TROPICAL ATMOSPHERE-OCEAN (TAO) PROGRAM

FINAL CRUISE REPORT

KA-07-03

July 13, 2007 – August 8, 2007

Area: Equatorial Pacific between 8°N and 8°S latitude along the 155°W Meridian and 8°S to 8°N Latitude along 170°W Meridian.

Itinerary:

KA-07-05	*Ford Island, Hawaii*	DEP	*July 13, 2007*
	Kwajalein, RMI	ARR	*August 8, 2007*

CRUISE DESCRIPTION

The Tropical Atmosphere Ocean (TAO) array consists of 70 buoys utilizing a taut line mooring configuration used to mount data collection sensors for climate research purposes. Fifteen buoys are serviced by JAMSTEC and the remaining 55 buoys from 95°W longitude to 165°E longitude are serviced by National Data Buoy Center (NDBC). Repair and maintenance of the buoys is performed by NDBC personnel on an annual basis utilizing the NOAA Vessel Ka I'mimoana and NOAA Vessel Ron H. Brown. The buoy deployment lifecycle are up to 18 months to ensure at least one year of data collection can be completed.

TAO Project Points of Contact:

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TAO Cruise Objective and Plan:

The objective of this cruise was the maintenance of the TAO Array along the 140°W and 125°W meridians. The scientific complement for the cruise embarked at ***Ford Island, HI*** on ***July 10, 2007***. The ship departed on ***July 13, 2007*** and conducted operations on the 155°W line. After completion of operations, **NOAA Ship *Ka'Imimoana*** proceeded to 8°S 170°W and worked buoys along the 170°W line and then proceeded to ***Kwajalein, RMI*** arriving on ***August 8, 2007***.

1.0 PERSONNEL

1.1 *CHIEF SCIENTIST AND PARTICIPATING SCIENTISTS*:

Chief Scientist: Brian Lake

Participating Scientists:

Name	Gender	Nationality	Affiliation
Brian Lake	M	US	NOAA/NDBC
James Rauch	M	US	NOAA/NDBC
William Thompson	M	US	NOAA/NDBC
Dai McClurg	M	US	NOAA/PMEL
Martin Suro	M	US	MBARI

2.0 TAO DATA INFORMATION

2.1 *TAO Data Recovery Summary*

Operations were conducted from (*8°N 155°W*) to (8°*S 155°W*) and (*8°S 170°W*) to (*8°N 170°W*). The following provides details on the data recovery efforts for the buoys serviced.

8N155W

Buoy ID: PM606A	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** 5386
Deployed Location: **:** 7-57.6N/154-58.9W	**Repair Location:** 7-57.7N/154-58.9W
Deployment Start Date: 10/1/06	**Visit End Date:** Still Active
Field Service Observations: During the pass-by, the buoy was sitting at the appropriate height in the water and there were no apparent signs of vandalism. The sensor data from meteorological sensors and	

all ocean sensors compared well against the ship SCS data.

5N155W

Buoy ID: PM592A	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** 4952 m
Deployed Location: 4-59.9N/154-55.8W	**Recovery Location:** 4-59.7N/154-55.9W
Deployment Start Date: 6/5/2006	**Recovery End Date:** 7/17/2007
Field Service Observations: All available sensor data was recovered and condition of buoy, tower and bridle look good. The inductive connection had two loose nuts and one missing bolt. Sheathed mooring cable was cut near temperature sensor at 25 meters depth. Temperature sensor at100 meters depth was missing.	

Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
100 meter Temperature	3/28/07	100 meter temperature sensor missing from the mooring

2N155W

Buoy ID: PM631A	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** 4678 m
Deployed Location: 1-59.4N/154-59.8W	**Repair Location:** 1-59.4N/155-0.8W
Deployment Start Date: 10/13/2006	**Visit End Date:** Still Deployed
Field Service Observations: During the pass-by, the buoy was sitting at the appropriate height in the water and there were no apparent signs of vandalism. The sensor data from meteorological sensors and all ocean sensors compared well against the ship's SCS data.	

