UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Alaska Fisheries Science Center
RACE Division
7600 Sand Point Way N.E.
Seattle, Washington 98115-6349

Final Project Instructions

Date Submitted: July 11, 2016

Platform: NOAA Ship Fairweather

Project Number: FA-16-03 (OMAO)

Project Title: FISHPAC-16 Leg 1

Project Dates: August 8, 2016 to August 30, 2016

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For Commander Brian W. Parker, NOAA
Commanding Officer
Marine Operations Center – Pacific
Commander Joe C. Bishop, NOAA
Acting Commanding Officer

I. Overview

A. Brief Summary and Project Period

NOAA has multiple high-priority needs for data to characterize seafloor habitats. The broad scope of the Essential Fish Habitat (EFH) mandate requires an efficient process for describing and mapping the habitats of federally managed species. Prior research indicates surficial sediments affect the distribution and abundance of many groundfish species. Seafloor characteristics also affect the performance of the survey trawls that are routinely used to provide estimates of abundance for stock-assessment models. In order to be accurate and useful, these estimates should be based on good, consistent estimates of survey catchability. Existing sediment data are limited and traditional sampling with grabs and cores is impractical over areas as large as the eastern Bering Sea (EBS) shelf. Acoustic tools, on the other hand, are suitable for large-scale surveying and recent research has shown that processed acoustic data are an effective substitute for descriptions of physical samples in both habitat and stock-assessment models for EBS groundfish and crabs.

The primary objective of the FISHPAC project is to collect acoustic data for EFH characterization and improved stock assessments. Three different sonars will be used to collect acoustic backscatter and bathymetry along tracklines defined by NMFS bottom-trawl-survey stations on the EBS shelf (http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-266.pdf). The three systems are a hull-mounted hydrographic-quality multibeam echosounder (Simrad EM710) and a prototype towed long-range side-scan sonar system (Klein 7180; LRSSS) that includes an independent single-beam echosounder (Elac). (A towed high-resolution Klein 5410 side-scan sonar will be held in reserve.)

Manufacturer	Simrad	Klein	Elac	Klein
Model number	EM710	7180	Custom	5410
Configuration	Hull-mounted	Towfish	Towfish (7180)	Towfish
Frequency (kHz)	70-100	180	38	455
Bathymetry data?	Yes	Yes (interferometry)	Yes	Yes (interferometry)
Backscatter data?	Yes (time series)	Yes (side-scan)	Yes	Yes (side-scan)

Groundtruthing will be conducted on a daily basis to support interpretation of the backscatter data. Although primarily a scientific study, the FISHPAC project will also provide hydrographic-quality bathymetric data to the NOAA Pacific Hydrographic Branch (PHB) for updating nautical charts in areas with outdated or non-existent information.

The project period begins August 08, 2016 in Dutch Harbor, Alaska and ends August 30, 2016 in Kodiak, Alaska.

B. Days at Sea (DAS)

Of the 23 DAS scheduled for this project, 3 DAS are funded by an OMAO allocation and 20 DAS are Program Funded. This project is estimated to exhibit a High Operational Tempo.

C. Operating Area

The operating area is located on the EBS continental shelf (Fig. 1). Survey operations in 2016 will be in the eastern region, with future work continuing in the western region. The EBS was selected because it supports important commercial fisheries for crab and groundfish species. The generally flat and featureless seafloor provides a relatively safe environment for towed survey equipment. Charted sounding data are generally sparse and outdated in offshore areas and quantitative information about seafloor habitats is also very limited. As such, high-accuracy acoustic data obtained by the FISHPAC project would contribute significantly to both the NOAA fisheries and the NOAA hydrographic missions.

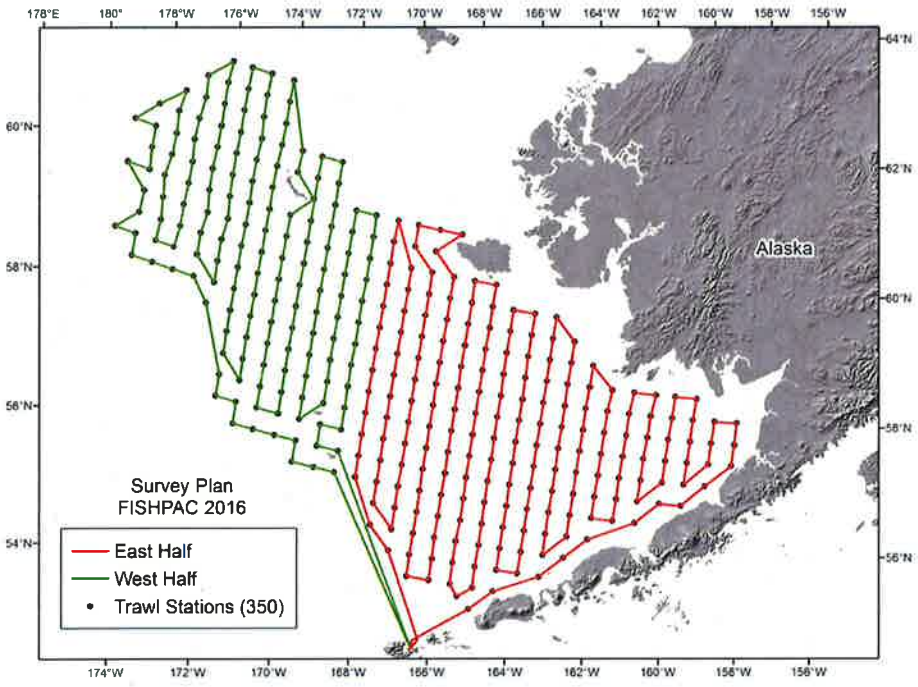


Figure 1. Survey tracklines for the FISHPAC project on NOAA Ship *Fairweather*. The eastern part of the continental shelf (red) lines will be surveyed in 2016. The western part (green) will be surveyed at a later date.

D. Summary of Objectives

This is a multi-mission project with four primary objectives:

1. Acquire acoustic backscatter for characterizing the EFH of groundfish and crab species in the EBS. Improved basin-scale continuous-value habitat utilization models will be produced for multiple species.

2. Acquire acoustic backscatter for characterizing NMFS bottom-trawl performance in different seabed habitats. A habitat-based catchability-at-size function will be developed to produce corrected abundance inputs for EBS stock assessments.

3. Provide hydrographic-quality bathymetric data to the PHB for updating nautical charts in areas with outdated or non-existent information.

4. Operationalize the Klein 7180 LRSSS for broad-scale fisheries and hydrographic surveys.

E. Participating Institutions

1. NOAA/NMFS – Alaska Fisheries Science Center (AFSC).

2. NOAA/NOS – Office of Coast Survey, Pacific Hydrographic Branch (PHB) and the Atlantic Hydrographic Branch (AHB).

3. U.S. Navy – Naval Undersea Warfare Center, Keyport Division (Navy).

4. LCHUFF Consulting LLC (LCH)

F. Personnel/Science Party: name, title, gender, affiliation, and nationality

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Ovard, Melody	Physical Scientist	07/23/2016	08/31/2016	Female	AHB	U.S.
Ramsay, Jessica	Physical Scientist	07/24/2016	08/30/2016	Female	PHB	U.S.
McConnaughey, Bob	Chief Scientist, Research Fishery Biologist	08/07/2016	08/30/2016	Male	AFSC	U.S.
Intelmann, Steve	Physical Scientist	08/07/2016	08/30/2016	Male	AFSC	U.S.
Syrjala, Steve	Statistician	08/07/2016	08/30/2016	Male	AFSC	U.S.
Huff, Lloyd	Consultant	08/07/2016	08/27/2016	Male	LCH	U.S.
Draper, Ed	Technician	08/07/2016	08/30/2016	Male	Navy	U.S.
Heather, Bill	Technician	08/07/2016	08/30/2016	Male	Navy	U.S.

