



Crowd Sourced Bathymetry Working Group Denver, CO

Heath Henley, PhD
Software Engineer
FarSounder, Inc.

Outline

- Intro
- Background + Motivation
- Summarize FLS Accuracy Results
- Conclusions + Goals for CSB-WG

Introduction: Hardware



FarSounder-500 3D-FLS

- Refresh rate: 1.6 sec
- Range: 500 m
- FOV: 90 degrees

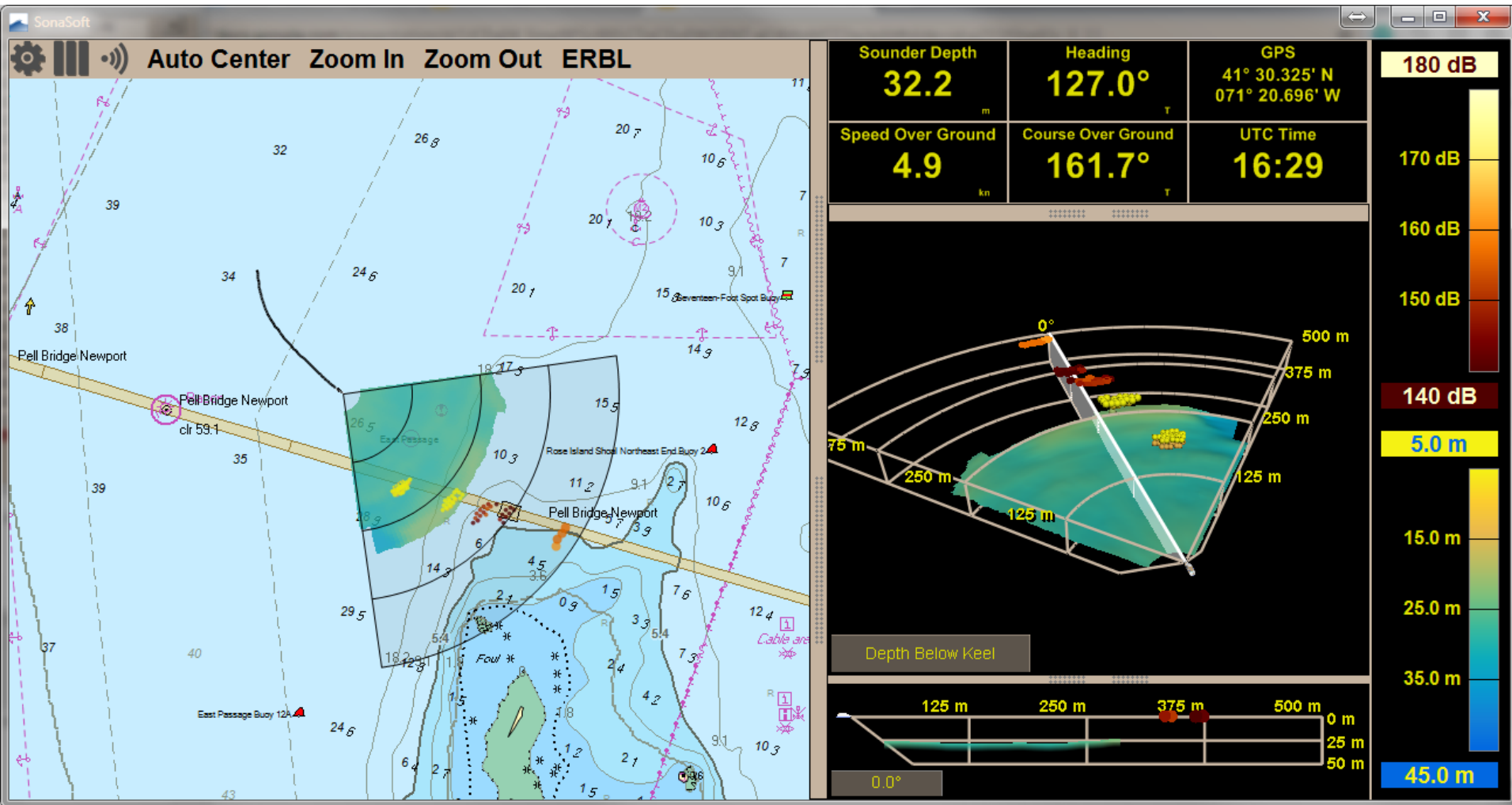


FarSounder-1000 3D-FLS

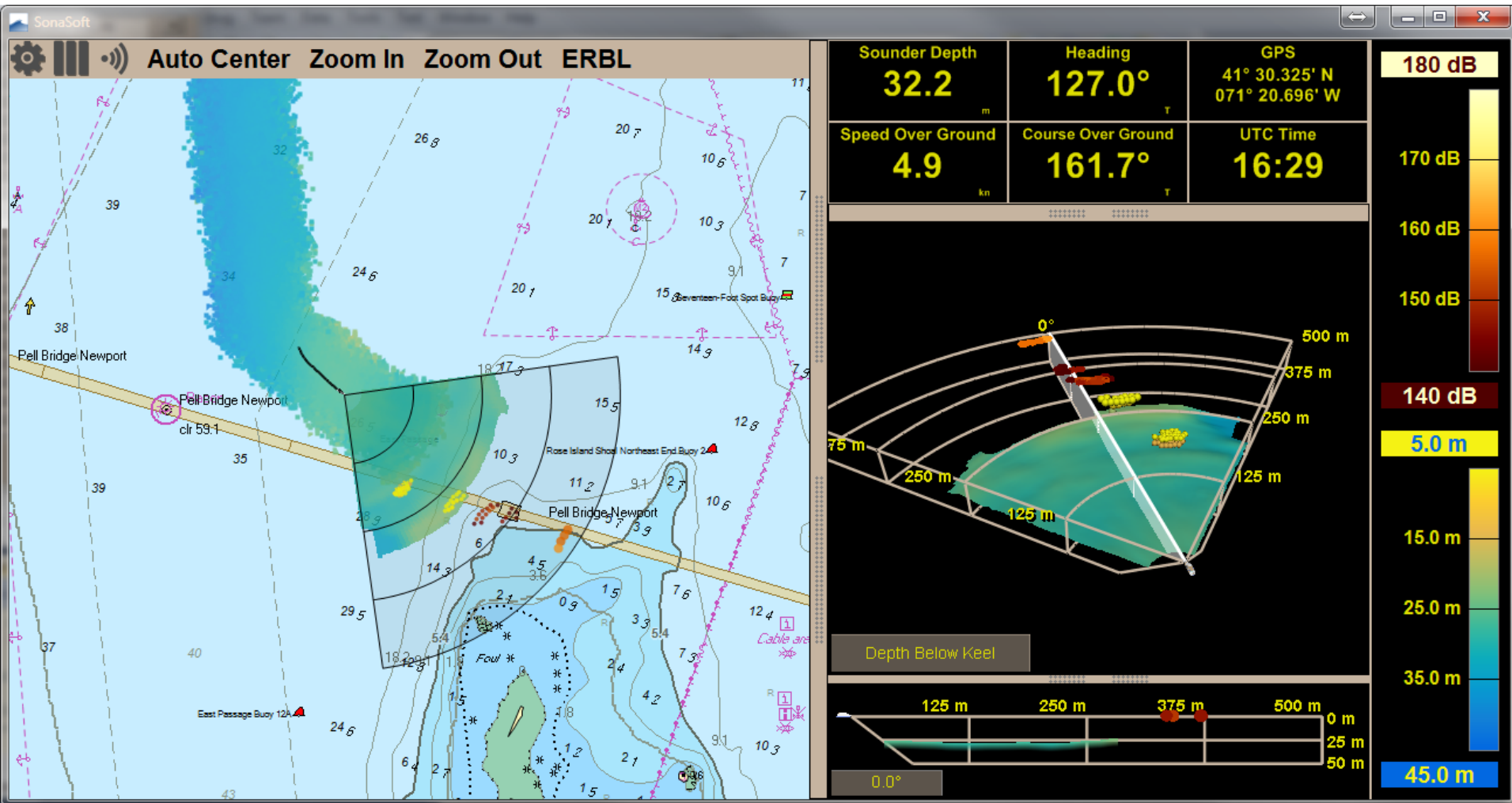
- Refresh rate: 1.6 sec
- Range: 1000 m
- FOV: 60 degrees



What is 3D Forward Looking Sonar?



What is 3D Forward Looking Sonar?



