# Project Instructions

**Date Submitted:** January 23, 2015

**Platform:** NOAA Ship *Okeanos Explorer*

**Project Number:** EX-15-01

**Project Title:** Ship Shakedown & Patch Test

**Project Dates:** February 9 - 12, 2015

Prepared by: Elizabeth Lobecker and Derek Sowers, NOAA
Expedition Co-Coordinators
Office of Ocean Exploration & Research

Approved by: _____ Dated: _____
John Mcdonough
Deputy Director
Office of Ocean Exploration & Research

Approved by: _____ Dated: _____
Captain Anne K. Lynch, NOAA
Commanding Officer
Marine Operations Center - Atlantic

# I. OVERVIEW

## A. Cruise Period

This document contains project instructions for EX-15-01. EX-15-01operations are expected to commence on February 9, 2015 at Davisville, RI and conclude on February 12, 2015 at Davisville RI. Multibeam and singlebeam mapping operations will be conducted 24 hours a day throughout the cruise. Sub-bottom profile mapping will be conducted 24 hours a day at the discretion of the CO.

## B. Operating Area

The primary operating area is the Western North Atlantic Ocean offshore from Rhode Island at the continental shelf break in the vicinity of Veatch Canyon.

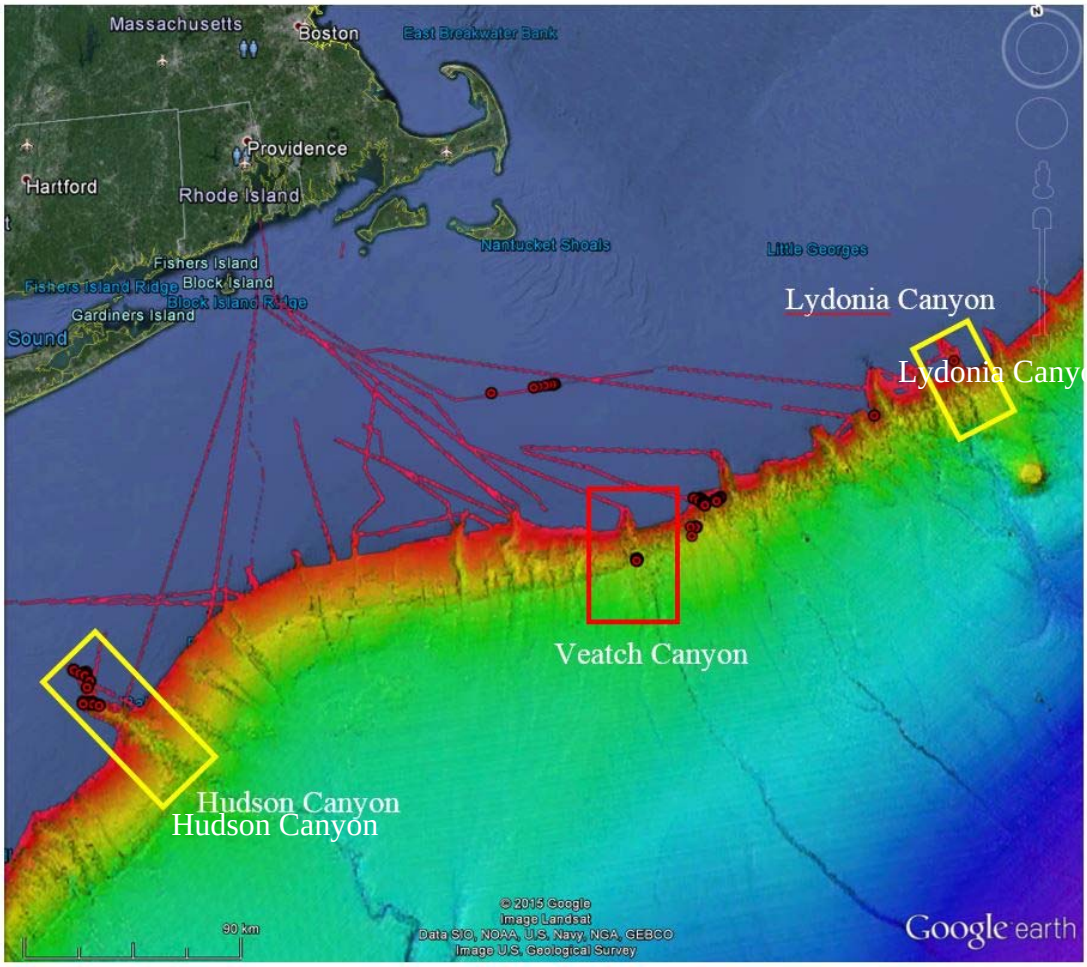


Figure 1: Operating area map. Multibeam patch test area indicated with red polygon. Yellow boxes are patch test weather contingency areas. Existing available bathymetry collected by Okeanos Explorer and University of New Hampshire Law of the Sea Project shown in background. Red dots indicate known gas seep locations previously discovered by *Okeanos Explorer*. Map produced in Google Earth Pro.

The yellow boxes shown in Figure 1 around Hudson Canyon and Lydonia Canyon are weather contingency areas for the multibeam patch test and EK80 seep data collection lines if they have substantially better forecasted sea state conditions than Veatch Canyon during the expedition.

Prior to departing for Veatch Canyon, calibration data for the EK80 must be collected while at anchor in Jamestown Harbor. This location was successfully used recently for this purpose on the *R/V Endeavor* based at the University of Rhode Island, as well as by the *F/V Henry B. Bigelow*. This calibration work will be conducted using guidance from the existing *Okeanos Explorer* EK60 Calibration SOP as well as additional guidance from the EK 80 test report from the *I/B Oden* contained in Appendix D of this document. Calibration work involves suspending the copper calibration sphere underneath the ship using three fishing pole outriggers (two on the port side, one on starboard). Small boat assistance in deploying the sphere and attaching it to the outrigger lines is likely to greatly speed up setting up the calibration gear. The FRB could be used for this purpose and could help deploy the calibration gear while minimizing risk of entanglement in the ship's anchor lines or propellers. Once the calibration gear is in place, calibration of the sonar is expected to take 6-8 hours. The proposed general location of the EK80 calibration work at anchor in Jamestown Harbor, RI is shown in Figure 2. The exact anchor location to be determined by the CO depending on circumstances.

