UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center
Fisheries Ecology Division
110 McAllister Road
Santa Cruz, CA 95060

Project Instructions

Date Submitted: September 18, 2017

Platform: NOAA Ship *Bell M. Shimada*

Project Number: SH-17-09 (OMAO)

Project Title: Advanced Technologies to Survey Rockfishes

Project Dates: October 5, 2017 to October 25, 2017

Prepared by: Mary M. Yoklavich Dated: 18 Sept 2017
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Approved by: Digitally signed by ROBERTS.KEITH.W.1042165537 Date: 2017.09.26 11:35:34 -07'00' Dated: _____
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Commanding Officer
Marine Operations Center – Pacific

I. Overview

A. Brief Summary and Project Period

Many species of rockfishes live in complex rocky habitats, have been over-fished, and are difficult or impossible to accurately survey using conventional bottom-trawl gear. Our ability to count these species in rocky habitats and to delineate the distribution and extent of these habitats is critical to the estimation of absolute abundance of these species for stock assessments. To that end, NMFS is pursuing the Untrawlable Habitat Strategic Initiative (UHSI) field research in the Southern California Bight. Associated with the goals of the UHSI, NMFS also recognizes the need for more high-resolution mapping of the seafloor in order to delineate and quantify rockfish habitats. Research planned for October 2017 on the *B. Shimada* represents year-2 of the UHSI project in Southern California. We are using the results from our year-1 study off the *R. Lasker* in October 2016 in Southern California to inform the experiments we will conduct in this second year from the *B. Shimada*. We also will continue our plan to map the seafloor at priority sites in and around the Channel Islands.

During this mission, we will 1) rendezvous with R/V *Velero IV* (contracted through NMFS) and use NMFS's Seabed autonomous underwater vehicle (AUV) as part of an underwater experiment to observe and quantify the behavior of rockfishes in reaction to mobile survey vehicles; 2) acquire high-resolution bathymetric data around the northern Channel Islands using the vessel's ME70 sonar; 3) survey rockfishes and habitats visually using the AUV; 4) deploy and retrieve small drop cameras to observe fishes on the seafloor.

This is a multi-year collaboration among researchers from the NMFS SWFSC, NWFSC, SEFSC, and AFSC, and complements ongoing similar surveys being conducted in the Gulf of Mexico as well as ongoing seafloor mapping and habitat surveys being conducted by NOAAs Channel Islands National Marine Sanctuary. The results of this mission will lead to more accurate estimates of demersal fish populations and associated habitats in deep-water, thereby supporting NOAA's objectives to achieve sustainable fisheries and improve our understanding of marine ecosystems. Our findings will improve stock assessments of species in untrawlable habitats, and will assist in the interpretation and understanding of the use of deepwater habitats by demersal fishes.

B. Days at Sea (DAS)

Of the 21 DAS scheduled for this project, 0 DAS are funded by an OMAO allocation, 21 DAS are funded by a Line Office Allocation, 0 DAS are Program Funded, and 0 DAS are Other Agency funded.

C. Operating Area

The operational area will include the waters in and around the Channel Islands National Marine Sanctuary (Santa Rosa, Santa Cruz, Anacapa Islands); see Appendix 1. The majority of operations will be conducted between 50m and 350m.

D. Summary of Objectives

There are five objectives associated with this project:

1) To collect high-resolution bathymetry data using the ship's ME70.

2) To groundtruth bathymetric data using NMFS' Seabed AUV
3) To conduct visual surveys of groundfishes using NMFS' Seabed AUV.
4) Rendezvous with R/V *Velero IV* (contracted by NMFS) at Footprint study site (Appendix 2), during which time the AUV will operate as part of an underwater experiment to observe and quantify the behavior of rockfishes in reaction to mobile survey vehicles.
5) To deploy and retrieve small drop cameras (Trigcams) at the Footprint study site to observe and quantify rockfishes associated with rocky habitats.

E. Participating Institutions

NOAA: NMFS – Southwest Fisheries Science Center; Northwest Fisheries Science Center; Alaska Fisheries Science Center; Alaska Fisheries Region; Southeast Fisheries Science Center; Deep Sea Coral Research and Technology Program; Untrawlable Habitat Strategic Initiative.
NOS – Office of National Marine Sanctuaries; National Centers for Coastal Ocean Science; Office of Coast Survey.

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

Name (Last, First)	**Title**	**Date Aboard**	**Date Disembark**	**Gender**	**Affiliation**	**Nationality**
Anderson, Jeff	Scientist, AUV	10/3/2017	10/27/2017	Male	Contractor	USA
Clarke, Elizabeth (Liz)	Scientist, AUV, P.I.	10/3/2017	10/27/2017	Female	NOAA NMFS	USA
Fruh, Erica	Scientist, AUV	10/3/2017	10/27/2017	Female	NOAA NMFS	USA
Chris Rooper	Scientist, Trigcam	10/9/2017	10/25/2017	Male	NOAA NMFS	USA
Kresimir Williams	Scientist, Trigcam	10/9/2017	10/13/2017	Male	NOAA NMFS	USA
Jodi Pirtle	Fishery Biologist/seafloor mapping	10/3/2017	10/25/2017	Female	NOAA NMFS	USA
Watters, Diana	Fishery Biologist/seafloor mapping	10/3/2017	10/26/2017	Female	NOAA NMFS	USA
Whitmire, Curt	Scientist, AUV	10/3/2017	10/27/2017	Male	NOAA NMFS	USA
Yoklavich, Mary	Chief Scientist, Fisheries Biologist	10/3/2017	10/26/2017	Female	NOAA NMFS	USA

G. Administrative

1. Points of Contacts:

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Operations Officer – LT Bryan Begun/LTJG Doug Pawlishen
NOAA Ship *Bell Shimada*
Ship Cellular: (541) 351-1105
Phone at Sea (VOIP): (541) 867-8923

2. Diplomatic Clearances

None Required.

3. Licenses and Permits

This project will be conducted under a Scientific Research Permit (U.S.) that is currently being reviewed for issuance to Mary Yoklavich by NOAAs Channel Islands National Marine Sanctuary. We will provide the ship with a pdf of this permit prior to sailing.

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:

Most science party will board the *Shimada* in Newport, OR on 3 October 2017. We will begin transit to the Channel Islands from Newport, OR on October 5, 2017. The ME70 will require some testing that could be performed in transit to our study site. Two scientists will join the cruise once the Shimada arrives in the Santa Barbara area (ETA: 1500 on 9 October 2017); this personnel transfer will be accomplished using the ship's small boat. One of these scientists (KW) will need to deboard the *Shimada* and return to Santa Barbara on 13 October 2017; we propose to transfer this scientist via small boat from the *Shimada* to the R/V *Velero* while on our study site, after which the *Velero* will transport the scientist to Santa Barbara.

Upon arrival at study site in Channel Islands, a patch test of the ME70 and a shakedown deployment of the AUV will take place at a selected location. Following successful testing, mapping operations will commence in one of our priority polygons (Appendix 1) during nighttime hours (1700-0700). Survey waypoint for line plans in priority areas are included in Appendix 3; selection of areas and lines for mapping each night will be based on sea-state, holidays in multibeam echosounder coverage, and remaining gaps. Selection will be finalized and made available to the Operations Officer during daily operations meeting. In Appendix 4 we provide a summary of length of lines and estimated time to complete the bathymetric survey in each priority area.

The majority of the AUV dives will be conducted in conjunction with research being carried out from a contracted research vessel (*Velero IV*) at 100-150 m depth on the Footprint seamount in the gap between Santa Cruz and Anacapa Islands (Appendix 2). A long baseline (LBL) acoustic positioning system will be used, which includes three seafloor transponders as reference points for improved navigation of the AUV relative to experimental camera systems being deployed from the R/V *Velero* IV. Two LBL transponders will be deployed in association with the camera systems from the *Velero* IV; the other LBL beacon will be deployed from the *Shimada* prior to AUV dives (Appendix 5A and B). Prior to deploying the AUV, each of the three transponders will need to be "surveyed in". This requires the *Shimada* to circle the location of the transponders while the AUV team collects position and acoustic data. Once the AUV surveys on the Footprint are complete, the AUV team will acoustically release the single transponder that was deployed from the *Shimada*. This transponder will float to the sea surface and be retrieved by the *Shimada* likely using the ship's small workboat. Also, use of the ship's small workboat may be required once or twice during the cruise to transfer one of the scientists from the *Shimada* to the *Velero* IV in order to assist with technical issues that may occur with the camera systems being used on the *Velero*.

We also will deploy about eight independent small drop cameras (trigcams; Appendix 6) onto the seafloor primarily at our Footprint study site each day prior to nighttime mapping operations. These cameras will be left on the seafloor for approximately 24 hrs, retrieved in late afternoon to swap out batteries and download data, and then re-deployed. Retrieval and redeployment of 8 trigcams each evening could take an estimated 3 hrs total; we will adjust the number of camera systems being used each night, based on amount of time required for deployment/retrieval.

B. Staging and Destaging:

We request a meeting with the operations officer and the survey techs one day prior to departure (October 4, 2017). This meeting will cover status and operation of the ME70 and Hypack/Hysweep software, and launch/retrieval protocols for the AUV and trigcams. AUV equipment will be loaded on the vessel by ship's crane in Newport, OR during the days prior to departure (beginning 2 October). The gear will be palletized and staged at dockside and crane operations should take less than 45 min. Destaging of the AUV will occur by ship's crane upon arrival at dock in San Diego on October 25-27, 2017, and all science gear will be removed from the vessel by October 27, 2017. Destaging of AUV gear will require the use of a forklift.