G. Administrative

1. Point of Contact: Dr. Bob McConnaughey (Chief Scientist). Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115-6349; 206.526.4150 (office); 360.632.5534 (mobile); bob.mcconnaughey@noaa.gov.

2. Diplomatic Clearances

None Required.

3. Licenses and Permits

None Required.

II. Operations

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

A. Project Itinerary

August 5, 2016 – vessel arrives Dutch Harbor, AK.

August 5-8, 2016 – offload survey launches, equipment, and personnel for Unalaska survey project.

August 7, 2016 – scientific party embarks.

August 8, 2016 – vessel departs Dutch Harbor. USBL calibration and equipment shakedown (local waters).

August 8-27, 2016 – conduct scientific operations (Bering Sea).

August 27, 2016 – vessel returns to vicinity of Dutch Harbor. End scientific operations, disembark science party members departing from Dutch Harbor, recover launches and survey team.

August 27-30, 2016 – vessel transits to Kodiak, AK.

August 30, 2016 – vessel arrives in Kodiak, AK.

B. Staging and Destaging

March – April, 2016 – integrate and test project navigation systems (Seattle, WA).

July 1-5, 2016 – mobilize and test scientific equipment (Homer, AK).

August 5-8, 2016 – final mobilization and readiness testing (Dutch Harbor, AK).

August 27-29 – demobilize all scientific equipment during transit to Kodiak, AK

August 30 – offload scientific equipment. Termination of the project.

C. Operations to be Conducted

Operations will be conducted 24 hours per day and 7 days per week for the duration of the project.

Standard Transect (Dutch Harbor)

The *Fairweather* is requested to transit the following AFSC-standard transect when departing and entering Dutch Harbor and to acquire bathymetry and backscatter data with the ship's Kongsberg EM710 multibeam echosounder (Fig. 2). The standard transect is defined by the following end points: (53.96100 N, 166.52800 W) and (54.02300 N and 166.52800 W) (Appendix B).

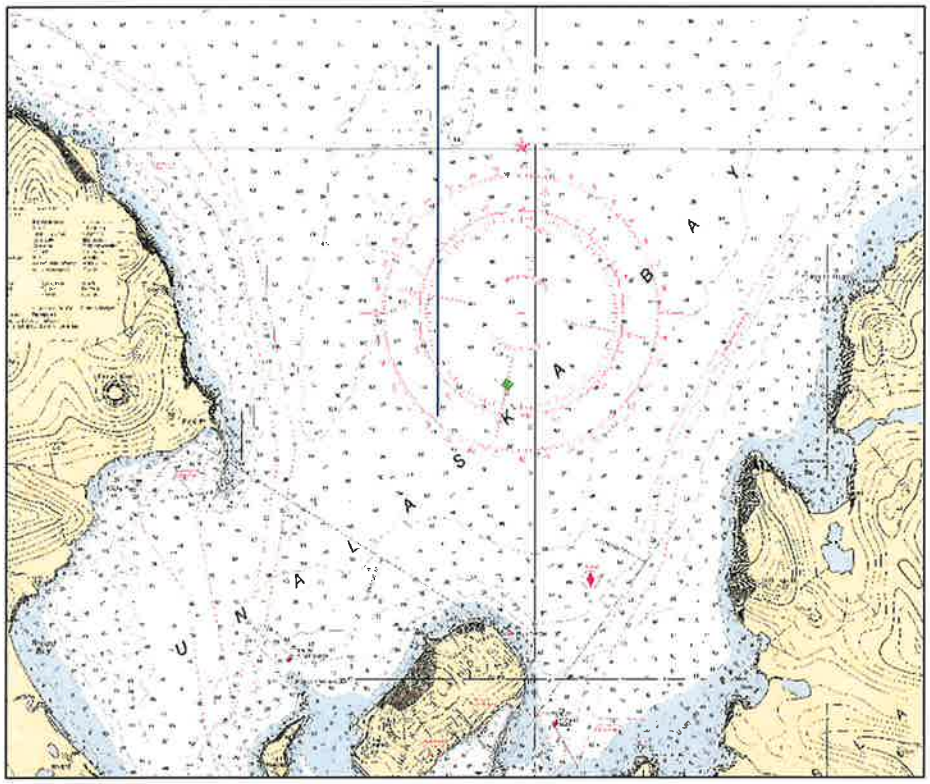


Figure 2. Overview of shakedown area in Unalaska Bay. The blue line indicates the standard Dutch Harbor transect. The green diamond represents the target location of the Compatt acoustic beacon used for the USBL calibration.

Survey Plan

The project will survey the seabed along a regular pattern of tracklines defined by fixed AFSC bottom-trawl stations (Fig. 1; Appendix B). After an initial period over stations along the Alaska Peninsula, subsequent lines will be oriented North-South (~0/180° T) and spaced ~ 20 nm apart. Each of the lines is composed of segments designed to intersect multiple trawl-survey stations with minor course changes between segments. The overall survey covers 8,007 km (4,323 nautical miles) including transits to/from the survey areas and transits between adjacent lines. The tracklines pass directly over a total of 196 trawl-survey stations. Each line will be surveyed once in a consistent manner.

Field operations each day will consist of 23 hours of continuous and simultaneous acquisition of bathymetry and backscatter with the ship's multibeam echosounder and the Klein 7180 LRSSS. Survey speed will be 10 knots under favorable conditions, but will be adjusted as necessary to ensure safe operating conditions and high-quality acoustic data.

Periodic underway deployments of the Free-fall Cone Penetrometer (FFCPT) at 6 knots will provide geophysical information for groundtruthing purposes and the requisite sound velocity profiles. Auxiliary collections from the LRSSS towfish include 38 kHz single-beam acoustic data, as well as optically-measured colored dissolved organic matter (CDOM), chlorophyll-a fluorescence, and turbidity in the pelagic environment. The ship will heave-to or hold station during the remaining time (~1 hour) each day in order to recover and inspect the LRSSS towfish, and to collect sediment samples with the SEABOSS benthic grab sampler. Every effort will be made to maintain this schedule for the duration of the cruise. The scientific crew anticipates working rotating 12 hour shifts.

In general, this survey plan is subject to substantial change based on the availability and condition of survey equipment and the current/projected environmental conditions. For example, in the event of foul weather at the beginning of the cruise, it may be preferable to spend time transiting to an alternative starting point to begin working rather than waiting for weather to clear. It may also be necessary to alter the sequence of waypoints to maintain productivity. All changes will be discussed with the Commanding Officer (CO) and the Field Operations Officer (FOO). Changes may be made on short notice; however, the Chief Scientist will make every effort to relay changes in a timely manner to allow for preparation and staffing. The unpredictable evolution of the survey plan is a major deviation from normal hydrographic procedures, requiring flexibility and patience by the crew.

