Hawaii Ocean Time-series
HOT-226 Operational Cruise Plan

Cruise ID: KM 10-19
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Richard Meyer
Chief Scientist:, University of Hawaii
OTG Marine Technicians: Justin Smith and Ben Colello

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

Loading: October 1, 2010 @ 0900
Departure: October 2, 2010 @ 0900
Arrival: October 6, 2010 @ 0800

**Warning - Navigational and array deployment hazard. **

HOT Profiler Mooring (HPM)- Deployed at Station ALOHA early July, 2010

This mooring's nominal location is **22° 44.985'N 158° 01.497'W**, approximately 1.5 miles WSW of the center of Station ALOHA. It has a small surface tether telemetry marker buoy and an instrument platform 80 m below the surface. This area of the circle should be avoided.

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 at least 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

Station	Activities
Kahe (sta. 1)	Weight Cast, Hyperpro cast, CTD cast (1000 m), Niskin cast.
ALOHA (sta. 2)	Sediment traps, gas array, net tows, CTD operations, primary productivity measurements, AC9/FRRf, misc. experiments
WHOTS mooring station (Sta. 50)	One CTD cast (yo-yo to 200 m), surface instrument intercomparisons.
Kaena (sta. 6)	CTD cast (near bottom)
Underway/continuous	ADCP, thermosalinograph, pCO2 system, fluorometry, and meteorology

2.0. SCIENCE PERSONNEL

Participant	Title	Affiliation/HOT Group
Daniela Böttjer	Post-doc	UH/CMORE
Susan Curless	Research Associate	UH/BEACH
Lance Fujieki	Computer Specialist	UH/BEACH
Scott Grant	Research Associate	UH.CMORE
Adriana Harlan	Research Associate	UH/BEACH
Dan Sadler	Research Associate	UH/BEACH
Brett Updyke	Research Associate	UH/BEACH
Donn Viviani	Graduate Student	UH/BEACH
Blake Watkins	Marine Engineer	UH/BEACH
Brenner Wai	Technician	UH/BEACH
Cameron Fumar	Research Assoicate	UH/PO
Bo Keopaseut	Research Associate	UH/PO
Jefrey Snyder	Marine Technician	UH/PO
Craig Nosse	Research Associate	UH/PO
Ilana Nimz	Volunteer	UH/PO
Jim Foley	Marine Educator	UH/CMORE
Michelle Hsia	Marine Educator	UH/CMORE
Bill Budenholzer	Teacher	Kailua Intermediate
Patti Stover	Teacher	Konawaena High
Daniela del Valle	Post-doc	UH/CMORE
Allison Fong	Graduate Student	UH/CMORE
Jackie Mueller	Graduate Student	UH/CMORE
Sara Thomas	Volunteer	UH/CMORE
Elisha Wood-Charlson	Post-doc	UH/CMORE
Justin Smith	Marine Technician	OTG
Ben Colello	Marine Technician	OTG

3.0. SUMMARY SCHEDULE

27 September	Pre-cruise meeting, MSB 307, 1300 hrs.
1 October	Ship loading starting at 0900 hrs.
2 October	Depart from Snug harbor at 0900 hrs. Science personnel on-board by 0800.
2 October	Station 1 Kahe Pt. operations.
2-5 October	Station ALOHA operations. Station 50 and Kaena CTD casts.
6 October	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 1000 lb. weight-test cast, one CTD cast to 1000 m, a Hyperpro cast (Sect. 4.2.7), and a Niskin cast will be conducted at this location on October 2nd. The A-frame, Sea-Mac winch, CTD crane and CTD winch will be required for these operations. A line with a small weight (~10lbs) deployed through the A-frame shall be used to attach the Niskin bottle. The Niskin will be deployed to a depth of approximately 40 m and will be lowered and retrieved by hand.

Following science operations at Kahe, a rescue boat launch and recovery drill shall be conducted.

