**Hawaii Ocean Time-series**
**HOT-208 General Cruise Plan**

Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Brian Wehmeyer
Chief Scientist: Fernando Santiago-Mandujano, University of Hawaii
OTG Marine Technicians: Daniel Fitzgerald and Tim McGovern

*Kilo Moana phone number: 842-9817, cell # 864-0065*
*Marine Center phone number: 842-9813*

Loading: January 16, 2009 @ 0900
Departure: January 19, 2009 @ 0900
Arrival: January 23, 2009 @ 0800

## 1.0 SCIENTIFIC OBJECTIVES

The objective of the cruise is to maintain a collection of hydrographic and biogeochemical data at the Hawaii Ocean Time-series (HOT) stations. The following locations will be occupied during the cruise, in the following order:

1) Station 1, referred to as Station Kahe, is located at 21º 20.6'N, 158º 16.4'W and will be occupied on the first day of the cruise for about 2 hours.
2) Station 2, referred to as Station ALOHA is defined as a circle with a 6 nautical mile radius centered at 22º 45'N, 158ºW. This is the main HOT station and will be occupied during the 2nd, 3rd, and 4th days of the cruise.
3) Station 50, is the site of the WHOTS Mooring, located at 22° 46'N, 157° 53.83'W will be occupied on the 4th day of the cruise for about one hour.
4) Station 6, referred to as Station Kaena, is located off Kaena Point at 21° 50.8'N, 158° 21.8'W will be occupied on the 4th day of the cruise for about 2 hours.

## 1.1 SCIENTIFIC OPERATIONS

| Station | Activities |
|---|---|
| Kahe (sta. 1) | Weight Cast, PRR cast, CTD cast (1000 m) |
| ALOHA (sta. 2) | Sediment traps, gas array, net tows, CTD operations, primary productivity measurements, AC9/FRRf, misc. experiments. |
| WHOTS mooring (sta. 50) | One one-hour CTD yo-yo cast (200 m). |
| Kaena (sta. 6) | CTD cast (2400 m) |
| Underway/continuous | ADCP, thermosalinograph, fluorometry, meteorology, pCO2 |

## 2.0. SCIENCE PERSONNEL

| Participant | Title | Affiliation/HOT Group |
|---|---|---|
| Karin Björkman | Research Specialist | UH/BEACH |
| Tara Clemente | Research Associate | UH/BEACH |
| Susan Curless | Research Associate | UH/BEACH |
| Ken Doggett | Research Associate | UH/CMORE |
| Lance Fujieki | Computer Specialist | UH/BEACH |
| Eric Grabowski | Research Associate | UH/BEACH |
| Adriana Harlan | Research Associate | UH/BEACH |
| Dan Sadler | Research Associate | UH/BEACH |
| Brett Updyke | Research Associate | UH/BEACH |
| Sam Wilson | Scientist | UH/CMORE |
| Blake Watkins | Marine Engineer | UH/BEACH |
| Jay Wheeler | Research Associate | UH/BEACH |
| Allyn Fetherolf | Graduate Student | UH/PO |
| Cameron Fumar | Undergrad Student | UH/PO |
| Paul Lethaby | Research Associate | UH/PO |
| Fernando Santiago-Mandujano | Chief Scientist – Res. Assoc. | UH/PO |
| Christin Shacat | Research Associate | UH/PO |
| Jefrey Snyder | Marine Technician | UH/PO |
| Stephanie Wagenhauser | Undergrad Student | UH/PO |
| Janice Jones | Scientist | UCSB |
| Jeff Krause | Scientist | UCSB |
| John Bullister | Scientist | PMEL |
| Dave Wisegarver | Technician | PMEL |
| Dan Fitzgerald | Marine Technician | OTG |
| Tim McGovern | Marine Technician | OTG |
| Vic Polidoro | Marine Technician | OTG |

## 3.0. SUMMARY SCHEDULE

| | |
|---|---|
| 13 January | Pre-cruise meeting, MSB 307, 1030 hrs |
| 16 January | Ship loading starting at 0900 hrs |
| 19 January | Depart from Snug harbor at 0900 hrs. Science personnel on-board by 0800. |
| 19 January | Station 1 Kahe Pt. operations. |
| 20-22 January | Station ALOHA operations. Station 50 and Kaena CTD casts. |
| 23 January | Arrive back to Snug harbor. ETA 0800 hrs. Full offload |

