

Hawaii Ocean Time-series HOT-277 Operational Cruise Plan

Cruise ID: KOK 15-15

Vessel: R/V *Ka'imikai-O-Kanaloa*, University of Hawaii

Master of the Vessel: Captain Don Jack

Chief Scientist: R. Walter Deppe, University of Hawaii

OTG Marine Technicians: Trevor Young and Steve Tottori

Marine Center phone number: 842-9813

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KOK Satellite Phone Numbers: 011-870-773-233658

Loading: October 9, 2015 @0900

Departure: October 12, 2015 @0800 (Science personnel on board by 0700).

Arrival: October 16, 2015 @ 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 October 12th 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 October 13-15th.
- 3) Station 52, the site of WHOTS-12 Mooring (anchor position 22° 40.061' N, 157° 56.9654' W) will be occupied on for about one hour on October 15th.
- 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 October 15th for about 2 hours.

1.1 SCIENTIFIC OPERATIONS

<u>Station</u>	<u>Activities</u>
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, optics casts, misc. experiments.
WHOTS mooring station (Sta. 52)	One CTD cast (yo-yo to 200 m), surface instrument intercomparisons.
Underway/continuous	ADCP, thermosalinograph, fluorometry, meteorology

2.0. SCIENCE PERSONNEL

Participant	Title	Affiliation
Susan Curless	Research Associate	UH
Lance Fujieki	Research Associate	UH
Dan Sadler	Research Associate	UH
Brenner Wai	Research Associate	UH
Alex Nelson	Research Associate	UH
Blake Watkins	Marine Engineer	UH
Brie Maillot	Technician	UH
Eric Shimabukuro	Research Associate	UH/SCOPE
Tara Clemente	Research Associate	UH/SCOPE
Greyson Adams	Research Associate	UH/SCOPE
Jim Burkitt	Research Associate	UH/SCOPE
Jefrey Snyder	Marine Technician	UH
Fernando Santiago-Mandujano	Research Associate	UH
Daniel McCoy	Research Associate	UH
R. Walter Deppe	Research Associate	UH
Sarah-Jeanne Royer	Post-Doc	UH
Markus Lindh	Post-Doc	UH
Chandler Bruttig	Undergraduate Student	UH
Caleb Hsu	Undergraduate Student	UH
Trevor Young	Marine Technician	OTG
Steve Tottori	Marine Technician	OTG

3.0. SUMMARY SCHEDULE

5 October	Pre-cruise planning meeting 1330 hrs, MSB-307
9 October	Ship loading at 0900 hrs.
12 October	Depart from Snug harbor at 0800 hrs. Science personnel on-board by 0700.
12 October	Station 1 Kahe Pt. operations.
13-15 October	Station ALOHA operations. Station 52 CTD yo-yo cast, Station Kaena
16 October	Arrive back to Snug Harbor. Full offload.

4.0. OPERATIONAL PLANS

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

4.1.1 A 500 lb. 1000 m weight-test cast, one CTD cast to 1000 m and a Hyperpro cast (Sect. 4.2.7) will be conducted at this location on October 12th. The CTD winch and small North American Crane will be required for these operations. After the operations are satisfactorily completed, the ship shall proceed to Station ALOHA.

4.1.2 SLDMB deployments

Deploy SLDMB drifters near Station Kahe for Victoria Futch. Two will be deployed after leaving Station Kahe for Station ALOHA and two will be dropped on the return transit at the same latitude. Consecutive deployments will be made approximately 5 minutes apart. These floats are part of an experiment to map an eddy feature located off the west side of Oahu.

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, one 1000-m CTD 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. 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 3028, 60482), 2 strobe lights, and 2 radio transmitters (channel 68: 156.425 MHz). Daily positions of the array shall be transmitted by email directly to the ship (argosfix@kok.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 0628 hrs on October 13th), 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 60484, 84857) strobe lights and a radio transmitter (channel 74: 156.725 MHz). Positions of the array will be emailed to argosfix@kok.soest.hawaii.edu, password: argosfix. **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 (1808 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 winch and crane for these operations. Water samples for biogeochemical measurements will 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, Dan Sadler**).

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 CTD cast 8. 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 60484, 84857), emailing positions to argosfix@kok.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 25 hours after its deployment. Assistance from the Bridge is requested in plotting the drift track of the array. CTD operations shall continue after the recovery.

4.2.6. Zooplankton 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 small 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, and 1400 on the second and fourth days, the Hyperpro will be deployed from the stern through a small block hung from the A-frame. The instrument is lowered and retrieved by hand. Each deployment will consist of three profiles before the instrument is retrieved.

4.2.8. Optics

No optics package deployments will be conducted during HOT-277. Sensors are out for calibration and are not available to be used at this time.

