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
CAPSTONE
Campaign to Address Pacific Monument Science, Technology, and Ocean Needs
Atlantic Seafloor Partnership for Integrated Research and Exploration
**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.

**CONSULTATIONS**

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

**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.

**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 km² 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 km² 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

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 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.
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
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+ km² mapped
- 122 vehicle dives
Expanding impacts: *Okeanos Explorer* and DEEP SEARCH
- 81.1% of US EEZ East Coast is now mapped
- Majority of this area has been mapped through OER funded projects (77%)
Updated map with EX data overlain with NCEI data (semi transparent).
Looking to the Future

Unmapped Seafloor in U.S. Waters
- Unmapped in Deep Water (>200m)
- Unmapped in Shallow Water (<200m)
- U.S. EEZ/Maritime Boundaries
- 200 m Isobath

Map produced by NOAA NCEI September 2019
Exploration Results for Management

Kelley Elliott
Expeditions and Exploration Division
Northeast Canyons Management Highlights

> 570 gas plumes off the U.S. East Coast

Increased knowledge of Deep-Sea coral diversity and distribution; Model Validation.

Northeast Canyons & Seamounts Monument

Frank R. Lautenberg Deep-Sea Coral Protection Area

“Billy Mitchell Fleet” Nominated to National Register of Historic Places
CAPSTONE Results: Management Highlights

Expansion of Papahānaumokuākea

UCH Data to Inform Management

Improved inventory of deepwater bottomfish and precious corals

Sampling for Critical Minerals
CAPSTONE Science Products

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

Proposed Monitor Sanctuary Expansion

Potentially Polluting Wreck

“Million Mounds” coral province

OceanExplorer.NOAA.gov
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
Innovation for Exploration

Craig Russell
*Okeanos Explorer* Program Manager
Telepresence-Enabled Science
Standard Protocols and Tools
Advanced Telepresence Network

VSAT & Network
Catalyzing Others

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

NOAA Ship Okeanos Explorer has mapped in excess of 1,970,000 square kilometers — That’s bigger than Alaska and California combined!

Systematic Mapping

Backscatter

Bathymetry

Slope
Ocean Mapping Innovation

Seep
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
Sample Collections Legacy

1248 Biological Samples
(including associates)

383 Geological Samples
ROV Operations Innovations
Technology Demonstrations

Barry Eakins, CIRES/NCEI
Technology Demonstrations
Looking to the Future

New CRADA Collaborations

Full Tele-mapping Test
Technology Development, Application, and Program Use