Sonar Operations

Seabed backscatter, bathymetric data, water-quality measurements, and sound-speed profiles will be acquired continuously during the project. The scientific party will be responsible for operating the two side-scan sonars and ship's personnel will be responsible for continuously and simultaneously operating the ship's Kongsberg EM710 multibeam echosounder. For this project, the quality of the backscatter from the Kongsberg system in the sector +/- 60 degrees from nadir takes precedence over bathymetry. Backscatter data must be acquired in backscatter time-series mode. Other minor deviations from standard hydrographic data collection methods may be addressed by scientific party members at the time of the survey.

Sonar data will be quality-checked by both the *Fairweather* Survey Department and the project team on a regular basis. As part of QC, the *Fairweather* Survey Department will be responsible for periodic initial processing (correctors applied) and examination of general data quality, backscatter coverage and quality, and bathymetry. Any issues that may arise with data quality, coverage, or specification will be immediately reported to the Chief Scientist and addressed as decided between the Survey Department and the Chief Scientist. The ship's survey personnel will be responsible for processing and submitting the bathymetry data to PHB while providing a copy of the raw and processed data to the Chief Scientist.

Groundtruth Operations

Groundtruth samples of surficial sediments will be collected at multiple locations along the survey lines, usually at the end of each 23-hour acoustic survey phase. Groundtruth station locations will be chosen based on a review of waterfall information. In heterogeneous regions, only reasonably large continuous patches will be sampled to maximize the likelihood of sampling the targeted backscatter. Trawl survey station locations will be preferentially used in very broad regions of homogenous backscatter. Both the FFCPT and the SEABOSS benthic grab sampler will be deployed at each groundtruth station (Appendix A). Regardless of the device used, the ship must heave to in a fashion similar to taking a standard sound velocity cast. The Officer of the Deck (OOD) can assist with planning by frequently updating the scientific crew on the minimum transit time to the next waypoint (*i.e.* trawl-survey station) at standard surveying speed.

The SEABOSS device collects a physical sample from the seabed with a modified van Veen grab. It incorporates digital-video and high-resolution digital-still cameras to provide a landscape perspective of the sampling location and, with the aid of a triggering device, a series of still-frame photos just prior to contact with the seafloor. One or two successful SEABOSS samples will be taken at each groundtruth station. Still imagery and video from the SEABOSS will be downloaded on deck after the sediments are collected. SEABOSS deployments only require a mechanical connection to the vessel's J-arm. Note that the triggering device on SEABOSS is sensitive to sea state and rolling seas can cause premature tripping of the grab sampler. The instrument needs to be brought on deck for examination and re-arming after each sample or premature tripping. Several attempts may be necessary to collect each usable sample. The OOD, with communications from the fantail, is expected to determine the best orientation for the ship to reduce the effects of weather and sea conditions. In the event of a general SEABOSS failure, a spring-loaded Shipek grab sampler will be substituted. Sediment samples will be collected directly from the SEABOSS bucket and will be sealed in individual bags without any chemicals or preservatives.

The FFCPT free falls in the water column and takes measurements as it embeds itself in the sediment. The data provide a high-resolution characterization of sediment layering and grain size, and provide two independent means of evaluating undrained shear strength. The FFCPT will be used to characterize the seabed at each station, and can be deployed simultaneously with the SEABOSS. The ship is responsible to ensure that the FFCPT and the supporting MVP winch are operational, and will provide skilled operators for both. The FFCPT must be deployed with ship personnel on the fantail actively monitoring the deployment and not done remotely from inside the ship.

Positioning and Correctors.

Accurate and precise positioning is a crucial element of the project. Adequate WAAS coverage is generally available in the study area and is sufficiently precise for project needs. In the event of a WAAS service interruption, C-Nav Globally Corrected GPS

positioning input (or equivalent) is recommended, in order to maintain a high degree of spatial correspondence among the sonar, groundtruth, and fisheries data.

An ultra-short baseline (USBL) system will determine the subsurface position of all towed equipment, by combining acoustic range and bearing data from a vessel-mounted transceiver with the ship's position from the project's independent WAAS/GPS receiver, and attitude and heading information from the vessel's own navigation system. The object to be tracked will be equipped with an acoustic transponder or responder that communicates with the transceiver that is permanently mounted on the ship's skeg. For this project, another USBL transceiver will be mounted on an over-the-side pole extending to 1.6 meters below the ship's keel. Prior to use, a dynamic calibration of the USBL systems is required to determine system offsets and provide accurate positioning information (Fig. 2, Fig. 3).

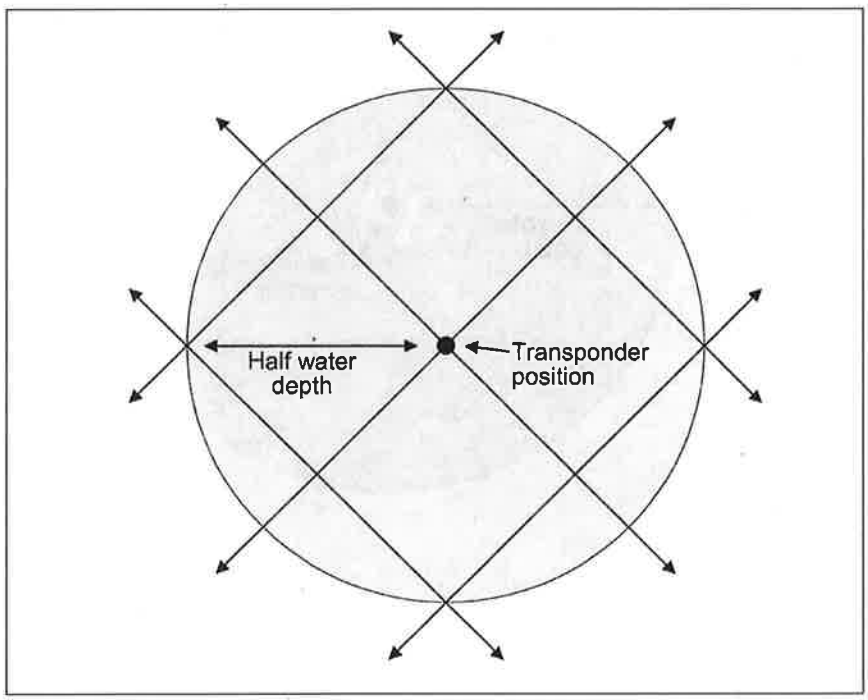


Figure 3. Example of transit lines used to collect USBL calibration data.

The EBS has few of the vertical-control reference stations that are traditionally used to vertically transform soundings and it is impractical to install the temporary tide gauges required to cover the study area. Under these circumstances, discrete tidal zoning is frequently used to provide time and range correctors to compensate for distance from a tide gauge. However, tidal zoning is inexact and may only be possible for part of the study area. Therefore, logging POSPac data is recommended so that heights can be transformed from the ellipsoid to the chart datum once V-Datum is available for the Arctic.

