Hawaii Ocean Time-series
HOT-286 Draft Cruise Plan

Cruise ID: KOK 16-11
Vessel: R/V *Ka'Imikai-O-Kanaloa*, University of Hawaii
Master of the Vessel: Captain Mike Hoshlyk
Chief Scientist: R. Walter Deppe, University of Hawaii
OTG Marine Technicians: Trevor Young and Jeff Koch

Marine Center phone number: 842-9813
KOK phone number: 842-9818
KOK Cell number: 690-5393
KOK Satellite Phone Numbers: 011-870-773-233658

Loading: August 5, 2016 @0900
Departure: August 8, 2016 @0800 (Science personnel on board by 0700).
Arrival: August 12, 2016 @ 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 August 8th 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 August 9-11th.
3) Station 50, the site of WHOTS-13 Mooring (anchor position 22° 47.24' N, 157° 54.45' W) will be occupied on for about one hour on August 11th.
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 August 11th 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, optics casts, misc. experiments.
WHOTS mooring station (Sta. 50)	One CTD cast (yo-yo to 200 m), surface instrument intercomparisons.
Underway/continuous	ADCP, thermosalinograph, fluorometry, meteorology

2.0. SCIENCE PERSONNEL

Participant	Title	Affiliation	Citizenship
Susan Curless	Research Associate	UH	USA
Alexa Nelson	Research Associate	UH	USA
Karin Björkman	Research Specialist	UH	Sweden
Dan Sadler	Research Associate	UH	USA
Brenner Wai	Research Associate	UH	USA
Blake Watkins	Marine Engineer	UH	USA
Jim Burkitt	Research Associate	UH/SCOPE	USA
Tara Clemente	Research Associate	UH/SCOPE	USA
Eric Shimabukuro	Research Associate	UH/SCOPE	USA
R. Walter Deppe	Research Associate	UH	USA
Fernando Santiago-Mandujano	Research Associate	UH	USA
Kellen Rosburg	Research Associate	UH	USA
Jefrey Snyder	Marine Technician	UH	USA
Alyssa Gellene	Research Specialist	USC/SCOPE	USA
Sarah-Jeanne Royer	Post-doc	UH	Canada
Eint Kyi	Graduate Student	UH	Myanmar
Morgan Linney	Graduate Student	UH	USA
Donn Viviani	Graduate Student	UH	USA
Alyssa Agustin	Graduate Student Volunteer	UH	USA
Trevor Young	Marine Technician	OTG	USA
Jeff Koch	Marine Technician	OTG	USA

3.0. SUMMARY SCHEDULE

1 August	Pre-cruise planning meeting 1330 hrs, MSB-307
5 August	Ship loading at 0900 hrs.
8 August	Depart from Pier 35 at 0800 hrs. **Science personnel on-board by 0700.**
8 August	Station 1 Kahe Pt. operations.
9-11 August	Station ALOHA operations. Station 50 CTD yo-yo cast, Station Kaena
12 August	Arrive back at Pier 35. Full offload.

4.0. OPERATIONAL PLANS

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

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 August 8th. 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.

4.2. 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 1 ARGOS satellite transmitter (platform #: 60484), 1 Iridium (platform #: 6190), strobe lights and a radio transmitter (channel 74: 156.725 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. Net Trap Deployment

A free floating net trap (similar to a plankton net, with a frame) will be deployed in a vertical orientation at a depth of 150m for about 24hrs before recovery. The array will be deployed from the stern of the vessel using the A-frame and the Sea-Mac winch. The trap diameter is 1 m with a mesh size for the net of 55 um (and the cod-end is 55 um). The net trap is attached to the surface with floats and is equipped with an ARGOS satellite transmitter (platform #'s: 84859, 60481), strobe lights and a radio transmitter (channel 72: 156.625 MHz). Prior to recovery, a pinger is hung over the side of the ship to communicate and close the trap. Once the trap is closed it can then be recovered. 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 net trap, the ship shall prepare to deploy the Primary Productivity Array.

4.2.4. Primary production experiment

Samples for the primary productivity experiment will be collected from the rosette. Before dawn (Sunrise 0607 hrs on August 9th), a free drifting incubation array will be deployed from the starboard stern rail using the small crane and the Sea-Mac winch. The array is equipped with two ARGOS satellite transmitters (platform #'s 60482, 3028), strobe lights and a radio transmitter (channel 68: 156.425 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 (1908 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.

4.2.5. 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 **(Dan Sadler, Fernando Santiago-Mandujano)**.

4.2.6. Gas Array deployment

A 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 60482, 3028), strobe lights 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 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.

4.2.7. 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.

4.2.8. 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.

4.2.9. Optics

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.

4.2.10. Automated Trace Element Sampler (ATE)

On the morning of August 10th, 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.

4.2.11. Surface hand net tow

Surface net tows are hand-deployed off the stern for about 10 minute periods. These surface net tows are scheduled for 0900, 1600, and 1800 on August 9th, 0900, 1300, and 1600 on August 10th, and 0930 and 1500 on August 11th. We request that the ship only move as fast a necessary to keep the net horizontal at the surface (stationary or <1 knot depending on the current).

4.2.12. 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, one on August 9th at 1000, and two on August 10th at 1500 and 1830. 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 ALOHA for an AC9/FRRf cast. Once the optics work is complete, the ship shall transit to Station 52 and conduct one 200 m CTD yo-yo cast.

