Hawaii National Marine Renewable Energy Center (HINMREC)

U.S. Department of Energy Award Number: DE-FG36-08GO18180

Task 4: Environmental Impact Monitoring at WETS

WETS Shore Side Report: ADCP Installation

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January 2015

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Work sponsored by the U.S. Department of Energy's Wind and Water Program under Award DE-FG36-08GO18180

Job No. 25268

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1. INTRODUCTION

The area north of Mokapu Peninsula, adjacent to Kaneohe Marine Corps Base Hawaii (MCBH), has been utilized by the U.S. Navy and Ocean Power Technologies, Inc. (OPT) for wave energy research since 2002. After a 2 year deployment, a prototype OPT PowerBuoy was retrieved from the 30 meter water depth offshore of North Beach at the MCBH in September of 2012. The Hawaii National Marine Renewable Energy Center (HNMREC) at the University of Hawaii, under contract with Department of Energy, desires to expand the present test site to water depths of 100 meters to allow for the testing of other wave energy devices.

Sea Engineering Inc. (SEI) has been contracted by the HNMREC to perform site engineering services including acquisition and deployment of an acoustic Doppler current profiler and wave gauge at the deep water test site.

The project location is shown in an aerial image in Figure 1-1. The test site is 1,600 to 2,000 meters wide and extends approximately 2,600 meters offshore from the 30 meter depth contour to the approximate 100 meter depth contour.

Figure 1-1. Aerial image of project site (Google Earth).

2. EQUIPMENT

2.1 Equipment Overview

In order to verify the results of the Waverider buoy at the Wave Energy Test Site off Kaneohe Marine Corps Base, a bottom mounted ADCP equipped with specialized software was deployed next to the Waverider. Due to the depths at this location, diver deployment/recovery is not an option. This requires use of a remote deployment/recovery system.

SEI evaluated different deployment/recovery options and concluded that the best option would be an acoustic release. This method allows the ADCP to be lowered to the bottom in its mount using a winch for deployment. The ADCP will be recovered by transmitting an acoustic signal that will trigger the release of a buoy from the ADCP mount that will float to the surface. Once at the surface, boat personnel will grab the buoy and recover the ADCP and mount by lifting the recovery line attached to the buoy.

2.2 Equipment List

The equipment used for this project is the following: an ADCP and associated software, ADCP mount, acoustic release(s), acoustic release surface control system, and a rope canister kit (buoy, recovery line etc).

Teledyne-RDI 300kHz ADCP with wave and Software
MSI Gimbaled Bottom Tripod ADCP Mount
Sonardyne Lightweight Release Transponder(s) (Acoustic Release)
SEI recommends two acoustic releases for redundancy in case of failure. If only one release is used and it fails, ROV recovery costs will be incurred.
Acoustic Release Surface Control System: SEI has a surface control system from previous deployments that will be used.
Batteries for Acoustic Release Surface Control System
Rope Canister Kit

3. DEPLOYMENT

SEI deployed a Teledyne RDI Sentinel V100 Acoustic Doppler Current Profiler (ADCP) near the site of the previously deployed Waverider buoy at 11:07 AM, November 24, 2014. The ADCP was mounted in a gimbaled bottom mount tripod manufactured by Mooring Systems International. The tripod and ADCP were picked up by three lifting lines with bungees attached to pull away from interfering with the ADCP's measurements once on the seafloor. One Sonardyne acoustic release was attached to tripod to aide its recovery. Once released by its address 2-2-2-1 the acoustic release will surface with a tag line. The tripod will be recovered by a 3/8 in line stored in a bucket mounted on the tripod that is attached to the tag line in the acoustic release.

