U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Fisheries Science Center
1845 Wasp Blvd. Bldg. 176 • Honolulu, Hawaii 96818
(808) 725-5300

Final Project Instructions

Date Submitted: June 6, 2016

Platform: NOAA Ship *Oscar Elton Sette*

Project Number: SE-16-03 (PIFSC)

Project Title: Oahu EK-60 Calibration and Shipboard Launch and Recovery Unmanned Aerial Systems (UAS) Testing

Project Dates: June 13, 2016 to June 21, 2016

Prepared by: BLISS.KELLI-ANN.ELIZABETH.1392697710 Digitally signed by BLISS.KELLI-ANN.ELIZABETH.1392697710 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=NOAA, cn=BLISS.KELLI-ANN.ELIZABETH.1392697710 Date: 2016.06.06 18:32:17 -10'00' Dated: _____
Kyle Koyanagi
For: Kelli-Ann Bliss, LT, Chief Scientist
Science Operations Division
Pacific Islands Fisheries Science Center

Approved by: _____ Dated: 6/7/16
Michael P. Seki, Ph.D., Director for
Pacific Islands Fisheries Science Center

Approved by: Matt Wingate Dated: 6/7/16
Commander Matthew J. Wingate, NOAA
Commanding Officer
Marine Operations Center – Pacific Islands

I. Overview

A. Brief Summary and Project Period

The NOAA Ship *Oscar Elton Sette* will be engaged as support for the Oahu Simrad EK-60 Calibration and Shipboard Launch and Recovery Unmanned Aerial Systems (UAS) Testing from June 13, 2016 to June 21, 2016, for a total of 9 days at sea (DAS). The Primary Objectives of the project are as follows: 1) Simrad EK-60 calibration, 2) Shipboard launch and recovery of Latitude Engineering UAS, 3) Cobb mid water trawl and testing of Marport net mensuration sensor system

1) The Simrad EK-60 is a scientific echo sounder that can simultaneously operate multiple frequencies ranging between 18-710 kHz and is utilized in fishery research applications. The Ecosystem and Oceanography Program of the Pacific Island Fisheries Science Center will be conducting Simrad EK-60 echo sounder (38 kHz, 70 kHz, 120 kHz, 200 kHz) calibrations off the west side of Oahu to set parameters for active acoustic data collected in 2016. Successful drift or two point anchor EK-60 calibrations are pivotal to this year and historical acoustic data sets.

2) Conduct ship based launch and recovery testing of a battery powered Latitude Engineering HQ-20 fixed wing hybrid quadrotor. The HQ-20 has the capability to conduct vertical takeoff and landing, has the flight duration of 2 hours with a 2 lbs. payload. Latitude Engineering pilots will conduct test flights to demonstrate the HQ-20 moving baseline differential GPS and ship landing logic system with repeated vertical takeoff and landing with fixed wing transition and flights.

3) Conduct Cobb mid water trawls equipment testing over water depths 1000 m or greater to test problematic equipment issues from SE-16-01 and test the newly installed Marport net mensuration sensor system.

B. Days at Sea (DAS)

Of the 9 DAS scheduled for this project, 9DAS are funded by an OMAO allocation, 0 DAS are funded by a Line Office Allocation, 0 DAS are Program Funded, and 0 DAS are Other Agency funded. This project is estimated to exhibit a moderate Operational Tempo.

C. Operating Area

The operational area for SE-16-03 encompasses the waters around the southwest shore of Oahu, Hawaii. The potential anchorage and drift EK-60 calibration sites, 12 nautical mile boundary for UAS operations, and 1000 meter contour for Cobb trawl testing for the project is presented as an attached files

Appendix 1: EK-60 Potential Calibration Anchorage Sites

Appendix 2: EK-60 Potential Calibration Site 1

Appendix 3: EK-60 Potential Calibration Site 2

Appendix 4: EK-60 Potential Calibration Site 3

Appendix 5: EK-60 Potential Drift Calibrations Sites

Appendix 6: Potential Cobb Trawl and UAS Operational Area

D. Summary of Objectives

Conduct successful drift or two point anchor calibration of Simrad EK-60 echo sounder (38 kHz, 70 kHz, 120 kHz, 200 kHz) off the west side of Oahu to set parameters for active acoustic data collected in 2016

Conduct successful ship based launch and recoveries of Latitude Engineering HQ-20 fixed wing hybrid quadrotor demonstrating its moving baseline differential GPS and ship landing logic system.

Conduct successful Cobb trawl equipment tests to ensure the full capacity for future deep trawling operations and test the Marport net mensuration sensor system.

Ancillary projects include night-light dipnetting, squid jigging, and biosampling of coastal pelagic fish species.

E. Participating Institutions

- NOAA Pacific Islands Fisheries Science Center (PIFSC):
  - Ecosystem Science Division (ESD)
  - Scientific Operations Division (SOD)
  - Fisheries Research Management Division (FRMD)
- Joint Institute for Marine and Atmospheric Research (JIMAR)
- NOAA Pacific Marine Environmental Laboratory (PMEL)
- NOAA Aircraft Operations Center (AOC) UAS Program
- Joint Institute for the Study of Atmosphere and Oceans (JISAO)
- Latitude Engineering

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

Name (Last, First)	Title	Date Embark	Date Disembark	Gender	Affiliation	Nationality
Kelli-Ann Bliss (LT)	Chief Scientist	6/13/2016	6/21/2016	F	NOAA Corps	USA
Adrienne Copeland	Acoustic Technician	6/13/2016	6/15/2016	F	JIMAR	USA
Dianna Miller	Acoustic Technician	6/13/2016	6/21/2016	F	JIMAR	USA
Donald Kobayashi	Research Fisheries Biologist	6/13/2016	6/17/2016	M	NOAA	USA
Rory Driskell	Biological Science Technician	6/13/2016	6/21/2016	M	NOAA	USA
(Charles) Justin Armer	Pilot	6/17/2016	6/21/2016	M	Latitude Engineering	USA
Adam Newell	Pilot	6/17/2016	6/21/2016	M	Latitude Engineering	USA
Jason Douglas	Pilot	6/17/2016	6/21/2016	M	Latitude Engineering	USA
Timothy Bates	UAS Scientist	6/17/2016	6/21/2016	M	JISAO	USA
Patricia Quinn	Visiting Scientist	6/17/2016	6/21/2016	F	NOAA	USA
Mark Rogers	Visiting Scientist (AOC)	6/17/2016	6/21/2016	M	NOAA	USA
Jamie Gove	Research Oceanographer	6/13/2016	6/15/2016	M	NOAA	USA
Robert Humphreys	Research Fisheries Biologist	6/14/2016	6/17/2016	M	NOAA	USA
Noriko Shoji	Science Operations Director	6/13/16	6/15/16	F	NOAA	USA
Andrew N Stradling	Marport Field Service Manager	6/14/2016	6/15/16	M	Marport Stout Inc.	USA
Stephane Le Guyader	Marport Senior Project Engineering Manager	6/14/2016	6/15/16	M	Marport Stout Inc.	France
Steven A G Deshayes	Marport Engineering Technician	6/14/2016	6/15/16	M	Marport Stout Inc.	France

G. Administrative

1. Points of Contacts:
   Kelli-Ann Bliss, Chief Scientist
   1845 Wasp Blvd, Building 176
   Honolulu, HI 96818
   (808) 725-5442

Kelli-Ann.E.Bliss@noaa.gov

Kyle Koyanagi
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(808) 725-5481
Kyle.Koyanagi@noaa.gov

Anthony Imberi, NOAA Operation Officer
NOAA Ship *Oscar Elton Sette*
1897 Ranger loop, Building 184
Honolulu, HI 96818
(808) 725-5790
OPS.Sette@noaa.gov

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

Pending Approvals

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:

13 June	Anticipated early morning departure Pearl Harbor: Embark Kelli-Ann Bliss, Adrienne Copeland, Dianna Miller, Rory Driskell, Jamison Gove, and Noriko Shoji at Ford Island in accordance with vessel's sailing board. Ship will swing compass. Transit to the west side of Oahu. Conduct welcome aboard and safety drills. Conduct CTD cast for EK-60 calibration. Commence EK-60 calibration operations throughout the evening into the next morning.
14 June	Early morning complete EK-60 calibrations. Embark Robert Humphreys, Donald Kobayashi, Andrew Stradling, Stephane Le Guyader, and Steven A G Deshayes from Waianae Small Boat Harbor to ship via small boat (SE-4). Transit to Cobb trawl testing location. Commence Cobb trawl and net mensuration system tests. End Cobb Trawl testing operations in late afternoon and transit to determined EK60 calibration location. Arrive on station to prepare EK-60 equipment for calibration activities.