0155W

Buoy ID: PM594B	**Buoy Configuration:** Standard with CO2
Buoy Type: ATLAS/CO2	**Water Depth:** 4644 m
Deployed Location: 0-0.27N/154-56.46W	**Recovered Location:** 0-0.0/154-56.9W
Deployment Start Date: 6/7/2006	**Recovered End Date:** 7/19/2007
Field Service Observations: All available sensor data was successfully recovered during the recovery operations. One bolt in the inductive connection was loose. The temperature sensors at 50 meters and 300 meters were lost at sea.	

Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss

50 meter Temperature	9/27/06	Lost at sea.
300 meter Temperature	12/13/06	Lost at sea.

2S155W

Buoy ID: PM632B	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** 4990 m
Deployed Location: 01-58.72S/155-00.22W	**Repair Location:** 02-00.3S/154-56.17W
Deployment Start Date: 10/15/2006	**Repair End Date:** Still Deployed
Field Service Observations: All data was successfully recovered during the repair operations. Temperature sensors from 120 meters through temperature/pressure sensor at 500 meters were not transmitting at time of the repair. Buoy had damage to the mast assembly.	

5S155W

Buoy ID: PM596A		**Buoy Configuration:** Standard
Buoy Type: ATLAS		**Water Depth:** 5034 m
Deployed Location: 4-58.71S/154-58.8W		**Recovered Location:** Not recovered, buoy lost at sea
Deployment Start Date: 6/9/2006		**Recovered End Date:** Not recovered, buoy lost at sea
Field Service Observations: Buoy was lost at sea. No data was recovered.		
Sensor	**Date of Real-time Sensor Data Loss**	**Reason for Data Loss**
Buoy	6/7/2007	Transmitter failed, lost at sea

8S155W

Buoy ID: PM633A	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** 4121 m
Deployed Location: 8-15.17S/155-0.05W	**Visit Location:** 7/23/07
Deployment Start Date: 10/17/2006	**Visit End Date:** Still deployed
Field Service Observations: During the pass-by of the buoy, it was noted the buoy was riding well in the water and there was no apparent damage to the buoy.	

8S170W

Buoy ID: PM634A	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** 5376 m
Deployment Location: 7-58.53S/170-01.45W	**Visit Location**: 7-58.6S/170-02.4W
Deployment Date: 10/21/2006	**Visit Date:** 7/26/07
Field Service Observations: During pass-by, the buoy appeared to be riding a bit low in the water. No signs of damage or vandalism. The sensor data from meteorological sensors and all ocean sensors compared well against the ship's SCS data.	

5S170W

Buoy ID: PM635A	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** 5413 m
Deployment Location: 4-59.8S/169-59.75W	**Recovery Location**: NA
Deployment Date: 10/22/2006	**Last Transmit:** 2/25/07
Field Service Observations: Buoy was set adrift and lost at sea. No recovery capable and no data were recovered.	

2S170W

Buoy ID: PM601A	**Buoy Configuration:** MBARI
Buoy Type: ATLAS/MBARI	**Water Depth:** 4960 m
Deployment Location: Not recorded	**Recovery Location**: 2-17.0S/170-0.5W
Deployment Date: 6/22/06	**Recovery Date:** 7/27/2007

Field Service Observations: The buoy was set adrift and the mooring line had long line fishing gear wrapped in it. The nylon parted within the first 500 meters of length. The anemometer was damaged and the 125 meter and 150 meter depth temperature sensors were lost at sea. All other buoy sensor data was recovered.

Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Anemometer	6/22/07	Anemometer was damaged
125 Meter Temperature Sensor	10/2/06	Lost at sea
150 Meter Temperature Sensor	1/10/07	Lost at sea

0170W

Buoy ID: PM602B	**Buoy Configuration:** CO2/FLUX
Buoy Type: ATLAS/CO2	**Water Depth:** 5602
Deployment Location: 0-2.08S/170-02.89W	**Recovery Location**: 0-3.8S/170-10.3W
Deployment Date: 6/24/2006	**Recovery Date:** 7/30/2007

Field Service Observations: The tower was slightly bent from ship collision. The 75 meter temperature/conductivity sensor slipped down the wire to 100 meters depth, the temperature/pressure sensor at 500 meters slipped down the wire to 700 meters depth, and the point current meter at 150 meters depth had three damaged transducer heads on it.

Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
75 Meter Temperature/Conductivity	04/22/2007	Data became invalid due to sensor slippage to 100 meters.
500 Meter Temperature/Pressure	03/16/2007	Data became invalid due to sensor slippage to 700 meters.

0170W ADCP

Buoy ID: KA011	**Buoy Configuration:** ADCP
Buoy Type: ADCP	**Water Depth:** 5441
Deployment Location: 0-0.09N/169-44.39W	**Recovery Location**: Not recorded
Deployment Date: 6/23/2006	**Recovery Date:** 7/29/2007
Field Service Observations: All data was successfully recovered during the recovery operations.	

2N170W

Buoy ID: PM603A	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** 5386 m
Deployment Location: 2-1.14N/170-0.76W	**Recovery Location**: 2-0.8N/170-0.8W
Deployment Date: 6/25/2006	**Recovery Date:** 7/31/2007
Field Service Observations: No damages or signs of vandalism. All data was recovered.	

Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Anemometer	12/1/2006	Sensor failed due to vane data failure.

5N170W

Buoy ID: PM636B	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** Not known, fathometer not working at deployment.
Deployment Location: 5-0.59N	**Repair Location**: 5-01.6N/169-59.0W
Deployment Date: 10/26/2006	**Repair Date:** 8/2/2007
Field Service Observations: New sea surface conductivity/temperature sensor was installed but the original sensor was not recovered. Payload data was downloaded and recovered.	

8N170W

Buoy ID: PM637A	**Buoy Configuration:** Standard
Buoy Type: ATLAS	**Water Depth:** Not known, fathometer not working at deployment.
Deployment Location: 7-59.65N/170-1.93W	**Visit Location**: 7-59.8N/170-1.8W
Deployment Date: 10/27/2006	**Visit Date:** 8/3/2007
Field Service Observations: During pass-by, the buoy appeared to be riding a bit low in the water. No signs of damage or vandalism. The sensor data from meteorological sensors and all ocean sensors compared well against the ship's sensor data.	

8N180W

Buoy ID: PM606B		**Buoy Configuration:** Standard
Buoy Type: ATLAS		**Water Depth:** 5955
Deployment Location: 8-0.09N/179-51.58W		**Recovery Location**: 7-59.8N/179-52.6W
Deployment Date: 6/30/2006		**Recovery Date:** 8/5/2007
Field Service Observations: Buoy was transmitting on failsafe ID. All data was recovered successfully.		
Sensor	**Date of Real-time Sensor Data Loss**	**Reason for Data Loss**
Buoy	12/3/2006	Transmission failure

2.2 *CTD Casts Completed*

A Sea-Bird 911plus CTD with dual temperature and conductivity sensors was provided by the program. Temperature and conductivity sensors are calibrated yearly at Sea-Bird and sent in for diagnostics as necessary. A Sea-Bird 24-position carousel and twenty four 5-liter Niskin bottles were used to collect water samples for the analysis of salinity.

