumarella | ID: 177839 [WORM] x3	567 m	
13:18	-	567 m	
13:19	Asteroidea (starfish; sea stars) | ID: 123080 [WORM]	567 m	
13:20	Demospongiae (horny sponges; demosponges) | ID: 164811 [WORM] many	567 m	
13:22	Octocorallia | ID: 1341 [WORM]	568 m	
13:23	Stylasteridae (lace corals) | ID: 22805 [WORM]	568 m	
13:23	Porifera (sponges) | ID: 558 [ ] several small	568 m	
13:23	Stylasteridae (lace corals) | ID: 22805 [WORM] Crypthelia? x1	568 m	
13:24	Asteroidea (starfish; sea stars) | ID: 123080 [WORM]	568 m	
13:26	Porifera (sponges) | ID: 558 [WORM] many	566 m	

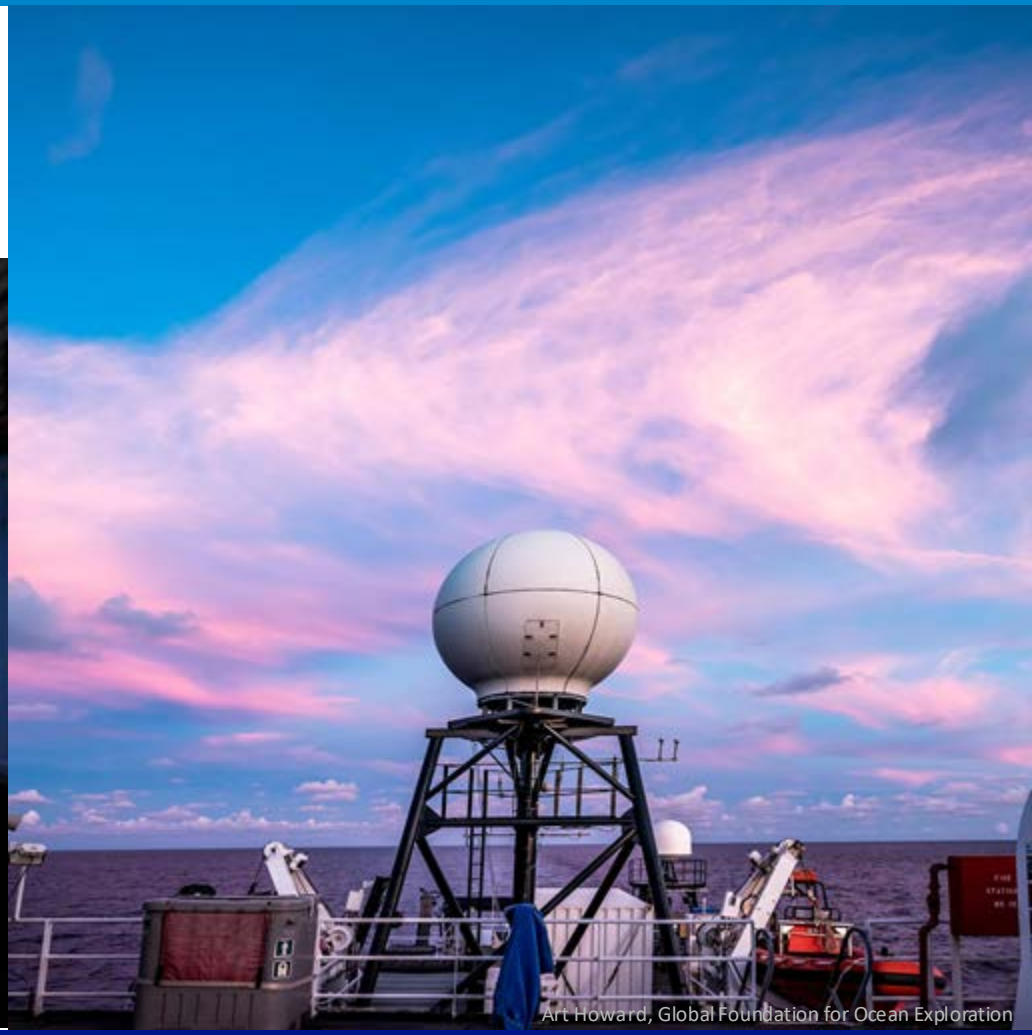
Sensor Values | Show Sensor Values

Advanced Telepresence Network

GLOBAL FOUNDATION FOR OCEAN EXPLORATION

VSAT & Network



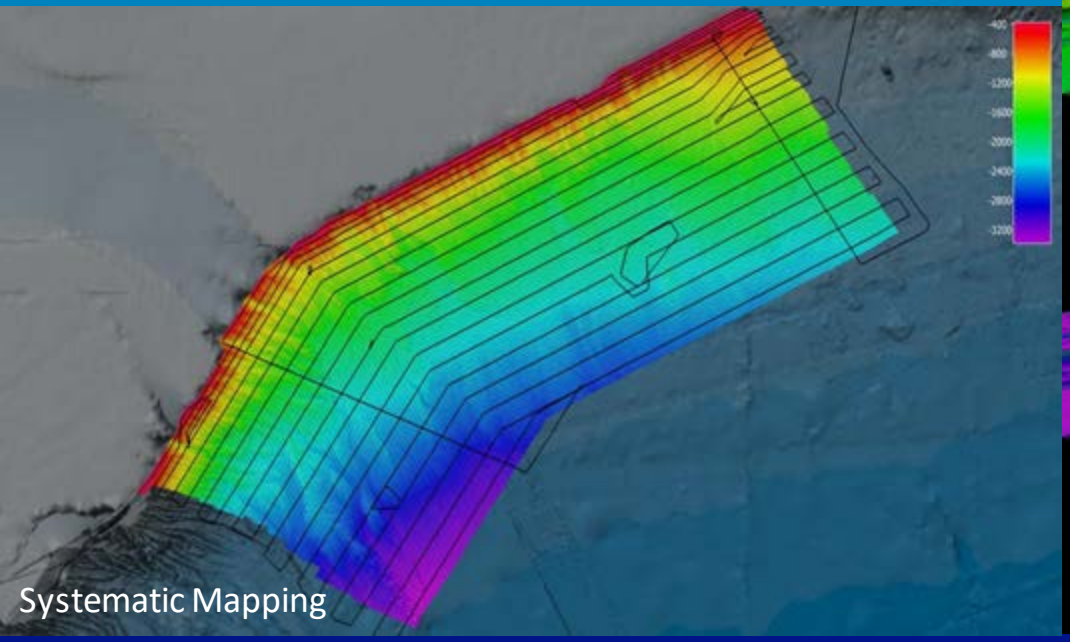


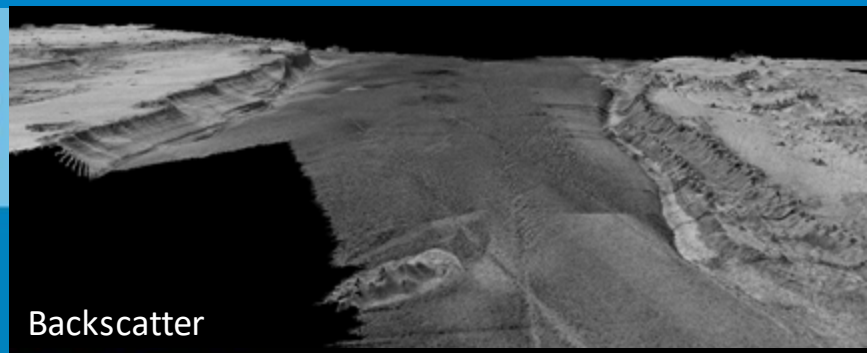
Art Howard, Global Foundation for Ocean Exploration