C. Operations to be Conducted:

<u>ME70 Testing and Data Acquisition for Seafloor Mapping.</u>
We will use the ship's ME70 sonar integrated with Hypack/Hysweep software for data collection, which results in real-time bathymetry, efficient line planning, and good communication with the bridge. This requires the configuration of a remote Hypack display monitor on the bridge so that personnel on the bridge and in the acoustics lab can simultaneously view survey line plans. A first order task will be to verify installation parameters and ME70 setup. DGPS, POS MV, ME70 and software configurations will be reviewed with survey and electronics technicians to assess DGPS integration with POS MV; reference points / vessel offsets; status of surface sound speed sensor (integration and calibration) and Hypack integration. Specifically, POS MV offsets showing lever arms and mounting angles and sensor mounting will be examined, as well as ME70 offsets applied in the ME70 control software (transducer, GPS and MRU offsets). Ship maneuvers will be required to complete ME70 patch tests – navigation timing, pitch and yaw over a distinct feature and roll over a flat surface with results analyzed in Caris. In addition, comparisons with a

reference surface and a GAMS calibration will be conducted. Real time surface sound speed will be checked against water column sound speed from XBT and CTD casts (sound speed corrections to the ME70 will be examined). Water column sound speed will be collected via XBT every four hours or as water conditions change during seafloor mapping. Data processing will include tide corrections and computing total propagated uncertainty. The Caris vessel file will be appended. A survey tech should be available during nighttime mapping as XBT casts will be conducted. To maintain data quality, it is requested that visiting scientists on the mapping shift be permitted access to the ship's science network to allow for access across the ME70, XBT, and CTD computers. To avoid acoustic interference, ADCP and other sounders will need to be secured during mapping operations.

Seabed AUV Data Acquisition.

We will use the NMFS Seabed AUV and attached cameras and sensors during daytime to quantitatively survey fishes and habitats in priority areas as designated by the scientific staff. Images of the seafloor will be collected from the AUV using HD downward looking and forward-angled cameras. The AUV will be programmed to survey at a height three meters from the seafloor. Images will be retrieved at the end of each mission. Initial scanning of the images to assess habitat and biota prior to the next day's operation will be the goal. AUV ops will be conducted for approx. 6-7 hrs per deployment (dependent on battery life). Standard Operating Procedures (SOP) for AUV operations, including pictures of the AUV, can be reviewed in the accompanying file (see March29_AUV_SOP_Ver2.pdf); the SOP will be supplied to the ship. All personnel participating in AUV operations should review the SOP. An operational risk assessment for AUV operations also will be provided. The SOP should be reviewed and discussed between AUV team, the ship's operations officer and other appropriate personnel so that any questions about operations can be clarified. At the beginning of the cruise and before all AUV operations, a meeting will occur with all personnel participating in AUV operations to review procedures and risks and to walk through AUV operations. On the first day of the cruise a trial deployment and ballasting of the AUV should be conducted. Prior to each deployment of the AUV a standard "GAR" (green-amber-red) review will be conducted with all personnel participating in AUV operations to assess and review current risks.

Under normal operations there is no requirement for the ship to maintain a specific station during AUV operations. However, in order to maintain communication with the AUV's acoustic modem and navigational system, the ship may be asked to make adjustments to their position relative to the AUV in order to achieve better communication with the AUV. A monitor that will show the relative position of the AUV and ship will be placed on the bridge to facilitate communication between the bridge and AUV operator. The AUV Team uses two modes of acoustic communications during an AUV mission. One form is an ultra-short baseline (USBL) relative navigation system. We use a Link Quest, Inc. TrackLink 1500MA system, which includes a transceiver mounted on the ship below the water line, and a transponder mounted on the AUV. The USBL system provides measures of relative range and bearing to the ship along with estimates of vehicle depth, via transducers operating at a frequency range of 31.0 - 43.2 kHz. The transceiver is ideally mounted in a location free from any line-of-sight obstructions (e.g., ship's keel) and in a location where bubbles are minimized (e.g., hyrdrophone pole, keel center board). For the NOAA Ship *Shimada* (as with the NOAA ship *Lasker*), we prefer to use the ship's center board as installation because it is most secure, minimizes potential entanglements with other equipment deployed aside the ship, and provides optimum line-of-sight communications. We hope to use the spare transducer-mounting hole in the centerboard trunk (aft section). The AUV team will provide a Delrin adapter plate, fabricated to specifications provided by David Murfin (NOAA-SWFSC) that will allow our transceiver to be mounted such that the transducer face is flush with the bottom plate of the centerboard. An electrical cable that runs from the

centerboard up through the multi-cable transit and into the Chem Lab will provide power and communications. The dry end of the cable, located in the Chem Lab, will be connected to a power supply and network interface provided by the AUV Team. This set up was used during a cruise aboard the *Shimada* in September 2015.

The second form of acoustic communications is an acoustic modem to provide control and telemetry packets to and from the AUV topside electronics unit and AUV onboard computers. We typically use paired ITC-3013 model transducers. Similar to the USBL, one transducer is mounted on the ship below the water line, while another one is mounted on the AUV. As with the USBL communications, optimum installation should be in a location to provide line-of-sight and minimization of bubbles. During a cruise aboard the *Shimada* in September 2015, we were able to use the EdgeTech 8012A transducer for one of the modem pairs. It was mounted on the aft section of the ship's centerboard. In our topside electronics set up, we use a Woods Hole Oceanographic Institution (WHOI) built ACOMMS communications terminal to connect the electrical cables providing power and communications to the acoustic modem. We attach pigtails to the electrical cable routed from the centerboard up to the Chem Lab, so that we can connect it to our WHOI ACOMMS terminal box. We also have a mooring whip where we can dangle one of our ITC-3013 transducers over the side of the ship to provide acoustic modem communications. While this is not our preferred set up, we did successfully implement this on the *Shimada* in September 2015.

During a cruise aboard the *Lasker* in October 2016, one LBL beacon was deployed from the side CTD winch. The LBL beacon is housed in a glass ball protected by a “hard hat” cover (Appendix 5A). It will be anchored to the bottom with two concrete blocks (70 lbs. each; Appendix 5B) and a small float will be attached to the hard hat about two meters above it. The beacon will be released after several days by the means of an acoustic burn wire release. The beacon will float to the surface and be retrieved by the *Shimada’s* small boat. The concrete anchor blocks will remain on the seafloor until retrieved by the submersible on the *Velero IV* at the end of the cruise.

AUV mission plans, including launch and recovery locations, expected surfacing locations, and dive duration will be made available to the ship’s and science crews prior to launch. It is expected that AUV launch operations will require approximately 45 minutes once all crew is mustered and the ship is on station. Recovery operations can be expected to take 60 minutes depending on sea state. It is requested that a CTD cast be conducted in the AUV’s operating area prior to launch and the cast data be provided to the AUV team for programming of the AUV.

Data products generated by the AUV will be coordinated with the science staff.

<u>TrigCam Data Collection</u>

The TrigCam is a low-cost still image stereo–camera system optimized for long duration deployments. It is capable of operating in “triggered” mode where images are only captured when motion is detected in the view field. In this project, the cameras will be configured to collect an image pair every 60 seconds. The TrigCams consist of two small USB3 machine-vision cameras and an ARM-based host PC (ODroid UX4, Appendix 6). Lighting is provided by LED strobes. The units are powered by a 24 V 10 Ah battery placed in a separate housing, allowing the units to collect images for up to 24 h per deployment at a rate of 0.1 Hz (10 s interval between shots). The camera, strobe, and battery units are contained within a small aluminum cage, with a 12” Trawl float attached to the top of the cage and a 25 lb lead weight attached to the bottom via a “weak link” designed to break off if the unit becomes snagged on the seafloor (Appendix 6). Each unit weighs less than 50 lbs in air.

During each afternoon, up to eight TrigCams will be deployed at randomly selected locations on the Footprint Bank. Deployment of the TrigCams will be accomplished by lowering the camera unit over the side of the *Shimada* using a doubled up 3/8 inch line until the unit rests on the seafloor. The line will then be retrieved by pulling up one end and the unit left on the seafloor for 24 hours. The total time for deployment of each unit should be less than 15 minutes upon reaching the deployment location.

Each unit will be retrieved using an acoustically released float. The acoustically released float and 150 m of small dimension spectra rope will be contained in a canister attached to the outside of the TrigCam frame. The ARC-1XD acoustic release (http://www.desertstar.com/page/arc-1xd) will be triggered using a deck mounted interrogation box. Upon release, the float will rise to the surface and be retrieved by the *Shimada*. The line and TrigCam unit will be retrieved using a small electric line-hauler.

Data from each unit will be downloaded, the battery changed out, and then redeployed at a new station. The total time of retrieval and redeployment for each unit should be 15-30 minutes.

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 that preclude normal operations:
Equipment failure: Mitigation – at sea repair, refocus acquisition to remaining systems.
Poor weather: Mitigation – switch to more protected area or suspend operations.
Safety concerns: Mitigation – discuss at safety briefing or with ship's command.

III. Equipment

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

1) Dynamic Positioning Capability
2) Hand held radios for communications among science crew, bridge and deck.
3) Capability for science party to communicate with another research vessel to coordinate operations between the two vessels.
4) Monitor, computer, keyboard and launcher for XBT. WinMK21 software (associated with launcher) for capturing XBT data. Pydro/Velocipy software, installed on computer in acoustics lab network, to convert sound velocity profiles.
5) Simrad ME70 sonar
6) Access to information on DGPS integration with POS MV; reference points / vessel offsets; ship surveys; status of surface sound speed sensor (integration and calibration) and Hypack integration with ME70.
7) Configuration of a remote Hypack display monitor on the bridge; latest version of Hypack and patches installed.
8) Access to the ship science network across the ME70, XBT and CTD computers.
9) Survey support (24 hours) to conduct CTD and XBT casts (every 4 hours while mapping is in progress), AUV and trigcam launch/recovery, and data processing.

