



UNITED STATES DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
NOAA Marine and Aviation Operations
Marine Operations Center
439 W. York Street
Norfolk, VA 23510-1114

October 13, 2017

MEMORANDUM FOR: Commander Eric Johnson, NOAA
Commanding Officer, NOAA Ship *Okeanos Explorer*

FROM: Commander Stephanie Koes, NOAA
Acting Commanding Officer, NOAA Marine Operations Center-
Atlantic

SUBJECT: Project Instruction for EX-17-09
Eastern Pacific Mapping (Telepresence Mapping)

Attached is the final Project Instruction for EX-17-09, Eastern Pacific Mapping (Telepresence Mapping), which is scheduled aboard NOAA Ship *Okeanos Explorer* during the period of October 16 – November 11, 2017. Of the 27 DAS scheduled for this project, 2 DAS are funded by an OMAO Allocation and 25 DAS are funded by Line Office Allocation. This project is estimated to exhibit a Medium Operational Tempo. Acknowledge receipt of these instructions via e-mail to Deputyops.MOA@noaa.gov at Marine Operations Center-Atlantic.





Ocean Exploration and Research



Project Instructions

Date Submitted: October 12, 2017
Platform: NOAA Ship *Okeanos Explorer*
Project Number: EX-17-09
Project Title: Eastern Pacific Mapping (Telepresence Mapping)
Project Dates: October 16 – November 11, 2017

Prepared by: *Elizabeth Lobecker* **Dated:** 10/11/17
Elizabeth Lobecker, NOAA
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Approved by: *CWR* **Dated:** 10/12/2017
Craig Russell
Program Manager
Office of Ocean Exploration & Research

Approved by: *SCOTT M. SIROIS* **Dated:** 13-OCT-2017
~~CAPTAIN SCOTT M. SIROIS, NOAA~~
Commanding Officer
Marine Operations Center - Atlantic

I. Overview

A. Brief Summary and Project Period

This document contains project instructions for EX-17-09, planned to depart Honolulu on October 16, 2017 and arrive in Balboa, Panama on November 11, 2017, for a total of 27 days at sea. Operations for this cruise include transit mapping and CTD operations along the Clarion-Clipperton Fracture Zone and the transit track between Honolulu, Hawaii and Balboa, Panama. Operations will include the use of the ship's deep water mapping systems (Kongsberg EM302 multibeam sonar, EK60 split-beam fisheries sonars, Acoustic Doppler Current Profilers (ADCPs), and Knudsen 3260 chirp sub-bottom profiler sonar), and the ship's high-bandwidth satellite connection for hourly data transfer, real-time ship to shore communications, real-time sonar control from shore, and real-time video streaming of sonar screens and ship's cameras. The objective of the CTD operations is to test the operation of a newly developed N₂ sensor and measure biologically produced excess nitrogen (N₂ gas produced as a result of denitrification processes) in the Eastern Tropical North Pacific (ETNP) Oxygen Minimum Zone (OMZ) located in international waters of the eastern Pacific.

NOAA's Office of Ocean Exploration and Research (OER) is the only federal organization dedicated to exploring our global ocean. OER works with partners to identify priority areas for exploration; support innovations in exploration tools and capabilities; and encourage the next generation of ocean explorers, scientists, and engineers to pursue careers in ocean exploration and related fields. The data and information collected during our expeditions and the research we fund gives resource managers, the academic community, and the private sector the information they need to identify, understand, and manage ocean resources for this and future generations of Americans.

NOAA Ship *Okeanos Explorer* is the only U.S. federal vessel dedicated to exploring our largely unknown ocean for the purpose of discovery and the advancement of knowledge. America's future depends on understanding the ocean. We explore the ocean to make valuable scientific, economic, and cultural discoveries; we explore because ocean health and resilience are vital to our economy and to our lives. Exploration supports NOAA mission priorities and national objectives by providing high-quality scientific information about the deep ocean to anyone who needs it.

In close collaboration with government agencies, academic institutions, and other partners, OER conducts deep-ocean exploration expeditions using advanced technologies on *Okeanos Explorer*. From mapping and characterizing previously unseen seafloor to collecting and disseminating information about ocean depths, this work helps to establish a foundation of information and fill data gaps. Data collected on the ship follow federal open-access data standards and are publicly available shortly after an expedition ends. This ensures the delivery of reliable scientific data needed to identify, understand, and manage key elements of the ocean environment.

NOAA Ship *Okeanos Explorer* systematically explores the ocean every day of every cruise to maximize public benefit from the ship's unique capabilities. With approximately 90-95% of the ocean unexplored, we pursue every opportunity to map, sample, explore, and survey at planned destinations as well as during transits; "Always Exploring" is a guiding principle. An integral element of *Okeanos Explorer's* "Always Exploring" model is the ship's seafloor and water column mapping capabilities. The sonars, or a subset of the sonars on board, will be operated at all times 24 hours per day throughout the cruise allowing for continued exploration and seabed, water column, and/or sub-bottom data collection and selected processing.

Objectives for the expedition include:

- Conduct preliminary seafloor mapping operations to contribute to geological understanding of remote areas of the Pacific Ocean.
- Provide a foundation of publicly accessible data and information products to spur further exploration, research, and management activities.
- Clarion Clipperton Fracture Zone mapping: Across the Pacific, there are several very large, multi-segment fracture zones (FZs) that indicate the former existence of oceanic transform faults (TFs) that existed for millions of years. These FZs underwent dramatic changes in segmentation as revealed by their structure. Mapping data provides a wealth of information about the structure of these TFs when they formed and the subsequent evolution of their FZs, possibly including information about whether the FZs were weakly or strongly coupled. Weakly coupled FZs can indicate extensive serpentinization, which can alter the production and composition of magma at subduction zones. The

suggested mapping data will result in a long transit swath of mapping data, which will allow a careful analysis of the FZ evolution. The cruise track is planned to focus specifically on the Clarion Fracture Zone.

- Test the operation of a newly developed N₂ sensor that was funded by an OER grant to the University of Washington Applied Physics Laboratory
- Measure biologically produced excess nitrogen (N₂ gas produced as a result of denitrification processes) in the Eastern Tropical North Pacific (ETNP) Oxygen Minimum Zone (OMZ) located in international waters.

Operations for this cruise will include 24 hour mapping, and continuous telepresence-based remote participation in mapping operations. Multibeam and splitbeam mapping operations will be conducted 24 hours a day throughout the cruise, except during CTD operations. Sub-bottom profile mapping will be conducted 24 hours a day at the discretion of the CO. XBT and Underway CTD sound velocity casts in support of multibeam sonar mapping operations will be conducted at an interval defined by prevailing oceanographic conditions, but not to exceed 6 hours. All mapping data will be fully processed according to standard procedures and will be archived with the National Centers for Environmental Information (NCEI).

CTD operations will include approximately 10 CTD stations, plus one or two short test casts, transecting the ETNP OMZ. At each station, a 'slow' hydrocast will be made to maximally 600 m. The cast will require approximately 1 hr of active winch operations to lower/raise the CTD and trigger 12 water samplers at set depths. An additional 10-15 minute wait is required at each trigger depth to fully soak and equilibrate the sensors, taking an additional 2-3 hrs. If the scientists find themselves running short of sample water on deck, or important Niskin bottles did not trigger correctly, and there is sufficient time left on station to perform a second 'fast' cast, we will perform a second cast with no waits to retrieve more sample water. Regardless of whether a second cast is performed, the total time on station will be maximally 4 hrs total. The Niskin bottles will be triggered on the ascent with sampling concentrated in the 100-500 m range.

Onboard water chemistry operations include O₂ distributions by Winkler titrations and an O₂ sensor on the CTD, and N₂ distributions by the Gas Tension Method. Samples for dissolved argon (Ar) and dissolved nitrogen (N₂) concentrations and isotopic fractionations will be

collected by the rosette sampler in 90 mL glass bottles, preserved with 0.5 mL of HCl 25% and returned to the shore based laboratory for analysis by mass-spectrometry. Samples for nitrous oxide (N₂O) concentrations, stable isotopes and isotopomers will be collected in 165 mL bottles, preserved with 5 mL NaOH 10 N and analyzed on-shore by mass spectrometry. Approximately 8 depths will be sampled at each station/cast. Access to a fumehood will be necessary to add NaOH to the nitrous oxide bottles. Also, benchspace and space under bench will be required to store the five coolers (dimensions: 92 x 44 x 42 cm, 36.5 x 17.6 x 16.8 inches) in the laboratory at room temperature, and for Annie Bourbonnais to install and work on her laptop. The cruise will also be an opportunity to, hopefully, test an in situ sensor in development at APL/UW to measure N₂O, a potent greenhouse gas released from OMZ regions. The prototype N₂O sensor will likely be dipped into seawater samples recovered by the rosette sampler and cross-calibrated against the standard analytical method measurements.

The transit routes between port and the operating areas will maximize mapping of discrete geologic features including seamounts and ridges with little or no existing modern sonar data coverage. The routes were chosen based on the most recent version of the global bathymetric compilation dataset compiled by J.J. Becker et al (http://topex.ucsd.edu/sandwell/publications/124_MG_Becker.pdf).

This expedition will be the eighth cruise to test telepresence enabled mapping operations on *Okeanos Explorer*. *Okeanos* is a leader in this mode of mapping cruise operation, and continues to see success and potential for further development.

The Expedition Coordinator for the cruise (Elizabeth Lobecker) will be based on shore at the Exploration Command Center (ECC) at the University of New Hampshire Center for Coastal and Ocean Mapping/Joint Hydrographic Center (UNH CCOM/JHC) with regular and ongoing communications with the ship (OPS, CO) and onboard Mapping Lead (Amanda Bittinger).

The screens of the mapping acquisition systems (EM 302, EK 60, SBP etc.) will be broadcast 24 hours per day, and will be monitored by both onboard and onshore mapping scientists. A new software configuration provided by OMAO will be used to provide remote access to all the sonar acquisition and data processing machines from shore. This setup will continue to be tested for its reliability and feasibility of controlling the mapping data acquisition and data management from shore. The raw data from all sonars will be transmitted to shore and further

processing will be completed on shore. Automated bathymetric gridding will occur on the ship in order for the onboard team to monitor and ensure adequate seabed coverage. The onboard Mapping Lead will be the primary liaison between ship and OER operations and will attend all the shipboard daily meetings and provide daily situation reports (SITREPS) to the broader OER *Okeanos* operational team.

As telepresence mapping protocols continue to develop during this type of telepresence enabled mapping expedition, possibilities open for OER to conduct operations with nimble teams of mapping personnel onboard and most of data acquisition, processing and quality checks of mapping data being completed on shore. Value gained from this model will continue to expand as the model is tested. Initial predicted benefits include: reduction in travel costs to the ship, participation of a larger number of mapping trainees in expeditions, cruise participation from individuals who are unable to sail, enhanced rapid data processing and archival techniques, enhanced onshore partnership development opportunities, enhanced rapid data report creation, and expanded possibilities for utilizing multiple ECCs during mapping missions.