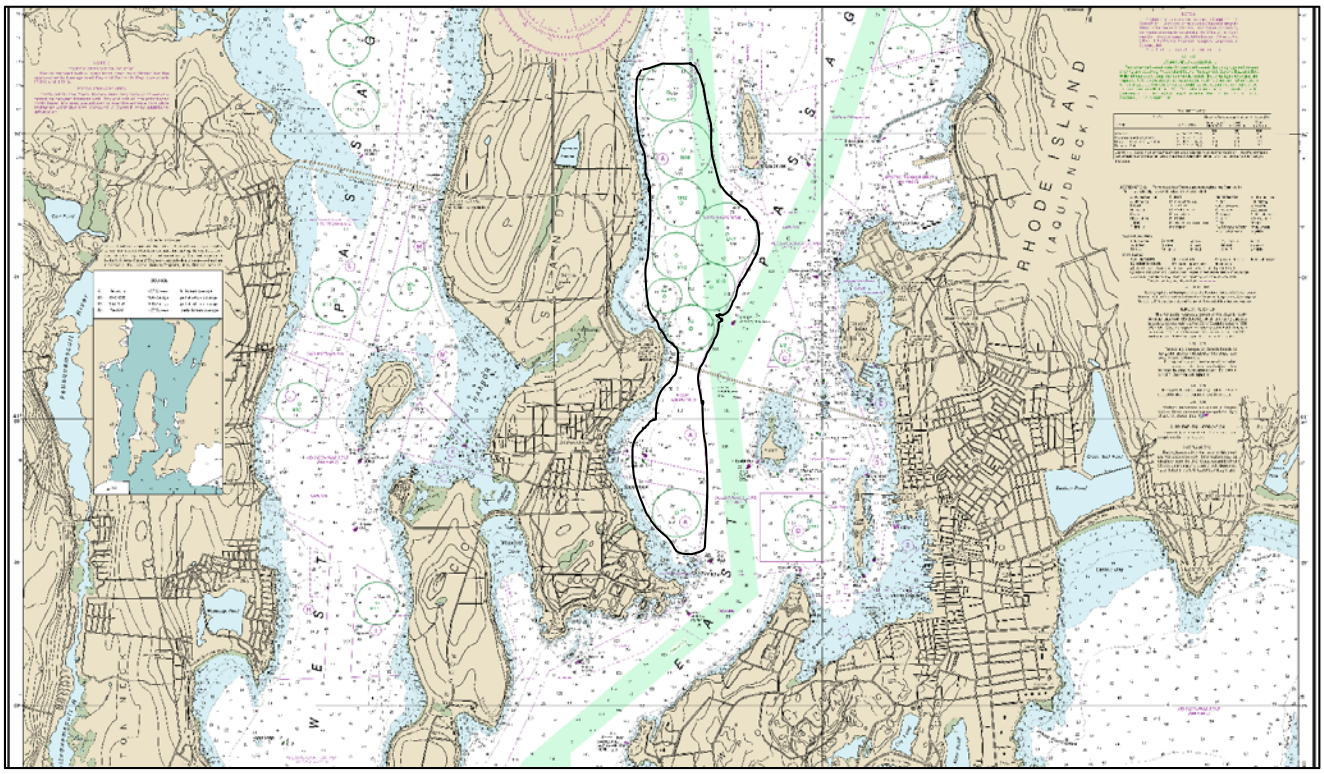


*Figure 2: Proposed anchorage area for calibration of EK80 sonar. The general proposed anchorage area is shown in the black outline polygon, as drawn on an excerpted section of NOAA RNC 13223.*

**Table 1:** Approximate waypoints for the EX-15-01 transit. The actual cruise track will vary due to prevailing conditions and the discretion of the Commanding Officer.

| EX-15-01 Transit Waypoints (approximate) | | Remarks |
|---|---|---|
| 71 22.2765 W | 40 59.5929 N | Exit Narragansett Bay |
| 71 8.778 W | 40 56.393 N | Transit to Veatch Canyon |
| 69 38.228 W | 40 1.319 N | Arrive Veatch Canyon Patch Test Area |
| 71 8.778 W | 40 56.393 N | Transit to Narragansett Bay |
| 71 22.2765 W | 40 59.5929 N | Enter Narragansett Bay |

Table 2: **Multibeam Patch Test / System Testing bounding box coordinates.**

| Multibeam Patch Bounding Box Coordiantes | | Remarks |
|---|---|---|
| 70 3.7 W | 39 58.4 N | Northwest Corner |
| 69 12.2 W | 40 11.5 N | Northeast Corner |
| 68 57.4 W | 39 40.4 N | Southeast Corner |
| 69 51.0 W | 39 25.3 N | Southwest Corner |

### C. Summary of Objectives

EX-15-01will be primarily focused on the annual ship and system shakedown and multibeam patch test operations, EK 80 sonar calibration and data collection over a known gas seep, and telepresence shakedown items. During EX-15-01, multibeam and single beam data (EK 60 or EK 80) may be collected 24 hours a day and XBT casts will be conducted at an interval defined by prevailing oceanographic conditions, but not to exceed 6 hours. Additionally, sub-bottom profile data may be collected up to 24 hours per day, unless it is deemed to interfere with other sonar testing (*e.g.* the EK 80). All multibeam data will be fully processed according to standard onboard procedures and will be archived with the National Geophysical Data Center. Ancillary sonar datasets will be archived at the National Oceanographic Data Center, except for the EK 80 research data files. Based on consultation with the NCDDC Data Management Team, the EK 80 files are deemed research data sets and they will not be archived.

**FEB 9 - FEB 12 2015 (Davisville, Rhode Island to Davisville, Rhode Island)**

The following are cruise objectives for EX-15-01:

1. Assess ship's essential operational equipment and procedures
    a. Annual review of small boat operational risk management and certification /practice for launch/recovery crews and coxswains.

2. Conduct emergency drills. Drills may include some or all of the following as determined by CO:

a. Fire/Damage Control
b. Abandon Ship
c. Man-Over-Board
d. Steering Casualty
e. Oil Spill/ Hazmat spill

3. Assess ship's equipment necessary to support operations
    a. Dynamic positioning system testing
    b. Test trigger jigger sync for EM 302, EK60, Sub-bottom sonars
    c. Assess impact of recent Windows 7 upgrades to mission computers

4. Conduct sound velocity comparison cast between CTD and XBT. Near surface values will be compared to values from the thermosalinograph (TSG) and Reson SVP-70 probe. CTD and XBT comparison casts will be obtained at Veatch Canyon prior to collecting multibeam lines for the patch test.

5. Conduct multibeam system testing in vicinity of Veatch Canyon.
    a. Conduct multibeam patch test.
    b. Conduct EM 302 system noise testing (BIST tests).
    c. Conduct multibeam reference surface survey.

6. XBT and CTD operations
    a. Conduct CTD cast at Veatch Canyon prior to multibeam patch test.
    b. Test the ship’s 3 XBT hand-launchers.
    c. XBT casts will be collected at regular interval of no more than 6 hours.
    d. Testing and verification of CTD sensors

7. Collect deep water multibeam sonar data (MBES)
    a. Conduct 24-hr/day mapping operations for the duration of the cruise while ship is underway in water deeper than 50 m, and when multibeam determined not to interfere with EK80 data acquisition.
    b. Collect bathymetric, sea floor backscatter, and water column backscatter data.

8. Conduct EK 80 testing with UNH CCOM scientists.
    a. Calibrate EK80 split-beam sonar. This is proposed to be conducted at anchor in Jamestown Harbor. If this is not feasible, calibration can be conducted while drifting freely in an area with low vessel traffic, no navigational hazards, and lack of fishing gear. Calibration data collection is expected to take 6-8 hours once calibration gear is in place.
    b. Collect water column data over known Veatch Canyon seeps using the EK80. The ship should collect data over the known seep location by running survey lines from several different orientations while obtaining EK 80 split-beam data. Repeat

lines with EK 60 split-beam sonar for comparison. Approximately eight hours of data acquisition at the seep location is anticipated.

9. Update EK 60 Calibration SOP incorporating any new information based specifically on the calibration equipment provided by UNH scientists. This calibration equipment will stay with the ship to enable future EK 60 calibration work without needing to borrow equipment from Kongsberg.

10. Verify inventory of spares of all mapping sensors.

11. Prepare 2015 Readiness Report.

12. Collect sub-bottom and singlebeam sonar data
    a. 24-hr/day EK60 single beam collection (when not calibrating other sonars or running EK80).
    b. 24-hr/day Knudsen sub-bottom profiler data collection (when not calibrating other sonars).

13. Telepresence Objectives: (VSAT 5 mb/sec ship to shore; T1 shore to ship)
    a. Install & Establish Operability of 2014 MacPro VES03
    b. Test configuration of new Harmonic Ellipse Encoders
    c. Monitor Performance of VSAT in roughest sea-state of opportunity
    d. Install iMac edit station.
    e. Install Synology NAS
    f. Wake Up Telepresence Systems, Test EVS workflow.

**D. Participating Institutions**

National Oceanic and Atmospheric Administration (NOAA), National Oceanographic Data Center, National Coastal Data Development Center, Stennis Space Center MS, 39529

National Oceanic and Atmospheric Administration (NOAA) – Office of Coast Survey – Atlantic and Pacific Hydrographic Branches

National Oceanic and Atmospheric Administration (NOAA) - Office of Ocean Exploration and Research (OER) - 1315 East-West Hwy, Silver Spring, MD 20910 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 Road, Durham, NH 03824 USA

University of Rhode Island, Graduate School of Oceanography's Inner Space Center, 215 South Ferry Rd. Narragansett, RI 02882 USA

### Personnel (Science Party)

A full mapping complement is necessary for this cruise. Mission personnel include two mapping lead/expedition coordinators as well as two qualified watchstanders for each of two 12 hour watches per day. The mapping leads are responsible for facilitating overall mapping operations, including participating in operational meetings, providing guidance for mapping/survey troubleshooting, and communicating status of mapping sensors to personnel on shore.