10) Ship's time server
11) CTD and CTD Winch
12) Gantry winch (starboard side) for daily launch and recovery of AUV
13) ADCP required for AUV ops.
14) AUV needs separate serial NMEA GPS (GGA) and heading (HDT) feeds to Chem lab.
15) Will need ship's workboat to assist in personnel transfers and perhaps retrieval of AUV
16) Access to the ship's centerboard to mount AUV USBL transceiver (AUV team to provide mounts), which will plug into ship's existing USBL wire (run previously by SWFSC to lab area). Details in previous section.
17) Access in lab area to unterminated end of wire from Edgetech acoustic release that is mounted in the ship's centerboard. AUV team will provide deck box and connectors to the unterminated cable.

B. Equipment and Capabilities provided by the scientists (itemized)

1) Seabed AUV: 6'H X 4.5'W X 6.5'L; 650 lbs.
   a. Two banks of 16 14.4V Lithium Ion Batteries enclosed in aluminum housings and 2 spare batteries contained in sturdy plastic container and wrapped in bubble wrap
2) Transducers (2) to track and communicate with AUV, mounted to ship (details on p. 6).
3) 2-3 VHF antennas will be mounted on ship to track AUV at surface. Wire will be run (and secured out of the way using cable ties) to high points on the vessel (both port and starboard), and the antennas will be securely attached with cable ties.
4) Long baseline (LBL) transponder to improve AUV navigation (see Appendix 5)
5) AUV crew supplied handheld radios
6) Charging Console
   a. Dimensions: 1m x 1m x 1m
   b. Power Requirements: Clean 120 VAC
   c. Cable Connection: Standard Ethernet
7) Equipment for AUV operation and other assorted spares (see Appendix 7)
8) Mission Planning and Data Processing laptop computers, Ethernet cables to connect to ship's science network
9) software: CARIS, ArcGIS, Fledermaus
10) 8 TrigCams, weights, acoustic releases, line and floats (see Appendix 6)
11) 16 24V NiMH battery packs
12) Wifi router for networking cameras
13) 3 Battery charging units
14) Acoustic release deck box and transponder
15) Electric line puller
16) 350 m of 3/8 line for TrigCam deployment

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 NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and quantity, MSDS, appropriate spill cleanup materials (neutralizing agents, buffers, or absorbents) in amounts adequate to address spills of a size equal to the amount of chemical

brought aboard, and chemical safety and spill response procedures. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

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

- List of chemicals by name with anticipated quantity
- List of spill response materials, including neutralizing agents, buffers, and absorbents
- Chemical safety and spill response procedures, such as excerpts of the program's Chemical Hygiene Plan or SOPs relevant for shipboard laboratories
- 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 HAZMAT material will be maintained in the chem lab.
- 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

Common Name of Material	**Qty**	**Notes**	**Trained Individual**	**Spill control**
Lithium Ion Batteries 12-cell NL2044 family	34	32 contained in aluminum housings, 2 contained in sturdy plastic container and wrapped in bubble wrap	Elizabeth Clarke	B
Parker O Ring lube	500ml	O ring lube	Elizabeth Clarke	B
Ethanol	1 liter	Cleaning O rings	Elizabeth Clarke	B
Corrosion X	500ml	Clean connectors	Elizabeth Clarke	B
Dow Corning 11 Valve Lubricant	500ml	Lubricating Underwater connectors	Elizabeth Clarke	B

Common Name of Material	Qty	Notes	Trained Individual	Spill control
AquaShield lubricant	500ml	Protecting underwater connectors	Elizabeth Clarke	B
LPS	250ml	Protecting and cleaning electronic connections	Elizabeth Clarke	B

C. Chemical safety and spill response procedures

Spill Control B:
☐Inhalation: Remove from exposure, rest and keep warm.
☐Skin contact: Wash off skin thoroughly with water. Remove contaminated clothing and wash before reuse.
☐Eye contact: Irrigate thoroughly with water for at least 15 minutes
☐Ingestion: Wash out mouth thoroughly with water and give plenty of water to drink.
☐Fire:

- Extinguishing Media Use appropriate extinguishing agent for surrounding fire. For damaged or ruptured cells, use Class D extinguisher or other appropriate agent. Class C fire extinguishers should be used to extinguish electrical fires. Do not use water to extinguish electrical or ruptured cell related fires. Firefighters should wear full protective gear.

☐Spill: Clean-Up Procedures: Absorb spill with inert absorbent material (cat litter). Shovel material into appropriate container for disposal. Clean spill area with detergent and water; collect wash water for proper disposal.

Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
Kat Litter	10 lbs	Lithium Ion Batteries, liquid spills	24 kg

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

V. Additional Projects

A. Supplementary (“Piggyback”) Projects

No supplementary projects are planned.

B. NOAA Fleet Ancillary Projects

No NOAA Fleet Ancillary Projects are planned.

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*

The mapping science party will require access to the science network for transferring data. Up to 2 Government computers provided by the project science team will need network access so that data can be moved from the ME70 acquisition computer to the science computers for data post-processing.

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 prior to departure, to discuss required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. 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 conducting 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 will 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.

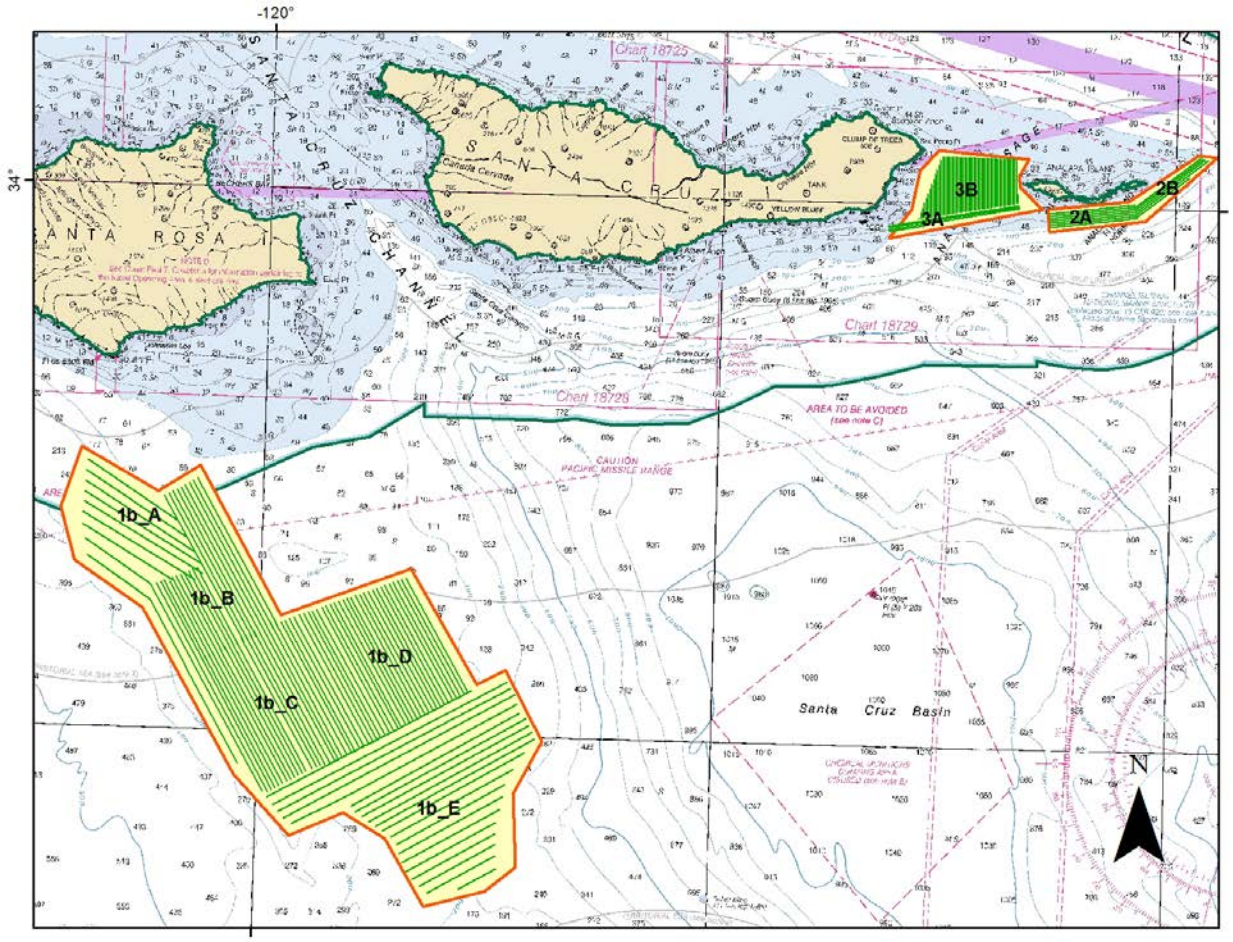
Completion of the above requirements prior to boarding the ship is required.

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.

