Hawaii Ocean Time-series
HOT-252 Operational Cruise Plan

Cruise ID: KM 13-08
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Rick Meyer
Chief Scientist: Brett Updyke, University of Hawaii
OTG Marine Technicians: Trevor Goodman and Dan Fitzgerald

Kilo Moana phone number: 842-9817, cell # 864-0065, satellite # 011-870-773234249
Marine Center phone number: 842-9813

Loading: May 15, 2013 @0900
Departure: May 16, 2013 @0900 (Science personnel on board by 0800)
Arrival: May 20, 2013 @ 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-9 Mooring (anchor position 22° 46.071'N 157° 53.956'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

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, ACS/AC9/FRRf, misc. experiments.
WHOTS mooring station (Sta. 50)	One CTD cast (yo-yo to 200 m), surface instrument intercomparisons.
Kaena (sta. 6)	One CTD cast (near bottom)
Underway/continuous	ADCP, thermosalinograph, pCO2 system, fluorometry, and meteorology.

2.0. SCIENCE PERSONNEL

Participant	Title	Affiliation/HOT Group
Lance Fujieki	Research Associate	UH/BEACH
Dan Sadler	Research Associate	UH/BEACH
Adriana Harlan	Research Associate	UH/BEACH
Brett Updyke	Research Associate	UH/BEACH
Blake Watkins	Marine Engineer	UH/BEACH
Christopher Schvarcz	Graduate Student	UH/BEACH
Donn Viviani	Graduate Student	UH/BEACH
Shimi Rii	Graduate Student	UH/BEACH
Stuart Goldberg	Postdoctoral Researcher	UH/BEACH
Benedetto Barone	Postdoctoral Researcher	UH/CMORE
Sara Thomas	Graduate Student	UH/CMORE
Jefrey Snyder	Marine Technician	UH/PO
Fernando Santiago-Mandujano	Research Associate	UH/PO
Cameron Fumar	Research Associate	UH/PO
Daniel McCoy	Research Associate	UH/PO
Michael Grissom	Graduate Student	UH/PO
Eli Wong	Undergraduate Student	UH/PO
Roberta Hamme	Scientist	Univ. of Victoria
Irina Shilova	Postdoctoral Researcher	UCSC
Brandon Carter	Research Specialist	UCSC
Zbigniew Kolber	Scientist	UCSC
Matt Mills	Research Associate	Stanford
Trevor Goodman	Marine Technician	OTG
Dan Fitzgerald	Marine Technician	OTG

3.0. SUMMARY SCHEDULE

8 May	Pre-cruise planning meeting 1400 hrs.
15 May	Ship loading at 0900 hrs.
16 May	Depart from Snug harbor at 0900 hrs. **Science personnel on-board by 0800.**
16 May	Station 1 Kahe Pt. operations.
16-19 May	Station ALOHA operations. Station 50 CTD yo-yo cast, Station Kaena
20 May	Arrive 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 May 16th. The A-frame, 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 (Sect. 4.2.2). After the sediment trap deployment is complete, two CTD casts 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 considering nowcast and forecast currents and weather information. 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, 60841), 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 and other experiments.

4.2.3 Primary Production experiment

Samples for the primary productivity experiment will be collected from Station 2 CTD cast 2. Before dawn (sunrise 0550 hrs on May 17th), 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 3028, 60482 emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), strobe lights and a radio transmitter (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 (1907 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 **(Cammy Fumar, Fernando Santiago-Mandujano)**.

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 03028, 60482 emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), a strobe light and a radio transmitter (156.425

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 and third 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, second 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. Each deployment will consist of three profiles before the instrument is retrieved.

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 two times during the cruise.

Each deployment will consist of two up and two down profiles to a target depth of 200 m at a constant speed of 10 m/min during both the downcast and upcast. An instrument soaking period at just below the surface will be required between the two profiles. The A-frame and capstan will be needed for this operation.