Motivation

Customers going to interesting areas



Broken Inaglor CC-BY-SA-3.0

Start collecting the bathymetry data

- Precision/accuracy (eg B-12 chap. 4)

Not MBES replacement

Collecting Data



URI's R/V Cap'n Bert

R/V Cap'n Bert (URI)

- Draft: 1.8 m
- Length: 16.3 m
- Beam: 5.7 m



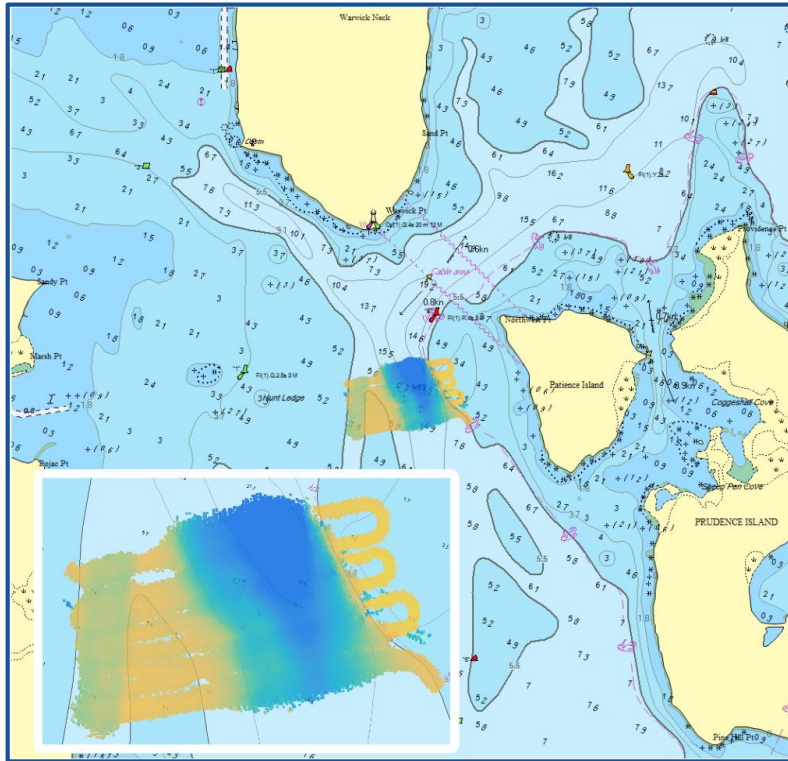
Furuno GPS (SC-30)

