

Orange Kayak Update

July 26 2011

- Results from second pool test
 - Plans for the future



Second Pool Test

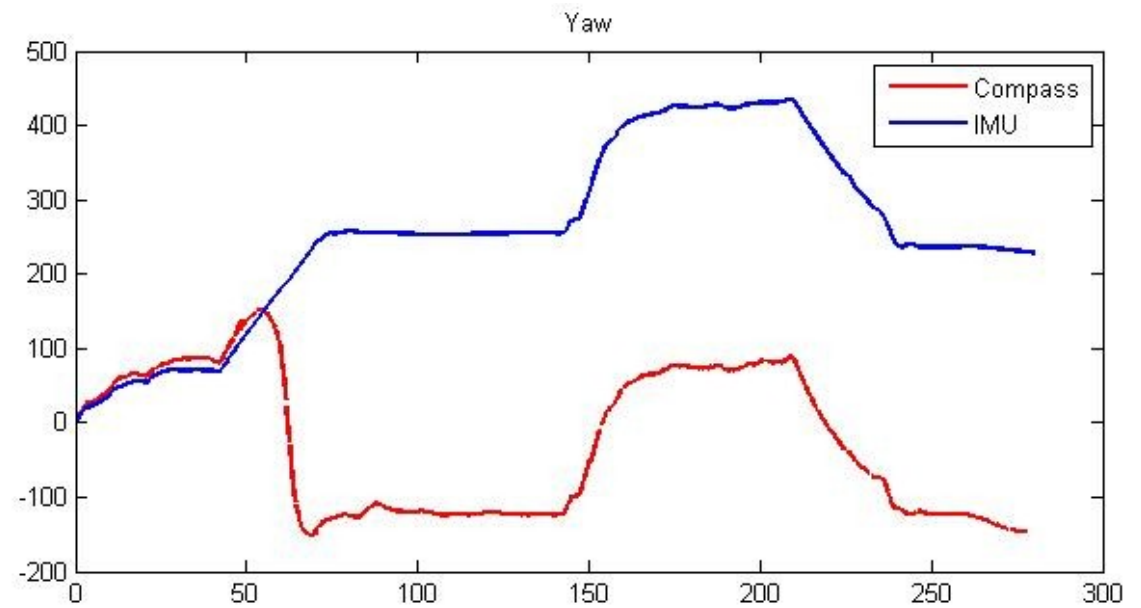
- System Improvements
 - Extended wifi range by incorporating wifi router
 - Successful, but router needed to be located on the kayak—might be a problem with the kayak computer's wifi antenna
 - Used new netbook for communication successfully
 - Used thruster with radio controller successfully
 - Thruster is sometimes intermittent—discussed later
 - Logged data from the DVL
 - Still questions about the DVL output—discussed later
 - Chee Wee mounted his small sensor array to the bow
 - Logged pressure at 1kHz with 19 COTS and 4 CW
 - Synchronized time stamps for pressure and non-pressure sensors
 - Streamlined data organization—script to make a good .mat

Second Pool Test

- Second look at non-pressure sensors
 - Compass, imu, dvl
- Yaw, roll, and hydrostratic tests by hand
 - Primarily to compare Chee Wee's small sensor array to the Honeywell sensors
- Maneuvers with thruster
 - Straight
 - Circle—large and small radius

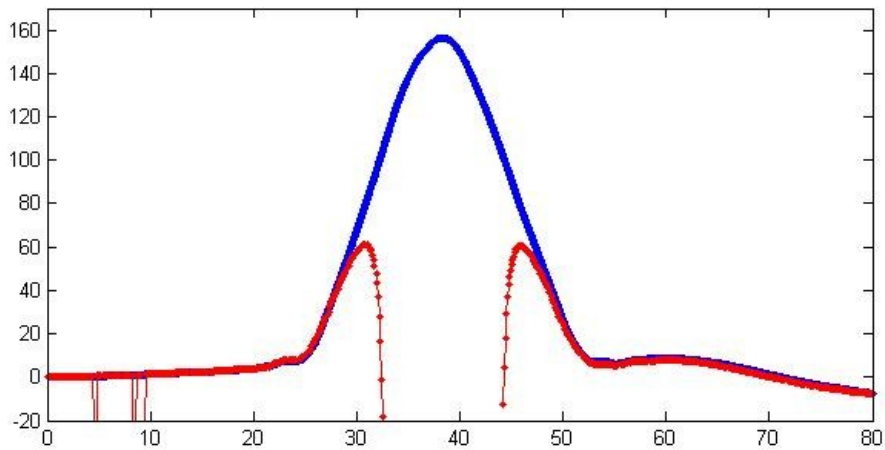
Compass and IMU

- Compass and IMU roll and pitch match well
- In general, the compass gave better results than during the first pool test
- There were fewer “jumps” in Yaw



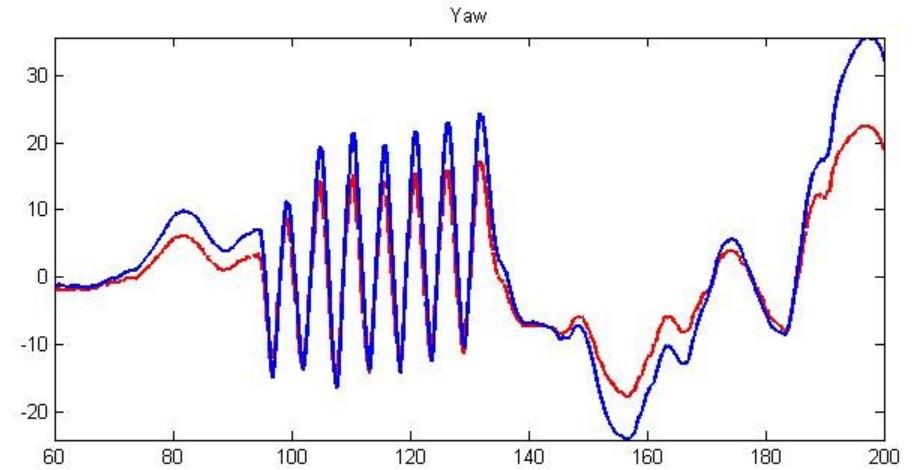
The compass readings are incorrectly scaled, but the correcting factor appears to be different in the two pool tests

Pool Test 1

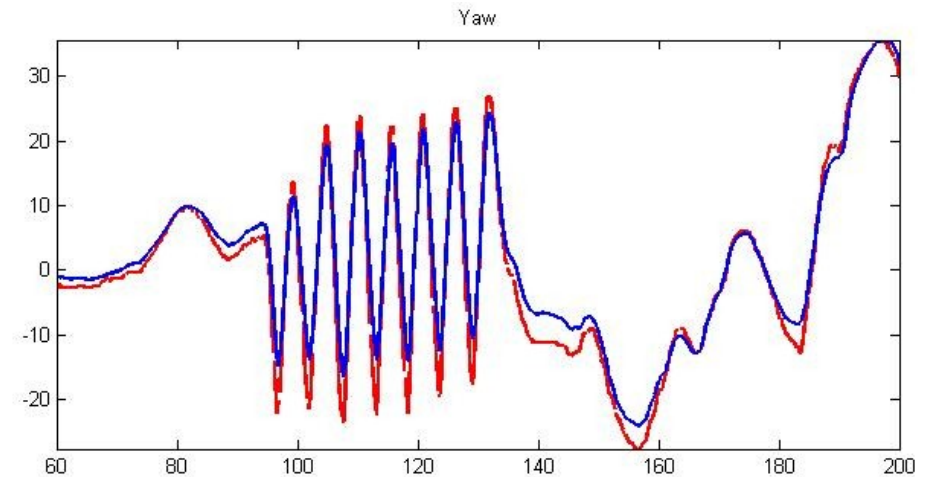
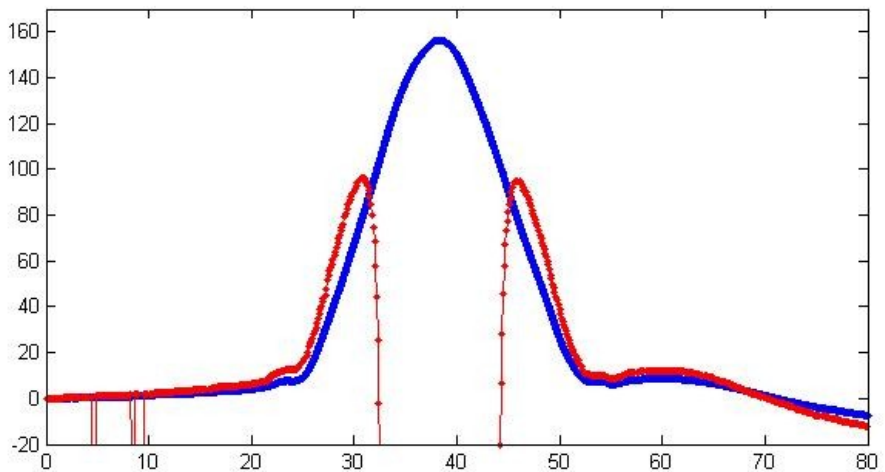


Factor of 2

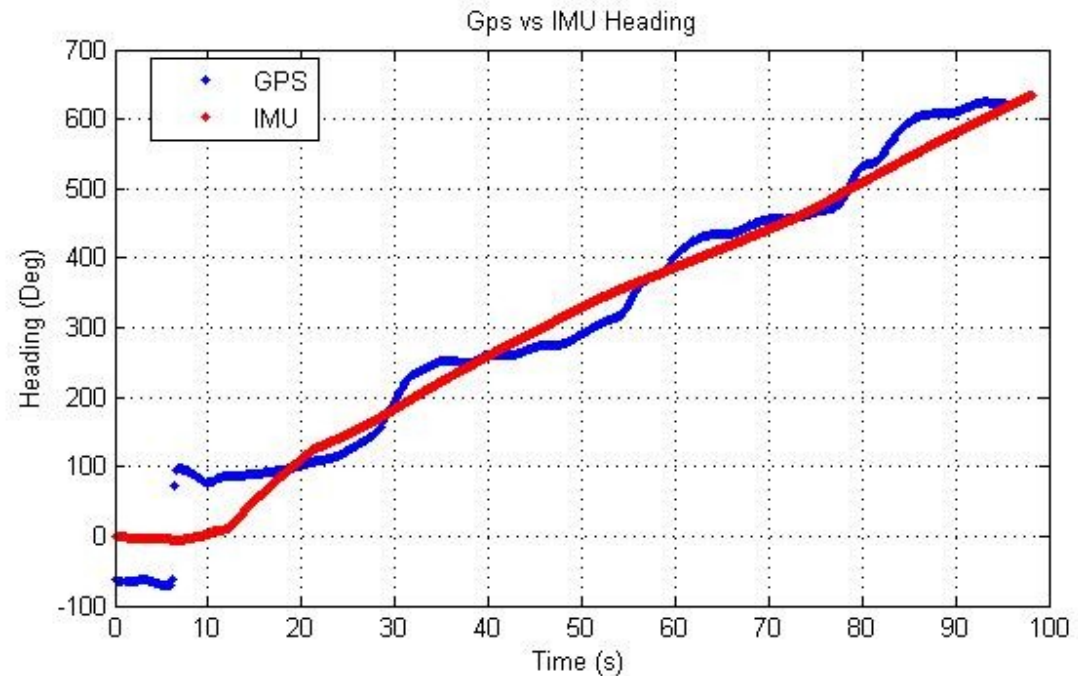
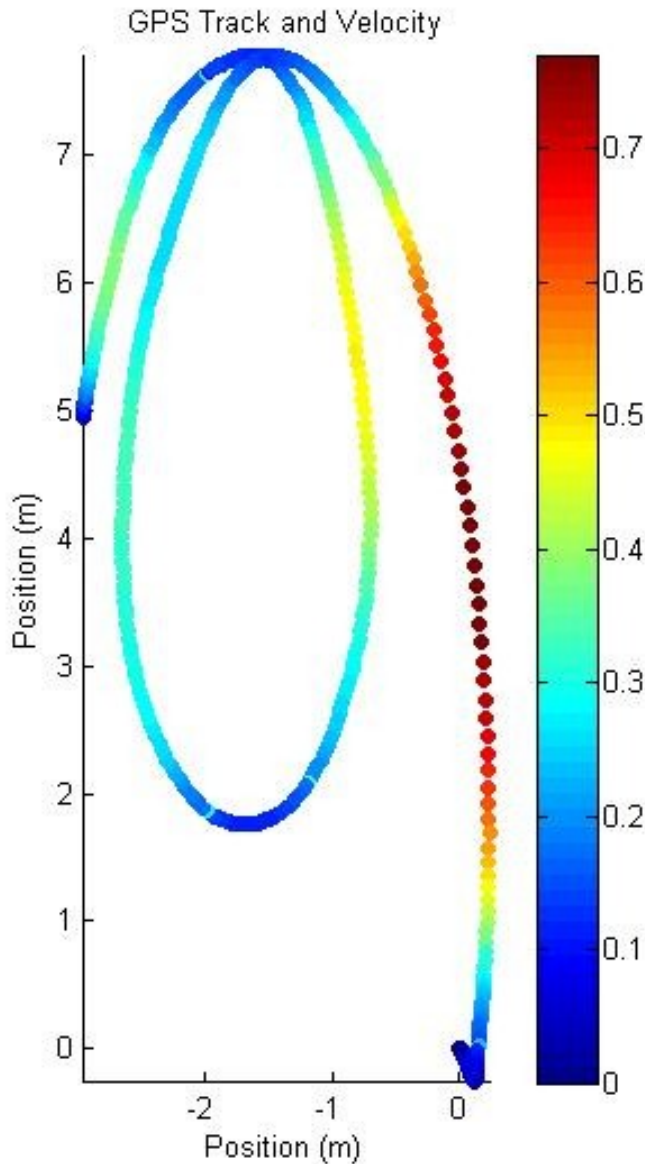
Pool Test 2



Factor of Pi

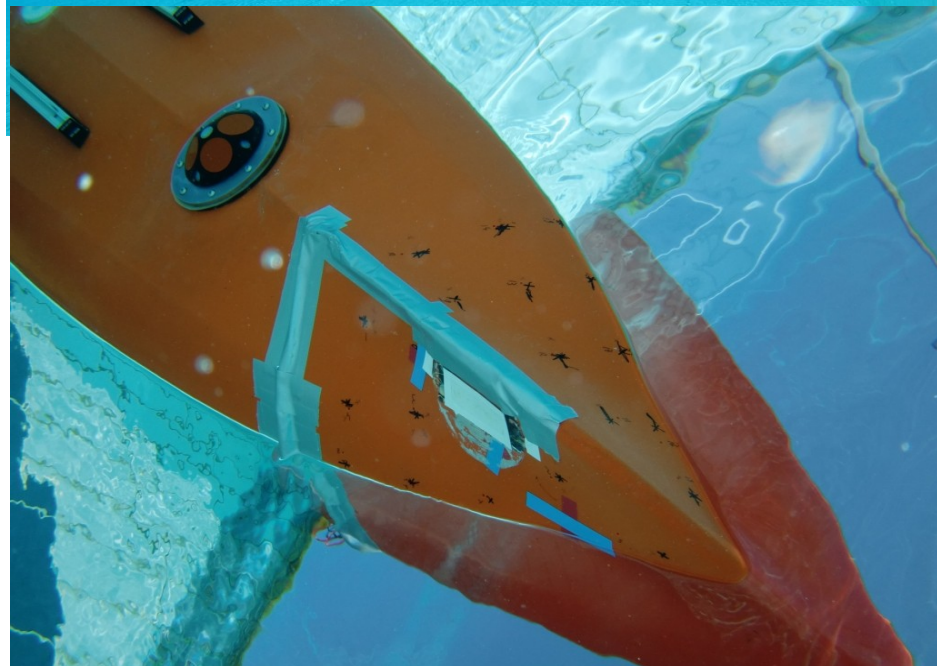
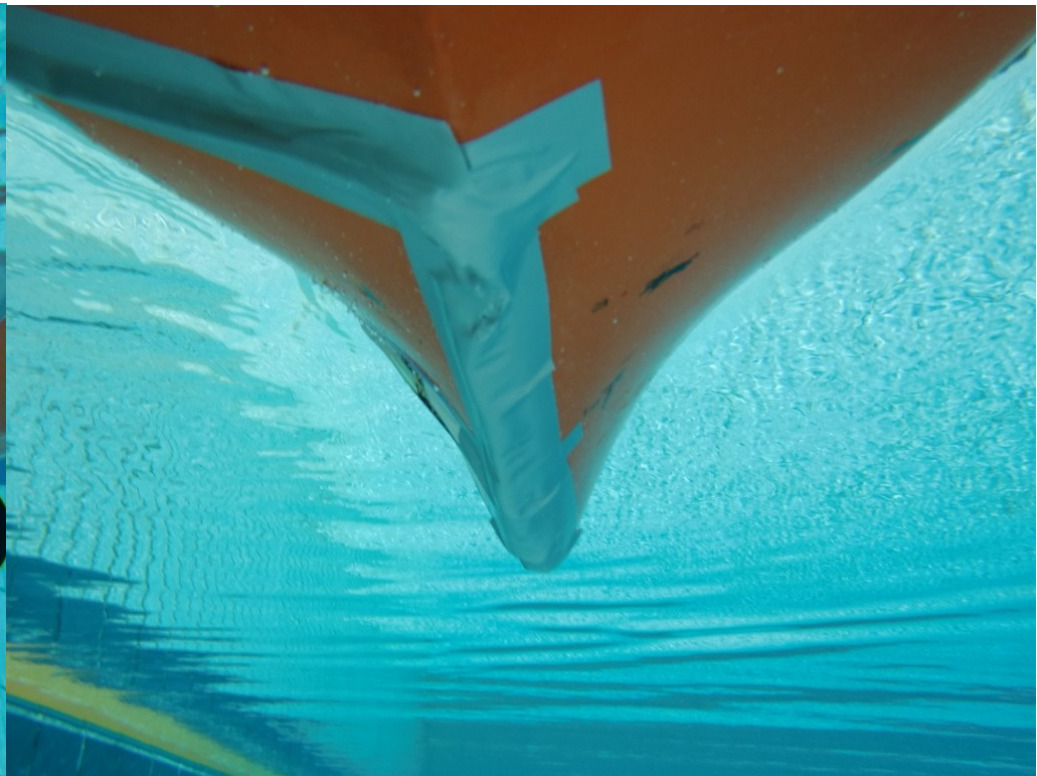
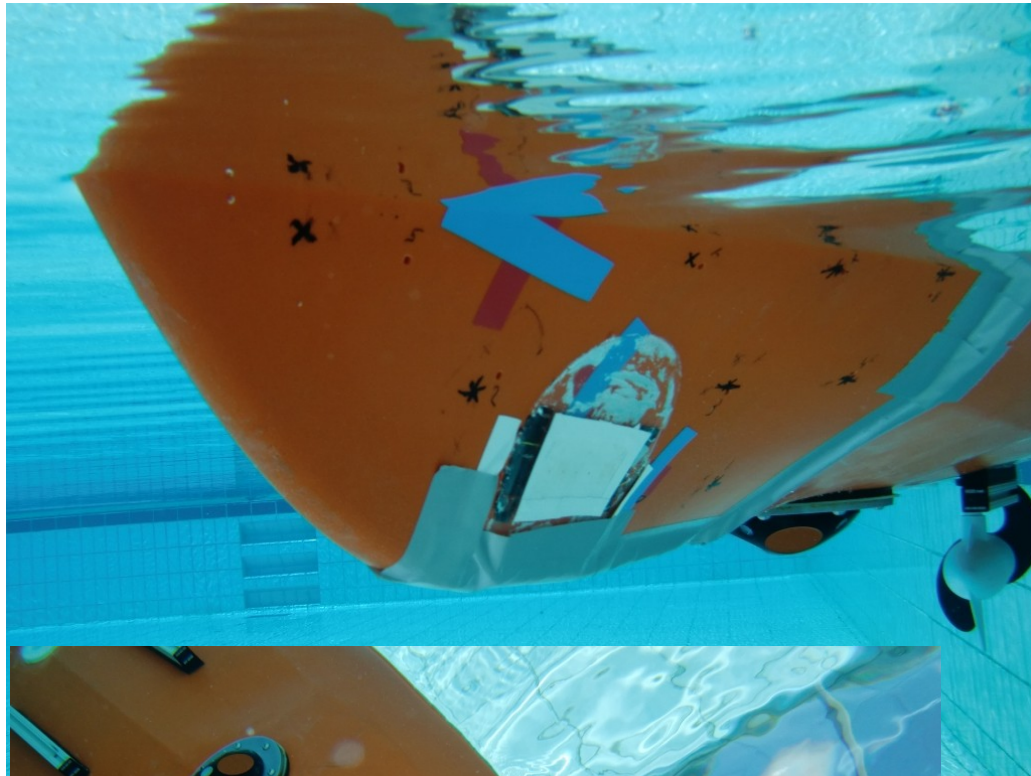


GPS



- More reliable than previous test
- Intermittent jumps
- Oddly oblong circular tracks
- No calibration / improvements to do

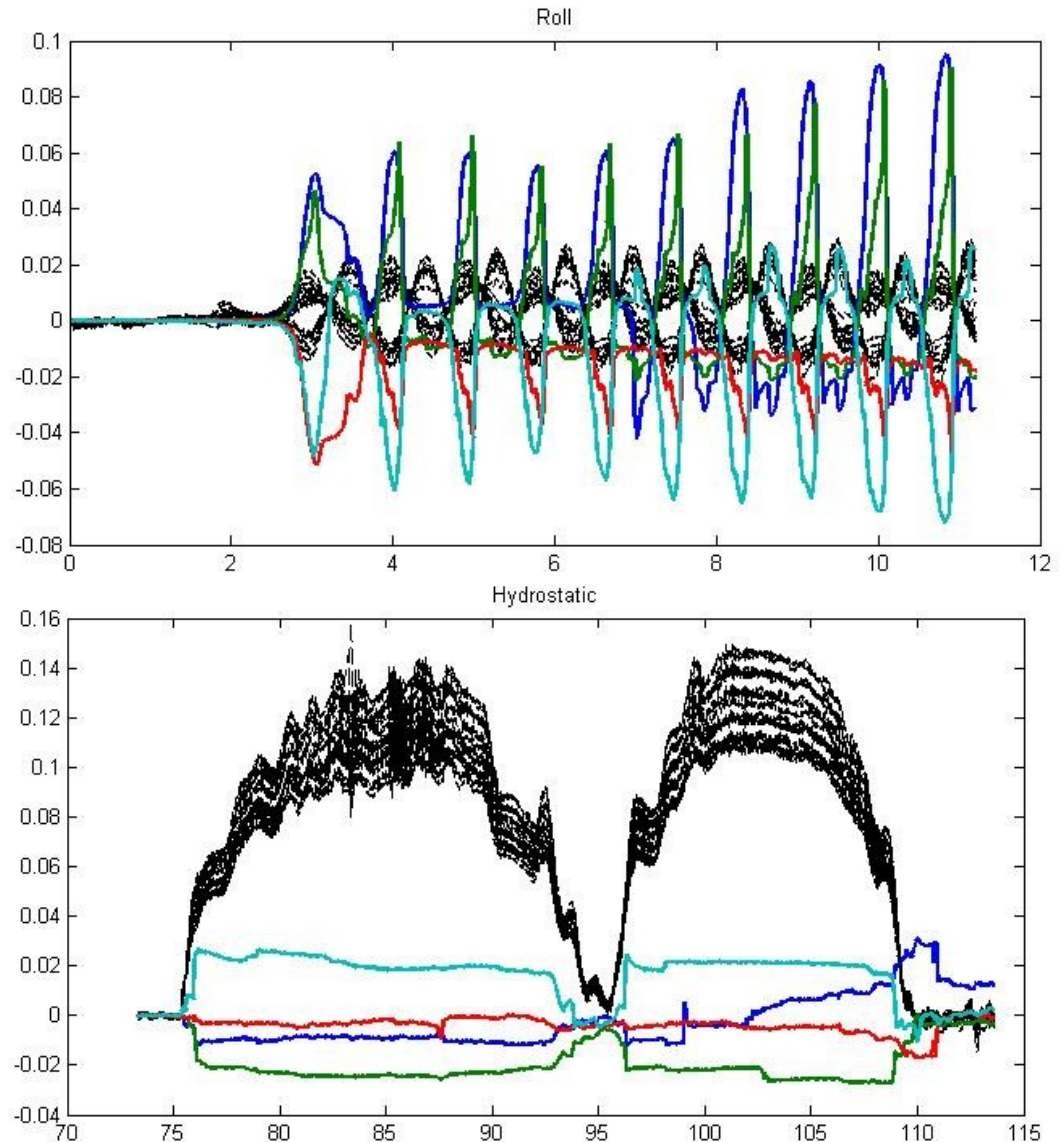
Chee Wee's sensor Array on Kayak



Cables are passed along keel under duct tape before up and into the bow cavity.

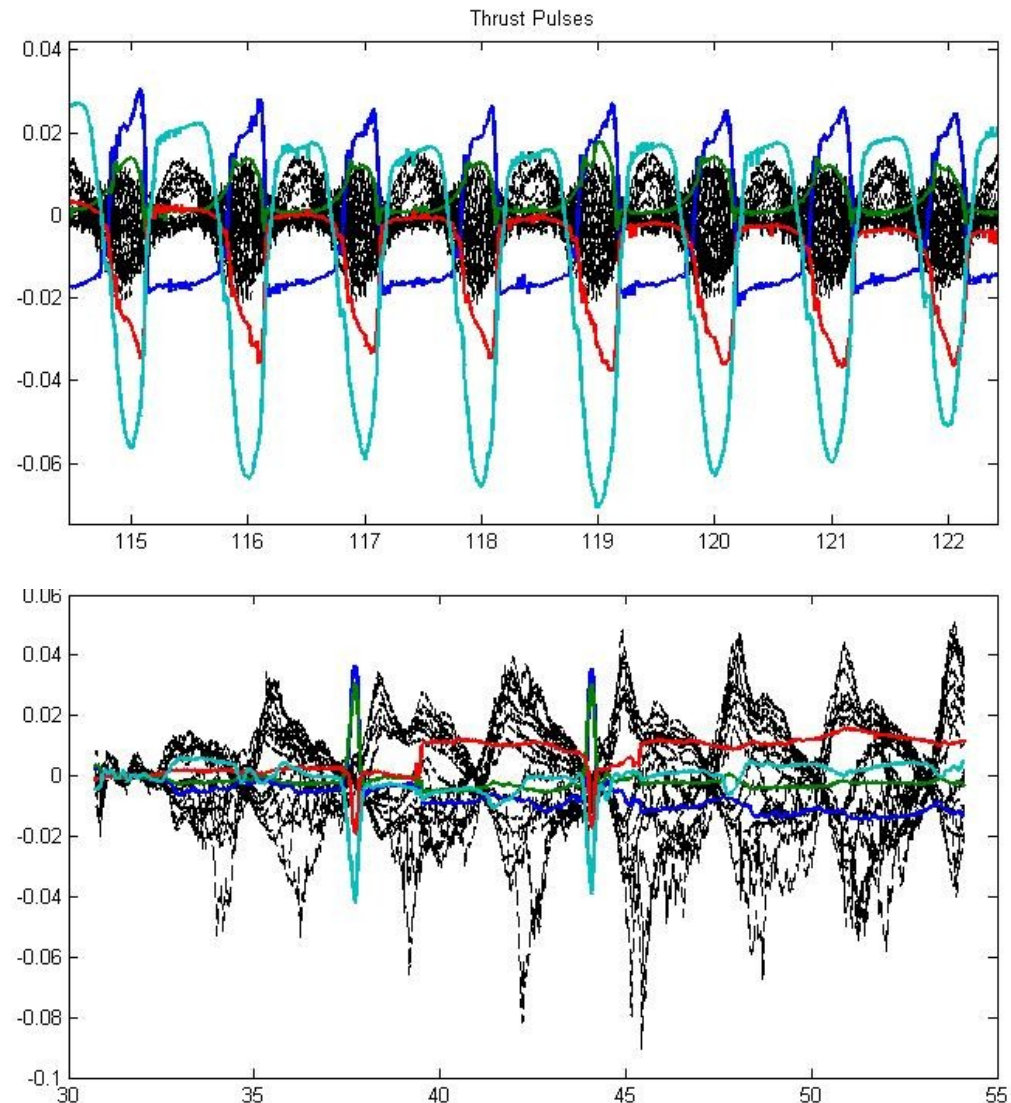
PDMS Sensor Array (CW)

- Sensors respond to motion, but does not seem to be due to pressure
 - Magnitude $\sim 100\times$ larger than previous measurements
 - Inconsistently follow the COTS pressure sensor results
 - Larger discrepancies when smother motions applied
- Possibly due to motion of wires
- COTS sensors in black for comparison



PDMS Sensor Array (CW)

- Based on dry post-examination of sensor array mounting (data not shown):
 - Cable motion causes large noise bursts
 - PDMS near cable connection very sensitive to motion
 - Some relaxation evident in pressure after stimulation, due to gaps between PDMS and kayak



Kayak maneuvers

- Thruster pulses intermittently at $\sim 1\text{Hz}$, which causes rolling at this frequency during turns
- Noticeable bow wave
- Two turn radii
 - Large turn radius with maximum natural thrust angle
 - Small turn radius with artificially large thrust angle by changing offset (see picture on next slide)

small radius turn thruster angle



Wifi router mounted
on kayak

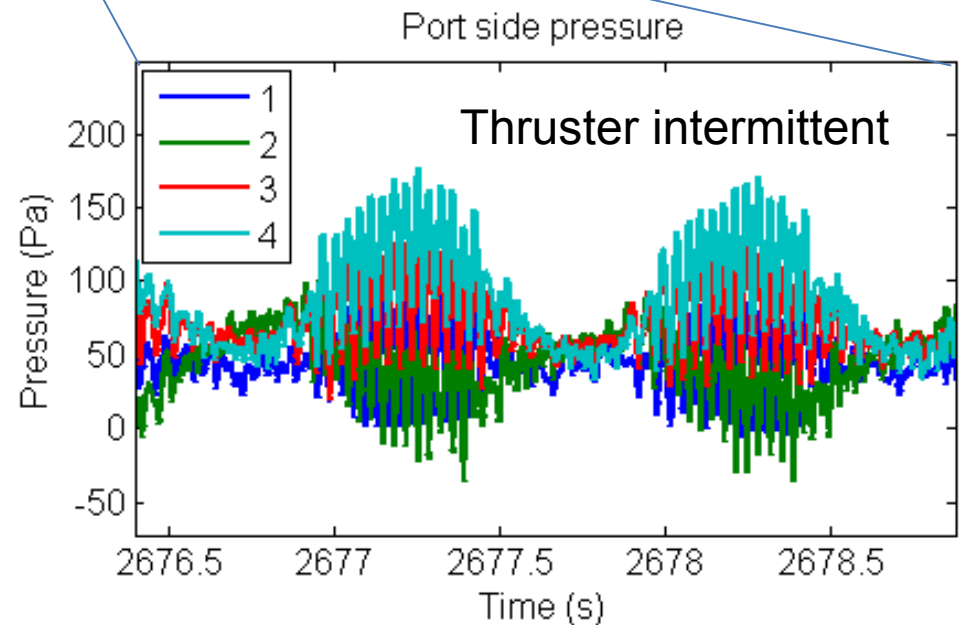
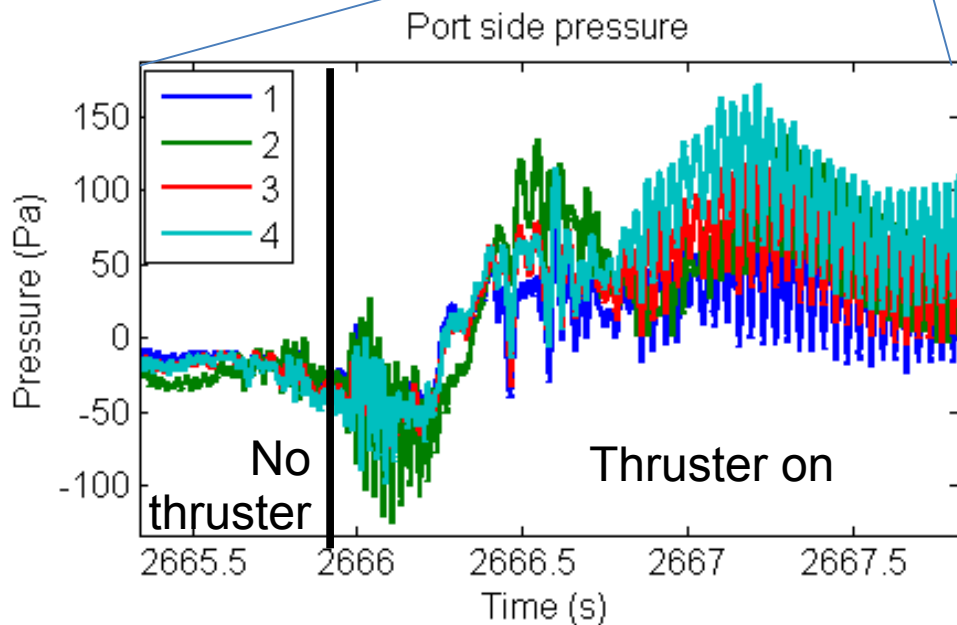
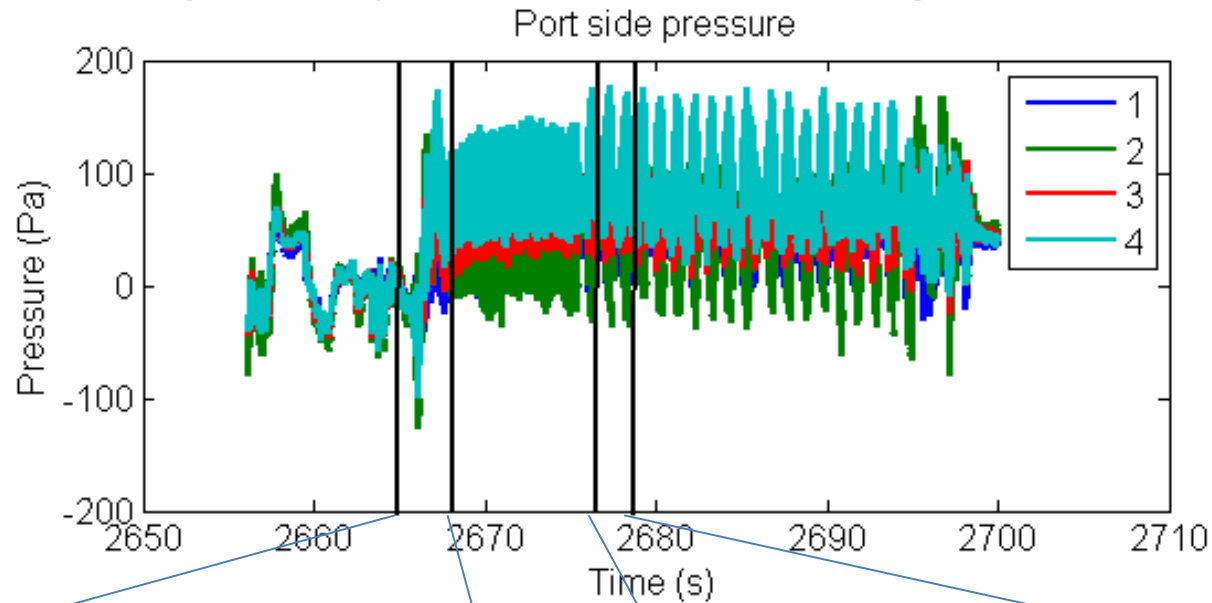
Turning/driftng: larger radius turn



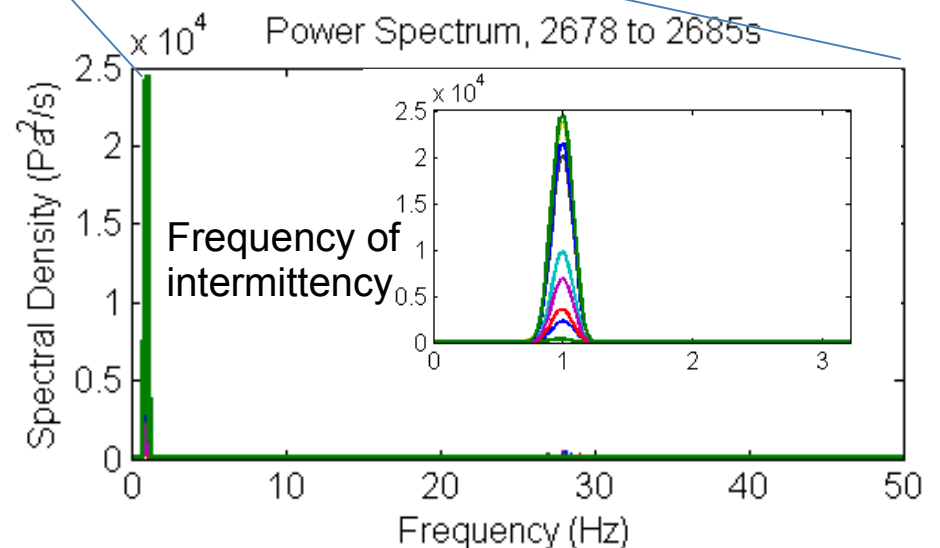
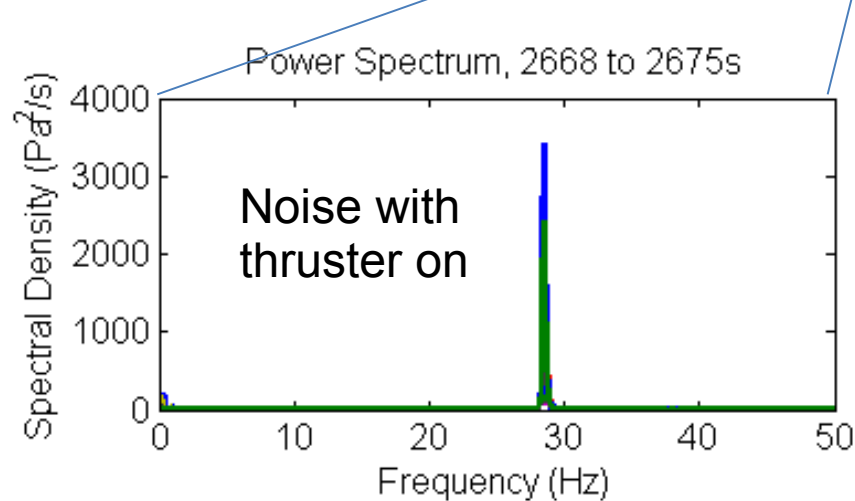
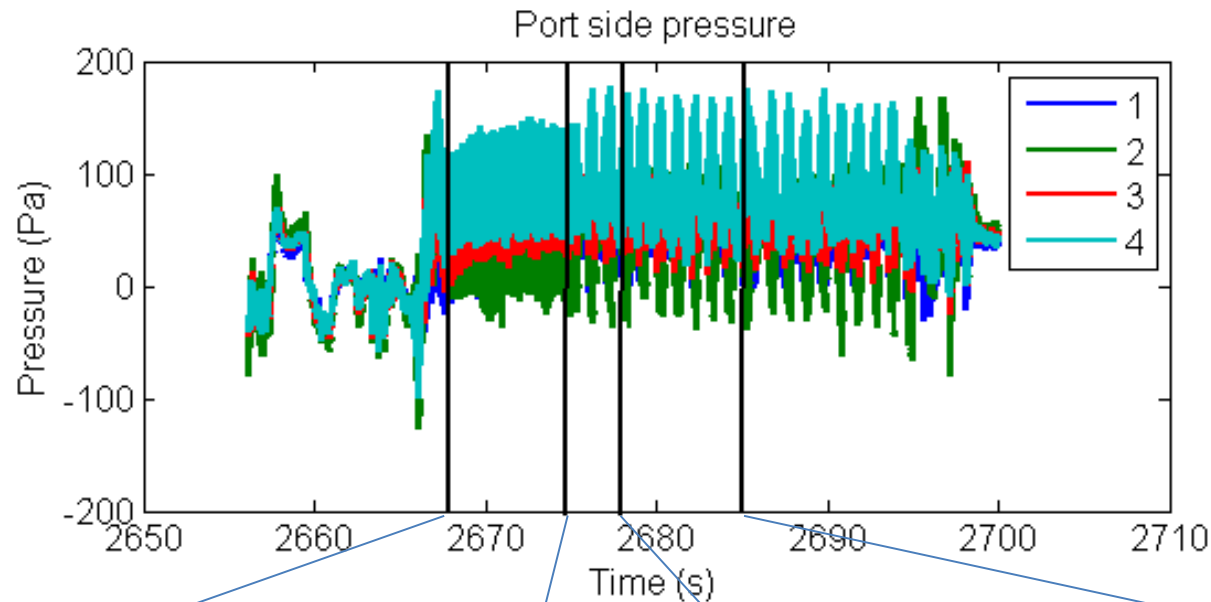
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Pressure data with Thruster

(straight line motion)

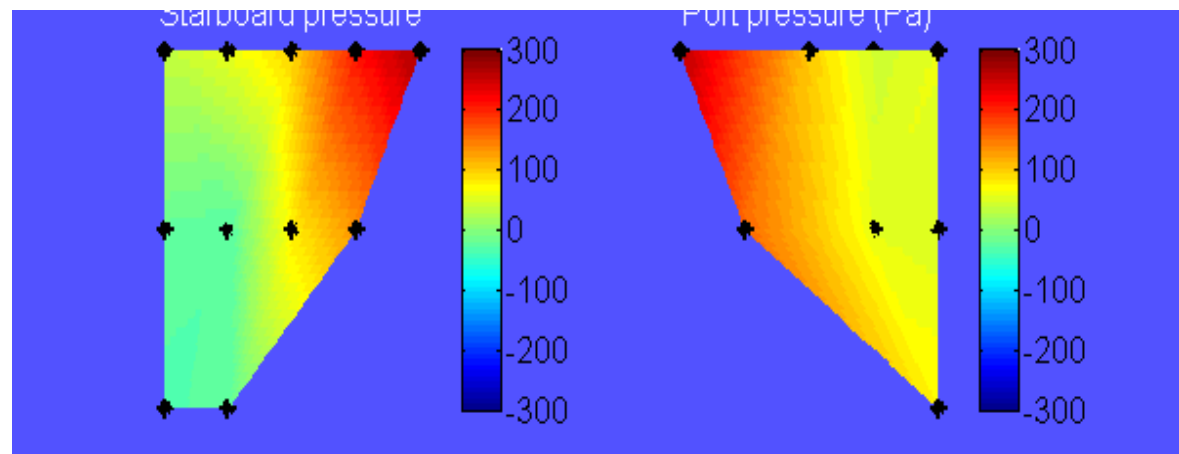


Pressure data with Thruster (straight line motion)



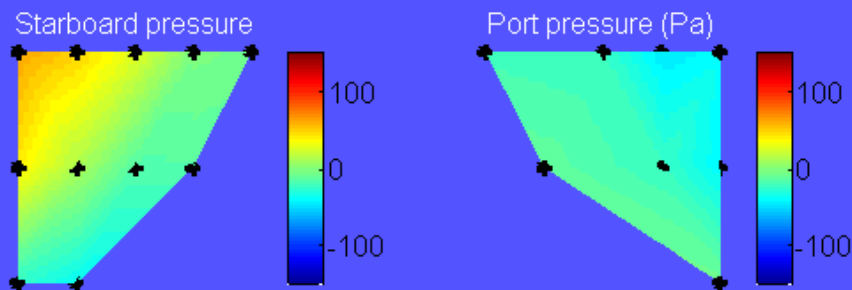
Bow pressure distribution during maneuvers

- Straight Motion

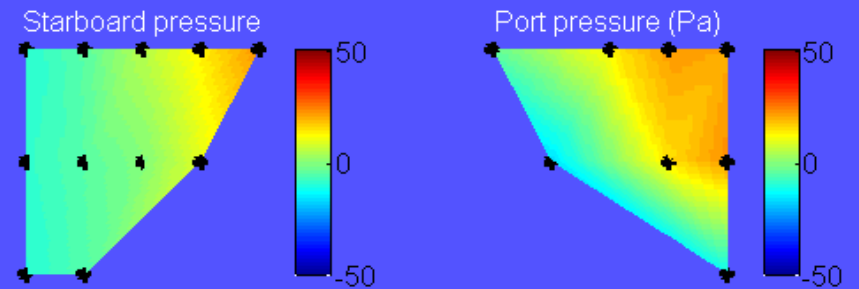
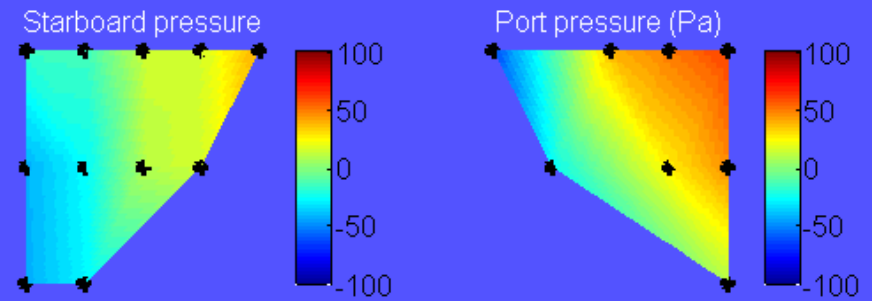
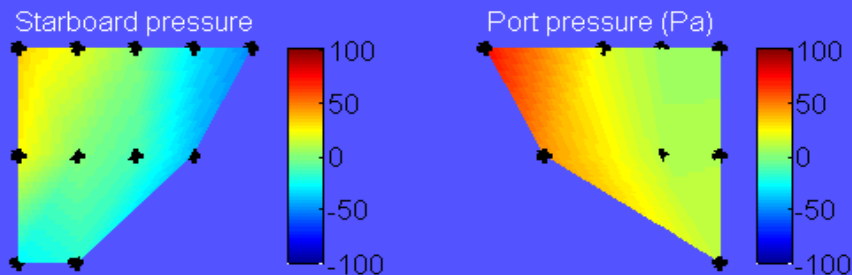


- Starboard turn

- Port turn



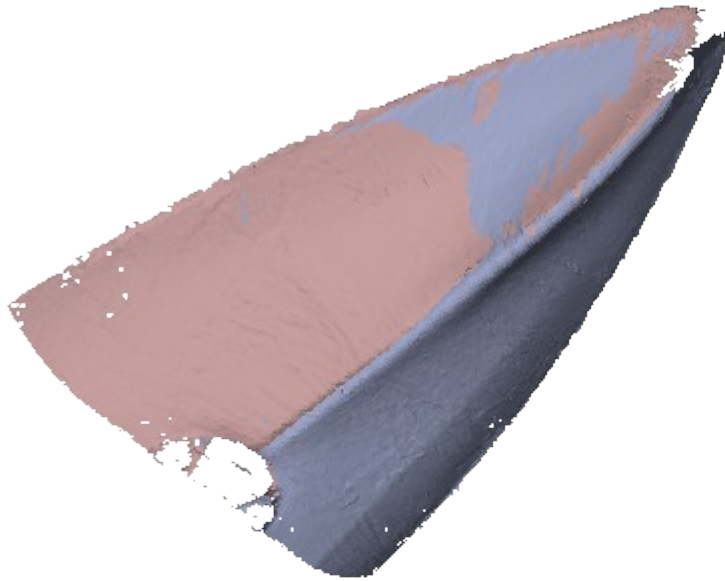
Smaller radius (less drift)



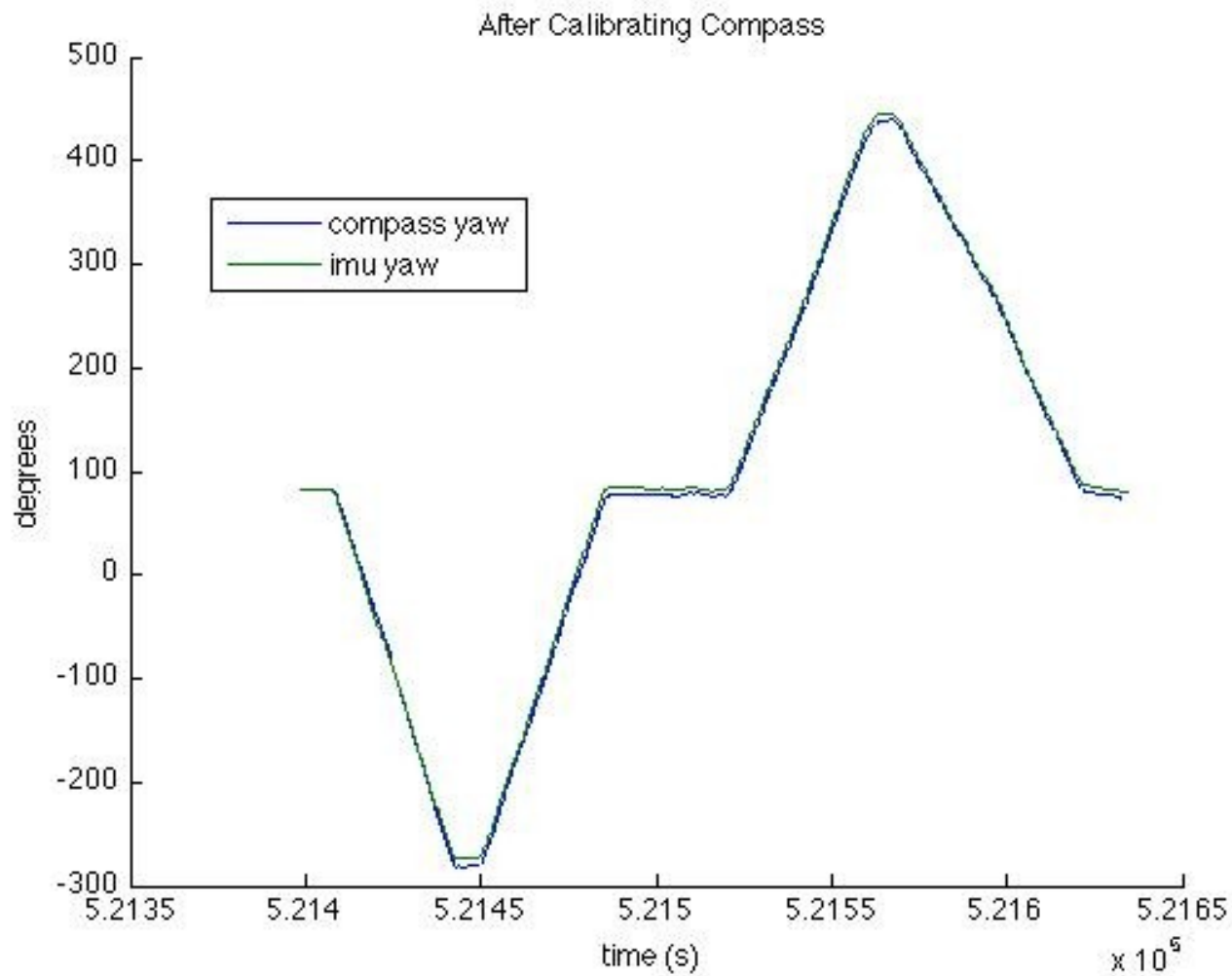
Goals for the Future

- Obtain reliable estimate of kayak state
 - Compass and dvl functionality
 - Use compass, imu, and dvl together to estimate kayak state
- Interpret pressure
 - Relate pressure to kayak dynamics
 - Yaw and roll compensation in pressure
- MEMS sensors on kayak
- Solve thruster and sensor intermittency
- Troubleshoot wifi antenna

Kayak Scan



Calibrated compass



Chee Wee's sensor array

Roll experiment