	Conduct CTD cast for EK-60 calibration. Commence EK-60 calibration operations throughout the evening into the next morning.
15 June	Early morning complete EK-60 calibrations. Transit to Cobb trawl testing location. Commence Cobb trawl and net mensuration system tests. Late afternoon end Cobb Trawl testing operations. Disembark Adrienne Copeland, Noriko Shoji, Jamison Gove, Andrew Stradling, Stephane Le Guyader, and Steven A G Deshayes to Waianae Small Boat Harbor from ship via small boat (SE-4)and transit to determined EK-60 calibration location. Arrive on station and prepare EK-60 equipment for calibration activities. Conduct CTD cast for EK-60 calibration. Commence EK-60 calibration operations throughout the evening into the next morning.
16 June	Early morning complete EK-60 calibrations. Transit to Cobb trawl testing location. Commence Cobb trawl and net mensuration system tests. Late afternoon end Cobb Trawl testing operations and transit to determined EK-60 calibration location. Arrive on station and prepare EK-60 equipment for drift calibration activities. No CTD cast. Commence EK-60 calibration operations throughout the evening into the next morning.
17 June	Early morning small boat transfer at Waianae Small Boat Harbor. Disembark scientist Don Kobayashi and Bob Humphreys. Embark Justin Armer, Jason Douglas, Adam Newell, Tim Bates, Patricia Quinn and Mark Rogers (SE-4). Transit to UAS station to begin operations. Conduct UAS launch and recovery operations. Late afternoon end UAS testing operations and transit to determined EK-60 calibration location. Arrive on station to prepare EK-60 equipment for drift calibration activities. Conduct CTD cast for EK-60 calibration. Commence EK-60 calibration operations throughout the evening into the next morning as needed.
18 June	Early morning complete EK-60 calibrations and begin transit to UAS operation area. Arrive on station to prepare for UAS operations. Conduct UAS launch and recovery operations. Late afternoon end UAS testing operations and transit to determined EK60 calibration location. Arrive on station to prepare EK-60 equipment for drift calibration activities. Conduct CTD cast for EK-60 calibration. Commence EK-60 calibration operations throughout the evening into the next morning as needed
19 June	Early morning complete EK-60 calibrations and begin transit to UAS operation area. Arrive on station to prepare for UAS operations. Conduct UAS launch and recovery operations. Late afternoon end UAS testing operations and transit to determined EK60 calibration location. Arrive on

station to prepare EK-60 equipment for drift calibration activities. Conduct CTD cast for EK-60 calibration. Commence EK-60 calibration operations throughout the evening into the next morning as needed

20 June — Early morning complete EK-60 calibrations and begin transit to UAS operation area. Arrive on station to prepare for UAS operations. Conduct UAS launch and recovery operations. Late afternoon end UAS testing operations and transit to determined EK60 calibration location. Arrive on station to prepare EK-60 equipment for drift calibration activities. Conduct CTD cast for EK-60 calibration. Commence EK-60 calibration operations throughout the evening into the next morning as needed

21 June — Early morning complete EK-60 Calibrations and depart for Ford Island, Pearl Harbor. Late morning arrive Ford Island Pearl harbor and disembark all scientific complement.

B. Staging and Destaging:

Prior to sailing on June 13, 2016, the ship's crew will install the Marport net mensuration sensor system, inspect the port- and starboard-side J-frames and associated oceanographic winches, conducting cable and DESH-5 winch for CTD operations, the trawl net reel and stern trawl winches, the Marport net mensuration system and displays (electronics lab and trawl house), the RD Instruments ADCP and associated computer and software, the thermosalinograph, the Simrad EK-60 echosounder, the Scientific Computing System (SCS), and the Global Positioning System (GPS) navigational systems are in proper working order. The lines for the outriggers are requested to be removed, and the stern anchor for two point anchoring requested to be loaded. All transducer faces and propellers should be inspected and cleaned of marine life no sooner than 1 week prior to sailing using methods recommended by manufacturers (e.g., using a soft wood block to clean the Simrad EK-60 transducer faces). The SeaBird 9/11+CTD system and frame, and the SEACAT portable CTD will be installed and inspected ensuring that they are fully operational. Electrical continuity of the J-frame conducting cable, the winch's slip ring assembly, and connections to the electronic laboratory will be confirmed by the Chief Electronics Technician before sailing.

All calibration gear will be loaded on the ship at least 2 days prior to the cruise. All gear will be stored in a white full pallet tub that will need to be stowed on the E-lab deck of the Sette. All electronic reel controls, control box, and the power cables for the calibration will be secured prior to the ship leaving for the cruise. The cables will be secured out of the way of operators for the duration of the cruise using removable zip ties.

All Cobb Trawl gear (trawl, doors, bridles) should remain aboard ship from the American Samoa deployment. Scientists will provide cod-end, TDRs, and absorbent padding. Mensuration equipment is also already aboard Sette, and should remain aboard following American Samoa deployment.

UAS gear will be loaded on 10 June and will consist of several pelican cases, a GPS style antenna and the HQ-20 UAS unit. Cobb trawl gear should be positioned in such a way as to make as much space as possible to launch from the fantail.

C. Operations to be Conducted:

The following operational plans can be considered only a guide as to how the Chief Scientist expects the surveys to progress without being able to predict the weather, operational and scheduling problems, and equipment failures. In particular, it should be noted that the amount of time required at each of the working areas is approximate and may be altered based on weather or the progress of the survey.

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

Conduct Simrad EK-60 calibration to ensure the collection of qualitative data and proper functionality of system and transducers. Calibration of the EK-60 frequencies 38 kHz, 70 kHz, 120 kHz, and 200 kHz will consist of using a metallic calibration sphere suspended underneath the ship for several hours. The calibration will be attempted either while dual point anchored in a designated vessel anchorage, in an area devoid of coral, or at sea using a drift methodology. If it is not possible to conduct the calibration without anchoring, a suitable anchoring location will be sought in the vicinity of the leeward waters of the Island of Oahu specifically either the waters of Makua Bay or the coast of Waianae depending on the wind and current conditions. These waters will also be sighted for the potential drift calibration method. The location will be assessed the week prior to the cruise for the most updated conditions with the understanding that the ideal conditions will be wind less than 5 knots, the current less than 0.5 knots, and an ocean bottom depth greater than or equal to 35 meters (deeper is better), for a successful calibration attempt.

Conduct ship based launch and recovery testing of Latitude Engineering's hybrid quadrotor UAS HQ-20. Testing will be conducted outside the 12 nautical miles domestic airspace boundary as a NOAA public aircraft operation and the mode C-ring that is 30 nautical miles from Honolulu. Multiple flights with a duration of 30 minutes or less will

be conducted within line of sight under 1000' of altitude during daylight hours. To demonstrate the UAS HQ-20's technology to launch and recover from a limited foot print in various weather condition UAS operations will be conducted from the fantail. Operations from a moving platform will validate the moving baseline differentials GPS and ship landing logic technology. SE-04 and a ship's coxswain will be on standby in case of an emergency water landing. The exact operations are covered in the HQ-20 Operations Plan.

Conduct Cobb trawl operations over water depths greater than 1000 m and deploy trawl to the maximum depth (approximately 900 m) with maximum wire out as done in project SE1503. Following a short soak the trawl will be recovered. Pending results, trawl deployment and recovery operations may be repeated up to three times daily to ensure reliable operation of all components. The primary purpose of this testing is twofold, to test the operation of the Marport mensuration system as compared to TDR devices placed on the trawl, and to ensure that rapid deployment (not powered out) and rapid retrieval (without pause for hydraulic cooling) can be accomplished for a deep tow targeting approximately 900 m (maximum wire out) being planned for the September West Hawaii IEA project off the leeward Big Island of Hawaii. Since this operation is planned for being relatively close to shore and relatively close to bottom it is imperative to have reliable control of the trawl and real-time knowledge of its position in the water column.

D. Dive Plan

Dives are not planned for this project.

E. Applicable Restrictions

Conditions which preclude normal operations:

1. Poor weather conditions.
   Operations will be dictated by weather. Operations will take place on the leeward (west) side of the island to mitigate the effects of the trade winds.

2. UAS operations need to be conducted in line of sight and outside the 12 nautical miles domestic airspace boundary as a NOAA public aircraft operation. UAS flight will also be restricted to outside the mode C-ring that is 30 nautical miles from Honolulu *(Appendix 6)*. The UAS will be limited to winds of 30 knots or less, below 1000 feet, within visual range (below clouds), and daytime ops only.

III. Equipment

Equipment and Capabilities provided by the ship (itemized)

- Stern trawl winch
- Deck crane
- Port J-frame
- Starboard J frame and Block CTD Casts

- Two anchors for EK-60 Calibrations
- Thermosalinograph
- RD Instruments ADCP and associated computer and software
- EK60 echosounder system at the frequencies of 38, 70, 120, and 200 kHz
- GPS navigational system
- Depth sounders and recorders
- Two-way radios for communication from the electronics lab to the winch operator
- Operational Scientific Computing System (SCS)
- Marport net mensuration system displays (electronics lab and trawl house)
- Navigational equipment and course plotter
- Assistance from the ship's deck department with the crane for staging and destaging.
- Sette Survey Technician
  6/13- 6/16 Daytime Cobb trawl and net mensuration testing and CTD for EK-60 calibration operations (no CTD 6/16 for transition to nights)
  6/17-6/21 CTD for EK-60 calibration and Survey Tech for night-time EK-60 calibration assistance.
- SE-4 and coxswain (UAS emergency recovery & personnel transfers)

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

- EK-60 calibration suite
- WetLab profiling and SeaPoint flow-through fluorometers
- Redundant dissolved oxygen sensors
- Water filtration equipment (vacuum pump, filtering ring, filter, forceps, etc.)
- Marport net mensuration system
- Time-depth recorders (TDRs) for post-tow net depth monitoring
- Cobb (Stauffer) trawls and bridles
- 5 × 7 "V" doors

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

Common Name of Material	**Qty**	**Notes**	**Trained Individual**	**Spill control**
Lithium Batteries	TBD	Flammable	Kelli-Ann Bliss	Neutralize with weak base
95% Ethanol	5 gallon	Flammable	Bliss, Kobayashi, Humphreys	Ventilate, remove heat and ignition sources.