Sound velocity measurements will be made using the sound velocity and pressure sensor (SVP) attached to the FFCPT and will be the responsibility of the ship's Survey Department. Frequent or continuous sound speed profiling with the FFCPT is necessary

to increase the reliability of bathymetric data for charting purposes. Full profiles will be collected at every seabed sampling station and at least every four hours while surveying the tracklines. This is particularly important because of a well-documented subsurface pool of cold water that migrates within the EBS. A minimum sound velocity of 1460 m/sec has been observed and the corresponding thermal gradient can disrupt sonar performance. Vessel speed should be reduced to 6 kts for underway deployments of the FFCPT and the operators of towed equipment must be notified prior to any vessel speed adjustment. Traditional CTDs and the MVP sensor should be available for calibration/comparison and as back-up if needed. The SVP will be compared to a multi-CTD drop prior to survey operations and again at the end of the cruise, in order to determine agreement between the instruments.

Additional information

More details about the operations to be conducted are included in the Hydrographic Survey Project Instructions for FA-16-03 (Appendix C).

D. Dive Plan

All dives are to be conducted in accordance with the requirements and regulations of the NOAA Diving Program (http://www.ndc.noaa.gov/dr.html) and require the approval of the ship's Commanding Officer.

Dives are not planned for this project.

E. Applicable Restrictions

Conditions which preclude normal operations:

1. Heavy seas/swell create hazardous conditions for launch and recovery of scientific equipment and will also degrade sonar system performance due to excessive towfish motion and bubble sweep-down along the hull.

2. Fishing gear/buoys across the ship's path could strike/entangle and damage towed scientific equipment.

3. Docking options may be limited by the USBL pole and mounting hardware on the port side of the vessel.

III. Equipment

A. Equipment and Capabilities provided by the ship (itemized)

1. Kongsberg EM710 multibeam echosounder and associated systems, with skilled operators for around-the-clock data acquisition and QC-related pre-processing.

2. Stable over-the-side pole for mounting the project's USBL transceiver.

3. DWSII winch for towing project equipment.

4. Markey winch and J-arm for deploying benthic samplers.

5. MVP winch and functional line-puller for deploying the FFCPT, with skilled operators for around-the-clock data acquisition and processing of SVPs.

6. Multiple Sea-Bird Electronics SBE-19+ SEACAT systems.

7. Access to C-Nav Globally Corrected GPS positioning service.

8. Periodic environmental measurements for estimating the acoustic absorption coefficient (*i.e.*, temperature, depth, salinity, pH), ideally incorporated into the SCS file.

9. Full utilization of the forward oceanographic lab (D-07-102) for operating project equipment (Fig. 3)

10. Partial utilization of the aft oceanographic lab (D-09-102) for staging deck operations and for limited use of counter space.

11. Partial utilization of the data processing center #2 (D-05-103) for operating the project's portable Data Archiving System (will not impact crew access to e-mail).

12. Selected navigation/sonar feeds to the project operations area in the forward oceanographic lab.

13. Scientific Computer System (SCS).

14. Adequate deck lighting for night-time operations.

15. Safety harnesses for working at the port side sampling station near the J-arm and at the stern.

16. Ship's crane for moving project equipment.

17. Capability to swap spooled drums of cable on the DWS winch while at sea.

18. A liaison for the scientific party and ship's crew

19. Wifi access to government issued computers in compliance with current IT standards for access to e-mail.

B. Equipment and Capabilities provided by the scientists (see Appendix A)

1. QINSy integrated navigation system including miscellaneous instruments to be interfaced with the ship's navigation/sonar systems.

2. Klein 7180 long-range side-scan sonar system (LRSSS) with deck cradle.

3. Klein 5410 side-scan sonar system.

4. Trimble WAAS/GPS receiver and antenna.

5. Sonardyne Fusion USBL system.

6. COMPATT acoustic beacon with floatation collar, anchor and acoustic release for USBL calibration.

7. SEABOSS benthic sampler system.

8. Portable rack-mounted Data Archiving System (23"x 31"x 24").

9. Free Fall Cone Penetrometer (FFCPT).

10. Two complete fiber-optic cable/drum/slip ring/deck cable/termination units (and stands) for use on ship's DWSII winch, including top plate (torque arm) that attaches to DWS winch frame to hold slip ring pin.

11. Shipek grab sampler.

12. 28" hanging block with throat rollers, guide arms and TCount transmitter.

13. Radio receiver and PC interface for TCount cable counter system.

14. Miscellaneous deck supplies, containers for processing sediments.

IV. Hazardous Materials

A. Policy and Compliance

The Chief Scientist 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). By Federal regulations and Office of 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
- 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.

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

The hazardous material inventory consists of small aerosol cans as standard consumer-scale packaging of Other Regulated Materials for Domestic Transport Only (ORM-D) classification. These items will be used to maintain and repair electrical and mechanical scientific equipment.

Common Name of Material	**UN #**	**Quantity**
Krylon fluorescent orange spray paint	1950	11-oz can (n=1)
DeoxIT contact cleaner & lubricant	1950	5.75-oz can (n=2)
CRC QD Electronic Cleaner	1950	11-oz cans (n=2)
LPS 3 rust inhibitor	1950	11-oz cans (n=2)
WD-40	1950	12-oz cans (n=2)

C. Storage and accidental release measures

The inventory will be stored in a sealed 5-gallon bucket outside of the work spaces when not in use. In the event of an uncontrolled release: personnel should wear appropriate protective clothing, eliminate all sources of ignition, and ventilate the area. Contain and collect liquid with an inert absorbent and place in a container for disposal. Clean spill area thoroughly. Report release to authorities as required.

D. Radioactive Materials

No radioactive isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

No supplementary science projects are planned.

B. NOAA Fleet Ancillary Projects

Description: During offshore operations, all survey launches will be deployed for critical hydrographic surveys in Unalaska Bay. Project Instructions for this project, OPR-Q328-FA-16, have been filed separately.

VI. Disposition of Data and Reports

Disposition of data gathered aboard NOAA ships will conform to NAO 216-101 *Ocean Data Acquisitions* and NAO 212-15 *Management of Environmental Data and Information.* To guide the implementation of these NAOs, NOAA's Environmental Data Management Committee (EDMC) provides the *NOAA Data Documentation Procedural Directive* (data documentation) and *NOAA Data Management Planning Procedural Directive* (preparation of Data Management Plans). OMAO is developing procedures and allocating resources to manage OMAO data and Programs are encouraged to do the same for their Project data.

A. Data Classifications: *Under Development*

a. OMAO Data

b. Program Data

B. Responsibilities: *Under Development*

VII. Meetings, Vessel Familiarization, and Project Evaluations

A. Pre-Project Meeting: The Chief Scientist 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 Chief Scientist in arranging this meeting.

B. 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.

C. Post-Project Meeting: The Commanding Officer is responsible for conducted a meeting no earlier than 24 hrs before or 7 days after the completion of a project to discuss the overall success and short comings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's

officers, applicable crew, the Chief Scientist, and members of the scientific party and is normally arranged by the Operations Officer and Chief Scientist.

D. 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 seven days prior to the project.

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding 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 Chief Scientist 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 Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship.