4.2.9. Automated Trace Element Sampler (ATE)

On the morning of May 18th, the ATE will be hand deployed off the back deck to a depth of 10 m to collect at Trace Metal Free Sample. The ATE will be recovered after 30 minutes in the water. The ATE is approximately 1’ tall and 4’’ in diameter, weighting 5 lbs.

If the ship has been stationary at ALOHA for previous cruise activities, it is requested that the ship steams approximately 10-15 minutes up current from current position prior to each ATE deployment to limit contamination of the trace metal sample from the ship’s hull.

4.3 Gas Array and floating Sediment Trap recovery

In the early morning of May 19th, the ship shall transit for the recovery of the Gas Array. The A-frame and the Sea-Mac winch will be needed to retrieve the Gas Array. After the array is recovered, the ship shall transit to recover the floating sediment trap array. After the array is recovered, the ship shall transit to Station ALOHA to conduct the AC9/FRRF and Hyperpro casts. Once these operations are complete, the ship shall transit to Station 50 and conduct one 200 m yo-yo cast.

4.4 Station 50 - WHOTS-9 Mooring

The anchor position of the WHOTS-9 mooring is 22° 46.071’N 157° 53.956’W. The watch circle of the buoy is about 2 nautical miles. Generally, the buoy stays on the edge of the watch circle. The buoy can be detected via radar in good weather conditions but is harder to detect with larger sea states.

4.4.1 CTD yo-yo cast (subsurface instrument intercomparison)

One 200-m CTD yo-yo cast with at least 5 full cycles will be conducted near the WHOTS mooring on October 9th for subsurface instrument intercomparison. This cast should be conducted downwind, down current, 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, one APEX profiling drifter will be deployed before transiting to Station Kaena.

4.5 APEX profiling drifter

Blake Watkins will be deploying one APEX profiling drifter from the University of Washington. The instrument weighs about 75 pounds and can be handled by a single person. We request the ship's small crane for this operation. Once deployed in the water, the instrument will sink and self-activate. The instrument will not be recovered. The Chief Scientist will choose the deployment location. After deployment, the ship shall transit to Station Kaena.

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 9th. Once the CTD cast is complete, 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 technicians 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, and all associated spare parts
3. One 20 ft. laboratory van with assorted equipment for radioisotope and general use (Van #23)
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. APEX profiling drifter

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

1. A-frame
2. A-frame block assembly
3. Caley winch and crane 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 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 12L water sampling bottles (to be used as spare)
25. 1000 lb weight.
26. Large Sea-Mac winch (Mod. 1025 EHS). 60 Amp Hubbel plug/connector (440 VAC, 3 phase, 60 Amp breaker)

Ship: R/V *KILO MOANA* **HOT 252 CTD CASTS** **Date: May 16-20, 2013**

Cast		Samples	#Bottles
Kahe Pt.			
s1c1	1000 m	O_2, Temp, DIC/Alk, Nuts, Chl a, LLN, LLP, DOC, FCM, Salts	24
Station ALOHA			
s2c1	200 m	IS(24@25 m)	24
s2c2	1000 m	Primary Production, DV(pb PP depths), SR(pb PP depths), IS(1@600), Salts	23
s2c3	4740 m (PO-1)	O_2, Temp, DOC, DIC/Alk, Nuts, RH(pb O_2 @ 7 depths), Salts	24
s2c4	1000 m (PO-2)	O_2, Temp, DOC, DIC/Alk, Nuts, Salts	24
s2c5	1000 m	PC/PN, SR(1@5,25,45,75,100,125,150,175), IS(1@25,DCM), Salts	24
s2c6	1000 m	PPO4, IS(6@25), RH(1@400,700,850, 2@1000), Salts	24
s2c7	1000 m (BEACH)	O_2, Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, Salts	23
s2c8	1000 m	PUR, ST(1@175,225,250,300,350,400,500,550), Salts	18
s2c9	1000 m	Gas Array(2@5,25,45,75,100,125), ST(1@200,600,650,700,770,800,900,1000), Salts	21
s2c10	1700 m	AP(6@5), RH(1@800,1250,1500, 2@1700), Salts	14
s2c11	1000 m	PSi, MC(1@5,25,45,75,100,125,150,175), Salts	18
s2c12	1000 m	CS(2@5,25,45,75,100,125,150,175), RH(1@100,250, 2@5,550), Salts	24
s2c13	1000 m	ATP, MC(1@200,300,500,770), SW(1@200,300,400,500, 600,700,800,900,1000), Salts	23
s2c14	1000 m	MC(1@5,25,45,75,100,125,150,175), SW(pb MC, 2@25), IS(1@25,DCM), Salts	14
s2c15	1000 m	HPLC, Chl a, Slides, Salts	22
s2c16	4740 m (PO-3)	Oxygen, MC(1@1000,2000,3000,4000), RH(1@2000,2400,2900,3400,3900, 2@4500), Salts	19
WHOTS Mooring			
s50c1	200 m yo-yo	CS(9@25, 1@5,45,75,100,125,150,175), BB(1@30,80), ST(2@200)	20
Kaena			
s6c1	2400 m	Chl, Salts	13