**Table 3:** Full list of the science party members and their affiliation

| Name | Affiliation | Position | M/F | Status |
|---|---|---|---|---|
| Elizabeth "Meme" Lobecker | NOAA OER (ERT Inc) | Expedition Co-Coordinator/ Mapping Team Lead | F | US Citizen |
| Derek Sowers | NOAA OER (ERT Inc) | Expedition Co-Coordinator/ Mapping Team Lead | M | US Citizen |
| Brendan Reser | GDIT/NCDDC | Data Management Team | F | US Citizen |
| Jared Drewniak | NOAA OER (ERT) | Telepresence Lead | M | US Citizen |
| Vanessa Self Miller | NOAA AHB | Mapping Watch Leader | F | US Citizen |
| Erin Weller | NOAA AHB | Mapping Watch Leader | F | US Citizen |
| Liam Pillsbury | UNH CCOM | Visiting Scientist | M | US Citizen |
| Dr. Tom Weber | UNH CCOM | Visiting Scientist | M | US Citizen |
| Kevin Jerram | UNH CCOM | Visiting Scientist | M | US Citizen |
| Josh Humberston | UCAR | Mapping Intern/Watchstander | M | US Citizen |

## E. Administrative

Key Points of Contact:

*Ship Operations*

Marine Operations Center, Atlantic (MOA)
439 West York Street
Norfolk, VA 23510-1145
Telephone: (757) 441-6776
Fax: (757) 441-6495

Chief, Operations Division, Atlantic (MOA)
LCDR Donald Beaucage
Telephone: (757) 441-6842
E-mail: ChiefOps.MOA@noaa.gov

*Mission Operations*

Elizabeth 'Meme' Lobecker, Expedition CO-Coordinator/Mapping Team Lead
NOAA Office of Ocean Exploration and Research (ERT, Inc)
Phone : (401) 662-9297/(603)862-1475
E-mail : elizabeth.lobecker@noaa.gov

Derek Sowers, Expedition CO-Coordinator/Mapping Team Lead
NOAA Office of Ocean Exploration and Research (ERT, Inc)
Mobile : (714) 321-6084, Office:(603)862-0369
E-mail : derek.sowers@noaa.gov

CDR Mark Wetzler, NOAA
Commanding Officer
NOAA Ship *Okeanos Explorer*
Phone: (401) 378-8284
Email: CO.Explorer@noaa.gov

LT Emily Rose, NOAA
Operations Officer
NOAA Ship *Okeanos Explorer*
Phone: Iridium - (808) 659-9179
E-mail: Ops.Explorer@noaa.gov

*Other Mission Contacts*

Jeremy Potter
NOAA Ocean Exploration & Research
Phone: 206-526-4803 / 206-518-1068
E-mail: jeremy.potter@noaa.gov

Alan Leonardi, Director
NOAA Ocean Exploration & Research
Phone: 301-734-1016
E-mail: alan.leonardi@noaa.gov

Jared Drewniak, Telepresence Lead
NOAA Office of Ocean Exploration & Research (Acentia)
Phone: (401) 874-6250 (o) / (401) 330-9662 (c)
Email: jared.drewniak@noaa.gov

*Shipments*

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

Depot prior to **COB February 5, 2015**.

Vessel shipping address:

ATTN: LT Emily Rose, NOAA
NOAA Ship *Okeanos Explorer*
2578 Davisville Rd.
North Kingstown, RI 02852

### F. Diplomatic Clearances

***NOT APPLICABLE TO THIS CRUISE***

### G. Licenses and Permits

See Appendix C for categorical exclusion documentation

## II. OPERATIONS

### A. Cruise Plan Itinerary*(All times and dates are subject to prevailing conditions and the discretion of the commanding officer)*

*Saturday, February 7*

- Mission personnel begin to arrive to ship, prepare for field season.

*Sunday, February 8*

- Mission personnel continue to arrive to ship, prepare for field season. Set up mounting brackets and fishing reels as feasible in preparation for EK80 calibration.

*Monday, February 9*

- Early morning departure from Quonset pier and move ship into anchorage in Jamestown Harbor, RI. Conduct EK80 calibration for 6-8 hours while at anchor in Jamestown. Following successful calibration, secure calibration gear and transit overnight to working grounds at Veatch Canyon.

*Tuesday, February 10*

- Upon arrival at Veatch Canyon conduct a CTD cast in the deeper portion of the canyon followed by an XBT cast for comparison purposes. Commence multibeam patch test line plan.

*Wednesday, February 11*

- Complete multibeam patch test lines data acquisition. Run survey lines over known gas

seep location from several different orientations while obtaining EK 80 split-beam data. Repeat lines with EK 60 split-beam sonar for comparison. Approximately eight hours of data acquisition at the seep location is anticipated. Continue other ship shakedown items. Depart at the end of the day for overnight transit back to North Kingstown.

*Thursday, February 12*

- Arrive in North Kingstown mid-day. Some mission personnel depart ship.

*Friday, February 13*

- Remaining mission personnel depart ship.

### B. Telepresence Events

There are currently no telepresence events scheduled.

### C. In-Port Events

There are currently no port events scheduled.

### D. Staging and Destaging

***NOT APPLICABLE TO THIS CRUISE***

### E. Sonar Operations

A multibeam patch test and ensuring mission readiness of mapping systems for the FY15 Field Season is the top priority focus of the cruise. Calibration and testing of the new EK 80 split-beam sonar in collaboration with UNH CCOM scientists will also be a focus. Additionally, EK 60 and Knudsen sub-bottom profiler data acquisition is planned for this cruise when not interfering with calibration and data collection of the EK 80 or EM302 sonars. The EK 80 transceiver will be installed in the sonar closet adjacent to the existing EK 60 transceiver. The EK 80 will use the existing 18 kHz sonar transducer normally utilized by the EK 60, so only one at a time can be operated. Initial installation and testing of the EK 80 will be completed on January 28, 2015 prior to the start of this expedition. More details on operational considerations for EK 80 testing can be found in Appendix D, which describes recent testing protocols of the EK 80 completed a 2014 expedition on the icebreaker *Oden*.

The mapping team will ensure that all the standard protocols, as laid out by the Commanding Officer and mapping lead directives, will be followed for efficient and safe mapping operations. The final decision to operate and collect sub-bottom profiler data will be at the discretion of the Commanding Officer.

### F. Applicable Restrictions

*NOT APPLICABLE TO THIS CRUISE*

## III. EQUIPMENT

### A. Equipment and capabilities provided by the ship

- Kongsberg Simrad EM302 Multibeam Echosounder (MBES)
- Kongsberg Simrad EK60DeepwaterEchosounder
- Knudsen Chirp 3260 Sub-bottom profiler (SBP)
- LHM Sippican XBT (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
- CNAV GPS
- POS/MV
- Seabird SBE-45 (Micro TSG)
- Kongsberg Dynamic Positioning-1 System
- NetApps mapping storage system
- CARIS HIPS Software
- IVS Fledermaus Software
- SIS Software
- Hypack Software
- Scientific Computing System (SCS)
- ECDIS
- Met/Wx Sensor Package
- Telepresence System
- VSAT High-Speed link (Comtech5Mbps ship to shore; 1.54 Mbps shore to ship)
- Cruise Information Management System (CIMS)

### B. Equipment and capabilities provided by the scientists

- Microtops II Ozone Monitor -Sunphotometer and handheld GPS required for NASA Marine Aerosols Network supplementary project.
- EK 80 broadband GPT and associated connection cables, EK 80 calibration gear (copper sphere(s), high-tensile strength line, outrigger poles, fishing reels, clamps, mounting brackets, etc.)

## IV. HAZARDOUS MATERIALS

### A. Policy and Compliance

The Expedition Coordinator is responsible for complying with DMS, Fleet Environmental Compliance #07, Hazardous Material and Hazardous Waste Management Requirements for Visiting Scientists, released July 2002. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

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 the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, and/or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard. The amount of hazardous material arriving and leaving the vessel shall be accounted for by the Expedition Coordinator.