C. Chemical safety and spill response procedures

ETHANOL (95%)

- Ventilate spill area
- Remove ignition sources

Wipe up small amounts with paper towels, vermiculite, or absorbent pads and let evaporate in a safe place (i.e. hood).

Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up

31 Gallon Chemical Spill Response Kit	1	Ethanol	31 Gallons

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

No Supplementary Projects are planned.

B. NOAA Fleet Ancillary Projects

Ancillary projects include night-light dipnetting, squid jigging, and biosampling of coastal pelagic fish species.

VI. Disposition of Data and Reports

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

A. Data Classifications: *Under Development*
   a. OMAO Data
   b. Program Data

B. Responsibilities: *Under Development*

VII. Meetings, Vessel Familiarization, and Project Evaluations

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

B. Vessel Familiarization Meeting: The Commanding Officer is responsible for ensuring scientific personnel are familiarized with applicable sections of the standing orders and vessel protocols, e.g., meals, watches, etiquette, drills, etc. A vessel familiarization

meeting shall be conducted in the first 24 hours of the project's start and is normally presented by the ship's Operations Officer.

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

D. Project Evaluation Report

Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the Chief Scientist. The form is available at http://www.omao.noaa.gov/fleeteval.html and provides a "Submit" button at the end of the form. Submitted form data is deposited into a spreadsheet used by OMAO management to analyze the information. Though the complete form is not shared with the ships', specific concerns and praises are followed up on while not divulging the identity of the evaluator.

VIII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the project.

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. The Chief Scientist is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys which were issued. The Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship.

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Chief Scientist will ensure that all non NOAA or non Federal scientists aboard also have proper orders. It is the responsibility of the Chief Scientist to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 17, 2000 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.corporateservices.noaa.gov/noaaforms/eforms/nf57-10-01.pdf.

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

The completed forms should be sent to the Regional Director of Health Services at the applicable Marine Operations Center. The NHSQ and Tuberculosis Screening Document should reach the Health Services Office no later than 4 weeks prior to the start of the project to allow time for the participant to obtain and submit additional information should health services require it, before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of either form. Ensure to fully complete each form and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

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

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

Contact information:

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

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

C. Shipboard Safety

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

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. At the discretion of the ship CO, safety shoes (i.e. steel or composite toe protection) may be required to participate in any work dealing with suspended loads, including CTD deployment and recovery. The ship does not provide safety-toed shoes/boots. The ship's Operations Officer should be consulted by the Chief Scientist to ensure members of the scientific party report aboard with the proper attire.

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via email and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required and it must be arranged through the ship's Commanding Officer at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *OMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

(1) Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
(2) Installation of the latest critical operating system security patches.
(3) No external public Internet Service Provider (ISP) connections.

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

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

F. Foreign National Guests Access to OMAO Facilities and Platforms

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 (FNRS) 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 Line Office Deemed Export point of contact to assist with the process.

Foreign National access must be sought not only for access to the ship involved in the project but also for any Federal Facility access (NOAA Marine Operations Centers, NOAA port offices, USCG Bases) that foreign nationals might have to traverse to gain access to and from the ship. 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 email generated by the Servicing Security Office granting approval for the foreign national guest's visit. (For NMFS-sponsored guests, this email will be transmitted by FNRS.) This email 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 Security Office.
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 approval from the Director of the Office of Marine and Aviation Operations 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 FNRS or Servicing Security Office email 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.

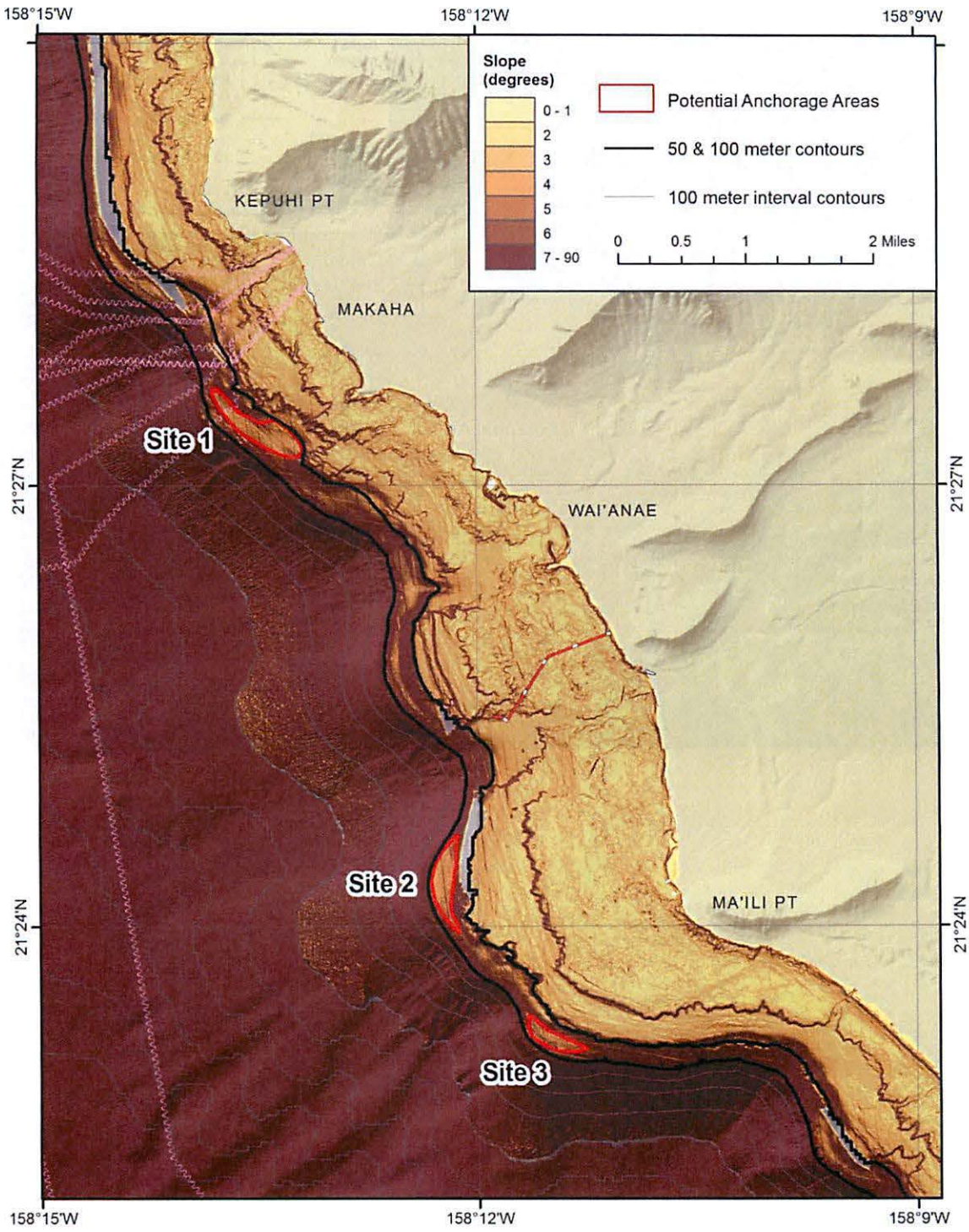
6. Export Control - 8 weeks in advance of the project, provide the Chief Scientist with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Chief Scientist of any OMAO-sponsored foreign nationals that will 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 Security Office.

Responsibilities of the Foreign National Sponsor:

