U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE/NOAA FISHERIES
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FINAL Project Instructions

Date Submitted:	July 25, 2013
Platform:	NOAA Ship *Hi'ialakai*
Project Number:	HA-13-05 (OMAO)
Project Title:	NWHI RAMP (Northwestern Hawaiian Islands RAMP)
Project Dates:	September 3, 2013 to September 19, 2013

Prepared by: _____ Dated: 7/25/13
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Approved by: _____ Dated: 8/28/2013
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Approved by: _____ Dated: 8/30/2013
Commander Robert A. Kamphaus, NOAA
Commanding Officer
Marine Operations Center – Pacific Islands

I. Overview

A. Brief Summary and Project Period

NOAA Ship *Hi'ialakai* will be engaged as support for the Northwestern Hawaiian Islands Reef Assessment and Monitoring Program (NWHI RAMP) from September 3 through September 19, 2013, for a total of 17 days at sea (DAS).

NWHI RAMP is a component of an integrated coral reef ecosystem assessment led by the Coral Reef Ecosystem Division (CRED) of the Pacific Island Fisheries Science Center in some 50 U.S.-affiliated Pacific Islands. This comprehensive, multi-agency research and education effort is sponsored by NOAA's Coral Reef Conservation Program (CRCP), a partnership between the National Marine Fisheries Service, National Ocean Service, and other NOAA agencies with the objective of improving, understanding, and managing coral reef ecosystems.

Small boats will be deployed from *Hi'ialakai* to reach dive survey areas around French Frigate Shoals, Pearl and Hermes Atoll, and Lisianski Island. Teams of SCUBA divers will focus on implementing the National Coral Reef Monitoring Program's (NCRMP) mandated climate change monitoring efforts. This cruise is dedicated to initiating a focused climate change and ocean acidification monitoring program in the Northwestern Hawaiian Islands and includes the deployment of temperature recording thermistor transects, the collection of seawater samples, the deployment of Calcification Accretion Units (CAUs), Bioerosion Monitoring Units (BMUs), and Autonomous Reef Monitoring Structures (ARMS).

Data collected during this mission are pivotal to long-term biological and oceanographic monitoring of coral reef ecosystems in the Hawaiian Archipelago. The 2013 expedition will add to information collected during monitoring and mapping surveys conducted in 2005, 2006, 2007, and 2010. Historical abundance and spatial distribution information about reef fishes, invertebrates, corals, and algae from previous RAMP cruises will allow scientists to compare that data with the climate change information/trends this cruise will begin to capture. The ultimate goal is to evaluate potential changes in the condition and integrity of coral reef ecosystems in the Hawaiian Archipelago and enable federal and state resource managers to more effectively conserve coral reefs ecosystems of the NWHI and manage ecosystem services in the face of a changing global climate.

B. Service Level Agreements

Of the 17 DAS scheduled for this project, 10 DAS are funded by the program and seven DAS are funded by OMAO. This project is estimated to exhibit a "High" Operational Tempo.

C. Operating Area

The Operating Area for HA-13-05 (*Appendix 1*) encompasses the waters within and surrounding the Northwestern Hawaiian Islands, specifically:

- French Frigate Shoals (*Appendix 2*)
- Lisianski Island (*Appendix 3*)
- Pearl and Hermes Atoll (*Appendix 4*)

The Station/Waypoint List for the project is presented as an attached file (*Appendix 5*).

D. Summary of Objectives

The ship will support assessment and monitoring operations in the waters surrounding French Frigate Shoals, Lisianski Island, and Pearl and Hermes Atoll. The scientific objectives of this project are to:

1. Deploy and/or service an array of Subsurface Temperature Recorders (STRs), Sea Surface Temperature buoys (SSTs), Ecological Acoustic Recorders (EARs), Acoustic Doppler Current Profilers (ADCPs), ARMS, CAUs, and BMUs to facilitate remote, long-term, monitoring of oceanographic and environmental conditions affecting the coral reef ecosystems of the NWHI.

2. Measure surface and near reef water samples for parameters associated with ocean acidification and climate change, including analysis of seawater for salinity, total alkalinity (TA), and dissolved inorganic carbon (DIC). The water used to measure these parameters will be collected via Niskin bottle grab samples, conductivity-temperature-depth (CTD) casts, and remotely operated water sampling devices.

3. Conduct shipboard CTD measurements to a depth of 500 m, and shipboard ADCP surveys around reef ecosystems to examine physical and biological linkages supporting and maintaining the island ecosystems.

4. Collect oceanographic data utilizing ship-based measurement systems (ADCP, ThermoSalinoGraph - TSG, and the Scientific Computer System - SCS) during all transits for the duration of the project.

5. Conduct investigations of marine microbial communities, including the collection of specimens via water sampling and plankton tows.

6. Determine the existence of threats to the health of these coral reef resources from anthropogenic sources, including marine debris.

E. Participating Institutions

- Joint Institute for Marine and Atmospheric Research (JIMAR)
- NOAA Pacific Islands Fisheries Science Center:
  - Coral Reef Ecosystem Division (CRED)
- NOAA Dive Program (NDP)
- San Diego State University (SDSU)
- Scripps Institution of Oceanography (SIO)
- University of Hawai'i at Mānoa (UHM)

F. Personnel / Science Party

Name (Last, First)	Title	Embark	Disembark	Gender	Affiliation	Nationality
Anderson, Jeff	ARMS Diver	9/3/13	9/19/13	Male	CRED/JIMAR	USA
Ayotte, Paula	PUC Diver	9/3/13	9/19/13	Female	CRED/JIMAR	USA
Bailey, Hatsue	Stratified Random Water Sampling Diver	9/3/13	9/19/13	Female	CRED/JIMAR	JPN (USA Perm. Resident)
Bostick, James	Chamber Operator / Dive Master	9/3/13	9/19/13	Male	NDP	USA
Edwards, Clint	CAU / Water Sampling Diver	9/3/13	9/19/13	Male	SIO	USA
Garriques, Joao	CAU / Water Sampling Diver	9/3/13	9/19/13	Male	CRED/JIMAR	USA
Gove, Jamison	Instrumentation Diver	9/3/13	9/19/13	Male	CRED/JIMAR	USA
Gray, Andrew	CAU / Water Sampling Diver	9/3/13	9/19/13	Male	CRED/JIMAR	USA
Hurley, Kaleonani	ARMS Processing	9/3/13	9/19/13	Female	UHM	USA
Johnson, Abby	Instrumentation Diver	9/3/13	9/19/13	Female	CRED/JIMAR	USA
Knowles, Benjamin	Stratified Random Water Sampling Diver	9/3/13	9/19/13	Male	SDSU	AUS (USA Perm. Resident)
TBN						
Reardon, Kerry	ARMS Diver	9/3/13	9/19/13	Female	CRED/JIMAR	USA
Reardon, Russell	Operations Lead / ARMS Diver	9/3/13	9/19/13	Male	CRED/JIMAR	USA
Schumacher, Brett	Stratified Random Water Sampling Diver	9/3/13	9/19/13	Male	CRED/JIMAR	USA
Timmers, Molly	ARMS Diver	9/3/13	9/19/13	Female	CRED/JIMAR	USA
Tootell, Jesse	CAU / Water Sampling Diver	9/3/13	9/19/13	Male	SIO	USA
Trick, Kevin	Data Manager	9/3/13	9/19/13	Male	CRED/JIMAR	USA
Venegas, Roberto	CTD Specialist	9/3/13	9/19/13	Male	CRED/JIMAR	USA
Vetter, Oliver	CAU / Water Sampling Diver	9/3/13	9/19/13	Male	CRED/JIMAR	WLS
Young, Charles	Chief Scientist / PUC Diver	9/3/13	9/19/13	Male	CRED/JIMAR	USA

G. Administrative

1. Points of Contact

Chief Scientist:

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Ship Operations Officer:

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Operations Officer, NOAA Ship *Hi'ialakai*
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2. Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of the United States. Diplomatic clearance is not applicable.