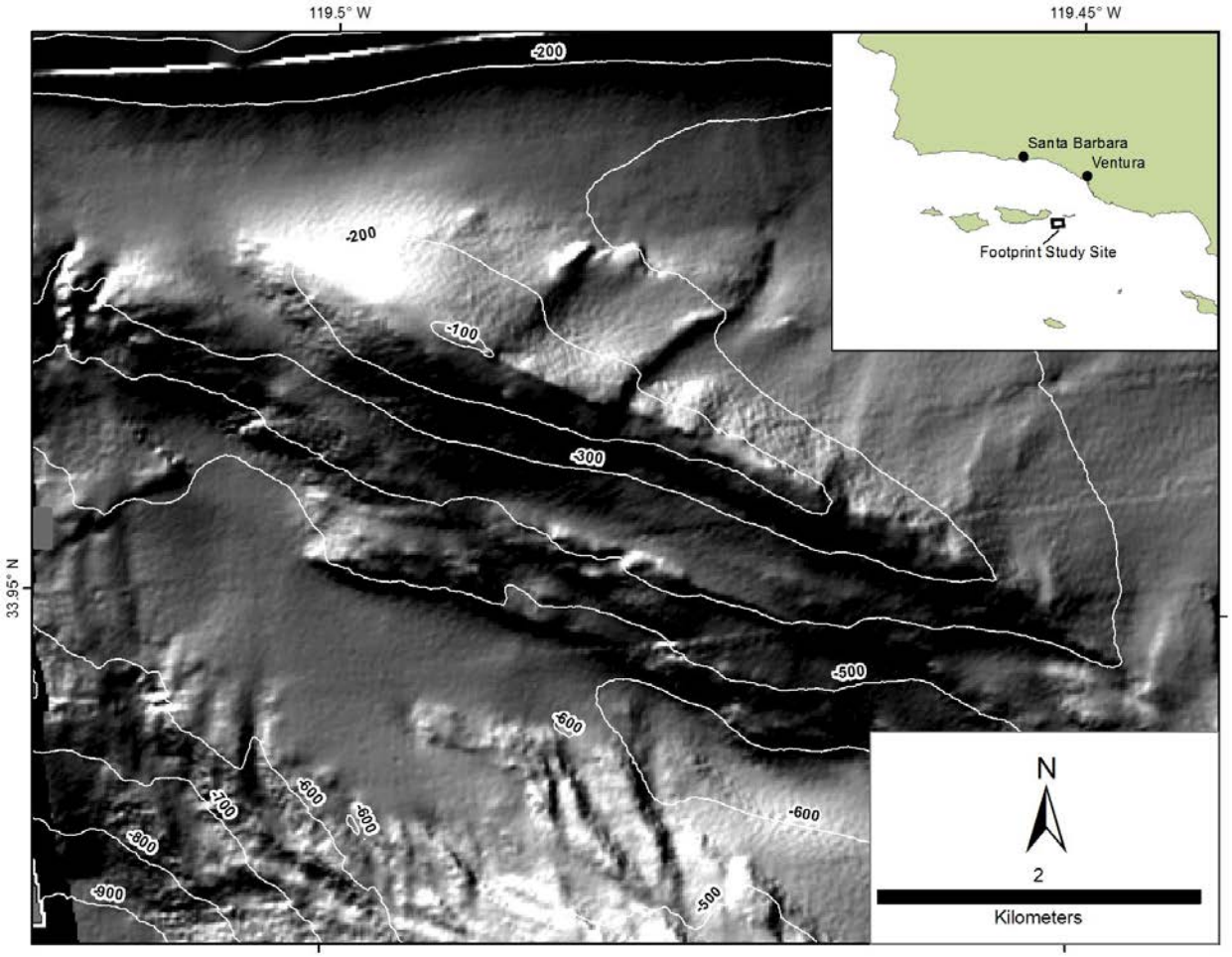
F. Foreign National Guests Access to OMAO Facilities and Platforms

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

IX. Appendices



Appendix 1. Study area in vicinity of northern Channel Islands in Southern California Bight. We will conduct seafloor mapping using the ME70 and visual surveys using an autonomous underwater vehicle (AUV) off on Santa Rosa Flats (1bA-E), south of Anacapa Island (2A, 2B), and in the Anacapa Passage (3A, 3B).



Appendix 2. Footprint Seamount study area located in the gap between Santa Cruz and Anacapa Islands in Southern California Bight. We will conduct visual surveys with an autonomous underwater vehicle (AUV) at depths 100-150 m and deploy a Long Baseline Beacon and trigcams at this site.

Appendix 3. Waypoints for line plans of priority polygons for mapping survey to be conducted in the southern Channel Islands.

Polygon1b_A

ID No.	Wypt_Name	1b_A line	Lat	Long
0	51_0	51	33.80587728	-120.0703885
1	51_1	51	33.76626295	-120.0428924
2	58_2	58	33.75740643	-120.063987
3	58_3	58	33.75455447	-120.0620201
4	59_4	59	33.75701092	-120.0670969
5	59_5	59	33.75406594	-120.0650742
6	60_6	60	33.75745098	-120.0711509
7	60_7	60	33.75352533	-120.0684537
8	61_8	61	33.75687877	-120.073683
9	61_9	61	33.75310015	-120.0711109
10	62_10	62	33.75568822	-120.0767644
11	62_11	62	33.75253911	-120.0746164
12	29_12	29	33.7553945	-120.0814342
13	29_13	29	33.75184094	-120.0789782
14	65_14	65	33.83012093	-120.1296108
15	65_15	65	33.79469871	-120.0631608
16	66_16	66	33.8236044	-120.1303712
17	66_17	66	33.78473778	-120.0563973
18	67_18	67	33.81707353	-120.130929
19	67_19	67	33.77554021	-120.0496624
20	68_20	68	33.8106494	-120.1313586
21	68_21	68	33.76857699	-120.0452966
22	69_22	69	33.8042677	-120.1317855
23	69_23	69	33.76377285	-120.0464547
24	70_24	70	33.79775011	-120.1322213
25	70_25	70	33.75977137	-120.0521787
26	71_26	71	33.79068691	-120.132334
27	71_27	71	33.75757105	-120.0652704
28	72_28	72	33.78153418	-120.1303622
29	72_29	72	33.75450487	-120.0809477
30	73_30	73	33.75097185	-120.0909227
31	73_31	73	33.77169547	-120.1279835
32	73_32	73	33.75016487	-120.089445

Polygon1b_B

ID No.	Wypt_Name	1b_B_line	Lat	Long
0	42_0	42	33.73372475	-119.9844477
1	42_1	42	33.73214251	-119.9833521
2	43_2	43	33.82059394	-120.0486677
3	43_3	43	33.7308209	-119.9866227
4	44_4	44	33.81915063	-120.0516583
5	44_5	44	33.72955128	-119.9897644
6	45_6	45	33.81770736	-120.0546488
7	45_7	45	33.72829578	-119.9928708
8	46_8	46	33.81626401	-120.0576392
9	46_9	46	33.72712795	-119.9957603
10	47_10	47	33.8148206	-120.0606294
11	47_11	47	33.72583202	-119.9989662
12	48_12	48	33.81337712	-120.0636196
13	48_13	48	33.72449008	-120.0022856
14	49_14	49	33.81193348	-120.0666097
15	49_15	49	33.72330938	-120.005206
16	50_16	50	33.81048987	-120.0695996
17	50_17	50	33.72209332	-120.0082136
18	51_18	51	33.80904619	-120.0725894
19	51_19	51	33.72081148	-120.0113836
20	52_20	52	33.76548221	-120.0471274
21	52_21	52	33.71922217	-120.0153135
22	53_22	53	33.7645024	-120.0504103
23	53_23	53	33.71798285	-120.018378
24	54_24	54	33.7633817	-120.0533294
25	54_25	54	33.7168277	-120.0212338
26	55_26	55	33.76233365	-120.0563407
27	55_27	55	33.71564679	-120.024153
28	56_28	56	33.76135796	-120.0594442
29	56_29	56	33.7144658	-120.0270722
30	57_30	57	33.76001262	-120.0623551
31	57_31	57	33.71328484	-120.0299913
32	58_32	58	33.759411	-120.0654718
33	58_33	58	33.71215037	-120.0327951
34	59_34	59	33.75701092	-120.0670969
35	59_35	59	33.71103926	-120.0355409
36	60_36	60	33.75745098	-120.0711509
37	60_37	60	33.70985427	-120.0384692
38	61_38	61	33.75670141	-120.0735622

39	61_39	61	33.70883116	-120.040997
40	62_40	62	33.75562574	-120.0767218
41	62_41	62	33.70761717	-120.0439964
42	29_42	29	33.75428277	-120.0806659
43	29_43	29	33.70621321	-120.0474649
44	65_44	65	33.7957147	-120.065065
45	65_45	65	33.79469871	-120.0631608
46	66_46	66	33.78565543	-120.058142
47	66_47	66	33.78473778	-120.0563973
48	67_48	67	33.77674056	-120.0520084
49	67_49	67	33.77554021	-120.0496624
50	68_50	68	33.76938603	-120.0469496
51	68_51	68	33.76857699	-120.0452966
52	69_52	69	33.76502781	-120.0490958
53	69_53	69	33.76213572	-120.0430093
54	70_54	70	33.76222288	-120.0573398
55	70_55	70	33.75801813	-120.0484881
56	71_56	71	33.75872755	-120.0676103
57	71_57	71	33.75757105	-120.0652704
58	73_58	73	33.75086577	-120.0906989
59	73_59	73	33.74550987	-120.0811183
60	73_60	73	33.70403246	-120.0528515

