

Hawaii Ocean Time-series HOT-231 Operational Cruise Plan

Cruise ID: KM 11-13

Vessel: R/V *Kilo Moana*, University of Hawaii

Master of the Vessel: Captain Gray Drewry

Chief Scientist: Craig Nosse, University of Hawaii

OTG Marine Technicians: Trevor Goodman, Trevor Young and TBD

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

Marine Center phone number: 842-9813

Loading: April 8, 2011 – load OTG Rad van on starboard side at approximately 1000

April 8, 2011 – load “23” van on port side and Blue van amidships at approximately 1100

April 8, 2011 – load HOT scientific equipment at approximately 1130

Departure: April 10, 2011 @ 0900

Arrival: April 14, 2011 @ 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. Four stations will be occupied during the cruise, in the following order:

- 1) Station 1, referred to as Station Kahe, is located at 21° 20.6'N, 158° 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 22° 45'N, 158°W. This is the main HOT station and will be occupied during the 2nd, 3rd, and 4th days of the cruise.
- 3) Station 50, the site of WHOTS-7 Mooring, approximate position 22° 46.0052'N 157° 53.9897'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 and will be occupied on the 4th day of the cruise for about 2 hours.

1.1 SCIENTIFIC OPERATIONS

| <u>Station</u> | <u>Activities</u> |
|---------------------------------|---|
| Kahe (sta. 1) | Weight Cast, Hyperpro cast, CTD cast (1000 m) |
| ALOHA (sta. 2) | Sediment traps, gas array, net tows, CTD operations, primary productivity measurements, ACS/AC9/FRRf, misc. experiments |
| WHOTS mooring station (Sta. 50) | One CTD cast (yo-yo to 200 m), surface and sub-surface instrument intercomparisons. |
| Kaena (sta. 6) | CTD cast (near bottom) |
| Underway/continuous | ADCP, thermosalinograph, pCO ₂ system, fluorometry, and meteorology |

2.0. SCIENCE PERSONNEL

| Participant | Title | Affiliation/HOT Group |
|---------------------|----------------------|------------------------------|
| Susan Curless | Research Associate | UH/BEACH |
| Lance Fujieki | Computer Specialist | UH/BEACH |
| Adriana Harlan | Research Associate | UH/BEACH |
| Dan Sadler | Research Associate | UH/BEACH |
| Brett Updyke | Research Associate | UH/BEACH |
| Blake Watkins | Marine Engineer | UH/BEACH |
| Donn Viviani | Graduate Student | UH/BEACH |
| Cameron Fumar | Research Associate | UH/PO |
| Jefrey Snyder | Marine Technician | UH/PO |
| Craig Nosse | Research Associate | UH/PO |
| David Hashisaka | Research Associate | UH/PO |
| Alison Andrews | Undergraduate Intern | UH/PO |
| Sherine Boomla | Volunteer | UH/PO |
| Sara Thomas | Technician | UH/CMORE |
| Scott Grant | Graduate Student | UH/CMORE |
| Jessica Fitzsimmons | Graduate Student | MIT |
| Trevor Goodman | Marine Technician | OTG |
| Trevor Young | Marine Technician | OTG |
| TBD | Marine Technician | OTG |

3.0. SUMMARY SCHEDULE

| | |
|---------------|--|
| 5 April | Pre-cruise planning meeting 1330 hrs. |
| 8 April | Ship loading. |
| 10 April | Depart from Snug harbor at 0900 hrs. Science personnel on-board by 0800. |
| 10 April | Station 1 Kahe Pt. operations. |
| 10 - 13 April | Station ALOHA operations. Station 50 CTD yo-yo cast, Station Kaena |
| 14 April | Arrive back to Snug Harbor. Full offload. |

4.0. OPERATIONAL PLANS

4.1. Station Kahe (21°20.6'N, 158°16.4'W)

A 1000 lb. weight-test cast, one CTD cast to 1000 m, and a Hyperpro cast (Sect. 4.2.7) will be conducted at this location on April 10th. The A-frame, Sea-Mac winch, CTD crane and CTD winch will be required for these operations.