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Chief Scientist will ensure that all non-NOAA or non-Federal scientists aboard also have proper orders. It is the responsibility of the Chief Scientist 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 17, 2000 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 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 – Pacific
2002 SE Marine Science Dr.
Newport, OR 97365
Telephone 541-867-8822
Fax 541-867-8856
Email MOP.Health-Services@noaa.gov

Prior to departure, the Chief Scientist must provide an electronic listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: contact name, address, relationship to member, and telephone number.

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. At the discretion of the ship CO, safety shoes (i.e. steel or composite toe protection) may be required to participate in any work dealing with suspended loads, including CTD deployment and recovery. The ship does not provide safety-toed shoes/boots. The ship's Operations Officer should be consulted by the Chief Scientist to ensure members of the scientific party report aboard with the proper attire.

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via email 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 and it must be arranged through the ship's Commanding Officer at least 30 days in advance.

E. IT Security

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:

(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 the above requirements prior to boarding the ship is required.

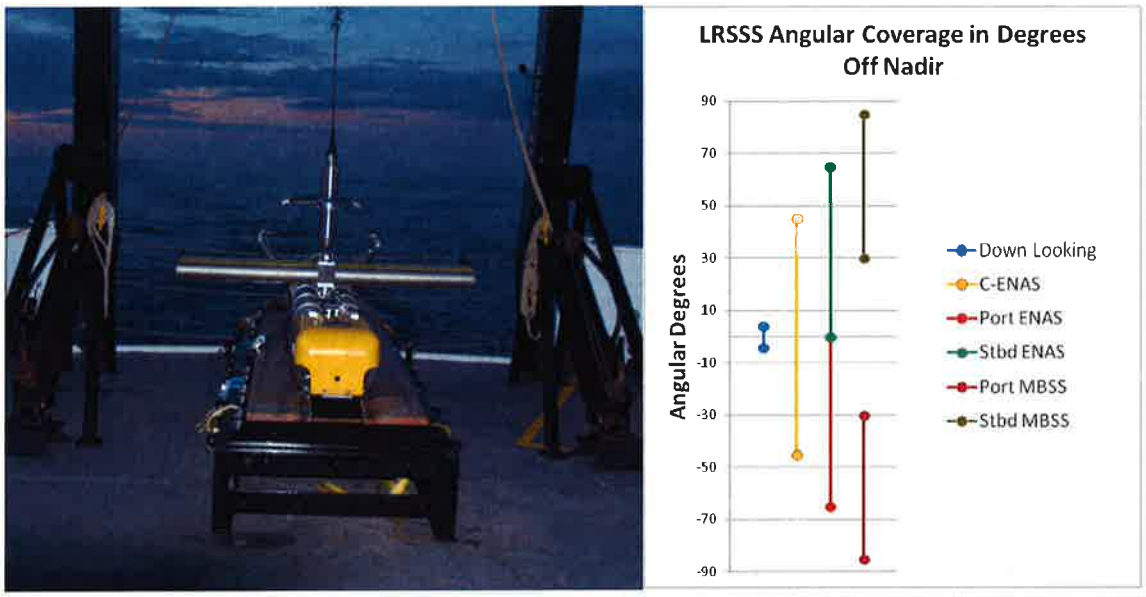
Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

F. Foreign National Guests Access to OMAO Facilities and Platforms

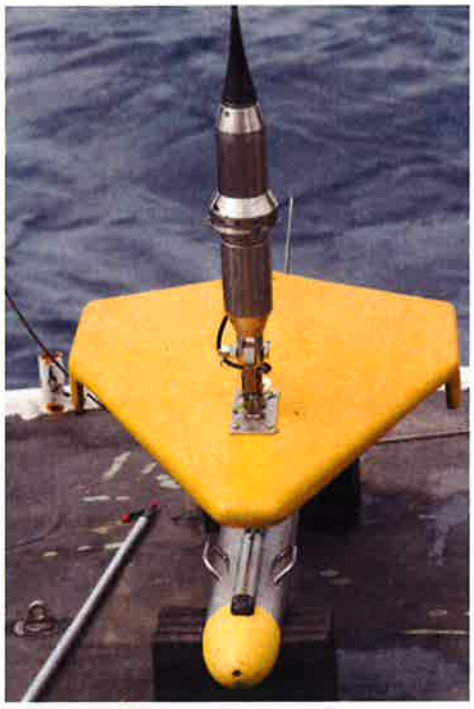
Foreign National access to the NOAA ship or Federal Facilities is not required for this project.