## 4.0. OPERATIONAL PLANS

### 4.1. Station Kahe (21$^{o}$20.6'N, 158$^{o}$16.4'W)

A Sea Glider deployment will be the first operation at this station if the weather is favorable (see Sect. 4.1.1). In addition, a 1000 lb. weight-test cast, one CTD cast to 1000 m, and a PRR cast (Sect. 4.2.7) will be conducted at this location in the afternoon of the first cruise day. The CTD winch and crane will be required for these operations. After the operations are satisfactorily completed, the ship shall proceed to Station ALOHA.

4.1.1 Seaglider Deployment

If weather permits, a Seaglider will be launched off of the stern using the A-frame. An iridium handset will be provided for communication between OTG and the glider pilots on island for use in this operation. We request turning on the ship location email broadcast. There are multiple time slots scheduled for these operations in case of inclement weather conditions or communication issues between land and sea based teams, but our first option will be to conduct the deployment upon arrival to Station Kahe. If the Seaglider misbehaves, the small boat will be launched to aid in the recovery operation.

4.2. Station ALOHA (22$^{o}$45'N, 158$^{o}$W with 6 nm radius)

4.2.1. Upon arrival to Station ALOHA, the sediment traps will be deployed (Sect. 4.2.2). Afterwards, one 200-m and one 1000-m casts will be conducted before deploying the Primary Productivity array (Sect. 4.2.3). These operations will be followed by a near-bottom CTD cast.

4.2.2. Sediment trap array deployment

Upon arrival to Station ALOHA, the floating sediment traps will be deployed at a location within Station ALOHA, which will be determined by local current conditions to be determined enroute to ALOHA. The array will be deployed from the stern using the A-frame and the 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 53 hours before recovery. The array is equipped with 2 ARGOS satellite transmitters (platform #'s 01833, 60481), 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 site 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.

After deployment of the sediment trap array, the ship shall return to the center of Station ALOHA to continue with CTD cast operations.

4.2.3 Primary production experiment

Samples for the primary productivity experiment will be collected from the rosette. Before dawn (sunrise 0714 hrs on January 20), a free drifting incubation array will be deployed from the stern. We request the use of the A-frame for this operation and will also use the Sea-Mac winch. The array is equipped with one ARGOS satellite transmitter (platform #'s 03028, 60482, emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), strobe lights and a radio transmitter (channel 68, 156.425 MHz). The **ship shall keep within site 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. The array will be recovered just at sunset (1812 hrs). CTD operations shall continue after recovery. All radioactive waste generated by the experiment shall be returned to the University of Hawaii. Only qualified personnel shall handle radioactive material.

4.2.4. 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 sampling bottles. We need the ship's CTD winch and crane for this operation. Water samples for biogeochemical measurements will also be collected on each cast. The cast after the deployment of the primary productivity array shall be made to the near bottom (approximately 4740 m). Following this cast, a series of 1000-m casts shall be made continuously every 3 hours for a 36-hour period, ending with a second near-bottom cast. It is highly desired that this burst sampling be done without interruption and we request the ship to maintain position within the study area for that period of time, and repositioning to the center of the Station before each cast whenever possible.

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 (**Jefrey Snyder and Tara Clemente**).

4.2.5. Gas Array deployment

A second free drifting incubation array will be deployed the third day of the cruise at ALOHA station. Samples for the gas array will be collected from the cast before deployment. We request the use of the A-frame for the gas array deployment, and will also use the Sea-Mac winch. The array is equipped with one ARGOS satellite transmitter (platform #'s 03028, 60482, emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), a strobe light and a radio transmitter (channel 68, 156.425 MHz). The ship will **not** need to keep within sight of the array until the time of the recovery, approximately 24 hours after its deployment. CTD operations shall continue after the recovery.