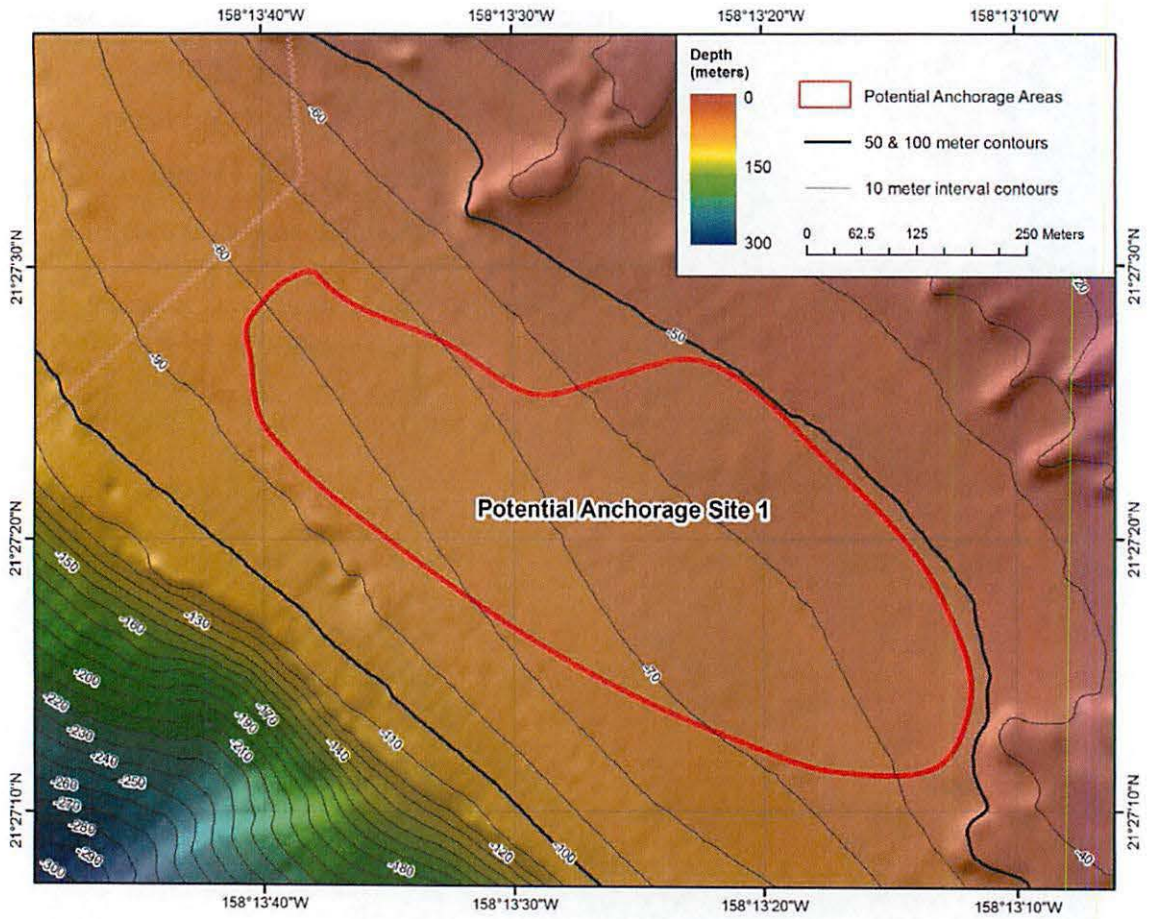
1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.
2. The DSN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

VIII. Appendices (all that apply)

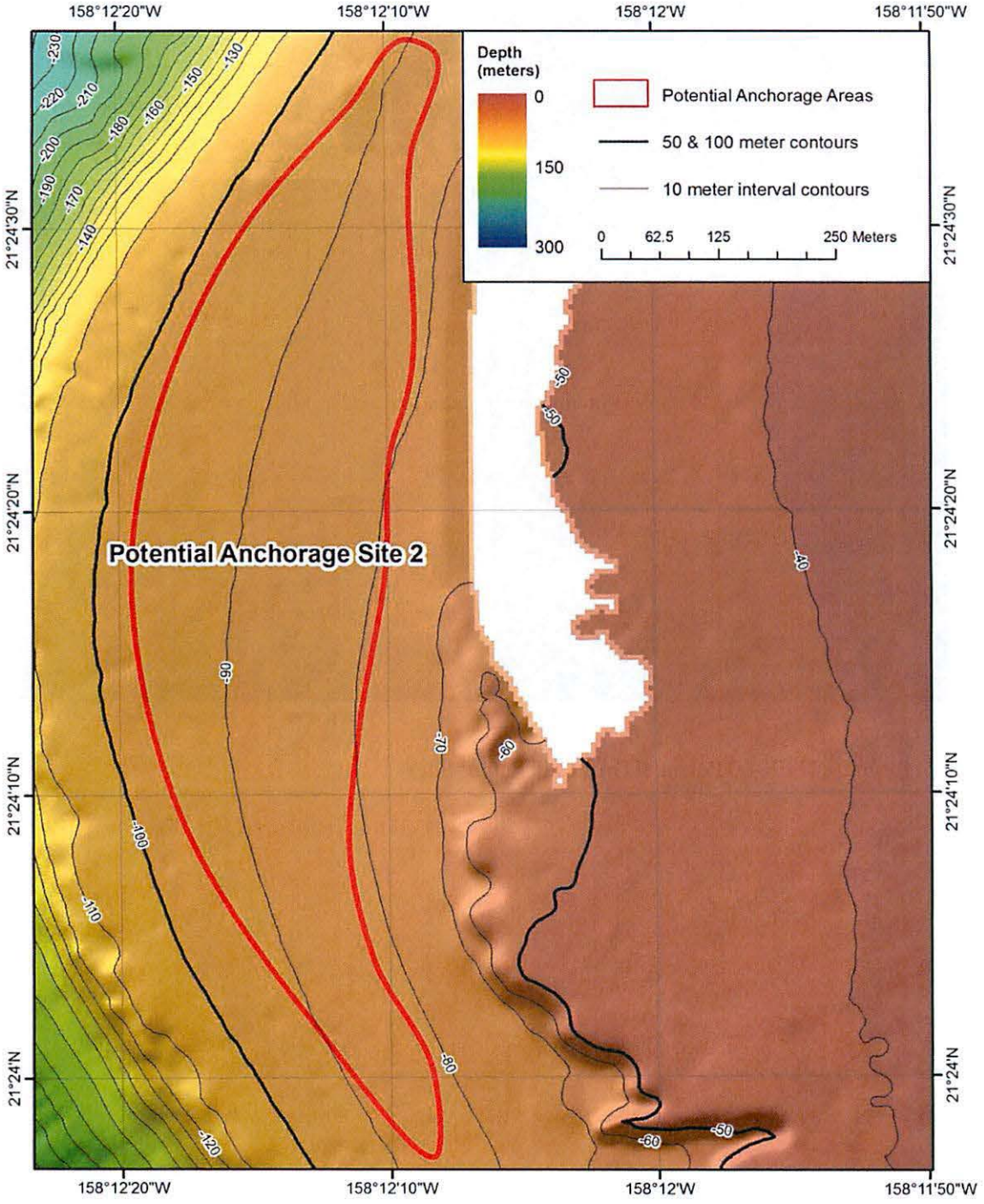
Appendix 1: EK-60 Potential Calibration Anchorage Sites



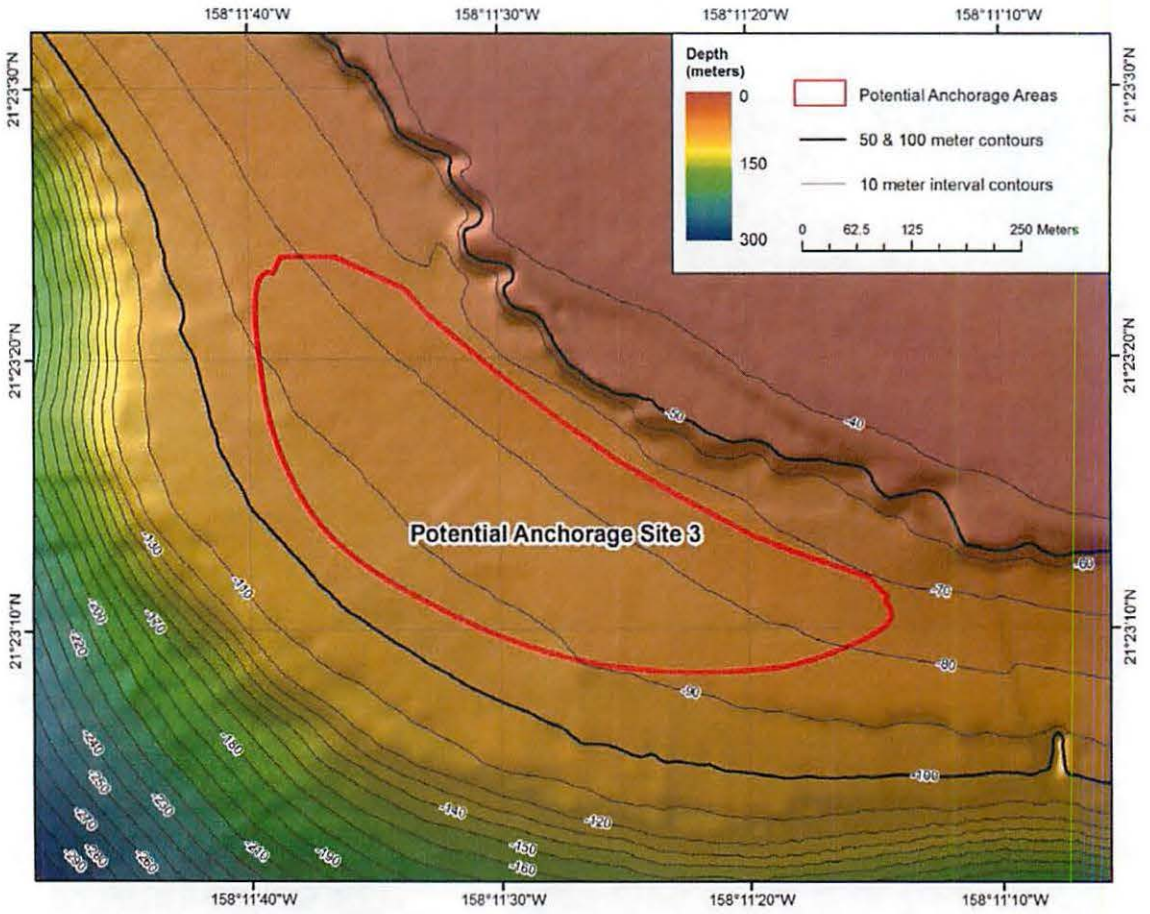
Appendix 2: EK-60 Potential Calibration Site 1