3. Licenses and Permits

A research permit application (# PMNM-2013-024) was submitted to the Papahānaumokuākea Marine National Monument by Russell Brainard (permittee) and Charles Young (Field Principle Investigator) on May 1, 2013 and is currently under review.

II. Operations

A. Project Itinerary

The following operational plans can be considered only a guide as to how the Chief Scientist expects the surveys to progress without being able to predict the weather, operational and scheduling problems, and equipment failures. Transit estimates have been calculated based on a ship's speed of nine knots westbound and eight knots eastbound.

September 3	**Depart Pearl Harbor**: Embark all scientific personnel at Ford Island, Pearl Harbor no later than (NLT) 0700. Depart Pearl Harbor 1000 and transit to French Frigate Shoals (~489 nmi, ~2d 6h). Complete operational briefings, pre-dive assessments, and safety drills.
September 4	**Transit**: Continue transit to FFS. No dive operations are anticipated.
September 5-7	**French Frigate Shoals**: Arrive at FFS ~ 1600 (depending on transit time) for half a day of scientific operations. Operations

to be conducted while at FFS include: moored instrument deployments and retrievals (deploy: 16 STRs, 25 CAUs, 25 BMUs, 12 ARMS, one ADCP; retrieve: eight STRs, 25 CAUs, 6-15 ARMS, two EARs and three EAR anchors, one SST anchor with instrument, one ADCP), collection of carbonate chemistry water samples at CAU and stratified random survey sites, and microbial collections at one to two sites per day. . Night operations during this period include ADCP transects (~25 km in length) radiating in each of the four cardinal directions from FFS, with ~10 CTD casts (depth: 500 m; Lat/Lon: TBD) and water samples obtained on the reciprocal course of each transect. Depart FFS (~1800) on September 7 and transit to Pearl and Hermes Atoll (~ 575 nmi, 2d 15h).

September 8-9 **Transit**: Continue transit to PHR. No dive operations are anticipated.

September 10-12 **Pearl and Hermes Atoll**: Arrive at PHR ~ 0900 for a full day of scientific operations. Operations to be conducted while at PHR include: moored instrument deployments and retrievals (deploy: 16 STRs, 25 CAUs, 12 ARMS, one ADCP; retrieve: 16 STRs, nine ARMS, three EAR anchors with instruments, one SST and two SST anchors, one ADCP), collection of carbonate chemistry water samples at CAU and stratified random survey sites, and microbial collections at one to two sites per day. Night operations during this period include ADCP transects (~25 km in length) radiating in each of the four cardinal directions from PHR, with ~10 CTD casts (depth: 500 m; Lat/Lon: TBD) and water samples obtained on the reciprocal course of each transect. Depart PHR (~1200) on September 12 and transit to Lisianski Island (~ 144nmi, 18h).

September 13-14 **Lisianski Island**: Arrive at LIS NLT 0700 for a full day of scientific operations. Operations to be conducted while at LIS include: moored instrument deployments and retrievals (deploy: 16 STRs, 25 CAUs, 12 ARMS, one ADCP; retrieve: six STRs, nine ARMS, one EAR and three EAR anchors, one SST anchor with instrument, one ADCP), collection of carbonate chemistry water samples at CAU and stratified random survey sites, and microbial collections at one to two sites per day. Night operations during this period include ADCP transects (~25 km in length) radiating in each of the four cardinal directions from LIS, with ~10 CTD casts (depth: 500 m; Lat/Lon: TBD) and water samples obtained on the reciprocal course of each transect. Depart LIS (~1800) on

September 14 and transit to the Ford Island, Pearl Harbor (~ 955nmi, 5d).

September 15-18 **Transit**: Continue transit to Pearl Harbor. No dive operations are anticipated.

September 19 **Arrive Pearl Harbor**: Arrive Ford Island, Pearl Harbor ~0800 ~~1800~~. End of project.

B. Staging and Destaging

Staging: Staging of large scientific gear and equipment will begin the week of August 26, or as otherwise coordinated with the Command. Most of the program-provided equipment will be on board from the preceding project, HA-13-04 MHI RAMP. Assistance from the ship's personnel for crane services for large gear, as well as for loading small boat fuel (pumped from truck to ship), will be necessary. Hand carried items will be loaded throughout the week prior to departure. All scientists anticipate embarking the vessel at Ford Island, Pearl Harbor, by 0700, on September 3, 2013.

Destaging: Upon completion of the project, full off-load of the program-provided gear will occur in Honolulu, in coordination with the Command, once the *Hi'ialakai* returns to Pearl Harbor.

C. Operations to be Conducted

The Chief Scientist has the authority to revise or alter the technical portion of the instructions as work progresses, provided that, after consultation with the Commanding Officer, it is ascertained that the proposed changes will not (1) jeopardize the safety of personnel or the ship, (2) exceed the overall time allotted for the project, (3) result in undue additional expenses, and (4) alter the general intent of the project instructions. In addition, the Chief Scientist must notify the Office of the Science Director of the Pacific Islands Fisheries Science Center at the earliest opportunity prior to making (1) deviations from the general project track or area of operations noted in the project instructions, (2) changes or additions of research operations to those specified in the project instructions, or (3) port calls not specifically identified in the project instructions.

Scientific Operations

The ship will support assessment and monitoring operations within the project Operations Area. Specifically, the ship will support the continuation of long-term climate change and ocean acidification monitoring operations of the coral reef ecosystems within the region.

Research and monitoring efforts will require extensive diving operations (both scuba and snorkeling) to be supported by *Hi'ialakai*. Up to five small boats will

be operating simultaneously during daylight hours to maximize productivity. *Hi'ialakai*'s 30-ft Northwind (HI-1A), 26-ft Ambar (HI-2), and 17-ft Northwind (HI-3), two CRED-provided 19-ft SAFE Boats and *Hi'ialakai*'s 17-ft Zodiac inflatable (HI-7) will be required to support the instrumentation and oceanographic survey teams.

As the RAMP project for this year is unique, due to its limited duration and specific climate change monitoring mission, the typical RAMP organizational structure will not exist. For this project only, operational teams will be identified as the Instrument Team, CAU/Water Team, Stratified-Random Water Team, ARMS Team, and Alternate Team.

The Instrumentation Team will deploy and remove a variety of moored instruments in accordance with the NCRMP directives. A total of 48 STRs will be deployed, and 30 STRs, six EARs, three SST buoys, and four anchors will be retrieved. Retrieved anchors and instruments will be secured on stackable aluminum pallets for transport back to Honolulu.