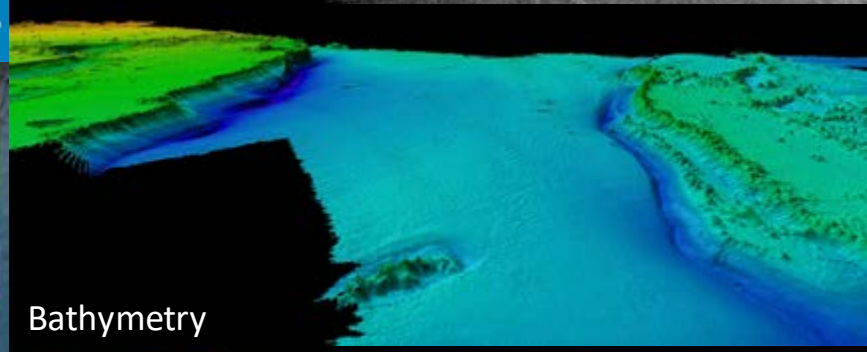
Catalyzing Others

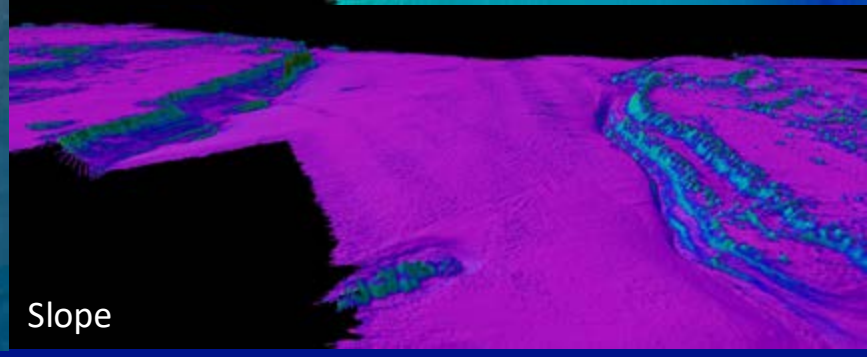
Fly-away VSAT for EXPRESS Campaign on NOAA ship *Reuben Lasker* - Underway

