Hawaii Ocean Time-series
HOT-216 Operational Cruise Plan

Cruise ID: KOK0916
Vessel: R/V *Ka'Imikai-O-Kanaloa*, University of Hawaii
Master of the Vessel: Captain Ross Barnes
Chief Scientist: Paul Lethaby, University of Hawaii
OTG Marine Technicians: Elly Speicher and Vic Polidoro

Marine Center phone number: 842-9813

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 52, is the site of the WHOTS-6 Mooring, located at 22° 39.989'N, 157° 56.961'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 3 hours.

1.1 SCIENTIFIC OPERATIONS

Station	Activities
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, AC9/FRRf, Sea glider recovery, ARGO float deployment, misc. experiments
WHOTS mooring station (Sta. 52)	Two CTD casts (200-m, yo-yo to 200 m).
Kaena (sta. 6)	CTD cast (2400 m)
Underway/continuous	ADCP, thermosalinograph, fluorometry, meteorology

2.0. SCIENCE PERSONNEL

Participant	Title	Affiliation/HOT Group
Donn Viviani	Graduate Student	UH/BEACH
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
Ken Doggett	Research Associate	UH/CMORE
Solange Duhamel	Post-Doc	UH/CMORE
Fernando Santiago-Mandujano	Research Associate	UH/PO
Paul Lethaby	Chief Scientist – Res. Assoc.	UH/PO
Jefrey Snyder	Marine Technician	UH/PO
Sarah Yasui	Undergraduate Student Assistant	UH/PO
Nancy Niklis	Volunteer	UH/PO
Jeff Krause	Post-Doc	UCSB
John Bullister	Scientist	UW
Dave Wisegarver	Technician	UW
Anill Rick Rupan	Research Engineer	UW
Qian Li	Graduate Student	UH
Elly Speicher	Marine Technician	OTG
Vic Polidoro	Marine Technician	OTG

3.0. SUMMARY SCHEDULE

27 October	Pre-cruise meeting, MSB 306, 1330 hrs.
30 October	Ship loading starting at 0900 hrs.
02 November	Depart from Snug harbor at 0900 hrs. Science personnel on-board by 0800.
02 November	Station 1 Kahe Pt. operations.
02-05 November	Station ALOHA operations. Station 52 and Kaena CTD casts.
06 November	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 500 m and a Hyperpro cast (Sect. 4.2.7) will be conducted at this location on November 2nd . The CTD winch and crane will be required for these operations. After the operations are satisfactorily completed, the ship shall proceed to Station ALOHA.

4.2. 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 rail using the small crane 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@satellite-email.com, 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 0638 hrs on November 3rd), a free drifting incubation array will be deployed from the stern rail using the small crane and the Sea-Mac winch. The array is equipped with two ARGOS satellite transmitters (platform #'s 03028, 60482, emailing positions to argosfix@satellite-email.com, 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 (1753 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 will need the ship's CTD winch and crane for these operations. 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 **(Fernando Santiago-Mandujano, Susan Curless)**.

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 CTD cast 9. The gas array will be deployed from the stern rail using the small crane and the Sea-Mac winch. The array is equipped with two ARGOS satellite transmitters (platform #'s 03028, 60482), emailing positions to argosfix@satellite-email.com, 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 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. 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 rail using the small crane. 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, weighting 5 lbs.

4.3 Floating sediment trap recovery

In the morning of November 5th , after the AC9/FRRf cast has been completed, we shall transit for the recovery of the floating sediment trap array. The small 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 recover the Gas Array. After the array is recovered, the ship shall transit to Station ALOHA to recover the Sea glider, conduct one Hyperpro cast, and one AC9/FRRf cast, after which the ship shall transit to Station 52 to conduct two CTD casts.

4.4 Sea Glider

The Sea glider will be recovered on the morning of November 5th after the free drifting arrays have been recovered. The Sea glider will be stationed at 22°45.5’N, 157°58.5’W during the cruise in a virtual mooring mode. We ask that the ship avoid this location until the day of recovery. The recovery should be similar to the array recoveries, maneuvering the glider to the stern where it will be snared. Blake Watkins will be in charge of this operation with shore side assistance from Steve Poulos.

4.5 WHOTS-6 Mooring (Station 52)

Two 200-m CTD casts shall be conducted near the WHOTS mooring on November 5th. The second cast is to be a yo-yo cast with at least 6 full cycles. These casts should be conducted downwind, down current, and about 200 m from the mooring. The nominal position of the mooring is 22°39.989’N, 157°56.961’W.

After these operations are completed, the ship will transit to Station Kaena dropping off the ARGO float on the way.

4.6 ARGO Float

The ARGO Float will be deployed at Station ALOHA once all operations there are completed. The float shall be positioned over the side with a slip line and realeased once the vessel has some forward motion. After the float is released the ship shall transit to Station Kaena. A. Rick Rupan will be in charge of this operation.

4.7 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 November 5th, after which the ship shall return to Snug harbor.

4.8 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.