The CAU/Water Team will recover and install CAUs, deploy newly associated BMUs when necessary, conduct photo-quadrant benthic surveys, conduct shallow water CTD casts, and collect ancillary water samples, at select locations around each island. CAUs are deployed in groups of five, at five locations around each island. The CAUs serve as a mechanism to quantify net reef calcification rates and BMUs serve as a tool to quantify net bioerosion rates on the same reef systems. Forereef water samples will be collected by SCUBA divers at various locations using a 5L Niskin bottle. DIC, TA, and salinity samples will be collected and later analyzed in a laboratory to calculate the carbonate system around the survey sites.

The Stratified-Random Water Team will conduct up to four benthic photo-quadrant surveys, capture water column temperature/pressure data using a STPR, and collect water samples each day the cruise is on station at an island.

The ARMS Team will recover and install ARMS at select locations. These small units are designed to mimic the complexity of the coral reef structure and to attract small invertebrates to recruit within them. ARMS samples will be processed onboard in a program-provided lab space, preserved in ethanol, and stored in the scientific freezer. It is expected that the processing of up to 30 ARMS will have to take place during the transit back to Honolulu from Lisianski Island. Each ARMS unit requires up to five hours of processing on deck. Each CRED scientist not engaged in other mission essential operations will assist the ARMS Team in processing each ARMS unit. It is requested that the *Hi'ialakai* personnel respect the delicate and time consuming nature of these procedures and afford the ARMS Team the latitude to conduct processing on the aft weather decks (specifically the winch deck and the fantail) during the return of this unique project.

The Alternate Team will be used as needed and provided specific missions on a daily basis. It can be expected that the Alternate Team will help the CAU/Water Team deploy CAU units, or retrieve ARMS, or be used as a transportation vessel for gear and scientists to and from the field, etc. The mission of the Alternate Team will be to fulfill needs based on daily progress reports from the four specifically directed teams.

Shipboard CTD casts will be conducted around/over each of the islands/banks to examine oceanographic conditions and water quality. Shipboard CTDs will be conducted to a depth of 500 m at several sites around each island and/or atoll, including but not limited to all of the permanent shipboard CTD sites that can be reached reasonably. Underway shipboard oceanographic measurements (ADCP, TSG, and SCS) will be recorded throughout the duration of the project. During shipboard CTD casts, water samples may be collected for salinity and carbonate chemistry analyses.

As part of the ongoing effort to understand the microbial community, two types of water samples will be collected at each REA site using diver-deployable Niskin bottles (four bottles; two liters per bottle). Two of the Niskin bottles will be filled with water collected from approximately one meter above the benthos, and two will be filled with water from within the reef (pore-water). The pore-water samples will be collected using Niskin bottles with a flexible stainless-steel hose attachment. These water samples will be returned to the ship and processed for dissolved organic carbon (DOC), particulate organic matter (POM), nutrients, microbial (Bacteria and Archaea) and viral abundance (fluorescent microscopy), FACS (heterotrophs vs. autotrophs), and microbial and viral community composition (coarse analysis: 16s rRNA). At two REA sites per island, approximately 60-80 L of reef water will be collected from reef crevices and surfaces for metagenomic analysis of the microbial and viral community associated with the reef benthos. All water samples will be collected at select REA sites.

In addition to understanding water-column microbial dynamics, investigating shifts in the microbial community associated with benthic composition is important as it can serve as an indicator of reef-ecosystem health. If time permits, six fist-sized samples of rubble (three of these will also contain a handful of the first 5-10 cm of sediment from different sand pockets), and six pieces of the most dominant algae-type will be collected in zip-top bags. Both the algae and the rubble/sediment samples will be frozen at -20°C. These samples will remain on the ship until it returns to Honolulu. The 16s bacterial rRNA genes associated with these samples will be sequenced to characterize the microbial communities associated with the benthos (rubble and algae). The sediment samples will be used to characterize the live/dead assemblage of benthic foraminifera, which can serve as a proxy for changes in water quality related to human impacts. These

samples will be saturated with Rose Bengal/EtOH solution, rinsed, and stored dry onboard the ship for microscopic analysis.

Snorkeling

All snorkeling shall be conducted in accordance with the NOAA Scientific Diving Manual (Section 4.13).

Small Boat

Per OMAO Supplement to the NOAA Small Boat Standards and Procedures Manual, March 2010, Section 4.03a2, a program certified Operator in Charge (OIC) must "earn the full confidence of both the Commanding Officer (CO) and Designated Examiner (DE) and has successfully completed the shipboard training requirements." As part of any OIC evaluation, it is understood that a small boat OIC will be designated to accompany and evaluate an OIC-in-training. This may limit the number of small boats the ship can deploy during this evaluation period, but every effort will be made to limit any impact to operations. An OIC-in-training is not guaranteed to be qualified by the CO and DE during a project.

Small boat deployment and recovery operations from a ship at sea are inherently dangerous. Experience levels of all personnel involved and environmental conditions are limiting factors regarding the decision to proceed with said operations. Proficiency levels of deck officers, deck department, or small boat crews may impact operations. All small boat crewmembers must have the full confidence of the CO and DE. At any time, the CO may call for a halt to boat deployment and recovery operations. If indicated, a Safety Stand Down, extra training or practice may be required to begin operations again. This is especially true when the ship has been in port or when program personnel have not been aboard for an extended period of time, as well as when boat operations are called for within 48 hours of departure.

While minimizing impact to science operations, ship's diver/coxswain training and proficiency regulations may require the use of a ship's small boat during an extended project. The CO will work with the Chief Scientist to plan and minimize impacts to fulfill such requirements.

CTD

When planning CTD operations, time must be allotted for cable maintenance as required in EEOI-017 which states that the cable shall be sprayed with fresh water during the reeling-in at the end of use each day and the cable shall be pressure lubed at the end of a project, or portion of a project, at least once each week during frequent use.

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.

The Dive Plans for HA-13-05 are presented in *Appendix 6* (attached file).

E. Applicable Restrictions

Conditions which preclude normal operations: Poor weather and sea conditions, equipment failure, safety concerns, and/or unforeseen circumstances, may alter or prohibit operations as planned. At these times, the Chief Scientist and Commanding Officer will determine the appropriate plan of action.

1. "Take" of Protected Species

    a. Under the Marine Mammal Protection Act and Endangered Species Act it is unlawful to take a protected species. The MMPA defines take as "harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect." The ESA defines take as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." An incidental take is one that incidental to, but not the purpose of, otherwise lawful activities.

    b. In the event of an incidental take of a marine mammal or federally listed threatened or endangered species during the project, the chief scientist will report the incident to the PIFSC Director, Deputy Director, and the Commanding Officer IMMEDIATELY via IRIDIUM, INMARSAT, and email. Samples should not be collected from any incidentally taken marine mammals, sea turtles, or seabirds.

    c. PIFSC has developed mitigation measures for our fisheries and ecosystem research projects to avoid take and comply with the Lecky, Murawski, and Merrick guidance. A copy of these documents is available at https://sites.google.com/a/noaa.gov/pifsc-science-operations/home/nepa-permits/protected-species-mitigation-measures and on the ship's bridge.

