CMORE HOE-PhoR
Draft Cruise Plan

Cruise ID: KM 13-09
Vessel: R/V Kilo Moana, University of Hawaii
Master of the Vessel: Rick Meyer
Chief Scientist: Karin Björkman, University of Hawaii
Junior Chief Scientist: Kristina Fontanez, MIT
OTG Marine Technicians: Dan Fitzgerald, Justin Smith

Kilo Moana phone number: 842-9817, cell # 864-0065, satellite # 001-870-336-956510
Marine Center phone number: 842-9813

Loading: May 21, 2013 @0900
Departure: May 22, 2013 @0900 (Science personnel on board by 0730).
Arrival: June 5, 2013 @ 0800

1.0 SCIENTIFIC OBJECTIVES

The objective of the cruise is to collect hydrographic and biogeochemical data at the Hawaii Ocean Time-series (HOT) station ALOHA. In addition, sampling will be done at the future Sea Water Air-Conditioning (SWAC) site close to the entrance of Honolulu Harbor. Four stations will be occupied during the cruise, in the following order:

1) SWAC 3 (Intake site; 21.2231, -157.8656; depth 545 m), SWAC 2 (Down slope; 21.2782, -157.8725; depth 175 m) and SWAC 1 (Diffuser site; 21.2804 N, 157.8713 W; depth 105 m), will be occupied on the first day of the cruise for approximately 3 hours.

2) Station 2, referred to as Station ALOHA, is defined as a circle with a 6 nautical mile radius centered at 22° 45’N, 158°W. This is the main HOT station and will be occupied for the duration of the cruise.

1.1 SCIENTIFIC OPERATIONS

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<td>CTD casts (500, 150, 95 m).</td>
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<td>Seaglider, sediment traps, gas arrays, hand net tows,</td>
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<td>ALOHA (sta. 2)</td>
<td>CTD operations, diaphragm pumps, McLane pumps, VANES cast, misc. experiments.</td>
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<td>Underway/continuous</td>
<td>ADCP, thermostalinograph, pCO2 system, fluorometry, and meteorology.</td>
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2.0. SCIENCE PERSONNEL

<table>
<thead>
<tr>
<th>Participant</th>
<th>Title</th>
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<tbody>
<tr>
<td>Karin Björkman (F)</td>
<td>Scientist</td>
<td>UH</td>
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<tr>
<td>Gonzalo Carrasco (M)</td>
<td>Scientist</td>
<td>MIT</td>
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<tr>
<td>John Casey (M)</td>
<td>Graduate student</td>
<td>UH</td>
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<tr>
<td>Mengli Chen (F)</td>
<td>Graduate student</td>
<td>MIT</td>
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<tr>
<td>Hilary Close (F)</td>
<td>Scientist</td>
<td>UH</td>
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<tr>
<td>Andres Cubillos-Ruiz (M)</td>
<td>Graduate student</td>
<td>MIT</td>
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<tr>
<td>Julie Diaz (F)</td>
<td>Scientist</td>
<td>WHOI/LDEO</td>
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<tr>
<td>Erica Donlon (F)</td>
<td>Research assistant</td>
<td>UH</td>
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<tr>
<td>Ken Doggett (M)</td>
<td>Research associate</td>
<td>UH</td>
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<tr>
<td>Solange Duhamel (F)</td>
<td>Scientist</td>
<td>LDEO</td>
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<tr>
<td>Sonya Dyhrman (F)</td>
<td>Scientist</td>
<td>LDEO</td>
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<tr>
<td>Sara Ferron Smith (F)</td>
<td>Research associate</td>
<td>UH</td>
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<td>Kristina Fontanez (F)</td>
<td>Scientist</td>
<td>MIT</td>
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<tr>
<td>Emile Grau (F)</td>
<td>Research assistant</td>
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<tr>
<td>Tyler Goepfert (M)</td>
<td>Graduate Student</td>
<td>WHOI</td>
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<tr>
<td>Dean Jacobsen (M)</td>
<td>Teacher Collage of Marshall Islands</td>
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<tr>
<td>Amelie Longo (F)</td>
<td>Undergraduate</td>
<td>LDEO</td>
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<tr>
<td>Kathrine Mackey (F)</td>
<td>Scientist</td>
<td>WHOI</td>
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<tr>
<td>Dawn Moran (F)</td>
<td>Scientist</td>
<td>WHOI</td>
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<tr>
<td>Ty Samo (M)</td>
<td>Scientist</td>
<td>UH</td>
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<tr>
<td>Sarah Searson (F)</td>
<td>Research associate</td>
<td>UH</td>
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<tr>
<td>Daniela del Valle (F)</td>
<td>Scientist</td>
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<tr>
<td>Blake Watkins (M)</td>
<td>Marine Engineer</td>
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<td>Sam Wilson (M)</td>
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<tr>
<td>Dan Fitzgerald</td>
<td>Marine Technician</td>
<td>OTG</td>
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<tr>
<td>Justin Smith</td>
<td>Marine Technician</td>
<td>OTG</td>
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(24 science + 2 OTG)