Ocean Mapping Innovation

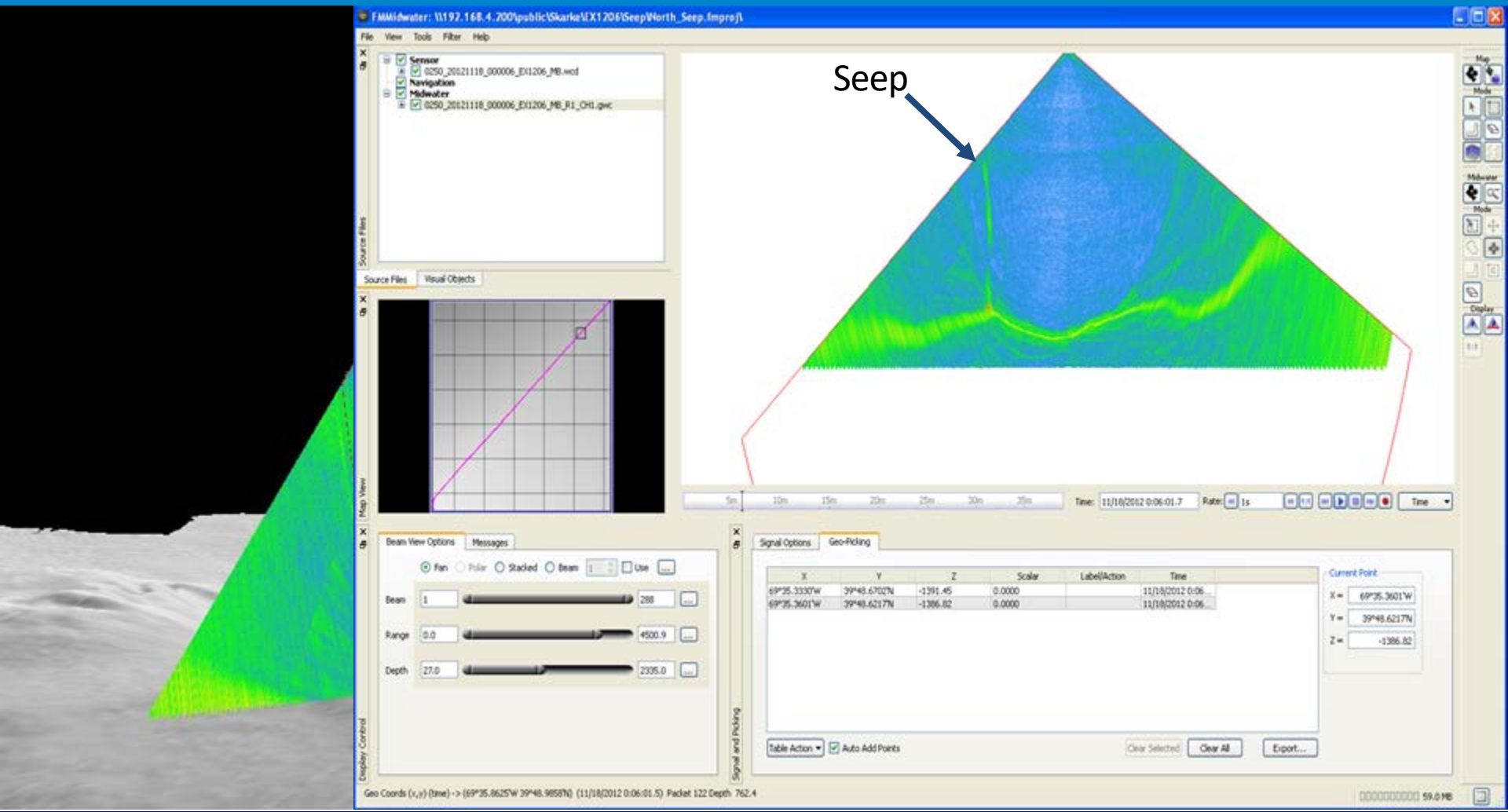

Systematic Mapping


Backscatter


Bathymetry

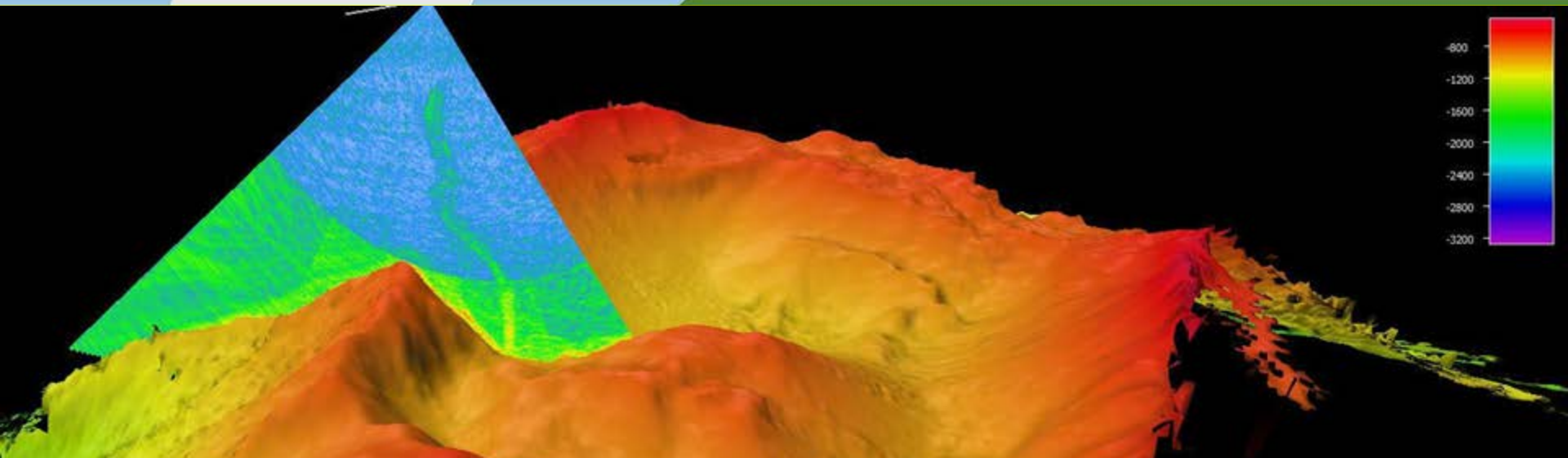

Slope

Ocean Mapping Innovation