MC=Matt Church, **SW**=Sam Wilson, **AP=**Adina Paytan, **DV=**Donn Viviani, **SR=**Shimi Rii,
CS=Chris Schvarcz, **IS**=Irina Shilova, **RH**=Roberta Hamme, **BB**=Barbara Balestra, **ST**=Sara Thomas

Ship: R/V *KILO MOANA* HOT 252 Date: May 16-20, 2013

TIME	Thur. 5/16	Fri. 5/17	Sat. 5/18	Sun. 5/19	Mon. 5/20
0000		S2C1	Net Tow		
0100					
0200		S2C2 PP	S2C9 Gas		
0300				AC9/FRRF	
0400		Deploy PP Array	Deploy Gas Array		
0500		S2C3 PO-1	S2C10 Open	Transit gas array	
0600				Recover gas array Transit sed traps	
0700				Recover traps	
0800			S2C11 PSi	Transit ALOHA	Arrive Snug
0900	Depart Snug				
1000		Net Tow	Net Tow ATE	AC9/FRRF	
1100	Arrive Kahe (11:30) Weight cast	S2C4 PO-2 (Begin 36 hr)	S2C12 Open		
1200	Hyperpro	Hyperpro	Net Tow	Hyperpro	
1300	S1C1 Kahe			Transit St. 50 S50C1 WHOTS	
1400		S2C5 PC/PN	S2C13 ATP		
1500	Transit ALOHA			Deploy APEX Transit St. Kaena	
1600					
1700		S2C6 PPO4	S2C14 OPEN		
1800					
1900		Recover PP array			
2000		S2C7 BEACH	S2C15 HPLC		
2100				S6C1 Kaena	
2200		Net Tow	Net Tow		
2300	Arrive ALOHA Deploy sed traps	S2C8 PUR	S2C16 PO-3 (end 36 hours)	Transit Snug	

May 17th: Sunrise 0550, Sunset 1907

6.0 HOT-252 Watch Schedule

0300-1500

Adriana Harlan – *Water Boss*
Dan Sadler – *Tag*
Lance Fujieki – *Alt. Tag*
Cammy Fumar – Watch Leader – *Console*
Jefrey Snyder – *Tag*
Mike Grissom – *Alt. Tag*

1500-0300

Brett Updyke – Chief Scientist **-** *Water Boss*
Chris Schvarcz – *Tag*
Fernando Santiago-Mandujano – Watch Leader **-** *Alt. Tag*
Daniel McCoy – *Console*
Eli Wong – *Tag*

0900-2100

Stu Goldberg

At Large

Blake Watkins
Shimi Rii
Donn Viviani
Benedetto Barone
Sara Thomas
Roberta Hamme
Irina Shilova
Brandon Carter
Zbigniew Kolber
Matt Mills

OTG

Trevor Goodman
Dan Fitzgerald