The onboard ship and mapping team will be provided with all information necessary to successfully conduct the mapping mission should the telepresence component experience significant challenges, such as lack of connectivity due to VSAT or network challenges.

B. Days at Sea (DAS)

Of the 27 DAS scheduled for this project, 2 DAS are funded by an OMAO allocation, 0 DAS are funded by an NOS Line Office Allocation, 0 DAS are Program Funded, and 25 DAS are funded by an OAR Line Office Allocation. This project is estimated to exhibit a Medium Operational Tempo due to 24 hour mapping and daytime CTD operations.

C. Operating Area

24-hour per day transit mapping operations will focus in the vicinity of the Clarion-Clipperton Fracture Zone. Mapping operations will focus in depths generally between 250 and 6,000 meters.

CTD operations will include approximately 10 CTD stations transecting the Eastern Tropical North Pacific Oxygen Minimum Zone. Each hydrocast will be to 600 m. Exact locations of CTD casts will be determined during the transit and will be carefully coordinated with the Operations Officer and ship's Department Heads to ensure casts are done during daylight hours and do not interfere with personnel schedule and ship engineering constraints. A table of approximate CTD locations is below.

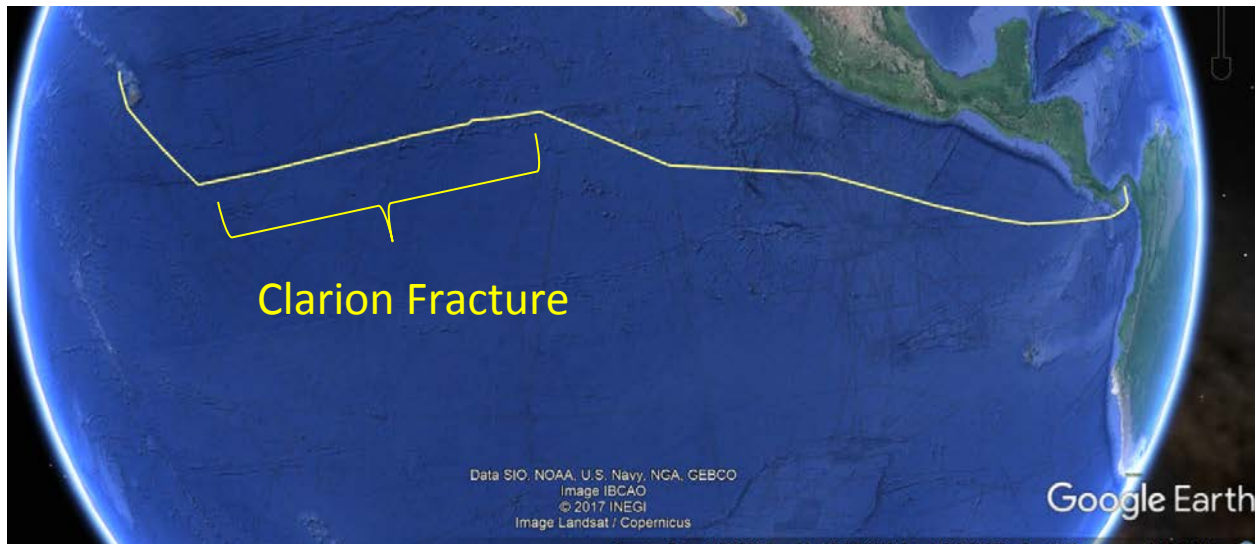


Figure 1. Overall EX1709 cruise track from Honolulu, HI to Balboa, Panama, spanning 4960 nautical miles.

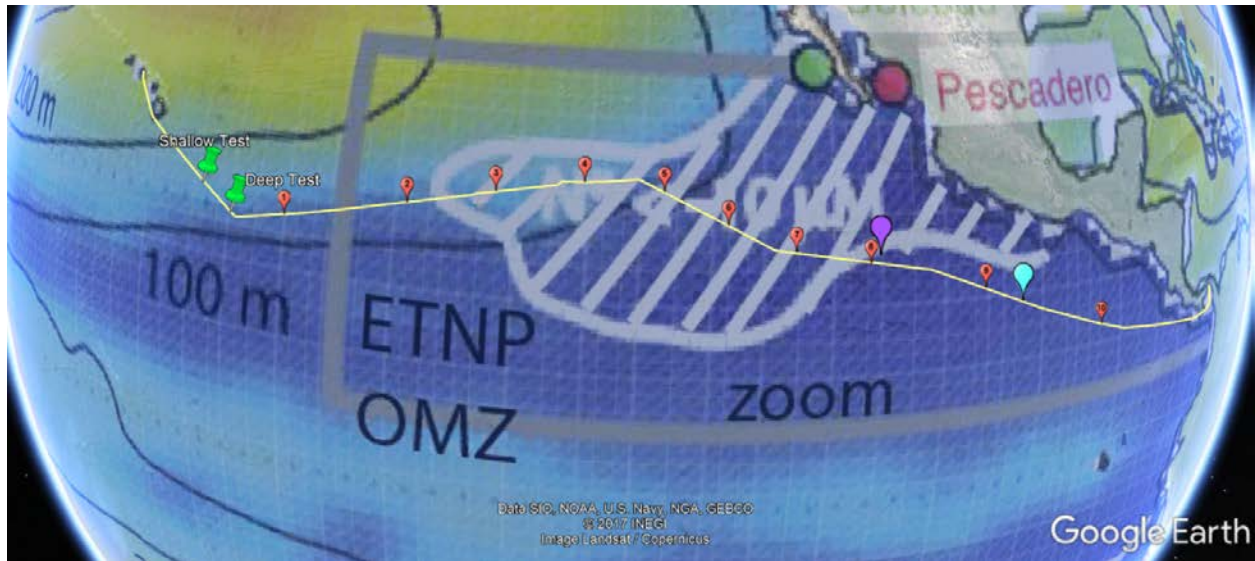


Figure 2. Overall cruise track with Oxygen Minimum Zone shown in white hashed polygon, with overall EX1709 cruise track shown in yellow. Green thumbtacks are locations of test CTD casts, red numbered balloons are locations of operational CTD casts, purple and blue balloons are approximate start and end locations of crossing satellite transition zone..

Table 1. Generalized cruise track waypoints EX1709.

EX-17-09 Generalized Cruise Track		
	Longitude (Degrees Decimal Minutes)	Latitude (Degrees Decimal Minutes)
1	157 57.008544 W	21 16.858533 N
2	157 48.032919 W	20 50.662848 N
3	155 57.300456 W	18 45.01533 N
4	147 37.930707 W	14 2.290134 N
5	147 17.0983308 W	14 4.8820626 N
6	143 1.9067586 W	14 53.6302224 N
7	140 34.6294686 W	15 24.1609038 N
8	138 9.8197914 W	15 55.3560084 N
9	134 35.9238564 W	16 38.4977448 N
10	132 37.3416156 W	17 0.8427258 N
11	132 31.1664588 W	17 5.0727528 N
12	128 52.4353854 W	17 43.0751946 N

13	127 49.3961748 W	17 53.2379526 N
14	127 37.6191942 W	18 4.2875094 N
15	126 42.5063166 W	18 6.301707 N
16	125 20.8533354 W	18 10.8064776 N
17	123 17.8380684 W	18 24.0676398 N
18	115 32.4562314 W	14 46.5512472 N
19	106 5.0094186 W	13 26.6515698 N
20	98 17.2615422 W	10 33.2671596 N
21	93 21.054192 W	8 56.975283 N
22	90 46.8165756 W	8 13.4400516 N
23	86 14.8652334 W	7 35.5316766 N
24	81 51.3247302 W	7 2.9192304 N
25	81 19.226013 W	7 3.2832762 N
26	79 49.1547936 W	7 12.8230326 N
27	79 14.8926816 W	7 29.3335854 N
28	79 27.381678 W	8 48.1812024 N

Table 2. EX1709 CTD cast locations along mapping transit line.

EX-17-09 CTD Cast Locations		
ID	Longitude	Latitude
Test shallow	150 27.8287158 W	15 37.1599788 N
Test deep	148 0.7479462 W	14 16.1970618 N
1	144 9.6639924 W	14 41.4872976 N
2	136 26.0163108 W	16 17.4251766 N
3	131 18.6724086 W	17 20.1805824 N
4	126 20.0895426 W	18 8.521071 N
5	121 51.1164726 W	17 48.3704586 N
6	118 13.1432106 W	16 6.284748 N
7	114 19.752549 W	14 41.7847488 N
8	109 53.7533508 W	13 56.7196488 N

9	102 23.840676 W	12 10.8780312 N
10	93. 1.943319 W	8. 52.2899562 N

D. Summary of Objectives

October 16 – November 11, 2017, Honolulu, HI to Balboa, Panama.

EX-17-09 operations will occur in the U.S. EEZ, international waters, Costa Rican EEZ, and Panamanian EEZ.

Mission objectives for EX-17-09 include a combination of mapping/operational, sensor technology development, CTD water chemistry science, education, outreach, and data management objectives:

1. Onboard Mapping
 - a. Conduct 24 hr/day mapping operations for the entirety of the cruise using EM 302 multibeam, EK 60 suite, and subbottom profiler sonars.
 - b. Execute transit mapping line plan as defined by onshore personnel, with adjustments made in the field as necessary. The mapping transit plan will gather data over approximately 1,400 nm of the Clarion-Clipperton Fracture Zone.
 - c. Collect high resolution mapping data from sonars in priority areas as dictated by operational needs as well as science and management community needs.
 - d. Collect XBT casts as mapping data quality requires, at least every 6 hours.
 - e. Create daily standard bathymetry mapping products.
 - f. Ensure all raw data from all sonars is transferred to shoreside repository hourly using automated scripts.
 - g. Collect sun photometer measurements as part of Exploration Project of Opportunity (EPO).
 - h. Transit speeds of 9-11 kts will be utilized.
 - i. Generate daily situation reports.
 - j. Host one EiT to further their offshore mapping training.
2. Onshore mapping
 - a. Test shoreside operation of sonar computers on the ship using desktop access through NOAA OMAO supplied laptop.
 - b. Test telepresence mapping workflow with OER physical scientists at UNH.

- c. Support onboard watchstanders by monitoring data collection from shore in realtime
 - d. Provide data acquisition and processing troubleshooting from shore
 - e. Possibly collaborate with GEBCO students based at CCOM.
3. Data Management
- a. Provide a foundation of publicly accessible data and information products to spur further exploration, research, and management activities;
 - b. Use daily bathymetric mapping products and SCS mailers to update *Okeanos* Atlas for onshore situational awareness.
 - c. Transfer all raw sonar data to shore using 10 mb/s bandwidth and automated transfer scripts.
4. Science
- a. Collect geophysical data at sites to aid the understanding of the geologic history of fracture zones.
 - b. Build capacity in the scientific community and public in telepresence-based mapping exploration.
 - c. Successfully conduct operations in conjunction with shore-based Exploration Command Centers and remote science team participants.
 - d. Test the operation of a newly developed N₂ sensor that was funded by an OER grant to the University of Washington Applied Physics Laboratory
 - e. Measure biologically produced excess nitrogen (N₂ gas produced as a result of denitrification processes) and nitrous oxide (N₂O) concentrations, stable isotopes and isotopomers in the Eastern Tropical North Pacific (ETNP) Oxygen Minimum Zone (OMZ) located in international waters.
 - f. Collect ADCP (300 kHz) and EK 60 data (18, 70, 120, 200 kHz) during CTD casts.
 - g. Live stream CTD deck camera and CTD acquisition screen during CTD operations.
5. Remote Science/Exploration Command Centers
- a. Provide operational support and training to scientists and managers to enable remote participation in at-sea operations.
 - b. Facilitate outreach and engagement activities and events at the ECCs.
 - c. Test and refine ship-to-shore communications procedures that engage multiple ECCs and other remote participants.
 - d. Test and refine operating procedures and products.