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

4.2.1. Upon arrival to Station ALOHA, the sediment traps will be deployed. After the sediment trap deployment is complete, one 200-m and one 1000-m cast 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, to be determined enroute to ALOHA by local current conditions. The array will be

deployed from the stern, using the A-frame and 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 50 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 continue with CTD cast operations to prepare water for the Primary Productivity Array.

4.2.3 Primary Production experiment

Samples for the primary productivity experiment will be collected from the rosette. Before dawn (sunrise 0616 hrs on April 11th), 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 two ARGOS satellite transmitters (platform #'s 60484, 84857, emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), strobe lights and a radio transmitter (channel 74, 156.725 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 (1849 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 Bullister sampling bottles. We will need the ship's CTD crane and winch for these operations. Water samples for biogeochemical measurements will be collected on each CTD 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. 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 (**Susan Curless, Jeffrey Snyder**).

4.2.5. Gas Array deployment

A second free drifting incubation array will be deployed the third day of the cruise at Station ALOHA. Samples for the gas array will be collected from Station 2 CTD cast 9. 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 60484, 84857), emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), a strobe light and a radio transmitter (channel 74, 156.725 MHz). The ship will **not** need to keep within sight of the array until the time of the recovery,

approximately 25 hours after its deployment. Assistance from the Bridge is requested in plotting the drift track of the array.

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 around noon and midnight on the second, third, and fourth days (see schedule) for a total of six slots. The A-frame and capstan will be needed for this operation. B. Watkins will be in charge of these operations.

4.2.7. 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. Around noon on the first, third and fourth days, the Hyperpro will be deployed from the stern through a small block hung from the A-frame. The instrument is hand-lowered and retrieved with assistance from the winch.

4.2.8. ACS/AC9/FRRf/LISST

An optical package including a Wet Labs AC9 that measures water column spectral absorption and attenuation at nine wavelengths, a Chelsea Fast Repetition Rate Fluorometer (FRRf), a SeaBird Seacat with temperature, conductivity, fluorometer, and pressure sensors, and a LISST particle size and distribution analyzer will be deployed to a target depth of 200 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 2nd 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, weighing 5 lbs.

4.3 Floating sediment trap recovery

In the early morning of April 13th 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 Gas Array is recovered, the ship shall transit to Station 50 conduct one 200 m yo-yo cast.

4.4 Station 50 - WHOTS-7 Mooring

(nominal position of mooring = 22° 46.0052'N 157° 53.9897'W)

4.4.1 CTD yo-yo cast (subsurface instrument intercomparison)

One 200-m CTD yo-yo cast with at least 6 full cycles will be conducted near the WHOTS mooring on April 13th for subsurface instrument intercomparisons. This cast should be conducted downwind, downcurrent, and about 200 m from the mooring.

4.4.2 Surface instrument intercomparison

While on station, the ship's meteorological system shall be in operation for surface instrument intercomparisons with the WHOTS mooring.

Once the yo-yo cast is completed, the ship shall transit to Station ALOHA to conduct one AC9/FRRf cast, one Hyperpro cast and two 200 m CTD casts. If the mooring is positioned such that it is within the Station ALOHA circle, these operations can be performed as close to the WHOTS mooring as safely possible to extend the surface instrument intercomparison.

After the AC9/FRRF and Hyperpro casts are complete, a trace-metal VANES cast will be conducted.

4.4.3 Trace-metal VANES samplers

Trace-metal clean samples will be collected using VANE samplers from the Massachusetts Institute of Technology (MIT). These samplers will be attached to the ship's CTD wire via clamps and deployed to 1000 m. Each VANES sampler contains a trace metal clean 1.5L bottle and is pre-programmed to open at depth, fill and close before the whole unit is raised back on deck. The VANES sampler also acts as a "weathervane," orienting the clean sample bottle upstream of the CTD wire to prevent trace metal contamination from the wire.