The following outlines the CTD casts completed during the cruise:

Date	Lat/Lon	Approximate Depth (m)	Completion Time	Notes
7/17/2007	7° 57.2412’N 154° 58.0500W	1052	1:49:54	Whole Degree Cast
7/18/2007	5° 00.2668’N 154° 55.9079’W	1065	3:13:11	Whole Degree Cast
7/18/2007	4° 00.3703’N 154° 57.6755’W	1092	12:28:35	Whole Degree Cast
7/18/2007	3° 00.0240’N 154° 59.1452’W	1080	20:23:38	Whole Degree Cast
7/19/2007	2° 00.1352’N 154° 59.8054’W	1045	4:41:47	Whole Degree Cast
7/19/2007	1° 00.0768’N 154°58.4393’W	1045	12:26:55	Whole Degree Cast
7/20/2007	00° 01.2774’N 154° 58.5072’W	1062	06:36:10	Whole Degree Cast
7/20/2007	01° 00.4385’S 154° 58.9046’W	1000	14:25:16	Whole Degree Cast
7/20/2007	01° 58.3600’S 155° 02.3190’W	1101	22:31:09	Whole Degree Cast
7/21/2007	02° 59.8958’S 155° 00.9073’W	1046	5:59:21	Whole Degree Cast
7/21/2007	04° 00.2562’S 155° 00.7645’W	1063	13:22:17	Whole Degree Cast
7/22/2007	04° 58.6873’S 154° 59.4253’W	1045	2:33:57	Whole Degree Cast
7/22/2007	06° 01.0069’S 155° 01.4397’W	1055	11:08:00	Whole Degree Cast
7/23/2007	08° 16.1384’S 155° 01.8690’W	3222	3:46:09	Whole Degree Cast
7/26/2007	07°58.1629’S 170° 03.7104’W	1000	8:51:50	Whole Degree Cast
7/27/2007	04° 57.7628’S 170° 00.1911’W	3154	12:08:02	Whole Degree Cast
7/27/2007	04° 00.9734’S 170° 05.4809’W	1000	20:21:34	Whole Degree Cast

7/28/2007	03° 00.2247'S 170° 03.3607'W	1052	4:59:04	Whole Degree Cast
7/28/2007	02° 19.3443'S 170° 00.8305'W	1054	11:23:47	Whole Degree Cast
7/29/2007	00° 59.2594'S 170° 02.8206'W	1098	8:23:11	Whole Degree Cast
7/30/2007	00° 02.7412'S 170° 13.5358'W	3126	13:52:13	Whole Degree Cast
8/1/2007	02° 01.3205'N 170° 02.0941'W	1049	10:35:33	Whole Degree Cast
8/2/2007	05° 02.9246'N 169° 58.5378'W	1000	6:01:44	Whole Degree Cast
8/2/2007	06° 00.0105'N 170° 00.0029'W	1060	13:16:14	Whole Degree Cast
8/2/2007	06° 59.8725'N 170° 01.3290'W	1180	20:40:46	Whole Degree Cast
8/3/2007	08° 02.5261'N 170° 01.2484'W	1000	6:17:44	Whole Degree Cast
8/6/2007	08° 00.5728'N 179° 53.6181'W	1064	5:28:58	Whole Degree Cast

The following outlines the scheduled CTD casts not completed and why:

CTD Cast	**Reason for not Completing**
7n155w, 6n155w, 2.5n155w, 1.5n155w, 0.5n155w, 0.5s155w, 1.5s155w, 2.5s155w, 7s155w, 7s170w, 6s170w, 2.5s170w, 1.5s170w, 0.5s170w, 0.5n170w, 1n170w, 1.5n170w, 2.5n170w, 3n170w, and 4n170w	Casts were cut to preserve enough time to complete buoy services.

2.3 *Ancillary Science Projects Completed on the Cruise*

The following outlines the ancillary science work performed in conjunction with the TAO operations on the cruise:

TAO-CO_2 -MBARI Mooring

NDBC technicians assisted the MBARI (Monterey Bay Research Institute) install TAO/CO_2 moorings at 0155W, 0170W, and 2N170W. The original plan was to install one of these moorings at 2S155W, but equipment shortfalls prevented this and the mooring was installed at 2N155W. MBARI subsurface was recovered from 0155W and 2S170W and re-deployed at 0155W.