- Position + Heading
- ROT
- SOG

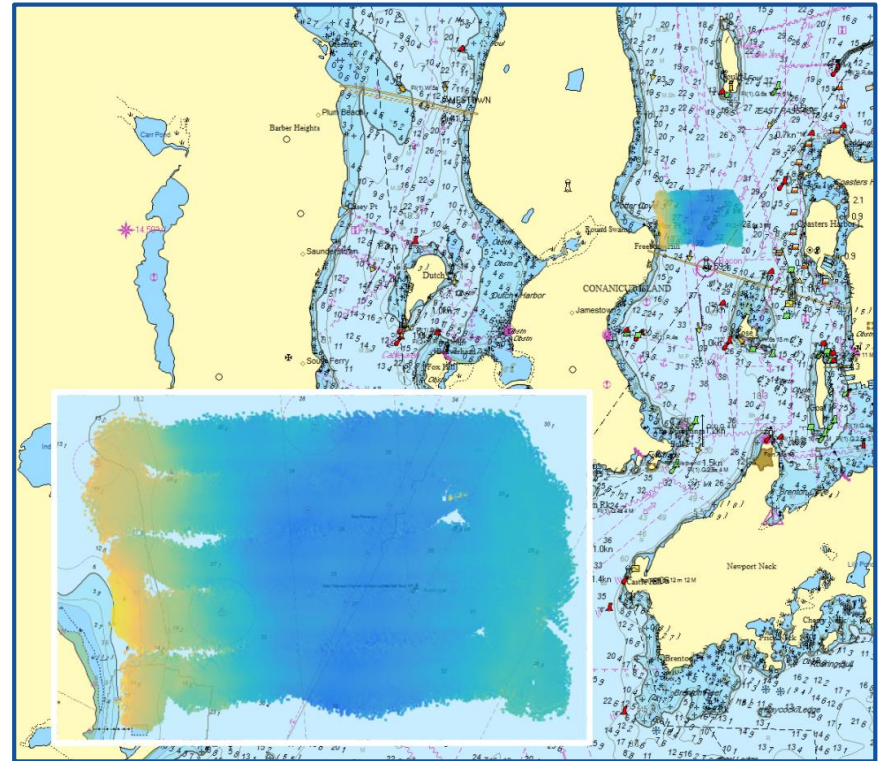


Aluminum Pole Bow Mount for FarSounder Transducer Module

Survey Areas



Patience Island Survey Area - Warwick, RI - December 2016



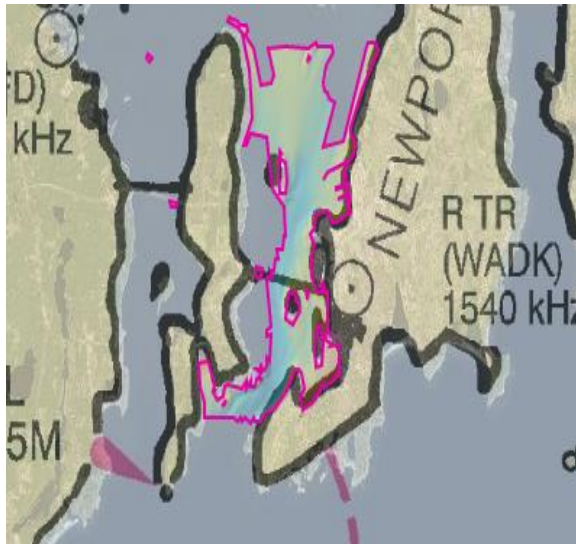
Newport Bridge Survey Area - Newport, RI - July 2015

Reference Datasets

TABLE I
NOAA SURVEY REFERENCE DATA

NOAA Survey	Year	Reference	Resolution (M)
H11930	2011	[8]	4
H11988	2008-2009	[9]	4
F00522	2006	[10]	0.75