4.4 Station 50 - WHOTS-13 Mooring

The anchor position of the WHOTS-13 mooring is 22° 47.24' N, 157° 54.45' 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 August 11th 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, a Hyperpro cast will be conducted within the circle that defines Station ALOHA. Once the Hyperpro cast is completed, the ship will 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. Underway surface seawater filtration system

Surface seawater will be obtained from the underway system, filtered through a high-capacity 0.2 micron filter into 2x 55-gallon barrels (1-2 hours of underway sampling). This water will be circulated through an ultra-filtration system (1x1x3.5 ft) using a peristaltic pump (1 day). As the water circulates through the filter the sample permeates out and is drained overboard. The system collects only

material greater than the nominal pore size of the filter. The underway water will be sampled upon reaching St. ALOHA. The barrels will be re-filled 2 more times for a total of 12,000 liters of water sampled over the course of the cruise while in St. ALOHA. Sample collection is not time-dependent. This system will be run by Sarah-Jeanne Royer.

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 (1- dark incubator, 1- big blue incubator)
18. SeapHOx Ocean CT(D)-pH-DO sensor
19. Pertinent MSDS
20. Chest Freezer (22 cubic inch)
21. Blue Equipment Van
22. Drifting net trap array with light and radio transmitter, floats, weights, Amsteel line
23. Caron incubator
24. Ultra-filtration system

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. Distilled, deionized water system
18. Electronic mail system
19. GPS system
20. Uncontaminated seawater supply
21. -80°C Freezer
22. 4°C Refrigerator and -20°C Freezer
23. Small capstan (~ 10 m/min)
24. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer
25. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
26. 1300 lb weight
27. Remote CTD dbar pressure display in the winch operator area.
28. Monitor in Rock Lab displaying ship coordinates, bottom depth and GMT.
29. OTG's transmissometer
30. SeaMac Winch

Ship: R/V *Ka'Imikai-O-Kanaloa* HOT 286 CTD CASTS Date: August 8-12, 2016

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	1000 m	Primary Production, DV(1@25,100), Salts	24
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), AG(1@5), DV(1@25,100), Salts	21
s2c5	1000 m	PPO4, SF-S(1@5,25), Salts	16
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), DV(1@25,100), Salts	24
s2c9	1000 m	DNA(1@200,225,250,275), SF-S(1@5,25), EK (16@ 150m), Salts	24
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), ML(2@15), Salts	6
s2c12	1000 m	ATP, DNA(2@300,400,500,770), SF-S(1@5,25), DV(1@25,100), Salts	23
s2c13	1000 m	MC(1@5,25,45,75,100,125,150,175), SW(pb MC,1@700), SF-S(1@5,25), ML(2@15), Salts	15
s2c14	1000 m	HPLC, Chl a, Slides, Salts	22
s2c15	4740 m (PO-3)	Oxygen, DNA(1@1000,2000,3000,4000), ML(1@1000,1500,2000,2500,3000,3500,4000 ; 2@15), Salts	21
WHOTS Mooring			
s50c1	200 m yo-yo	DIC/TA(1@5), KW-B(1@5,25,45), SF-S(4@25)	8
Kaena			
s6c1	2400 m	Chl, Salts	13

MC=Matt Church, **SW**=Sam Wilson, **SF-S=**Sara Ferrón-Smith, **KW-B**=Kate Watkins-Brandt, **ML**=Morgan Linney, **AG**=Alyssa Gellene, **EK**=Eint Kyi, **DV**=Donn Viviani

Ship: R/V *Ka'Imikai-O-Kanaloa* HOT 286 Date: August 8-12, 2016

TIME	Mon. 8/8	Tue. 8/9	Wed. 8/10	Thu. 8/11	Fri. 8/12
0000		Arrive ALOHA (0000) Deploy sed traps			Transit Snug
0100					
0200		S2C1 PP	S2C8 GAS		
0300		Deploy Net Trap		Optics	
0400		Deploy PP Array	Deploy Gas Array		
0500		S2C2 PO-1	S2C9 OPEN	Transit gas array	
0600			Recover Net Trap		
0700				Recover gas array Transit sed traps	
0800	Depart Snug		S2C10 PSi	Recover traps	Arrive Snug
0900		DC net tow	DC net tow	Transit ALOHA DC net tow	
1000	Arrive Kahe (11:00)	Manta Trawl	Net Tow ATE	Optics	
1100	Weight cast	S2C3 PO-2 (Begin 36 hr)	S2C11 OPEN		
1200	Hyperpro	Net Tow	Net Tow	Transit St. 50 S50C1 WHOTS	
1300	S1C1 Kahe	Hyperpro	DC net tow	Transit ALOHA	
1400	Transit ALOHA	S2C4 PC/PN	S2C12 ATP	Hyperpro	
1500			Manta Trawl	DC net tow Transit St. Kaena	
1600		DC net tow	DC net tow		
1700		S2C5 PPO4	S2C13 OPEN		
1800		DC net tow	Manta Trawl		
1900		Recover PP array			
2000		S2C6 BEACH	S2C14 HPLC	S6C1 Kaena	
2100					
2200		Net Tow Net Tow	Net Tow		
2300		S2C7 PUR	S2C15 PO-3 (end 36 hours)		

August 9th: Sunrise 0607, Sunset 1908

6.0 HOT-275 Watch Schedule

0300-1500

Tara Clemente
Alex Nelson **–** *Water Boss*
Brenner Wai – *Tag*
Dan Sadler – Watch Leader – *Alt. Tag*
Walt Deppe – Chief Scientist **–***Console*
Jefrey Snyder – *Tag*

1500-0300

Susan Curless **–** *Water Boss*
Karin Björkman
Eric Shimabukuro *–Tag*
Kellen Rosburg **–** *Console*
Fernando Santiago-Mandujano – Watch Leader – *Alt. Tag*
Jim Burkitt – *Tag*

0900-2100

Alyssa Agustin

At Large

Blake Watkins
Sarah-Jeanne Royer
Eint Kyi
Morgan Linney
Alyssa Gellene
Donn Viviani

OTG

Trevor Young
Jeff Koch