### B. Radioactive Isotopes

***NOT APPLICABLE TO THIS CRUISE***

### C. Inventory

***NOT APPLICABLE TO THIS CRUISE***

## V. ADDITIONAL PROJECTS

### A. Supplementary Projects

*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 (mapping interns) 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 is stewarded by OER physical scientists.

See Appendix E for full Survey of Opportunity Form.

### B. NOAA Fleet Ancillary Projects

***NOT APPLICABLE TO THIS CRUISE***

## VI. DISPOSITION OF DATA AND REPORTS

### A. Data Responsibilities

All data acquired on *Okeanos Explorer*, except for the experimental EK 80 data, 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[http://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_212/212-15.html].

*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.

*Deliverables*

a. At sea
   - Daily plans of the Day (POD)
   - Daily situation reports (SITREPS)
   - Daily summary bathymetry data files

b. Post cruise
   - Refined SOPs for all pertinent operational activities
   - Assessments of all activities

c. Science
   - Multibeam and XBT raw and processed data (see appendix B for the formal cruise data management plan)
   - EK 60 raw data
   - Knudsen 3260 sub-bottom profiler raw data
   - Mapping data report
   - 2014 System Readiness Report

*Archive*

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

### B. Pre and Post Cruise Meeting

*Pre-Cruise Meeting*

Prior to departure, the Operation's Officer will conduct a meeting of the scientific party to inform them of cruise objectives and vessel protocols, e.g., meals, watches, etiquette, etc.

*Post-Cruise Meeting*

Upon completion of the cruise, a meeting will be held by the Operation's Officer and attended by the ship's Commanding Officer, Survey Technician, the Expedition Coordinator and members of the scientific party and crew to review the cruise. Concerns regarding safety, efficiency, and suggestions for improvements for future cruises should be discussed.

*Shipboard Meetings*

Daily Operations Briefing meetings will be held at 1430 in the forward lounge 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. A safety brief and overview of POD will occur on the Bridge each morning at 0800. Daily Situation Reports (SITREPS) will be posted as well and shared daily through e-mail and/or the EX PLONE site (http://tethys.gso.uri.edu/OkeanosExplorerPortal).

*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 http://www.omao.noaa.gov/fleeteval.html and provides a "Submit" button at the end of the form. 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.

## VII. MISCELLANEOUS

### A. Meals and Berthing

Meals and berthing are required for up to 20scientists. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the cruise, and ending two hours after

the termination of the cruise. 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 make-up 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/noaaforms/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 tofully 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 formsto 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 Transferwhich requires the sender to setup an account.Accellion's Web Users Guideis 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 toaccellionAlerts@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 using the Google Form at https://docs.google.com/a/noaa.gov/forms/d/1pcoSgPluUVxaY64CM1hJ75l1iIYirTk48G-lv37Am_k/viewform

### C. Shipboard Safety

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. Hard hats are also 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.

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 on board*Okeanos Explorer*.
- All personnel on board 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. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required it must be arranged at least 30 days in advance.

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](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: john.mcdonough@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 IP (VoIP) Phone:
301-713-7772 (expect a delay once picked up by directory)

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

expeditioncoordinator.explorer@noaa.gov - For dissemination of all hands emails by Expedition Coordinator while on board. See ET for password.

### E. IT Security

Any computer that will be hooked into the ship's network must comply with the NMAO Fleet IT Security Policy prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

1. 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 3 days of embarking.

### F. Foreign National Guests Access to OMAO Facilities and Platforms

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow's March 16, 2006 memo.

The following are basic requirements. Full compliance with NAO 207-12is required.

Responsibilities of the Expedition Coordinator:

1. Provide the Commanding Officer with the e-mail generated by the FRNS granting approval for the foreign national guest's visit. This e-mail will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12have been complied with.

2. Escorts – The Expedition Coordinator is responsible to provide escorts to comply with NAO 207-12Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators NAO 207-12) at least annually or as required by the servicing Regional Security Officer.
3. Export Control - The NEFSC currently neither possesses nor utilizes technologies that are subject to Export Administration Regulations (EAR).

The Commanding Officer and the Expedition Coordinator will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.
2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written NMAO approval and compliance with export and sanction regulations.
3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.
4. Ensure receipt from the Expedition Coordinator or the DSN of the FRNS e-mail granting approval for the foreign national guest's visit.
5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.
6. Export Control - 8 weeks in advance of the cruise, provide the Expedition Coordinator with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Expedition Coordinator of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the Expedition Coordinator can take steps to prevent unlicensed export of Program controlled technology. The Commanding Officer and the Expedition Coordinator will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.
7. Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators NAO 207-12) at least annually or as required by the servicing Regional Security Officer.

Responsibilities of the Foreign National Sponsor:

1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.
2. The DSN of the foreign national shall assign an on-board Program individual, who will be responsible for the foreign national while on board. The identified individual must be a

U.S. citizen, NOAA (or DOC) employee. According to DOC/OSY, this requirement cannot be altered.

3. Ensure completion and submission of the Certification of Conditions and Responsibilities for a Foreign National Guest as required by NAO 207-12 Section 5.03.h.

## Appendix A Data Management Plan

Data Management Plan
Okeanos Explorer (EX1501): Ship Shakedown and Patch Test

*OER Data Management Objectives*
*Data pipelines will be tested and data management standard operating procedures will be exercised. A new EK80 instrument will be tested.*

22-Jan-15



## 1. General Description of Data to be Managed

**1.1 Name and Purpose of the Data Collection Project**

Okeanos Explorer (EX1501): Ship Shakedown and Patch Test

**1.2 Summary description of the data to be collected.**

Multibeam and single beam data will be collected 24 hours a day and XBT casts will be conducted at an interval defined by prevailing oceanographic conditions, but not to exceed 6 hours. Additionally, EK 60 and sub-bottom profile data will be collected 24 hours per day.

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

Davisville, expedition, exploration, explorer, mapping survey, marine education, multibeam, multibeam backscatter, multibeam sonar, multi-beam sonar, noaa, noaa fleet, ocean, ocean discovery, ocean education, ocean exploration, ocean exploration and research, ocean literacy, ocean research, OER, okeanos, okeanos explorer, R337, Rhode Island, science, scientific computing system, scientific mission, scientific research, SCS, sea, single beam sonar, singlebeam sonar, single-beam sonar, stewardship, sub-bottom profile, systematic exploration, technology, transformational research, undersea, underwater, water column backscatter

**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: 2/9/2015 to 2/12/2015

**1.6 Planned or actual geographic coverage of the data.**

| | | | |
|---|---|---|---|
| Latitude Boundaries: | 41 | to | 39 |
| Longitude Boundaries: | -72 | to | -68 |

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

Cruise Plan, Cruise Summary, Data Management Plan, EK60 Singlebeam Data, EK80 Echosounder, Floating Point GeoTIF, GSF, HDCS, Highlight Images, Mapping Summary, Multibeam (processed), Multibeam (product), Multibeam (raw), NetCDF, Quick Look Report, SCS Output (compressed), SCS Output (native), Sub-Bottom Profile data, Water Column Backscatter, XBT (raw)

**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 Ex |
| Title: | Multibeam Mapping Expert, Contractor (ERT, Inc.) |
| Affiliation/Dept: | NOAA Office of Ocean Exploration and Research, UNH CCOM/JHC |
| E-Mail: | elizabeth.lobecker@noaa.gov |
| Phone: | 6038621475 |

## 3. Point of Contact for Managing the Data

| | |
|---|---|
| Data POC Name: | Susan Gottfried |
| Title: | 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 NetCDF-4 format to NODC; multibeam data and metadata will be compressed and delivered in a bagit format to NGDC.

**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 and are not quality controlled. CTDs are processed into profiles for display only on the Okeanos Atlas.