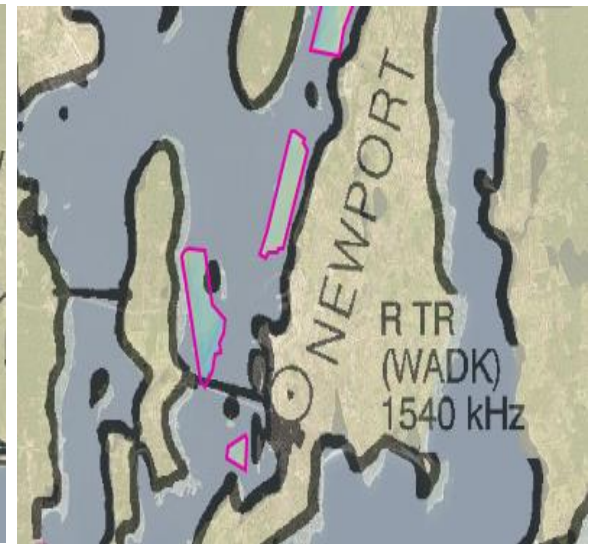
H11930



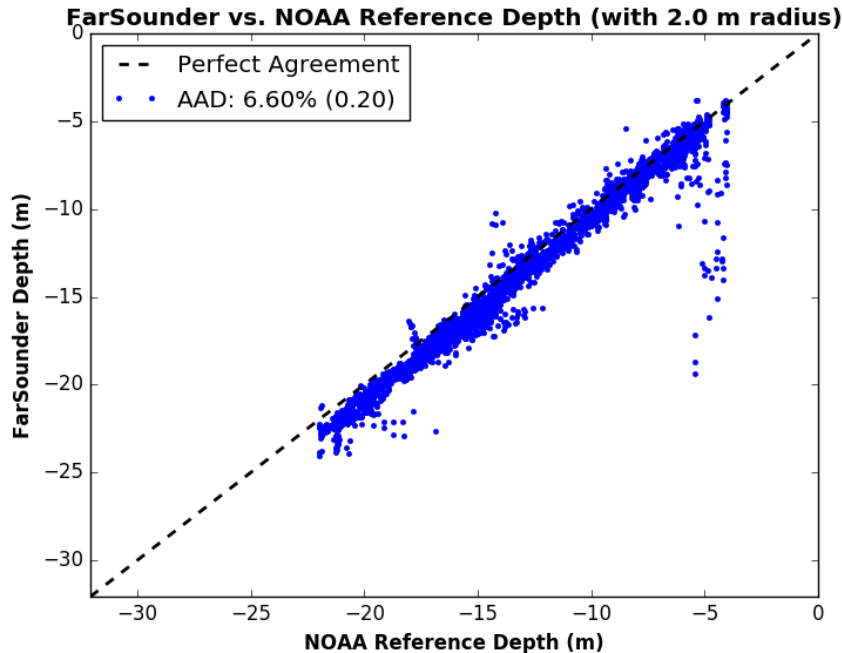
H11988



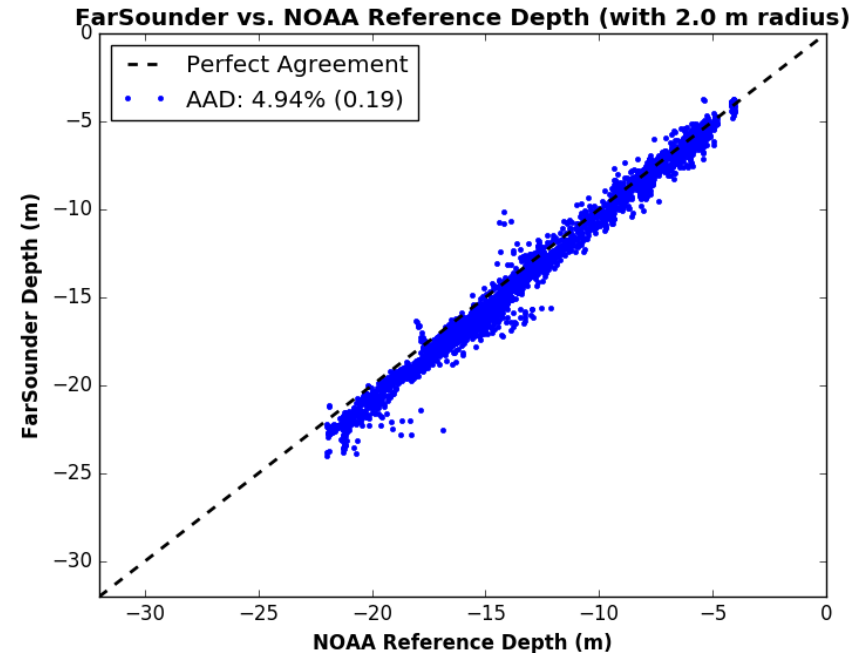
F00522



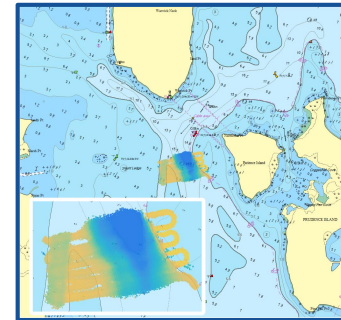
Results: Patience Island Survey



- No outlier removal
- Real-time tide height prediction

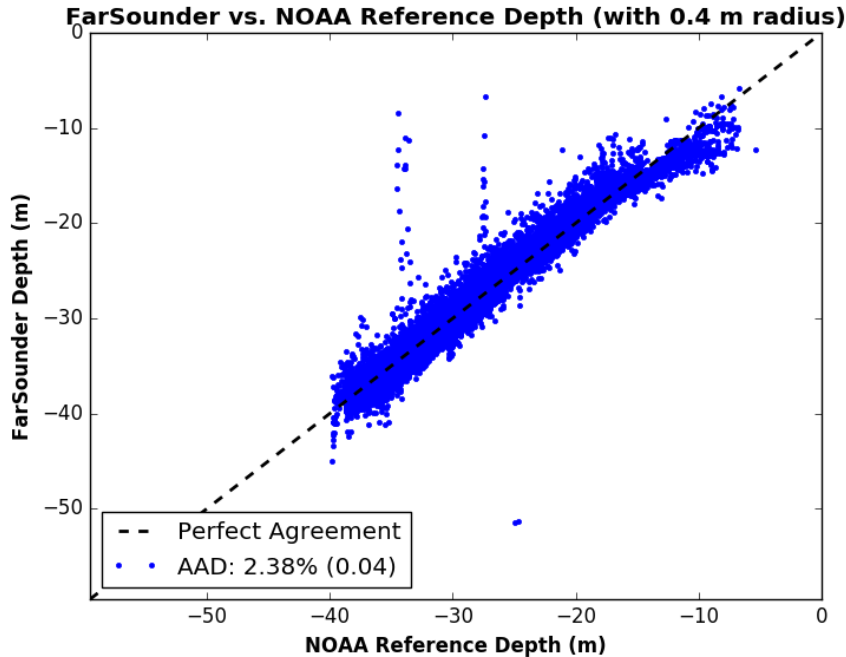


- Outliers* removed
- Tide station data

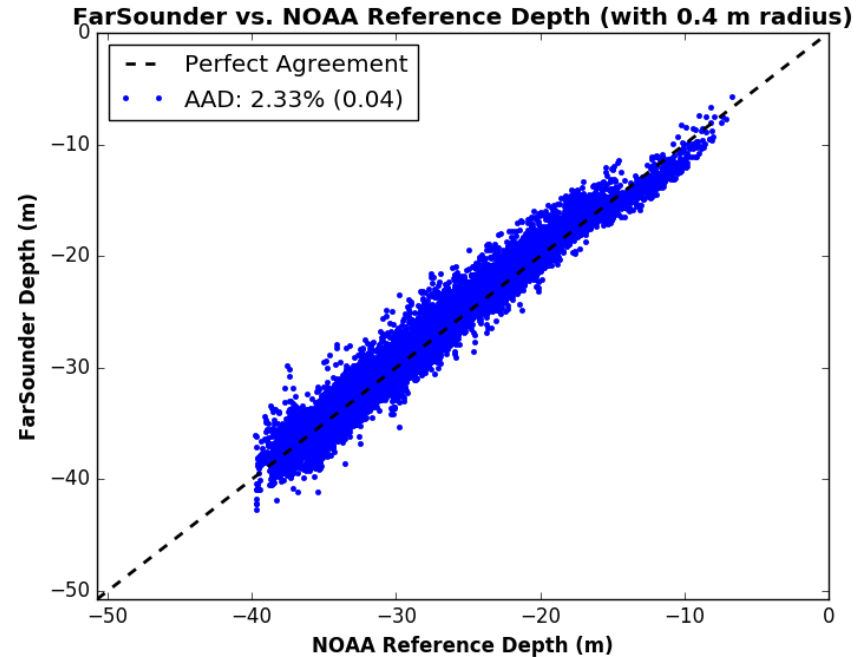


*The cutoff for classification of a data point as an outlier was arbitrarily chosen as the value of percent error such that 99.7% of the data fall below the cutoff.