2. Activities in the Hawaiian Islands Humpback Whale National Marine Sanctuary

    a. The humpback whale season in Hawaii is November through May.

b. Unless otherwise authorized under the MMPA and ESA, it is unlawful to approach, or cause a vessel or other object to approach, within 100 yards of any humpback whale within the Sanctuary. Please reference the complete list of prohibited activities and boundary maps at https://sites.google.com/a/noaa.gov/pifsc-science-operations/home/nepa-permits/protected-species-mitigation-measures. A copy of these materials will also be available on the ship's bridge.

III. Equipment

A. Equipment and Capabilities Provided by the Ship

1. **Equipment**: To successfully meet the project objectives, the scientific compliment aboard will need the ship to provide the items listed below. Prior to sailing, the ship's crew will inspect these items to ensure they are in proper working order for the project:

J-frame
A-frame
Aft deck crane
30-ft Northwind launch, HI-1A
26-ft Ambar launch, HI-2
17-ft Northwind launch, HI-3
17-ft Zodiac inflatable and 50hp motor, HI-7
SCUBA compressor (Nitrox and Air)
Recompression chamber
Dive lockers
Scientific freezer
Wetlab faucets and drains
Acoustic Doppler Current Profiler (ADCP)
Scientific Computer System (SCS)
ThermoSalinoGraph (TSG)
Sea Surface Sound Velocity (SSSV)
CTD and rosette
Adequate fresh water for gear and small boat wash-down
Iridium phone
VHF radios for ship's small boats
Global Positioning System (GPS) for ship's small boats
Depth sounders for ship's small boats
Ethanol and gasoline storage tanks
Rack space for up to three standard (55-gal) fuel drums

2. **Capabilities**: It is requested that the ship provide the following:

a. Permission for Scientists to ready scientific work spaces (e.g., set up computer server) during the week prior to departure.

b. Assistance from the ship's Deck Department in craning and staging large gear during loading and off-loading.

c. Support from the Engineering and Deck Departments prior to sailing to transfer 1.51 kL (400 gallons) of program-provided gasoline into the ship's stainless steel fuel tank to be used as outboard engine fuel. The gasoline will be delivered by truck and may be pumped directly into the deck tank. *Hi'ialakai* will be responsible for providing diesel fuel for HI-1A and HI-2.

d. Support from the Engineering and Deck Departments to provide storage capacity for ~200 L (53 gal) of waste ethanol generated during the project.

e. The ship is requested to provide, at a minimum, one NOAA Working Diver to participate in scientific operations, as manning allows.

f. In the event that during the SE-1305 cruise (July 2013) CRED's "deep water" EARs are not recovered, the ship is requested to conduct the acoustic release and retrieval of "deep water" EAR instruments. The "deep water" EARs range in depth between ~220 – 1000 ft. There is one "deep water" EAR off the southern coast of each island this project will visit. The operation will require the *Hi'ialakai* to come on station, execute an acoustic release signal, and recover the EAR upon surfacing. Total time of evolution is approximately 2 hrs.

g. *Hi'ialakai*'s HI-1A, HI-2, and HI-3 will be required to support the program's dive teams on a daily basis. The ship's HI-7 may be required as a backup should one of the other boats become inoperable or to mitigate unforeseen events. The ship should plan to provide coxswains for the HI-1A, HI-2, and HI-3 during all days of diving operations. Should one of these vessels become inoperable, a ship coxswain will be needed for the replacement platform, HI-7.

h. An experienced survey technician is requested to conduct nighttime CTDs and shipboard pCO_2 sampling operations and to assist the science party with water filtration and sampling operations, including chlorophyll filtration and the fixing of carbonate chemistry samples. Operable Wet Lab facilities are necessary to support water sampling and the cleaning of field

equipment. Approximately eight to ten 0.9 m x 0.6 m totes of the program's glass sample bottles and plastic sample bags filled with seawater will need to be stored onboard in an air conditioned space.

i. To support the ARMS Lab (10-ft container box), power, freshwater, saltwater and compressed air sources and connections on the fantail will be necessary. Work space on the fantail and winch deck will be required for ARMS processing during the transit back to Honolulu.

j. To support CAU processing, power connections on deck for one chest freezer (~ 6 ft x 3 ft x 3 ft) will be necessary. Note: Similar program freezers were carried previously on the bridge deck (starboard rail) and on the boat deck (port side).

k. To be consistent with the mission objectives, the ship and its compliment of small boats will employ all methods feasible to minimize damage to coral reef habitats during any anchoring operations that may be required.

B. Equipment and Capabilities Provided by the Scientists

1. **Equipment**: The program's full equipment list is presented in *Appendix 7* (attached file).

2. **Capabilities**: In addition to scientific expertise, the program will provide the following capabilities:

    a. Coxswains and routine maintenance for program-provided SAFE Boats.

    b. A scientist to assist on deck with deployment and recovery of the CTD rosette and to perform water filtration and sampling activities.

IV. Hazardous Materials

A. Policy and Compliance

The Chief Scientist is responsible for complying with Fleet Environmental Compliance 07 (FEC 07) Hazardous Material 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 the anticipated quantity brought aboard, MSDS

and appropriate neutralizing agents, buffers, or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and a chemical hygiene plan. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

Per FEC 07, the scientific party will include with their project instructions and provide to the CO of the respective ship 60 to 90 days before departure:

- A list of hazardous materials by name and anticipated quantity
- Include a chemical spill plan that addresses all of the chemicals the program is bringing aboard. This shall include:
  - Procedures on how the spilled chemicals will be contained and cleaned up.
  - A complete inventory (including volumes/amounts) of the chemical spill supplies and equipment brought aboard by the program. This must be sufficient to clean and neutralize all of the chemicals brought aboard by the program.
  - A list of the trained personnel that will be accompanying the project and the training they've completed.

Inventory of Hazardous Materials

Common Name	Quantity	Notes	Trained Individual	Spill Control*
10,000X SYBR Gold (nucleic acid stain)	1 ml	Stored in sealed container in Scientific refrigerator	Ben Knowles	NT
5% Hydrochloric Acid	5 L	Stored in sealed plastic bucket in Wet Lab	Ben Knowles	A
Chloroform	10 ml	Stored in Hazmat cabinet in Wet Lab within sealed metal secondary container and padding	Ben Knowles	F
Commercial Bleach	7.5 L	Stored in ARMS labs in secondary containment	Molly Timmers and Kerry Reardon	F
DAPI Nucleic Acid Stain	500 µg	Stored in sealed plastic container in Scientific fridge	Ben Knowles	NT

Common Name	Quantity	Notes	Trained Individual	Spill Control*
DMSO Buffer	12 L	Stored in Hazmat cabinet in Wet Lab	Molly Timmers and Kerry Reardon	F
Dynamic Descaler	76 L	Biodegradable; neutralize with copious amounts of water. Inventory stored in ½ pallet tote on fantail. In-use quantity held in ½ pallet tote behind ARMS lab.	Molly Timmers and Kerry Reardon	A
95% Ethyl Alcohol (190 proof, Non-denatured)	570 L	Highly Volatile, Flammable Bulk stored in ship's fantail tank. Daily use quantity (19 L carboy) stored in ARMS lab in secondary containment. Preserved samples stored in secondary containment in Scientific freezer.	Ship's Chief Engineer (Bulk) Molly Timmers and Kerry Reardon (Daily use and sample quantities)	Ship SOP (bulk) AL (Daily use)
Gasoline, unleaded	1.51 kL	Volatile, Flammable Stored in ship's fantail tank.	Ship's Chief Engineer	Ship SOP
25% Glutaraldehyde (disinfectant/fixative)	10 ml	Stored in sealed plastic container in Scientific refrigerator	Ben Knowles	F