## 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:**

not applicable

**6.2 Where will the metadata be hosted?**

| | |
|---|---|
| Organization: | OER Web Accessible Folder at NCDDC |
| URL: | http://www.ncddc.noaa.gov/oer-waf/ |
| Meta Std: | ISO 19115-2 Geographic Information with Extensions for Imagery and Gridded Data will be the metadata standard employed; a NetCDF-4 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. |

**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 are not to be made available to the public at all, or with limitations, provide a valid reason.**

Not Applicable

**7.1.2 If there are limitations to public data access, describe how data are protected from unauthorized access or disclosure.**

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.**

Org: NOAA National Center for Environmental Information

URL: explore.noaa.gov/digitalatlas

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

Hold Time: immediate release

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 at the NOAA National Center for Environmental Information

**8.2 If no archive planned, why?**

not applicable

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

approximately 60-90 days

**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 Okeanos Explorer Program.

## Appendix B: Categorical Exclusion

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
OCEANIC AND ATMOSPHERIC RESEARCH
Office of Ocean Exploration and Research
Silver Spring, MD 20910

January 7, 2015

MEMORANDUM FOR: The Record

FROM: John McDonough
Deputy Director NOAA Office of Ocean Exploration and Research (OER)

John Mcdonough
Digitally signed by John Mcdonough
DN: cn=John Mcdonough, o=Ocean Exploration, ou=NOAA/OAR, email=john.mcdonough@noaa.gov, c=US
Date: 2015.01.08 17:22:14 -05'00'

SUBJECT: Categorical Exclusion for NOAA Ship *Okeanos Explorer* Cruise EX-15-01

NAO 216-6, Environmental Review Procedures, requires all proposed projects to be reviewed with respect to environmental consequences on the human environment. This memorandum addresses the NOAA Ship *Okeanos Explorer's* scientific sensors possible effect on the human environment.

This project is part of the NOAA Office of Ocean Exploration and Research's "Science Program" and entails multi-disciplinary ocean mapping and exploration activities designed to increase knowledge of the marine environment. This project is entitled "EX-15-01 Patch Test and Ship Shakedown" and will be led by Elizabeth Lobecker and Derek Sowers, Physical Scientists for the *Okeanos Explorer* program within OER. NOAA Ship *Okeanos Explorer* will depart North Kingstown, Rhode Island on February 9, 2015, and arrive in port in North Kingstown, Rhode Island on February 12, 2015, and will conduct sonar mapping operations at all times during the cruise. The ship will transit to Veatch Canyon in the North Atlantic for multibeam sonar patch test and EK80 calibration and data collection work, then return to port in North Kingstown. Acoustic instruments that will be operational during the project are a 30 kHz multibeam echosounder (Kongsberg EM 302), an 18 kHz singlebeam echosounder (Kongsberg EK60/EK80), and a 3.5 kHz sub-bottom profiler (Knudsen Chirp 3260). Additionally, expendable bathythermographs (XBTs) will be deployed at regular intervals in association with multibeam data collection.

As expected for ocean research with limited duration or presence in the marine environment, this project will not have the potential for significant impacts. Knowledgeable experts who are aware of the sensitivities of the marine environment will conduct the at-sea portions of this project.

This project would not result in any changes to the human environment. As defined in Sections 5.05 and 6.03.c.3 (a) of NAO 216-6, this is a research project of limited size or magnitude or with only short-term effects on the environment and for which any cumulative effects are negligible. As such, this project is categorically excluded from the need to prepare an environmental assessment.

## Appendix C. NASA Maritime Aerosols Network Survey of Opportunity

### Survey or Project Name

| |
|---|
| **Maritime Aerosol Network** |

### Points of Contact (POC)

| *Lead POC or Principle Investigator (PI & Affiliation)* | *Supporting Team Members ashore* |
|---|---|
| **POC: Dr. Alexander Smirnov** | *Supporting Team Members aboard (if required)*<br><br>**Derek Sowers, OER Physical Scientist** |

### 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 D: Additional information about EK 80 sonar testing based on 2014 testing on *I/B Oden*.

# *Sphere Deployment for EK60/80 Target Strength Calibration*

*Kevin Jerram and Larry Mayer*
*University of New Hampshire*
*Center for Coastal and Ocean Mapping*
*I/B* ODEN *SWERUS-C3 Leg 2*

## 1. OVERVIEW

This plan describes an *in situ* beam pattern measurement procedure for the Simrad ES18-11 split-beam scientific echosounder transducer installed aboard the Swedish icebreaker *ODEN*. These procedures were developed during SWERUS-C3 Leg 2 (19 Aug – 4 Oct 2014) using the Simrad EK60 transceiver (18 kHz) installed permanently aboard *ODEN* and a Simrad EK80 wideband transceiver (10-30 kHz) installed temporarily for the expedition.

The primary task during calibration is deployment of a target sphere in the echosounder field of view (FOV) to enable comparison of measured target strength (TS) to calculated target strength for the sphere. Because the theoretical target strength depends on sphere parameters, frequency of ensonification, and ambient environmental conditions. A CTD profile should be conducted prior to calibration to obtain temperature and salinity depth profiles. Measurements on the main response axis (MRA) are of primary importance to provide a general offset for TS in the center of the beam pattern. If no other data are collected elsewhere in the echosounder FOV, this MRA offset may be used in conjunction with beam pattern models to estimate TS corrections across the beam pattern. If conditions and time constraints allow, and only after MRA data have been collected, it is also useful to collect data with the sphere in positions across the beam pattern to provide beam pattern corrections directly.

From our experience, preparation of the materials on deck and selection of favorable sea conditions can save several hours of ship time. It is ideal to minimize current relative to the ship, such as by drifting in light winds and calm seas, because relative currents of 1 kt or more will severely complicate sphere deployment and control. More importantly, stress and failure of the lines, rods, and reels increase the chances of losing the sphere and may present hazards to personnel on deck. The first calibration of SWERUS-C3 Leg 2 was performed with both the EK60 and EK80 transceivers connected individually to the ES18-11 transducer at anchor off Barrow, Alaska. Calibration sphere deployment and control was severely complicated by 1+ kt currents during this exercise. A second calibration using only the EK80 transceiver was completed mid-cruise while drifting in open water with a relative current of 0.5 kt or less, a swell height of ~1 m, and light winds; these conditions greatly simplified sphere deployment and control.

The calibration procedure described here is broken into sections describing materials and personnel needed, preparation, deployment, data collection, and retrieval. This procedure is only one of many methods that could be employed, so it should be taken as a rough guide and improved (and documented) whenever possible.

# 2. MATERIALS AND PERSONNEL

The following materials and personnel were used for calibration and are listed here for reference.

| Description | Qty. | Comments |
|---|---|---|
| Assistants and software operator with radios | 3 | 2-3 people on deck, 1 person on bridge |
| Calibration sphere with loop or harness for hanging | 1+ | 63 mm copper sphere on bridge |
| Several hours of ship time for data collection | 4+ | SWERUS calibrations ran 4-8 hours |
| Deep sea reels ('downriggers') with 100+ m high strength line | 3 | Green 'spectra' line is excellent |
| Deep sea reel mounts with aluminum base plates | 4 | Screws are ¼" x 20 thread, not metric |
| Large C-clamps for securing reel mount base plates to rail | 8 | 2 C-clamps per reel location |
| Extendable/nesting fiberglass outrigger rods with locking pins | 3 | Pins are color-coded for sections |
| Large stainless hose clamps for securing outermost rod sections | 12 | 4 hose clamps per rod location |
| 20 m length of monofilament line with locking hook for sinker | 20 m | At least 20-lb test line |
| 10 m length of monofilament line with locking hook for sphere | 10 m | At least 20-lb test line |
| Spool (or fishing reel) of monofilament line for sphere control | 100 m | At least 20-lb test line |
| Three-way swivel for connecting bow, port, and starboard lines | 1+ | |
| Short ladder for installing aft mobile outriggers during deployment | 1 | Crew should be aware of work near rail |

# 3. PREPARATION

## 3.1. OVERVIEW

The ES18-11 transducer is located slightly to starboard of centerline at frame 93, or approximately the alongship position of the forward bulkhead of the bridge. Three lines on reels with outrigger rods are used for positioning the sphere within the beam. Control over the sphere position within the beam requires approximately equiangular and equidistant spacing of rods and reels with respect to the transducer. Because of the broad bow on *ODEN*, the calibration setup requires a sphere and sinker to be suspended beneath the ship using three lines from rods and reels secured at the bow rail, midship port rail, and midship starboard rail.