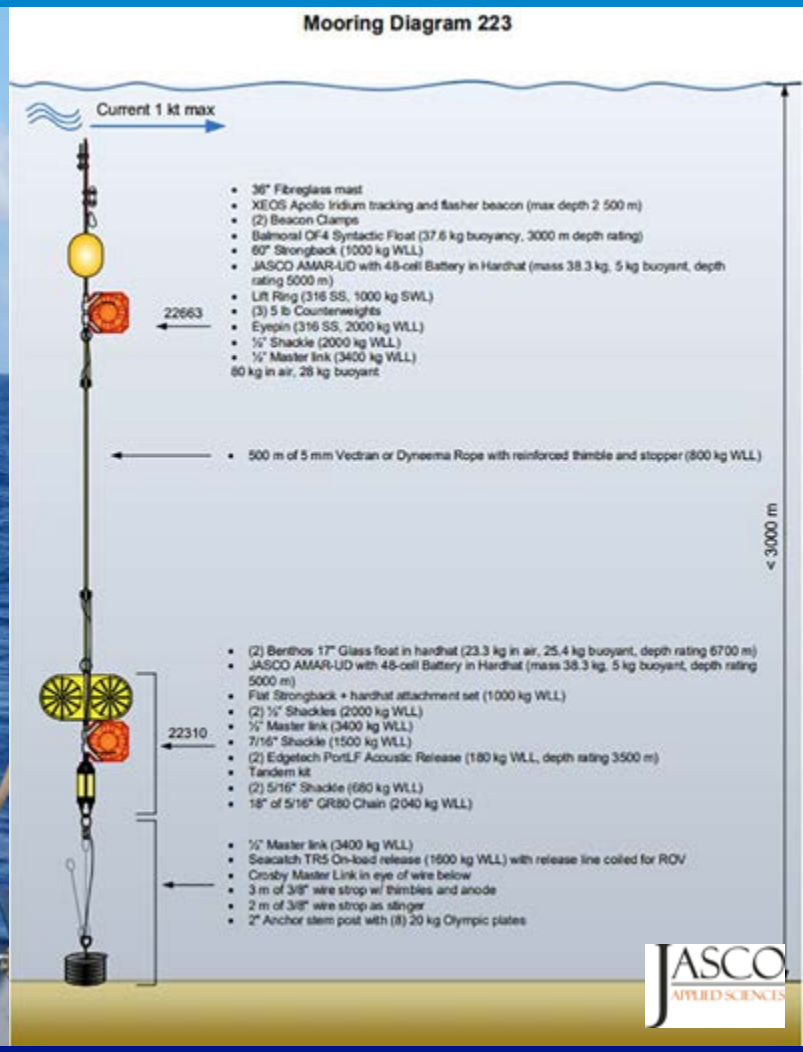


Acoustic Calibration Innovation

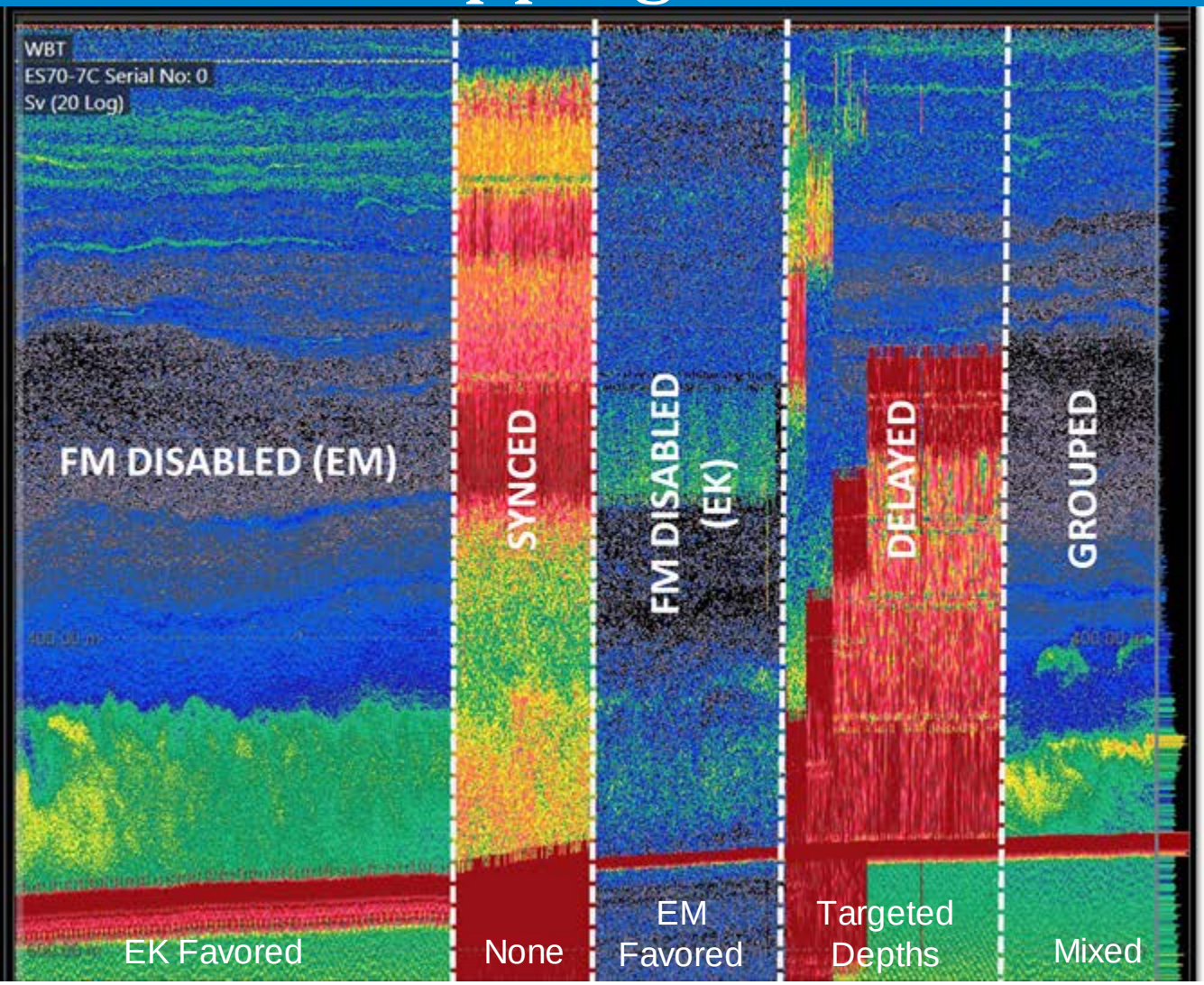
Tele-mapping Innovation



Ocean Mapping Innovation



Ocean Mapping Innovation



DEEP (FM) SYNCHRONIZATION OPTIONS

1. Disable FM in EM302
2. Synchronize all sonars to fire at once
3. Disable FM in EK80 70 kHz
4. Delay EK in EK80 software
5. Group in KSync

