U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Pacific Islands Fisheries Science Center
1845 Wasp Blvd. Bldg. 176 • Honolulu, Hawaii 96818

Draft Project Instructions

Date Submitted:

Platform: NOAA Ship *Hi'ialakai*

Project Number: HA-17-01

Project Title: MARAMP (Marianna Archipelago RAMP)

Project Dates: March 16th to July 9th

Prepared by: _____ Dated: _____

Joao Garriques, Operations Lead

For: Brett Schumacher Ph.D., Chief Scientist Leg I
Thomas Oliver Ph.D., Chief Scientist Leg II
Kelvin Gorospe Ph.D., Chief Scientist Leg III
Coral Reef Ecosystem Program
Pacific Islands Fisheries Science Center

Approved by: _____ Dated: _____

Michael Seki, Ph.D., Director
Pacific Islands Fisheries Science Center

Approved by: _____ Dated: _____

Commander Matthew J. Wingate, NOAA
Commanding Officer
Marine Operations Center – Pacific Islands

(This page intentionally left blank.)

I. Overview

A. Brief Summary and Project Period

NOAA Ship *Hi'ialakai* will be engaged as support for the Marianna Archipelago Reef Assessment and Monitoring Program (MARAMP) from March 16th through July 9th, 2017, for a total of 104 days at sea (DAS).

MARAMP is a component of an integrated coral reef ecosystem assessment led by the Coral Reef Ecosystem Program (CREP) of the Pacific Islands Fisheries Science Center (PIFSC) 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 management of coral reef ecosystems.

Small boats will be deployed from *Hi'ialakai* to reach dive survey areas around Jarvis, Howland, Baker, Wake Atoll, Guam and the Northern Mariana Islands of Rota, Aguijan, Tinian, Saipan, Sarigan, Zealandia Bank, Pagan, Asuncion, Farallon de Pajaros, Supply Reef, Maug, Agrihan, Alamagan, and Guguan. Teams of SCUBA divers will conduct fine-scale, rapid ecological assessment (REA) surveys of reef fishes, corals, other invertebrates, and algae. Taxonomic diversity of coral reefs will be evaluated by retrieving Autonomous Reef Monitoring Structures (ARMS) previously placed on the seafloor.

Scientists will collect data to monitor nearshore physical and ecological factors associated with ocean acidification and general water quality, including data on water temperature, salinity, and other physical and biological characteristics of the coral reef environment using an assortment of oceanographic sampling and monitoring instruments, including systems deployed from the ship, underwater moored instruments, and sensors on the ship.

Data collected during this mission are pivotal to long-term biological and oceanographic monitoring of coral reef ecosystems in Pacific Remote Island Areas (PRIAs), Guam, and the Commonwealth of the Northern Mariana Islands (CNMI). The 2017 expedition will add to information collected during monitoring and mapping surveys conducted in 2005, 2007, 2009, 2011 and 2014. Data on the abundance and spatial distribution of reef fishes, invertebrates, corals, and algae will allow scientists to evaluate potential changes in the condition and integrity of coral reef ecosystems in PRIAs, Guam, and the CNMI. This research will enable federal and state resource managers to more effectively conserve coral reefs ecosystems of these areas and to manage ecosystem services. Data collected during the project also support monitoring components of the CRCP Coral Reef Ecosystem Integrated Observing System (CREIOS) in the Pacific.

B. Service Level Agreements

Of the 104 DAS scheduled for this project, 0 DAS are funded by the program, and 104 DAS are funded by Office of Marine and Aviation Operations (OMAO). This project is estimated to exhibit a High Operational Tempo.

C. Operating Area

The Operating Area for of HA-17-01 follows

Leg I: The operating area includes transit across the central and western Pacific Ocean, from Pearl Harbor, Hawaii to Apra Harbor, Guam, with dive operations occurring on route at Jarvis, Howland, Baker Islands and at Wake Atoll (*Appendix 1)*.

Leg II: The operating area includes Guam and the Commonwealth of the Northern Mariana Islands (CNMI: Rota, Aguijan, Tinian, and Saipan) (*Appendix 2)*.

Leg III: The operating area includes the Commonwealth of the Northern Mariana Islands (CNMI: Sarigan, Zealandia Bank, Pagan, Asuncion, Farallon de Pajaros, Supply Reef, Maug, Agrihan, Alamagan, and Guguan) (*Appendix 3)*.

Leg IV: The operating area includes the transit across the western and central Pacific Ocean from Tanapag Harbor, Saipan to Pearl Harbor, Hawaii.

Detailed working maps with proposed operational polygons are presented as appendices *(Appendix 4)*. The Station/Waypoint List for instrument deployments and retrievals of the project is presented as an attached file (*Appendix 5*). Benthic and fish REA sites will be provided to the prior the beginning of each Leg in and excel file format.

D. Summary of Objectives

The ship will support assessment and monitoring operations in the waters surrounding PRIAs and the Mariana Archipelago. The scientific objectives of this project are to:

1. Conduct ecosystem monitoring of the species composition, abundance, percent cover, size distribution, recruitment and general health of the fishes, corals, other invertebrates, and algae of the shallow water (< 35 m) coral reef ecosystems of PRIAs and the Mariana Archipelago.

2. Deploy, retrieve and/or service an array of Subsurface Temperature Recorders (STRs), Autonomous Reef Monitoring Structures (ARMS, Calcification Accretion Units (CAUs), Bioerosion Monitoring Units (BMUs), Ecological Acoustic Recorders (EARs), moored Acoustic Doppler Current Profilers (ADCPs) as well as anchored arrays consisting of a portable underwater collector (PUC), a Conductivity Temperature Pressure (CTP) recorder, and a thermistor string to allow remote long-term monitoring of oceanographic and environmental conditions affecting the coral reef ecosystems of PRIAs and the Mariana Archipelago. This effort is in support of the CREIOS.

3. Monitor nearshore physical and ecological factors associated with ocean acidification and general water quality, including analysis of seawater for nutrients, chlorophyll concentration, salinity, temperature, dissolved oxygen, transmissivity, total alkalinity, and dissolved inorganic carbon. These parameters will be measured via the collection of water in Niskin bottles and conductivity-

temperature-depth (CTD) casts. Shallow-water CTDs are conducted from small boats to a depth of ~30 m.

4. Collect shallow water coral cores to examine calcification/growth rates in recent decades and assess potential early impacts of ocean acidification. Coring operations will be conducted opportunistically (as scientific dives).

5. Conduct plankton tows to expand upon the documentation of the marine biota on coral reefs.

6. Conduct shipboard ADCP surveys around reef ecosystems to examine physical and biological linkages supporting and maintaining the island ecosystems.

7. 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.

8. Conduct investigations of marine microbial communities, including the collection of specimens via water sampling, plankton tows, coral/algal biopsies and benthic grab samples.

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

10. Investigate coral bleaching events impacts and recovery at Jarvis, Howland and Baker Islands via Benthic and Oceanographic surveys

11. Conduct a variety of shallow water oceanographic experiments to investigate the impacts of climate change on coral reefs in partnership with scientists from the Woods Hole Oceanographic Institution

12. Deploy and recovery of High Frequency Acoustic Recording Packages (HARPs) used for long term monitoring of cetaceans in the Pacific Island Region.

13. Conduct 4 shipboard CTD casts at each island 15 km offshore in each cardinal direction along with a concurrent water sample using a CREP-provided shallow water CTD unit and a remotely-triggered niskin bottle. The cast and water collection will be conducted by CREP Ocean and Climate Change Team personnel and/or the trained survey technician along with a deckhand utilizing the ships CTD winch. If a hand lowered cast may be conducted safely, the CTD winch may not be used. These will ideally occur at 1715 after each day of operating around an island. Multiple CTDs may need to be conducted in a given evening if the ship will not be at an island for 4 nights. These offshore CTDs may not be conducted in circumstances where the time taken to conduct them would cause a delay to the start of the next operational day.

14. Use photomosaics to collect coral community composition data at climate stations and contextualize any physical and/or biological changes recorded at the climate stations over time. The collection of photomosaics is straightforward and requires little special equipment or dive operations. The mosaic camera system consists of two SLR Nikon D7000 cameras and a single GoPro video camera

mounted to a custom frame. To obtain continuous coverage of the reef floor within a plot, the diver operating the camera system swims a gridded pattern approximately 1.5 m above the average depth of the plot at speeds sufficient to maintain maximum overlap between adjacent images. Depending on local conditions a single mosaic will take 45–60 minutes. To calibrate mosaic images, a second diver collects a series of detailed measurements between a number of temporary and/or permanent reference markers deployed during surveys.

E. Participating Institutions

- Joint Institute for Marine and Atmospheric Research (JIMAR)
- NOAA Pacific Islands Fisheries Science Center (PIFSC):
  - Coral Reef Ecosystem Program (CREP)
  - PIFSC Scientific Operations Division (SOD)
- NOAA Diving Program (NDP)
- San Diego State University (SDSU)
- NOAA Commissioned Officer Corps (NOAA CORPS)
- Scrips Institute of Oceanography (SIO)
- Woods Hole Oceanographic Institution (WHOI)
- University of Hawai`i (UH)

F. Personnel/Science Party

Leg I

Name (Last, First)	Title	Gender	Affiliation	Nationality	Date Embark	Date disembark
Lino, Kevin	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
Heenan, Adel	Fish Diver	Female	JIMAR/CREP	UK	TBD	TBD
Purves, Andrew	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
Wester, Tate	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
Weible, Rebecca	Fish Diver	Female	UH	USA	TBD	TBD
Swanson, Dione	Benthic Diver	Female	JIMAR/CREP	USA	TBD	TBD
Ferguson, Marie	Benthic Diver	Female	JIMAR/CREP	USA	TBD	TBD
Lichowski, Frances	Benthic Diver	Female	JIMAR/CREP	GER (USA Perm. resident)	TBD	TBD
McCoy, Kaylyn	Tow Diver	Female	JIMAR/CREP	USA	TBD	TBD
Gray, Andrew	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Schumacher, Brett	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Garriques, Joao	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Pomeroy, Noah	Instrumentation Diver	Male	JIMAR/CREP	USA	TBD	TBD
Morioka, James	Instrumentation Diver	Male	JIMAR/CREP	USA	TBD	TBD
Raja, Kristin	Instrumentation Diver	Female	NOAA CORPS	USA	TBD	TBD

