

Northwest National Marine Renewable Energy Center

University of Washington, Seattle, WA 98195

Research Cruise Report

Admiralty Inlet, Washington

May 3-6, 2010

R/V Jack Robertson, University of Washington Applied Physics Lab



Survey Crew

Capt. Andrew Reay-Ellers, University of Washington, Applied Physics Lab

Jim Thomson, University of Washington, Applied Physics Lab (PI)

Brian Polagye, University of Washington, Mechanical Engineering (co-PI)

Joe Talbert, University of Washington, Applied Physics Lab

Chris Bassett, University of Washington, Mechanical Engineering

Jeff Epler, University of Washington, Mechanical Engineering

Eric Nelson, National Renewable Energy Laboratory

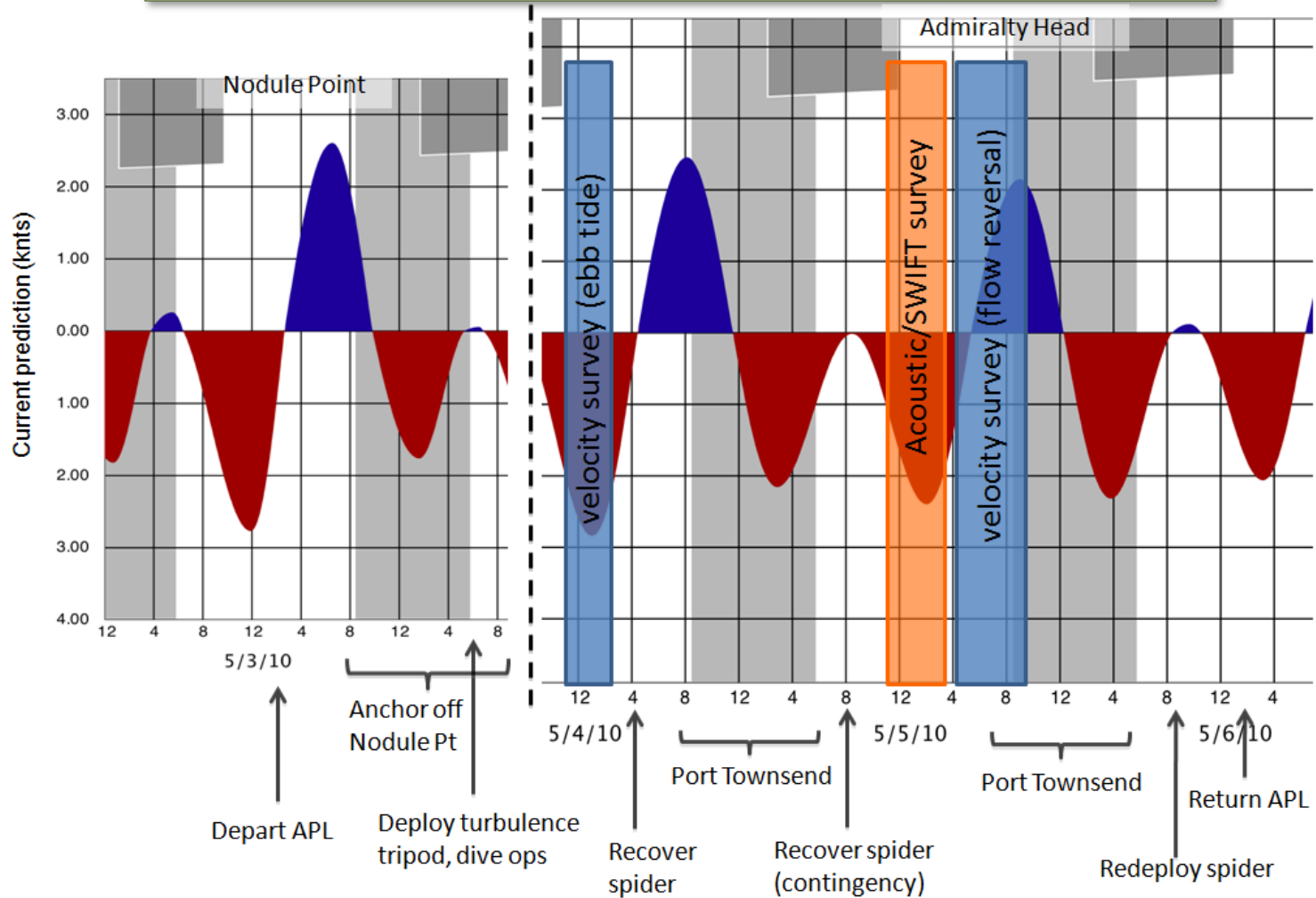
Cruise Summary

From May 4-6, 2010 the R/V Jack Robertson was on station in northern Admiralty Inlet conducting studies in support of Snohomish Public Utility District's license application for the deployment of two OpenHydro hydrokinetic turbines. The primary purpose for this survey was to recover and redeploy the sea spider instrumentation package. In addition, NNMREC conducted a racetrack velocity survey to further test a developing methodology to resolve variations in tidal amplitude and phase at potential tidal energy sites. No substantial changes were made to the sea spider during this cruise. On the morning of May 4th, NNMREC deployed a larger tripod off Marrowstone Island as part of a new study with Pacific Northwest National Lab to characterize turbulence at tidal energy sites.

Cruise Plan

Admiralty Inlet Survey & Turnaround

R/V Robertson, Northwest National Marine Renewable Energy Center (UW)



1 Daily Operations Summary

1.1 May 3, 2010

R/V Jack Robertson departed APL dock (1200) and transited to Nodule Point off Marrowstone Island in very rough seas (small craft advisory in effect). Anchored off Nodule Point at 1700.