Polygon1b_C

ID No.	Wypt_Name	1b_C_line	Lat	Long
0	39_0	39	33.73681449	-119.9747999
1	39_1	39	33.65853406	-119.9208188
2	40_2	40	33.73575545	-119.9781071
3	40_3	40	33.65733443	-119.9240735
4	41_4	41	33.73470304	-119.9813933
5	41_5	41	33.65583451	-119.9270739
6	42_6	42	33.73372475	-119.9844477
7	42_7	42	33.65515034	-119.9301017
8	43_8	43	33.73436292	-119.9890676
9	43_9	43	33.65354243	-119.9333424
10	44_10	44	33.73298386	-119.9921326
11	44_11	44	33.65184127	-119.9362134
12	45_12	45	33.7316195	-119.9951644
13	45_13	45	33.6503342	-119.9391347
14	46_14	46	33.73034692	-119.9979922

15	46_15	46	33.64979185	-119.9422027
16	47_16	47	33.72894031	-120.0011174
17	47_17	47	33.64773384	-119.9449803
18	48_18	48	33.7274853	-120.0043499
19	48_19	48	33.64731515	-119.9491613
20	49_20	49	33.72619957	-120.007206
21	49_21	49	33.64660488	-119.9521882
22	50_22	50	33.7248768	-120.0101442
23	50_23	50	33.64557585	-119.9552041
24	51_24	51	33.72348486	-120.0132358
25	51_25	51	33.64453762	-119.958601
26	52_26	52	33.72176142	-120.0170635
27	52_27	52	33.64284358	-119.9627381
28	53_28	53	33.72041269	-120.0200585
29	53_29	53	33.64149386	-119.9655385
30	54_30	54	33.71915846	-120.0228434
31	54_31	54	33.64014399	-119.9683388
32	55_32	55	33.71787548	-120.0256922
33	55_33	55	33.63879415	-119.9711389
34	56_34	56	33.71659234	-120.0285409
35	56_35	56	33.63744426	-119.973939
36	57_36	57	33.71530914	-120.0313895
37	57_37	57	33.6360943	-119.976739
38	58_38	58	33.71407784	-120.0341227
39	58_39	58	33.63474428	-119.979539
40	59_40	59	33.71287233	-120.0367985
41	59_41	59	33.63339412	-119.9823388
42	60_42	60	33.71158465	-120.0396565
43	60_43	60	33.63204399	-119.9851386
44	61_44	61	33.71047658	-120.0421156
45	61_45	61	33.6306938	-119.9879382
46	62_46	62	33.70915656	-120.0450449
47	62_47	62	33.62934354	-119.9907378
48	29_48	29	33.70762638	-120.0484403
49	29_49	29	33.62970492	-119.9947172
50	73_50	73	33.70526098	-120.0536883
51	73_51	73	33.64651547	-120.0137097
52	63_52	63	33.63498205	-119.9720738
53	63_53	63	33.6598522	-119.9186572

Polygon1b_D

ID No.	Wypt_Name	1b_D_line	Lat	Long
0	17_0	17	33.76280042	-119.8935381
1	17_1	17	33.69377039	-119.8454548
2	18_2	18	33.76180719	-119.8966478
3	18_3	18	33.69257817	-119.8484679
4	19_4	19	33.76086652	-119.8995929
5	19_5	19	33.69119321	-119.8509863
6	20_6	20	33.75989124	-119.902646
7	20_7	20	33.69000377	-119.8538772
8	21_8	21	33.75892406	-119.9056735
9	21_9	21	33.68871503	-119.8566428
10	22_10	22	33.75792089	-119.9088134
11	22_11	22	33.68742058	-119.8596523
12	23_12	23	33.75695182	-119.911846
13	23_13	23	33.6859306	-119.8622888
14	2_14	2	33.75596651	-119.9149294
15	2_15	2	33.68463886	-119.8651761
16	3_16	3	33.75499895	-119.9179568
17	3_17	3	33.68334988	-119.8679413
18	4_18	4	33.75403131	-119.9209842
19	4_19	4	33.68206094	-119.8707064
20	5_20	5	33.75302788	-119.924123
21	5_21	5	33.68076617	-119.8737153
22	6_22	6	33.75204228	-119.927206
23	6_23	6	33.67947417	-119.8766022
24	7_24	7	33.75109215	-119.9301777
25	7_25	7	33.6781878	-119.879245
26	8_26	8	33.75005975	-119.9334066
27	8_27	8	33.67658692	-119.8822436
28	9_28	9	33.7491013	-119.9364037
29	9_29	9	33.67539956	-119.8850117
30	10_30	10	33.74817006	-119.9393155
31	10_31	10	33.67431705	-119.887661
32	11_32	11	33.74714718	-119.9425133
33	11_33	11	33.67281795	-119.8906627
34	12_34	12	33.74613415	-119.9456804
35	12_35	12	33.67142076	-119.8936675
36	13_36	13	33.74521039	-119.9485679
37	13_37	13	33.67023887	-119.8961914
38	14_38	14	33.74418923	-119.9517595

39	14_39	14	33.66894066	-119.8993215
40	15_40	15	33.74322851	-119.9547619
41	15_41	15	33.66755187	-119.9019602
42	1_42	1	33.74202808	-119.9585133
43	1_43	1	33.66583703	-119.9054422
44	28_44	28	33.7410136	-119.961683
45	28_45	28	33.66423835	-119.9083178
46	36_46	36	33.74002905	-119.9647591
47	36_47	36	33.66314675	-119.9113325
48	37_48	37	33.73902406	-119.9678984
49	37_49	37	33.66164999	-119.9142112
50	38_50	38	33.73806608	-119.9708908
51	38_51	38	33.66066301	-119.9171072
52	63_52	63	33.65974934	-119.9188783
53	63_53	63	33.6950031	-119.8430253

Polygon1b_E

ID No.	Wypt_Name	1b_E_line	Lat	Long
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1	1_1	1	33.66583703	-119.9054422
2	28_2	28	33.66461071	-119.9085764
3	28_3	28	33.66423835	-119.9083178
4	36_4	36	33.66334436	-119.9114697
5	36_5	36	33.66314675	-119.9113325
6	37_6	37	33.66202927	-119.9144741
7	37_7	37	33.66164999	-119.9142112
8	38_8	38	33.66082683	-119.917221
9	38_9	38	33.66066301	-119.9171072
10	39_10	39	33.65908544	-119.9211986
11	39_11	39	33.65853406	-119.9208188
12	40_12	40	33.65771275	-119.9243338
13	40_13	40	33.65733443	-119.9240735
14	41_14	41	33.6563559	-119.9274326
15	41_15	41	33.65583451	-119.9270739
16	42_16	42	33.65517854	-119.9301212
17	42_17	42	33.65515034	-119.9301017
18	43_18	43	33.65371557	-119.9334616
19	43_19	43	33.65354243	-119.9333424
20	44_20	44	33.65235536	-119.9365673

21	44_21	44	33.65184127	-119.9362134
22	45_22	45	33.6510231	-119.939609
23	45_23	45	33.6503342	-119.9391347
24	46_24	46	33.64986475	-119.9422532
25	46_25	46	33.64979185	-119.9422027
26	47_26	47	33.64845257	-119.9454766
27	47_27	47	33.64773384	-119.9449803
28	63_28	63	33.62611368	-119.9911026
29	63_29	63	33.66571264	-119.9060586
30	64_30	64	33.62186551	-119.9868275
31	64_31	64	33.70055282	-119.8167381
32	75_32	75	33.61764604	-119.982582
33	75_33	75	33.69673843	-119.8139271
34	76_34	76	33.61347595	-119.9783867
35	76_35	76	33.69324387	-119.8105164
36	77_36	77	33.61028977	-119.9723394
37	77_37	77	33.62881555	-119.9302668
38	77_38	77	33.68735898	-119.8089817
39	78_39	78	33.62206834	-119.9289333
40	78_40	78	33.68187723	-119.80709
41	79_41	79	33.618444	-119.9256717
42	79_42	79	33.67871209	-119.8020804
43	80_43	80	33.6156316	-119.9207482
44	80_44	80	33.67454255	-119.7999345
45	81_45	81	33.61281899	-119.9158249
46	81_46	81	33.67037304	-119.7977889
47	82_47	82	33.61008204	-119.9107466
48	82_48	82	33.66620339	-119.7956435
49	83_49	83	33.60736503	-119.9056271
50	83_50	83	33.65749672	-119.8028169
51	84_51	84	33.60388701	-119.8990747
52	84_52	84	33.64711151	-119.8104371
53	85_53	85	33.59925577	-119.8948842
54	85_54	85	33.63762289	-119.8162141
55	86_55	86	33.59357172	-119.8928502
56	86_56	86	33.63013766	-119.817878
57	87_57	87	33.58807741	-119.8902141
58	87_58	87	33.62245137	-119.8197402
59	88_59	88	33.58261701	-119.8875087
60	88_60	88	33.61445718	-119.8222338
61	89_61	89	33.5781362	-119.8827968

62	89_62	89	33.60747284	-119.8226552
63	90_63	90	33.57412793	-119.8771173
64	90_64	90	33.60072827	-119.8225846
65	91_65	91	33.57011928	-119.8714383
66	91_66	91	33.59398368	-119.822514
67	92_67	92	33.57287063	-119.8486989
68	92_68	92	33.58609235	-119.8215867