3.0. SUMMARY SCHEDULE

20 May Requesting access to ship for setting up trace metal enclosure in lab 2
21 May  Ship loading at 0900 hrs.
22 May  Depart from Snug harbor at 0900 hrs. Science personnel on-board by 0700.
       Safety briefing, orientation meeting 0730.
22 May  Station SWAC 3,2,1 CTD operations.
22 May - 4 June Station ALOHA operations.
5 June  Arrive back to Snug Harbor. Partial offload.

4.0. OPERATIONAL PLAN

4.1. SWAC station sampling –
SWAC 3 (Intake site; 21.2231, -157.8656; depth 545 m),
SWAC 2 (Down slope; 21.2782, -157.8725; depth 175 m) and
SWAC 1 (Diffuser site; 21.2804 N, 157.8713 W; depth 105 m), will be occupied
on the first day of the cruise for approximately 3 hours total.

4.2. Station ALOHA (22°45’N, 158°W with 6 nm radius)

4.2.1. Sediment trap array deployment
Upon arrival to Station ALOHA, the floating sediment traps will be deployed at a
location within Station ALOHA, to be determined en route to ALOHA by local
current conditions. The array will be deployed from the stern, using the A-frame
and large Sea-Mac winch. Power requirement for the winch is 440 VAC, three
phase at 10 amps. After deployment we request that the Bridge verify that the
radio transmitters are functioning and directionally correct.
The array will drift for about 9 days before recovery. The array is equipped with 2
ARGOS satellite transmitters (platform #’s 01833, 60843), 2 strobe lights, and 2
radio transmitters (channel 72, 156.625 MHz). Daily positions of the array shall
be transmitted by email directly to the ship (argosfix@km.soest.hawaii.edu,
password: argosfix), therefore the ship will not need to keep within sight of the
array until the time of the recovery. Assistance from the Bridge is requested in
plotting the drift track of the array. We request the use of the ship’s radio direction
finder for locating the array before recovery.

NOTE: depending on the speed and distance this array travels, the date for
recovery may shift to maximize time for operations at Station ALOHA.

4.2.2. On the first day at Station ALOHA (5/23), Seaglider 148 will be deployed (Sect.
4.4). Once the glider is deployed, CTD casts will recommence.

4.2.3. Water column measurements
Vertical profiles of temperature, conductivity and dissolved oxygen will be made
with an instrument package consisting of a Sea-Bird CTD attached to a 24-place
rosette with 12 liter Bullister sampling bottles. We will need the ship’s CTD
winch and A-frame for these operations. Water samples for biogeochemical
measurements will be collected on each cast.
There will be an additional instrument to be included with the OTG CTD package –
an ISUS, which is a real time, chemical free sensor for measuring nitrate. Its
power requirement is 0.625 amps at 12V.

4.2.4 Diaphragm pump water collection
On the first day on station (5/23/13) large volume water collection using a
diaphragm pump, at 10 m depth, will be done. This operation is expected to take
approximately 2 hours. Later in the cruise (5/25) a small volume (~10 L) will also
be collected using this pump system taking less than 20 minutes.
This operation requires the use of the ships compressed air.
4.2.5 McLane pumps
McLane pumps will be deployed on several occasions throughout the cruise. These will be attached to a Kevlar covered wire (MVP wire 0.33”). Two to seven (2-7) pumps will be attached to the line for each pump sampling. Each McLane pump session is expected to take 4-6 hours to complete. The target depths range from 200 to 1500 m depending on the cast.