The main lines and sinker must be deployed from the bow and moved aft to their calibration positions; to speed this process, some pieces of equipment are installed beforehand at their calibration positions and some equipment is placed initially at the bow. The sphere is deployed along the bow line using an independent monofilament line for control *only after* all rods and reels are in place and the sinker is clearly visible in the echosounder field of view. Having the rods, reels, lines, sinker, sphere, and personnel prepared and in place before the calibration will save many hours of ship time.

Figure 1 provides a general overview of the calibration setup, with more detailed preparation notes following.

## 3.2. SHIP

*ODEN* should be drifting in deep water (>100 m) with engines secured, calm seas, and light winds. Current relative to the ship should be 0.5 kt or less and swell should be 1 m or less. Though these conditions may be rare, they are practically necessary and more than worth the wait. No other activities should be planned on the foredeck (namely, anchoring or CTD winch operation) or along the rail on the forward half of the ship. The captain and mate on watch should be aware of the plan to deploy gear over the side and that people will be working near the rail. In particular, securing the two aft rods involves standing on a ladder near the rail; it is

mandatory to have at least two people with radios on site during this operation and best to consult with the crew on proper safety measures.

## 3.3. OTHER ECHOSOUNDERS

All other echosounders should be secured, including the bridge fathometer. The EK60/80 will be operated in 'standalone' mode (i.e., not triggered by any other system) with a ping rate of approximately 1 Hz and recording range of at least twice the expected sphere depth to get an idea of the ambient scattering environment. Ideally, depending on the ship's needs for heat, the steam valves audible in the galley (and visible in the EK echograms) should be secured.

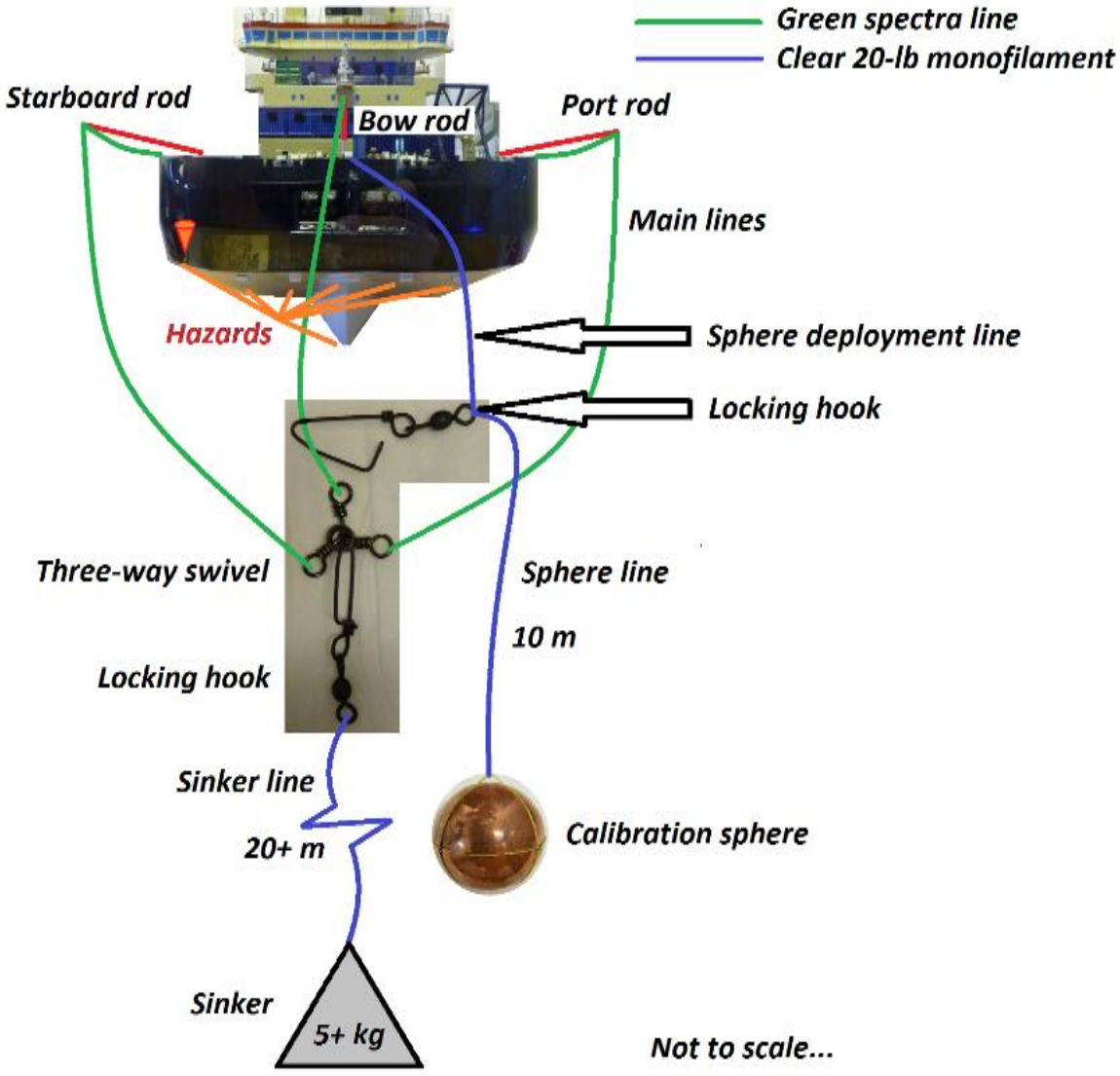


*Figure 1. General layout of rods, lines, sinker, and sphere.*

## 3.4. SPHERE AND SPHERE LINES

The sphere will be suspended from a 10 m monofilament line and must have some means of attachment to this line. A tight-fitting harness may be made of spectra or monofilament (Fig 2) or, in the case of the ship's 63 mm copper sphere, a monofilament line may be embedded in the sphere. A bucket of warm water and dish detergent should be ready for washing the sphere immediately before entry to the water to ensure a clean water-metal boundary after handling.

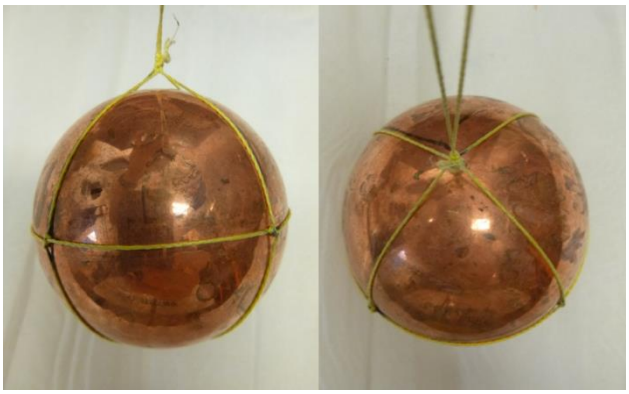

*Figure 2. Detail of calibration sphere and harness (64 mm provided by UNH CCOM; 63 mm available on bridge).*

To prepare for deployment, the sphere is attached to a 10 m monofilament line with a locking hook on the upper end. This hook, in turn, has a separate monofilament line running to a spool or separate small fishing reel. Once all other equipment is in place, the hook is locked around the bow line and the sphere is gently lowered along the bow line toward the three-way swivel under control from the separate monofilament line on a spool or fishing reel. Controlling the sphere in this manner reduces risk of sphere loss during line setup and provides two additional forms of security. If the upper monofilament breaks, the sphere is still supported by the bow line; likewise, if the bow line breaks, the sphere is still supported by the upper monofilament. If both lines break, then it's time to starting knitting a harness for the back-up sphere while waiting for better conditions. The separate monofilament line can also be used to reduce load on the bow line during retrieval, when the sinker is also being retrieved. Be sure to lock the hook around the bow line before deployment.

## 3.5. SINKER AND SINKER LINES

A sinker with mass of 3-5 kg should be procured and attached to a 20 m length of monofilament line with a locking hook at the end. This sinker keeps a slight amount of tension on the lines to reduce the drag effects of current during deployment and minimize risk of snags on the hull. The sinker also serves as an initial, low-risk echosounder target to verify line positioning before lowering of the more valuable target sphere. High-density, low-drag sinkers are preferred and should be wrapped in electrical tape to minimize chafe on the monofilament, as this line is strong in tension but extremely susceptible to impacts and cuts when cold. Large shackles and spare C-clamps have been used successfully as sinkers; spare gym weights are also likely candidates. The locking hook at the end of the 20 m monofilament line will be locked through the center of the three-way swivel prior to deployment from the bow. It is recommended that the line handler wear tough gloves for handling the monofilament with the sinker attached, as the line can be both slippery and painful to handle with bare hands.