Polygon2A

ID No.	Wypt_Name	2A_line	Lat	Long
0	1_0	1	33.99452359	-119.3617573
1	1_1	1	33.98770138	-119.4253519
2	2_2	2	33.99589183	-119.3620497
3	2_3	2	33.98908214	-119.4255268
4	3_4	3	33.99726008	-119.3623419
5	3_5	3	33.9904629	-119.4257018
6	4_6	4	33.99862833	-119.3626343
7	4_7	4	33.99184366	-119.4258767
8	5_8	5	33.99999657	-119.3629266
9	5_9	5	33.99322441	-119.4260516
10	6_10	6	34.00136472	-119.363219
11	6_11	6	33.99460517	-119.4262266
12	7_12	7	34.00273296	-119.3635114
13	7_13	7	33.99598601	-119.4264015

Polygon2B

ID No.	Wypt_Name	2B_line	Lat	Long
0	1_0	1	34.0200796	-119.3239616
1	1_1	1	33.99539614	-119.3614765
2	2_2	2	34.03087639	-119.3102306
3	2_3	2	33.9968079	-119.3620197
4	3_4	3	34.03139049	-119.3121392
5	3_5	3	33.99821965	-119.3625629
6	4_6	4	34.03190446	-119.3140477
7	4_7	4	33.99963131	-119.3631061
8	5_8	5	34.0324184	-119.3159563
9	5_9	5	34.00104305	-119.3636494

Polygon3A

ID No.	Wypt_Name	3A_line	Lat	Long
0	1_0	1	33.98689104	-119.5188425
1	1_1	1	33.98297502	-119.544416
2	2_2	2	33.99877316	-119.4485359
3	2_3	2	33.98406071	-119.5448065
4	3_4	3	33.99984564	-119.4490133
5	3_5	3	33.9851464	-119.5451968
6	4_6	4	34.0009183	-119.4494908
7	4_7	4	33.98630953	-119.5450819

Polygon3B

ID No.	Wypt_Name	3B_line	Lat	Long
0	1_0	1	33.99134351	-119.5226681
1	1_1	1	33.99162084	-119.5226763
2	2_2	2	33.99154487	-119.5213211
3	2_3	2	33.99459832	-119.5214114
4	3_4	3	33.99174621	-119.5199741
5	3_5	3	33.9975758	-119.5201464
6	4_6	4	33.99194754	-119.5186272
7	4_7	4	34.00055326	-119.5188814
8	5_8	5	33.99214877	-119.5172801
9	5_9	5	34.00353071	-119.5176161
10	6_10	6	33.99235007	-119.5159332
11	6_11	6	34.00650815	-119.5163509
12	7_12	7	33.99255136	-119.514586
13	7_13	7	34.00948559	-119.5150854
14	8_14	8	33.99275254	-119.5132391
15	8_15	8	34.01246301	-119.5138201
16	9_16	9	33.9929538	-119.5118921
17	9_17	9	34.01544042	-119.5125546
18	10_18	10	33.99315504	-119.510545
19	10_19	10	34.01841782	-119.511289
20	11_20	11	33.99335618	-119.5091979
21	11_21	11	34.0213953	-119.5100233
22	12_22	12	33.9935574	-119.5078508
23	12_23	12	34.02437269	-119.5087574
24	13_24	13	33.9937586	-119.5065037

25	13_25	13	34.02735006	-119.5074916
26	14_26	14	33.9939597	-119.5051566
27	14_27	14	34.02953956	-119.5062024
28	15_28	15	33.99416087	-119.5038095
29	15_29	15	34.02952218	-119.5048484
30	16_30	16	33.99436203	-119.5024624
31	16_31	16	34.02950478	-119.5034943
32	17_32	17	33.99456308	-119.5011154
33	17_33	17	34.02948746	-119.5021403
34	18_34	18	33.99476421	-119.4997682
35	18_35	18	34.02947004	-119.5007862
36	19_36	19	33.99496532	-119.4984212
37	19_37	19	34.0294526	-119.4994322
38	20_38	20	33.99516642	-119.4970741
39	20_39	20	34.02943514	-119.4980781
40	21_40	21	33.99536741	-119.4957269
41	21_41	21	34.02941767	-119.496724
42	22_42	22	33.99556848	-119.4943798
43	22_43	22	34.02940027	-119.49537
44	23_44	23	33.99576954	-119.4930327
45	23_45	23	34.02938277	-119.4940159
46	24_46	24	33.99597049	-119.4916854
47	24_47	24	34.02936526	-119.4926617
48	25_48	25	33.99617152	-119.4903382
49	25_49	25	34.02934773	-119.4913076
50	26_50	26	33.99637253	-119.4889911
51	26_51	26	34.02933027	-119.4899536
52	27_52	27	33.99657344	-119.4876439
53	27_53	27	34.02931271	-119.4885995
54	28_54	28	33.99677442	-119.4862968
55	28_55	28	34.02929514	-119.4872455
56	29_56	29	33.99697539	-119.4849495
57	29_57	29	34.02927755	-119.4858913
58	30_58	30	33.99717625	-119.4836024
59	30_59	30	34.02926003	-119.4845374
60	31_60	31	33.99737719	-119.4822551
61	31_61	31	34.02924241	-119.4831832
62	32_62	32	33.99757812	-119.480908
63	32_63	32	34.02922477	-119.4818292
64	33_64	33	33.99777894	-119.4795608
65	33_65	33	34.02920712	-119.4804751

66	34_66	34	33.99797983	-119.4782135
67	34_67	34	34.02918955	-119.4791211
68	35_68	35	33.99818072	-119.4768663
69	35_69	35	34.02917187	-119.477767
70	36_70	36	33.99838149	-119.475519
71	36_71	36	34.02915418	-119.4764128
72	37_72	37	33.99858235	-119.4741717
73	37_73	37	34.02913647	-119.4750587
74	38_74	38	33.99878319	-119.4728244
75	38_75	38	34.02911883	-119.4737047
76	39_76	39	33.99898401	-119.4714772
77	39_77	39	34.02910109	-119.4723506
78	40_78	40	33.99918473	-119.4701299
79	40_79	40	34.02908334	-119.4709965
80	41_80	41	33.99938552	-119.4687827
81	41_81	41	34.02906556	-119.4696425
82	42_82	42	33.9995863	-119.4674353
83	42_83	42	34.02904787	-119.4682883
84	43_84	43	33.99978698	-119.4660882
85	43_85	43	34.02903007	-119.4669344
86	44_86	44	33.99998773	-119.4647409
87	44_87	44	34.02901226	-119.4655803
88	45_88	45	34.00018847	-119.4633936
89	45_89	45	34.02899443	-119.4642262
90	46_90	46	34.0003891	-119.4620462
91	46_91	46	34.02897667	-119.4628721
92	47_92	47	34.00058981	-119.4606989
93	47_93	47	34.02895881	-119.461518
94	48_94	48	34.0007905	-119.4593515
95	48_95	48	34.02894094	-119.4601638
96	49_96	49	34.00099109	-119.4580041
97	49_97	49	34.02892305	-119.4588098
98	50_98	50	34.00119175	-119.4566568
99	50_99	50	34.02890524	-119.4574557
100	51_100	51	34.0013924	-119.4553094
101	51_101	51	34.02888732	-119.4561016
102	52_102	52	34.00159295	-119.4539622
103	52_103	52	34.02886938	-119.4547476
104	53_104	53	34.00179357	-119.4526147
105	53_105	53	34.02885143	-119.4533934
106	54_106	54	34.00199417	-119.4512675

107	54_107	54	34.02883347	-119.4520394
108	55_108	55	34.00219477	-119.44992
109	55_109	55	34.00743148	-119.4500704

Appendix 4. Summary of line planning information for priority areas of the bathymetric survey.

	Min depth (fa)	Min depth (m)	LineSet	# Lines	Total Length (km)	Ave. Length (km)	Total Length (nmi)	Ave. Length (nmi)	Est. time (hrs) @ 6 kts	Total time (hrs) plus 10%	Description
1b_A	100	183	1b_A_SH1801	9	72.2	8.0	39.0	4.3	6.5	7.2	NW Santa Rosa Flats
1b_B	60	110	1b_B_SH1801	30	179.7	6.0	97.0	3.2	16.2	17.8	NW Santa Rosa Flats
1b_C	55	101	1b_C_SH1801	27	267.7	9.9	144.5	5.4	24.1	26.5	SW Santa Rosa Flats
1b_D	65	119	1b_D_SH1801	27	252.4	9.3	136.3	5.0	22.7	25.0	SE Santa Rosa Flats
1b_E	70	128	1b_E_SH1801	34	217.6	6.4	117.5	3.5	19.6	21.6	S Santa Rosa Flats
2A	15	27	SAnacapa_1	7	41.2	5.9	22.3	3.2	3.7	4.1	S Anacapa
2B	20	36.6	SAnacapa_2	5	27.8	5.6	15.0	3.0	2.5	2.8	SE Anacapa
3A	15	27	AnacapaPassage_A	4	29.5	7.4	15.9	4.0	2.7	3.0	S Anacapa Passage EW
3B	15	27	AnacapaPassage_B	55	167.0	3.0	90.2	1.6	15.0	16.5	Anacapa Passage NS

Appendix 5. (A) Specifications of the Teledyne Benthos Long Baseline (LBL) undersea positioning beacon, and (B) underwater image of beacon and concrete anchors on seafloor (two green laser dots are 20 cm apart).

A.

A Teledyne Benthos **SMART Products** Datasheet

Teledyne Benthos

SM-975/976

Subsea Nodes

Subsea Observation System, Data Logging and Telemetry

SM-976 deployment example

SM-975 in protective hard hat

THE SM SERIES SUBSEA NODE is a unique concept from Teledyne Benthos that combines the proven technology of an underwater acoustic release with the reliable undersea communications functionality of an acoustic modem.