After the rescue boat drill is satisfactorily completed, 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. After the sediment trap deployment is complete, two 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 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 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 0623 hrs on October 3rd), 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 (1817 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 Caley CTD winch and crane for these operations. If there are any problems with the Caley system, we shall switch to the ship's trawl winch and A-frame. 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, 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 **(Susan Curless, Jefrey Snyder)**.

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 Station 2 CTD cast 10. 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 24 hours after its deployment. Assistance from the bridge is requested in plotting the drift track of the array. CTD operations shall continue after the deployment.

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.

4.2.6.1 Surface net tow

Surface net tows are hand-deployed off the stern for about 15-20 minute periods. One net tow is scheduled for 13:00 on 3 October but others may be introduced to the schedule at appropriate time slots. We request that the ship remain stationary during these tows. Jim Foley will be in charge of these net tows.

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.

4.3 Floating sediment trap recovery

In the morning of October 5th, 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 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 October 5th for subsurface instrument intercomparions. 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 and one Hyperpro cast. If the mooring is positioned such that it is within the Station ALOHA circle, the AC9/FRRf cast and Hyperpro cast will be performed as close to the WHOTS mooring as safely possible to extend the surface instrument intercompariosn. After those operations are complete the ship shall transit to Station Kaena.

4.5 Sea Glider #146 Deployment

Two hours of time is required for deploying a sea glider. Approximately 30 minutes will be needed to deploy the glider using the winch and ship's A-frame. Once the glider is in the water, it will conduct a shallow test dive (~30 min) and call its operational status into the command center.

It is requested that during the test dive, the ship stays close to the deployment site until the status of the glider has been confirmed to be operational. One hour has been scheduled for small boat operations for the recovery of the glider should it malfunction during the test dive.

There are four scheduled time slots for sea glider deployment attempts. Deployment will not be attempted unless the weather conditions are safe for launching the small boat. It will be at the Captain's discretion if these operations are to be completed.

4.6 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 October 5th, 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 OTG electronics technician will be in charge of the ADCP system.

4.8 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. 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, pCO_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, all spare parts
3. One 20 ft. laboratory van with assorted equipment for radioisotope and general use.
4. One 12 ft. equipment van to be located on the main deck. (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. 5L Niskin bottle with line and weight
21. Surface hand net

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

1. A-frame
2. A-frame block assembly
3. Caley Crane and winch with conducting wire for CTD
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. Radio direction finder
6. Space on the main deck for one equipment van
7. Space on upper deck for two laboratory vans
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. Meteorological suite
15. Copy machine
16. Grappling hooks and line
17. Laptop with Nobeltec charting software and GPS feed
18. Running fresh water and seawater hoses
19. Electronic mail system
20. GPS system
21. Uncontaminated seawater supply
22. Small capstan (~ 10 m/min)
23. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, *p*CO2 and access to real-time data through the network.

24. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
25. OTG's 20 ft. laboratory van for radioisotope use
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 and pallet jack.
31. Table at CTD sampling area.

Ship: R/V *KILO MOANA* **HOT 226 CTD CASTS** **October 2nd-6th, 2010**

Cast		Samples	#Bottles
Kahe Pt.			
s1c1	1000 m	O_2, Temp, DIC/Alk, Nuts, Chl a, LLN, $LLPO_4$, DOC, FCM, Salts JF(pb on 5,25,750,900,1000)	24
Station ALOHA			
s2c1	200 m	DB (24@5m)	24
s2c2	1000 m	Primary Production, DV(pb on PP depths), Salts	22
s2c3	200 m	CMORE(5@25,5@45,5@75), DB/DV(8@5), DdV(1@25)	24
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, DOC, Salts	24
s2c6	1000 m	PC/PN, EWC(2@5), Salts	16
s2c7	1000 m	PPO4, Salts, JF(1@5,45,100,200,350,500,1000)	21
s2c8	1000 m (BEACH)	O_2, Temp, DIC/Alk, Nuts, LLN, LLP,DOC, Keeling, Quay, Salts	23
s2c9	1000 m	PUR, CMORE(5@1000,5@770,5@500), Salts	24
s2c10	1000 m	Gas Array(2@5,25,45,75,100,125), DdV(1@5,25,45,75,100,125), Salts	20
s2c11	1000 m	CMORE(5@125,5@200), PO(12@1000), DdV(1@100), Salts	24
s2c12	1000 m	PSi, MC(5,25,45,75,100,125,150,175), Salts	18
s2c13	1000 m	MIT, DV(1@25,75) DV(pb@5,45,100,125), Salts JF(1@5,25,45,75,100,125,150,175)	21
s2c14	1000 m	ATP, MC(200,300,500,770), Salts SW(1@200,300,400,500, 600,700,800,900,1000)	23
s2c15	1000 m	PE, MC(5,25,45,75,100,125,150,175), SW(pb MC), Salts	22
s2c16	1000 m	HPLC, Chl a, Slides, Salts	22
s2c17	4740 m (PO-3)	Oxygen, MC(1000,2000,3000,4000), DV(1@4800,4750), Salts	14
WHOTS Mooring			
S50c1	200 m yo-yo	BW(14@175m), SG(5@45)	19
Kaena			
S6c1	2400 m	Chl, Salts	13

