**Hawaii Ocean Time-series**
**HOT-181 General Cruise Plan**

Cruise ID: KM0614
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Rick Myers
Chief Scientist: Fernando Santiago-Mandujano, University of Hawaii
OTG Marine Technicians: Kuhio Vellalos, Gabe Foreman

Loading: May 24, 2006 @ 0900 HST
Departure: May 25, 2006 @ 0900
Arrival: May 29, 2006 @ 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. Five stations 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 51, is the site of the MOSEAN Mooring, located at 22º 45'N, 158º 6'W will be occupied on the 4th day of the cruise for about 30 minutes.
4) Station 50, is the site of the WHOTS Mooring, located at 22º 46.1'N, 157º 53.4'W will be occupied on the 4th day of the cruise for about 30 minutes.
5) An underwater bottom camera will be deployed in transit to Station ALOHA, at 21º 54.1'N, 158º 16.5'W, and retrieved at the end of the cruise, the deployment will take 30 minutes, and the recovery operation will take 2.5 hours.

## 1.1 SCIENTIFIC OPERATIONS

| Station | Activities |
|---|---|
| Kahe (sta. 1) | Weight Cast, PRR cast, CTD cast (1000 m) |
| ALOHA (sta. 2) | Sediment traps, net tows, CTD operations, primary productivity measurements, AC9/FRRf, deployment of two ARGO floats, misc. experiments. |
| MOSEAN mooring station (Sta. 51) | CTD cast (200 m). |
| WHOTS mooring station (Sta. 50) | CTD cast (200 m). |
| 21º 54.1'N, 158º 16.5'W | Deployment and recovery of underwater camera. |
| Underway/continuous | ADCP, thermosalinograph, fluorometry, meteorology |

## 2.0. SCIENCE PERSONNEL

| Participant | Title | Affiliation/HOT Group |
|---|---|---|
| Karin Björkman | Research Specialist | UH/BEACH |
| Marina Brandon | Graduate Student | UH |
| Susan Curless | Research Associate | UH/BEACH |
| Suzanne Defelice | Research Associate | UH/PO |
| Stuart Donachie | Scientist | UH |
| Pierre Dutrieux | Graduate Student | UH/PO |
| Ken Doggett | Research Associate | UH/BEACH |
| Gabe Foreman | Marine Technician | OTG |
| Lance Fujieki | Computer Specialist | UH/BEACH |
| Eric Grabowski | Research Associate | UH/BEACH |
| Adriana Harlan | Technician | UH/BEACH |
| Kurt Heinze | Technician | UW |
| Paul Lethaby | Research Associate | UH/PO |
| Claire Mahaffey | Postdoctoral Researcher | UH/BEACH |
| Rex Malmstrom | Scientist | MIT |
| Dan Sadler | Research Associate | UH/BEACH |
| Fernando Santiago-Mandujano | Research Associate | UH/ PO |
| Justin Smith | Undergraduate Student | UH/PO |
| Jefrey Snyder | Marine Technician | UH/PO |
| Matt Sullivan | Scientist | MIT |
| Like Thompson | Scientist | MIT |
| Kuhio Vellalos | Marine Technician | OTG |
| Mingxi Yang | Graduate Student | UH/PO |
| John Yeh | Graduate Student | UH/PO |
| Blake Watkins | Marine Engineer | UH/BEACH |

## 3.0. SUMMARY SCHEDULE

| | |
|---|---|
| 18 May | Pre-cruise meeting |
| 24 May | Ship loading starting at 0900 hrs |
| 25 May | Depart from Snug harbor at 0900 hrs. Science personnel on-board by 0830. |
| 25 May | Station 1 Kahe Pt. operations. Deployment of underwater camera. |
| 26-28 May | Station ALOHA operations. Stations 51 and 50 CTD casts. Recovery of underwater camera. |
| 29 May | Arrive back to Snug harbor. ETA 0800 hrs, full offload |

## 4.0. OPERATIONAL PLANS

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

A 400 lb. weight-test cast, one CTD cast to 1000 m, and a PRR cast (Sect. 4.2.8) will be conducted at this location in the afternoon of May 25. The CTD winch and crane will be required for these operations. After the operations are satisfactorily completed, the ship shall proceed to deploy the underwater camera.