6. Outreach

- a. Onshore EC and EITs participate in various UNH outreach activities based in the UNH ECC including TBD.

7. Ship

- a. Prior to ship departure, all scientific sonar transducers should be inspected and cleaned as needed to ensure reliable performance. This work requires a SCUBA dive prior to the departure date of the cruise.
- b. Conduct one shallow then full depth test CTD casts to confirm all sensors functional including altimeter, and ship and crew readiness, prior to 10 required stations in or near the OMZ.
- c. Conduct ship safety drills including man overboard and maneuvering.
- d. Provide a high quality stable internet connection with the new VSAT.
- e. Provide stable and reliable VoIP telecommunications.
- f. Successfully transition to the new Atlantic basin Satellite and move the downlink station from Steele Valley Ca to Homedale NJ. With less than a 3 hour interruption to VSAT services

E. Participating Institutions

- National Oceanic and Atmospheric Administration (NOAA), Office of Ocean Exploration and Research (OER)–1315 East-West Hwy, Silver Spring, MD 20910 USA
- NOAA, National Oceanographic Data Center, National Coastal Data Development Center, Stennis Space Center MS, 39529 USA
- University Corporation for Atmospheric Research Joint Office for Science Support (JOSS), PO Box 3000 Boulder, CO 80307 USA
- University of New Hampshire (UNH) Center for Coastal and Ocean Mapping (CCOM) Jere A. Chase Ocean Engineering Lab, 24 Colovos Rd, Durham, NH 03824 USA
- Global Foundation for Ocean Exploration, P.O. Box 417, Mystic, CT 06355
- University of Washington Applied Physics laboratory, 1013 NE 40th Street, Seattle, WA 98105-6698
- University of Massachusetts Dartmouth, School for Marine Science & Technology, 706 S. Rodney French Blvd, New Bedford, MA
- University of Idaho, Department of Geological Sciences

F. Personnel (Mission Party)

Table 2: Full list of shore based and sea going mission party members and their affiliations

Nationality	Affiliation	Gender	Date Disembark	Date Aboard	Location during cruise	Title	Name (First, Last)	#
ONBOARD MAPPING AND SCIENCE TEAM								
USA	UCAR	F	N/A	10/14/17	Ship	Onboard Mapping Lead	Amanda Bittinger	1
USA	UCAR	M	TBD	10/14/17	Ship	Onboard Mapping Watch Lead	Dan Freitas	2
Canada (Green card holder)	UMass	F	11/12	10/14	Ship	CTD science lead	Annie Bourbonnais	3
USA	UW/APL	M	11/12	10/12	Ship	N2 Sensor development lead	Andrew Reed	4
USA	UCAR	F	TBD	11/15		Mapping watchstander	Sarah Rosenthal	5
ONSHORE MAPPING TEAM								
		n/a	n/a	n/a	UNH CCOM/JHC ECC	Expedition Coordinator	Elizabeth 'Meme' Lobecker	1

G. Administrative

1. Points of Contact:

Ship Operations

Chief, Operations Division, Atlantic (MOA)	Marine Operations Center, Atlantic (MOA)
LT Joe Carrier, NOAA	439 West York Street
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	Fax: (757) 441-6495

Mission Operations

CDR Eric Johnson, NOAA	Elizabeth 'Meme' Lobecker
Commanding Officer	Mapping Manager
NOAA Ship <i>Okeanos Explorer</i>	NOAA Office of Ocean Exploration
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Email: CO.Explorer@noaa.gov	O: (603) 862-1475
	C: (240) 429-7023
LT Aaron Colohan, NOAA	E-mail: elizabeth.lobecker@noaa.gov
Operations Officer	
NOAA Ship <i>Okeanos Explorer</i>	
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Chris Beaverson

OER Science and Technology

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Other Mission Contacts

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Alan Leonardi, Director

NOAA Ocean Exploration & Research

Phone: 301-734-1016/ Cell: 202-631-1790

E-mail: alan.leonardi@noaa.gov

Vessel Shipping Address

Shipments: Send an email to the *Okeanos Explorer* Operations Officer at OPS.Explorer@noaa.gov indicating the size and number of items being shipped.

Items sent to Honolulu should arrive at the following address prior to COB 10/13/17.
NOAA Ship *Okeanos Explorer*
c/o LT Aaron Colohan
1897 Ranger Loop Road BLDG 184
Honolulu, HI 96818

2. Diplomatic Clearances

Requests to conduct marine scientific research to acquire mapping and CTD data in the waters under the jurisdiction of Costa Rica, Panama and France (Clipperton Island) were submitted to the U.S. State Department via their online RATS system on July 26th – application F2017-082. Consent from Panama was received on September 18, 2017. The approval letter from Panama is in the appendix of this project instructions. **Consent is pending for Costa Rica and France.** France is not likely necessary as cruise track no longer transits through French waters near Clipperton Island.

3. Licenses and Permits

The expedition is being planned and conducted by NOAA as an agency of the U.S. Federal government.

Pursuant to the National Environmental Policy Act (NEPA), NOAA OER is required to include in its planning and decision-making processes appropriate and careful consideration of the potential environmental consequences of actions it proposes to fund, authorize and/or conduct. NOAA's Administrative Order (NAO) 216-6A Companion Manual describes the agency's specific procedures for NEPA compliance. Among these is the need to review all proposed NOAA-supported field projects for their environmental effects. A categorical exclusion (CE) worksheet has been completed for this survey, in accordance with Section 4 of the Companion Manual. This worksheet describes EX1709 and explains how it is consistent with one or more of the CE categories listed/described in Appendix E of the Companion

Manual. The completed worksheet also summarizes the review conducted to determine that no extraordinary circumstances exist that would preclude the use of a CE or require preparation of an environmental assessment or environmental impact statement.

Informal consultation was initiated under Section 7 of the Endangered Species Act (ESA), requesting NOAA Fisheries' Protected Resources Division concurrence with our biological evaluation determining that 2016 Marianas Expedition and all other planned *Okeanos Explorer* operations during the 2016-17 field season, may affect, but are not likely to adversely affect, ESA-listed marine species. The informal consultation was completed on February 3, 2016 when NOAA OER received a signed letter from the Regional Administrator of NMFS Pacific Islands Regional Office, stating that NMFS concurs with OER's determination that conducting proposed *Okeanos Explorer* cruises are not likely to adversely affect ESA-listed marine species. Documentation is provided in appendix of this PI.

OER has completed consultation with NOAA's Habitat Conservation Division on potential impacts of our operations to Essential Fish Habitat (EFH). They concurred that our operations would not adversely affect EFH provided adherence to our proposed procedures and their guidance stated in the letter. Documentation is provided in the appendix of this PI.

II. Operations

The Expedition Coordinator is responsible for ensuring the scientific staff are trained in planned operations and are knowledgeable of project objectives, priorities and environmental compliance procedures. The Commanding Officer is responsible for ensuring all operations conform to the ship's accepted practices and procedures.

A. Project Itinerary

(All times and dates are subject to prevailing conditions and the discretion of the Commanding Officer)

Activities	Approx Operations Time (hrs)	Date
Pre-departure staging of CTD equipment dockside		10/5
Onboard mission personnel arrive to ship	-	10/12-10/15
Load CTD equipment onto ship (forklift and sling)	-	10/10, 10/11 with 10/12 as contingency
Depart port 0900 from Ford Island pier	-	10/16
Transit mapping to Clarion-Clipperton Fracture Zone	~4 days	10/16 – 10/19
Test CTD cast on first or second day of cruise	Up to 4 hrs	10/17 or 10/18
Clarion-Clipperton FZ mapping	~ 6.5 days	10/20-10/27
Conduct approximately 10 CTDs once per day @ 4 hrs each	40 hrs	10/21-10/31
Enter OMZ		10/21
Satellite transition to occur between 109°W and 99°W	3 hours or less(no impact to vessel track, noted for awareness)	~11/1 or 11/2

Strategic mapping transit to Balboa, Panama	12 days including contingency	10/31-11/11
Approximate date of entry into Costa Rica EEZ	-	11/8
Approximate date of entry into Panama EEZ	-	11/10
Arrive sea buoy Balboa		11/11, late arrival OK prior to sunset.

Table 4: Detailed Cruise Itinerary. This is an approximate itinerary and is subject to change based on survey results, field conditions, and discretion of the CO.

B. Staging and Destaging

Staging of the UW-APL supplied CTD system is requested to occur October 10-11.

UW- APL will supply a CTD system which includes the SBE11 deckbox and SBE9 CTD and General Oceanic rosette. Two people from APL (Craig McNeil and Jesse Doshier), will fly to Hawaii on 9 October to load the CTD on the ship and set it up and test it working closely with ships personnel. Request use of forklift and crane sling to load the heavy CTD equipment onto the ship early morning of October 10. Use the winch and hydrowire supplied by the NOAA Ship *Okeanos Explorer* will be required as well as ship technician support to connect the deck box to the winch and the CTD to the wire. During this same time, UW PhD student (Andrew Reed) will also load and setup the Winkler titration kit. UMass scientist (Annie Bourbonnais) will load her sampling gear on October 14.

The UW-APL CTD system, UMass water samples, and any remaining HazMat will be destaged and removed from the ship during the Key West inport by UW personnel (Ray Hollingsworth) flying in for this purpose following EX1710 (another mapping cruise), approximately November 23-24 (depending on Thanksgiving holiday).

C. Operations to be Conducted

1. Telepresence / Outreach Events
 - a. Two live video feeds will be used throughout the cruise to provide situational awareness for onshore personnel.
 - b. The live feeds will show either sonar acquisition screens or the CTD camera and CTD acquisition screen, depending on operations.
2. In-Port Events
 - a. There are no in-port events planned for this cruise.

D. SCUBA Dive Plan

All dives are to be conducted in accordance with the requirements and regulations of the [NOAA Diving Program](#) and require the approval of the ship's Commanding Officer.

E. Applicable Restrictions

Sonar Operations

EM 302, EK 60, ADCP, and sub-bottom profiler data acquisition is planned for this cruise. All data acquisition will be conducted in accordance with established standard operating procedures under the direction of the mapping team lead. These operating procedures will include protection measures when operating in the vicinity of marine mammals, sea turtles or Endangered Species Act-listed species as described in appendices of this document. The final decision to operate and collect 24-hour sub-bottom profiler data will be at the discretion of the Commanding Officer.