MC=Matt Church, **SW**=Sam Wilson, **DB**=Daniela Böttjer, **DV**=Donn Viviani, **JF**=Jim Foley, **BW**=Brenner Wai, **EWC**=Elisha Wood-Charlson, **DdV**=Daniela del Valle, **SG**=Scott Grant

SHIP R/V *KILO MOANA* **HOT 226** **Date: October 2 – 6, 2010**

TIME	Sat. 10/2	Sun. 10/3	Mon. 10/4	Tue. 10/5	Wed. 10/6
0000		S2C1			
0100		S2C2 PP	Net Tow		
0200			S2C10 Gas		
0300		S2C3		AC9/FRRF	
0400		Deploy PP Array	Deploy Gas Array	Transit sed traps	
0500		S2C4 PO-1	S2C11 Open	Recover traps Transit gas array	
0600			Deploy Sea Glider	Recover gas array	
0700				Transit St. 50	
0800			S2C12 PSi	S50C1 WHOTS	Arrive Snug
0900	Depart Snug			Transit St. ALOHA	
1000		Net Tow	Net Tow		
1100	Arrive Kahe (11:30) Weight cast	S2C5 PO-2 (Begin 36 hr)	S2C13 MIT	AC9/FRRF	
1200	Hyperpro	Net Tow	Hyperpro AC9/FRRF	Hyperpro Deploy Sea Glider	
1300	S1C1	Surface net tow			
1400	Niskin cast Rescue Boat ops	S2C6 PC/PN	S2C14 ATP		
1500	Transit ALOHA	Deploy Sea Glider	Deploy Sea Glider	Transit St. Kaena	
1600					
1700		S2C7 PPO4	S2C15 PE		
1800		Recover PP array			
1900					
2000		S2C8 BEACH	S2C16 HPLC		
2100				S6C1	
2200		Net Tow	Net Tow		
2300	Arrive ALOHA Deploy sed traps	S2C9 PUR	S2C17 PO-3 (end 36 hours)	Transit Snug	

October 3rd: Sunrise 0623, Sunset 1817

6.0 HOT-226 Watch Schedule

0300-1500

Adriana Harlan **–** *Water Boss*
Dan Sadler – *Tag*
Lance Fujieki – *Alt Tag*
Cameron Fumar – *Console*
Jefrey Snyder – Watch Leader -*Tag*

1500-0300

Susan Curless – Watch Leader - *Water Boss*
Brett Updyke – *Tag*
Bo Keopaseut – *Console*
Craig Nosse – Chief Scientist – *Tag*

0900-2100

Ilana Nimz
Sara Thomas

At Large

Blake Watkins
Donn Viviani – *Alt Tag*
Daniela Böttjer
Scott Grant – *Alt Tag*
Jim Foley
Michelle Hsia
Bill Budenholzer
Patti Stover
Brenner Wai
Daniela del Valle
Allison Fong
Jackie Mueller
Elisha Wood-Charlson

OTG

Justin Smith
Ben Colello