Timmers, Molly	Instrumentation Diver	Female	JIMAR/CREP	USA	TBD	TBD
TBD	Instrumentation Diver	TBD	TBD	TBD	TBD	TBD
TBD	Photomosaic	TBD	SIO	TBD	TBD	TBD
TBD	Microbiologist	TBD	SDSU	TBD	TBD	TBD
TBD	Chamber Operator	TBD	NDP	TBD	TBD	TBD
Trick, Kevin	Data Manager	Male	JIMAR/CREP	USA	TBD	TBD
TBD	Ocean Acidification	TBD	WHOI	TBD	TBD	TBD

Leg II

Name (Last, First)	**Title**	**Gender**	**Affiliation**	**Nationality**	**Date Embark**	**Date disembark**
Gorospe, Kelvin	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
Giuseffi, Louise	Fish Diver	Female	SOD	USA	TBD	TBD
Purves, Andrew	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
Wester, Tate	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
TBD	Fish Diver	TBD	TBD	USA	TBD	TBD
Swanson, Dione	Benthic Diver	Female	JIMAR/CREP	USA	TBD	TBD
TBD	Benthic Diver	TBD	TBD	TBD	TBD	TBD
TBD	Benthic Diver	TBD	TBD	TBD	TBD	TBD
Asher, Jake	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Gray, Andrew	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Schumacher, Brett	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Garriques, Joao	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Oliver, Thomas	Instrumentation Diver	Male	JIMAR/CREP	USA	TBD	TBD
Morioka, James	Instrumentation Diver	Male	JIMAR/CREP	USA	TBD	TBD
Raja, Kristin	Instrumentation Diver	Female	NOAACORPS	USA	TBD	TBD
Reardon, Kerry	Instrumentation Diver	Female	JIMAR/CREP	USA	TBD	TBD
TBD	Instrumentation Diver	TBD	TBD	TBD	TBD	TBD
TBD	Photomosaic	TBD	SIO	TBD	TBD	TBD
TBD	Microbiologist	TBD	SDSU	TBD	TBD	TBD
TBD	Chamber Operator	TBD	NDP	TBD	TBD	TBD
Trick, Kevin	Data Manager	Male	JIMAR/CREP	USA	TBD	TBD
TBD	Instrumentation Diver	TBD	TBD	TBD	TBD	TBD

Leg III

Name (Last, First)	Title	Gender	Affiliation	Nationality	Date Embark	Date Disembark
Ayotte, Paula	Fish Diver	Female	JIMAR/CREP	USA	TBD	TBD
Zamzow, Jill	Fish Diver	Female	JIMAR/CREP	USA	TBD	TBD
Gray, Andrew	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
Gorospe, Kelvin	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
Asher, Jacob	Fish Diver	Male	JIMAR/CREP	USA	TBD	TBD
Vargas-Angel, Bernardo	Benthic Diver	Male	JIMAR/CREP	USA	TBD	TBD
TBD	Benthic Diver	TBD	TBD	TBD	TBD	TBD
TBD	Benthic Diver	TBD	TBD	TBD	TBD	TBD
Lino, Kevin	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Gray, Andrew	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Lichowski, Frances	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Garriques, Joao	Tow Diver	Male	JIMAR/CREP	USA	TBD	TBD
Morioka, James	Instrumentation Diver	Male	JIMAR/CREP	USA	TBD	TBD
TBD	Instrumentation Diver	TBD	TBD	TBD	TBD	TBD
TBD	Instrumentation Diver	TBD	TBD	TBD	TBD	TBD
Reardon, Kerry	Instrumentation Diver	Female	JIMAR/CREP	USA	TBD	TBD
TBD	Instrumentation Diver	TBD	TBD	TBD	TBD	TBD
TBD	Photomosaic	TBD	SIO	TBD	TBD	TBD
TBD	Microbiologist	TBD	SDSU	TBD	TBD	TBD
TBD	Chamber Operator	TBD	NDP	TBD	TBD	TBD
TBD	Data Manager	Male	JIMAR/CREP	TBD	TBD	TBD
TBD	Instrumentation Diver	TBD	TBD	TBD	TBD	TBD

G. Administrative

1. Points of Contacts:

Chief Scientists*:

Brett Schumacher, PhD. (Leg 1)
brett.schumacher@noaa.gov
NOAA IRC
Attn: NMFS / PIFSC / CREP
1845 Wasp Blvd, Building 176, Honolulu, HI 96818
808-725-5405

Thomas Oliver, PhD. (Leg 2)
thomas.oliver@noaa.gov
NOAA IRC
Attn: NMFS / PIFSC / CREP
1845 Wasp Blvd, Building 176, Honolulu, HI 96818
808-725-5444

Kelvin Gorospe, PhD (Leg 3)
kelvin.gorospe@noaa.gov
NOAA IRC
Attn: NMFS / PIFSC / CREP
1845 Wasp Blvd, Building 176, Honolulu, HI 96818
808-725-5488

Project Operations Lead*:

Joao Garriques (Leg *1-3)*
Joao.Garriques@noaa.gov
NOAA IRC
Attn: NMFS / PIFSC / CREP
1845 Wasp Blvd, Building 176, Honolulu, HI 96818
808-725-5407

Ship Operations Officer:

Bryan Stephen
OPS.Hiialakai@noaa.gov
NOAA Ship *Hi'ialakai*
1897 Ranger Loop, Building 184, Honolulu, HI 96818
In-Port: 808-725-5780
At Sea: 808-684-3235

* The Leg I Chief Scientist and Project Operations Lead are the designated program points of contact for all project planning and pre-departure correspondence with the ship.

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

This project will be conducted with all the appropriate permits in place. Permit numbers, permit holders and date ranges will be provided via Project Instructions Amendment once the permit approvals are received.

In order to conduct monitoring surveys and sample collections in the waters of Wake Island within the Pacific Remote Islands Marine National Monument,

letters of notification and request for support have been submitted to the Base Commander, Wake Island and the Chief, Support agreements.

The following are the Permits needed for the project.

a. US National Park Service, Guam: Scientific Research and Collecting Permit

b. US Fish and Wildlife Service, Guam National Wildlife Refuge: Special Use Permit for RAMP in or around Ritidian Point

c. Department of Agriculture and Wildlife Resources, Guam: RAMP collection and monitoring activities within Guam Marine Preserves

d. CNMI Department of Lands and Natural Resources, Division of Fish and Wildlife: Scientific Research License

e. CNMI Division of Environmental Quality, Coastal Resource Management Office: Special Research Permit

f. Refuges: Special Use Permit for research in Rose Atoll, Palmyra Atoll, Kingman Reef, Howland Island, Baker Island, and Jarvis Island National Wildlife Refuges, USFWS permit (pending)

g. Department of the Army Nationwide Permit

h. National Environmental Policy Act, Programmatic Environmental Assessment for Research Activities Conducted by the Coral Reef Ecosystem Division, PIFSC, 2010-2015*. Finding of No Significant Impact (FONSI) signed May 7, 2010. (http://www.pifsc.noaa.gov/nepa/CRED_Programmatic%20Environmental%20Assessment_Final.pdf) *It is noted that while this NEPA document was originally intended to carry out program-level research activities for a period of five years, the analysis in the EA was intended to span an indefinite period of time, and is not limited to a five year period (see section 2.3 in EA).

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

Weather, equipment failures, and scheduling problems are unpredictable. As such, the following intended itinerary should be considered as only a guide for survey progression. In particular, the order in which survey areas are worked within a single island area or among islands within close proximity may be altered as appropriate based on weather, sea conditions, or the progress of the survey. Transit estimates have been calculated based on a ship's speed of 9.7 knots westbound, 9.2 knots north and southbound, and 8.7 knots eastbound.

Pre-Project

Mar 8-15	Loading of 10' ARMS Lab container, boat cradle and chest freezer with Navy crane. Small boat fuel (gasoline). Conduct small boat and davit familiarization for scientific personnel. Conduct station walk-throughs and dive neurological examinations for scientific personnel joining on Leg II and Leg III.

Leg I:

Mar 16	**Depart Pearl Harbor:** Embark full scientific complement at Ford Island. Depart the NOAA pier and begin transit to Fuel Pier. Depart Fuel Pier and begin transit to Jarvis Island (~1,300 nmi, ~5d, 21h). Conduct ship tasks (e.g. welcome aboard brief, drills)
Mar 17-22	**Transit:** Continue transit to Jarvis Island. Complete operational briefings, pre-dive neurological assessments, and station walk-throughs.
Mar 22-26	**Jarvis Island:** Arrive Jarvis Island for a half day of operations on March 22. Operations to be conducted while at Jarvis Island include fish and benthic REA surveys; towed-diver surveys; ocean and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 10 plankton tows will be collected. Night operations include CTD and ADCP transects each night around Jarvis Island. Depart Jarvis Island March 26th and transit to Baker Island (~990 nmi, ~4d, 6h; *adjusted 4d, 5h due to time zone)
March 27-30	**Transit:** Continue transit to Baker Island.
Mar 31	**Baker Island:** Arrive Baker Island for a full day of operations. Operations to be conducted while at Baker Island include fish and benthic REA surveys; towed-diver surveys; ocean and climate

	change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 2 plankton tows will be collected. Deploy a HARP at Baker. Night operations include CTDs, ADCP transects and multi-beam mapping around Baker Island. Depart Baker Island March 31st and transit to Howland Island (~40 nmi, ~5h)
Apr 1	**Howland Island:** Arrive Howland Island for a full day of operations. Operations to be conducted while at Howland Island include fish and benthic REA surveys; towed-diver surveys; ocean and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 2 plankton tows will be collected. Night operations include CTDs and ADCP transects each night around Howland Island. Deploy and recover of Howland Island HARP while dive operations are in place. Depart Howland Island on April 1st and transit to Wake Atoll (~1480nmi, ~6d, ~9h; adjusted 7d, 8h due to Date Line and time zones)
Apr 2-8	**Transit:** Continue transit to Wake Atoll.
Apr 9-13	**Wake Atoll:** Arrive Wake Atoll for a full day of operations. Operations to be conducted while at Wake Atoll include fish and benthic REA surveys; towed-diver surveys; ocean and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 10 plankton tows will be collected. Night operations include CTDs and ADCP transects and multi-beam mapping each night around Wake atoll. Depart Wake Atoll on April 13th and transit to Apra Harbor, Guam (~1325nmi, ~6d h; adjusted to 5d, 23h due to time zones).
Apr 14-18	**Transit:** Continue transit to Apra Harbor, Guam.
Apr 19	**Guam:** Arrive Apra Harbor, Guam. End of Leg I. Most of the scientific staff will remain on board during the in-port for Leg II.