III. Equipment

A. Equipment and capabilities provided by the ship

- 2 working small boats in seaworthy and reliable working condition for mission operations and fast rescue
- NOAA OER 6000 m ~~Deep Discoverer~~ ROV
- NOAA ~~Seirios~~ Camera Platform

- Kongsberg Simrad EM302 MultibeamEchosounder (MBES)
- Kongsberg Simrad EK60DeepwaterEchosounders and GPTs (18, 70, 120, 200 kHz)
- Knudsen Chirp 3260 Sub-bottom profiler (SBP)
- Teledyne RDI Workhorse Mariner (300 kHz) ADCP
- Teledyne RDI Ocean Surveyor (38 kHz) ADCP
- Teledyne UnderwayCTD
- LHM Sippican XBT Mark21 System(Deep Blue probes)
- AOML Automated XBT Launcher (Deep Blue probes)
- Seabird SBE 911Plus CTD
- Seabird SBE 32 Carousel and 24 2.5 L Niskin Bottles
- Light Scattering Sensor (LSS)
- Oxidation – Reduction Potential (ORP)
- Dissolved Oxygen (DO) sensor
- Altimeter Sensor and battery pack
- MarineStar GPS
- POS/MV
- Seabird SBE-45 (Micro TSG)
- Kongsberg Dynamic Positioning-1 System
- Netshares mapping storage system
- IVS Fledermaus Software suite
- SIS Software
- Hypack Software
- Scientific Computing System (SCS)
- ECDIS
- Met/Wx Sensor Package
- Telepresence System
- VSAT High-Speed link (Comtech 9 Mbps ship to shore; 1.54 Mbps shore to ship)
- Cruise Information Management System (CIMS)
- Three VoIP telephone lines
- CTD winch and hydrowire
- SCS shipboard data feed
- Refrigerated storage for water samples

B. Equipment and capabilities provided by the scientists

- Microtops II Ozone Monitor Sunphotometer and handheld GPS required for NASA Marine Aerosols Network supplementary project.
- CTD system, including laptop with Seasoft software, SBE11 deckbox, rosette, bottles, carousel, SBE911, and sensors
- Chemical titration equipment for Winklers

IV. Hazardous Materials

A. Policy and Compliance

The Expedition Coordinator is responsible for complying with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or the OMAO procedure that supersedes it). The Expedition Coordinator and Science Team Lead will be responsible for transporting all samples and HAZMAT on and off the ship. By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and quantity, MSDS, appropriate spill cleanup materials (neutralizing agents, buffers, or absorbents) in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and chemical safety and spill response procedures. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

Per OMAO procedure, the scientific party will include with their project instructions and provide to the CO of the respective ship 30 days before departure:

- List of chemicals by name with anticipated quantity
- List of spill response materials, including neutralizing agents, buffers, and absorbents
- Chemical safety and spill response procedures, such as excerpts of the program's Chemical Hygiene Plan or SOPs relevant for shipboard laboratories
 - *(Note: HazMat for McNeil sampling provided, we will provide up to two 5 gallon tub HazMat cleanup kits containing gloves, dust masks, pans, broom, bags, acid neutralizing agent, etc.)*
- For bulk quantities of chemicals in excess of 50 gallons total or in containers larger than

10 gallons each, notify ship's Operations Officer regarding quantity, packaging and chemical to verify safe stowage is available as soon as chemical quantities are known.

- *(Note: Andrew Reed will collect titration waste in 5 gallon waste disposal containers for return to APL/UW, or, as is typically done and preferable, the titration waste can be diluted and send down an overboard sink without collection, with ship's permission. If not going overboard, we expect to collect approximately 5-15 gallons of titration waste during the cruise. We will provide these HazMat plastic collection containers and all labels. We request distilled – ideally MilliQ - water source if available onboard, expecting to use approximately 1 gallon per station. If not available, we will need to purchase some in Hawaii pharmacy and bring aboard for the cruise. We request an 8' by 3' benchtop space for the Winkler titration kit situated near or ideally beside a sink to rinse sample bottles after they have been acid washed, these rinse waters should flow overboard via overboard sink. Samples will be temporarily stored in ship's laboratory refrigerator prior to running them through the Winkler titrator system. We request another workstation for Andrew to sit at for data analysis and processing, with access to a networked printer.)*

Upon embarkation and prior to loading hazardous materials aboard the vessel, the scientific party will provide to the CO or their designee:

- An inventory list showing actual amount of hazardous material brought aboard
- An MSDS for each material
- Confirmation that neutralizing agents and spill equipment were brought aboard sufficient to contain and cleanup all of the hazardous material brought aboard by the program
- Confirmation that chemical safety and spill response procedures were brought aboard

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory showing that all chemicals were removed from the vessel. The CO's designee will maintain a log to track scientific party hazardous materials. MSDS will be made available to the ship's complement, in compliance with Hazard Communication Laws.

Scientific parties are expected to manage and respond to spills of scientific hazardous materials. Overboard discharge of hazardous materials is not permitted aboard NOAA ships.

B. Inventory

Table 1. Standard OER furnished chemicals for physical sample preservation.

Approx. locations	Use	Item
Wetlab, under the chemical hood	Sample preservation	95% Denatured Ethanol (22.5 gallons)
Wetlab, under the chemical	Sample preservation	10% Buffered Formalin (1 gallon)
Wetlab, under chemical hood	Sample preservation	1 gallon Clorox bleach
Wetlab, under chemical hood	Sample preservation	3.5 liters formaldehyde

Table 2. Inventory of chemicals for use on Okeanos during Oct/Nov, 2017 supplied by Craig McNeil for Nitrogen sensor CTD project. MSDS provided as separate 53 page PDF attachment.

#	Description	Unit weight (solid)	Quantity	Total weight	Volume (liquid)	Container type
1	sodium hydroxide (8 M)				0.5L	glass bottle
2	manganous chloride (3 M)				1.0 L	glass bottle
3	sulfuric acid (5 M)				2 L	glass bottle
4	sodium iodide (4 M)				0.5 L	glass bottle
5	sodium thiosulfate (0.01 N)				2 L	glass bottle
6	potassium iodate (0.01 N)				4 L	glass bottle
7	sodium sulfite	500 g	1	500 g		plastic bottle
8	nitric acid (10%)				200 mL	glass bottle

Table 3. Inventory of chemicals supplied by Mark Altabet and Annie Bourbonnais to collect N₂/Ar and N₂O samples.

Description	Quantity and volume	Container type

1) Hydrochloric acid, 25% v/v	1 x 500 mL	plastic bottle
2) Sodium hydroxide 10 N	3 x 500 mL	Plastic bottle

Table 4. Inventory of chemicals maintained by ROV team.

Product	Manufacturer	Location	Qty	Labelled	MSDS Located?	
Adhesive Pliobond 25	Ruscoe Company	Tool Room	0	Yes	Yes	
Fluid Film	Eureka Chemical Company	Tool Room	3	Yes	Yes	
AP 120 Metal Prep	POR 15	Pit	1	Yes	Yes	
AquaShield	AOG Aviation Spares Inc	Tool Room/Pit	10	Yes	Yes	
Butane Fuel	Master Appliance	Tool Room	2	Yes	Yes	
Cut-Ease Lube	AGS	Pit	1	Yes	Yes	
DC 4	Dow Corning	Tool Room/Pit	12	Yes	Yes	1
Rust-oleum	Rust-oleum	Tool Room	2	Yes	Yes	
Flux Off	Chemtronics	Tool Room	1	Yes	Yes	
Gloss	Rustoleum	Tool Room	1	Yes	Yes	
Hydraulic Oil in Tank	Exxon	Hangar	65	Yes	Yes	1
Isopropanol	PTI Process Chemicals	Tool Room/pit	2	Yes	Yes	
Loctite 242	Loctite	Tool Room	3	Yes	Yes	
PVC Cement	Oatey	Tool Room	0	Yes	Yes	
Vitrea 13 Mineral Oil	Shell	Hangar	10 gal	Yes	Yes	
Vitrea 13 Mineral Oil in Tank	Shell	Hangar	32	Yes	Yes	
Phosphoric Acid		Tool Room	1	Yes	Yes	
Pipetite Paste	La-Co	Tool Room/Pit	1	Yes	Yes	
Primer	Rustoleum	Tool Room	2	Yes	Yes	
Propane Bottles		Tool Room	2	Yes	Yes	
Spindle Oil 10, ROS PT	Motor Oil Inc	Tool	14	Yes	Yes	1

		Room/Pit				
Scotchkote 43906	3M	Tool Room/Pit	7	Yes	Yes	
Molykote 316	Dow Corning	Hangar	2	Yes	Yes	
Silicone Spray	3M	Tool Room	6	Yes	Yes	1
DC 557	Dow Corning	Tool Room/Pit	1	Yes	Yes	
Synthetic Hydraulic Oil	Amsoil	Pit	50	Yes	Yes	1
Cutting Fluid	Tap Magic	Tool Room	1	Yes	Yes	
Xtra-thick Cutting Fluid	Tap Magic	Tool Room	1	Yes	Yes	
Tether Potting Catalyst	Phillystran	Pit	8	Yes	Yes	
Tether Potting Compound	Phillystran	Pit	8	Yes	Yes	
ThermaPlex Bearing Grease	LPS	Pit	1	Yes	Yes	
Tritech Seaking	Diala Oil	Pit	1	Yes	Yes	1
Tuff Coat M Marine Lubricant	Dynacon	Winch Room	20	Yes	Yes	
DC 111	Dow Corning	Tool Room/Pit	11	Yes	Yes	1
WD-40	WD-40 Company	Tool Room/Pit	3	Yes	Yes	

C. Chemical safety and spill response procedures

All safety and spill response procedures will be handled according to OMAO guidelines and following the manufacturers MSDS which has been provided to the ship's ECO.

D. Radioactive Materials

NOT APPLICABLE TO THIS CRUISE

V. Additional Projects

A. Exploration Projects of Opportunity

See Appendix for full Exploration Projects of Opportunity Forms.

1) NASA Maritime Aerosol Network

During the cruise the marine aerosol layer observations will be collected for the NASA Maritime Aerosol Network (MAN). Observations will be made by mission personnel (as time allows) with a sun photometer instrument provided by the NASA MAN program. Resulting data will be delivered to the NASA MAN primary investigator Alexander Smirnov by the expedition coordinator. All collected data will be archived and publically available at: http://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html

Equipment resides on the ship and is stewarded by the Expedition Coordinator.

2) Two visiting scientists will sail to conduct ten opportunistic CTD casts in or near the oxygen minimum zone in international waters near Mexico.

The CTD rosette will carry a newly developed, OER FFO funded Nitrogen sensor which measures biologically produced excess nitrogen (N₂ gas produced as a result of denitrification processes) in the Eastern Tropical North Pacific (ETNP) Oxygen Minimum Zone (OMZ) located in international waters. To ensure successful operation of the new sensor, and to provide hands-on training to shipboard technicians in its use at sea, we propose to send along two people on the cruise. Andrew Reed is knowledgeable on the setup and operation of the new sensor. Annie Bourbonnais is an expert rosette sampler who will take and store seawater samples for calibration and validation of the new sensor.