4.1.1 Deployment of free vehicle baited camera

An underwater camera consisting of a surface mast assembly and frame with Benthos floats and acoustic releases will be deployed in transit to Station ALOHA, at 21° 54.1'N, 158° 16.5'W. We request the use of the A-frame for this operation and will also use the Sea-Mac winch. This instrument will sink to the bottom of the ocean, where it will remain until its retrieval at the end of the cruise. This operation will be conducted by J. Yeh, and it will take 30 min. After this, the ship shall proceed to Station ALOHA.

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. Afterwards, two 200-m casts will be conducted before deploying the Gas array. One 100-m CTD cast will be conducted after the Gas array deployment, followed by a near-bottom CTD cast.

4.2.2. Sediment trap 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 our 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 01325 and 01833), 2 strobe lights, and 2 radio transmitters (channel 74, 156.725 MHz). Daily positions of the array shall be transmitted by email directly to the ship, 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 Gas Array deployment

Samples for the gas array will be collected from casts 1 and 2. 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 2 ARGOS satellite transmitters, a strobe light and a radio transmitter (channel 69). 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.

4.2.4. 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 second cast after the deployment of the gas array (cast 4) 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 (Eric Grabowski, Paul Lethaby).

4.2.5. Primary production experiment

Samples for the primary productivity experiment will be collected from the rosette (cast 10). Just before dawn (sunrise 0547 hrs on May 27), a second 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 2 ARGOS satellite transmitters, strobe lights and a radio transmitter (channel 72, 156.625 MHz). The ship shall keep within site of the array while performing CTD operations for the approximately 12-hour duration the array will be in the water. The array will be recovered just at sunset (1911 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.

4.2.6. Plankton net tows

Plankton nets will be deployed from the stern and shall be towed for half-hour periods. Half-hour periods are scheduled at around noon and two consecutive half-hour periods at midnight on the second, third, and fourth days (see schedule) with a total of eight 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. Automated Trace Element Sampler (ATE)

On May 26 at 1330, 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.

4.2.8. Profiling Reflectance Radiometer (PRR).

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

4.2.9. 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. We request the use of the ship's trawl winch and A-frame for this operation.

4.3 Floating sediment trap recovery

On May 28, after the second deep cast and other operations at Station ALOHA have been completed, we shall transit for the recovery of the floating sediment trap array. The main crane 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 51 to conduct a 200-m CTD cast.

4.4 MOSEAN Mooring (Station 51)

A 200-m CTD cast will be conducted near the MOSEAN mooring. The cast should be conducted downwind, downcurrent, and at about 200 m from the mooring. The nominal position of the mooring is 22$^{o}$ 45'N, 158$^{o}$ 6'W. After this cast, the ship shall transit to Station ALOHA to continue operations. After operations at ALOHA are completed, the ship shall transit to Station 50 to conduct one 200 m CTD cast.

4.5 WHOTS Mooring (Station 50)

One 200-m CTD cast will be conducted near the WHOTS mooring. The cast should be conducted downwind, downcurrent, and at about 200 m from the mooring. The nominal position of the mooring is 22$^{o}$ 46.1'N, 157$^{o}$ 53.4'W. After this cast is completed, the ship shall transit to retrieve the underwater camera.

4.6 Recovery of free vehicle baited camera (21$^{o}$ 54.1'N, 158$^{o}$ 16.5'W)

The underwater camera deployed at the beginning of the cruise (Sect. 4.1.1), will be recovered in the evening of May 28. The instrument's acoustic release will be triggered, and the instrument will be retrieved when it reaches the surface. We request the use of the A-frame for this operation and will also use the Sea-Mac winch. The instrument is equipped with a strobe light and a radio transmitter (channel 73, 156.675 MHz). The time for this operation will be about 2.5 hours, after which the ship shall return to Snug harbor.