ROV Operations Innovation

ROV Operations Innovations

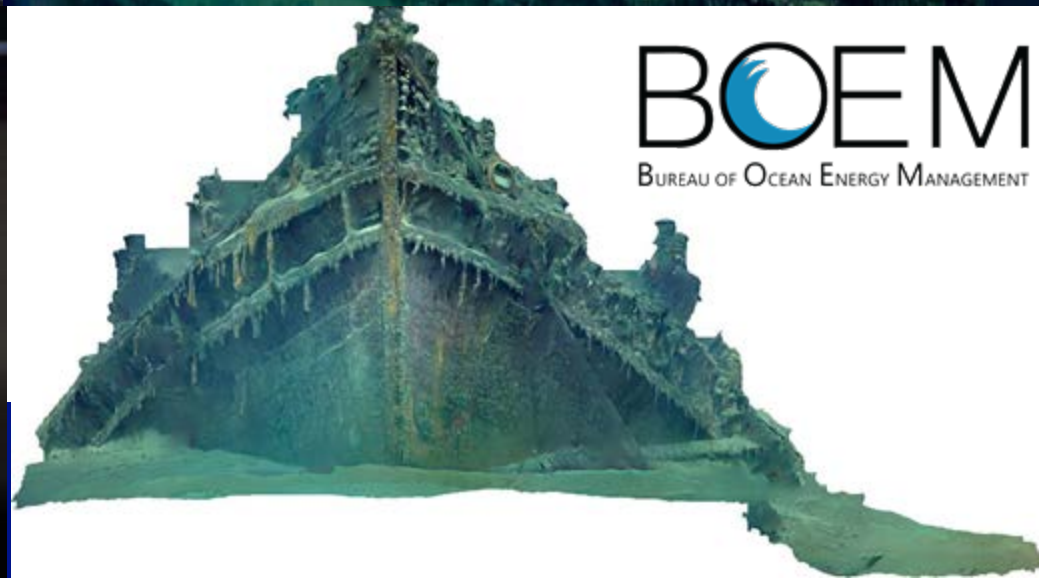
ROV Operations Innovations

Sample Collections Legacy

1248 Biological Samples
(including associates)

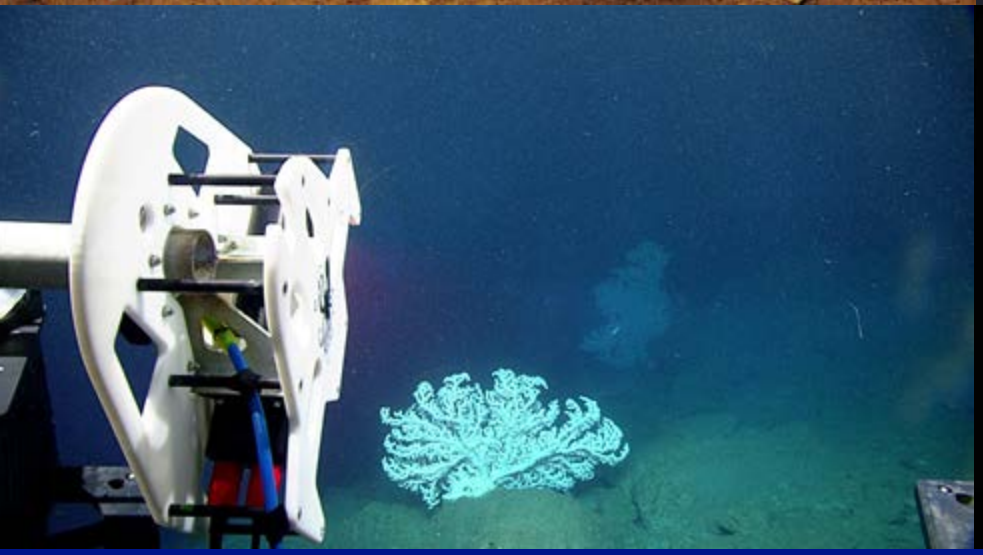
383 Geological Samples

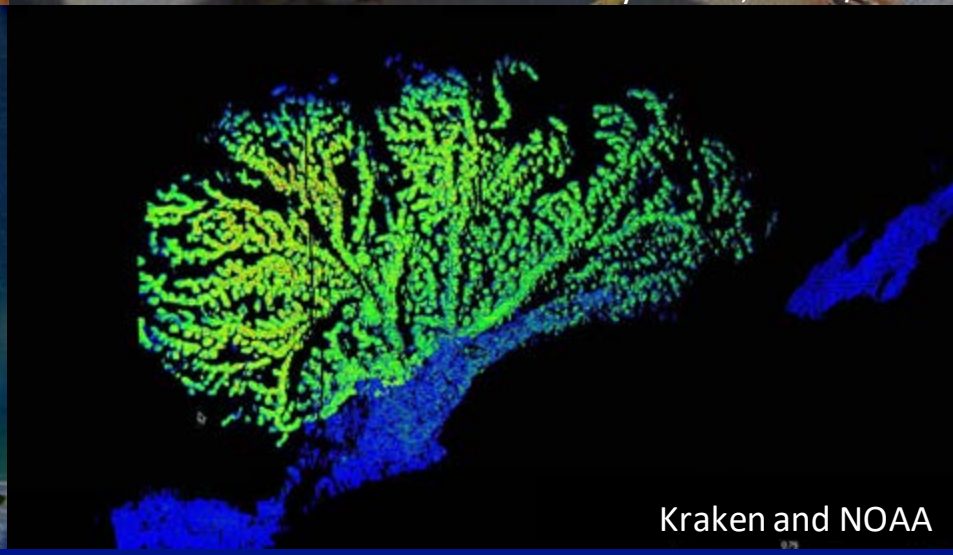
ROV Operations Innovations



Technology Demonstrations