B. NOAA Fleet Ancillary Projects

No NOAA Fleet Ancillary Projects are planned.

VI. Disposition of Data and Reports

A. Data Responsibilities

All data acquired on *Okeanos Explorer* will be provided to the public archives without proprietary rights. All data management activities shall be executed in accordance with [NAO 212-15, Management of Environmental and Geospatial Data and Information](#)

Ship Responsibilities

The Commanding Officer is responsible for all data collected for missions until those data have been transferred to mission party designees. Data transfers will be documented on NOAA Form 61-29. Reporting and sending copies of project data to NESDIS (ROSCOP form) is the responsibility of OER.

NOAA OER Responsibilities

The Expedition Coordinator will work with the *Okeanos Explorer* Operations Officer to ensure data pipeline protocols are followed for final archive of all data acquired on *Okeanos Explorer* without proprietary rights. See Appendix section for detailed data management plans.

Deliverables

1. At sea
 - a. Daily plans of the Day (POD)
 - b. Daily situation reports (SITREPS)
 - c. Daily summary bathymetry data files
 - d. Raw sonar files (EM 302, EK 60, Subbottom, ADCP)
 - e. Refined SOPs for all pertinent operational activities
 - f. Assessments of all activities
2. Science
 - a. Multibeam raw and processed data (see Appendix section for the formal cruise data management plan)
 - b. XBT raw and processed data

- c. EK 60 raw data
- d. Knudsen 3260 sub-bottom profiler raw data
- e. ADCP raw data
- f. Mapping data report

Archive

OER and *Okeanos Explorer* will work together to ensure documentation and stewardship of acquired data sets in accordance with NAO 212-15. The Cruise Information Management System is the primary tool used to accomplish this activity.

VII. Meetings, Vessel Familiarization, and Project Evaluations

A. Shipboard Meetings

A safety brief and overview of POD will occur on the Bridge each morning at 0800. As necessary and no less than every third day, daily Operations Briefing meetings will be held at a time convenient for OPS officer and onboard mapping lead to review the current day, and define operations, associated requirements, and staffing needs for the following day. A Plan of the Day (POD) will be posted each evening for the next day in specified locations throughout the ship. Daily Situation Reports (SITREPS) will be posted as well and shared daily through e-mail.

1. Pre-Cruise Meeting:

The Expedition Coordinator and Commanding Officer will conduct a meeting of pertinent members of the scientific party and ship's crew to discuss required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. This meeting shall be conducted before the beginning of the project with sufficient time to allow for preparation of the ship and project personnel. The ship's Operations Officer usually is delegated to assist the Expedition Coordinator in arranging this meeting.

2. Vessel Familiarization Meeting:

The Commanding Officer is responsible for ensuring scientific personnel are familiarized with applicable sections of the standing orders and vessel protocols; e.g., meals, watches, etiquette, drills, etc. A vessel familiarization meeting shall be conducted in the first 24 hours of the project's start and is normally presented by the ship's Operations Officer.

3. Post-Cruise Meeting:

The Commanding Officer is responsible for conducting a meeting no earlier than 24 hours

before or seven days after the completion of a project to discuss the overall project outcomes. During this meeting the following will be discussed; concerns regarding safety and efficiency; challenges encountered and suggestions for future improvements (all mitigation ideas will be documented for future projects); as well as successes during the project. This meeting shall be attended by ship's officers, applicable crew, the Expedition Coordinator, and representatives of the scientific party and is normally arranged by the Operations Officer and Expedition Coordinator.

4. Project Evaluation Report:

Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the Chief Scientist. The form is available at <https://sites.google.com/a/noaa.gov/omao-intranet-dev/operations/marine/customer-satisfaction-survey> and provides a "Submit" button at the end of the form. It is also located at https://docs.google.com/a/noaa.gov/forms/d/1a5hCCkgIwaSII4DmrHPudAehQ9HqhRqY3J_FXqbJp9g/viewform. Submitted form data is deposited into a spreadsheet used by OMAO management to analyze the information. Though the complete form is not shared with the ships, specific concerns and praises are followed up on while not divulging the identity of the evaluator.

VIII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least twenty-one days prior to the survey (e.g., Expedition Coordinator is allergic to fin fish).

Berthing requirements, including number and gender of the scientific party, will be provided to

the ship by the Expedition Coordinator. The Expedition Coordinator and Operations Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current makeup of the ship's complement. The Expedition Coordinator is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys which were issued. The Expedition Coordinator is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the cruise and at its conclusion prior to departing the ship.

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Expedition Coordinator will ensure that all non-NOAA or non-Federal scientists aboard also have proper orders. It is the responsibility of the Expedition Coordinator to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 7, 1999 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website <http://www.corporateservices.noaa.gov/noaforms/eforms/nf57-10-01.pdf>.

All NHSQs submitted after March 1, 2014 must be accompanied by [NOAA Form \(NF\) 57-10-02](#)- Tuberculosis Screening Document in compliance with [OMAO Policy 1008](#) (Tuberculosis Protection Program).

The completed forms should be sent to the Regional Director of Health Services at the applicable Marine Operations Center. The NHSQ and Tuberculosis Screening Document should reach the Health Services Office no later than 4 weeks prior to the start of the project to allow time for the participant to obtain and submit additional information should health services require it, before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of either form. Ensure to fully complete each form and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

The participant can mail, fax, or email the forms to the contact information below. Participants should take precautions to protect their Personally Identifiable Information (PII) and medical information and ensure all correspondence adheres to DOC guidance (http://ocio.os.doc.gov/ITPolicyandPrograms/IT_Privacy/PROD01_008240).

The only secure email process approved by NOAA is [Accellion Secure File Transfer](#) which requires the sender to setup an account. [Accellion's Web Users Guide](#) is a valuable aid in using this service, however to reduce cost the DOC contract doesn't provide for automatically issuing full functioning accounts. To receive access to a "Send Tab", after your Accellion account has been established send an email from the associated email account to accellionAlerts@doc.gov requesting access to the "Send Tab" function. They will notify you via email usually within 1 business day of your approval. The "Send Tab" function will be accessible for 30 days.

Contact Information:

Regional Director of Health Services
Marine Operations Center – Atlantic
439 W. York Street
Norfolk, VA 23510
Telephone: (757) 441.6320
Fax: (757) 441.3760
E-mail: MOA.Health.Services@noaa.gov

Please make sure the medical.explorer@noaa.gov email address is cc'd on all medical correspondence.

Prior to departure, the Expedition Coordinator must provide a listing of emergency contacts to the Operations Officer for all members of the scientific party, with the following information: name, address, relationship to member, and telephone number.

Emergency contact form can be accessed at
https://docs.google.com/a/noaa.gov/forms/d/e/1FAIpQLSfses6_kyQu-BFdAuldWHZdc6apyU4G5wQzRLwlUY84ykKfcg/viewform

C. Shipboard Safety

Hard hats are required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. Steel-toed shoes are required to participate in any work dealing with suspended loads, including CTD deployments and recovery. The ship does not provide steel-toed boots.

Operational Risk Management: For every operation to be conducted aboard the ship (NOAA-wide initiative), risk management procedures will be followed. For each operation, risks will be identified and assessed for probability and severity. Risk mitigation strategies/measures will be investigated and implemented where possible. After mitigation, the residual risk will have to be assessed to make Go-No Go decisions for the operations. Particularly with new operations, risk assessment will be ongoing and updated as necessary. This does not only apply to over-the-side operations, but to everyday tasks aboard the vessel that pose risk to personnel and property.

- CTD, ROV (and other pertinent) ORM documents will be followed by all personnel working onboard *Okeanos Explorer*.
- All personnel onboard are in the position of calling a halt to operations/activities in the event of a safety concern.

D. Communications

A daily situation report (SITREP) on operations prepared by the Expedition Coordinator will be relayed to the program office. Sometimes it is necessary for the Expedition Coordinator to communicate with another vessel, aircraft, or shore facility. Through various modes of communication, the ship is able to maintain contact with the Marine Operations Center on an as needed basis. These methods will be made available to the Expedition Coordinator upon request, in order to conduct official business. The ship's primary means of communication with the Marine Operations Center is via e-mail and the Very Small Aperture Terminal (VSAT) link. VSAT bandwidth at **9 Mbps** will be paid by OER and provided by OMAO.

Specific information on how to contact NOAA Ship *Okeanos Explorer* and all other fleet vessels can be found at <http://www.moc.noaa.gov/MOC/phone.html#EX>

Important Telephone and Facsimile Numbers and E-mail Addresses

Ocean Exploration and Research (OER):

OER Program Administration
Phone: (301) 734-1010
Fax: (301) 713-4252
E-mail: craig.russell@noaa.gov

University of New Hampshire, Center for Coastal and Ocean Mapping

Phone: (603) 862-3438
Fax: (603) 862-0839

NOAA Ship *Okeanos Explorer* - Telephone methods listed in order of increasing expense:

Okeanos Explorer Cellular: (401) 713-4114
Okeanos Explorer Iridium:(808) 659-9179
OER Mission Iridium (dry lab): (808) 851-3827

EX INMARSAT B
Line 1: 011-870-764-852-328
Line 2: 011-870-764-852-329

Voice Over Internet Protocol (VoIP) Phone:

(541) 867-8932

(541) 867-8933

(541) 867-8934

E-mail: Ops.Explorer@noaa.gov- (mention the person's name in SUBJECT field)

E-mail: expeditioncoordinator.explorer@noaa.gov for dissemination of all hands emails by Expedition Coordinator while onboard. See ET for password.

E. IT Security

1. Any computer that will be hooked into the ship's network must comply with the OMAO Fleet IT Security Policy 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to: Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
2. Installation of the latest critical operating system security patches.
3. No external public Internet Service Provider (ISP) connections.

Completion of these requirements prior to boarding the ship is required.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within three days of embarking.

F. Foreign National Guests Access to OMAO Facilities and Platforms

Not applicable to this cruise.

Appendix A: Survey of Opportunity Form: NASA Marine Aerosols Project

SURVEYS OF OPPORTUNITY - INITIAL REQUEST FORM

A surveys of opportunity is a small, exploratory expedition that takes advantage of the elastic schedules of ocean-going, research vessels, - in this case, the Okeanos Explorer - by maximizing transit times between ports or projects, or by filling small gaps in the ship's calendar.

Given the ship's unique technology and capabilities, NOAA's Office of Ocean Exploration and Research (OER) invites regional researchers to help acquire additional data within the vessel's operating areas to assess specific but poorly known sites, adding to an inventory of submerged resources. In circumstances where individuals cannot serve on a "survey of opportunity", then OER ensures that acquired data and any other pertinent information are transferred to the appropriate researchers after the expedition. Previously successful surveys of opportunity have included mapping geological features, locating and characterizing shipwrecks, and defining marine protected areas. Some surveys are completed in only a few hours, while others last a couple days.