The MBARI technician took nutrient samples from each CTD cast at 0, 10, 25, 40, 60, 100, 150, and 200 meters.

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Pacific Marine Environmental Laboratory (PMEL) Argo Profiling CTD Floats

8 Argo floats were scheduled for deployment on this cruise. The chief scientist verified and briefed the Operations Officer on the deployment positions prior to the start of the cruise. All Argo Float deployments were completed as scheduled.

Questions concerning ARGO Floats should be directed to:

Gregory Johnson, NOAA/PMEL
Tel: (206) 526-6806
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or

Elizabeth Steffen, NOAA/PMEL
Tel: (206) 526-6747
E-mail: pmel_floats@noaa.gov

The following outlines the Argo floats deployed during the cruise:

Serial Number	Location	Date	Time GMT
3086	00° 00.1873'S 154° 56.6675'W	7/20/2007	07:31
3807	08° 14.3092'S 155° 01.8944'W	7/23/2007	04:06
3350	08° 04.5727'S 165° 01.3620'W	7/25/2007	06:03
3351	00° 02.4769'S 170° 03.0341'W	7/31/2007	07:06
3363	02° 59.0815'N 170° 00.3078'W	8/1/2007	16:32
3356	05° 03.3674'N 169° 56.8867'W	8/2/2007	06:14
3367	06° 59.5902'N 170° 00.4130'W	8/2/2007	21:03
3148	08° 00.0098'N 172° 59.9459'E	8/7/2007	18:38

Atlantic Oceanographic and Meteorological Laboratory (AOML) Surface Drifters

10 AOML Surface Drifters were scheduled for deployment on this cruise. The chief scientist verified and briefed the Operations Officer on the deployment positions prior to the start of the cruise. All AOML Surface Drifter deployments were completed as scheduled.

Questions concerning AOML Surface Drifters should be directed to:

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Global Drifter Center,
Tel: (305) 361‑4546
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The following outlines the AOML Surface Drifters deployed during the cruise track:

Serial Number	Location	Date	Time GMT
71974	04° 58.6862'N 154° 55.3594'W	7/18/07	05:02
59843	02° 55.8547'N 154° 59.4023'W	7/18/07	21:04
59900	00° 01.0970'S 154° 56.6391'W	7/20/07	07:40
59831	03° 00.0649'S 155° 00.6467'W	7/21/07	06:09
59908	05° 00.6606'S 154°57.8339'W	7/22/07	03:13
59907	04° 56.6502'S 170° 00.1026'W	7/27/07	12:25
59896	02° 59.6765'S 170° 03.0932'W	7/28/07	05:08
59893	00° 01.2020'S 170° 03.6994'W	7/31/07	07:29
59835	02° 59.1662'N 170° 00.2105'W	8/1/07	16:34
59899	05° 03.7798'N 169° 57.2287'W	8/2/07	06:22
59982	06° 00.7408'N 169° 58.7907'W	8/2/07	13:30

PCO2 and Nitrate Mapping System and Nutrient Samples

Twenty-seven 30ml water samples were collected on this cruise. The chief scientist verified and briefed the Operations Officer on the specifications of the water samples to be collected during CTD casts prior to the start of the cruise. All water samples were collected as scheduled.

Questions concerning Nutrient Samples should be directed to:

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The following outlines the nutrient samples taken during the cruise:

Sample Number	GMT Date	GMT Time	Cast Number	Lat	Long
U500	7/17/2007	1:49:54	KA30011	07 57.8913N	154 58.4292W
U501	7/18/2007	3:13:11	KA30021	05 00.6452N	154 55.9286W
U502	7/18/2007	12:28:35	KA30031	04 00.5246N	154 58.0731W
U503	7/18/2007	20:23:38	KA30041	03 00.7136N	154 59.4333W
U504	7/19/2007	4:41:47	KA30051	02 00.3134N	154 59.8876W
U505	7/19/2007	12:26:55	KA30061	01 00.2149N	154 58.4422W
U506	7/20/2007	6:36:10	KA30071	00 02.0605S	154 58.4564W
U507	7/20/2007	14:25:16	KA30081	01 00.5092S	154 59.2809W
U508	7/20/2007	22:31:09	KA30091	01 58.9765S	155 02.6490W
U509	7/21/2007	5:59:21	KA30101	02 59.6208S	155 00.7626W
U510	7/21/2007	13:22:17	KA30111	04 00.1738S	155 01.1472W
U511	7/22/2007	2:33:57	KA30121	04 58.4768S	154 59.4283W
U512	7/22/2007	10:34:58	KA30131	00 60.6940S	155 1.781W
U513	7/23/2007	3:46:09	KA30141	08 14.5122S	155 02.0181W
U500	7/17/2007	1:49:54	KA30011	07 57.8913N	154 58.4292W
U501	7/18/2007	3:13:11	KA30021	05 00.6452N	154 55.9286W
U502	7/18/2007	12:28:35	KA30031	04 00.5246N	154 58.0731W
U503	7/18/2007	20:23:38	KA30041	03 00.7136N	154 59.4333W
U504	7/19/2007	4:41:47	KA30051	02 00.3134N	154 59.8876W
U505	7/19/2007	12:26:55	KA30061	01 00.2149N	154 58.4422W
U506	7/20/2007	6:36:10	KA30071	00 02.0605S	154 58.4564W
U507	7/20/2007	14:25:16	KA30081	01 00.5092S	154 59.2809W
U508	7/20/2007	22:31:09	KA30091	01 58.9765S	155 02.6490W
U509	7/21/2007	5:59:21	KA30101	02 59.6208S	155 00.7626W
U510	7/21/2007	13:22:17	KA30111	04 00.1738S	155 01.1472W

U511	7/22/2007	2:33:57	KA30121	04 58.4768S	15459.4283W
U512	7/22/2007	10:34:58	KA30131	00 60.6940S	155 1.781W
U514	7/26/2007	8:51:50	KA30151	0757.5939S	170 04.0864W
U515	7/27/2007	12:08:02	KA30161	04 56.9245S	170 00.4144W
U516	7/27/2007	20:21:34	KA30171	04 01.7744S	170 06.1121W
U517	7/28/2007	4:59:04	KA30181	02 59.9202S	170 03.0974W
U518	7/28/2007	11:23:47	KA30191	02 18.9797S	170 00.6605W
U519	7/29/2007	8:23:11	KA30201	00 58.8160S	170 02.8794W
U520	7/30/2007	13:52:13	KA30211	00 02.1557S	170 13.3583W
U521	8/1/2007	10:35:33	KA30221	02 01.5434N	170 01.9968W
U522	8/2/2007	6:01:44	KA30321	05 03.5616N	169 57.2222W
U523	8/2/2007	13:16:14	KA30241	06 00.2751N	169 59.0700W
U524	8/2/2007	20:40:46	KA30251	06 59.9485N	170 00.6045W
U525	8/3/2007	6:17:44	KA30261	08 03.1554N	169 59.0260W

Low Nutrient Sea Water Samples

Sixteen – 20 liter jugs were filled with clean, low nutrient seawater. This water was collected from the KA's flow through system between 20N and 5N along the ships track. The samples were shipped back to PMEL at the end of KA-07-04.

The following indicates the samples taken during the cruise:

LAT	**LONG**	**Flask#1**	**Flask#2**	**NOTES**
8N	155W	410	808	
4N	155W	731	833	
1S	155W	52	741	
4S	155W	5	316	
8S	155W			
6S	170W	213	852	
4S	170W	444	457	
1.5N	170W	259	864	
5N	170W	645	815	
8N	170W	MISSED	MISSED	Bottle stuck

Point of Contact for this Project is:

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