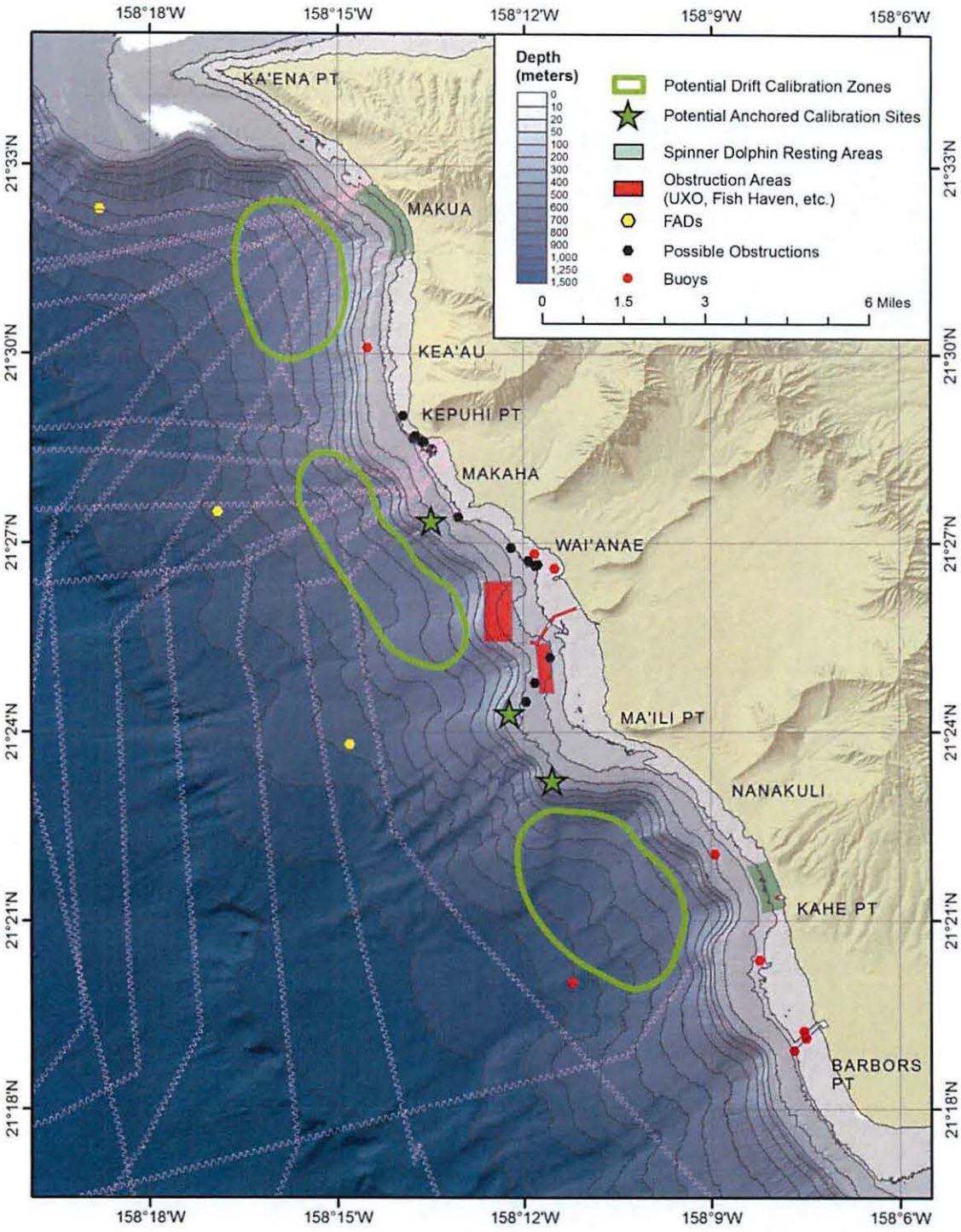
Appendix 3: Potential Calibration Site 2



Appendix 4: Potential Calibration Site 3

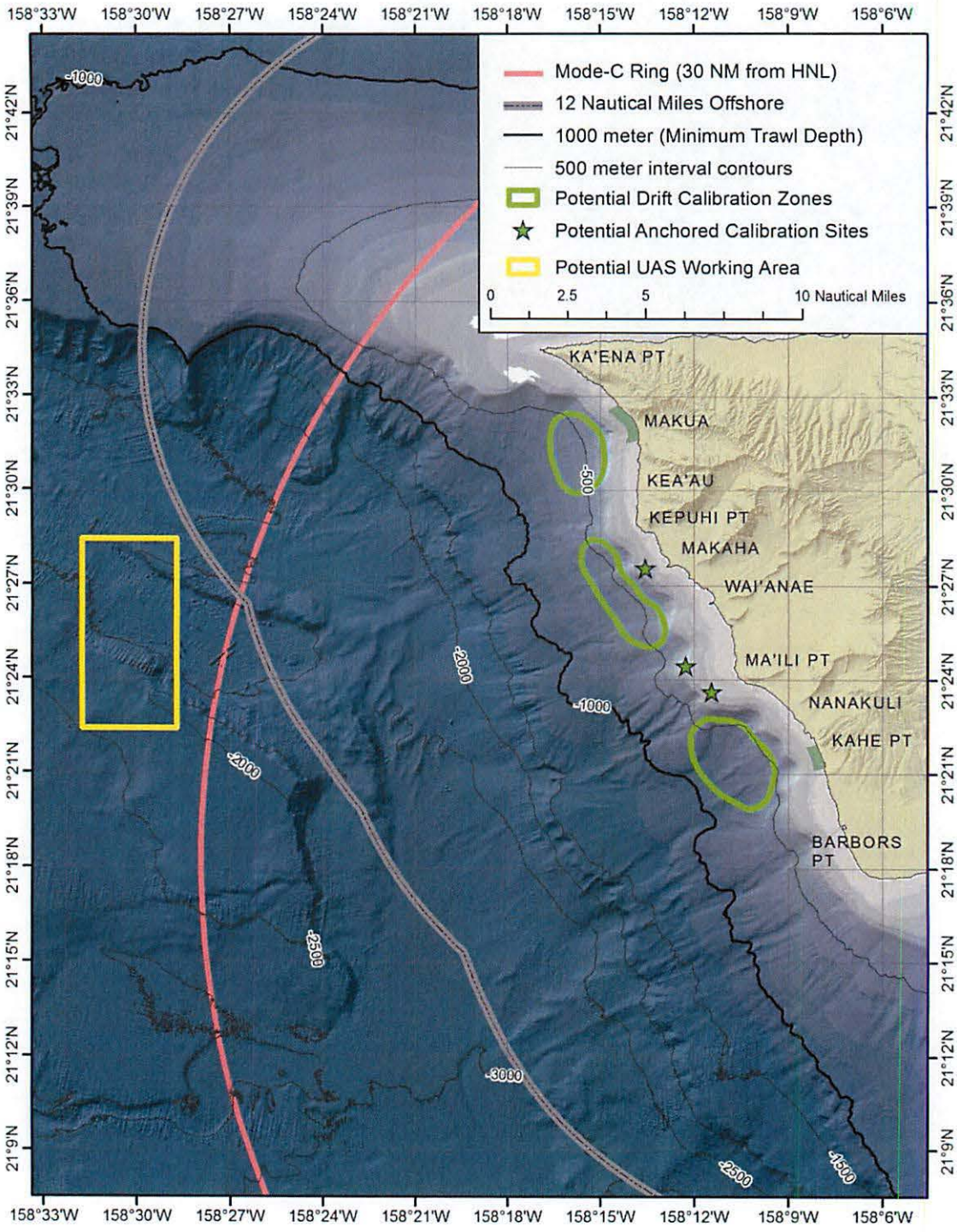


Appendix 5: EK-60 Potential Drift Calibrations Sites



Revision Date: 06JUN2016

Appendix 6: Potential Cobb Trawl & UAS Operational Area



NOAA Ship *Oscar Elton Sette*	OFFICE OF MARINE AND AVIATION OPERATIONS	DOCUMENT NO.	VERSION 1.0
		EFFECTIVE DATE	
	AUTHORIZED BY: /s/ (Commanding Officer) (Commander Keith Golden) Commanding Officer, NOAA Ship *Oscar Elton Sette*	REVIEW DATE	
		RESPONSIBLE POSITION Commanding Officer	

Shipboard HQ-20 Unmanned Aircraft System Operations

1. PURPOSE

1.1 To provide the minimum requirements for completing UAS Operations aboard the NOAA Ship Oscar Elton Sette

2. SCOPE

2.1 This procedure shall apply to performing HQ-20 UAS Operations aboard the NOAA Ship Oscar Elton Sette

3. RESPONSIBILITIES AND PROCEDURES

3.1 All hands participating in UAS Operations should read and become familiar with this procedure.

UAS Operations are conducted at the discretion of the CO, OOD and UAS Pilot. The OOD, CO and UAS Pilot have the authority to cancel operations if he/she has any doubts regarding the safety of the operation.