Although exploration potential and scientific merit plays a role in which opportunistic surveys are conducted, they are not chosen through a peer-reviewed process. Rather, their selection is based more on the vessel operating in the right place with the right equipment at the right time, and the ship's calendar and on-board resources allow for the added work. All requests for a survey of opportunity are archived with OER and the ship, and expire only when the survey work is completed. There is no guarantee that any request for a survey will be accomplished, nor is there any system of prioritization or ranking. Keep in mind that this proposal may be available to the public upon request except for privileged information and material that is personal, proprietary or otherwise exempt from disclosure under law.

Survey or Project Name

Maritime Aerosol Network

Points of Contact (POC)

<i>Lead POC or Principle Investigator (PI & Affiliation)</i> POC: Dr. Alexander Smirnov	<i>Supporting Team Members ashore</i>
	<i>Supporting Team Members aboard (if required)</i>

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Activities Description(s) *(Include goals, objectives and tasks)*

The Maritime Aerosol Network (MAN) component of AERONET provides ship-borne aerosol optical depth measurements from the Microtops II sun photometers. These data provide an alternative to observations from islands as well as establish validation points for satellite and aerosol transport models. Since 2004, these instruments have been deployed periodically on ships of opportunity and research vessels to monitor aerosol properties over the World Oceans.

Appendix B: Project of Opportunity: UW-APL Nitrogen Sensor Project Description Details

Cruise Participation (V8 on 10/11/2017)

Ship	NOAA <i>Okeanos Explorer</i>		
Cruise	Oct/Nov 2017 transect from Hawaii to Panama, then onto Keys West. Chief Scientist is Steven Hammond.		
Dates	Monday October 02 - Ship all gear from APL/UW to Hawaii. Thursday October 05 - All gear from APL/UW arrives at ship. Monday October 09 - Travel from Seattle to Honolulu (Jesse Doshier, Craig, Andrew) Tuesday October 10 - Load and setup CTD (Jesse, Craig) and Winkler kit (Andrew) Wednesday October 11 - Load and setup CTD (Jesse, Craig) and Winkler kit (Andrew) Thursday October 12 - OMAO Fleet Inspection day. Contingency day for APL/UW. Friday October 13 - Travel to Seattle (Craig and Jesse), Andrew stays. Monday October 16 - Depart Honolulu, HI (Andrew and Annie onboard) Saturday November 11 - Arrive Panama City, Panama Monday November 13 - Travel to Seattle (Andrew) and Boston (Annie) Wednesday November 15 - Depart Panama City, Panama Wednesday November 22 - Arrive Key West, FL November 22-23 Offload gear (Ray Hollingsworth, APL shipper)		
Scientists	Dr. Annie Bourbonnais (University of Massachusetts Dartmouth- UMD) will sail Hawaii to Panama along with PhD Student Andrew Reed (Applied Physics Laboratory – APL, at the University of Washington- UW). McNeil and Jesse Doshier (APL engineer) will assist with installations/loading in Hawaii. Details of personnel/gear/HazMat transfers are still TBD. Gear will be offloaded in Keys West by Ray Hollingsworth (APL shipper).		
Project	“Profiling Sensor Map N ₂ Gas Production in OMZs”, NOAA NA16OAR0110196, 09/01/2016 –08/31/2018).		
Purpose	To measure biologically produced excess nitrogen (N ₂ gas produced as a result of denitrification processes) in the Eastern Tropical North Pacific (ETNP) Oxygen Minimum Zone (OMZ) located in international waters. To ensure successful operation of the new sensor, and to provide hands-on training to shipboard technicians in its use at sea, we propose to send along two people on the cruise. Andrew Reed is knowledgeable on the setup and operation of the new sensor. Annie Bourbonnais is an expert rosette sampler who will take and store seawater samples for calibration and validation of the new sensor.		
Contact	<table><tr><td>Dr. Craig McNeil Applied Physics Laboratory University of Washington 1013 NE 40th Street Seattle, WA 98105-6698</td><td>Email: cmcneil@apl.washington.edu Office: 206-543-2157 Cell: 206-265-1941</td></tr></table>	Dr. Craig McNeil Applied Physics Laboratory University of Washington 1013 NE 40th Street Seattle, WA 98105-6698	Email: cmcneil@apl.washington.edu Office: 206-543-2157 Cell: 206-265-1941
Dr. Craig McNeil Applied Physics Laboratory University of Washington 1013 NE 40th Street Seattle, WA 98105-6698	Email: cmcneil@apl.washington.edu Office: 206-543-2157 Cell: 206-265-1941		

Sampling Approximately 10 CTD stations transecting the ETNP OMZ (see attached map for approximate locations). Each hydrocast will be to maximally 600 m, limited by sensor operating depths, and will take approximately 4 hrs total on station. The Niskin bottles will be triggered on the way up with sampling concentrated in the 100-500 m range. We will try to adapt our sampling to minimize impact on the crew and scientists.

Explanation This is the first use of the new sensor in the open ocean OMZ, so we want to wait long enough at each targeted depth to ensure the new sensor fully equilibrates.

Map: Our targeted sampling region is the shaded white region in the upper left corner of Fig. 1. This is a region of high 'excess N₂'. Also shown are approximate locations of our 10 CTD stations and two test stations. The exact locations will be informed by the data we collect and other constraints (weather, other science operations, ship's daily routines, etc.)



Figure 1: Map showing approximate locations of 10 CTD stations (red icons) along the cruise track. We would like to perform two test casts (blue icons) early on in the cruise, one shallow (~200 m) and one deep (600 m) to provide training to all operators and ensure proper operation of the sampling equipment.

Table 1: CTD stations (tentative):

Station ID	Date	Depth (dbar)	Latitude	Longitude
Shallow test	?	200	16N 30.0	150W 32.80
Deep test		600	15N 23.620	148 W 4.984
1		600 max	14N 58.578	144N 13.221
2		600 max	16N 11.582	136W 26.598
3		600 max	17N 7.593	131W 17.752
4		600 max	17N 45.093	126W 16.819
5		600 max	18N 7.621	121W 50.509
6		600 max	16N 6.213	118W 10.757
7		600 max	14N 41.785	114W 19.753
8		600 max	13N 56.720	109W 53.753
9		600 max	12N 1.055	102W 24.105
10		600 max	9N 1.496	93W 0.684

Email records

Some details (07/20/2017 by Craig McNeil)

1) Serial Uplink on the ship CTD - For the cruise, APL requires what is known as a "serial data Uplink capability" on the NOAA Okeanos Explorer CTD. The Uplink capability requires a particular electronic board inside the CTD, and in UNOLS only 50% of the fleet's CTD have this board embedded in the CTD. Chris Siani (APL electrical engineer) is coordinating APL's CTD needs and is POC (copied here). We will test all our sensors on a cruise in Hood Canal on the RV Robertson in about 3 weeks time (15-18 Aug, 2017). We upgraded our boat's CTD to include the Uplink capability last year (at the SBE factory). The tested and in situ calibrated dissolved gas sensors will be removed from the Robertson's CTD after the Hood Canal cruise, the preferred configurations documented, then packaged and ultimately sent directly to the NOAA Okeanos in Hawaii to be installed on the ship's CTD. [The sensor suite details are the new titanium GTD/N2 sensor with SBE-5T pump running at ~0.5 A, a SBE-43 DO sensor, and possibly another modified SBE-43]. Chris will supply us with any necessary custom cables (inc. technical drawings) to make sure the sensors mount and integrate on the ship's CTD easily. For this, Chris needs asap the s/n on the CTD systems on the NOAA Oceanus Explorer to evaluate these compatibility issues, thanks.

2) Temporary refrigeration of deep (cold) samples collected during the cruise for Winkler titrations - I will buy or send a desktop fridge as needed, but if there is one available for science use aboard then all the better. A picture or details would be much appreciated.

3) Outreach – If the Chief Scientist agrees, I am definitely interested in adding an outreach component to this cruise. We have exciting multidisciplinary experimental oceanography going on and it seems like a perfect outreach opportunity. I can offer my POC for Seattle Public Schools who is Marie-Claude Bourque, the Science Department Chair for Jane Adams Middle School. Her emails address is mpbourque@seattleschools.org (copied here). In preliminary discussions, she has enthusiastically embraced the idea of using this cruise opportunity and the high bandwidth capabilities offered on the ship in the science classroom. Typically, there are 30 students aged 11-15 yrs per class, probably 3 classes which would be a great start.

Appendix C: Data Management Plan

Data Management Plan

Okeanos Explorer (EX1709): Transit to Panama



Ocean Exploration and Research

OER Data Management Objectives

To ensure the full complement of data is documented and archived in a timely manner.

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1. General Description of Data to be Managed

1.1 Name and Purpose of the Data Collection Project

Okeanos Explorer (EX1709): Transit to Panama

1.2 Summary description of the data to be collected.

Operations for this cruise will include 24 hour mapping, and continuous telepresence-based remote participation in mapping operations. Multibeam and splitbeam mapping operations will be conducted 24 hours a day throughout the cruise, except during CTD operations. Sub-bottom profile mapping will be conducted 24 hours a day at the discretion of the CO. XBT and Underway CTD sound velocity casts in support of multibeam sonar mapping operations will be conducted at an interval defined by prevailing oceanographic conditions, but not to exceed 6 hours.

1.3 Keywords or phrases that could be used to enable users to find the data.

expedition, exploration, explorer, marine education, noaa, ocean, ocean discovery, ocean education, ocean exploration, ocean exploration and research, ocean literacy, ocean research, OER, science, scientific mission, scientific research, sea, stewardship, systematic exploration, technology, transformational research, undersea, underwater, Davisville, mapping survey, multibeam, multibeam backscatter, multibeam sonar, multi-beam sonar, noaa fleet, okeanos, okeanos explorer, R337, Rhode Island, scientific computing system, SCS, single beam sonar, singlebeam sonar, single-beam sonar, sub-bottom profile, water column backscatter, Clarion Clipperton Fracture Zone, Honolulu, Balboa, Oxygen Minimum Zone, denitrification process, fracture zones, transform faults, serpentinization, subduction zones, Panama

1.4 If this mission is part of a series of missions, what is the series name?

Okeanos Mapping Cruises

1.5 Planned or actual temporal coverage of the data.

Dates: 10/16/2017 to 11/11/2017

1.6 Planned or actual geographic coverage of the data.

Latitude Boundaries: 8.81 to 21.34

Longitude Boundaries: -158.26 to -79.57

1.7 What data types will you be creating or capturing and submitting for archive?

Cruise Plan, Cruise Summary, Data Management Plan, Highlight Images, Quick Look Report, ADCP, Bottom Backscatter, EK60 Singlebeam Data, Expedition Cruise Report, Mapping Summary, Multibeam (image), Multibeam (processed), Multibeam (product), Multibeam (raw), NetCDF, SCS Output (compressed), SCS Output (native), Sub-Bottom Profile data, Water Column Backscatter

1.8 What platforms will be employed during this mission?

NOAA Ship Okeanos Explorer

2. Point of Contact for this Data Producing Project

Overall POC: Elizabeth Lobecker, Multibeam Mapping Expert, Contractor (ERT, Inc.), NOAA Office of Ocean Exploration and Research, elizabeth.lobecker@noaa.gov

Title: Expedition Coordinator, Multibeam Mapping Team Lead

Affiliation/Dept: NOAA Office of Ocean Exploration and Research

E-Mail: elizabeth.lobecker@noaa.gov

Phone: 603-862-1475

3. Point of Contact for Managing the Data

Data POC Name: Susan Gottfried

Title: OER Data Management Coordinator

E-Mail: susan.gottfried@noaa.gov

4. Resources

4.1 Have resources for management of these data been identified? True

4.2 Approximate percentage of the budget devoted to data management. (specify % or "unknown")
unknown

5. Data Lineage and Quality

5.1 What is the processing workflow from collection to public release?

SCS data shall be delivered in its native format as well as an archive-ready, documented, and compressed NetCDF3 format to NCEI-MD; multibeam data and metadata will be compressed and delivered in a bagit format to NCEI-CO

5.2 What quality control procedures will be employed?

Quality control procedures for the data from the Kongsberg EM302 is handled at UNH CCOM/JHC. Raw (level-0) bathymetry files are cleaned/edited into new data files (level-1) and converted to a variety of products (level-2).