4.7 Acoustic Doppler Current Profiler

The ship's acoustic Doppler current profiler (ADCP) will be in operation during the duration of the cruise. The STAG electronics technician will be in charge of the ADCP system.

4.8 Thermosalinograph and Fluorometer

The ship's thermosalinograph 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 STAG electronics technician will be in charge of the thermosalinograph operation.

4.9 ARGO profiler floats deployment

Two ARGO profiler floats will be deployed near Sta. ALOHA by Kurt Heinze (UW, Steve Riser's group). The profilers will be hand deployed over the side of the ship on May 28, before leaving ALOHA station.

## 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. 4 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. Storage van with assorted equipment (main deck)
6. Large vacuum waste container
7. Liquid nitrogen dewers
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 with light and radio transmitter, floats, weights, polypro. Line, spare buoy, etc.
12. PRR, AC-9/FRRf and other optical measuring instruments.
13. Sea-Mac winch (440 VAC, 3 phase at 10 amps) and Kevlar line
14. Oxygen titration system
15. Plankton nets and towing lines
16. Desktop and laptop personal computers
17. Assorted tools
18. All required sampling bottles.
19. Deck incubation system
20. 400 lb weight.
21. Acoustic transponders for mooring release
22. Pertinent MSDS
23. Automated Trace Element Sampler (ATE)

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

1. A-frame and trawl winch
2. A-frame block assembly
3. Appleton crane and winch with conducting wire for CTD
4. Electric power for winches (440 VAC three phase at 10 amps) and vans (208 VAC single phase at 30 amps for labvan, 110 VAC 10 amps for equipment van)
5. Radio direction finder
6. Space on the main deck for one storage van, Sea-Mac winch
7. Space on the upper deck for two lab vans
8. Hand-held VHF transceivers
9. Precision depth recorder
10. Shackles, sheaves, hooks and lines
11. Shipboard Acoustic Doppler Current Profiler
12. Thermosalinograph and Fluorometer
13. Copy machine
14. Grappling hooks and line

15. Navlink2 PC or equivalent
16. Running fresh water and seawater, hoses
17. Electronic mail system
18. GPS system
19. Uncontaminated seawater supply
20. Capstan
21. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer
22. OTG's 24-place rosette, and 24 12-l water sampling bottles

Ship: R/V *KILO MOANA* **HOT 181 CTD CASTS** 25 – 29 May, 2006

| Cast | | Samples | #Bottles | |
|---|---|---|---|---|
| **Kahe Pt.** | | | | |
| s1c1 | 1000 m | $O_2$, Temp, DIC/Alk, Nuts, Chl a, LLN, $LLPO_4$, DOC, FCM, Salts | 24 | |
| **Station ALOHA** | | | | |
| s2c1 | 200 m | Gas Array (7@5, 25, 45), KB (3@30), Salts, | 24 | |
| s2c2 | 200 m | Gas Array (7@75, 100, 125) , KB (3@30), Salts, | 24 | |
| s2c3 | 100 m | RM (6@25, 1@45, 2@100, 1@150, 1@200) | 11 | |
| s2c4 | 4740 m (PO-1) | $O_2$, Temp, DOC, DIC/Alk, Nuts, Salts | 24 | |
| s2c5 | 1000 m (PO-2) | $O_2$, Temp, Nuts, DIC/Alk, Quay, DOC, Salts | | 24 |
| s2c6 | 1000 m | ATP, Salts, MC (200,300,500,770), KB(100,125,150,175) | 19 | |
| s2c7 | 1000 m | PE, Salts, MC(5,25,45,75,100,125,150,175), KB(5,25,45,75) | 24 | |
| s2c8 | 1000 m | HPLC, Chl a, Slides, Salts, | 22 | |
| s2c9 | 1000 m(BEACH) | $O_2$, Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, Salts | 23 | |
| s2c10 | 1000 m | Primary Production, CM (2@750), Salts | 24 | |
| s2c11 | 1000 m | Open, CM(16@30), MB(2@10,2@DCM,2@700), RM(1@45, 1@100) | 24 | |
| s2c12 | 1000 m | Open | 3 | |
| s2c13 | 1000 m | MIT, MC(pb-5,25,45,75,100,125,150,175), SD(5,75,125,250,500,1000) | 24 | |
| s2c14 | 1000 m | PC/PN, Salts | 14 | |
| s2c15 | 1000 m | PPO4, Salts | 14 | |
| s2c16 | 1000 m | Open, CM(11@30,1@750), RM(1@25, 1@100, 1@150, 1@200), SD(5,75,125,250,500,1000) | 22 | |
| s2c17 | 4740 m (PO-3) | Oxygen, Salts, MC(1@1000,2000,3000,4000), PUR | 24 | |
| s2c18 | 200 m | RM (1@25, 1@45, 2@100, 1@150, 1@200) | 6 | |
| s2c19 | 200 m | PSi, ZJ | 22 | |
| **MOSEAN Mooring** | | | | |
| s51c1 | 1000 m | Salts, CM(8@30,1@750) MB(1@10,1@DCM,1@700) | 12 | |
| **WHOTS Mooring** | | | | |
| S50c1 | 200 m | Salts, LB(4@5) | 7 | |