Common Name	Quantity	Notes	Trained Individual	Spill Control*
Liquid Nitrogen	12 L	Stored in Wet Lab Scientific dewar	Ben Knowles	LN
Mercuric Chloride (Saturated solution, 7g $HgCl_2$ in 60 ml of deionized water)	60 ml	Scientific samples consist of 200 µl $HgCl_2$ solution in 500 ml of seawater	Charles Young	M
32% Paraformaldehyde (disinfectant/fixative)	10 ml	Stored in Hazmat cabinet in Wet Lab	Ben Knowles	F
Pool Time Shock XtraBlue 6 in 1 Pool Shock	2.3 kg	Corrosive Contained in five 1-lb bags within lidded 5-gal bucket on Grated Deck	Kerry Reardon	P
Sodium Hydroxide (NaOH) pellets	500 g	Highly caustic Stored in Hazmat cabinet in Wet Lab	Ben Knowles	B

***Spill Control Key**

A: Acids

- Wear appropriate personal protective equipment (PPE) and clothing during clean-up.
- Keep upwind. Keep out of low areas.
- Ventilate closed spaces before entering them.
- Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
- **Large Spills**: Dike ahead of spill for containment. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal.
- **Small Spills**: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
- Never return spills to original containers for re-use.
- Neutralize spill area and washings with soda ash or lime. Collect in a non-combustible container for disposal.
- J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this type.

AL: Alcohols (daily use quantities)

- Extinguish smoking lamp. Remove all sources of ignition.

- Wear appropriate PPE and clothing during clean-up.
- Ventilate closed spaces before entering them.
- Use absorbent socks to surround spills or to divert fluid flow.
- Use vermiculite or kitty litter to soak up and absorb fluid.
- Do not use combustible materials, such as saw dust.
- Use absorbent pads/diapers to wipe up the spill or a dust pan to sweep up vermiculite/kitty litter.
- Place used absorbents in plastic bag or pail.
- Clean surface thoroughly to remove residual contamination.
- Bags containing used absorbents will be properly disposed of once the ship returns to port.

B: Bases

- Wear appropriate PPE (gloves, etc) and clothing during clean-up.
- Keep upwind. Keep out of low areas.
- Ventilate closed spaces before entering them.
- Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
- **Large Spills**: Sweep or scoop all spilled material, contaminated soil or other materials and place into plastic waste containers for disposal. Clean up any residual powder with damp paper towels, using Base Eater as necessary. Place the towel in the same sealed container.
- **Small Spills**: Clean up any residual powder with damp paper towels, using Base Eater as necessary. Clean surface thoroughly to remove residual contamination.
- Never return spills to original containers for re-use.
- Neutralize spill area and washings with product such as Grainger Base Eater Spill Kit. Collect in a non-combustible container for prompt disposal.

F: Fixatives/Formalin/Formaldehyde

- Wear appropriate PPE (gloves, goggles, breathing mask).
- Ventilate area of leak or spill. Remove all sources of ignition.
- Isolate hazard area. Keep unnecessary and unprotected personnel from entering.
- Contain and recover liquid when possible.
- Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e.g., vermiculite, kitty litter, absorbent pads), and place in a chemical waste container. A dust pan and plastic bags are available to aid in cleanup and disposal.
- Do not use combustible materials, such as saw dust.

LN: Liquid Nitrogen

- Wear appropriate PPE (close-toed shoes, cryogloves, goggles, long-sleeved and long-legged clothes are of particular importance).
- Ventilate area.
- Contain spill where safe to do so.

- Nitrogen is more harmful in its liquid state than in its gaseous state, in a well-ventilated area. Minimally handle or interfere with the spilled LN, and allow it to sublimate off after restricting personnel access to the contained spill area under well maintained ventilation.

M: Mercury

- Wear appropriate PPE and clothing during clean-up (a minimum of nitrile gloves, shoes and eyewear).
- Stop the flow of fluid by using absorbent material (e.g. cloth, fleece, paper) to dike and soak up the spilled solution.
- Contaminated area should be wiped with water dampened absorbent material, until one feels the area is sufficiently clean.
- If all the $HgCl_2$ solution from a spill is not wiped up, then potential exists for the $HgCl_2$ to come out of solution, and $HgCl_2$ crystals are more problematic (from a health perspective) than $HgCl_2$ in solution.
- Pick up used absorbents and place in a suitable container for reclamation or disposal in a method that does not generate dust
- All PPE and absorbent material contaminated with $HgCl_2$ should be contained in a zip-top bag labeled "$HgCl_2$ Waste," kept within the ship's HAZMAT locker, and properly disposed of once the ship returns to port.
- The concentration of $HgCl_2$ in solution, once mixed with copious amounts of fresh/salt water, will rapidly dilute the concentration of $HgCl_2$ relieving concern for further contamination by effluent, as concentrations will be below environmental toxicity, see MSDS for toxicological information.
- Areas of skin contact should be thoroughly rinsed under fresh/salt water for a minimum of 15 minutes.
- $HgCl_2$ solution contact with eyes/ingestion should be immediately addressed by the ship's doctor, rinse eyes for a minimum of 15 minutes, do not induce vomiting.

NT: Non-toxic

- Wear appropriate PPE and clothing during clean-up.
- Ventilate area.
- Contain spill where safe to do so.
- Absorb liquid with paper towel while wearing gloves; place waste in sealed plastic container until processed on land.

P: Powdered Chlorine Salts

- Wear appropriate PPE (gloves, eyewear, dust mask, etc.) and clothing during clean-up.
- Ventilate area.
- Keep upwind. Avoid inhalation of salts, granules or dust.
- **Large Spills**: Sweep or scoop all spilled material, contaminated soil or other materials and place into clean, dry containers for disposal. Do not close containers containing wet or damp material. If wet or damp, container should be

left open in a well-ventilated area to disperse any hazardous gases that may form. Once cleaned, neutralize/flood the spill area with large amounts of water as appropriate.

- **Small Spills**: Sweep or scoop up spilled material and add it to dive gear "disinfectant" rinse tote if available and full of water. If dive gear "disinfectant" rinse tote is not available, dispose of collected material into a clean, dry container. Once cleaned, neutralize/flood spill area with large amounts of water as appropriate.
- Never return spills to original containers for re-use.

Inventory of Spill Kit Supplies

Product Name	Amount	Chemicals useful against	Amount of clean up possible
Absorbent pads	20	A, AL, F	~4 L
Base Eater	Large Kit	B	~19 L
Dust pan	1 set	A, F, P	n/a
Goggles	1 pair	A, F	n/a
Kitty litter	5.4 kg	A, AL,F	~4 L
Nitrile gloves	6 pairs	A, F	n/a
NEUTRASORB®	3.2 kg	A	Varies with acid concentration
Plastic bags	5	A, AL, F, P	~4 L (each)
Vermiculite	16 kg	AL, F, NT	~38 L of chemical spilled
Vinyl gloves	20 pairs	A, F	n/a

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.