4.2.6. Zoo net tows

A plankton net will be deployed from the stern and shall be towed for half-hour periods. Half-hour periods are scheduled at around noon (between 1000 and 1400) and at midnight (between 2200 and 0200) on the second and third days (see schedule) with a total of seven available slots to accommodate cancellations due to sea state or other unforeseen problems. The A-frame and capstan will be needed for this operation. B. Watkins will be in charge of these operations.

4.2.7. Profiling Reflectance Radiometer (PRR).

Around noon on each day a profiling reflectance radiometer will be deployed from the main deck using the A-frame. The instrument is hand-lowered and retrieved with assistance from the winch.

4.2.8. AC9/FRRf

The Wet Labs AC9 is an optical instrument that measures water column spectral absorption and attenuation at nine wavelengths. The AC9 package also includes a Fast Repetition Rate Fluorometer (FRRf), and a Sea-Bird Seacat with temperature, conductivity, fluorometer, and pressure sensors. The package will be deployed to a target depth of 250 m at a constant speed of 10 m/min during the downcast and upcast. The A-frame and capstan will be needed for this operation.

4.2.9. Automated Trace Element Sampler (ATE)

On the 3rd day of the cruise, the ATE will be hand deployed off the back deck to a depth of 10 m. The ATE will be recovered after 30 minutes in the water. The ATE is approximately 1' tall and 4'' in diameter, weighting 5 lbs.

4.3 Floating sediment trap recovery

In the morning of the fourth cruise day, after the AC9/FRRf cast has been completed, we shall transit for the recovery of the floating sediment trap array. 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 recover the Gas Array. After the array is recovered, the ship shall transit to Station 50 to conduct one one-hour yo-yo CTD cast.

4.4 WHOTS Mooring (Station 50)

One one-hour 200-m CTD yo-yo cast will be conducted near the WHOTS mooring on the fourth cruise day. This cast should be conducted downwind, downcurrent, and at about 200 m from the mooring's buoy. The watch leader will determine the position of the buoy from the WHOTS web site (`http://ocelot.whoi.edu/projects/WHOTS/data/whots4_pos.txt`) and will give this information to the bridge. The nominal position of the mooring's anchor is 22° 46'N, 157° 53.83'W. After the cast is completed the ship shall transit to ALOHA to conduct one PRR cast, followed by one AC9/FRRf cast. After these operations are completed, the ship shall transit to Station Kaena.

4.5 Station Kaena (21° 50.8'N, 158° 21.8'W)

A near-bottom CTD cast (~2500 m) will be conducted at this location in the evening of the fourth cruise day, after which the ship shall return to Snug Harbor.

4.6. 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 technician will be in charge of the ADCP system.

4.7. Thermosalinograph, Fluorometer and pCO2 system

The ship's thermosalinograph, fluorometer, and pCO2 sampling the uncontaminated seawater supply system will be in operation during the duration of the cruise while the ship is outside of Snug harbor. Salinity samples to calibrate the thermosalinograph will be taken from the intake hose at 4-hour intervals throughout the duration of the cruise by the science personnel. The OTG electronics technician will be in charge of the thermosalinograph and fluorometer operations.

4.8. Meteorological Instruments

The ship's meteorological instrumentation (anemometers, barometer, air temperature and humidity sensors, etc.) will be in operation during the duration of the cruise. The OTG

electronics technicians will be in charge of this system. We request information about sensor's calibrations and their current status.

4.9. Magnetometer

The ship's magnetometer will be deployed two times during the cruise. The first deployment will be during the transit to Station ALOHA on the first cruise day and the second will be during the transit to Station Kaena on the fourth cruise day. It will take roughly 10 minutes to deploy and recover this instrument. The magnetometer needs to be deployed before the ship reaches cruising speed. OTG personnel will be in charge of this operation. They will notify the watch leader when the magnetometer is deployed and recovered.