There will be 6-8 VANES samplers clamped to the wire for the cast to 1000 m. The CTD winch system and the 1000 lb. weight will be needed for this operation which should take approximately 3 hours to complete. Jessica Fitzsimmons will be in charge of the VANES sampler operations. After the operations are complete, 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 April 13th. Once the CTD cast is complete, 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 technicians will be in charge of the ADCP system.

4.7 Thermosalinograph, $p\text{CO}_2$ system, Fluorometer, and meteorological system

The ship's thermosalinograph, $p\text{CO}_2$ 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. 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 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, $p\text{CO}_2$ system, Fluorometer, and meteorological suite operations.

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 12L Bullister sampling bottles, and all associated spare parts
3. One 20 ft. laboratory van with assorted equipment for radioisotope and general use ("23" Van)
4. One 12 ft. equipment van ("Blue" Van)
5. Distilled, deionized water and all required chemicals and isotopes
6. Large vacuum waste container
7. Liquid nitrogen dewar
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. Hyperpro 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. Trace-metal VANES samplers

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

1. A-frame
2. A-frame block assembly
3. CTD winch and CTD crane
4. Electric power for winches (440 VAC, 3 phase, 60 Amp breaker) and vans (208 VAC single phase at 60 amps for labvan, 110 VAC 10 amps for equipment van)
5. OTG "Rad" Van
6. Radio direction finder
7. Space on the main deck for one equipment van
8. Space on upper deck for two laboratory vans
9. Space on upper deck for incubators
10. Hand-held VHF transceivers
11. Precision depth recorder
12. Shackles, sheaves, hooks and lines
13. Shipboard Acoustic Doppler Current Profiler
14. Thermosalinograph, *p*CO₂ system, and Fluorometer
15. Meteorological suite
16. Copy machine
17. Grappling hooks and line
18. Laptop with Nobeltec charting software and GPS feed
19. Running fresh water and seawater hoses
20. Electronic mail system
21. GPS system
22. Uncontaminated seawater supply
23. Small capstan (~ 10 m/min)
24. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, *p*CO₂ and access to real-time data through the network.
25. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
26. 1000 lb weight.
27. Large Sea-Mac winch (Mod. 1025 EHS). 60 Amp Hubbel plug/connector (440 VAC, 3 phase, 60 Amp breaker)
28. Seapoint fluorometer (to be used as a spare)
29. Lifting basket to transport carboys from the main deck to the 02 deck
30. CTD sled
31. Pallet jack
32. Table at CTD sampling area

| Cast | Samples | #Bottles |
|-----------------------------|---|----------|
| <u>Kahe Pt.</u> | | |
| s1c1 | 1000 m O ₂ , Temp, DIC/Alk, Nuts, Chl a, LLN, LLPO ₄ , DOC, FCM, Salts | 24 |
| <u>Station ALOHA</u> | | |
| s2c1 | 200 m CMORE(5@25,5@45,5@75), DV(9@5) | 24 |
| s2c2 | 200 m Primary Production, DV(pb PP depths), Salts | 22 |
| s2c3 | 4740 m (PO-1) O ₂ , Temp, DOC, DIC/Alk, Nuts, Salts | 24 |
| s2c4 | 1000 m (PO-2) O ₂ , Temp, Nuts, DIC/Alk, DOC, Salts | 24 |
| s2c5 | 1000 m PC/PN, Salts | 14 |
| s2c6 | 1000 m PPO ₄ , Salts | 14 |
| s2c7 | 1000 m (BEACH) O ₂ ,Temp,DIC/Alk, Nuts,LLN, LLP,DOC,Keeling,Quay,Salts | 23 |
| s2c8 | 1000 m PUR, CMORE(5@1000,5@770,5@500), Salts | 24 |
| s2c9 | 1000 m Gas Array(2@5,25,45,75,100,125), Salts | 14 |
| s2c10 | 1000 m CMORE(5@125,5@200), PO(6@1000), Salts | 17 |
| s2c11 | 1000 m PSi, MC(1@5,25,45,75,100,125,150,175), SG(1@45), Salts | 19 |
| s2c12 | 1000 m Open, Salts | 3 |
| s2c13 | 1000 m ATP, MC(1@200,300,500,770), Salts SW(1@200,300,400,500, 600,700,800,900,1000) | 23 |
| 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) Oxygen, MC(1@1000,2000,3000,4000), DV(1@4800,4750), SG(1@4000), Salts | 15 |
| s2c17 | 200 m DV(24@5) | 24 |
| <u>WHOTS Mooring</u> | | |
| S50c1 | 200 m yo-yo SG(1@45) | 1 |