4.2.9. Automated Trace Element Sampler (ATE)

On the morning of October 14th, 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.

4.2.10. Seaglider #512

One seaglider, sg512, (deployed during HOT-274, 18 Jul 2015) may be diving near Station ALOHA and may transit at times through the circle. The glider will report its GPS positions to kok_master@kok.soest.hawaii.edu and to HOTPO@kok.soest.hawaii.edu when it is within the circle vicinity. The ARGOS ID for sg512 = 90993, although, it appears that the ARGOS transmitter has stopped transmitting (as of late July) - so no ARGOS fixes are expected. It positioning is GPS and its broadcasting is currently over the Iridium system. **Recovery within Station ALOHA is planned on October 15th, at about 1130.**

4.2.10. Manta Trawls

A manta trawl for collecting plastic will be towed behind the ship for between 15-30 minutes per tow. The ship will reduce speed to 1.5-3 knots during the tow. Three tows will be conducted at Station ALOHA. Three tows will be conducted along a transect from Station ALOHA to Station Kaena on the return transit. Sarah-Jeanne Royer will be in charge of these operations.

4.3. Gas Array and floating Sediment sediment trap recovery

In the morning of August 11th, after the optics cast has been completed, the ship shall transit for the recovery of the Gas Array. The small crane and the Sea-Mac winch will be needed to retrieve the sediment trap array. After the Gas Array is recovered, the ship shall transit to recover the floating sediment trap array. After the sediment traps are recovered, the ship shall transit to Station 52 and conduct one 200 m CTD yo-yo cast.

4.4 Station 52 - WHOTS-12 Mooring

The anchor position of the WHOTS-12 mooring is 22° 40.061' N, 157° 56.9654' 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 15th for subsurface instrument intercomparison. The final cycle will be conducted to 500-m to collect water from that depth. 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, a Hyperpro cast will be conducted within the circle that defines Station ALOHA. Once the Hyperpro cast is completed, an APEX float will be deployed.

4.4.3 APEX Float Deployment

One APEX float from the University of Washington will be deployed prior to leaving Station ALOHA. The instrument weighs about 75 pounds and can be handled by a single person. Once deployed in the water, the instrument will sink and self-activate. The instrument will not be recovered. After the float has been deployed, the ship shall transit to Station Kaena.

4.5 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 August 11. Once the CTD cast is complete, 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 technicians 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 technicians will be in charge of the thermosalinograph and fluorometer operations.

4.8. Procedures using underway water intake system

4.8.1. Filtering system for plastic debris

A filtration system for plastic debris collection will be connected to an outlet of the underway seawater system and will sample in continuous throughout the cruise. Sarah-Jeanne Royer will be in charge of this system.

4.8.2. Sampling from underway water intake system

Surface water samples will be collected from the underway seawater system during transits between Honolulu and Station ALOHA. During transits, individual samples (ca. 4L) will be collected twice every hour (at least 20 samples per transit), filtered in a sink, and stored in a freezer. Procedures will include radioactive work with tritiated leucine, ^3H -Leu. Markus Lindh will be in charge of these 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 20 ft. laboratory vans (#23, #24) with assorted equipment for radioisotope and general use.
4. Distilled, deionized water and all required chemicals and isotopes
5. Large vacuum waste containers
6. Liquid nitrogen dewar
7. Drifting sediment trap array with strobe lights, satellite and radio transmitters, floats, weights
8. Polypropylene line
9. Sediment traps and crosses
10. Drifting primary production array and gas array with light and radio transmitter, floats, weights, polypropylene line, spare buoy, etc.
11. Hyperpro and other optical measuring instruments.
12. Oxygen titration system
13. Plankton nets and towing lines
14. Desktop and laptop personal computers
15. Assorted tools
16. All required sampling bottles
17. Deck incubation system
18. Pertinent MSDS
19. Chest Freezer (22 cubic inch)
20. One 12 ft. equipment van ("Blue" Van)
21. APEX Float
22. Manta trawl
23. On-deck dark incubator
24. Filtration system for plastic debris (to be connected to underway pump)

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 laboratory van (**#23**)
7. Space on upper deck for two vans (**#24 and blue equipment 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. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer
21. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
22. 500 lb weight
23. Remote CTD dbar pressure display in the winch operator area.
24. Monitor in Rock Lab displaying ship coordinates, bottom depth and GMT.