## 5.0 EQUIPMENT

5.1 The HOT science party shall be bringing the following

1. Seabird CTD system, all sensors, deck boxes and computer CTD acquisition systems
2. Rosette and 24 12-l water sampling bottles, all spare parts
3. Two laboratory vans with assorted equipment for radioisotope and general use
4. Distilled, deionized water and all required chemicals and isotopes
5. Equipment van with assorted equipment (main deck)
6. Large vacuum waste container
7. Liquid nitrogen dewer
8. Drifting sediment trap array with strobe lights, satellite and radio transmitters, floats, weights
9. Kevlar line, polypropylene line
10. Sediment traps and crosses
11. Drifting primary production array and gas array with light and radio transmitter, floats, weights, polypro. Line, spare buoy, etc.
12. PRR, AC-9/FRRf and other optical measuring instruments.
13. Oxygen titration system
14. Plankton nets and towing lines
15. Desktop and laptop personal computers
16. Assorted tools
17. All required sampling bottles.
18. Deck incubation system
19. Pertinent MSDS
20. One laboratory van (John Bullister's van)

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

1. A-frame
2. A-frame block assembly
3. Appleton crane and winch with conducting wire for CTD
4. Electric power for winches (440 VAC, 3 phase, 60 Amp breaker, 440 VAC, 3 phase, 10 Amp) and vans (208 VAC single phase at 60 amps for labvan, 110 VAC 10 amps for equipment van)
5. Radio direction finder
6. Space on the main deck for one equipment van
7. Space on upper deck for two lab vans port side, and one on the starboard side

8. Space on upper deck for incubators
9. Hand-held VHF transceivers
10. Precision depth recorder
11. Shackles, sheaves, hooks and lines
12. Shipboard Acoustic Doppler Current Profiler
13. Thermosalinograph, *p*CO2 system, and Fluorometer
14. Copy machine
15. Grappling hooks and line
16. Navlink2 PC or equivalent
17. Running fresh water and seawater, hoses
18. Electronic mail system
19. GPS system
20. Uncontaminated seawater supply
21. Small capstan (~ 10 m/min)
22. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, *p*CO2
23. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
24. Pinger (to be used as spare)
25. 1000 lb weight.
26. Remote CTD decibar pressure display in the winch operator cabin.
27. Large Sea-Mac winch (Mod. 1025 EHS). 60 Amp Hubbel plug/connector (440 VAC, 3 phase, 60 Amp breaker)
28. Ship's location email broadcast
29. Ship's meteorological instruments
30. Spare CTD Seapoint fluorometer

**Ship: R/V *KILO MOANA*  HOT 208 CTD CASTS  January 19 –23 2009**

| Cast | | Samples | #Bottles |
|---|---|---|---|
| **Kahe Pt.** | | | |
| s1c1 | 1000 m | $O_2$, Temp, DIC/Alk, Nuts, Chl a, LLN, $LLPO_4$, DOC, FCM, JB(pb $O_2$), Salts | 24 |
| **Station ALOHA** | | | |
| s2c1 | 200 m | CMORE(5@25, 5@45, 5@75) | 15 |
| s2c2 | 1000 m | Primary Production, Salts, SW (1@25, 1@125), MB(pb on all depths) | 24 |
| s2c3 | 4740 m (PO-1) | $O_2$, Temp, DOC, DIC/Alk, Nuts, JB(pb $O_2$,DIC), Salts | 24 |
| s2c4 | 1000 m (PO-2) | $O_2$, Temp, Nuts, DIC/Alk, DOC, Salts, JB(pb $O_2$,DIC) | 24 |
| s2c5 | 1000 m | PC/PN, SW(1@5,25,45,75,100,125,150,175), Salts | 22 |
| s2c6 | 1000 m | PPO4, Salts | 16 |
| s2c7 | 1000 m (BEACH) | $O_2$, Temp, DIC/Alk, Nuts, LLN, LLP,DOC, Keeling, Quay, Salts, JB(pb $O_2$,DIC) | 23 |
| s2c8 | 1000 m | PUR, CMORE(5@1000,5@770,5@500), Salts | 24 |
| s2c9 | 1000 m | Gas Array (2@125,100) (3@5,25,45,75) MB(1@175,150,125,100,75,45,25,5) | 24 |
| s2c10 | 1000 m | CMORE(5@125,5@200), PO(6@1000), Salts | 18 |
| s2c11 | 1000 m | PSi, MC(5,25,45,75,100,125,150,175), Salts SW(1@5,25,45,75,100,125), SW(pbMC@150,175) | 24 |
| s2c12 | 1000 m | MIT, Salts | 10 |
| s2c13 | 1000 m | ATP, MC(200,300,500,770), SW (1@200,300,400,500, 600,700,800,900,1000), Salts | 24 |
| s2c14 | 1000 m | PE, MC(5,25,45,75,100,125,150,175), SW(pb MC), Salts | 22 |
| s2c15 | 1000 m | HPLC, Chl a, Slides, Salts | 22 |
| s2c16 | 4740 m (PO-3) | $O_2$, MC(1000,2000,3000,4000), JB(pb $O_2$), Salts | 12 |
| **WHOTS Mooring** | | | |
| S50c1 | 200 m yo-yo | BC (1@DCM,70,40,15), BL (1@5, 25, 45, 75, 100, 125, 150) | 11 |
| **Kaena** | | | |
| S6c1 | 2400 m | Chl, Salts | 13 |