MC=Matt Church, SW=Sam Wilson, DV=Donn Viviani, SG=ScottGrant

Ship: R/V KILO MOANA**HOT 231****Date: April 10 – 14, 2011**

| TIME | Sun. 4/10 | Mon. 4/11 | Tues. 4/12 | Wed. 4/13 | Thur. 4/14 |
|------|------------------------------------|----------------------------|------------------------------|------------------------------------|-------------|
| 0000 | | S2C1 | | | |
| 0100 | | S2C2 PP | Net Tow | | |
| 0200 | | | S2C9 Gas | | |
| 0300 | | Deploy PP Array | | AC9/FRRF | |
| 0400 | | S2C3 PO-1 | Deploy Gas Array | Transit sed traps | |
| 0500 | | | S2C10 Open | Recover traps Transit gas array | |
| 0600 | | | | Recover gas array | |
| 0700 | | | | Transit St. 50 | |
| 0800 | | | S2C11 PSi | S50C1 WHOTS | Arrive Snug |
| 0900 | Depart Snug | | | Transit St. ALOHA | |
| 1000 | | Net Tow | Net Tow | S2C17 | |
| 1100 | Arrive Kahe (11:30) Weight cast | S2C4 PO-2 (Begin 36 hr) | S2C12 Open | AC9/FRRF | |
| 1200 | Hyperpro | Net Tow | Hyperpro ACS/AC9/FRRF | Hyperpro VANES | |
| 1300 | S1C1 | ATE | | | |
| 1400 | | S2C5 PC/PN | S2C13 ATP | | |
| 1500 | Transit ALOHA | | | Transit St. Kaena | |
| 1600 | | | | | |
| 1700 | | S2C6 PPO4 | S2C14 PE | | |
| 1800 | | Recover PP array | | | |
| 1900 | | | | | |
| 2000 | | S2C7 BEACH | S2C15 HPLC | | |
| 2100 | | | | S6C1 | |
| 2200 | | Net Tow | Net Tow | | |
| 2300 | Arrive ALOHA Deploy sed traps | S2C8 PUR | S2C16 Open (end 36 hours) | Transit Snug | |

April 11th: Sunrise 0616, Sunset 1849

6.0 HOT-231 Watch Schedule

0300-1500

Adriana Harlan – *Water Boss*

Dan Sadler

Lance Fujieki – *Tag*

Jefrey Snyder – *Watch Leader – Tag*

Cammy Fumar - *Console*

Sherine Boomla

1500-0300

Susan Curless – *Watch Leader - Water Boss*

Brett Updyke – *Tag*

Craig Nosse – *Chief Scientist - Console*

Dave Hashisaka – *Tag*

Alison Andrews - *Alt Tag*

At Large

Blake Watkins

Donn Viviani – *Alt Tag*

Sara Thomas

Scott Grant

Jessica Fitzsimmons

OTG

Trevor Goodman

Trevor Young

TBD