	Temporary offloading of HARP unit alongside the pier will be required for program staff to service unit.
Apr 20-22	**Apra Harbor, Guam in-port period:** Disembark departing scientists. Ship refueling, small boat fuel resupply and stores resupply to occur during in-port period. Conduct small boat familiarization, station walk-throughs and dive neurological examinations for incoming partners and scientists not able to complete this prior to departure from Honolulu
Apr 23-24	**Apra Harbor, Guam in-port period:** Conduct small boat operations to train upcoming partners. Program boats will be used for this purpose (Minimal ship support is required. Chamber Operator, DMT, Engineers and Crane Operator, line handlers will be needed). .

Leg II:

Apr 25-May2	**Depart Apra Harbor, Guam:** Depart Apra Harbor to continue Guam Dive operations. Small boats (except pier side davit boat) may be launched prior the ship getting underway if working on the vicinity of Apra Harbor. Operations to be conducted while at Guam include fish and benthic REA surveys; towed-diver surveys; cryptofauna and oceanography and climate change studies, including moored instrument deployments (deploy: ARMS, STRs, BMUs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection up to six 50cm coral cores, collection of photomosaics, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 14 plankton tows will be collected. Night Operations include CTD ADCP transects and multi-beam mapping around Guam. Depart Guam on May 2nd and transit to Rota (~50nmi, ~6h).
May 3-4	**Rota:** Arrive Rota May 3rd for a full day of operations. Operations to be conducted while at Rota include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 6 plankton tows will be collected. Night operations include CTDs and ADCP transects each night around Rota

May 5	**Rest day:** If necessary and feasible conduct multi-beam mapping around Rota or Aguijan.
May 6	**Rota:** Continue operations in Rota. Depart Rota and transit to Saipan (~75nmi, ~9h)
May 7-13	**Saipan:** Arrive Saipan on the 7th for a full day of operations. Operations to be conducted while at Saipan include fish and benthic REA surveys; towed-diver surveys; cryptofauna and oceanography and climate change studies, including moored instrument deployments (deploy: ARMS, STRs, BMUs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 14 plankton tows will be collected. Night operations include CTDs, ADCP transects and multi-beam mapping each night around Aguijan (30nmi, 3h). Depart Saipan on the 13th of May and transit to Aguijan (~35nm, ~4h)
May 14-15	**Aguijan:** Arrive Aguijan May 14th for a full day of operations. Operations to be conducted while at Aguijan include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 4 plankton tows will be collected. Night operations include CTDs, ADCP transects and multi-beam mapping around Aguijan. Depart Aguijan on April 15th and transit to Tinian (~15nmi, ~2hr).
May 16	**Rest Day**: If necessary and feasible conduct multi-beam mapping around Rota or Aguijan.
May 17-19	**Tinian:** Arrive Tinian for a full day of operations. Operations to be conducted while at Tinian include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A

	total of 6 plankton tows will be collected. Recover and deploy Tinian HARP. Night operations include CTDs, ADCP transects and multi-beam mapping around Aguijan (~20nmi, ~2h). Depart Tinian on 19th and transit to Saipan (~20nmi, ~2h).
May 20	**Saipan:** Arrive Tanapag Harbor. Prior to arrival recover Saipan HARP prior to pulling in to harbor. Temporary offloading of HARP unit alongside the pier will be required for program staff to service unit.
May 21-24	**In-port Saipan:** Disembark/embark departing scientists. Resupply small boat fuel. Conduct small boat familiarization, station walk-throughs and dive neurological examinations for scientists unable to attend walkthroughs prior to departure from Pearl Harbor.
Leg III:	
May 25	**Depart Saipan Harbor:** Deploy Saipan HARP after departure. Upon completion begin transit to Alamagan (~145 nmi, ~16h).
May 26	**Alamagan:** Arrive Alamagan for a full day of operations. Operations to be conducted while at Alamagan include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 2 plankton tows will be collected. Night operations include CTDs and ADCP transects around Alamagan. Depart and transit to Agrihan (~70nmi, ~8h)
May 27-28	**Agrihan:** Arrive Agrihan for a full day of operations. Operations to be conducted while at Agrihan include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 6 plankton tows will be collected. Night operations include CTDs and ADCP transects around Agrihan. Depart on May 28th and transit to Pagan (~50nmi, ~6h).

May 29-Jun 4	**Pagan:** Arrive Pagan on May 29th for a full day of operations. Operations to be conducted while at Pagan include fish and benthic REA surveys; towed-diver surveys; cryptofauna and oceanography and climate change studies, including moored instrument deployments (deploy: ARMS, STRs, BMUs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 14 plankton tows will be collected. Night operations include CTDs and ADCP transects each night around Pagan.
Jun 5	**Rest day:** Recover and deploy HARP at Pagan. Depart upon deployment and transit to Farallon de Pajaros (~160nmi, ~17h). No additional scientific dive operations are scheduled this day.
Jun 6	**Farallon de Pajaros (FDP):** Arrive FDP for a full day of diving operations. Operations to be conducted while at FDP include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 2 plankton tows will be collected. Night operations include CTDs ADCP transects around FDP. Depart and transit to Maug (~40nmi, ~6h).
Jun 7-13	**Maug:** Arrive Maug on June 7th for a full day of operations. Operations to be conducted while at Maug include fish and benthic REA surveys; towed-diver surveys; cryptofauna and oceanography and climate change studies, including moored instrument deployments (deploy: ARMS, STRs, BMUs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 14 plankton tows will be collected. Night operations include CTDs and ADCP transects each night around Maug. Depart on June 13th and transit to Asuncion (~30nmi, ~4h)
Jun 14-15	**Asuncion:** Arrive Asuncion for a full day of diving operations. Operations to be conducted while at Asuncion include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments

	(deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 6 plankton tows will be collected. Night operations include CTDs, ADCP transects and multi-beam mapping around Asuncion. Depart on the 15th and transit to Zelandia Bank (~170nmi, ~19h)
Jun 16	**Zelandia Bank/Rest day:** Arrive Zelandia for one dive only. Launch a program boat with Instrumentation divers (two) and retrieve 1 STR. Dives will be planned such that the divers involved do not exceed the 10 consecutive dive-day rule. No additional scientific dive operations are scheduled this day. Depart and continue transit to Sarigan (~15nmi, ~3h)
Jun 17-18	**Sarigan:** Arrive Sarigan for a full day of diving operations. Operations to be conducted while at Sarigan include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 6 plankton tows will be collected. Night operations include CTDs, ADCP transects and multi-beam mapping around Anatahan. Depart Sarigan on June 18th and transit to Guguan (~40nmi, ~6h)
Jun 19	**Guguan:** Arrive Guguan for a full day of diving operations. Operations to be conducted while at Guguan include fish and benthic REA surveys; towed-diver surveys; oceanography and climate change studies, including moored instrument deployments (deploy: STRs and CAUs as well as temporary deployment [up to 48hrs] of an anchored array consisting of PUCs, ADCP, CTP, and thermistor string), collection of photomosaics, collection up to six 50cm coral cores, collection of carbonate chemistry and small boat CTD casts at all the CAU and coring sites, and microbial collections at one or two sites per day. A total of 2 plankton tows will be collected. Depart Guguan and transit to Saipan (~130nmi, ~14h).
Jun 20	**Saipan Harbor:** Arrive Saipan Harbor. If necessary, launch small boats to complete Saipan dive operations before pulling into port. Small boats may meet the ship at the pier after operations, with the exception of pier-side davit boat. End of Leg III

Jun 21-23	**Saipan In-port:** Disembark all scientific party. Resupply ship stores.
Jun 24	Depart Saipan Harbor and transit to Pearl Harbor, Hawaii (3,235nmi, ~16d 2h: adjusted to 15d 6h due to Date Line and time zone crossing).
Jun 25-Jul 8	**Transit:** Continue transit to Pearl Harbor.
Jul 9	**End of Project:** Arrive Pearl Harbor, Hawaii.

B. Staging and Destaging

Staging: Staging of large scientific gear and equipment will begin the week of March 6th, or as otherwise coordinated with the Command. Assistance from the ship's personnel for craning aboard large gear and for loading small boat gasoline (delivered by truck and pumped directly into the ship's hip tanks) will be necessary. Ethyl alcohol will be delivered in and transferred to the Ethanol Tank on the the ship's quick release rack. Hand carried items will be loaded in lab areas throughout the week prior to departure. All scientists anticipate embarking the vessel at Ford Island, Pearl Harbor on March 16, 2016, and will be aboard for the fueling. The ship itself will not return to the pier prior to beginning transit to Jarvis Island.

Mid-project Refueling: Replenishment of unleaded gasoline will be required at Guam and Saipan during scheduled in-ports. Support from ships personnel is necessary to arrange the logistics of purchase, transport and transfer of additional unleaded gasoline during in-ports. Such logistics are typically facilitated through the ship's Port Agent. Payment of gasoline will be made using program accounting codes or program provided credit card. *Hi'ialakai* will be responsible for providing diesel fuel for their jet boats. Ship refueling will take place in Guam during the first in-port.

Destaging: Full off-load of all program-provided gear and small boats will begin in coordination with the Command upon return to Pearl Harbor, July 9th, the program boats and cradles will be priority items for offload as they will be needed for a subsequent project on another ship.

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 Rapid Ecological Assessments (REAs) and the continuation of long-term monitoring of reef fish, corals, other invertebrates, and algae, and oceanographic monitoring of the coral reef ecosystems of 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 29-ft Metal Shark (HI-1), 26-ft Ambar (HI-2), and 17-ft Northwind (HI-3), as well as two program-provided 19-ft SAFE Boats will be required to support the REA, towed diver, instrumentation, and microbial survey teams on a daily basis.