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory of hazardous material indicating all materials have been used or 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 and scientific hazardous materials. Overboard discharge of scientific chemicals is not permitted during projects aboard NOAA ships.

B. Radioactive Isotopes

Not applicable.

V. Additional Projects

Supplementary (piggyback) and ancillary projects are secondary to the objectives of the project and should be treated as additional investigations. The difference between the two types of secondary projects is that an ancillary project does not have representation aboard and is accomplished by the ship's force.

A. Supplementary ("Piggyback") Projects

No supplementary projects are planned.

B. NOAA Fleet Ancillary Projects

Ancillary tasks will be accomplished in accordance with the NOAA Fleet Standing Ancillary Instructions.

VI. Disposition of Data and Reports

A. Data Responsibilities

Integrated ecosystem observations of coral reefs are collected to characterize the spatial and temporal variability of the distribution, abundance, and diversity of corals, algae, other macroinvertebrates in the context of their benthic habitats and oceanographic environments. All data are quality assured, processed, and made available to region managers and stakeholders.

B. Pre and Post Project Meeting

Pre-Project Meeting: Prior to departure, a meeting between the Chief Scientist, the Commanding Officer and their respective staffs will be held to identify operational and logistic requirements and concerns.

Post-Project Meeting: Upon completion of the project, a meeting will normally be held at 0830 (unless prior alternate arrangements are made) and attended by the ship's officers, the Chief Scientist and members of the scientific party to review the project. Concerns regarding safety, efficiency, and suggestions for improvements for future projects should be discussed. Minutes of the post-project meeting will be distributed to all participants by email, and to the Commanding Officer and Operations Officer, Marine Operations Center - Pacific Islands.

C. Ship Operation Evaluation Report

Within seven days of the completion of the project, a Marine Operations Satisfaction Survey (NOAA Form 57-11-05) is to be completed by the Chief Scientist. The preferred method of transmittal of this form is via email to OMAO.Customer.Satisfaction@noaa.gov. If email is not an option, a hard copy may be forwarded to:

Director, NOAA Marine and Aviation Operations
NOAA Office of Marine and Aviation Operations
8403 Colesville Road, Suite 500
Silver Spring, MD 20910

VII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served three times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Packed lunches will be required for scientists on all full-day operations. 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 survey.

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 7, 1999, which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, Revised: 02 JAN 2012) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website at http://www.corporateservices.noaa.gov/~noaaforms/eforms/nf57-10-01.pdf. The completed form should be sent to the Regional Director of Health Services at Marine Operations Center. The participant can mail, fax, or scan the form into an email using the contact information below. The NHSQ should reach the Health Services Office no later than four weeks prior to the project to allow time for the participant to obtain and submit additional information that health services might require before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of the NHSQ. Be sure to include proof of tuberculosis (TB) testing, sign and date the 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.

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

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

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

All scientists will comply with standing safety regulations of PIFSC and that of the Ship's Specific Instructions.

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 e-mail and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30-day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required and it must be arranged at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *NMAO 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.
4. Provide the Electronics Technician with a spreadsheet of the following information:

Device	Name	Operating System	LAN MAC Address	WAN MAC Address
Iphone	*Scientist*	*MAC OS*	*21:34:6K:P8:W6:77*	*21:34:6K:P8:W6:78*
Laptop	*Scientist*	*Windows XP*	*23:34:6K:P8:M6:77*	*23:34:6K:P8:M6:78*

Completion of these requirements prior to boarding the ship is required. Clearance for non-NOAA computers should be coordinated with PIFSC ITS.

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 prior to boarding the ship. Arrangements to take the Course should be coordinated with PIFSC/CRED administration.

F. Foreign National Guests Access to OMAO Facilities and Platforms

The foreign national participant for project HA-13-05 is Oliver Vetter. Chamber Operator Jim Bostick will serve as the onboard foreign national sponsor for this participant.

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM DeBow's March 16, 2006 memo (http://deemedexports.noaa.gov). National Marine Fisheries Service personnel will use the Foreign National Registration System (FRNS) to submit requests for access to NOAA facilities and ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated NMFS Deemed Exports point of contact to assist with the process.

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

Responsibilities of the Chief Scientist:

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

2. Escorts – The Chief Scientist is responsible for providing escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.

3. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.

4. Export Control – Ensure that approved controls are in place for any technologies that are subject to Export Administration Regulations (EAR).

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

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.

2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written NMAO approval and compliance with export and sanction regulations.

3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.

4. Ensure receipt from the Chief Scientist or the DSN of the FRNS e-mail granting approval for the foreign national guest's visit.

5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.

6. Export Control – Eight weeks in advance of the project, provide the Chief Scientist with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Chief Scientist of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the Chief Scientist can take steps to prevent unlicensed export of program controlled technology. The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

7. Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.

Responsibilities of the Foreign National Sponsor:

1. Export Control – The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.

2. The DSN of the foreign national shall assign an on-board program individual, who will be responsible for the foreign national while on board. The identified individual must be a U.S. citizen, NOAA (or DOC) employee. According to DOC/OSY, this requirement cannot be altered.