Data from sensors monitored through the SCS are archived in their native format and are not quality controlled. Data from CTD casts and XBT firings are archived in their native format. CTDs are post-processed by the data management team as a quality control measure and customized CTD profiles are generated for display on the Okeanos Atlas (explore.noaa.gov/okeanosatlas).

6. Data Documentation

6.1 Does the metadata comply with the Data Documentation Directive?

True

6.1.1 If metadata are non-existent or non-compliant, please explain:

6.2 Where will the metadata be hosted?

Organization:

An ISO format collection-level metadata record will be generated during pre-cruise planning and published in an OER catalog and Web Accessible Folder (WAF) hosted at NCEI-MS for public discovery and access. The record will be harvested by data.gov.

<https://www.ncddc.noaa.gov/oer-waf/ISO/Resolved/2017/>

URL:

ISO 19115-2 Geographic Information with Extensions for Imagery and Gridded Data will be the metadata standard employed; a NetCDF3 standard for oceanographic data will be employed for the SCS data; the Library of Congress standard, MACHINE READABLE CATALOG (MARC), will be employed for NOAA Central Library records.

Meta Std:

6.3 Process for producing and maintaining metadata:

Metadata will be generated via xml editors or metadata generation tools.

7. Data Access**7.1** Do the data comply with the Data Access Directive?

True

7.1.1 If the data will not be available to the public, or with limitations, provide a valid reason.

Not Applicable

7.1.2 If there are limitations, describe how data are protected from unauthorized access.

Account access to mission systems are maintained and controlled by the Program. Data access prior to public accessibility is documented through the use of Data Request forms and standard operating procedures.

7.2 Name and URL of organization or facility providing data access.

NOAA National Centers for Environmental Information

Org:

www.ncei.noaa.gov

URL:

7.3 Approximate delay between data collection and dissemination. By what authority?

Hold Time:

none

Authority:

not applicable

7.4 Prepare a Data Access Statement

No data access constraints, unless data are protected under the National Historic Preservation Act of 1966.

8. Data Preservation and Protection**8.1** Actual or planned long-term data archive location:

Data from this mission will be preserved and stewarded through the NOAA National Centers for Environmental Information. Refer to the Okeanos Explorer FY17 Data Management Plan at NOAA's EDMC DMP Repository (EX_FY17_DMP_Final.pdf) for detailed descriptions of the processes, procedures, and partners involved in this collaborative effort.

Okeanos Explorer (EX1709): Transit to Panama

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8.2 If no archive planned, why?

Not applicable

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8.3 If any delay between data collection and submission to an archive facility, please explain.

8.4 How will data be protected from accidental or malicious modification or deletion?

Data management standard operating procedures minimizing accidental or malicious modification or deletion are in place aboard the Okeanos Explorer and will be enforced.

8.5 Prepare a Data Use Statement

Data use shall be credited to NOAA Office of Ocean Exploration and Research.

Appendix D: Diplomatic Clearances

Panama



REPÚBLICA DE PANAMÁ
Ministerio de Relaciones Exteriores

PANAMÁ 4, PANAMÁ

NV/DGPE/DHO/MIRE-2017-66723

El Ministerio de Relaciones Exteriores – Dirección General de Política Exterior- saluda muy atentamente a la Honorable Embajada de los Estados Unidos de América, en ocasión de referencia a la Nota No. 1059 de fecha 24 de agosto de 2017, mediante la cual se adjunta autorización del Permiso Especial de Navegación especial emitido por la Autoridad Marítima de Panamá a favor de la embarcación OKEANOS EXPLORER, del 9 al 13 de noviembre de 2017.

El Ministerio de Relaciones Exteriores – Dirección General de Política Exterior- aprovecha la oportunidad para expresar a la Honorable Embajada de los Estados Unidos de América las seguridades de su más alta y distinguida consideración.

Panamá, 18 de septiembre de 2017



A la Honorable
Embajada de los Estados Unidos de América
Ciudad.

E/Amh/rf

Costa Rica pending as of 10/11/17

Appendix E: Environmental Permits

ESA Section 7 Consultation for 2016/2017 CAPSTONE Cruises



January 14, 2016

Ann Garrett
Assistant Regional Administrator
Protected Resources Division
NMFS Pacific Islands Regional Office
1845 Wasp Blvd., Building 176
Honolulu, HI 96818

Re: Request to Initiate Consultation under Section 7 of the Endangered Species Act for the Campaign to Address Pacific Monument Science, Technology and Ocean Needs (CAPSTONE Project)

Dear Ms. Garrett:

Operating under a partnership with NOAA's Office of Ocean Exploration and Research and the Office of Marine and Aviation Operations, the *Okeanos Explorer* team is preparing to continue the CAPSTONE campaign into the Central and Western Pacific during the 2016 and 2017 field seasons. The action area for the 2016 – 2017 season will include the marine environments in and around: the Papahānaumokuākea Marine National Monument (PMNM); Oahu and the big island of Hawai'i; the area south and west of Molokai, Lana'i, and Kaho'olawe, the Geologists Seamounts located about 100 nm south of Honolulu; the Musicians Seamounts located about 150 nm NNE of Nihoa Island; all of the Pacific Remote Island Areas composing the Pacific Remote Islands Marine National Monument (PRIMNM); the Commonwealth of the Northern Marianas Islands (CNMI) and the Marianas Trench Marine National Monument (MTMNM); the vicinity of American Samoa and the National Marine Sanctuary of American Samoa (NMSAS); the Rose Atoll Marine National Monument (RAMNM); and the vessel transit areas between Honolulu, Hawai'i, Guam, Saipan, Kwajalein, Pago Pago.

The activity would occur during two years and could include up to twenty different research cruises aboard the NOAA Ship *Okeanos Explorer* scheduled between February 2016 and December 2017. All cruises will focus on collecting critical baseline information in monuments and sanctuaries to meet NOAA science and management needs. The overarching goal of the project is to extend and improve the understanding of the distribution and diversity of deep-water habitats within the marine protected areas in the Pacific. Data and information from the cruises will build on previous work where appropriate, and provide a foundation of publicly-accessible baseline information to improve management and spur further exploration and research. Like previous expeditions in the Gulf of Mexico, western Atlantic, Indonesia, and Hawaii, NOAA



will work with the scientific community and public to characterize unknown and poorly-known areas through telepresence-based exploration. Operations will use the ship's deep water mapping systems, NOAA's 6000m remotely operated vehicles (ROV), CTD rosette, and a high-bandwidth satellite connection for real-time ship to shore communications. These expeditions will help establish a baseline of information in the region to catalyze further exploration, research and management activities.


We propose to conduct activities to explore and improve understanding of the distribution and diversity of deep water habitats. No activities would occur on land. The expedition teams (26 crew and up to 20 rotating scientists/technicians on each cruise leg) would be authorized to conduct mapping and ROV surveys using the *Okeanos Explorer's* multibeam, split beam, subbottom profiler and acoustic Doppler current profiler (ADCP) sonar systems, utilizing the ship's conductivity-temperature-depth (CTD) sampling rosette for various water measurements and deploying an ROV.

Enclosed is a Biological Evaluation (BE) to initiate consultation under Section 7(a)(2) of the Endangered Species Act (ESA). As described in the BE, we have determined that the proposed 2016 CAPSTONE cruises may affect, but are not likely to adversely affect, the following ESA-listed marine species: green sea turtles (*Chelonia mydas*), hawksbill sea turtles (*Eretmochelys imbricata*), North Pacific distinct population segment of loggerhead sea turtles (*Caretta caretta*), olive ridley sea turtles (*Lepidochelys olivacea*), leatherback sea turtles (*Dermochelys coriacea*), Main Hawaiian Islands false killer whale distinct population segment (*Pseudorca crassidens*), humpback whales (*Megaptera novaeangliae*), sperm whales (*Physeter macrocephalus*), fin whales (*Balaenoptera physalus*), blue whales (*Balaenoptera musculus*), sei whales (*Balaenoptera borealis*), north pacific right whales (*Eubalaena japonica*), the Indo-West Pacific and Central Pacific distinct population segments of the scalloped hammerhead shark (*Sphyrna lewini*), Hawaiian monk seals (*Neomonachus schauinslandi*), Hawaiian monk seal critical habitat; and the coral species *Acropora globiceps*, *A. jacquelineae*, *A. retusa*, *A. speciosa*, *Euphyllia paradivisa*, *Isopora crateriformis*, and *Seriatopora aculeata*.

We request your concurrence with our 'not likely to adversely affect' determination for the species listed above and for Hawaiian monk seal critical habitat.

Please contact Kelley Elliott (Kelley.Elliott@noaa.gov, 301-734-1024) with questions regarding this consultation request.

Respectfully,


For John McLaughlin

Essential Fish Habitat Consultation



Kelley Elliott - NOAA Federal <kelley.elliott@noaa.gov>

EFH Consultation Response for CAPSTONE cruises

Richard Hall - NOAA Federal <richard.hall@noaa.gov>

Wed, Nov 30, 2016 at 4:21 PM

To: Kelley Elliott - NOAA Affiliate <kelley.elliott@noaa.gov>

Cc: Ian Lundgren - NOAA Affiliate <ian.lundgren@noaa.gov>, Samantha Brooke <samantha.brooke@noaa.gov>, Kasey Cantwell - NOAA Affiliate <kasey.cantwell@noaa.gov>

Kelley,

On November 14, 2016, the Office of Exploration and Research (OER), through personal communication, initiated a request for an Essential Fish Habitat consultation for a series of cruises by the NOAA Ship *Okeanos Explorer*. The cruises would run from early-December 2016 through late-September 2017, and include the waters around the Main Hawaiian Islands, the Musician Seamounts (north of Hawaii), the American Samoa Archipelago; Johnston, Howland, Baker, Jarvis, Kingman and Palmyra Atolls of the Pacific Remote Islands, and portions of the Cook Islands. The operational minimum depth during the cruises would be 250 m, with the majority of the cruise activities would be in water depths over 500 m.

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855 et seq.) requires review of federally permitted projects for potential impacts to EFH (§305(b)). Pursuant to this authority, I have reviewed and provided comments as necessary for the Habitat Conservation Division of NOAA's Pacific Islands Regional Office.