1.2 May 4, 2010

R/V Jack Robertson underway at 0545 to deploy the Tidal Turbulence Tripod (TTT) in approximately 22m of water off Nodule Point. This tripod is instrumented with an ADV (acoustic Doppler velocimeter) and ADCP to characterize turbulence. Deployment completed at 0730.

Arrived on station in northern Admiralty Inlet at 0905. Recovery float surfaced on first ping and sea spider back on deck at 0920.

From 0930 to 1410, conducted 13 racetrack surveys on a strong ebb tide.

R/V Jack Robertson arrived at dock in Port Townsend at 1440, concluding operations for the day.

1.3 May 5, 2010

R/V Jack Robertson remained in port for the day on the 5th to complete instrumentation turn-around. Wave action off Admiralty Head was too intense to collect meaningful data from the planned acoustic survey and the extended duration of the flood tide was inefficient to conduct further racetrack velocity surveys.

Chris Bassett and Eric Nelson made a trip over to Admiralty Head to reset the Automatic Information System (AIS) receiver collecting ship track data, which had lost power during a storm at the end of April.

1.4 May 6, 2010

R/V Jack Robertson underway at 0630. Heather Dillon (UW Mechanical Engineering) and Ross Anderson (reporter) aboard to observe the redeployment.

Sea spider redeployed around 0715. Landing approximately 14m from target (48 9.185N, 122 41.271W) in calm seas and a weakly flooding current.

After dropping guests back off in Port Townsend at 0810, R/V Jack Robertson returned to APL dock at 1400, via Port Townsend canal after a delay at the Ballard Locks.

2 Shipboard Surveys

2.1 Water velocity

Thirteen racetrack velocity surveys were conducted over a strong ebb. These surveys were repeated over a relatively short (600m x 400m) survey track to better understand phase and amplitude variations in the tidal currents within the survey area. The survey track was offset from the original racetrack survey pattern established in August, 2009 to further characterize current intensity. Good ADCP correlations were obtained on all four legs of the track.

3 Sea Spider

3.1 Instrument status

During this deployment, tripod instrumentation consisted of:

- ADCP (300 kHz RDI workhorse, 0:45 ensembles): velocity
- CTD (Star Oddi DST): salinity, temperature, pressure
- CTDO (SeaBird 16+): salinity, temperature, pressure, dissolved oxygen (on loan from WA Dept. of Ecology)
- Fish tag receiver (Vemco VR2W): fish tag detections (on loan from NOAA: National Marine Fisheries Service)
- Echolocation hydrophone (Chelonia TPod): analog echolocation hydrophone
- Echolocation hydrophone (Chelonia CPod): digital echolocation hydrophone
- Hydrophone (Loggerhead, 7 seconds continuous recording every 10 minutes): ambient noise
- Sediment trap

Upon recovery, all instruments were functional and data were offloaded successfully. The sediment trap was no longer attached to the sea spider, possibly lost during the rough deployment conditions in February 2010. The recording hydrophone shut down prematurely on April 28th, due to a full memory card.

3.2 Instrument replacement/reconfiguration

Limited changes were made to instrument configuration and no new instruments were added to the package:

- Fish tag receiver exchanged for a VR2 from NMFS
- CTDO exchanged for identical unit from WA Dept. of Ecology
- ADCP pings/ensemble reduced to 25 from 26 due to battery limitations
- Eight composite panels installed to study the long-term effects of salt water absorption on shear and tensile strength.

3.3 Platform condition

The tripod platform had minor biological fouling during this deployment. Four chitin, approximately 2” in length were attached to the fiberglass frame and there was intermittent marine growth on several different surfaces (CTDO cables, titanium bolt on ADCP pressure case, hydrophone head, lead ballast). Stainless steel mounting hardware generally showed little corrosion. Aluminum mounting rails continued to corrode, with the mount for the CTDO corroding at a much faster rate than the mounts for the retrieval line canisters. Consequently, the CTDO mount was replaced with a fiberglass rail.

4 Tidal Turbulence Tripod

This was the initial deployment of the Tidal Turbulence Tripod (TTT) which is designed to study turbulence at tidal energy sites. This deployment is funded under a subcontract from Pacific Northwest National Lab. The tripod is a 4m tall aluminum frame ballasted by 2000 lbs of steel. A Nortek Vector Acoustic Doppler Velocimeter (ADV) is attached to the apex of the tripod, sampling currents from a small volume of water at a rate of 32 Hz. A 600 kHz RDI Workhorse Sentinel ADCP is attached near the bottom of the tripod, sampling currents throughout the water column at 2 Hz. The data collected by the

ADV will be used to characterize turbulence spectra. Attempts will then be made to relate these to the lower resolution information collected by the ADCP.

The TTT is deployed in 22m of water off Marrowstone Island. Peak currents during the deployment are expected to slightly exceed 2 m/s. For this deployment, Dr. Thomson and Joe Talbert dove on the tripod to install the ADV. Both the ADV and ADCP will be recovered in a similar dive operation planned for late May 2010. The tripod frame will be recovered by the R/V Jack Roberston during the next major survey cruise in August 2010.

5 Lessons Learned

5.1 Acoustic release orientation

During the February 2010 redeployment, the configuration of one acoustic release was altered to minimize the risk of binding between the release arm and recovery line shackle. The acoustic release orientation was changed from horizontal (along the top edge of sea spider frame) to vertical (along one of the sea spider legs). This new configuration appears preferable, as the recovery float released to the surface on the first try and the sea spider was back on deck within 15 minutes of initiating the recovery operation. Increasing the recovery float buoyancy to 70 lbs also reduced the float rise time and improved buoy visibility on the surface. This configuration will be used for the two new sea spiders being built up for an August deployment.