SHIP R/V *KILO MOANA* HOT 181 DATE 25 – 29 May, 2006

| TIME | Thur. 5/25 | Fri. 5/26 | Sat. 5/27 | Sun. 5/28 | Mon. 5/29 |
|---|---|---|---|---|---|
| 0000 | | S2C1 Gas 1 | | | |
| 0100 | | S2C2 Gas 2 | Net Tow | | |
| 0200 | | | S2C10 PP | Net Tow | |
| 0300 | | | | AC9/FRRF | |
| 0400 | | S2C3 (100 m) | S2C11 Open | S2C18 (200 m) Transit sed traps | |
| 0500 | | Deploy gas array | Deploy PP array | Recover traps | |
| 0600 | | S2C4 PO-1 | Transit gas array | Transit St. 51 | |
| 0700 | | | Recover gas array | | |
| 0800 | | | S2C12 Open | S51C1 MOSEAN | Arrive Snug offload |
| 0900 | Depart Snug | | | Transit ALOHA | |
| 1000 | | Net Tow | Net Tow | | |
| 1100 | Arrive Kahe | S2C5 PO-2 (Begin 36 hr) | S2C13 MIT | S2C19 PSi/ZJ | |
| 1200 | Weight cast PRR | | PRR AC9/FRRF | PRR AC9/FRRF | |
| 1300 | S1C1 | Net Tow ATE | Net Tow | AC9/FRRF | |
| 1400 | Transit ALOHA | S2C6 ATP | S2C14 PC/PN | Transit St. 50 | |
| 1500 | | | | S50C1 | |
| 1600 | | Claire Net | | Deploy ARGO Claire Net | |
| 1700 | Deploy camera | S2C7 PE | S2C15 PPO4 | Transit retrieve camera | |
| 1800 | | | Recover PP array | | |
| 1900 | | | | | |
| 2000 | | S2C8 HPLC | S2C16 Open | | |
| 2100 | | | | Recover Camera | |
| 2200 | | Net Tow | Net Tow | | |
| 2300 | Arrive ALOHA Deploy sed traps | S2C9 BEACH | S2C17 PO-3 (end 36 hours) | Transit Snug | |

**May 27: Sunrise 0547 Sunset 1911**

## 6.0 HOT-181 Watch Schedule

**0300-1500**

Fernando S-Mandujano – Chief Scientist
Jefrey Snyder
Justin Smith
Eric Grabowski – Watch Leader
Lance Fujieki
Ken Doggett
Adriana Harlan
Kurt Heinze

**1500-0300**

Paul Lethaby - Watch Leader
Suzanne Defelice
John Yeh
Pierre Dutrieux
Karin Björkman
Susan Curless
Dan Sadler

**At Large**

Blake Watkins
Claire Mahaffey
Marina Brandon
Mingxi Yang
Stuart Donachie
Rex Malmstrom
Matt Sullivan
Luke Thompson

**OTG**

Kuhio Vellalos
Gabe Foreman