3.2 **PRE PROJECT DEPARTURE PLANNING**

3.2.1 APPROVALS

- Flight will be conducted under the authority of the NOAA/FAA Class G Airspace Memorandum of Understanding.
- Responsibilties:
  - The Mission Commander bringing the UAS to the ship is also responsible for obtaining all the required approvals/permits required of a UAS operation. Copies of the approvals/permits will be provided to the ship's Operations Officer.
  - The ship's Operations Officer will verify with AOC that all required aviation related approvals have been obtained and that the permits/approvals match up with the operations specified in the Project Instructions. The Operations Officer will provide results and copies to the ship's CO.
  - AOC Policy 220-1-5, Unmanned Aircraft Systems Operations, defines Pilot in Command (PIC), Supplemental Pilot (SP), and Mission Commander (MC) roles and requirements.

3.2.2 AIRWORTHINESS STATEMENT

- A statement of platform airworthiness is required for each mission. This is a memorandum provided by NOAA AOC specific for each UAS project. It specifies the criteria used to assess and approve the airworthiness of an aircraft and any restrictions or limitations to be abided by while conducting missions with that aircraft.

- The ship's Operation Officer will be provided with an airworthiness statement prior to any unmanned aircraft operations. The Operations Officer will provide this to the Commanding Officer.

3.2.3 OPERATIONAL RISK MANAGEMENT (ORM) ANALYSIS

- Completed prior to the commencement of any UAS project.
- The ORM will be led by the AOC according to their standard ORM procedures.
- The Mission Commander for the operation shall conduct the majority of the ORM analysis.
- The ORM team will consist of personnel at AOC, personnel from the appropriate MOC and personnel from the ship's command. Other ORM team members may be involved in the discussion if relevant.
- The Commanding Officer, AOC, and Commanding Officer, MOC, will be the final approving authority.
- The Commanding Officer, AOC, and Commanding Officer, MOC will conduct a flight readiness review board prior to the operation and provide a Memorandum dictating how the UAS shall operate.

3.2.4 STAGING SPACE ABOARD THE *VESSEL*

- The ground control station (GCS) consists of a hand controller, laptop, cables and antennae and will be located on the fantail in clear sight of the launch and recovery area.

4. UAS FACTS AND RESTRICTIONS (BASED ON THE HQ-20)

- **Range:** Operations will be limited to daytime and line of sight.
- **Altitude:** The HQ-20 will only operate below 1000 ft for this mission.
- **Wind and Sea State:** The HQ-20 should not be launched when wind speeds are greater than 30 knots (Beaufort 6 or above).
- **Clouds and Visibility:** Flight operation limitations for clouds and visibility will be set at the ORM Analysis for each mission. The HQ-20 shall be operated within visual line of sight and under class E airspace weather minimums (3 statude miles flight visibility and 500 ft below any clouds).
- **Vessels, Rigs, Congested Areas:** The SP will consult with the OOD regarding surface contacts in the operations area and relay this information to the PIC. The PIC will not overfly their ship or other vessels.
- **Other Aircraft:** Specific procedures for aircraft deconfliction will be set by the ORM Analysis participants. Minimally, if another aircraft is sighted in the operations area the information will be passed to the PIC/SP. The PIC will keep clear of any other aircraft. The SP will attempt to notify the encroaching aircraft of UAS operations via appropriate VHF aircraft monitoring frequency. Once the aircraft is clear of the operating area normal operations will resume. If applicable securite calls shall be made via Aviation frequency notifying incoming traffic of the UAS operation.
- Only personnel with duties related to the UAS activity are allowed in the vicinity of a launch and recovery.
- When the HQ-20 is operating in the vicinity of the ship the PIC and SP will fly no lower than 150' Above Ground Level (AGL) until the approach for recovery.
- Incident and accident reporting procedures will be followed and AOC will investigate any accidents.

5. DAILY PLANNING

5.1 SAFETY BRIEFING

A morning safety briefing will be held including all parties involved. The following and any other issues affecting the safety and/or success of the operations will be discussed.

- Presence of other vessels, wildlife, fishing gear, navigational aids, land, etc.
- Equipment status

- Other operations that might be occurring simultaneously
- A review of the previous relevant UAS missions
- Safety concerns regarding the previous or upcoming UAS operation
- UAS status
- Mission objectives
- Weather forecast, winds and sea state
- Identification of roles
- Scheduled launch time
- Launch procedures
- Recovery procedures
- Limiting airspace factors
- Emergency procedures
- Coordination with any concurrent small boat operations

5.2 PERSONNEL

Name	Role
CMD Keith Golden	CO
Justin Armer (LE)	PIC- Internal Pilot
Adam Newell (LE)	SP- External Pilot
Jason Douglas (LE)	VO
Tim Bates (JISAO/UW)	PM
CPT Philip Hall (AOC)	MC

- **Commanding Officer (CO)** – Responsible for all operations on the ship.

- **UAS Pilot in Command (PIC)** – Manages the mission and tasked with the overall responsibility for the safe execution of the mission
  - Ensures all crew members understand and can properly perform their specific roles for the flight.
  - Provides and ensures all documentation, including pre- and post-flight briefs
  - Adheres to all SOPs and checklist requirements
  - Acts as the final authority to the safe operation of the aircraft.
  - Oversees aircraft system preparation, launch, airborne operations, landing, and preventative maintanence are.
  - Updates waypoints, updates altitudes as needed, manages the aircraft's rally location in case of loss of link.

- **UAS Supplemental Pilot (SP)** –Implements the mission designed by the project PIC
  - Maintains situational awareness of the aircraft, surface and aerial contacts, developing weather observations, and conveys that information to the PIC.
  - Acts as a liaison between the PIC and other personnel.
  - Communicates with the Officer of the Deck, conducts radio communications, and handles any other flight related issues that the PIC will be unable to attend to due to the heads down nature of controlling the UAS

- **Visual Observer (VO):** The visual observer will be an external observer for "see and avoid" purposes.
  - Ensures that the operational area is clear for UAS operations
  - Communicates with the PIC via radio regarding any possible hazards to the UAS , personnel or property during all phases of flight.
  - Watchs for birds, aircraft, and unauthorized personnel in the immediate area of flight for launcsh or recovery.

- **Project Manager (PM):** Shall be in charge of the overall operation while deployed
  - Responsible for all aspect of the project and works closely with the ship, operational and scientific teams to ensure all project objectives are met.
  - Approves any changes to definition or project scope and objectives.
  - Ensures the involvement of all relevant stake holders during deployment.
  - Ensures that all project deliverables are on-time, with in scope and with in budget.
  - Monitors, tracks and reports progress to the UAS program manager when communications are available.
  - Creates and maintains comprehensive project documentation.

- **Mission Commander (MC):** Shall be responsible for acting as the interface between Ship's command, scientific parties and HQ-20 flight crew
  - Conducts the daily briefing in conjunction with the UAS PIC to all personnel regarding UAS operations and contingency plans.
  - Provides SITREPS to both AOC and the UAS program manager.
  - Coordinates between the approved aircraft traffic control authority.
  - Briefs the approval authority of the HQ-20 procedures.
  - Ensures NOTAMs are filed appropriately.
  - Communicates with any aircraft in the vicinity using the aircraft radio

- **Officer on the Deck (OOD):** The OOD will assist the PIC/SP in accomplishing the flight objectives while abiding by the Command's Standing Orders.
  - Maneuvers for launch and recovery, sailing a planned route, holding station, or altering course and speed as requested.
  - Provides situational updates to the SP regarding radar or visual contacts, developing weather, course or speed changes, and anything else relevant to safe operation.
  - Coordinates with the Chief Boatswain, or their designee, for small boat operations.

- **Operations Officer (OPS): The** OPS will serve as a liaison between the PM/MC, or PIC/SP as applicable, and the ship's departments to ensure the necessary resources for UAS operations are provided by the ship and its crew.
  - Uploads flight data to the ship's network, and compiles mission data for reporting to the appropriate MOC with the help of the PM/MC.

- **Electronics Technician (ET):** The ET will assist the PIC and SP with communication issues.
  - Assists the PIC and SP with running cables from the GCS to the antenna which will be mounted at a location deemed suitable by the PIC/SP and ET
  - Assists with conducting a frequency spectrum analysis while the ship's electronics and communication equipment are fully powered up to ensure that there will be no conflict with link between the UAS. If the ship does not have the necessary equipment to conduct a frequency analysis AOC will provide the necessary equipment.

- **Chief Boatswain (CB):** If the UAS is landed in the water, the CB is responsible for ensuring the small boat and small boat crew are prepared to recover it.

- **Fire-watch:** The Fire watch may also be the Visual Observer.

  - The Firewatch will be posted with a 3-5 gallon bucket filled with seawater to mount an immediate response should the unmanned aircraft ignite (the lithium-ion battery may ignite if substantially impacted and traditional fire extinguishers are ineffective on Lithium fires).
  - A class D fire extinguisher can be used in substitution of the bucket of sand.

- **NOTE:** Any member of the operation has the responsibility to stop an operation in the interest of safety and the operation will only resume when all parties are satisfied that the danger has been addressed.