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

APPENDICES

Appendix 1: Operating Area for HA-13-05 NWHI RAMP

Appendix 2: French Frigate Shoals

Appendix 3: Lisianski Island

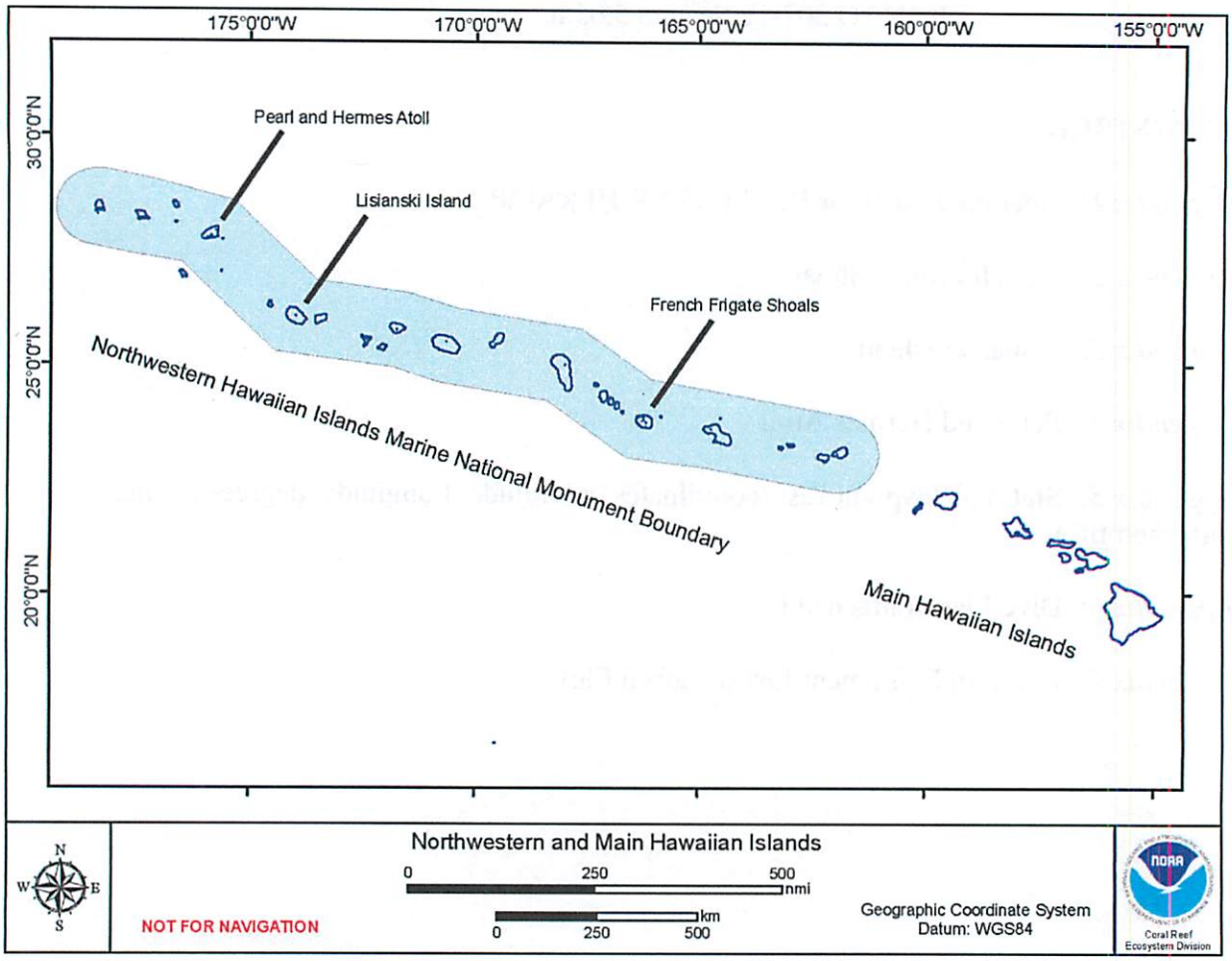
Appendix 4: Pearl and Hermes Atoll

Appendix 5: Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes) (attached file)

Appendix 6: Dive Plans (attached file)

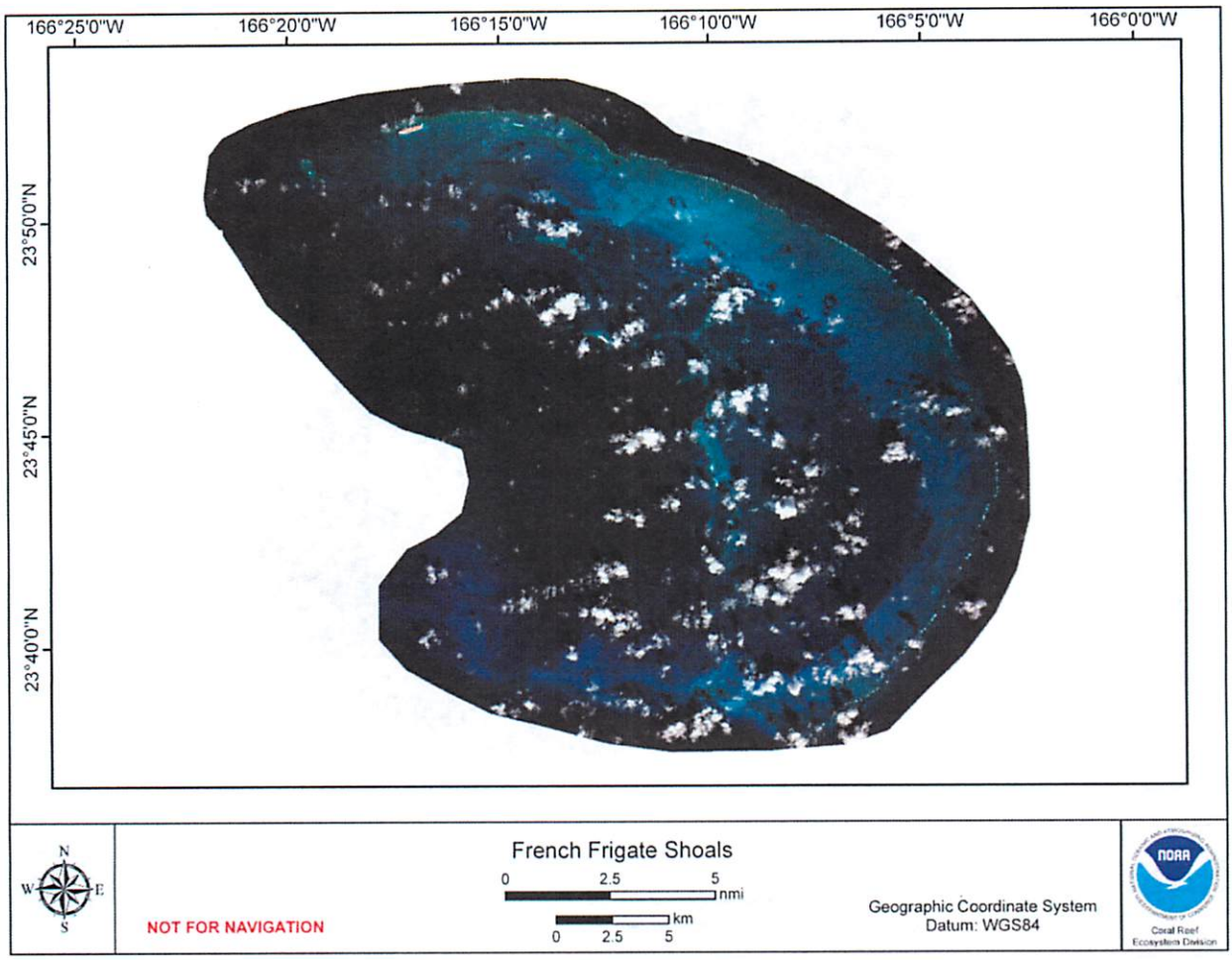
Appendix 7: Program Equipment List (attached file)