## 3.6. REELS

The reels ('downriggers', Fig. 3) are controlled with large winch handles; cranking clockwise locks the reel and retrieves line, whereas cranking counterclockwise unlocks the reel and releases line. Care should be taken to avoid excessive counterclockwise cranking to release line, as the handle may unwind off the spool shaft entirely and lead to ill-timed disassembly of the locking mechanism. Reels should be checked well before calibration for proper functions of the handles and counters. Each reel should have at least 100 m of high-strength spectra line ready for deployment without tangles, knots, or damaged sections. Dried goop from previous deployments should be removed and the lengths of line inspected by hand for signs of chafe. These lines scrape against the hull during deployment and retrieval, and must be in good condition to maximize chances of sphere survival. The counter is reset to 000 by sliding the counter mechanism to the right and spinning the gear to reset the digits, then sliding back into contact with the main gear on the spool. All counters should read 000 at the start of deployment.


*Figure 3. Detail of deep sea reel ('downrigger') and counter.*

Four reel mounts are available and should be secured to the ship rail in four specific locations: the rail beneath the port aft rod, the rail beneath the starboard aft rod, the rail beneath the bow rod, and a spare on the bow rail offset to starboard. Figure 4 indicates the positions of the two bow mounts; the starboard bow mount will be used to secure the starboard reel during deployment and while the port reel is moved aft.

*Figure 4. Detail of bow reel mounts. Mount on left is center bow mount for securing bow reel throughout deployment and calibration; mount on right is starboard bow mount for temporarily securing starboard reel during line deployment and port line movement.*

## 3.7. OUTRIGGER RODS

Three fiberglass outrigger rods, each comprised of multiple nesting sections with stainless locking pins, are employed to provide outboard line clearance from the hull. Rod preparation involves securing the outermost (largest diameter) section of each rod to various deck features using stainless hose clamps. As shown in Figure 5, the bow rod is secured to the atmospheric instrument platform railing and the two aft rods are secured to the aft-most deck drain pipes (mirrored positions on port and starboard main deck). These positions are compromises between achieving desirable line clearance and minimizing the obstruction to normal deck operations.

*Figure 5. Detail of outrigger positions and means of attachment to hull features.*

Because the aft rods extend much further than necessary, their outermost (largest diameter) sections may be mounted 'upside down' with the locking pin at the bottom (inboard) to keep the remaining inner sections from sliding down/inboard. All other sections, except the two innermost (smallest diameter) sections, are left inside the rods in their secured position. The two innermost (smallest diameter) sections of all three rods should be removed and assembled/pinned into three 'mobile outriggers' with eyelets at the ends; these will be used for line deployment from the bow and then inserted in the larger sections once in place. If desired, electrical tape can be wrapped around the end of each section to keep it from sliding within the next largest section. This should be done to the third innermost section, which will receive the 'mobile outrigger' during line deployment.

Notes: A possible improvement would be to add a small carabiner to each eyelet. Pulleys or blocks should not be used, as the line may skip off the wheel and chafe against the body. A caribiner at the end of each rod would allow the three lines to be tied to the three-way swivel before clipping into the rods, rather than requiring the lines to run through the eyelets before tying to the swivel. It may be helpful to use electrical tape to hang a few extra pins of appropriate sizes at each rod so they are readily accessible when needed.

### 3.8. SOFTWARE

The EK60 software has a 'calibration' mode which can be employed to locate the target sphere (or shackle, initially) in the echogram and provide a visual tracking record of sphere detection coverage within the echosounder field of view. The software operator should test and become familiar with 'calibration' mode prior to shackle and sphere deployment, even if only to use the target tracking feature.

The EK80 software used during SWERUS-C3 Leg 2 has a 'calibration' mode which is not functional as of this writing. In lieu of this mode, sphere data may be collected while pinging normally with a reasonable recording range (~300 m) and ping rate (~1 Hz). As of this writing, a 'fish detection' function is available which works for CW transmission but not for FM transmission. This fish detection feature can be used while transmitting in CW mode to locate the shackle and sphere within the echosounder field of view. Once the target sphere is located on the MRA, the transmission mode may be switched to FM for data collection. The range visible on the screen directly controls the range of fish detections.

In both cases, it is essential to make sure that data are being recorded in the settings desired for calibration (pulse length, power, frequency, etc.) and to a range sufficient to cover the sphere and shackle. As long as the sphere appears near the MRA in the echogram being recorded, the data are likely to be useful for calibration. In the worst-case scenario for both the EK60 and EK80, no calibration mode or fish detection feature is functioning properly to determine target coverage throughout the echosounder field of view. In this case, calibration can still be performed by finding a sphere location close to the MRA by methodically moving the sphere fore-aft and port-starboard until the apparent sphere scattering strength reaches a maximum in the echogram (i.e., it reaches a highest value or color). Data would be collected throughout this process and then for some duration once the sphere is believed to be on the MRA.

## 4. DEPLOYMENT

This list provides an outline of the order of operations used during SWERUS-C3 Leg 2 EK60/80 calibrations.

### 4.1. FINAL PREPARATION

1) Prepare sphere, sinker, lines, rods, reels, software, ship, personnel, etc., as outlined above.
2) Retrieve lines on all reels and reset counters to 000
3) Create three 'mobile outrigger' rods using the two innermost sections of each outrigger (with eyelet at end)
   a) Place these with reels at the bow, keeping one to port of the atmospheric platform, one at the center forward reel mount, and one at the starboard forward reel mount
4) Secure the bow reel in the center bow reel mount
5) Secure the starboard reel in the forward starboard reel mount for temporary use during deployment
   a) The port reel will be the first for repositioning aft and does not have a temporary mount on the bow
6) Place the port reel with the port mobile outrigger between the CTD A-frame and the atmospheric platform
7) Run each line through the eyelet on its corresponding mobile outrigger
8) Pass the port line around the forward side of all atmospheric platform supports and underneath the triangular bow extension to ensure the line will run freely through the eyelet, over the port rail, and toward the center forward reel with no hull or anchor chain obstructions

a) If at anchor, a boathook will be needed to pass the line between the hull and the anchor chain; ask a crew member for assistance

9) Securely tie all three main lines to individual eyelets on the three-way swivel so each line can rotate independently
   a) 'If you can't tie a knot, tie a lot'
10) Verify that all three lines will run directly into the water with no hull obstructions once the sinker is attached
11) Connect the locking hook on the end of the 20+ m sinker line to the center of the three-way swivel, being careful to keep lines from tangling or getting caught underfoot; the deck has many small sharp edges
12) Pass the bow mobile outrigger up to the atmospheric instrument platform and use a pin to secure it in the outrigger sections secured to the rail
   a) Ensure the outrigger extension is at least two sections beyond the bow for line clearance (see picture)

*Figure 6. Detail of bow outrigger.*

13) Lean the starboard mobile outrigger against the rail such that the starboard line will run freely from the starboard reel (in its temporary mount) and into the water during sinker deployment
14) Lean the port mobile outrigger against the rail such that the port line will run freely from the reel (placed temporarily on deck) and into the water during sinker deployment
15) Release all drag on the port and starboard reels (counterclockwise on the handle)
16) Take all slack out of the bow line and lock the bow reel (clockwise on the handle)
17) The final preparation is complete and the sinker is ready for deployment

## 4.2. SINKER DEPLOYMENT

18) When the ship is ready, the bridge crew is notified, and all personnel are properly caffeinated, lower the sinker over the bow rail by handing out the monofilament sinker line
   a) Be careful to keep the line from touching the hull as much as possible
   b) Gloves should be used to reduce cuts and burns from the monofilament under tension
19) Once the sinker is at the end of its 20 m line, gently release the monofilament so that the load is transferred as smoothly as possible to the locked bow line
20) Release the bow line and lower the sinker slowly to a bow reel count of 150-200 (approximately 50-65 m)
   a) The port and starboard reels should be releasing line freely as the sinker is lowered but should be adjusted to keep slight tension to avoid tangling
21) Once the sinker has reached its initial depth, lock the bow reel and note the counter number
22) The port line is ready for movement to its aft station