5.3 COMMUNICATION

- OOD will coordinate with the MC
- The visual observer will directly communicate with the SP and/or PIC.
- SP/PIC/ MC will monitor aviation frequency and VHF.
- OOD will monitor VHF 16/13, applicable VTS frequencies, and VHF.
- The MC will coordinate with the Air Traffic Control Authority in order to file NOTAMS and be added to the appropriate flight schedule if applicable.
- The MC will communicate with the operations officer in order to schedule UAS operations aboard the ship.

5.4 OPERATIONS PLAN

- The fixed wing hybrid quadrotor UAS technology will be tested aboard the NOAA Ship Oscar Elton Sette in June 2016 off the coast of Oahu. Flights will be conducted outside the 30 nautical mile mode-C ring as a NOAA public aircraft operation. The field demonstration will be conducted with Latitude Engineering's HQ-20, a smaller version of the HQ-60 with a limited payload and endurance. Our goal is to demonstrate the HQ technology from a ship with limited deck space and to validate the moving baseline differential GPS and ship landing logic. The UAS will take off from the ship, switch to fixed wing flight, and return and land on the ship. This series of events will be repeated multiple times to build up experience with ship board operations. The autopilot controls will be fine-tuned to improve tracking during the touchdown phase of the flight. The minimum landing foot-print will be tested along with the weather conditions needed to fly (if given that opportunity by mother nature). Multiple flights will be done each day over 4 days. Flights will all be during daylight hours, within line of sight, and under 1000' altitude. The UAS will be piloted by Latitude Engineering pilots Justin Armen and Jason Douglas who are FAA certified pilots, and lead instructors and test pilots for the HQ UASs. The HQ platforms have flown over 400 flights totaling over 120 hours in their development-testing phase.

  Launch/Recovery Procedure-
  The HQ-20 utilizes an electric multirotor VTOL launch and recovery system. The electric multirotor system lifts the aircraft vertically to 75 ft AGL. Once at 75 ft. AGL, the forward thrust motor engages propelling the aircraft to flight speed. When the aircraft reaches rotation speed, the VTOL system disengages and the aircraft performs a standard fixed wing climbout profile. Recovery is accomplished by performing a standard fixed wing landing pattern. Upon reaching final approach the autopilot performs a series of checks to verify that the aircraft is established on a stabilized approach profile and in the proper configuration for landing. In the event the aircraft is not on proper glide or lateral alignment the autopilot will initiate an autonomous go around. If the final approach profile checks out then the aircraft will execute an autonomous VTOL recovery. At a height of 75 ft. AGL the aircraft will engage the electric VTOL system. As the vehicle slows, the autopilot will transition flight controls from the aerodynamic surfaces to the electric multirotor system. After the aircraft has fully transitioned into VTOL mode it will navigate to the prescribed touchdown point at an altitude of 75 ft. AGL. Upon reaching the touchdown point, the aircraft will descend vertically until ground contact is detected.

  Communication System Description –
  The UAS flight crew will issue a NOTAM each day before operations. The flight crew will monitor the aircraft VHF for traffic and announce UAS operations to any aircraft in the vicinity.

  Lost Link Procedure
  During the pre-flight process, the operator sets up a lost link waypoint and a

communications timeout (generally 20 seconds but can be increased or decreased). If communication is lost, the UAS will climb to the Minimum Safe Altitude (MSA)(1000 ft) and proceed to the waypoint. The UAS will be manually landed as soon as safely possible.

Emergency Procedures
Should the UAS encounter an emergency such as a system malfunction or engine failure the external pilot will take control of the UAS and attempt to guide it back to the ship. The UAS will be landed as soon as possible.

6. LAUNCH PROCEDURES

- OOD provides a 15 minute and 5 minute heads up to launch via VHF to all parties.
- The PIC and SP will assemble the UAS on the launch deck. The VO may assist as needed.
- Following HQ-20 assembly the PIC will return to the GCS and the SP will remain on the launch deck with the aircraft.
- The SP will request that the OOD position the ship and reduce/increase speed for desired launch conditions The OOD will then set days shapes and AIS
- Deck Dept: Prepare to launch the small boat in the event of a failed launch.
- Aircraft Observer / Fire-watch: Standby ready to assist with bucket of sand or a class D fire extinguisher if the Lithium Ion battery should catch fire.
- The OOD will announce over the ship's all-call: **"Attention. All hands stay clear of the fantail for UAS launch."**
- The PIC/ SP will conduct pre-flight checks with the PIC at the GCS hand controller and the SP handling the HQ-20.
- Following successful completion of pre-flight checks the PIC will notify the OOD that the aircraft is ready for launch.
- The OOD will broadcast securite calls to notify nearby traffic of UAS operations on VHF channel 16/13 and any other appropriate frequency. The MC will make radio call to notify any aircraft traffic over 121.5 MHz.
- The OOD will confirm the PIC, SP, Deck Department, and the Aircraft Observer are ready for launch. If personnel are ready, and there are no other concerns, the OOD will notify PIC/SP to proceed with launch.
- PIC/SP: The PIC will power up the engine, and the SP will launch the aircraft. The aircraft should begin to climb, gain speed, and begin its mission. The SP will return to the GCS laptop.

7. IN FLIGHT PROCEDURES

- The OOD will log the time and location of launch in the ship's log.
- The PIC/SP and OOD will proceed with the UAS mission as planned.
- The OOD will announce over ship's all-call: **" Attention all hands HQ-20 launch operations complete, the deck is open."**

- The Deck Department will stand by to deploy small boat in the event of an unplanned HQ-20 landing
- The OOD will alert the SP to the presence of any surface contacts in the vicinity of UAS operations and the SP will keep the OOD updated with location of the UAS.
- The OOD will maintain a 1 nm CPA with contacts, requesting course changes from traffic if possible.
- The aircraft observer will report any aircraft in the vicinity to the SP/MC. The SP/MC will attempt to contact the encroaching aircraft via VHF air traffic radio and will direct the PIC to stay clear.
- The OOD will notify the Deck Department 15 minutes prior to any planned HQ-20 landing.
- Aircraft Observer / Fire-watch: Continually monitor the UAS while in flight and inform SP/PIC/MC of any other aircraft or concerns in the area.

8. RECOVERY PROCEDURES

- SP notify OOD 15 minutes prior to a planned capture.
- 10 minutes pror to capture the OOD will make a page over the 1MC that all decks are secured to only crew directly involved in the UAS operation
- The OOD will maneuver the ship as directed by the PIC.
- The OOD will notify the PIC/SP when the ship is finished maneuvering.
- The PIC will then maneuver the aircraft for approach. The PIC will then request an approach from the OOD and the OOD will respond as necessary.
- The PIC will then start the approach and the MC will provide updates to the OOD as to the distance/time the HQ-20 is from the recovery.
- Once on deck the OOD will log the time and location of HQ-20 landing in the ship's log and will reposition the ship for small boat recovery.
- In the event of a missed landing or wave off the PIC will position the aircraft for another approach and inform the OOD that they would like another
- In the event the HQ-20 misses the deck and lands in the water, the OOD will notify the CB to deploy the small boat for recovery.

9. EMERGENCY RECOVERY:

- Failed Launch: The OOD will keep the ship clear of the downed UAS, mark the position, notify the CB to deploy the small boat for UAS recovery, and position the ship for small boat deployment. The small boat team will recover the UAS and return to the ship.
- UAS Unexpectedly Comes Down: OOD works with PIC/SP to determine bearing and range, then steams to the general area of the UAS ensuring not to run it over. Call out numerous look outs. Once in sight notify the CB to deploy the small boat for UAS

recovery, and position the ship for small boat deployment. The small boat team will recover the UAS and return to the ship.

- UAS Loses Ground Control Signal: If the HQ-20 receives zero packets (bits of information) from the GCS for a period of twenty seconds it initiates its loss of link procedure. The operator can program one of the following options in the event of loss of link:

  i. Go to Rally': The UAS flies to a previously specified altitude and rally point, proceeds to a landing waypoint and executes the autoland function upon arrival at that landing waypoint. The rally/landing waypoint can be fixed or carried with the ship. This is the default setting when operated from a NOAA Ship and normally commands the aircraft to return to the designated rally waypoint at a specified distance and bearing from the GCS. As long as the HQ-20 is receiving packets from the GCS the rally/landing waypoint will be continually updated based on the ship's position. If 'Go to Rally' is initiated due to loss of link the HQ-20 will return to the last received rally position. As the HQ-20 approaches the rally point and ship, link should be reestablished and the PIC and SP can continue the mission if desired.

  ii. It is the PIC's responsibility to inform the OOD when the HQ-20 enters 'Loss of Link' mode and the OOD should mark the location on the ship's navigation software. From that position the HQ-20's rally and landing waypoints can be determined. The OOD should hold station in the vicinity of these waypoints for recovery, but should stand off from the rally and landing waypoints by 300 yards. If the HQ-20 returns to the rally location without re-establishing link it will automatically initiate a landing.

10. LITHIUM BATTERIES

- If the HQ-20 strikes the deck or rigging the Li-ion battery may ignite. As with any metal fire, water or CO2 is ineffective at fighting the fire. A burning Li-ion battery should be put in a bucket of salt water to put the fire out. A class D fire extinguisher may also be provided.
- In the event of a UAS related incident or accident, standard OMAO reporting procedures will be followed.