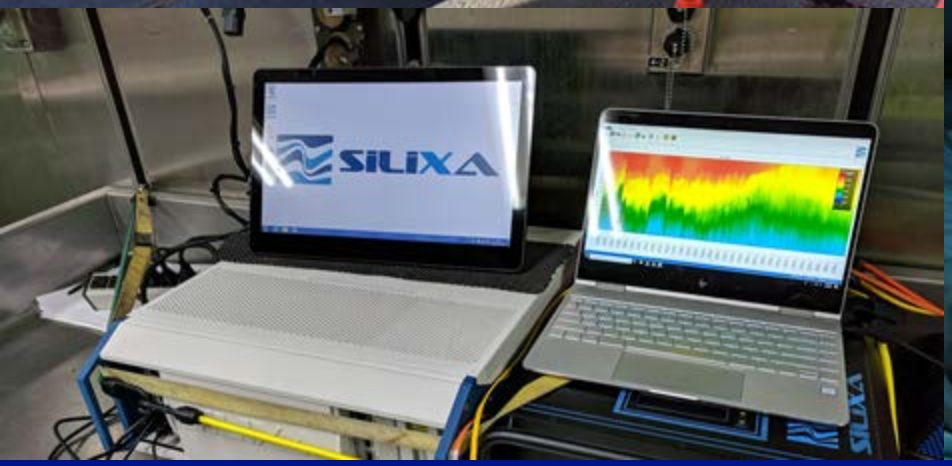
Barry Eakins, CIRES/NCEI





Kraken and NOAA

Technology Demonstrations



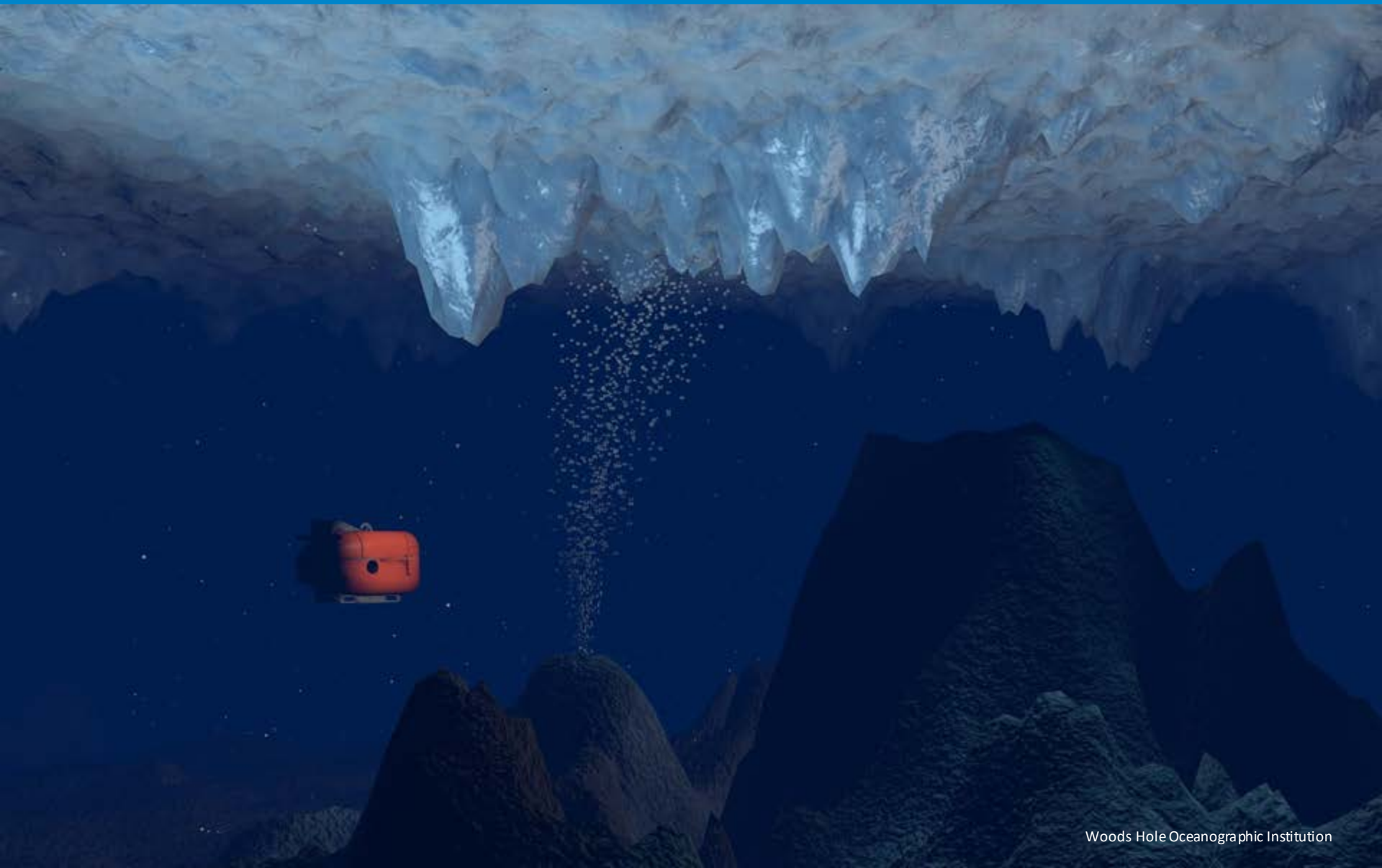
Looking to the Future

OCEAN INFINITY

Seabed Intelligence

New CRADA Collaborations

Technology Development, Application, and Program Use



Woods Hole Oceanographic Institution

OceanExplorer.NOAA.gov

Ocean Exploration and Research