The Sentinel V100 ADCP was programmed by the onboard Ready V software. The battery capacity was changed to1620 watt-hours to account for the additional external battery pack that allowed for a 90 day deployment duration. Two profiles were setup to measure waves and currents. The profiles were offset 1800 seconds (30 minutes) and are hourly. The waves profile was a custom profile with a duration of 19:10 minutes and following characteristics:

Ping Interval = 0.5 s
Number of Pings =2300
Range 84 m

The currents profile was also a custom profile with duration of 5 minutes and the following characteristics:

Ping interval = 1 s
Number of pings =300
Range 84 m

Below in Figure 3-1presents a photograph of the deployment setup. The Sonardyne acoustic release, rope canister, and floatation are attached to the frame on the left leg of the tripod as seen the photo. The bucket containing the 3/8 in line is seen offset to right relative to the ADCP. The external battery pack is shown in Figure 3-2. On the left side of Figure 3-2 there is a loop to be used for and ROV recovery in case of the acoustic release fails. The three additional 30 pound red lead weights are also visible in both Figures. The ADCP and external battery are wrapped in tape to ease the cleanup of biofouling.

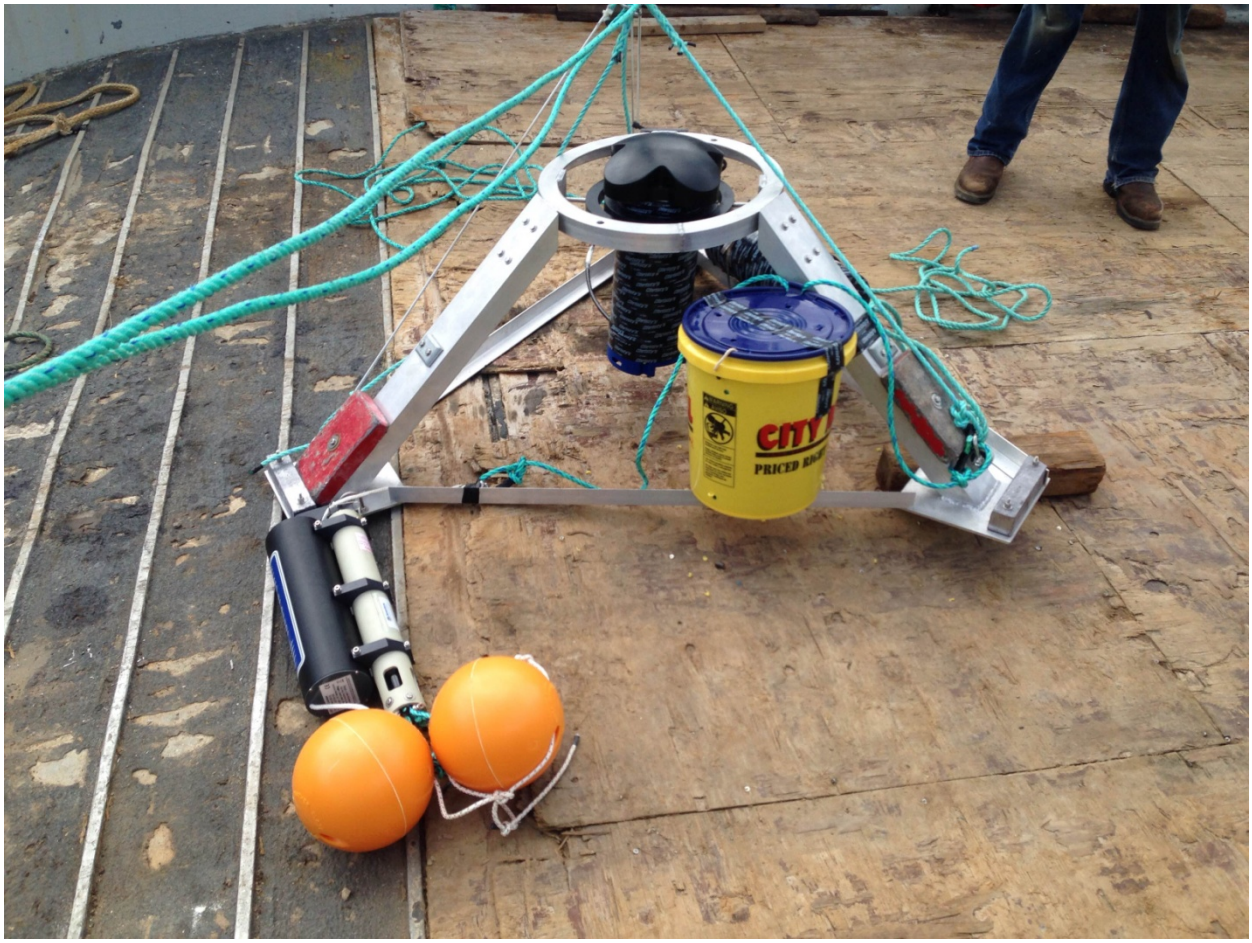

Figure 3-1. ADCP deployment setup

Figure 3-2. ADCP external battery

APPENDIX A

Sentinel V

Self-Contained 20m, 50m, 100m Profiling ADCP

TECHNICAL SPECIFICATIONS

Depth Cell Size[1]		**V20 (1000kHz)**		**V50 (500kHz)**		**V100 (300kHz)**	
	Depth Cell Size[1]	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow
	0.3m	19.3/24.0	6.6/12.5				
	0.5m	20.6/25.3	4.3/8.0	45.0/58.6	11.5/21.8		
	1.0m	22.4/27.3	2.1/4.0	51.5/65.6	4.3/8.0	96.3/122.6	6.5/12.3
	2.0m	24.8/29.8	1.0/1.9	57.0/71.6	2.1/4.0	105.3/132.4	3.3/6.2
	4.0m			64.2/79.3	1.0/1.9	116.5/144.3	1.6/3.1
	6.0m					121.7/151.5	1.1/2.0
Communications and Recording	Wireless	802.11b/g/n					
	Internal memory	One 16GB Micro SD Card included					
Profile Parameters	Velocity accuracy	V20/V50: 0.3% of the water velocity relative to the ADCP ±0.3cm/s V100: 0.5% of the water velocity relative to the ADCP ±0.5cm/s					