**SHIP R/V *KILO MOANA* HOT 208 Date January 19-23, 2009**

| TIME | Monday 1/19 | Tuesday 1/20 | Wednesday 1/21 | Thursday 1/22 | Friday 1/23 |
|---|---|---|---|---|---|
| 0000 | | S2C1 | | | |
| 0100 | | S2C2 PP | Net Tow | | |
| 0200 | | | S2C9 Gas | | |
| 0300 | | | | AC9/FRRF | |
| 0400 | | Deploy PP Array | Deploy Gas Array | Transit sed traps | |
| 0500 | | S2C3 PO-1 | S2C10 Open | Recover traps | |
| 0600 | | | | Transit gas array | |
| 0700 | | | *(Deploy Seaglider)* | Recover gas array | |
| 0800 | | | S2C11 PSi | Transit St 50 | Arrive Snug |
| 0900 | Depart Snug | | ATE | | |
| 1000 | | Net Tow | Net Tow | S50C1 | |
| 1100 | Arrive Kahe (11:30) *(Deploy Seaglider)* | S2C4 PO-2 (Begin 36 hr) | S2C12 MIT | PRR AC9/FRRF | |
| 1200 | Weight cast | Net Tow | PRR AC9/FRRF | | |
| 1300 | PRR S1C1 | | Net Tow | | |
| 1400 | Transit ALOHA | S2C5 PC/PN | S2C13 ATP | *(Seaglider Ops.)* | |
| 1500 | deploy magnetometer | | *(Deploy Seaglider)* | | |
| 1600 | | S2C6 PPO4 | *(Seaglider Ops.)* | Transit St. Kaena deploy magnetometer | |
| 1700 | | | S2C14 PE | | |
| 1800 | | Recover PP array | | | |
| 1900 | | | | | |
| 2000 | | S2C7 BEACH | S2C15 HPLC | Recover magnetometer | |
| 2100 | | | | S6C1 | |
| 2200 | Recover magnetometer | Net Tow | Net Tow | | |
| 2300 | Arrive ALOHA Deploy sed traps | S2C8 PUR | S2C16 PO-3 (end 36 hours) | Transit Snug | |

**January 20: Sunrise 0714 Sunset 1812**

# 6.0 HOT-208 Watch Schedule

**0300-1500**

Eric Grabowski – *Alt-Tag*
Adriana Harlan - *Water Boss*
Lance Fujieki - *Alt water boss*
Jay Wheeler –*Tag*
Jefrey Snyder– Watch Leader - *Tag*
Fernando Santiago-Mandujano - Chief Scientist - *Console*
Cameron Fumar
Stephanie Wagenhauser

**1500-0300**

Tara Clemente – Watch Leader
Karin Björkman
Susan Curless- *Water Boss–Alt Tag*
Dan Sadler –*Tag*
Paul Lethaby - *Tag*
Christin Shacat – *Console*
Allyn Fetherolf

**At Large**

Sam Wilson - *Alt Tag*
Blake Watkins
Brett Updyke - *Alt Tag*
Ken Doggett
John Bullister
Dave Wisegarver
Janice Jones
Jeff Krause

**OTG**

Dan Fitzgerald
Tim McGovern
Vic Polidoro