The REA and towed-diver surveys will include monitoring of species composition, abundance, size distribution, and spatial distribution of reef fishes, corals, other invertebrates, and algae of the region and will further ground-truth shallow-water benthic habitat maps. Benthic community structure and demography parameters, including percent cover, taxonomic richness, density, size-class distribution, and health condition, will be assessed along line and belt transects to provide spatial-temporal appraisals of coral reef dynamics in the region. Scientists may also obtain limited specimens of algae, corals, and other invertebrates. All deployments, retrievals, and specimen collections will be conducted as stipulated through pertinent Agency-approved Special Activity Permit guidelines.

A number of Autonomous Reef Monitoring Structures (ARMS) will be recovered and replaced or newly installed at select locations by the Ocean and Climate Change Team. These small units are designed to mimic the complexity of the coral reef structure and to attract small invertebrates to recruit within them. Samples from ARMS will be processed onboard in a program-provided lab space, preserved in ethanol, and stored in the scientific freezer until the ship returns to Pearl Harbor.

Calcification Accretion Units (CAUs) will be recovered and replaced or newly installed at select locations. CAUs serve as a mechanism to quantify accretion rates of calcifying coralline algae and scleractinian corals; this information will allow for comparisons to determine possible consequences of increased ocean acidity and lowered aragonite saturation states. Additionally, a Bioerosion Monitoring Unit (BMU) will be installed on CAUs at select locations. Each BMU is made of a 1cm x 2cm x 5cm block of calcium carbonate rock mounted on a similarly sized piece of polyvinylchloride plate. The BMUs rest flush on the seafloor and serve as a mechanism to quantify bioerosion rates across coral reefs experiencing different physical oceanography and local human impacts. BMUs will be retrieved on a subsequent mission and measured for changes in weight and scanned for changes in density using microcomputed tomography.

Approximately 123 STRs, 445 CAUs, 48 ARMS, and 85 BMUs will be deployed and 123 STRs, 445 CAUs, 48 ARMS, 28 anchors, 1 SST buoy, and 5 EARs will be retrieved. In addition, the following instruments will be deployed and retrieved during the same project: 8 moored ADCPs deployed and retrieved within one month and 9 anchored arrays consisting of a PUC, ADCP, CTP, and thermistor string deployed and retrieved

within 48 hours. Retrieved anchors will be secured on stackable aluminum pallets for transport back to Pearl Harbor.

Photomosaics will also be used to collect coral community composition data at climate stations and contextualize any physical and/or biological changes recorded at the climate stations over time. The collection of photomosaics is straightforward and requires little special equipment or dive operations. The mosaic camera system consists of two SLR Nikon D7000 cameras and a single GoPro video camera mounted to a custom frame. The camera used to generate processed photomosaics uses a wide-angle lens (18 mm) to ensure high overlap among adjacent images. The other camera uses a longer focal length lens (55 mm) to capture images with sub-cm spatial resolution. Image frames from the extreme wide angle GoPro video camera can be used for photomosaic processing in the rare event of missing imagery for a given portion of the reef. To obtain continuous coverage of the reef floor within a plot, the diver operating the camera system swims a gridded pattern approximately 1.5 m above the average depth of the plot at speeds sufficient to maintain maximum overlap between adjacent images. Images are simultaneously captured every second from both DSLR cameras, while the GoPro continuously captures 30fps HD video. Lasers are mounted above the longer focal length camera to provide approximate scale in the high resolution imagery. Depending on local conditions a single mosaic will take 45–60 minutes. To calibrate mosaic images, a second diver collects a series of detailed measurements between a number of temporary and/or permanent reference markers deployed during surveys.

As part of CREP's effort to investigate ocean acidification and carbonate chemistry, the Ocean and Climate Change Team may also obtain coral cores at several locations, if time and operational conditions allow. Up to 3 cores may be collected with a diver-held pneumatic drill at each given site. Each core would measure 20-40 cm in length and 3.8 cm in diameter. Locations for coring will not be planned in advance. Coring operations will be conducted opportunistically as appropriate, and as a scientific dive. In addition, underway shipboard oceanographic measurements (ADCP, TSG, and SCS) will be recorded throughout the duration of the project and water samples may be collected from small boats for nutrient, chlorophyll, 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 select REA sites 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.

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).

Coral reef biodiversity remains greatly under described, especially with regards to the smaller invertebrate animals that reside in and on the reef. Many of these organisms have planktonic larvae that can be collected and thus their occurrence documented via plankton samples. A plankton net 50 cm diameter with a 80 µm mesh size having a 1 L cod end jar attached to net with flow meter will be trailed a few yards behind the stern of a small boat. Each tow will be assigned a unique station number with corresponding GPS coordinates, date & time recorded for start and finish of each tow. The tows will be just below the surface, for 5 minutes and the small boat will be going just fast enough for net to be tight and flow meter to run (1–2 knots). The net will be brought back onto the small boat and processed in the field. The outside of the plankton net will be washed down with seawater applied to outside collecting flora and fauna in the cod end. Depending on the number of days spent at each island, we expect to conduct 5–20 plankton tows per island, for a maximum of 110 plankton tow samples for the entire cruise. This project is led by Gustav Paulay at the Florida Museum of Natural History.

HARPs are passive acoustic recorders. They are deployed at various sites around the Pacific in depths of 600-800m. Their purpose is to record the occurrence of cetaceans. For this project Four HARPs will be retrieved and five HARPs will be deployed. The recoveries will occur at Wake Atoll, Saipan, Tinian, and Pagan. Deployments will occur at Howland Island, Wake Atoll, Saipan, Tinian, and Pagan.

Snorkeling Operations

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

Small Boat Operations

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 Operations

Multi-beam mapping requires the need of CTD casts for the purpose of calculating sound velocity profiles. The program will be providing a CTD and cage for this purpose. Such surveying would be undertaken on a not-to-interfere basis with the ship's primary mission. The program will also like to take offshore CTDs transects and water samples associated with CTDs. The program will be providing CTD and niskin bottle.

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 encompassing Legs I – III of HA-17-01 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.

NMFS employees are not exempt from the requirements of the Marine Mammal Protection Act (MMPA) or the Endangered Species Act (ESA). PIFSC has developed mitigation measures for its fisheries and ecosystem research projects to avoid take and to 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/nepa-permits/protected-species-mitigation-measures and on the ship's bridge.

1. "Take" of Protected Species

    a. Under the MMPA and ESA 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 is 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 ship's Commanding Officer then the PIFSC Director and Deputy Director IMMEDIATELY via IRIDIUM, INMARSAT, and email. Samples should not be collected from any incidentally taken marine mammals, sea turtles, or seabirds.

III. Equipment

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

1. Equipment: To successfully meet the project objectives, the scientific complement 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
29-ft Metal Shark launch, HI-1
26-ft Ambar launch, HI-2
17-ft Northwind launch, HI-3
SCUBA compressor (Nitrox and Air)
Recompression chamber
Dive lockers
Stainless Steel Lockers (3)
Scientific freezer with shelving
Wet Lab faucets and drains
Acoustic Doppler Current Profiler (ADCP)
Scientific Computer System (SCS)
ThermoSalinoGraph (TSG)
Sea Surface Sound Velocity (SSSV)
Operational multibeam echo sounder
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
Gasoline storage tanks
Sufficient HAZMAT storage for 380L of ethanol

*These small but difficult to repair units are critical to the success and efficiency of our daily field operations. Resupply during operations in remote operations is not possible. Therefore, an adequate number of backups and spare parts must be on board the ship to ensure that research objectives are not compromised due to technical failures.

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

a. Assistance from the Command and ship's Deck Department in conducting davit hook checkouts for program personnel participating on Leg II and III prior to departure of HA-17-01.

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

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

d. Support from the Engineering and Deck departments prior to sailing to transfer 3.78 kL (1000 gallons) of program-provided gasoline into the ship's stainless steel fuel tanks to be used as outboard engine fuel. The gasoline will be delivered by truck to be pumped directly into the deck tanks.

e. Mid-project support will be necessary to assist in arranging the logistics of purchase, delivery, and transfer of additional unleaded gasoline during in-ports in both Guam and Saipan. Such logistics are typically facilitated by the Operations Officer through the ship's Port Agent. Payment of gasoline is made via DD1149(Guam) and PO (Saipan), using program accounting codes.

f. Support from the Engineering and Deck departments prior to sailing to transfer 380L of program-provided ethyl alcohol into the port fantail releasable rack. Additional storage capacity for 4 standard 19L (5 gal) carboys of waste ethanol generated during the project is necessary.

g. Support from the engineering department to transfer used engine motor oil to the ship's waste oil tanks from program small boats engines following maintenance.

h. *Hi'ialakai*'s HI-1 (Metal Shark), HI-2, and HI-3 will be required to support the program's dive teams on a daily basis. The ship should plan to provide coxswains for HI-1 (Metal Shark), HI-2, and HI-3 during all days of diving operations.

i. An experienced survey technician is requested to conduct multi-beam mapping operations and offshore CTD casts and water collections at CTD locations 15km offshore of each island at each cardinal direction.

j. Support from the medical officer and deck department to conduct neurological exams, boat familiarizations and station walk-throughs prior departure (as appropriate) and for new divers each leg. This may be required up to four times: once in Honolulu prior departure for all Leg II and Leg III personnel, once during the transit to Jarvis, once during Guam in-port (minimal new personnel) and once during Saipan in-port (minimal new personnel).

k. Operable Wet Lab facilities are necessary to support water sampling and the cleaning of field equipment. Approximately 16 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.

l. To support the ARMS Lab (10-ft container box), working power, freshwater, saltwater and compressed air sources and connections on the fantail will be necessary.

m. To support CAU processing, deck power connection 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).

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

o. To support mid-day swaps of personnel and gear from small boats during operational days, retrieving and re-launching boats as necessary.

p. Deck department will provide the needed personnel to assist with the retrieval and deployment of HARPs.

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

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 coxswains and routine maintenance for program provided boats.

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 material
- Confirmation that neutralizing agents and spill equipment were brought aboard sufficient to contain and cleanup all of the hazardous material brought aboard by the program
- Confirmation that chemical safety and spill response procedures were brought aboard

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

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

B. Inventory of Hazardous Materials

See *Appendix 8.*

C. Chemical safety and spill response procedures

See *Appendix 9.*

D. Radioactive Materials

No radioactive isotopes are planned for this project.

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

Collection of multibeam echo sounder data:

This ancillary project requires the assistance of the ship's Survey Technician, if aboard, or similarly trained individual, to run the multibeam surveying operation. Although extensive multibeam surveying has been conducted throughout the Pacific Islands Region, gaps in coverage remain that preclude characterizing the suitability of uncovered areas as habitat for deep sea corals, and may limit the ability to effectively survey and study these areas with other technologies. Using multibeam bathymetry data supplied by the PIFSC/CREP, services of the ship's Survey Technician or other trained shipboard personnel are requested to identify data gaps that are within range of shipboard multibeam echosounders and conduct survey operations to collect multibeam data to fill them. Multibeam data should be collected following standard practices for insuring high quality data, including collecting sound velocity profiles with a CTD and applying them before beginning a multibeam survey session, and every six hours thereafter, or more frequently if required. Surveying will be conducted on a not-to-interfere basis with the ship's primary mission. Data collected, including both multibeam and sound velocity data, should be provided to the Chief Scientist via the CREP data manager at the conclusion of the project using a program supplied hard drive and will include information on all system specifications, settings and offsets required to enable the development of metadata records meeting ISO 1911 standards.

Surveying should prioritize the shallowest gaps first and work progressively deeper. Depths as shallow as the ship is able to safely navigate may contain black corals, wire corals or other azoothanthellate coral species and are a high priority. It is anticipated that the NOAA Ship Okeanos Explorer will conduct multibeam surveying at depths below 500 m throughout the region between FY15 – FY17, so gaps at those depths should receive the lowest priority. However, if gaps shallower than 500 m have been filled and survey time is available, gaps between 500 m and 3000 m those deeper areas should also be surveyed.

VI. Disposition of Data and Reports

The project will follow the current PIFSC and CRED data management plans, both of which comply with NOAA requirements. 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*

1. OMAO Data

2. Program Data - *Under Development.*

Contact Nori Shoji (noriko.shoji@noaa.gov), Director, Science Operations Division, for PIFSC data policy updates.

B. Responsibilities: ***Under Development***

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, and fishes in the context of their benthic habitats and oceanographic environments. All data are quality assured, processed, and made available to region managers and stakeholders.

VII. Meetings, Vessel Familiarization, and Project Evaluations

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

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

C. Post-Project Meeting: The Commanding Officer is responsible for conducting a meeting no earlier than 24 hrs before or 7 days after the completion of a project to discuss the overall success and shortcomings 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 competition of 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 y 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. In addition, packed lunches will be required 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, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.corporateservices.noaa.gov/noaaforms/eforms/nf57-10-01.pdf.

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

The completed forms should be sent to the Regional Director of Health Services at the applicable Marine Operations Center. The NHSQ and Tuberculosis Screening Document should reach the Health Services Office no later than 4 weeks prior to the start of the

project to allow time for the participant to obtain and submit additional information should health services require it, before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of either form. Ensure to fully complete each form and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

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

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

Contact information:

Regional Director of Health Services
Marine Operations Center – Pacific
2002 SE Marine Science Dr.
Newport, OR 97365
Telephone 541-867-8822
Fax 541-867-8856
Email MOP.Health-Services@noaa.gov

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

C. Shipboard Safety

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. Steel-toed shoes are required to participate in any work dealing with suspended loads, including CTD deployments and recovery. The ship does not provide steel-toed boots. Hard hats are also required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

All scientists will comply with standing safety regulations of PIFSC and that of the vessel's Standing Orders from the Commanding Officer:

E. 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 it must be arranged at least 30 days in advance.

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
Iphone	*Scientist*	*MAC OS*	*21:34:6K:P8:W6:77*
Laptop	*Scientist*	*Windows XP*	*23:34:6K:P8:M6:77*

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

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course prior to embarking. Arrangements to take the Course and/or achieve security clearance for any non-NOAA computers should be coordinated with PIFSC/CREP administration well in advance of the project.

F. Foreign National Guests Access to OMAO Facilities and Platforms

The foreign national participants for project HA-17-01 are Adel Heenan and no others. Chamber Operator TBD will serve as the onboard foreign national sponsor for the participant.

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow'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 to provide 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 - 8 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 Leg I

Appendix 2: Operating Area for Leg II

Appendix 3: Operating Area for Leg III

Appendix 4: Maps of Proposed Survey Polygons

Appendix 5: The Station/Waypoint List for instrument deployments and retrievals

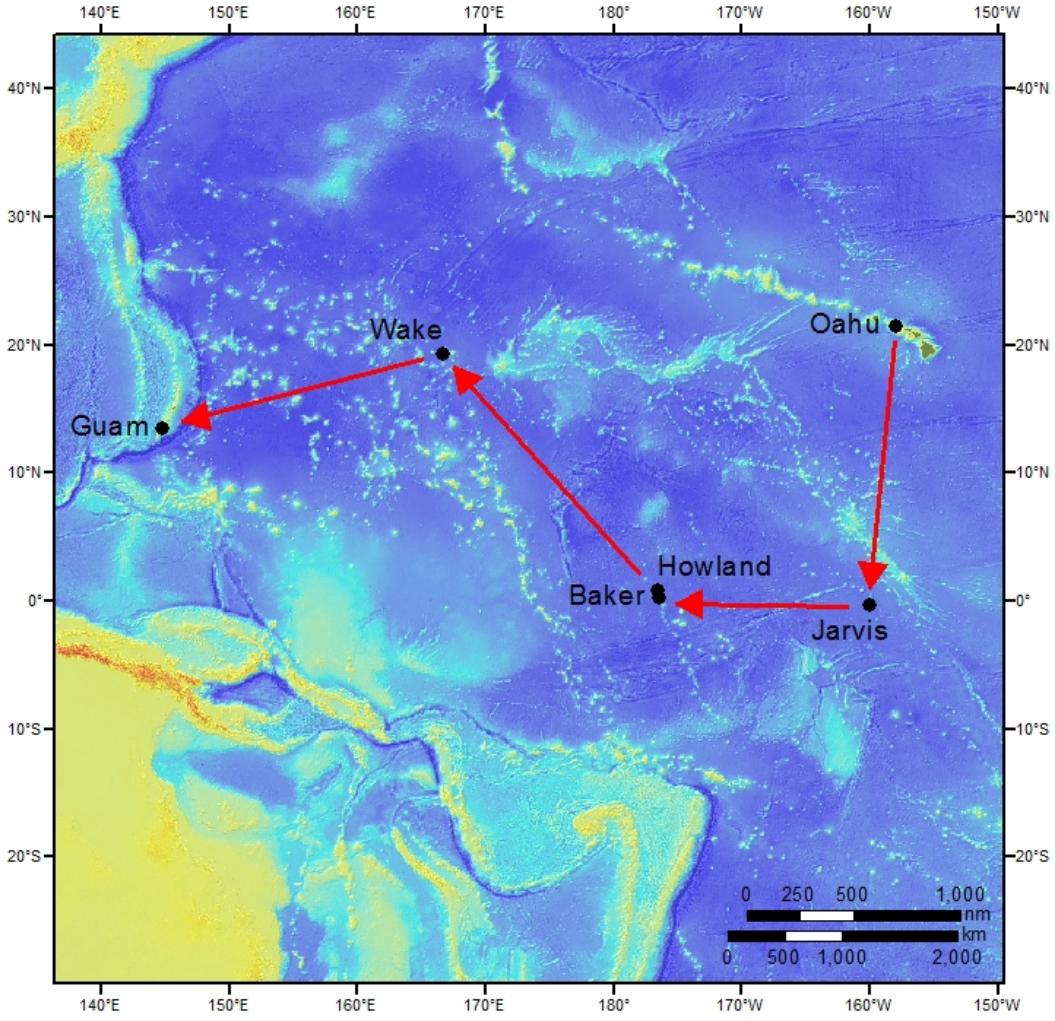
Appendix 6: Dive Plans

Appendix 7: Program full equipment load list

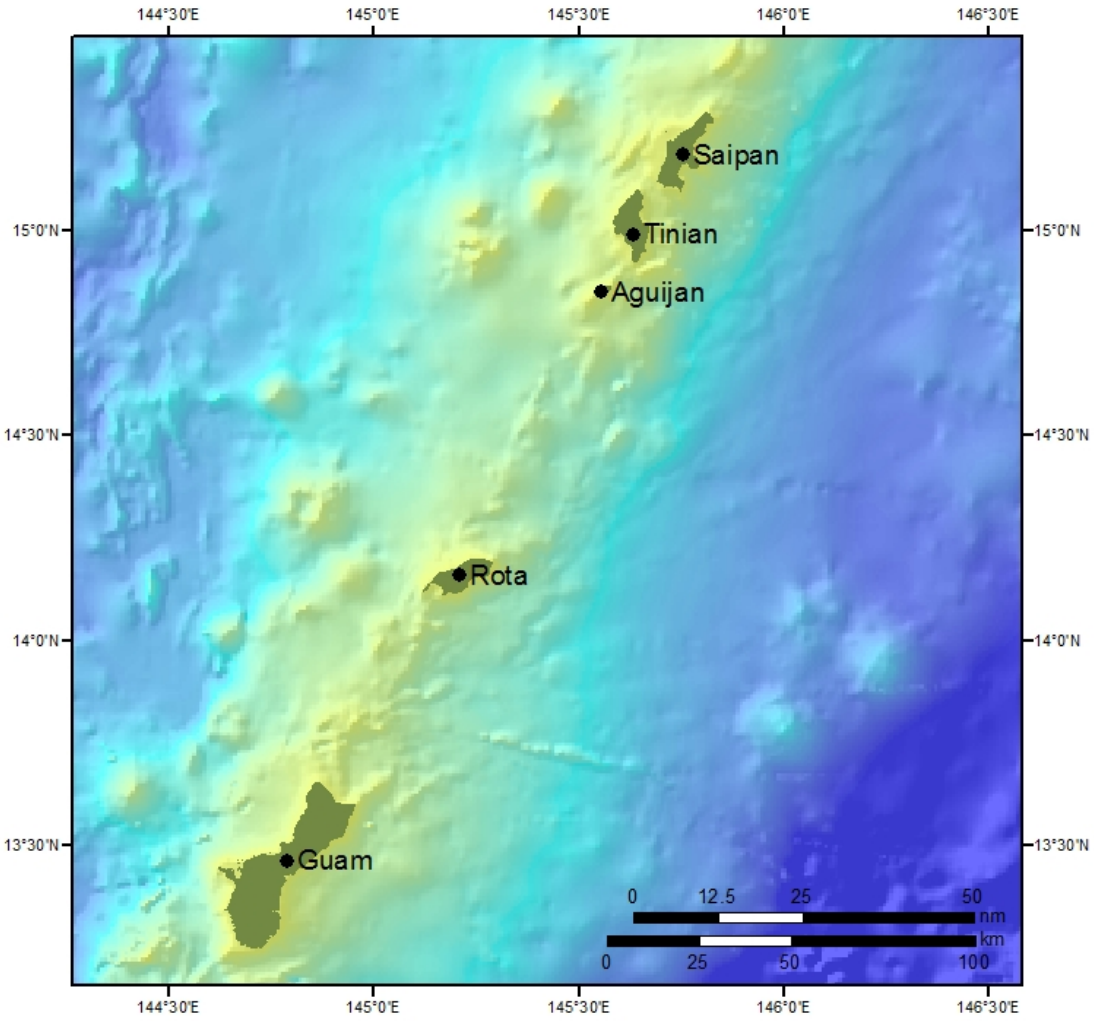
Appendix 8: Inventory of Hazardous Material

Appendix 9: Chemical Safety and Spill Response Procedures

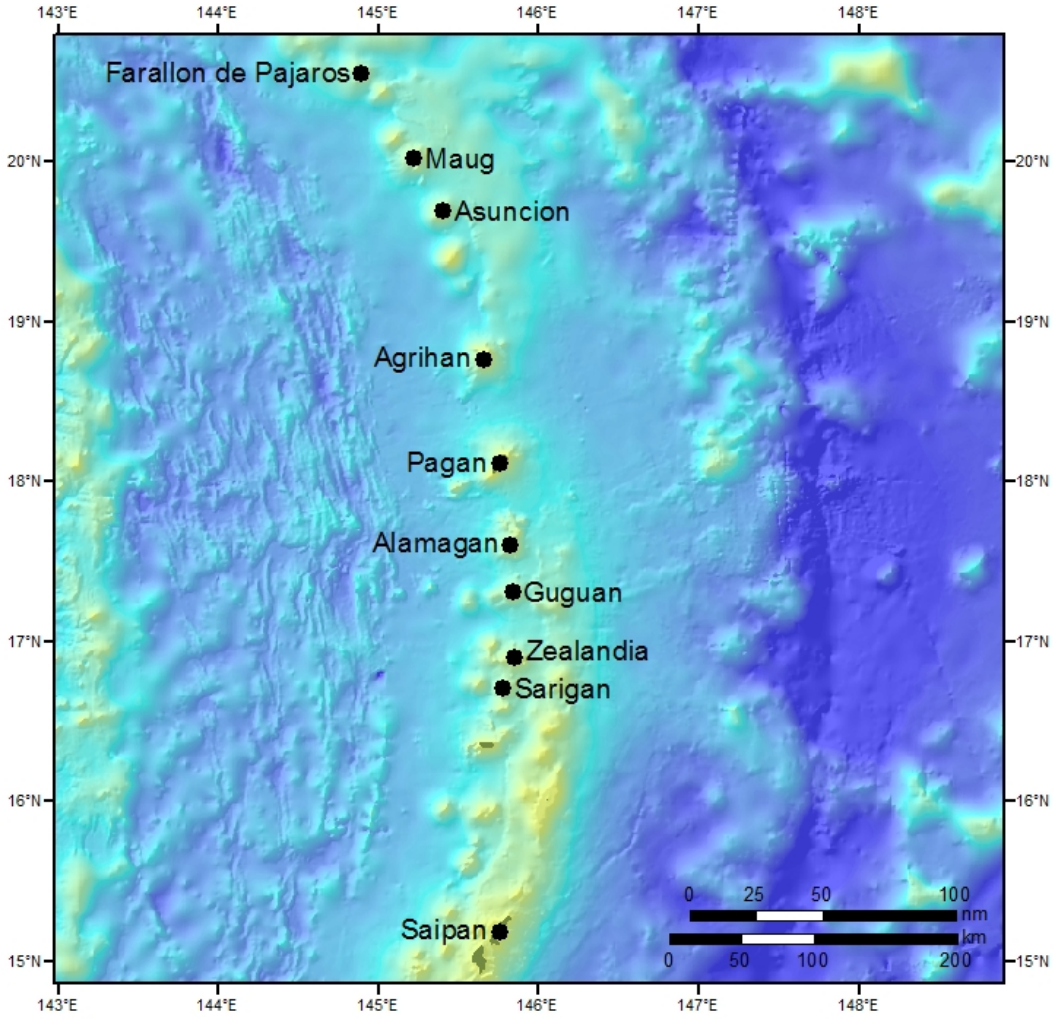
Appendix 1: **Operating Area for Leg I**



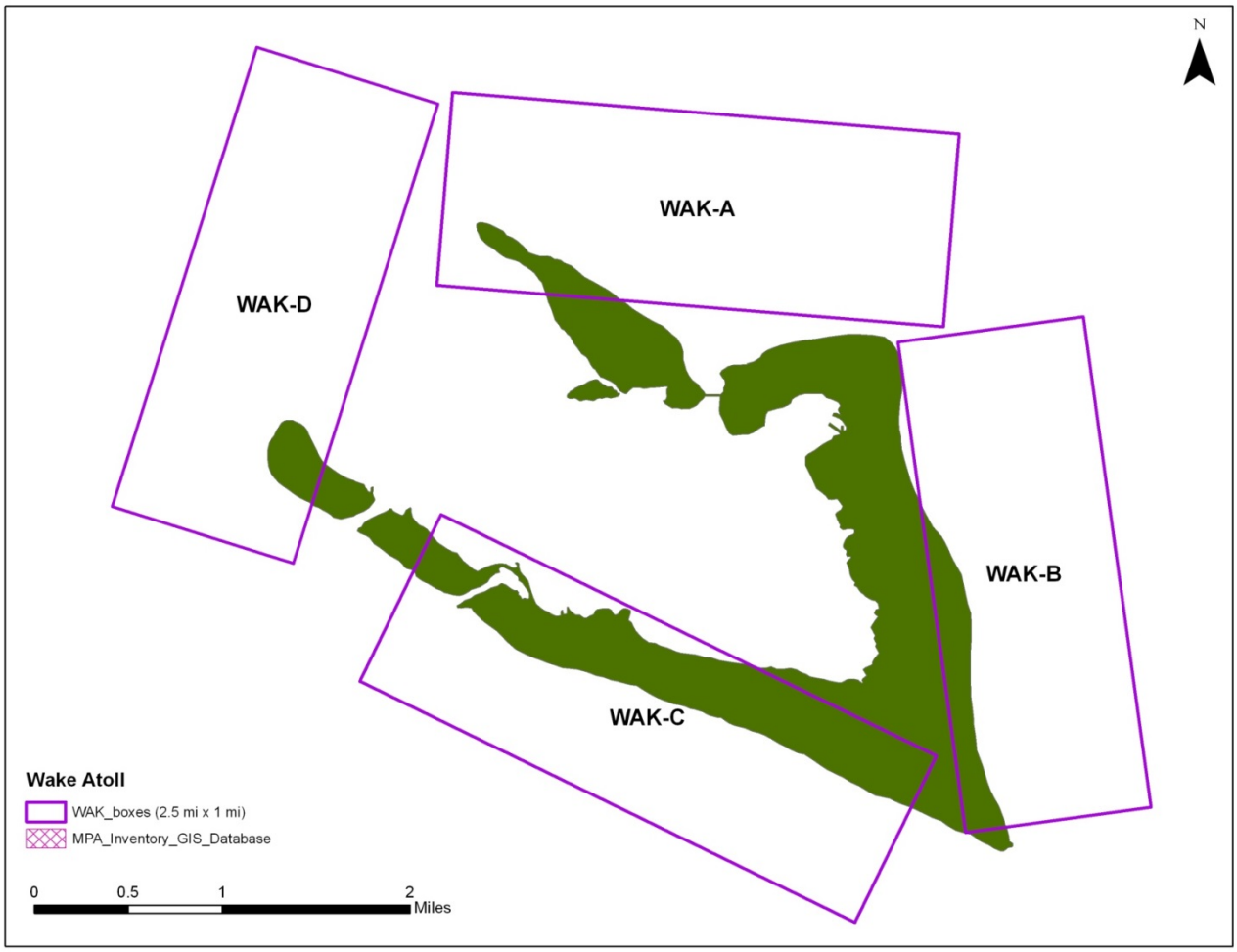
Appendix 2: Operating Area for Leg II



Appendix 3: **Operating Area for Leg III**

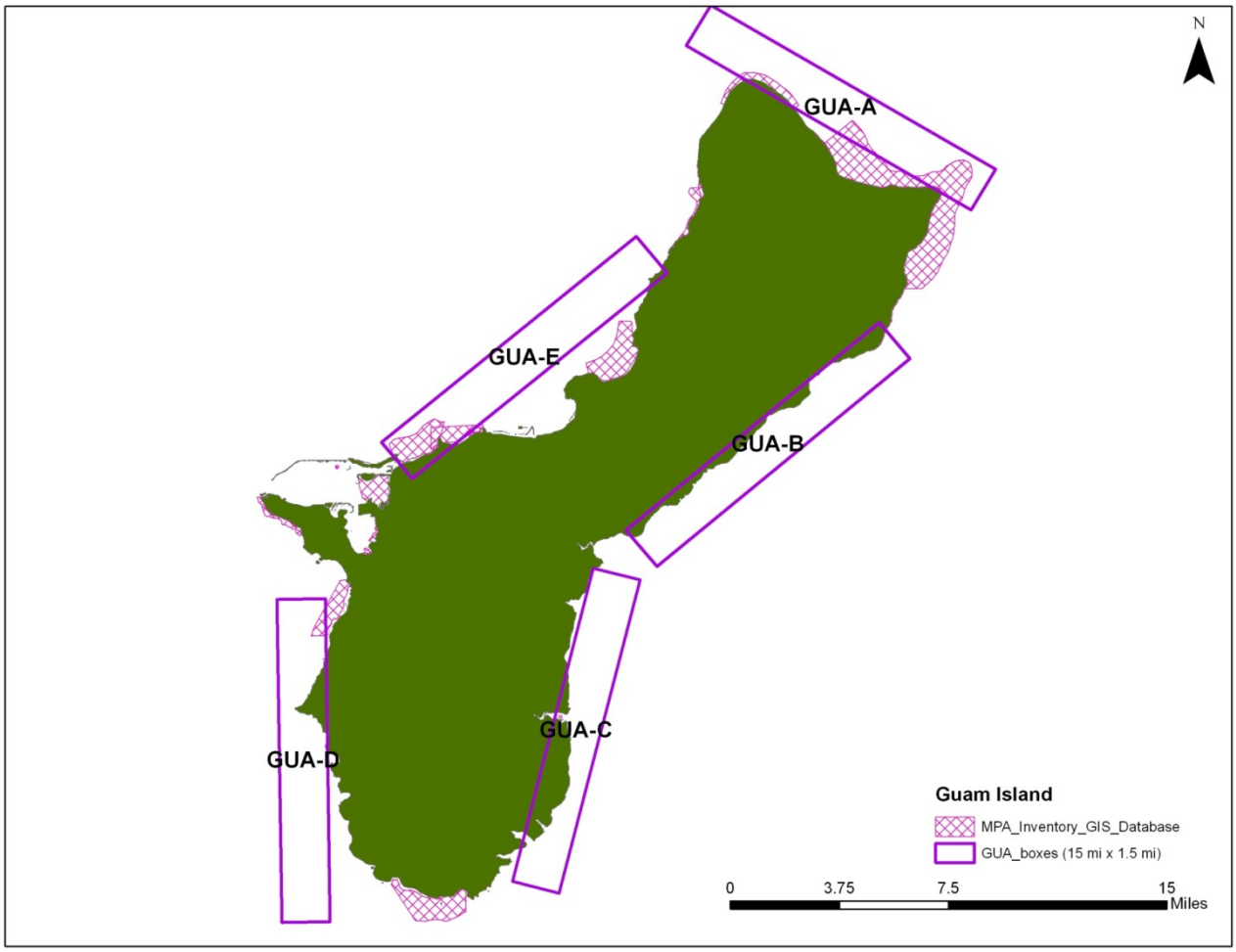


Appendix 4: Maps of Proposed Survey Polygons



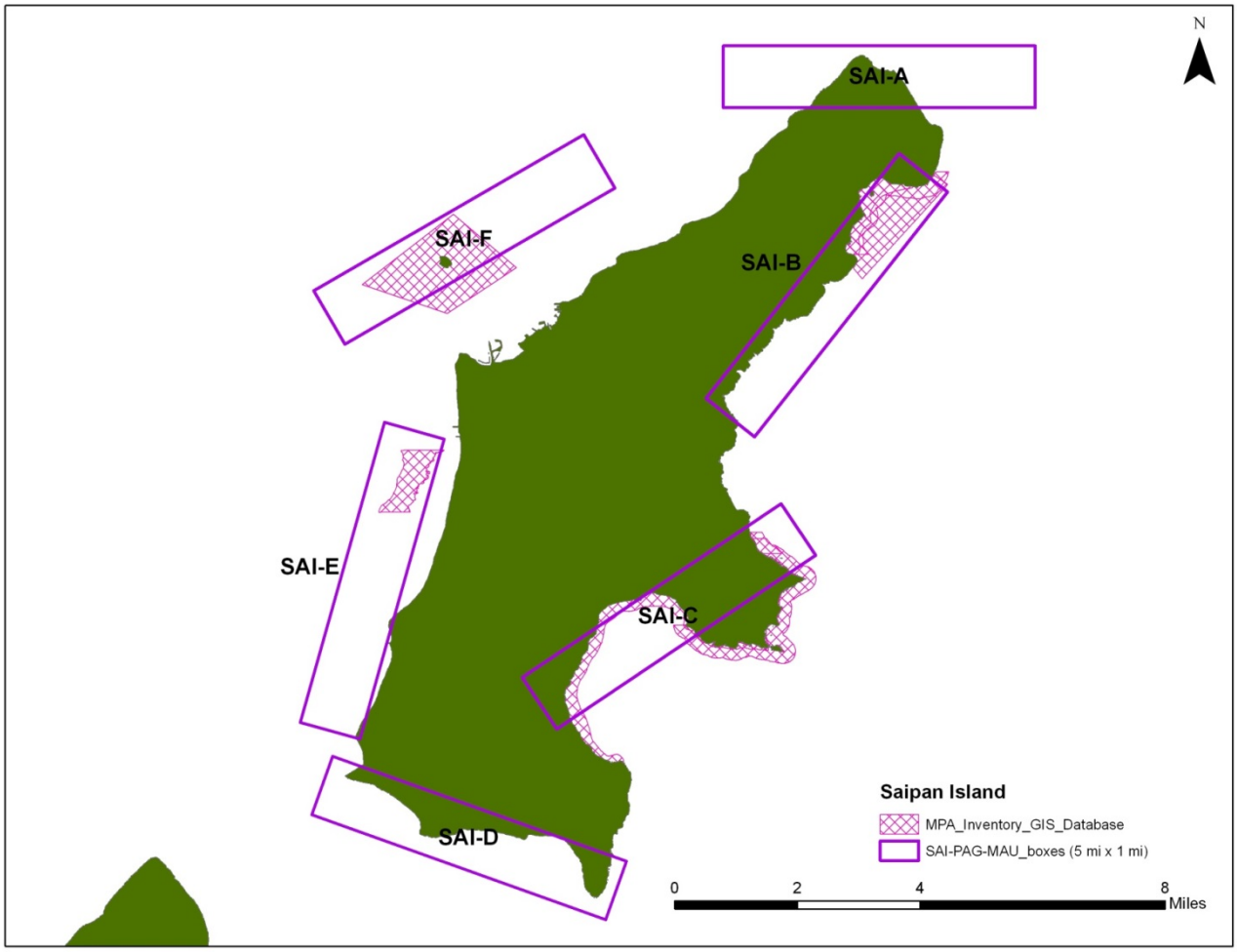
Map of Proposed Survey Polygons Wake

Appendix 4 (Continued):



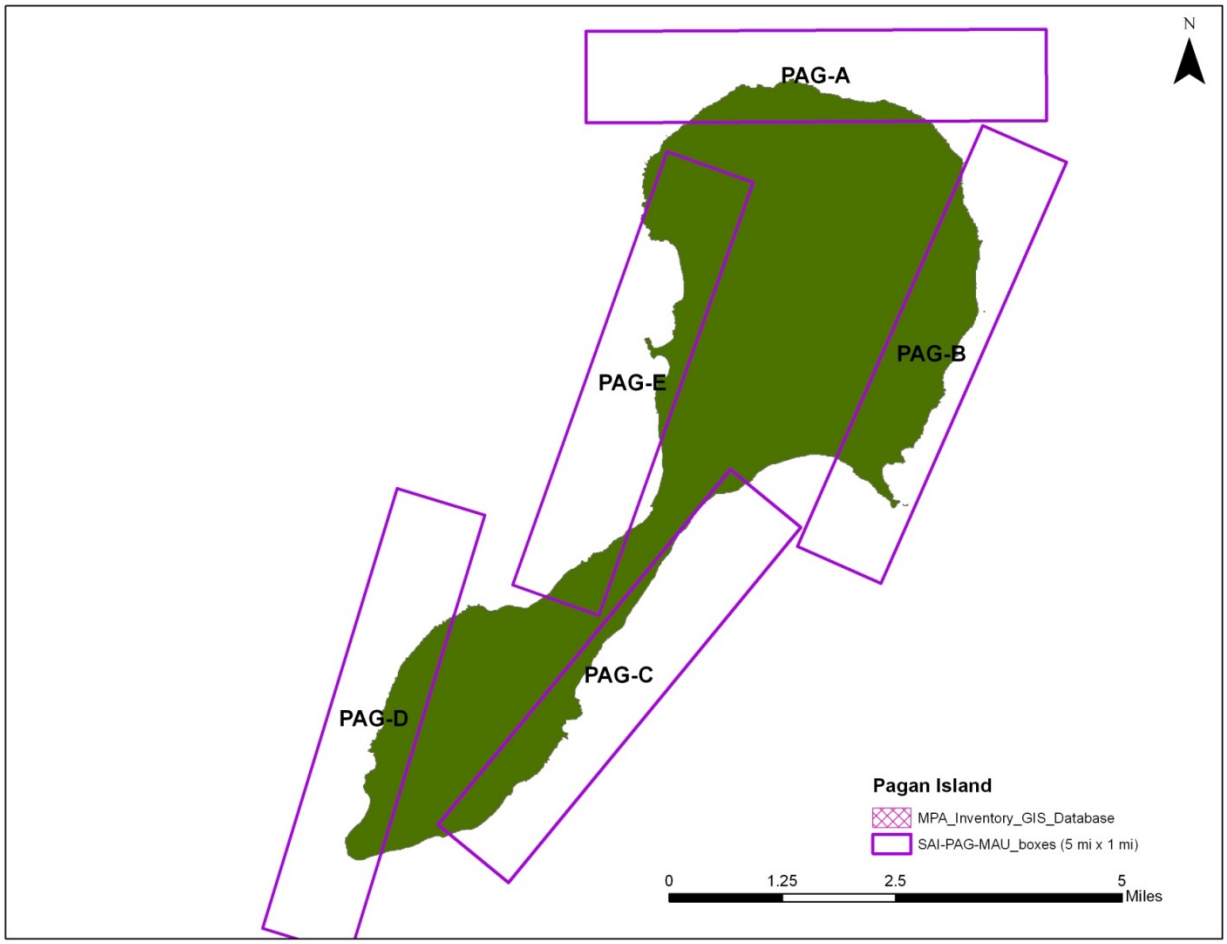
Map of Proposed Survey Polygons Guam

Appendix 4 (Continued):



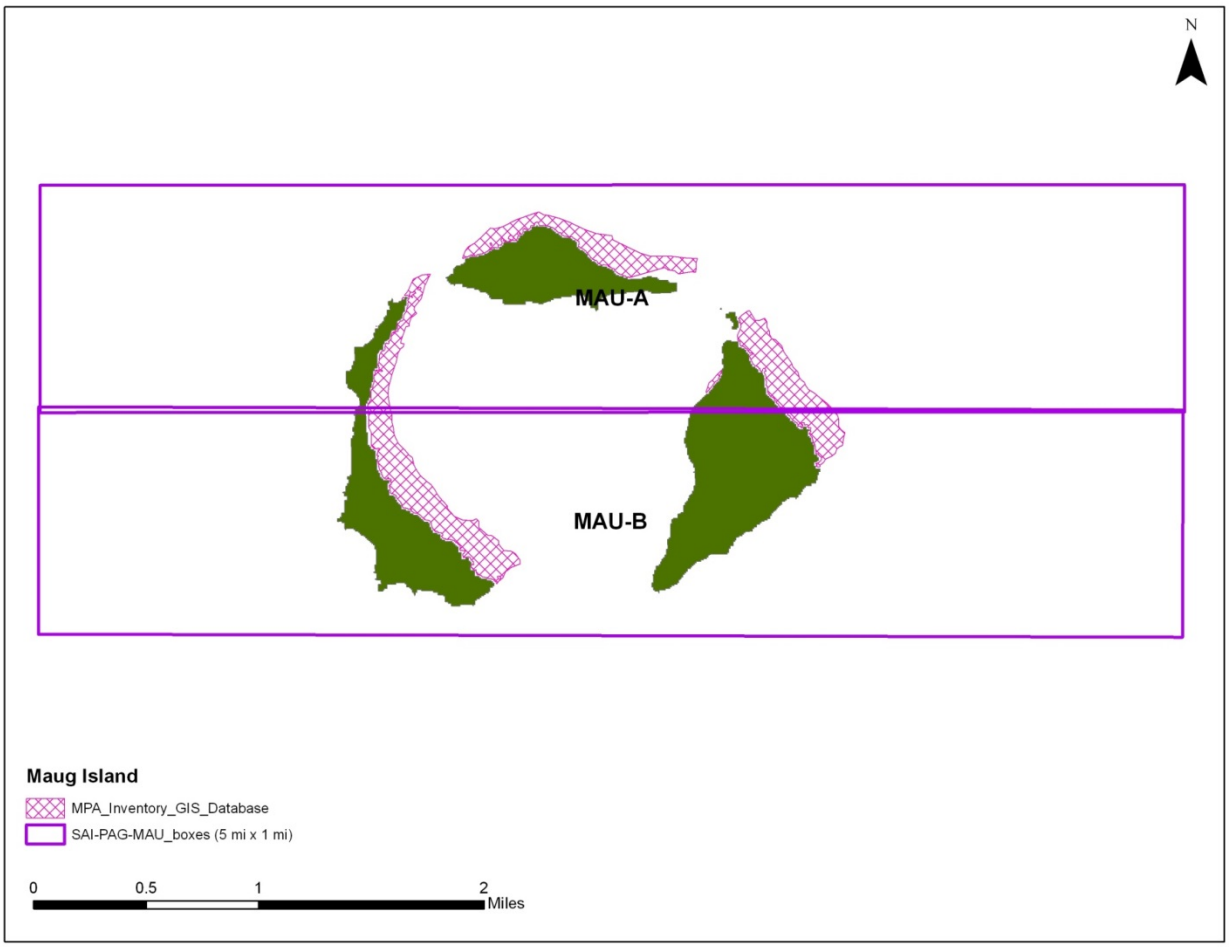
Map of Proposed Survey Polygons Saipan

Appendix 4 (Continued):



Map of Proposed Survey Polygons Pagan

Appendix 4 (Continued):



Map of Proposed Survey Polygons Maug

Appendix 5: The Station/Waypoint List for instrument deployments and retrievals

(Please see attached file)

PENDING

Appendix 6: **Dive Plans**

(Please see attached file)

Appendix 7: **Program full equipment load list**

(Please see attached file)

Appendix 8: **Section IV.B. Hazardous Materials Inventory**

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	(I) TBD (II) TBD (III) TBD	NT
25% Glutaraldehyde (disinfectant/fixative)	10 ml	Stored in sealed plastic container in Scientific refrigerator	(I) TBD (II) TBD (III) TBD	F
32% Paraformaldehyde (disinfectant/fixative)	10 ml	Stored in Hazmat cabinet in wetlab	(I) TBD (II) TBD (III) TBD	F
5% Hydrochloric Acid	5 L	Stored in sealed plastic bucket in wet-lab	(I) TBD (II) TBD (III) TBD	A
95% Ethyl Alcohol (190 proof)	380 L	Highly Volatile, Flammable Bulk stored ethanol tank in port fantail release rack Daily use quantity (19 L carboy) stored in ARMS lab in secondary containment. Preserved samples stored in secondary containment in Scientific freezer.	Bulk: Ship's Chief Engineer Daily use and sample quantities: (I) Molly Timmers (II-III) Kerry Reardon	Ship SOP (bulk) AL (Daily use)
Aquamend underwater Epoxy	200sticks / 63.5 kgs	Stored in Stainless Steel lockers on Fantail and Dry Lab	(I) Noah Pomeroy (II/III) James Morioka	NT
Chloroform	70 ml	Stored in Hazmat cabinet in wet-lab within sealed metal secondary container and padding	(I) Noah Pomeroy (II-III) James Morioka	F
Commercial Bleach	75 L	Stored in ARMS lab in secondary containment	(I) Joao Garriques (II-III) Kerry Reardon	F

Common Name	Quantity	Notes	Trained Individual	Spill Control*
DAPI Nucleic Acid Stain	500 µg	Stored in sealed plastic container in Scientific fridge	(I) TBD (II) TBD (III) TBD	NT
DMSO Buffer	10 L	Stored in Hazmat cabinet in wetlab	(I) Molly Timmers (II-III) Kerry Reardon	F
Dynamic Descaler (Aqueous Hydrogen Chloride)	57 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 crane	(I) Molly Timmers (II-III) Kerry Reardon	A
Gasoline, unleaded	3.7 kL	Volatile, Flammable Stored in ship's fantail tanks	Ship's Chief Engineer	Ship SOP
Liquid Nitrogen	12 L	Stored in wetlab Scientific dewar	(I) TBD (II) TBD (III) TBD	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	(I) Noah Pomeroy (II-III) James Morioka	M
Methanol 95%	1L	Stored in wet lab	(I) TBD (II) TBD (III) TBD	AL
Methanol 70%	3L	Daily use quantity (19L carboy) stored in Microbial lab in secondary containment Preserved samples stores in secondary containment in Microbial Fridge	(I) TBD (II) TBD (III) TBD	AL
Mytomycin (antibiotic)	1mg	Stored in program mini-fridge	(I) TBD (II) TBD (III) TBD	P

Common Name	Quantity	Notes	Trained Individual	Spill Control*
Pool Time Shock XtraBlue 6 in 1 Pool Shock (primarily Sodium Dichloro-s-Triazinetrione-Dihydrate)	4.6 kg	Corrosive Contained in ten 1-lb bags within lidded 5-gal bucket on Grated Deck	(I) Joao Garriques (II-III) Kerry Reardon	P
RNAlater	1000ml	Stored in undersink cabinet	(I) TBD (II) TBD (III) TBD	NT
Scothcast Flame Retardant Compound 2130 (Insulating resin)	225ml	Stored undersink cabinet	(I-II-III) Andrew Gray	NT
Sodium Hydroxide (NaOH) pellets	500 g	Highly caustic Stored in Hazmat cabinet in wetlab	(I) TBD (II) TBD (III) TBD	B
TCBS agar culture plate (Thiosulfate citrate bile salts sucrose agar)	1L	Stored in microbial fridge	(I) TBD (II) TBD (III) TBD	NT
Weld-On PVC glue, solvent	237ml	Flammable Stores in Hazmat cabinet in wetlab	(I-II-III) Andrew Gray	NT
Z Fix (buffered zinc formalin fixative)	3.8L	Toxic Stored in Hazmat cabinet in wetlab	(I-II) Dione Swanson (III) Bernardo Vargas-Angel	F

Appendix 9: Section IV.C. Chemical Safety and Spill Response Procedures

***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 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 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 and eyewear).
- Stop the flow of fluid by using absorbent material (e.g. cloth, fleece, paper) to dike and soak up the spilled solution.
- Use Mercury Spill Kit if need be.
- Sprinkle area with sulfur or calcium polysulfide to suppress mercury.
- Contaminated area should be wiped with water dampened absorbent material, until one feels the area is sufficiently clean.
- Pick up used absorbents and place in a suitable container for reclamation or disposal in a method that does not generate dust
- **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.**
- 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.

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.

GNF: Non-Flammable gases (ex. Oxygen, Nitrox)

- Ventilate area.
- Isolate cylinder and move exposed personnel to fresh air.

Inventory of Spill Kit Supplies

Product Name	Amount	Chemicals useful against	Amount of clean up possible
Absorbent pads	20	A, AL, F, M	~4 L
Base Eater	Large Kit	B	~19 L
Dust pan	1 set	A, F, P	n/a
Goggles	5 pair	A, F, G, LN, M	n/a
Kitty litter	5.4 kg	A, AL, F	~4 L
Nitrile gloves	12 pairs	A, F, G, LN, M	n/a
NEUTRASORB®	3.2 kg	A	Varies with acid concentration
Plastic bags	5	A, AL, F, P	~4 L (each)
Vermiculite	2.5 kg	AL, F, NT, M	~6 L of chemical spilled
Vinyl gloves	20 pairs	A, F, G	n/a