11. LOGS

11.1 OOD WILL RECORD IN THE SHIP'S LOG:

- Completion of frequency spectrum analysis
- UAS securite calls
- UAS launch time
- UAS recovery time
- Time and ship's position of lost link exceeding 20 seconds.
- An uncontrolled landing, low battery autoland, loss of link landing, etc.
- Any Mishap involving the UAS
- The PIC and SP will maintain logs in accordance with AOC procedures.

11.2 SHIP'S OPS OFFICER WILL:

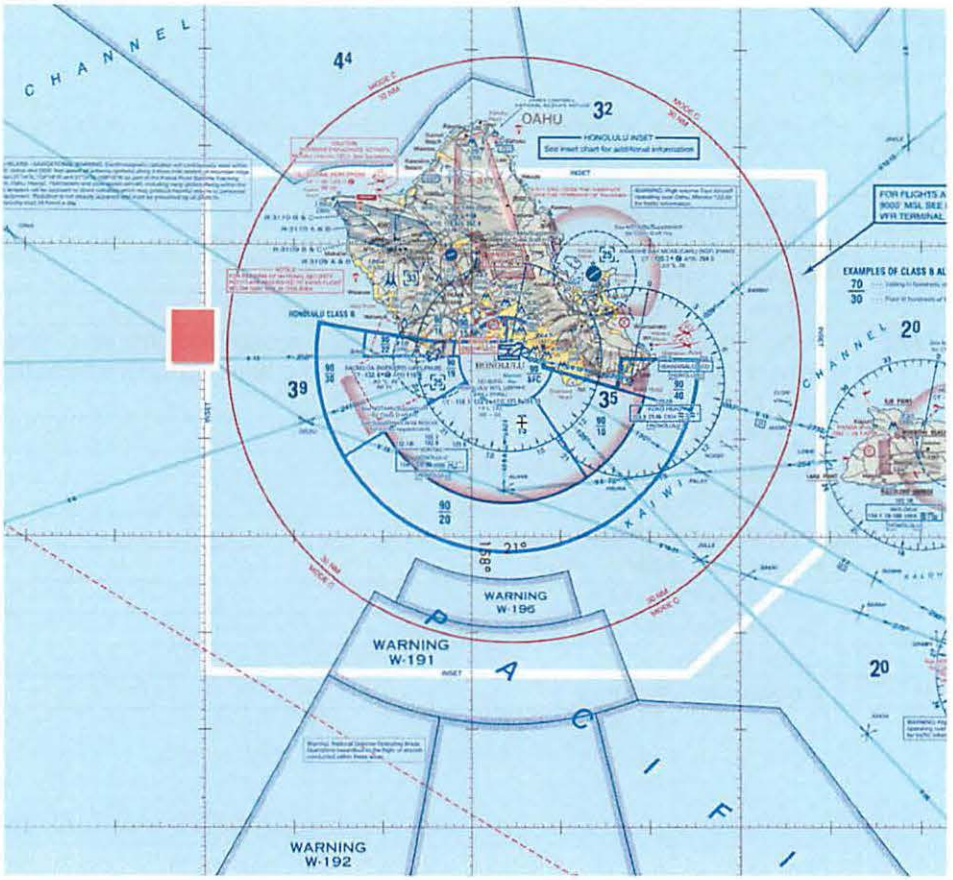
- Transfer flight logs and files to the ship's network.
- Compile flight information for reports to MOC.

12. RECORDS AND REPORTS

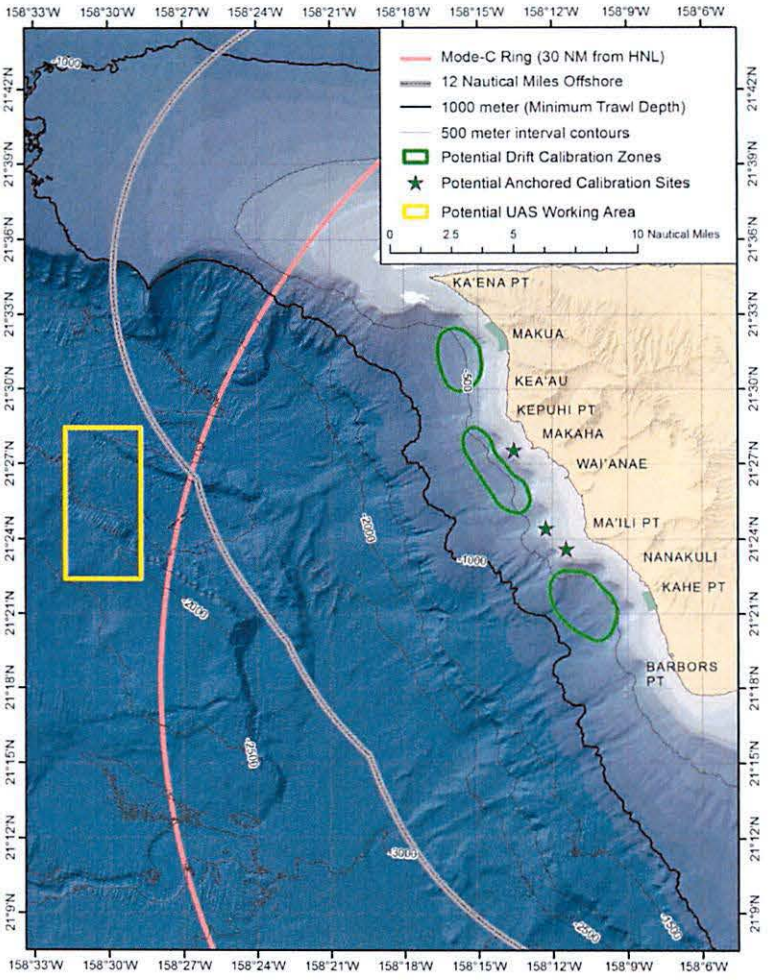
Ship's Deck Log
Daily SITREP
Flight Data Record

13. DEFINITIONS

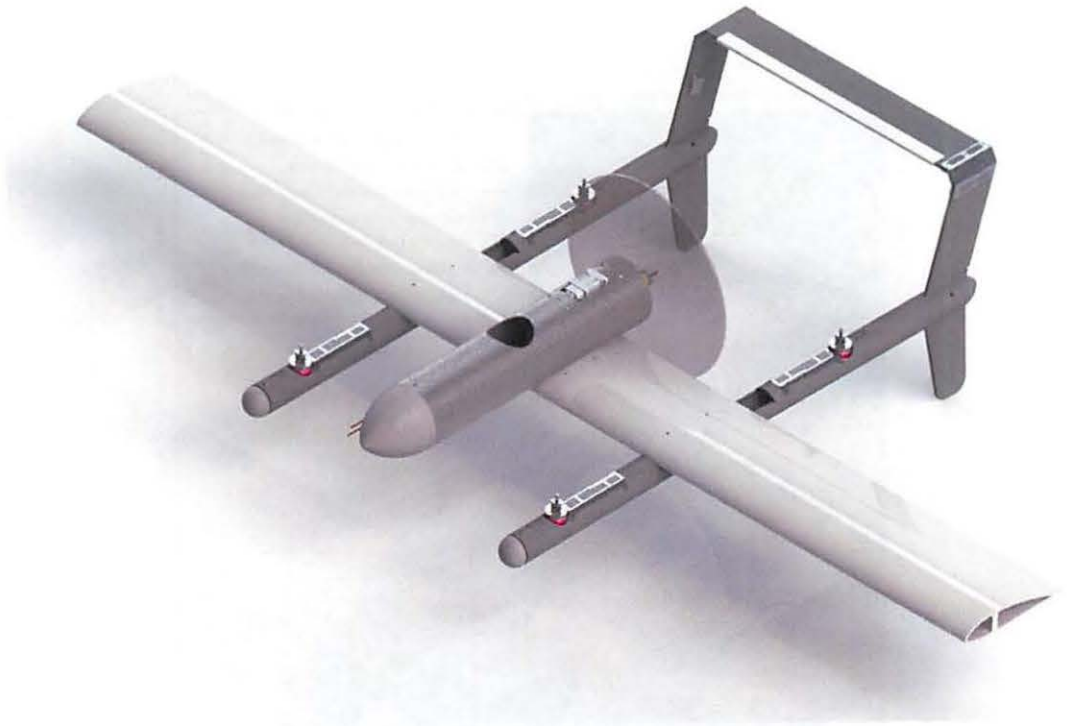
CO	Commanding Officer
AOC	NOAA's Aircraft Operations Center
MOC	NOAA's Marine Operations Center
OOD	Officer of the Deck
NOTAM	A Notice to Airmen(NOTAM or NoTAM) is a notice filed with an aviation authority to alert aircraft pilots of potential hazards along a flight route or at a location that could affect the safety of the flight
AIS	Automated Identification System
RAM	Restricted In Ability to Manuever
PIC	Pilot in Command
MC	Mission Commander
PM	Project Manager
SP	Supplimental Pilot
VO	Visual Observer
CB	Chief Bosun
OPS	Operations Officer



Working area shown in red square.



Working area shown in yellow square.



HQ-20