4.9 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 OTG technicians will be in charge of the thermosalinograph and fluorometer 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 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
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

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

1. A-frame
2. A-frame block assembly
3. 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 lab van, 110 VAC 10 amps for equipment van)
5. Radio direction finder
6. Space in the main deck hanger for one storage van
7. Space on upper deck for one lab van and the tool van
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 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
23. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
24. 500 lb weight.
25. Remote CTD decibar pressure display in the winch operator cabin.
26. Large Sea-Mac winch (Mod. 1025 EHS). 60 Amp Hubbel plug/connector (440 VAC, 3 phase, 60 Amp breaker)
27. Monitor in Rock Lab displaying ship coordinates and GMT.
28. Seapoint fluorometer (to be used as a spare)

Ship: R/V *Ka'Imikai-O-Kanaloa* HOT 216 CTD CASTS November 2 – 6, 2009

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	CMORE(5@25,5@45,5@75), BU (2@5), QL(1@5,15,50,100,150,200)	23
s2c2	1000 m	Primary Production, MB(pb on all depths), Salts	22
s2c3	4740 m (PO-1)	O_2, Temp, DOC, DIC/Alk, Nuts, Salts, JB(pb O_2 depths)	24
s2c4	1000 m (PO-2)	O_2, Temp, Nuts, DIC/Alk, DOC, Salts, JB(pb O_2 depths)	24
s2c5	1000 m	PC/PN, SD(1@75), Salts	15
s2c6	1000 m	PPO4, SD (1@75), QL(1@5,15,50,100,150,200), Salts	21
s2c7	1000 m (BEACH)	O_2, Temp, DIC/Alk, Nuts, LLN, LLP,DOC, Keeling, Quay, Salts JB(pb O_2 depths), KB(pb@5,45,75,100,150)	23
s2c8	1000 m	PUR, CMORE(5@1000,5@770,5@500),SD(pb@75), Salts	24
s2c9	1000 m	Gas Array (2@5,25,45,75,100,125), MB(1@175,150,125,100,75,45,25,5), SD(1@75), Salts	23
s2c10	1000 m	CMORE(5@125,5@200),DV(2@25),SD(1@75), Salts	15
s2c11	1000 m	PSi, MC(5,25,45,75,100,125,150,175), SD(1@75), Salts	19
s2c12	1000 m	MIT, SD(1@75), PO Salinity water(6@1020), Salts QL(1@5,15,50,100,150,200)	23
s2c13	1000 m	ATP, SW(1@200,300,400,500, 600,700,800,900,1000), MC(200,300,500,770), SD(pb@75), Salts	24
s2c14	1000 m	PE, MC(5,25,45,75,100,125,150,175), SW(pb MC), SD(1@75), Salts	23
s2c15	1000 m	HPLC, Chl a, Slides, SD(pb@5,25,45,75,100,125,1000), Salts	22
s2c16	4740 m (PO-3)	Oxygen, MC(1000,2000,3000,4000), DV(1@4800), Salts JB(pb O_2 Depths), QL(1@5,15,50,100,150,200)	19
WHOTS Mooring			
S52c1	200 m	DV(16@25),KD(1@25,125), QL(1@5,15,50,100,150,200)	22
S52c2	200 m yo-yo	BL(1@ 5,25,45,75,100,125,150,175, 6@25), BC(1@15,40,70)	19
Kaena			
S6c1	2400 m	Chl, Salts	13

MC=Matt Church, **SW**=Sam Wilson, **MB=**Mark Brzezinski, **SD**=Solange Duhamel, **DV**=Donn Viviani, **BU**=Brett Updyke
JB=John Bullister, **BC**=Brandon Carter, **BL**=Binglin Li, **QL**=Qian Li

SHIP: R/V *Ka'Imikai-O-Kanaloa* HOT 216 Date: November 2 – 6, 2009

TIME	Mon. 11/2	Tues. 11/3	Wed. 11/4	Thurs. 11/5	Fri. 11/6
0000		Arrive ALOHA Deploy sed traps			
0100		S2C1	Net Tow		
0200		S2C2 PP	S2C9 Gas		
0300				AC9/FRRF	
0400		Deploy PP Array	Deploy Gas Array	Transit sed traps	
0500		S2C3 PO-1	S2C10 Open		
0600				Recover traps Transit gas array	
0700				Recover gas array	
0800			S2C11 PSi	Transit St. ALOHA	Arrive Snug
0900	Depart Snug			Recover Glider	
1000		Net Tow	Net Tow		
1100	Kahe Weight cast	S2C4 PO-2 (Begin 36 hr)	S2C12 MIT	AC9/FRRF	
1200	Hyperpro	Net Tow	Hyperpro AC9/FRRF	Hyperpro	
1300	S1C1	ATE		Transit St. 52	
1400	Transit ALOHA	S2C5 PC/PN	S2C13 ATP	S52C1 WHOTS	
1500				S52C2 WHOTS	
1600				Deploy ARGO Float Transit St. Kaena	
1700		S2C6 PPO4	S2C14 PE		
1800		Recover PP array			
1900					
2000		S2C7 BEACH	S2C15 HPLC		
2100				S6C1	
2200		Net Tow	Net Tow		
2300		S2C8 PUR	S2C16 PO-3 (end 36 hours)	Transit Snug	

November 3: Sunrise 0638, Sunset 1753

6.0 HOT-216 Watch Schedule

0300-1500

Adriana Harlan – *Water Boss*
Lance Fujieki – *Alt Tag*
Dan Sadler – *Tag*
Fernando Santiago-Mandujano – Watch Leader - *Console*
Jefrey Snyder – *Deck Boss*
Nancy Niklis – *Tag*

1500-0300

Susan Curless – Watch Leader - *Water Boss*
Brett Updyke – *Tag*
Paul Lethaby – **Chief Scientist** - *Console*
Sarah Yasui – *Tag*
A. Rick Rupan

0900-2100

At Large

Donn Viviani – *Alt Tag*
Blake Watkins
Jef Krause
Solange Duhamel
Ken Doggett – *Alt Tag*
John Bullister
Dave Wisegarver
Qian Li

OTG

Elly Speicher
Vic Polidoro