The proposed cruises are the final legs of the larger 2-year Campaign to Address Pacific Monuments Science, Technology and Ocean Needs (CAPSTONE Project), which is designed to improve the understanding of the distribution and diversity of deepwater habitats within the Pacific monuments and protected areas.

The primary activities to be conducted during this series of cruises would be: remotely operated vehicle (ROV) dives to conduct engineering trials and sonar calibration and testing during two shakedown cruises scheduled for the waters of the Main Hawaiian Islands (no biological or geological samples would be collected); and mapping and ROV dives in the waters of American Samoa, West Samoa, the Pacific Remote Islands, the Musician Seamounts, and portions of the Cook Islands. Five cruises would be dedicated mapping cruise, resulting in 92 days of constant mapping, while six cruises would be combined ROV and mapping cruises which would result in approximately 96 ROV dives and 110 days of overnight mapping. Other activities to be performed during the cruises would include: deployment and recovery of a conductivity-temperature-depth (CTD) sampling rosette and underway CTDs, and possible deployment of Argo floats to acquire ocean chemistry data. During ROV dives various biological and geological samples would be collected.

In order to avoid/minimize impacts to EFH, the OER and the *Okeanos Explorer* have proposed to institute the following procedures:

- The vessel would employ the use of dynamic positioning during ROV dives (no anchoring);
- ROVs would be operated in a manner to avoid seafloor disturbance, and setting the ROV on the seafloor will be held to a minimum. For those situations when the ROV does make contact with the seafloor, visual observations will confirm that the area is sand, mud, or hard-bottom;
- Sample collections would be limited (typically 4 - 6 total rocks and primary biological specimens per dive) that represent new species, new records, or the dominant morphotype animal in a community. Clonal biological specimens (corals, sponges) would be subsampled; and
- Instruments deployed to collect water samples and current data (except for expendable instruments) would not be allowed to contact the seafloor;

In addition to the management practices proposed by OER and the *Okeanos Explorer*, NMFS provides the following guidance to further avoid/minimize impacts to EFH from the proposed cruise activities and vessel operations:

1. Except in an emergency, the vessel should not anchor while at sea;
2. The vessel should adhere to MARPOL discharge regulations at all times during the proposed cruises;
3. The ROV should be thoroughly rinsed between dives, allowed to dry, and checked for the presence of biological

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organisms to prevent the spread of invasive or non-endemic species from one location to another.

4. The use of detergents and other pollutants which may be washed into the marine environment should be avoided or held to a minimum;

Based on my review of the documents provided, and through our personal communications, NOAA Fisheries has determined that the proposed cruises of the NOAA Ship *Okeanos Explorer* would not adversely affect EFH provided adherence to OER proposed procedures and the NMFS guidance made above. Thank you for the opportunity to review the plans for the upcoming field season of the *Okeanos Explorer*, and to provide our comments. This completes your obligation to consult with our office with regards to EFH for this series of actions. If you have any questions or comments feel free to contact me at your convenience.

--

Richard Hall
Fishery Policy Analyst
Pacific Islands Regional Office
NOAA Inouye Regional Center
1845 Wasp Blvd., Building 176
Honolulu, HI 96818
[808-725-5018](tel:808-725-5018)

Appendix F. Categorical Exclusion

Categorical Exclusion (CE) Determination Worksheet

Project Title: EX-17-09. Eastern Pacific Mapping (Telepresence Mapping)
Date Review Completed: October 11, 2017
Completed by: CDR William Mowitz, NOAA Office of Ocean Exploration and Research

Worksheet File Name: 2017-10-02-OER-CE-EX1709

Signature:  CDR W. Mowitz

Step 1. CE applicability

1. What is the proposed federal action?

The proposed action is to collect baseline mapping data using the NOAA Ship *Okeanos Explorer's* sonar systems and CTD rosette system on the NOAA Ship *Okeanos Explorer*.

The expedition will commence on October 16, 2017 in Honolulu, HI (21° 21.659'N, 157° 59.438'W) and conclude on November 11, 2016 in Balboa, Panama, and will conduct operations in US waters near Oahu, in international waters along the Clarion-Clipperton Fracture Zone, within the waters of Costa Rica and Panama. See Project Instructions EX-17-09 for more details.

2. Which class of CE in Appendix E of the NAO 216-6A Companion Manual is applicable to this action and why?

The topical scope of this action is consistent with CE number E4 in Appendix E of the Companion Manual to NOAA Administrative Order (NAO) 216-6A:

Activities that remotely survey or observe living resources in the field using non-invasive techniques, which have little to no potential to adversely affect the environment or interfere with organisms or habitat.

Step 2. Extraordinary Circumstances Consideration

3. Would the action result in adverse effects on human health or safety that are not negligible?

No. The NOAA Ship *Okeanos Explorer* will be operating in remote deep sea areas of the

Pacific Ocean. Expedition EX-17-09 will conduct transit operations along the Clarion-Clipperton Fracture Zone in international waters, and transit mapping operations from Hawaii to this zone, and from this zone to Balboa, Panama, including through Costa Rica waters. All operation areas are underwater and therefore have no human presence, (see *Figure 1 of EX-17-09 Project Instructions for a map of generalized cruise track*) and additionally do not involve any procedures or outcomes known to result in impacts on human health and safety more than would be negligible.

1. Would the action result in adverse effects on an area with unique environmental characteristics that are not negligible?

This survey/expedition overlaps with the following areas with unique environmental characteristics: deep sea seamounts and seafloor fracture zones. However, the survey effects will be negligible or less than negligible, as acoustic mapping operations will not cause any impact on the seabed.

2. Would the action result in adverse effects on species or habitats protected by the ESA, MMPA, MSA, NMSA, or MBTA that are not negligible?

OER has taken measures to ensure that any effects on species or habitats protected by the ESA, MMPA, MSA or NMSA meet the definition of “negligible”. In January 2016, request from OER was submitted to the NMFS PIRO Protected Resources Division to initiate consultation under Section 7 of the ESA. Accompanying this request was a biological assessment that described the planned operations proposed for 2016-2017 expeditions in the Pacific and identified all ESA-listed species, including corals, in the vicinity of the operations. On February 7, 2016, OER received a letter that concurred with our determination that these 2016-2017 operations are not likely to adversely affect ESA-listed species. The original ESA Section 7 concurrence letter is provided as an appendix in the Project Instructions document for EX-17-09. At the time of writing this CE, a reinitiation of the consultation was underway in order to confirm that the geographic scope of this project, which is further east in the Pacific than the original evaluation considered, does not affect the “negligible effect” decision of initial consultation. The reinitiation will evaluate (1) for the presence of additional protected species, and (2) the potential impact of the requested overboard discharge of diluted CTD water sample titration wastewater. The results of this consultation will be appended to the project instructions as soon as available.

Given the offshore focus area of our work, it is highly improbable that we will encounter marine mammals protected under the MMPA or sea birds protected under the MBTA. If we did

encounter any marine mammals or seabirds, our effect would be negligible because of the best management practices to which we adhere to avoid or minimize environmental impacts.

OER also initiated a request for a Magnuson-Stevens Essential Fish Habitat (EFH) consultation for this same series of cruises and subsequently received a determination that the proposed cruises will not reduce the quality and/or quantity of EFH, provided there is adherence to the OER proposed procedures and the NMFS guidance conveyed via email from NMFS PIRO's Richard Hall, dated November 30, 2016.

Operations will not occur in any sanctuaries and therefore NMSA does not apply.

3. Would the action result in the potential to generate, use, store, transport, or dispose of hazardous or toxic substances, in a manner that may have a significant effect on the environment?

No. The cruise operations will be in compliance with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or superseding OMAO procedures) to ensure generation, use, storage, transport, and disposal of such substances will not result in significant impacts.

4. Would the action result in adverse effects on properties listed or eligible for listing on the National Register of Historic Places authorized by the National Historic Preservation Act of 1966, National Historic Landmarks designated by the Secretary of the Interior, or National Monuments designated through the Antiquities Act of 1906; Federally recognized Tribal and Native Alaskan lands, cultural or natural resources, or religious or cultural sites that cannot be resolved through applicable regulatory processes?

There are no operations planned for this cruise that involve underwater cultural heritage sites.

5. Would the action result in a disproportionately high and adverse effect on the health or the environment of minority or low-income communities, compared to the impacts on other communities (EO 12898)?

No, the NOAA Ship *Okeanos Explorer* will be operating in remote deep sea areas of the Pacific Ocean (see figure 1, EX 17-07 Cruise Project Instructions). There are no communities within or near the geographic scope of the cruise, and the cruise does not involve actions known or likely to result in adverse impacts on human health.

6. Would the action contribute to the introduction, continued existence, or spread of

noxious weeds or nonnative invasive species known to occur in the area or actions that may promote the introduction, growth, or expansion of the range of the species?

No. During EX-17-09, the ship will not make landfall in areas other than commercial ports. The ship and OER mission team will comply with all applicable local and federal regulations regarding the prevention or spread of invasive species. At the completion of every CTD cast, the CTD will be thoroughly rinsed with fresh water and completely dried to prevent spreading organisms from one site to another. Also the Engineering Department aboard the NOAA Ship *Okeanos Explorer* attends yearly Ballast Management Training in accordance with NOAA Form 57-07-13NPDES VGP Annual Inspection and Report to prevent the introduction of invasive species.

7. Would the action result in a potential violation of Federal, State, or local law or requirements imposed for protection of the environment?

The proposed action **will not** result in any violations of Federal, State, or local law or requirements imposed for protection of the environment. The survey coordinators obtained (or are in the process of obtaining) authorizations and/or consultations pursuant to applicable laws. See responses to questions #4, 5, and 6 for details.

8. Would the action result in highly controversial environmental effects?

No. The exploration activities will be localized and of short duration in any particular area at any given time. Given this project's scope and breadth, no notable or lasting changes or highly controversial effects to the environment will result.

9. Does the action have the potential to establish a precedent for future action or an action that represents a decision in principle about future actions with potentially significant environmental effects?

No. While each cruise contributes to the overarching goal of exploring, mapping, and sampling the ocean, every cruise is independently useful and not connected to subsequent cruises.

10. Would the action result in environmental effects that are uncertain, unique, or unknown?

No. The techniques and equipment used are standard for this type of field activity.

11. Does the action have the potential for significant cumulative impacts when the proposed action is combined with other past, present and reasonably foreseeable future actions, even though the impacts of the proposed action may not be significant by themselves?

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By definition, actions that a federal agency classifies as a categorical exclusion have no potential, individually or cumulatively, to significantly affect the environment. This cruise is consistent with a class of CE established by NOAA, and there are no extraordinary circumstances for this action that may otherwise result in potentially significant impacts.

CE Determination

I have determined that a Categorical Exclusion is the appropriate level of NEPA analysis for this action and that no extraordinary circumstances exist that would require preparation of an environmental assessment or environmental impact statement.

I have determined that an environmental assessment or environmental impact statement is required for this action.

Signature:

Signed by: Craig Russell, Program Manager

Date Signed: