



Williwaw Engineering

December 26, 2015

Luis A. Vega, Ph.D.
Manager
National Marine Renewable Energy Center
University of Hawaii
1680 East West Road, POST 112A
Honolulu, HI 96822

Subject: December 2015 Monthly Report – RCUH P.O. #Z10066105

Dear Luis,

The following constitutes my monthly report for the subject agreement for services associated with December 2015.

Work Completed under Task 3: Support HNEI in Device Performance Data Collection Throughout Development:

- Monitored the device regularly via remote connection to the NWEI host PC in Room 106, Battery French. Downloaded data from PC as necessary, and updated device control settings when necessary.
- Completed uploads of raw Azura data to the Department of Energy MHK repository for months of June – Nov 2015.
- Analyzed output power data to produce monthly power performance data plot; see Attachment 1 for results.
- Analyzed Azura float angle data using MATLAB to produce plots of 30 minute average float angle data for the deployment period. The Azura has not settled in the water noticeably since the Nov 23 re-ballast. See Attachment 2 for results.
- Plotted daily humidity sensor data for the cRIO enclosure and drybox on board the Azura. The results continue to show that the drybox, which is entirely sealed from the Azura hull, has maintained very low humidity throughout the deployment period while humidity has slowly increased inside the cRIO enclosure since the June deployment. See Attachment 3 for a plot of these results.

Please let me know if you have any questions or comments concerning this project.

Sincerely,

Terry Lettenmaier

PO Box 550, South Beach, Oregon 97366

Phone: 541-961-5833
email: lett@peak.org

Attachment 1: Azura power performance data plots

Attachment 2: Azura 30 minute average float angle data plots

Attachment 3: Azura cRIO enclosure and drybox humidity

Attachment 1

Azura power performance data plots

Summary

- The Azura was not operational during the period Dec 1-8 due to a hydraulic oil leak.
- On Dec 21 the Kaneohe Bay Waverider buoy broke loose of its moorings and stopped providing valid wave data.
- During the period Dec 8-21 the Azura had higher output power during periods of high seas than during previous months, for two possible reasons:
 - The AB subsurface float that is normally part of the Azura mooring system was not in place; it broke loose in mid November.
 - The Azura was run with proportional-integral (PI) control of motor pressure during most of the Dec 8-21 period rather than the constant hydraulic motor displacement control used previously.
- See the following slides for power performance data plots from data recorded while the Azura was run with PID control during the period Dec 8-21. Note that power was significantly higher than previously for $H_m0 > 2m$.

Azura Power Performance – December 8-21, 2015

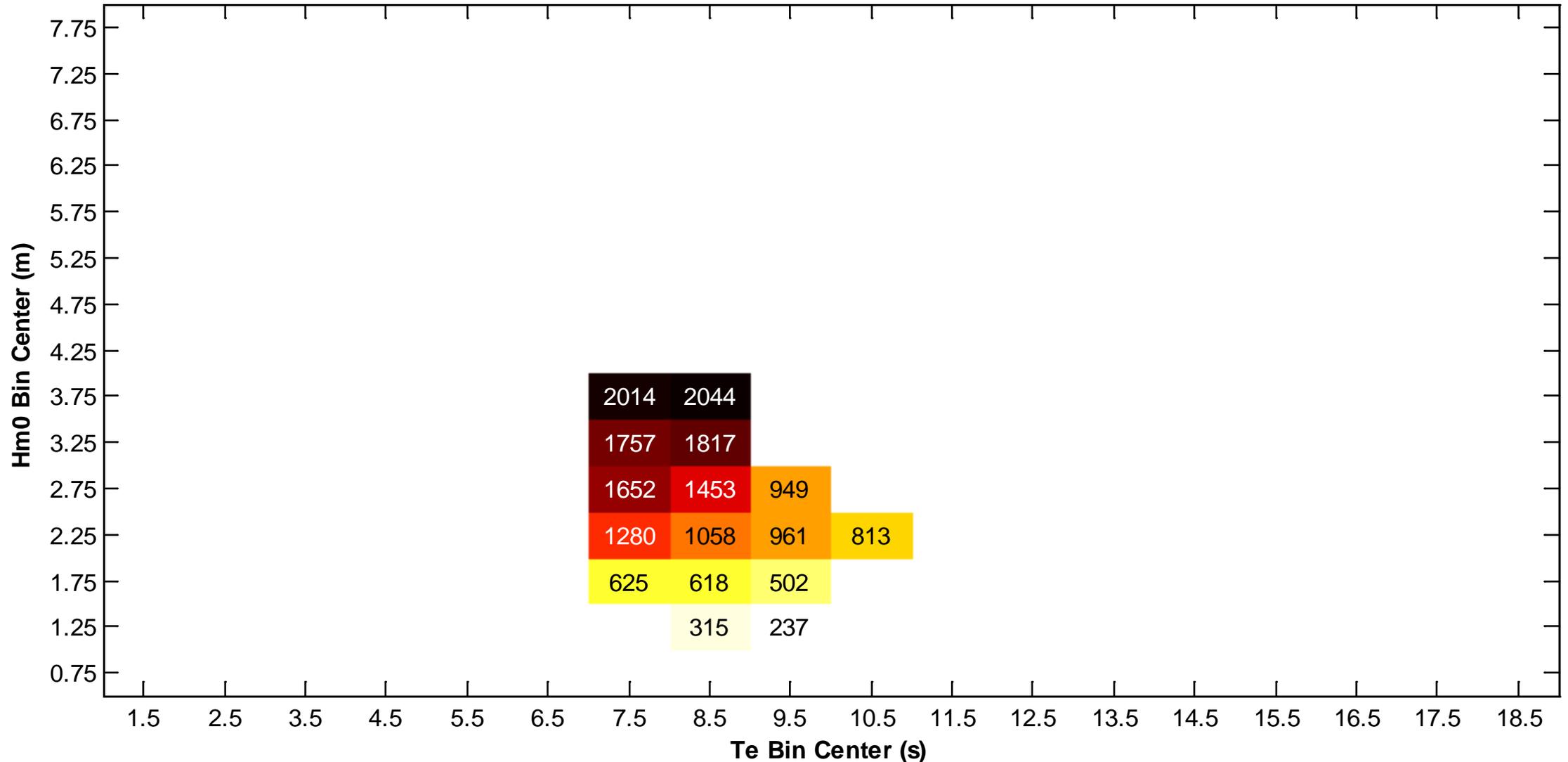


Williwaw Engineering

95th percentile power matrix

95th Percentile Device Dc Output Power (W)

Dec 8-21, 2015 - operation with PI control only. 30 minute periods with > 20 minutes operation included



Azura Power Performance – December 8-21, 2015

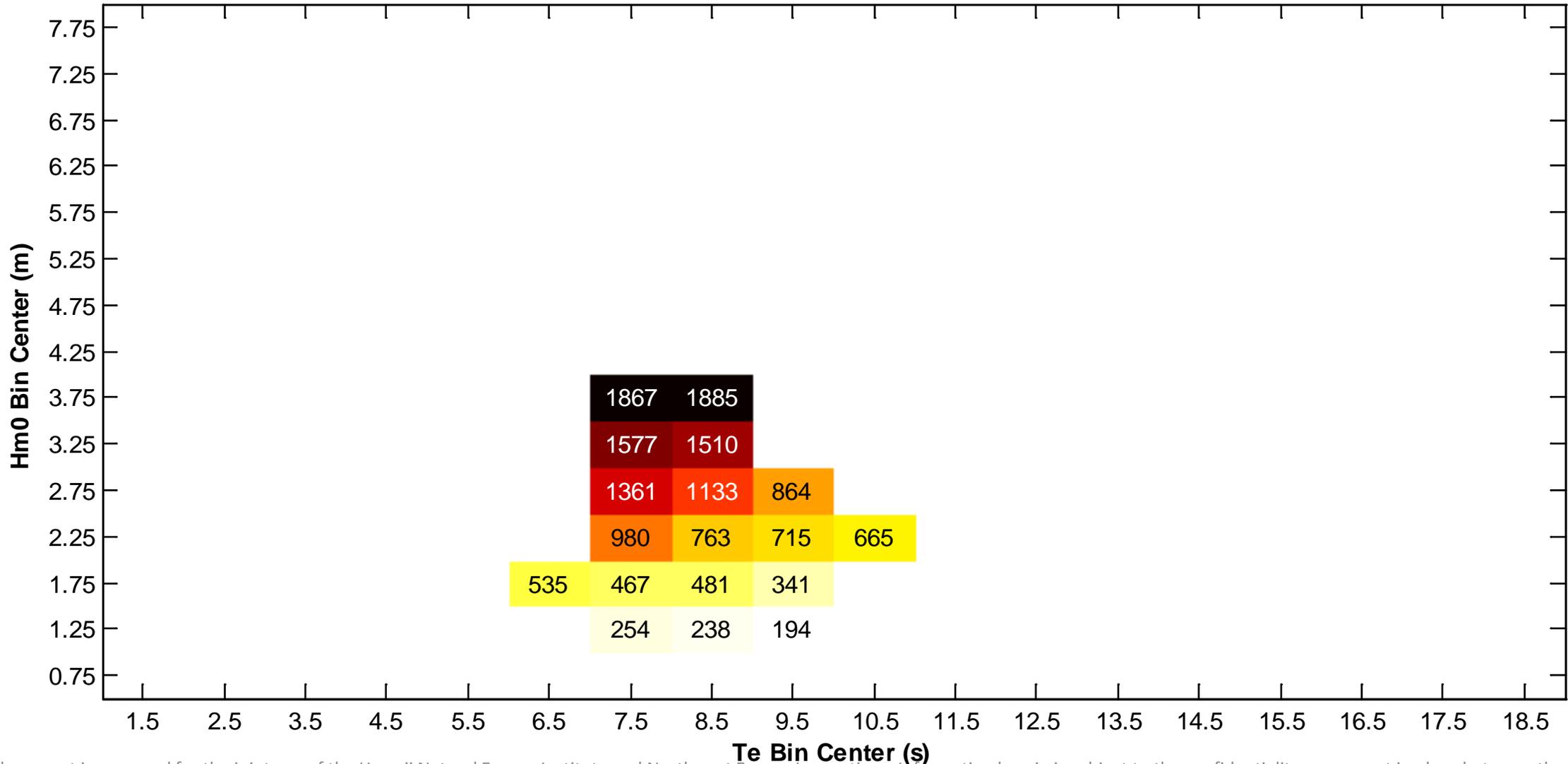


Williwaw Engineering

Mean power matrix

Mean Device Dc Output Power (W)

Dec 8-21, 2015 - operation with PI control only. 30 minute periods with > 20 minutes operation included



Azura Power Performance – December 8-21, 2015

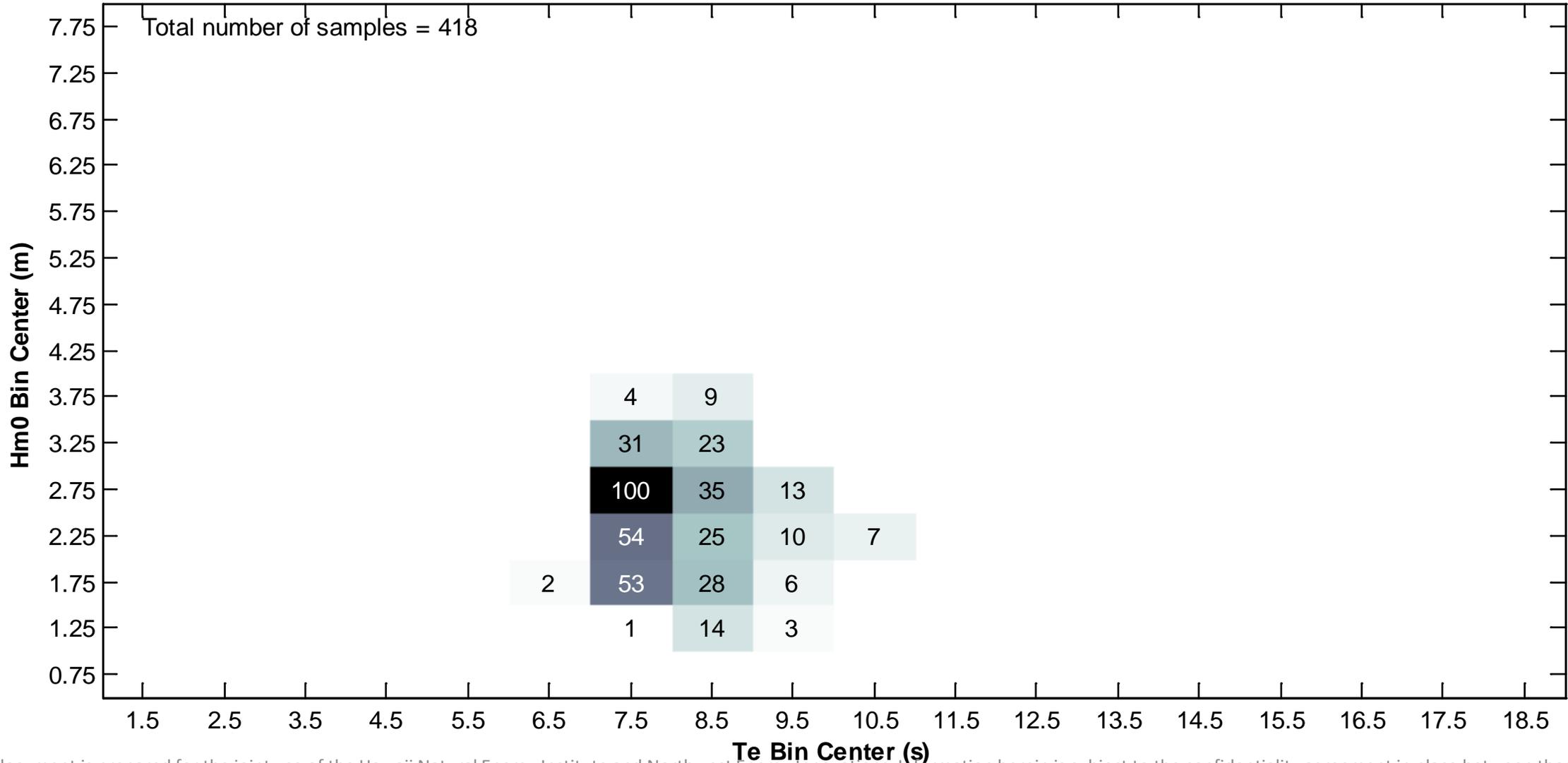


Williwaw Engineering

Sample Count

Sample Count (30 min sample periods)

Dec 8-21, 2015 - operation with PI control only. 30 minute periods with > 20 minutes operation included



Attachment 2

Azura 30 minute average float angle data plots

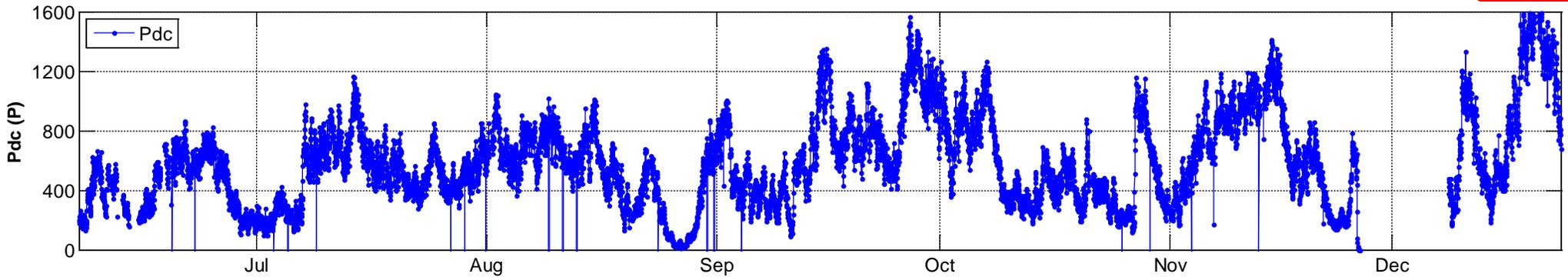
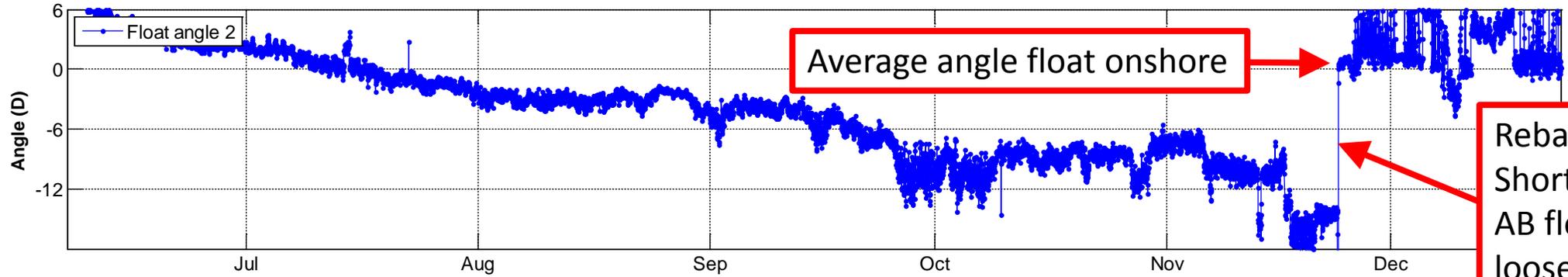
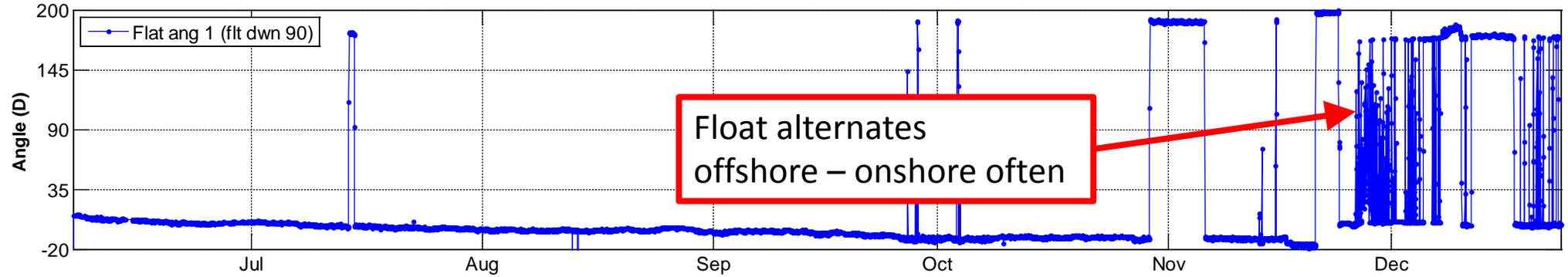
Summary

- See Slide 2 for plot of June-Dec 2015 data
- Average float angle has been steady near zero angle during time when the float was on onshore side of hull since November 23, when Sea Engineering added air to the Azura hull to re-ballast.
- Since the AB float broke loose on Nov 16 and the Nov 23 re-ballast, the float has frequently alternated between the onshore and offshore sides. The device was at no load for an extended time Nov 26-Dec 8, also, seas were often high after Dec 8.

Azura 30 min average float angle data through Dec 2015



Float angle plots from file NWEI 30m avg power w float angle 201506 to 201512.txt



Attachment 3

Azura cRIO enclosure and drybox humidity plots

Azura cRIO enclosure and drybox humidity Dec 2015