VIII. Appendices

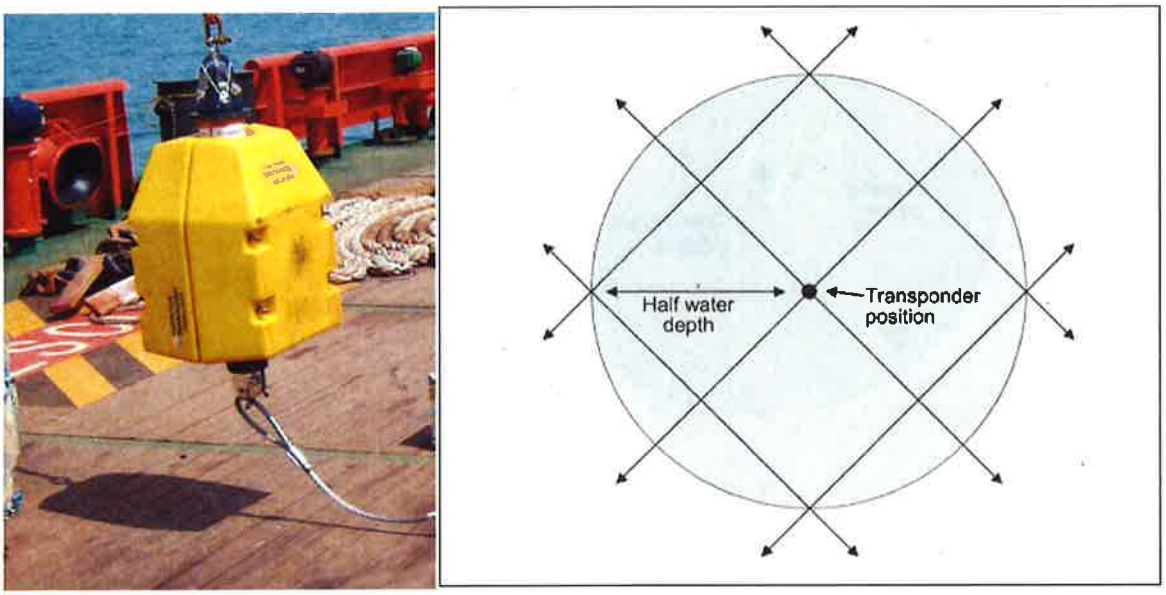
Appendix A. Scientific Equipment



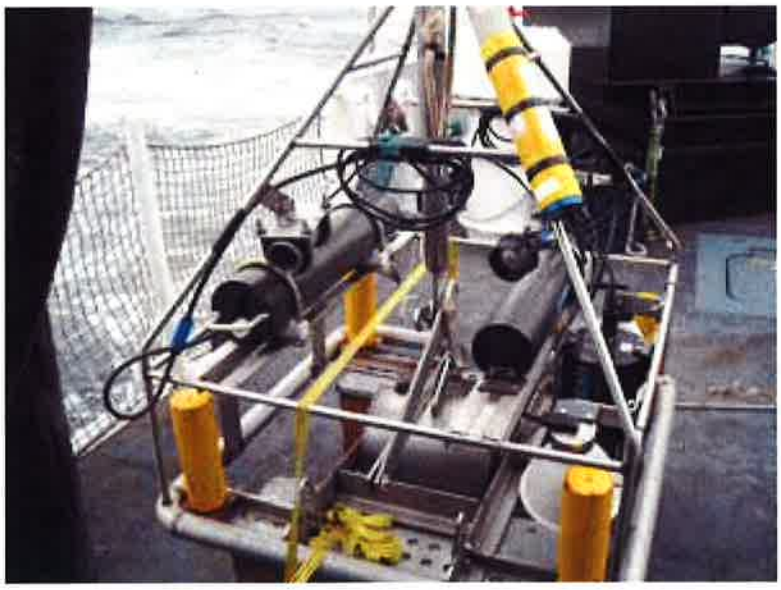
The Klein 7180 long-range side scan sonar in its on-deck cradle. Overlapping angular coverage by the acoustic subsystems enables a "cascading calibration" of the full survey swath using the calibrated output from the down-looking sonar at nadir.



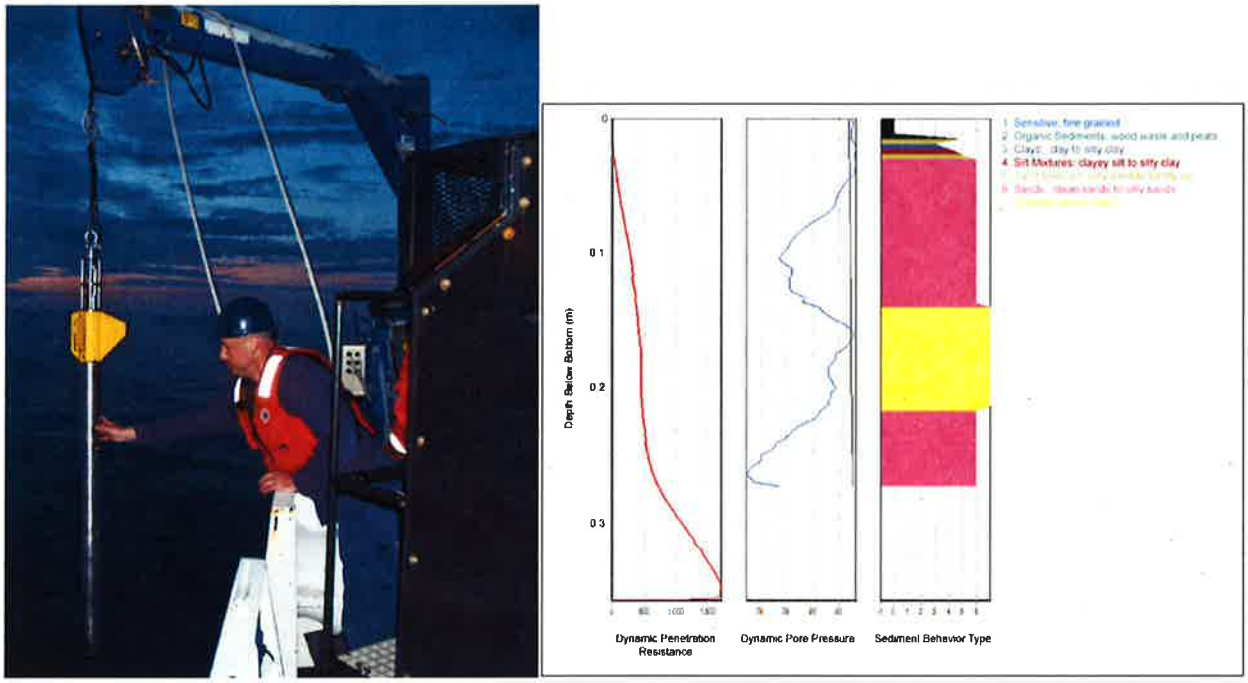
Klein 5410 side scan sonar towfish attached to the depressor wing and termination of the double armored fiber-optic tow cable.



Medium frequency (18-36 kHz) COMPATT transponder and example of transit lines used to collect USBL calibration data.



Seabed Observation and Sampling System (SEABOSS).



FFCPT probe and line-pulling sheave, with representative output from an underway penetration of the seafloor. Penetration resistance and pore pressure can be used to infer sediment type.

Appendix B. Station/Waypoint List

A. AFSC standard acoustic transect (Dutch Harbor)

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
1 (2)	Southern	53.9610	53°57.66'	166.5280	166°31.68'	
2 (1)	Northern	54.0230	54°01.38'	166.5280	166°31.68'	

B. Target location for the acoustic beacon used for the USBL calibration

N. Latitude	W. Longitude
53.966171	-166.508169

C. FISHPAC 2016 survey tracklines

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
1	Z05	54.6667	54°40.00'	-165.1500	165°09.00'	82.3
2	A06	55.0000	55°00.00'	-164.5833	164°35.00'	62.5
3	B08	55.3333	55°20.00'	-163.4167	163°25.00'	52.7
4	C09	55.6667	55°40.00'	-162.8333	162°50.00'	51.0
5	D10	56.0000	56°00.00'	-162.2333	162°14.00'	70.2
6	E12	56.3333	56°20.00'	-161.0000	161°00.00'	52.6
7	F13	56.6667	56°40.00'	-160.3667	160°22.00'	59.4

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
8	F14	56.6667	56°40.00'	-159.7500	159°45.00'	36.5
9	G15	57.0000	57°00.00'	-159.1167	159°07.00'	32.7
10	H16	57.3333	57°20.00'	-158.4000	158°24.00'	31.3
11	I16	57.6667	57°40.00'	-158.3500	158°21.00'	35.0
12	J16	58.0000	58°00.00'	-158.3167	158°19.00'	33.6
13	J15	58.0000	58°00.00'	-158.9667	158°58.00'	40.1
14	I15	57.6667	57°40.00'	-159.0167	159°01.00'	46.8
15	H15	57.3333	57°20.00'	-159.0667	159°04.00'	48.4
16	G14	57.0000	57°00.00'	-159.7167	159°43.00'	55.7
17	H14	57.3333	57°20.00'	-159.6667	159°40.00'	55.8
18	I14	57.6667	57°40.00'	-159.6333	159°38.00'	49.6
19	J14	58.0000	58°00.00'	-159.6000	159°36.00'	41.6
20	K14	58.3333	58°20.00'	-159.5500	159°33.00'	24.8
21	K13	58.3333	58°20.00'	-160.1833	160°11.00'	36.6
22	J13	58.0000	58°00.00'	-160.2167	160°13.00'	50.4
23	I13	57.6667	57°40.00'	-160.2667	160°16.00'	54.1
24	H13	57.3333	57°20.00'	-160.3000	160°18.00'	60.7
25	G13	57.0000	57°00.00'	-160.3333	160°20.00'	63.0