Appendix 1: Operating Area for HA-13-05 NWHI RAMP



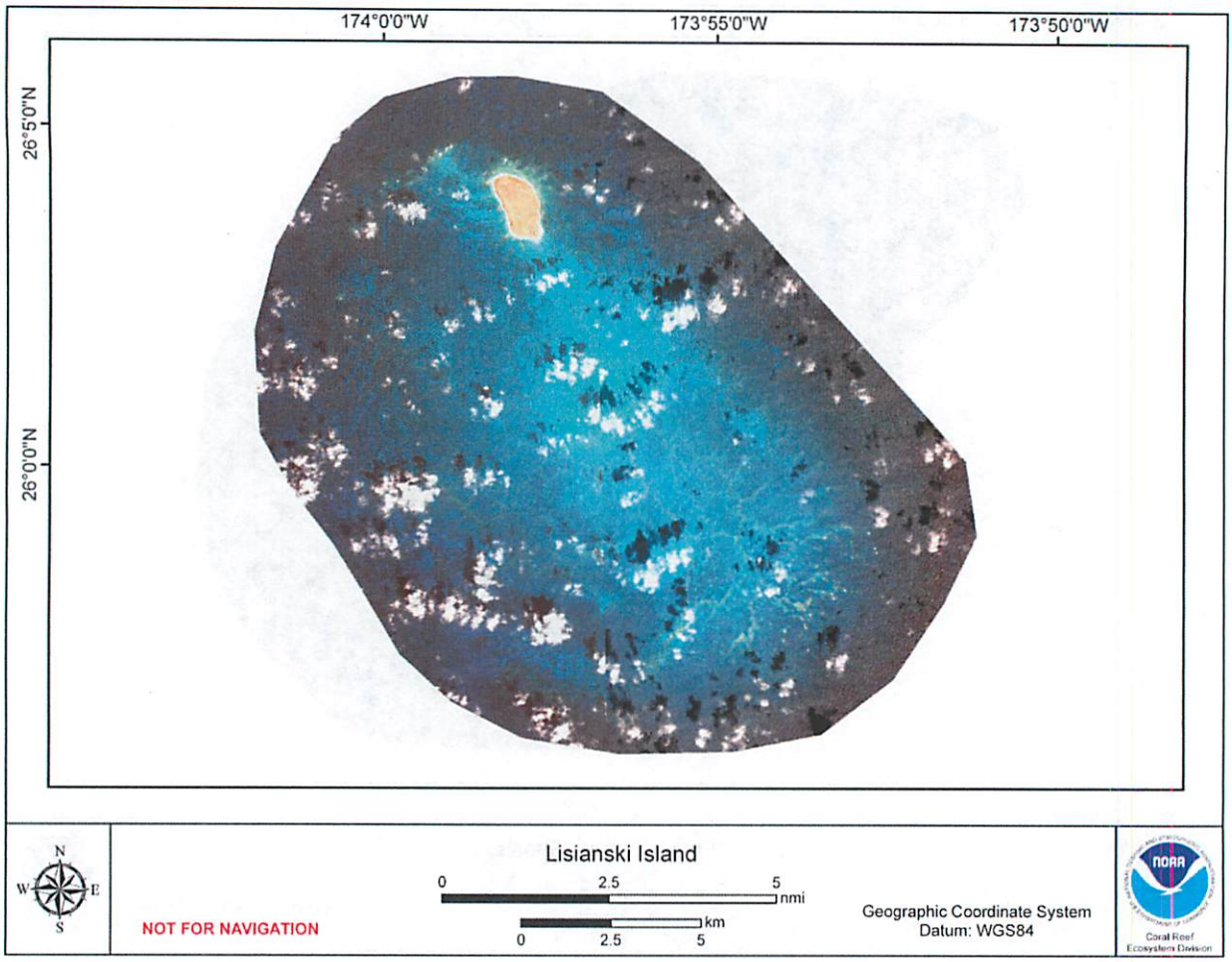
Operating Area for HA-13-05 NWHI RAMP Encompasses the Waters of the Northwestern Hawaiian Islands

Appendix 2: French Frigate Shoals



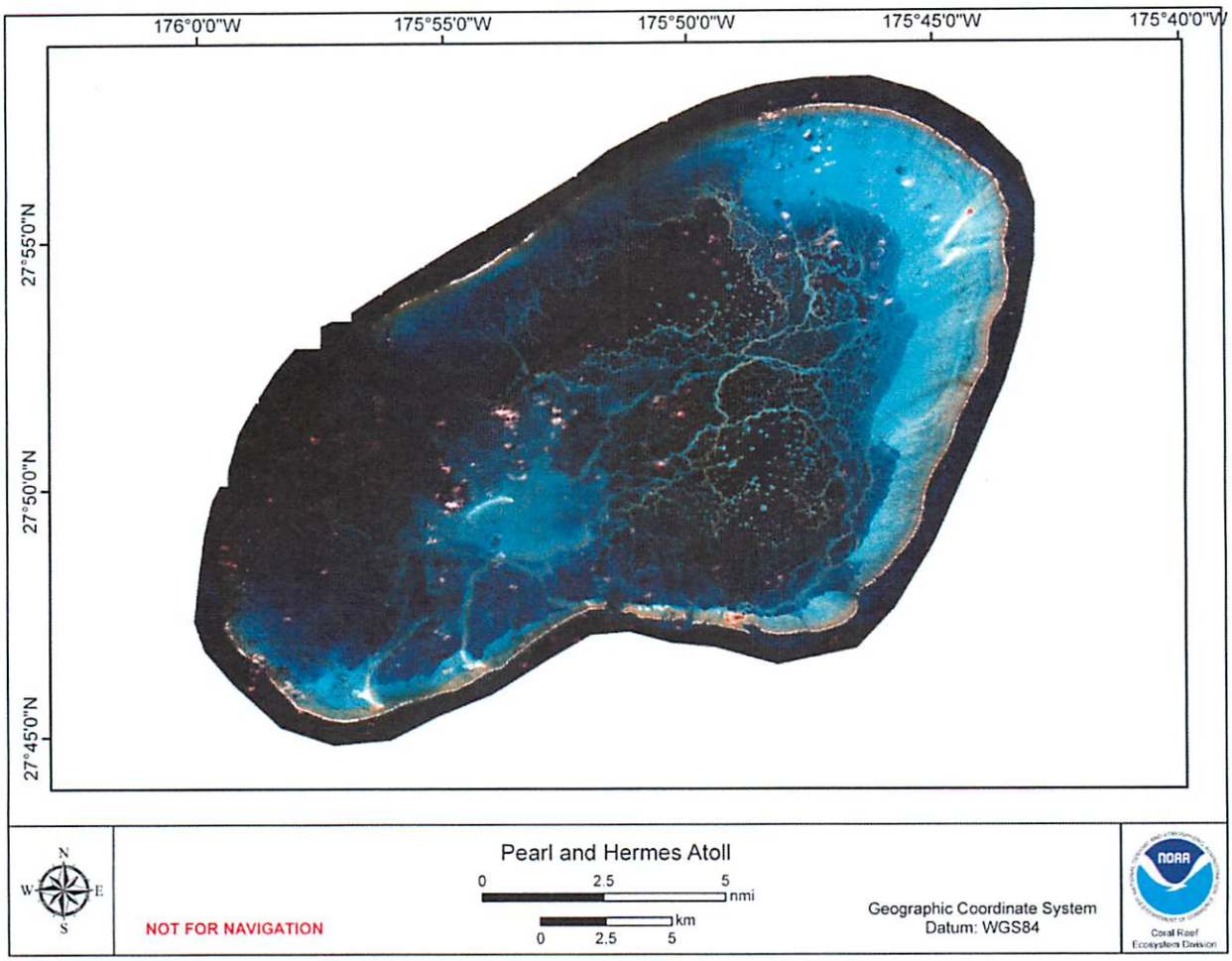
Generalized Map of French Frigate Shoals

Appendix 3: Lisianski Island



Generalized Map of Lisianski Island

Appendix 4: Pearl and Hermes Atoll



Generalized Map of Pearl and Hermes Atoll

Appendix 5: **Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes)**

(Attached File)

Appendix 6: Dive Plans

(Attached File)

Appendix 7: Program Provided Equipment List

(Attached File)