The SM-975 supports all the most current optional features of the Teledyne Benthos underwater acoustic modem line such as: in-band acoustic recorder, positioning, and high capacity data logging. This easily deployed system features the ATM-900 Series modem electronics, batteries, and a transducer, all contained in a 6,000m rated housing with a burn wire release mechanism. The acoustic modem allows the user full telemetry capability to full ocean depth, with RS-232 connectivity to attached sensors. More than one sensor can be employed simultaneously.

The SM-976 is similar in design to the SM-975 and is primarily intended for short deployments. The SM-976 features rechargeable lithium ion batteries and comes in a convenient storage/transport case that includes a battery charger and complete spare parts kit. The SM-976 is an ideal product for use as a node in a long baseline (LBL) positioning system.

Node with CTD

PRODUCT FEATURES

- Integrated system for easy deployment, recovery and storage
- Enables real-time communication with your subsea instrument
- Functions as an LBL node or acoustic network repeater
- Supports multiple sensors and instruments

APPLICATIONS

- Environmental monitoring (physical oceanographic and bio-geochemical sensors available)
- Undersea positioning (Standard long-baseline configurations)
- Geophysical exploration (compatible with geophones for seismic studies)

TELEDYNE BENTHOS
Everywhereyoulook™

A Teledyne Marine Systems Company

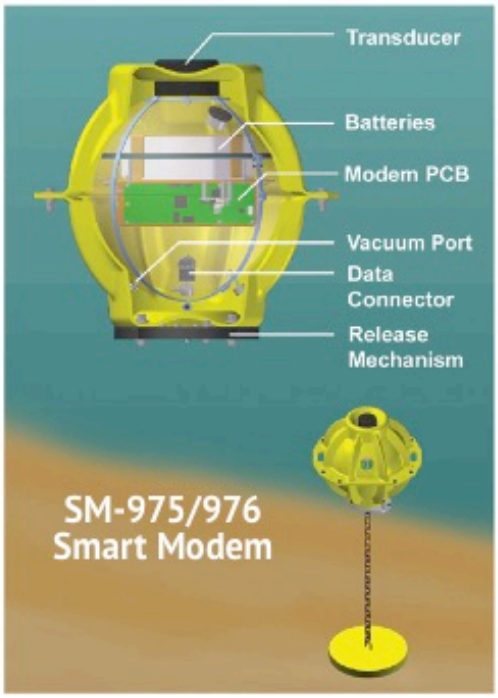
A Teledyne Benthos SMART Products Datasheet

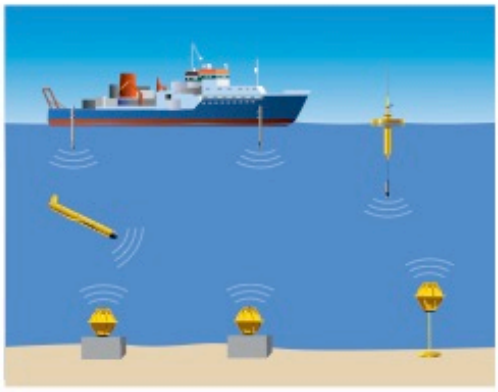
SM-975/976

Subsea Nodes

TECHNICAL SPECIFICATIONS

Models	33 cm or 43 cm sphere (13 in or 17 in)
Connectivity	RS-232 port on outside of sphere
Vacuum	Titanium vacuum port
Depth	6700 meters (maximum) (21,982 ft)
Life	SM-975 Up to 2 years (depending on usage) SM-976 Up to 1 year (depending on usage)
Batteries	SM-975 30 D-cell alkaline batteries (Dual battery pack, 17 inch) SM-976 Rechargeable lithium ion
Weight (Not including anchor)	SM-975 33 cm = 18 kg, 43 cm = 32 kg (13 in = 40 lbs, 17 in = 70 lbs) SM-976 33 cm = 18 kg, 43 cm = 27 kg (13 in = 40 lbs, 17 in = 60 lbs)
Net buoyancy	SM-975 33 cm = 2 kg, 43 cm = 9 kg (13 in = 5 lbs, 17 in = 20 lbs) SM-976 33 cm = 2 kg, 43 cm = 17 kg (13 in = 5 lbs, 17 in = 38 lbs)
Acoustic slant range	Up to 10 km (6 mi)
Frequency	9-14 kHz, 16-21 kHz, 22-27 kHz
Transducer pattern	Omnidirectional from upper hemisphere
Release	Electrolytic dissolving wire (upon receipt of correct command)
Hard hat	Super yellow ribbed hard hat
Topside controller	ATM-900 Series modems and UDB-9400 Deck Box
Data Retrieval	Vessel, AUV/UUV, Gateway Buoy





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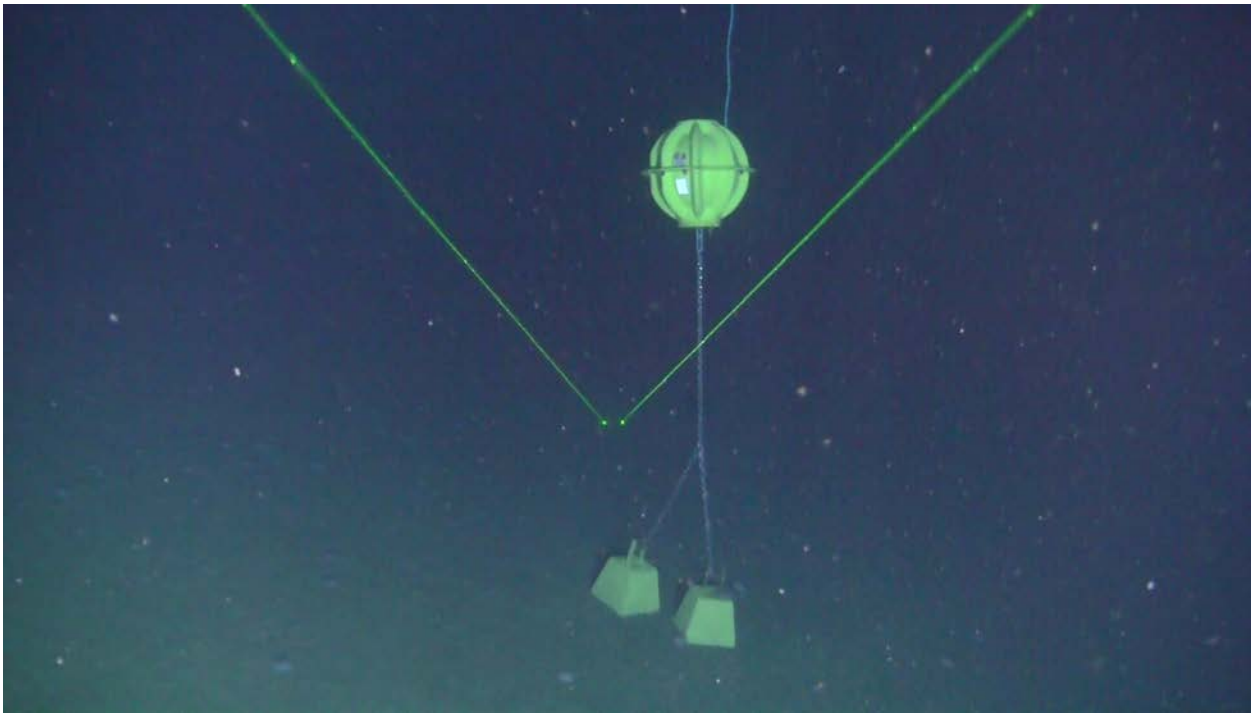
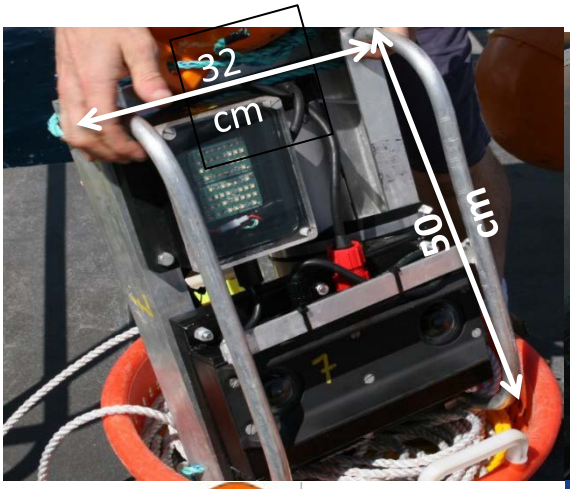
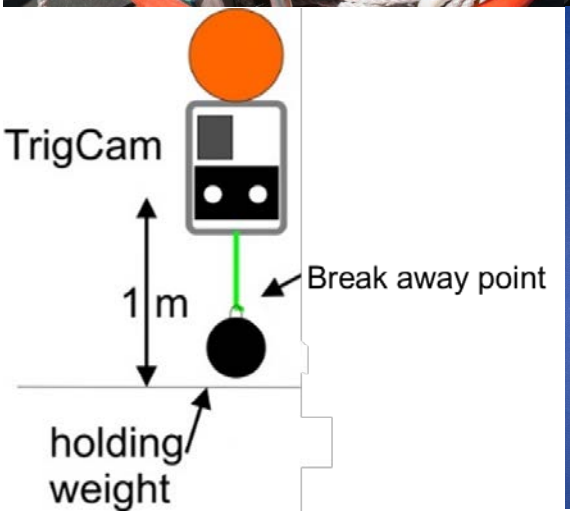
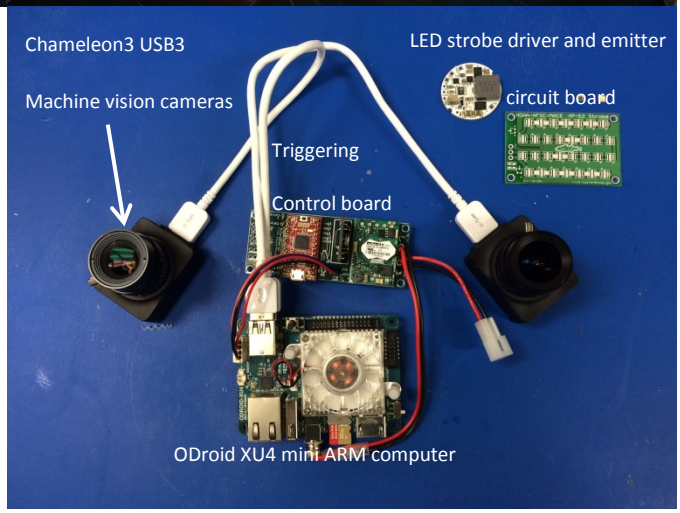
B.