4.2.6 Gas Array deployment
A free drifting incubation array will be deployed multiple times during this cruise, for both dawn-to-dusk and dusk-to-dawn deployments, starting on the second day of the cruise at Station ALOHA. We request the use of the A-frame for this operation and will also use the Sea-Mac winch. The array is equipped with two ARGOS satellite transmitters (platform #’s 03028, 60482 emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), a strobe light and a radio transmitter (156.425 MHz).

The **ship shall keep within sight of the array** while performing CTD operations for the last 6 hours of the approximately 12-hour time the array will be in the water unless the array drifts outside of the ALOHA circle. If the array drifts out of the circle, the ship should return inside the circle to conduct CTD casts, and the monitoring of the array will be coordinated with the watch leader. CTD operations shall continue after recovery.

4.2.7 VANE sampling
Trace-metal clean samples will be collected using VANE samplers attached to the Kevlar covered wire (MVP wire, 0.33”). Two VANE casts will be conducted with target depths of 250 m and 1500 m respectively. Each cast will have 5 VANES attached to the wire. The deep cast cast (Depths: 250, 500, 700, 1000, 1200, and 1400m) and a shallow cast (Depths: 25, bottom of mixed layer ~50, 75, 100, chl-max~130, and 175m) will be conducted on consecutive days. In conjunction to the VANES deployments, CTD water collection targeting the same depths as the VANES will be conducted. Complimentary measurements to the Fe studies will also be taken for Nd isotopes (5 L) in order to identify the source of the dust-derived Fe: Asia or Hawaii (Katharina Pahnke). The VANES will also be deployed through the A-frame on the back deck.

4.2.8 Surface hand net tow
Surface net tows are hand-deployed off the stern for about 20 minute periods. Two back-to-back tows are requested every day at 1030 starting on May 23 (~45 minutes total, Sonya Dyhrman). In addition, repeat hand net tows will be done on 3 occasions at night, and 4-6 occasions during the day (1 hour total per session, Dean Jacobsen). We request that the ship remain stationary during these tows.

4.2.9 Automated Trace Element Sampler (ATE)
Each day that the ship is occupying Station ALOHA, the ATE will be hand deployed off the back deck to a depth of 10 m to collect at Trace Metal Free
Sample. The ATE will be recovered after 30 minutes in the water. The ATE is approximately 1’ tall and 4” in diameter, weighting 5 lbs.

**If the ship has been stationary at ALOHA for previous cruise activities, it is requested that the ship steams approximately 10-15 minutes up current from current position prior to each ATE deployment to limit contamination of the trace metal sample from the ship’s hull.**

4.2.10. Hyperpro
The Hyperpro is a profiling unit with one up-looking and one down-looking hyperspectral radiometer, a WET Labs ECO-BB2F triplet (measuring Chlorophyll-a fluorescence and backscattering in the blue and red wavelengths), temperature and conductivity sensors. This instrument also incorporates a ship mounted surface radiometer. The Hyperpro will be deployed 3-4 times during the cruise. The Hyperpro is deployed from the stern through a small block hung from the A-frame. The instrument is hand-lowered and retrieved. Each deployment will consist of three profiles before the instrument is retrieved and take approximately 45 min to complete.

4.3 Sediment Trap recovery
In the afternoon of May 31st, the ship shall transit for the recovery of the sediment trap array. A CTD cast (S3C1) to 500 m will be conducted in the vicinity of the array prior to retrieval. The A-frame and the Sea-Mac winch will be needed to retrieve the sediment trap array. After the array is recovered, the ship shall transit to Station ALOHA and continue to conduct CTD operations.

NOTE: depending on the speed and distance this array travels, the date for recovery may shift to maximize time for operations at Station ALOHA.

4.4 Seaglider Operations
One seaglider, sg148, will be deployed, on the first day of operations, at Station ALOHA (5/23). At least one hour prior to the planned deployment time, the seaglider will be staged on the back deck and set up to run in the pre-launch mode. The location of staging the seaglider should be to give its antenna the maximum unobstructed or clear view of the sky. This aids the communication cycle during pre-launch with the land based basestation. The field checkout team will also be regularly communicating by Iridium phone with the basestation pilot. The actual deployment over the side and subsequent initial dive evaluation will require about one hour.