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
26	F12	56.6667	56°40.00'	-160.9833	160°59.00'	68.4
27	G12	57.0000	57°00.00'	-160.9500	160°57.00'	64.6
28	H12	57.3333	57°20.00'	-160.9333	160°56.00'	61.7
29	I12	57.6667	57°40.00'	-160.8833	160°53.00'	56.3
30	J12	58.0000	58°00.00'	-160.8500	160°51.00'	45.0
31	K12	58.3333	58°20.00'	-160.7500	160°45.00'	25.5
32	K11	58.3333	58°20.00'	-161.4000	161°24.00'	38.3
33	J11	58.0000	58°00.00'	-161.4833	161°29.00'	54.4
34	I11	57.6667	57°40.00'	-161.5000	161°30.00'	52.9
35	H11	57.3333	57°20.00'	-161.5333	161°32.00'	55.9
36	G11	57.0000	57°00.00'	-161.5667	161°34.00'	68.7
37	F11	56.6667	56°40.00'	-161.5833	161°35.00'	89.0
38	E11	56.3333	56°20.00'	-161.6167	161°37.00'	64.3
39	E10	56.3333	56°20.00'	-162.2000	162°12.00'	78.4
40	F10	56.6667	56°40.00'	-162.1833	162°11.00'	71.5
41	G10	57.0000	57°00.00'	-162.1667	162°10.00'	60.2
42	H10	57.3333	57°20.00'	-162.1500	162°09.00'	50.6
43	I10	57.6667	57°40.00'	-162.1333	162°08.00'	46.8

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
44	J10	58.0000	58°00.00'	-162.1167	162°07.00'	37.3
45	K10	58.3333	58°20.00'	-162.0500	162°03.00'	46.6
46	L09	58.6667	58°40.00'	-162.7000	162°42.00'	26.2
47	K09	58.3333	58°20.00'	-162.7167	162°43.00'	31.3
48	J09	58.0000	58°00.00'	-162.7500	162°45.00'	40.7
49	I09	57.6667	57°40.00'	-162.7500	162°45.00'	43.3
50	H09	57.3333	57°20.00'	-162.7667	162°46.00'	48.3
51	G09	57.0000	57°00.00'	-162.7833	162°47.00'	60.4
52	F09	56.6667	56°40.00'	-162.7833	162°47.00'	72.2
53	E09	56.3333	56°20.00'	-162.8000	162°48.00'	78.8
54	D09	56.0000	56°00.00'	-162.8167	162°49.00'	78.7
55	C08	55.6667	55°40.00'	-163.4000	163°24.00'	80.9
56	D08	56.0000	56°00.00'	-163.4000	163°24.00'	88.3
57	E08	56.3333	56°20.00'	-163.4000	163°24.00'	84.7
58	F08	56.6667	56°40.00'	-163.3833	163°23.00'	75.0
59	G08	57.0000	57°00.00'	-163.3833	163°23.00'	65.7
60	H08	57.3333	57°20.00'	-163.3833	163°23.00'	53.1
61	I08	57.6667	57°40.00'	-163.3667	163°22.00'	46.4

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
62	J08	58.0000	58°00.00'	-163.3667	163°22.00'	43.2
63	K08	58.3333	58°20.00'	-163.3667	163°22.00'	36.8
64	L08	58.6667	58°40.00'	-163.3500	163°21.00'	30.8
65	M08	59.0000	59°00.00'	-163.3500	163°21.00'	21.2
66	N07	59.3333	59°20.00'	-164.0000	164°00.00'	21.1
67	M07	59.0000	59°00.00'	-164.0000	164°00.00'	27.3
68	L07	58.6667	58°40.00'	-164.0000	164°00.00'	33.9
69	K07	58.3333	58°20.00'	-164.0000	164°00.00'	40.3
70	J07	58.0000	58°00.00'	-164.0000	164°00.00'	46.2
71	I07	57.6667	57°40.00'	-164.0000	164°00.00'	51.6
72	H07	57.3333	57°20.00'	-164.0000	164°00.00'	61.5
73	G07	57.0000	57°00.00'	-164.0000	164°00.00'	68.0
74	F07	56.6667	56°40.00'	-164.0000	164°00.00'	75.3
75	E07	56.3333	56°20.00'	-164.0000	164°00.00'	85.9
76	D07	56.0000	56°00.00'	-164.0000	164°00.00'	90.5
77	C07	55.6667	55°40.00'	-164.0000	164°00.00'	94.6
78	B07	55.3333	55°20.00'	-164.0000	164°00.00'	76.9
79	B06	55.3333	55°20.00'	-164.5833	164°35.00'	101.6

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
80	C06	55.6667	55°40.00'	-164.5833	164°35.00'	96.4
81	D06	56.0000	56°00.00'	-164.5833	164°35.00'	92.8
82	E06	56.3333	56°20.00'	-164.5833	164°35.00'	87.1
83	F06	56.6667	56°40.00'	-164.6000	164°36.00'	74.6
84	G06	57.0000	57°00.00'	-164.6000	164°36.00'	69.4
85	H06	57.3333	57°20.00'	-164.6167	164°37.00'	65.4
86	I06	57.6667	57°40.00'	-164.6167	164°37.00'	52.9
87	J06	58.0000	58°00.00'	-164.6167	164°37.00'	44.4
88	K06	58.3333	58°20.00'	-164.6333	164°38.00'	43.4
89	L06	58.6667	58°40.00'	-164.6500	164°39.00'	36.7
90	M06	59.0000	59°00.00'	-164.6500	164°39.00'	27.2
91	N06	59.3333	59°20.00'	-164.6500	164°39.00'	21.2
92	N05	59.3333	59°20.00'	-165.3167	165°19.00'	19.9
93	M05	59.0000	59°00.00'	-165.3000	165°18.00'	27.2
94	L05	58.6667	58°40.00'	-165.3000	165°18.00'	39.0
95	K05	58.3333	58°20.00'	-165.2833	165°17.00'	44.5
96	J05	58.0000	58°00.00'	-165.2500	165°15.00'	49.2
97	I05	57.6667	57°40.00'	-165.2500	165°15.00'	60.8

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
98	H05	57.3333	57°20.00'	-165.2333	165°14.00'	66.8
99	G05	57.0000	57°00.00'	-165.2167	165°13.00'	70.7
100	F05	56.6667	56°40.00'	-165.2167	165°13.00'	75.6
101	E05	56.3333	56°20.00'	-165.2000	165°12.00'	86.2
102	D05	56.0000	56°00.00'	-165.1833	165°11.00'	96.3
103	C05	55.6667	55°40.00'	-165.1667	165°10.00'	108.7
104	B05	55.3333	55°20.00'	-165.1667	165°10.00'	111.4
105	A05	55.0000	55°00.00'	-165.1500	165°09.00'	111.6
106	AZ0504	54.8333	54°50.00'	-165.5167	165°31.00'	163.5
107	A04	55.0000	55°00.00'	-165.7500	165°45.00'	130.3
108	B04	55.3333	55°20.00'	-165.7833	165°47.00'	120.4
109	C04	55.6667	55°40.00'	-165.8000	165°48.00'	117.6
110	D04	56.0000	56°00.00'	-165.7833	165°47.00'	107.0
111	E04	56.3333	56°20.00'	-165.8000	165°48.00'	91.8
112	F04	56.6667	56°40.00'	-165.8333	165°50.00'	78.9
113	G04	57.0000	57°00.00'	-165.8500	165°51.00'	72.2
114	H04	57.3333	57°20.00'	-165.8667	165°52.00'	68.2
115	I04	57.6667	57°40.00'	-165.8833	165°53.00'	63.9