Cast	Depth	Samples	#Bottles
<u>Kahe Pt.</u>			
s1c1	1000 m	O ₂ , Temp, DIC/Alk, Nuts, Chl a, LLN, LLP, DOC, FCM, Salts	24
<u>Station ALOHA</u>			
s2c1	1000 m	Primary Production, Salts	22
s2c2	4740 m (PO-1)	O ₂ , Temp, DOC, DIC/Alk, Nuts, Salts	24
s2c3	1000 m (PO-2)	O ₂ , Temp, DOC, DIC/Alk, Nuts, Salts	24
s2c4	1000 m	PC/PN, DNA(1@5,25,45,75), Salts	18
s2c5	1000 m	PPO4, SF-S(1@5,25), S-JR(4@25), Salts	20
s2c6	1000 m (BEACH)	O ₂ , Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, Salts, SF-S(1@5,pb@25)	24
s2c7	1000 m	PUR, SF-S(1@5,25), DNA(1@,100,125,150,175), Salts	16
s2c8	1000 m	Gas Array(3@5,25,45,75,100,125), SF-S(1@5,25), Salts	22
s2c9	1000 m	DNA(1@200,225,250,275), SF-S(1@5,25), Salts	8
s2c10	1000 m	PSi, SF-S(1@5,25), KW-B(1@5,25,45), Salts	14
s2c11	1000 m	SF-S(1@5,25), Salts	4
s2c12	1000 m	ATP, DNA(2@300,400,500,770), SF-S(1@5,25), Salts	21
s2c13	1000 m	MC(1@5,25,45,75,100,125,150,175), SW(pb MC,1@700), SF-S(1@5, 25), BB(1@ DCM), Salts	14
s2c14	1000 m	HPLC, Chl a, Slides, Salts	24
s2c15	4740 m (PO-3)	Oxygen, DNA(1@1000,2000,3000,4000), KW-B(1@5,25,45), RB(2@ 4000), Salts	17
<u>WHOTS Mooring</u>			
s52c1	200 m yo-yo (final cycle to 500 m)	DIC/TA(1@5), S-JR(2@25), EK(1@300,500)	5
<u>Kaena</u>			
s6c1	2400 m	Chl, Salts	13

MC=Matt Church, SW=Sam Wilson, SF-S=Sara Ferrón-Smith, KW-B=Kate Watkins-Brandt,
S-JR=Sarah-Jeanne Royer, BB=Benedetto Barone, RB = Roman Battisti, EK= Eint Kyi

Ship: R/V Ka'Imikai-O-Kanaloa HOT 277 Date: October 12-15, 2015

TIME	Mon. 10/12	Tue. 10/13	Wed. 10/14	Thu. 10/15	Fri. 10/16
0000		Arrive ALOHA (0000) Deploy Traps			Transit Snug
0100					
0200		S2C1 PP	S2C8 Gas		
0300					
0400		Deploy PP Array	Deploy Gas Array		Deploy drifters
0500		S2C2 PO-1	S2C9 Open	Transit gas array	
0600				Recover gas array Transit sed traps	
0700				Recover traps	
0800	Depart Snug		S2C10 PSi	Transit St. 52	Arrive Snug
0900					
1000	Arrive Kahe (11:00)	S-JR Manta Trawl	Net Tow ATE	S52C1 WHOTS	
1100	Weight cast	S2C3 PO-2 (Begin 36 hr)	S2C11 Open	Recover seaglider	
1200	Hyperpro S1C1 Kahe	Net Tow	Net Tow		
1300		Hyperpro		Hyperpro	
1400	Transit ALOHA Deploy drifters	S2C4 PC/PN	S2C12 ATP	Deploy APEX Transit St. Kaena	
1500					
1600		S-JR Manta Trawl	S-JR Manta Trawl	S-JR Manta Trawl	
1700		S2C5 PPO4	S2C13 Open		
1800		Recover PP array		S-JR Manta Trawl	
1900					
2000		S2C6 BEACH	S2C14 HPLC	S-JR Manta Trawl	
2100				S6C1 Kaena	
2200		Net Tow Net Tow	Net Tow		
2300		S2C7 PUR	S2C15 PO-3 (end 36 hours)		

October 13th: Sunrise 0628, Sunset 1808

6.0 HOT-277 Watch Schedule

0300-1500

Tara Clemente – *Alt. Water Boss*
Alex Nelson – *Water Boss*
Lance Fujieki – *Alt. Tag*
Dan Sadler – *Watch Leader – Tag*
Danny McCoy – *Console*
Jefrey Snyder – *Tag*
Jim Burkitt – *Alt. Tag*
Caleb Hsu

1500-0300

Susan Curless – *Water Boss*
Brenner Wai – *Tag*
Eric Shimabukuro – *Alt. Tag*
Walt Deppe – *Chief Scientist – Console*
Fernando Santiago-Mandujano – *Watch Leader - Tag*
Greyson Adams – *Alt. Tag*
Chandler Bruttig

0900-2100

Brie Maillot

At Large

Blake Watkins
Sarah-Jeanne Royer
Markus Lindh

OTG

Trevor Young
Steve Tottori