Operations may resume as soon as the glider is deployed and on its first dive, but it is requested that that the vessel stay within the area until the seaglider begins its 2nd or 3rd short dive.

Throughout the remainder of the cruise sg148 will be diving and profiling in the Station ALOHA area and at times transiting within the circle boundary of Station ALOHA.
The seaglider surface GPS fixes and alert info will be sent to the onboard email seaglider@km.soest.hawaii.edu, which is accessible both by the science party and Captain.

sg148 ARGOS = 90992

It is requested that when the KM is within the circle, the OTG initiated cronjob (forwarding the ship's position) send out the email message to poulos@soest.hawaii.edu once every two hour period.

4.5 Acoustic Doppler Current Profiler
The ship’s acoustic Doppler current profiler (ADCP) will be in operation during the duration of the cruise. The OTG electronics technicians will be in charge of the ADCP system.

4.6 Thermosalinograph, $pCO_2$ system, Fluorometer, and meteorological system
The ship’s thermosalinograph, $pCO_2$ system and fluorometer sampling the uncontaminated seawater supply system will be in operation during the duration of the cruise while the ship is outside of Snug Harbor. The ship’s meteorological system shall be in operation throughout the cruise. Access to real-time underway data through the ship’s network will be required. The OTG technicians will be in charge of the thermosalinograph, $pCO_2$ system, Fluorometer, and meteorological suite operations.

4.7 We also request that OTG group initiate the shell script to automatically send the ships coordinates approximately hourly by email to poulos@soest.hawaii.edu and lfujieki@soest.hawaii.edu. This will be important to cross-calibrate the instrumentation in the water (sea-glider).
Whenever pumping of the ship’s tanks is needed, it must be conducted outside the circle that defines station ALOHA (Sect. 1.0). To avoid disruptions in the schedule, this operation should be coordinated with the chief scientist or the watch leaders (Blake Watkins, Sarah Searson).

5.0 EQUIPMENT

5.1 The science party shall be bringing the following

1. One 20 ft. laboratory van with assorted equipment for radioisotope and general use (Van #23)
2. One 20 ft laboratory van for radioisotope and flow cytometry use (Karl, FCM van)
3. One 20 ft OTG van
4. Distilled, deionized water and all required chemicals and isotopes
5. Large vacuum waste container
6. Liquid nitrogen dewar
7. Drifting sediment trap array with strobe lights, satellite and radio transmitters, floats, weights
8. Polypropylene line
9. Sediment traps and crosses
10. Oxygen titration system
11. Plankton nets and towing lines
12. Desktop and laptop personal computers
13. Assorted tools
14. All required sampling bottles
15. Deck incubation system
16. Pertinent MSDS

5.2 We will need the use of the following ship's equipment:

1. OTG’s 24-place rosette, and 24 12-l water sampling bottles
2. CTD Instrument package
3. A-frame
4. A-frame block assembly
5. One 20 ft van with assorted equipment for radioisotope and general use (OTG radiation van)

6. Winch and conducting wire for CTD operations (0.681)
7. MVP Kevlar line minimum of 1500 m (for McLane pumps and VANES casts)
8. Electric power for winches (440 VAC, 3 phase, 60 Amp breaker) and vans (208 VAC single phase at 60 amps for lab van, 110 VAC 10 amps for equipment van)
9. Radio direction finder
10. Space on upper deck for three laboratory vans
11. Space on upper deck for incubators
12. Hand-held VHF transceivers
13. Precision depth recorder
14. Shackles, sheaves, hooks and lines
15. Shipboard Acoustic Doppler Current Profiler
16. Thermosalinograph, pCO2 system, and Fluorometer
17. Meteorological suite
18. Copy machine
19. Grappling hooks and line
20. Laptop with Nobeltec charting software and GPS feed
21. Running fresh water and seawater hoses
22. Electronic mail system
23. GPS system
24. Uncontaminated seawater supply

**25. Small capstan (~ 10 m/min)**

26. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, pCO2 and access to real-time data through the network.

**27. 1000 lb weight.**

28. Large Sea-Mac winch (Mod. 1025 EHS). 60 Amp Hubbel plug/connector (440 VAC, 3 phase, 60 Amp breaker)