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
116	J04	58.0000	58°00.00'	-165.9000	165°54.00'	55.6
117	K04	58.3333	58°20.00'	-165.9167	165°55.00'	43.9
118	L04	58.6667	58°40.00'	-165.9333	165°56.00'	36.9
119	M04	59.0000	59°00.00'	-165.9333	165°56.00'	29.6
120	N04	59.3333	59°20.00'	-165.9500	165°57.00'	23.8
121	O04	59.6667	59°40.00'	-165.9667	165°58.00'	24.4
122	O03	59.6667	59°40.00'	-166.6333	166°38.00'	27.5
123	N03	59.3333	59°20.00'	-166.6000	166°36.00'	27.5
124	M03	59.0000	59°00.00'	-166.5833	166°35.00'	33.4
125	L03	58.6667	58°40.00'	-166.5667	166°34.00'	41.1
126	K03	58.3333	58°20.00'	-166.5500	166°33.00'	47.1
127	J03	58.0000	58°00.00'	-166.5167	166°31.00'	60.5
128	I03	57.6667	57°40.00'	-166.5000	166°30.00'	66.3
129	H03	57.3333	57°20.00'	-166.4833	166°29.00'	69.1
130	G03	57.0000	57°00.00'	-166.4667	166°28.00'	73.7
131	F03	56.6667	56°40.00'	-166.4333	166°26.00'	84.1
132	E03	56.3333	56°20.00'	-166.4167	166°25.00'	103.4
133	D03	56.0000	56°00.00'	-166.4000	166°24.00'	124.1

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
134	C03	55.6667	55°40.00'	-166.3833	166°23.00'	127.1
135	B03	55.3333	55°20.00'	-166.3500	166°21.00'	132.9
136	A03	55.0000	55°00.00'	-166.3333	166°20.00'	143.6
137	A02	55.0000	55°00.00'	-166.9333	166°56.00'	155.5
138	B02	55.3333	55°20.00'	-166.9667	166°58.00'	139.7
139	C02	55.6667	55°40.00'	-166.9833	166°59.00'	134.9
140	D02	56.0000	56°00.00'	-167.0000	167°00.00'	134.7
141	E02	56.3333	56°20.00'	-167.0333	167°02.00'	113.8
142	F02	56.6667	56°40.00'	-167.0667	167°04.00'	95.3
143	G02	57.0000	57°00.00'	-167.0833	167°05.00'	73.7
144	H02	57.3333	57°20.00'	-167.1167	167°07.00'	70.7
145	I02	57.6667	57°40.00'	-167.1333	167°08.00'	67.7
146	J02	58.0000	58°00.00'	-167.1667	167°10.00'	63.6
147	K02	58.3333	58°20.00'	-167.1833	167°11.00'	51.5
148	L02	58.6667	58°40.00'	-167.2167	167°13.00'	43.3
149	M02	59.0000	59°00.00'	-167.2333	167°14.00'	39.4
150	N02	59.3333	59°20.00'	-167.2667	167°16.00'	31.6
151	O02	59.6667	59°40.00'	-167.2833	167°17.00'	30.6

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
152	P01	60.0000	60°00.00'	-167.9833	167°59.00'	25.2
153	Q02	60.3333	60°20.00'	-167.3000	167°18.00'	29.8
154	Q01	60.3333	60°20.00'	-167.9833	167°59.00'	30.8
155	Q18	60.3333	60°20.00'	-168.6833	168°41.00'	36.1
156	P18	60.0000	60°00.00'	-168.6500	168°39.00'	38.4
157	O01	59.6667	59°40.00'	-167.9500	167°57.00'	34.6
158	N01	59.3333	59°20.00'	-167.9167	167°55.00'	39.3
159	M01	59.0000	59°00.00'	-167.8833	167°53.00'	41.2
160	L01	58.6667	58°40.00'	-167.8667	167°52.00'	46.5
161	K01	58.3333	58°20.00'	-167.8333	167°50.00'	60.1
162	J01	58.0000	58°00.00'	-167.8000	167°48.00'	66.9
163	I01	57.6667	57°40.00'	-167.7667	167°46.00'	68.9
164	H01	57.3333	57°20.00'	-167.7333	167°44.00'	73.4
165	G01	57.0000	57°00.00'	-167.7000	167°42.00'	77.0
166	F01	56.6667	56°40.00'	-167.6667	167°40.00'	102.6
167	E01	56.3333	56°20.00'	-167.6500	167°39.00'	129.1
168	D01	56.0000	56°00.00'	-167.6167	167°37.00'	133.4
169	C01	55.6667	55°40.00'	-167.5833	167°35.00'	135.4

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
170	D18	56.0000	56°00.00'	-168.2167	168°13.00'	150.3
171	E18	56.3333	56°20.00'	-168.2500	168°15.00'	153.1
172	F18	56.6667	56°40.00'	-168.2833	168°17.00'	106.6
173	G18	57.0000	57°00.00'	-168.3333	168°20.00'	80.6
174	H18	57.3333	57°20.00'	-168.3667	168°22.00'	73.9
175	I18	57.6667	57°40.00'	-168.4000	168°24.00'	70.5
176	J18	58.0000	58°00.00'	-168.4333	168°26.00'	69.2
177	K18	58.3333	58°20.00'	-168.4667	168°28.00'	64.8
178	L18	58.6667	58°40.00'	-168.5000	168°30.00'	53.2
179	M18	59.0000	59°00.00'	-168.5333	168°32.00'	46.1
180	N18	59.3333	59°20.00'	-168.5667	168°34.00'	41.5
181	O18	59.6667	59°40.00'	-168.6167	168°37.00'	38.9
182	Q19	60.3333	60°20.00'	-169.3333	169°20.00'	42.7
183	P19	60.0000	60°00.00'	-169.3167	169°19.00'	45.6
184	O19	59.6667	59°40.00'	-169.2667	169°16.00'	47.5
185	N19	59.3333	59°20.00'	-169.2333	169°14.00'	49.5
186	M19	59.0000	59°00.00'	-169.1833	169°11.00'	53.8
187	L19	58.6667	58°40.00'	-169.1500	169°09.00'	62.5

Sequence	Waypoint	N. Latitude		W. Longitude		Avg. Bottom Depth (m)
188	K19	58.3333	58°20.00'	-169.1167	169°07.00'	67.4
189	J19	58.0000	58°00.00'	-169.0667	169°04.00'	69.8
190	I19	57.6667	57°40.00'	-169.0333	169°02.00'	68.6
191	H19	57.3333	57°20.00'	-168.9833	168°59.00'	70.8
192	G19	57.0000	57°00.00'	-168.9500	168°57.00'	79.7
193	F19	56.6667	56°40.00'	-168.9000	168°54.00'	100.3
194	E19	56.3333	56°20.00'	-168.8667	168°52.00'	128.4
195	C18	55.6667	55°40.00'	-168.1833	168°11.00'	135.5
196	B01	55.3333	55°20.00'	-167.5500	167°33.00'	147.7

Appendix C. Hydrographic Survey Project Instructions for FA-16-03.