Hawaii Ocean Time-series
HOT-186 General Cruise Plan

Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Bryon Wilson
Chief Scientist: Eric Grabowski, University of Hawaii
OTG Marine Technicians: Gabe Foreman, Steve Tottori

Loading: October 17, 2006, loading of vans, heavy equipment and regular HOT gear.
Departure: October 18, 2006 @ 0900
Arrival: October 24, 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 21^{o} 20.6'N, 158^{o} 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^{o} 45'N, 158^{o}W. This is the main HOT station and will be occupied during the 2nd, 3rd, 4th ,5th and 6th days of the cruise.
3) Station 51, is the site of the MOSEAN Mooring, located at 22^{o} 45'N, 158^{o} 6'W will be occupied on the 5th day of the cruise for about 2 hours.
4) Station 50, is the site of the WHOTS Mooring, located at 22^{o} 45.994'N, 157^{o} 53.992'W will be occupied on the 6th day of the cruise for about 14 hours.
5) Station 6, referred to as Station Kaena, is located off Kaena Point at 21^{o} 50.8'N, 158^{o} 21.8'W will be occupied on the 6th 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, net tows, CTD operations, primary productivity measurements, AC9/FRRf, misc. experiments.
MOSEAN mooring station (Sta. 51)	CTD cast (200 m).
WHOTS mooring station (Sta. 50)	CTD operations (1000 m).
Kaena (sta. 6)	CTD cast (2400 m)
Underway/continuous	ADCP, thermosalinograph, fluorometry, meteorology

2.0. SCIENCE PERSONNEL

Participant	Title	Affiliation/HOT Group
Eric Grabowski	Research Associate	UH/BEACH
Dan Sadler	Research Associate	UH/BEACH
Claire Mahaffey	Postdoctoral Researcher	UH/BEACH
Karin Björkman	Research Specialist	UH/BEACH
Susan Curless	Research Associate	UH/BEACH
Adriana Harlan	Technician	UH/BEACH
Ken Doggett	Research Associate	UH/BEACH
Blake Watkins	Marine Engineer	UH/BEACH
Doug White	Research Associate	UH/BEACH
Fernando Santiago-Mandujano	Research Associate	UH/PO
Jefrey Snyder	Marine Technician	UH/PO
Paul Lethaby	Research Associate	UH/PO
John Yeh	Graduate Student	UH/PO
Matthew Sullivan	Postdoctoral Researcher	MIT
Maureen Coleman	Graduate Student	MIT
Sarah Bagby	Graduate Student	MIT
Yan Mei Shi	Graduate Student	MIT
John Bullister	Scientist	PMEL
Dave Wisegarver	Scientist	PMEL
Maria Calleja Cortès	Graduate Student	IMEDEA
Misty Miller	Research Tech	UH
Elizabeth Hambleton	Research Tech	UH
Nicole Cormier	Volunteer	Hilo
Erica Wasner	Volunteer	PO
Gabe Foreman	Marine Technician	OTG
Steve Tottori	Marine Technician	OTG

3.0. SUMMARY SCHEDULE

10 October	Pre-cruise meeting
17 October	Ship loading starting at 0900 hrs, loading of vans, heavy equipment and HOT gear
18 October	Depart from Snug harbor at 0900 hrs. Science personnel on-board by 0830.
18 October	Station 1 Kahe Pt. operations.
19-23 October	Station ALOHA operations. Stations 51, 50 and 6 CTD casts.
24 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 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 October 18. 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, a series of CTD casts will commence. Following the third CTD cast the gas array will be deployed.

4.2.2. Gas Array deployment / recovery

Samples for the gas array will be collected from casts 1 and 2. At 0330 on Oct. 19, the gas array will be deployed at a location within Station ALOHA, which will be determined by local current conditions to be determined at ALOHA.We request the use of the A-frame for the gas array deployment/recovery, and will also use the Sea-Mac winch. The array is equipped with one ARGOS satellite transmitter (platform # 08500, emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), a strobe light and a radio transmitter (channel 69, 156.475 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 following the deployment of the gas array.

After recovery of the gas array at 0400 on Oct.20, the ship shall return to the center of Station ALOHA to continue with CTD cast operations for a near-bottom CTD cast.

4.2.3 Sediment trap deployment

At 2330 on Oct.19, the floating sediment traps will be deployed at a location within Station ALOHA, which will be determined by local current conditions at 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 03028), 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 (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 the deployment of the sediment trap we will proceed with a net tow followed by the recovery of the gas array.