## 4.3. PORT LINE MOVEMENT

23) With at least two people on deck, begin slowly moving the port mobile outrigger and reel along the rail
    a) It is ideal to have one person dedicated to spotting the line, one person on the reel, and one person on the mobile outrigger; the observer can assist for 'hand-offs' in tight spaces and at the deck break
    b) Keep the mobile outrigger as far outboard as possible to provide maximum hull clearance for the line
    c) Release reel tension as necessary to relieve stress on the outrigger handler
    d) The widest portion of the hull is likely the most hazardous for the line (Fig. 7, left); move swiftly through this region while still allowing the sinker to settle and the line to keep up with your progress aft
    e) Hand-offs of the rod and reel from one person to an extra person will need to take place at the deck break and for maneuvering around containers and lifeboat lines
    f) All handlers should be aware of the line status and proceed only when the line appears free of the hull
    g) It may be useful to have a boathook handy for small hazards and moving the lifeboat lines
24) At the port aft station, secure the reel in its rail mount and install the mobile outrigger in the outer sections previously secured to the deck drain (Fig. 7, right).
    a) Installing the rod with tension on the line will be very difficult, especially if there is a current
    b) To relieve outrigger load, support the sinker line by hand and release several meters of line on the reel
    c) Two people may be necessary to handle the outrigger, especially if wind or swell are present
        i) Consult with crew on safe operations near the rail
    d) Make sure the eyelet on the outrigger is pointed down and the line runs smoothly through it

*Figure 7. Details of widest hull section (left) and port aft station (right).*

25) Lock the port reel and note the counter number
26) At this point, it is possible that the sinker is on the edge of the EK60/80 field of view
    a) The software operator should provide updates on visibility of any new targets

## 4.4. STARBOARD LINE MOVEMENT

27) Movement of the starboard reel and rod to the aft station is performed in the same way as the port side
    a) Apply the port line movement instructions to the starboard line
    b) WARNING: At the time of writing, there is a major line hazard on the starboard forward quarter (Figs. 1 and 8); be sure the line clears this feature using the mobile outrigger or a long boathook

*Figure 8. A line hazard with sharp edges on the forward starboard quarter*

## 4.5. INITIAL TARGET POSITIONING

28) Once all reels and outriggers are secured in their stations, the sinker position should be adjusted to be well within the echosounder field of view before sphere deployment
    a) A good starting point is to have equal line released from all reels (approximately 200 on all counters); in very low currents, the sinker should settle near the MRA and be readily visible in the calibration mode (EK60) or using the fish detection feature (EK80)
29) Adjust reels in increments of 5 or 10 counter clicks to achieve a sinker position near the echosounder MRA and at least 20 m below any prominent scattering layers visible in the echogram
30) The sinker may take a minute to settle after each major move
31) Once the sinker is very close to the MRA, the sphere is ready for deployment

## 4.6. SPHERE DEPLOYMENT

32) Attach the sphere line locking hook around the bow line
33) One person will control the lower sphere monofilament line for initial entry to the water
34) One person will control the upper sphere monofilament line, ready to support the sphere
35) Lower the sphere over the bow rail by handing out the lower monofilament sphere line
    a) Be careful to keep the line from touching the hull as much as possible
36) Once the sphere is at the end of its 10 m lower line, gently release the monofilament so that the load is transferred as smoothly as possible to the upper sphere line (on a spool or fishing reel, under control of a second person on deck)
37) Release monofilament line from the spool or fishing reel to allow the hook to slide down along the bow line
    a) Assuming small currents and a sufficiently deep sinker bow line, the sphere will descend until the hook reaches the three-way swivel; at this point the sphere should be hanging (and visible in the echogram) approximately 10 m below the swivel and 10 m above the sinker
    b) Assuming small currents, the monofilament tension will decrease when the sphere reaches the swivel

38) Several additional meters of monofilament should be released and the spool or fishing reel should be secured on deck to prevent additional line running out under drag from the current
    a) Additional monofilament will need to be released if the bow line is released for repositioning the sphere

## 5. DATA COLLECTION

39) Ensure the EK60/80 software is pinging in standalone mode at a reasonable ping rate, with all other echosounders secured, and recording to a range greater than the sinker depth
40) Under direction from the software operator, adjust reels to position the sphere on the MRA and outside any scattering layers visible in the echogram
    a) Range on the software should be adjusted to exclude the sinker from target detection to avoid confusion with the sphere
    b) The EK80 target detection method is not supported in FM mode as of this writing; CW mode must be used for sphere positioning, then data collection may be performed in FM or CW as necessary
41) Adjust parameters for target detection (EK60 calibration mode; EK80 normal pinging with fish detection feature) so the sphere is the most readily visible target detected in the field of view
    a) As a test, reel in line on the bow reel and ensure that the target moves accordingly in the echosounder software; release the same amount of line to return the sphere to the MRA after this test
42) Collect data as long as desired for each combination of settings
    a) The sphere will drift throughout the echosounder field of view depending on currents and vessel motion; if the average position is near the MRA, then this drift may actually be quite advantageous for beam pattern corrections off the MRA
    b) If time constraints and currents are negligible, it may be possible to manually move the sphere throughout the echosounder field of view with small adjustments to reels; this was found to be nearly impossible to control in a current greater than 0.5 kt, and should not take precedence over data collection on or near the MRA
    c) During SWERUS-C3 Leg 2, calibration data were collected in 15-minute blocks for each combination of settings to provide approximately 900 pings and sphere detections for each mode
    d) During EK80 FM calibration, it was necessary to check the sphere position in CW mode between data collection blocks; some modes were repeated because the sphere (again, not visible in the fish detection feature using FM mode) was determined to have drifted away from the MRA during data collection
43) Adjust the sphere position and repeat data collection as necessary for all combinations of settings that have been or will be used for normal EK60/80 data collection underway
44) After data collection is complete, notify the crew that the sphere is ready for retrieval
    a) The ship typically needs at least 30 minutes to warm up the engines to get underway as soon as the sphere and sinker are out of the water

## 6. RETRIEVAL

45) Retrieval of the sphere and sinker consists generally of the same steps as deployment, though these steps are performed in reverse order

46) Remove the starboard mobile outrigger and reel and move forward along the rail while maintaining as much line clearance from the hull as possible
    a) Be sure to clear the hazard on the starboard forward quarter (Figs. 1 and 8)
47) At the bow, place the starboard reel in the temporary mount and rest the outrigger rod against the rail in the same position used for sinker deployment
48) Remove the port mobile outrigger and reel and proceed toward the bow in the same fashion as the starboard side
49) At the bow, place the port reel on deck and rest the outrigger rod against the rail in the same position used for sinker deployment
50) With all three lines running clearly from the bow to the water, prepare for sphere retrieval by slowly bringing in line on the bow reel, starboard reel, and sphere monofilament line
    a) This method reduces strain on any given line and improves the chance of successful sphere retrieval
    b) The port reel may also be used to take up slack on the port line, but the majority of lifting should be performed with the bow and starboard reels
    c) It is advisable to proceed slowly and ensure that the bow and starboard reel counters are approximately the same, with slight tension on the monofilament line
    d) As the counters approach 000, prepare to retrieve the three-way swivel by hand
51) Grab the three-way swivel by hand to support the sphere and sinker lines
52) Pull in the sphere and sinker monofilament lines together until the sphere is in hand
    a) The sinker should still be in the water when the sphere is in hand
    b) Ensure the sphere is safely on deck before continuing with sinker retrieval
53) When the sinker and sphere are both safely on deck, the main lines may be cut near the three-way swivel, all rods and reels secured on deck, and the bridge notified that all equipment is out of the water

## Acknowledgements

Many thanks are due to the *ODEN* deck crew and scientists Rezwan Mohammad and Denis Chernykh for their patience and excellent assistance throughout both calibrations during SWERUS-C3 Leg 2.