	Velocity resolution	0.1cm/s					
	Velocity range	±5m/s (default); ±20m/s (maximum)					
	Ping rate	Up to 4Hz					
Echo Intensity Profile	Vertical resolution	Depth cell size					
	Dynamic range	80dB					
	Precision	±1.5dB					
Transducer and Hardware	Beam angle	25°					
	Configuration	4-beam, convex; 5th beam vertical					
	Depth rating	200m					
	Materials	Transducer, housing, and end cap: plastic Connector: metal shell					
Standard Sensors	Temperature (mounted on transducer)	Range -5° to 45°C, precision ±0.4°C, resolution 0.1°					
	Compass (magneto-inductive sensor)	Accuracy 2° RMS, resolution 0.1°, max. dip angle 85°					
	Tilt (MEMS accelerometers)	Pitch range ±90°, roll range ±180°, accuracy 2° RMS, precision 0.05° RMS, resolution 0.1°					
	Pressure sensor (mounted on transducer)	Range 300m, accuracy 0.1%FS					
Power	External DC input	12–20VDC					
	Internal battery voltage	18VDC new					
	Battery capacity; over-the-counter @0°C	100 watt hours (typical)					
	Battery pack @5°C	510 watt hours					
Software	Teledyne RDI's new software included	ReadyV—Pre-deployment (resident in ADCP) ReadyVLite—Pre-deployment (mobile app) Velocity—Post-processing (data handling, display, and export)					
Environmental	Standard depth rating	200m					
	Operating temperature	-5° to 45°C					
	Storage temperature (without batteries)	-30° to 60°C					
	Weight in air	7.5kg – 16.0kg					
	Weight in water	1.6kg – 6.0kg					
Available Options	External battery case • AC/DC power converter • 5th beam (at time of order only) • Waves processing • Straight or right-angle metal shell connector						
Dimensions	Special configuration drawing available upon request						

1 User's choice of depth cell not limited to the typical values specified.
2 Ranges specified are typical at temperature of 5°C and salinity of 35psu; longer ranges are possible.
3 User selects the bandwidth mode; wide = 25% or narrow = 6%.
4 Standard deviations (Std Dev) are typical values for single ping data.

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