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 recovery of the gas array (cast 12) 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 (cast 25). 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. Primary production experiment

Samples for the primary productivity experiment will be collected from the rosette (cast 18). Just before dawn (sunrise 0629 hrs on October 21), 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 one ARGOS satellite transmitter (platform # 60481, emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), 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 (1802 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

Two types of net tows will be conducted during the cruise

4.2.6.1. Zoo net tows

These are our standard HOT zooplankton tows. Plankton nets will be deployed from the stern and shall be towed for half-hour periods. Half-hour periods are scheduled 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.

4.2.6.2. Claire net tows

These tows are hand-deployed off the stern for about half-hour periods, about two times during the cruise. We request that the ship remain stationary during these tows. C. Mahaffey will be in charge of these net tows.

4.2.7. Profiling Reflectance Radiometer (PRR).

Around noon on most days 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.

4.2.8. 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.

4.3 Floating sediment trap recovery

On October 22, after the AC9/FRRf cast has 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 22º 45'N, 158º 6'W. After this cast, the ship shall transit to a position near Station 50 but still in ALOHA to continue with CTD operations. Following cast 31 the ship shall transit to Station 50.

4.5 WHOTS Mooring (Station 50)

Four CTD casts will be conducted near the WHOTS mooring. Cast 1 will consist of three 1000m casts without removing the CTD from the water. The CTD will be in the water for aproxamety 3hr. Cast 2 will consist of 200m casts (yoyo) up and down for aproxiamtly 3hr. Cast 3 will consist of three 1000m casts without removing the CTD from the water. The CTD will be in the water for aproxamety 3hr. Cast 4 will consist of 200m casts (yoyo) up and down for aproxiamtly 3hr. The casts should be conducted downwind, downcurrent, and at about 200 m from the mooring. The nominal position of the mooring is 22º 45.994'N, 157º 53.992'W.

4.6 After the last CTD (Station 50 cast 4) at 1600 on Oct. 23 the ship shall transit to Station Kaena to conduct one near-bottom CTD cast.

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

A near-bottom CTD cast (~2500 m) will be conducted at this location in the evening of July 15, 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 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 electronics technician will be in charge of the thermosalinograph operation.

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. 24-place rosette, and 24 12-l water sampling bottles
3. One HOT laboratory van with assorted equipment for radioisotope and general use and John Bullister's van
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. Pertinent MSDS

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 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
7. Space on the upper deck for two lab vans, one HOT van and John Bullister's van
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. Small capstan (~ 10 m/min)
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
23. OTG's Rad Van

Ship: R/V *KILO MOANA* **HOT 186 CTD CASTS** 18 – 24 October, 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), Salts,	21
s2c2	200 m	Gas Array (7@75, 100, 125) , MR(2@45), Salts	23
s2c3	100m	CM/KB (24@30m)	24
s2c4	100m	CM/KB (24@30m)	24
s2c5	500m	MS (24@500m)	24
s2c6	500m	MS (24@500m)	24
s2c7	200m	ZJ	12
s2c8	1000m	MR(1000,800,600,400,200,175,150,125,100,75,45,10)	12
s2c9	100m	CM(24@30m)	24
s2c10	150m	MS (24@125m)	24
s2c11	150m	MS (24@125m)	24
s2c12	4740 m (PO-1)	O_2, Temp, DOC, DIC/Alk, Nuts, Salts, JB(pb)	24
s2c13	1000 m (PO-2)	O_2, Temp, Nuts, DIC/Alk, Quay, DOC, Salts , JB(pb)	24
s2c14	1000 m	ATP, Salts, MC (200,300,500,770), KB(100,125,150,200,300) MR(2@1000,2@DCM)	24
s2c15	1000 m	PE, Salts, MC(5,25,45,75,100,125,150,175), KB(5,25,45,75)	24
s2c16	1000 m	HPLC, Chl a, Slides, Salts,	22
s2c17	1000 m(BEACH)	O_2, Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, Salts, JB(pb)	23
s2c18	1000 m	Primary Production, Salts	22
s2c19	1000 m	CM(24@30),	24
s2c20	1000 m	PSi, MC(5,25,45,75,100,125,150,175)	18
s2c21	1000m	MIT	14
s2c22	1000 m	PC/PN, Salts	14

s2c23	1000 m	PPO4, Salts	14
s2c24	1000 m	PUR	14
s2c25	4740 m (PO-3)	Oxygen, Salts, MC(1@1000,2000,3000,4000) MR(1@4000,3000,2000,1000,800,600,400,175,125,100,75,10)	24
s2c26	100m	MS (24@75m)	24
s2c27	100m	MS (24@75m)	24
s2c28	1000m	MR(1000,800,600,400,200,175,150,125,100,75,45,10)	12
s2c39	100m	MS (24@25m)	24
s2c30	100m	MS (24@25m)	24