Appendix 6. Individual Trig-Cams to be deployed in 100-150 m water depth on the Footprint study site in southern California Channel Islands. Upper image shows a TrigCam Unit with the LED strobe in the upper left corner, the camera housing in the lower center, mounted in an aluminum cage. Upper right image shows two units with trawl floats attached to the tops of the frames, and the associated buoy line. Lower left diagram shows the deployment rigging. Lower right image shows the components used for the TrigCam camera system.







Appendix 7. Packing list for AUV equipment and spares, including three coffin cases (94”Lx27”Wx34”H), four bulk containers (47”Lx39”Wx42”T), and two fish totes (43”Lx48”Wx31”H).

Item	stock	model_number	CD number
AUV01 (gray coffin) 94"x27"x34”H			
line- poly and nylon			
AUV frame top pontoon	1		CD0004092881
Chassis (CPU)	1		CD0004092884
CPU housing	1		CD0004092882
Octans	1	CT-1489	CD0001674020
Octans Housing	1		CD0004074983
Props - Mejzlik Modellbau 24 x 12W	3	PMK2412WT	
6' to 14' boat hooks with hook adapter	7		
59in to 144in boat hook with happy hooker attached	1		
Thruster	1		CD0004074984
Thruster	1		CD0004074977
Skins- molded plastic	4		
Ship RF antenna	2		
AUV RF antenna	1		
Hemisphere GPS	1	V102 (PN804-0075-000#RevB)	
AUV02 (black coffin) 94"x27"x34”H			
AUV frame bottom pontoon	1		CD0004092881
Parosci	1	118756	CD0004074979
11 mp Nikon DX camera (C5)	1	GE4000C	CD0001724939
RF antennas pouch(CRED16)	1		
wooden cradle board	1		
ADCP (Teledyne RDI)	1	WHN1200-1-UG48	CD0004074963
USBL to AUV mounting kit (2parts and hose clamps)	1		
Acoustic Modem transducer head (on vehicle)	1		
Thruster	1		CD0004074985
strobe in housing	1		
connectors toolbox (pins and crimps)			
Brother Ptouch label maker (1/4 to 3/4 tz tapes)			
C', AA and AAA alkaline batteries- NOT RESTRICTED	20		
CPC connectors, pins and crimpers			
Gige vision camera - Allied Vision	1	GC2440C	CD0004074972
Gige vision camera - Allied Vision	1	GC2440C	CD0004074970
Acoustic Modem transducer head with cable for	1		

pole			
struts containing cables	2		
line - poly and nylon			
USBL cable for pole	1		
RF coax cable	1		
AUV03 (purple coffin) 94"x27"x34”H			
Teledyne TR-6001-17 Transponder (Larry)	1	TR-6001	CD0004074967
Teledyne TR-6001-17 Transponder (Moe)	1	TR-6001	CD0004074968
Teledyne TR-6001-17 Transponder (Curly)	1	TR-6001	CD0004074969
spectra line (400')	1		
floats	1		
LBL manual and spare parts	1		
Tote 305 (black) 47"x39"x42"H			
USBL Black case (TrackLink 1500 USBL)			
Transceiver (TC1500MA)	1		CD000160323?
Transponder (TN1510B)	1		CD00016092??
cable (power/serial to USBL) (short)	1		
Acoustic Modem transducer head (Y)	1	ITC3013	CD0004074980
Acoustic Modem transducer head (Z)	1	ITC3013	CD0004074981
Monitor pelican case			
HP Officejet H470	1		
Monitor	1		CD0001733799
UPS	1		
Spare Cable Pelican			
spare vehicle cables	6		
dummy plugs	20		
CTD wire whips	2	SBE 17031	
aluminum calibration target and bag	1		
spare Thruster	1		
spare Thruster	1		
spare Thruster	1		
stools	4		
aluminium mounts	8		
Tote 304 (white) 43"x48"x31"H			
Control Box for LBL	1		CD0000475004
stainless steel hardware	1000		
raingear and clothing	2		
Prop case	1		
Props - Mejzlik Modellbau 24 x 12W	10	PMK2412WT	
Box of kimwipes	2		

PPE	8
spare electronics chassis- parts only	1
Vacuum Pump- Gast (PIFSC)	1

Electronics Toolbox (CRED09)

Multi-Tester	1
Soldering Iron	1
Wedges for opening housings (plastic)	2
Solder (60 tin 40 lead)	2
Scotch Linerless Rubber Splicing Tape	1
hard hat	4

Tote 306 (black) 47"x39"x42"H

Deck Cable Pelican

spare deck cables	3
rolled steel drop weights	12

Square Pelican

shrink wrap (various sizes)	1
Wire assorted sizes and colors	1
Pipe Cleaners	4
Banana Connectors	9
Alligator Clips	10
hose clamps	60

Electronics Pelican

USB to serial adapters	8
Wire multipurpose	8
null modem adapter (M to F)	8
gender changers (9-pin F to M)	8
gender changers (9-pin to F)	8
USB cables	8
Serial 9-pin F to serial 25-pin M	8
serial 9-pin M to serial 25-pin F	8
shear pins for props (Formalium)	8
backing screws to hold thruster together (#6x32x3/4)	8
cotter pins	8
bearings (full ceramic)	8
Ethernet cables	8
Monitor Cable (VGA male male 25ft)	1
EdgePort serial hub (8 ports)	1
ethernet gigabit (8 port)	1
Dlink USB hub (4 ports)	1
Netgear 54 gigabit ethernet hub (5 ports)	1
Moxa serial hub (8 ports)	1

Galvanic Timed Releases (various times)	100		
LBL Transducer Pelican			
LBL transducer and cable	1		
BluView Pelican			
BluView sonar	1	P900-130	
Tote 302 (white) 43"x48"x31"H			
various tarps	2		
ARGOS tag and accessories	1		
TOPSIDE-Electronics Rack case			
Edgeport netgear cables pouch(CRED14)	1		
DC Power Supply- spare	1	XTR 60-14	
DC Power Supply- Deck	1	XTR 60-14	
DC Power Supply- USBL	1	XTR 60-14	
DC Power Supply- Batteries	1	XTR 60-14	
EdgePort serial hub (8 ports)	1		
power strips	4		
Whoi-acoms acoustic modem box	1	256020	
Netgear 54 gigabit ethernet hub (5 port)	1	GS105 v2	
FreeWave RF modem	1	FGR2-CE-U	
Garmin GPSmap 76CS x (Aax2)	1		
Garmin GPSmap 76CS x (Aax2)	1		
GPS dash mount	1		
GPS antennas + cable 10'	2		
GPS Integrated power supply and data cable (12v) 7ft	1		
Action Packer			
Orings - spares (in notebooks)	500		
spare battery controller cards	2		
Whoi-acoms acoustic modem box	1	256020	CD0004074978
USBL 1510 removable head		TN1510BHR	CD0004092896
anti-static mat	1		
Aqua Shield (14 oz)	1		
Dow corning 111 (14 oz)	1		
DC 4 (5.3 oz)	1		
Parker O-ring lube	1		
aluminium pole mounts			
Tote 303 (black tall) 47"x39"x44"H			
gray case (3x3x2) (CRED05)			
Makita Tool bag (CRED07)	1		
Black Socket Set case (CRED04)	1		
zip ties (assorted)	1000		

extension cords	6		
Y Push heads	3		
West Marine SS hook (small recovery hooks)	3		
line and straps- poly and nylon			
Drill bits	50		
Box of wood screws (3 1/2in)	1		
Red Toolbox (CRED08)			
hand tools general	35		
tape various types	1		
Assorted dummy plugs	40		
Dremel tool kit	1		
small wooden crate			
SBE 49 CTD	1	SBE 49 Fastcat	
Novatech ST-400AR - Xenon Flasher battery housing	1	ST-400AR	
Novatech ST-400AR - Xenon Flasher battery housing	1	ST-400AR	
large wooden crate			
Delta T multibeam	1	837-000-201	CD0001674014
spare strobe			
black camera DSPL camera housings	2		
11 mp Nikon DX camera (C6)	1	GE4000C	CD0001724938
DSPL green laser	1		
Yellow bag - block and tackle	1		
tarp	2		
USBL Pelican			
USBL tranceiver DEEP	1		CD0004075003
USBL tranceiver DEEP	1		
USBL Pelican			
USBL transponder DEEP	1		CD0004075002
USBL transponder DEEP	1		
Spare Battery Bank and Housing	1		CD0004074976