MOSEAN Mooring

S51c1	200m		3

WHOTS Mooring

S50c1	1000 m (x3)	Salts	4
S50c2	200 m (yoyo)	Salts	4
S50c3	1000 m(x3)	Salts	4
S50c4	200m (yoyo)	Salts, J. Zehr (2@75m)	6

Kaena

S6c1	chl, salts		13

TIME	Wed. 10/18	Thur. 10/19	Fri. 10/20	Sat. 10/21	Sun. 10/22
0000			Net Tow		
0100		S2C2 Gas 2		Net Tow	
0200		S2C3 CM/KB	Transit gas array	S2C18 PP	
0300		Deploy gas array			AC9/FRRf
0400		S2C4 CM/KB	Recover gas array	S2C19 CM (30m)	Transit sed traps
0500			Transit ALOHA	Deploy PP Array	
0600		Basket Lift S2C5 MS (500m)	S2C12 PO-1		Recover sed traps
0700					Transit St. 51
0800		S2C6 MS (500m)		S2C20 PSi	
0900	Depart Snug				S51C1 MOSEAN
1000		Net Tow	Net Tow	Net Tow	Transit St. 50 (ALOHA)
1100	Arrive Kahe	S2C7 ZJ (200m)	S2C13 PO-2 (Begin 36 hr)	S2C21 MIT	
1200	Weight cast PRR	Net Tow		PRR AC9/FRRf	PRR AC9/FRRf
1300	S1C1				AC9/FRRf
1400	Transit ALOHA	S2C8 MR(1000m)	S2C14 ATP	S2C22 PC/PN	
1500					S2C26 MS (75m)
1600					
1700		S2C9 CM (30m)	S2C15 PE	S2C23 PPO4	S2C27 MS (75m)
1800				Recover PP Array	
1900		S2C10 MS (125m)			S2C28 MR(1000m)
2000			S2C16 HPLC	S2C24 PUR	
2100		S2C11 MS (125m)			
2200			Net Tow	Net Tow	S2C29 MS (25m)
2300	Arrive ALOHA S2C1 Gas 1	Deploy sed traps	S2C17 BEACH	S2C25 PO-3 (End 36 hr)	

October 21: Sunrise 0629 Sunset 1802

TIME	Mon. 10/23	Tues. 10/24
0000	S2C30 MS (25m)	
0100	Transit to St. 50	
0200	S50c1	
0300		
0400		
0500	S50c2	
0600		
0700		
0800		Arrive Snug (offload)
0900	S50c3	
1000		
1100		
1200	S50c4 (JZ 2@75m)	
1300		
1400		
1500		
1600		
1700	Transit St. Kaena	
1800		
1900		
2000		
2100	S6C1	
2200		
2300	Transit Snug	

6.0 HOT-186 Watch Schedule

0300-1500

Eric Grabowski – Chief Scientist – *Alt Tag, alt Water Boss*
Ken Doggett – *Alt Tag, alt Water Boss*
Adriana Harlan – *Water Boss*
Dan Sadler - *Tag*
Nicole Cormier – *Volunteer(BEACH)*
Fernando Santiago-Mandujano – Watch Leader
John Yeh – *Tag*

1500-0300

Karin Björkman – *Alt Tag*
Susan Curless – Watch Leader, *Water Boss*
Doug White - *Tag*
Paul Lethaby –
Jefrey Snyder - *Tag*

At Large

Claire Mahaffey
Blake Watkins
Matthew Sullivan
Maureen Coleman
Sarah Bagby
Yan Mei Shi
John Bullister
Dave Wisegarver
Maria Calleja Cortès
Misty Miller
Elizabeth Hambleton
Erica Wasner – *Volunteer(PO)-(9am-9pm)*

OTG

Gabe Foreman
Steve Tottori