Results: Newport Bridge Survey

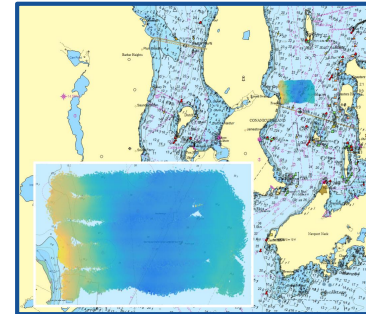


- No outlier removal
- Real-time tide height prediction

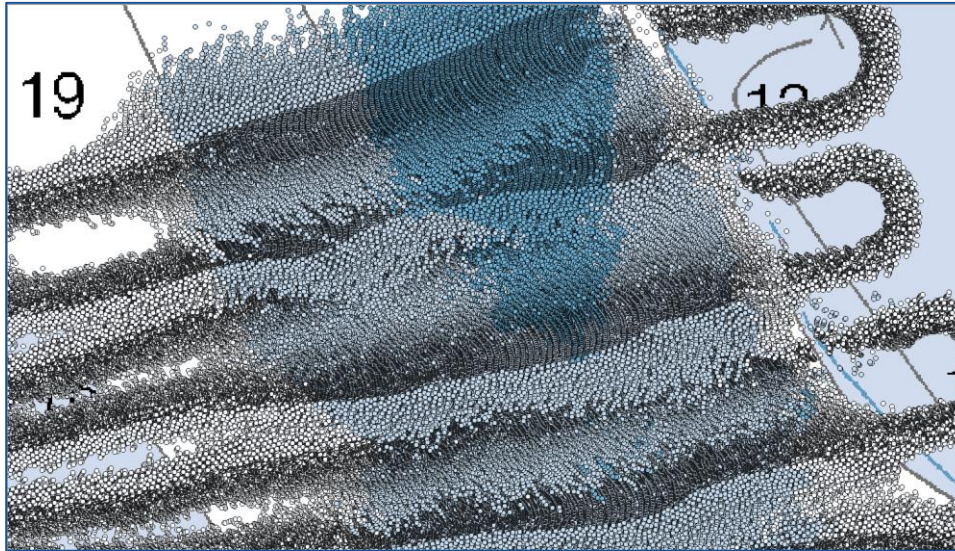


- Outliers* removed
- Tide station data

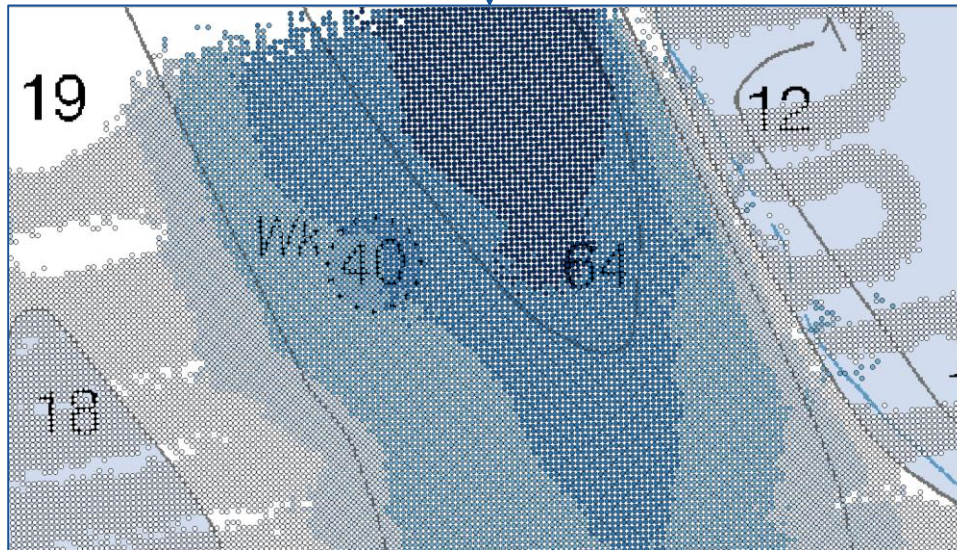
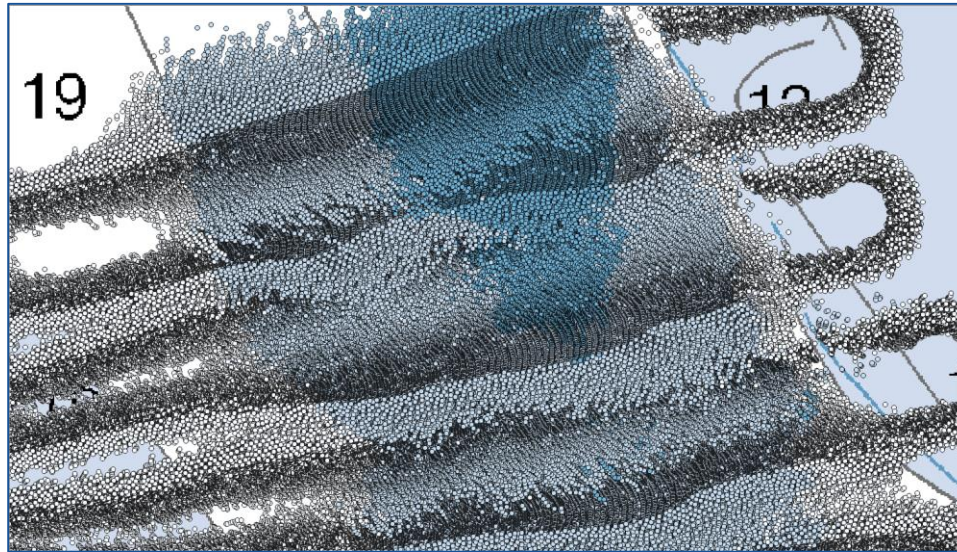
*The cutoff for classification of a data point as an outlier was arbitrarily chosen as the value of percent error such that 99.7% of the data fall below the cutoff.



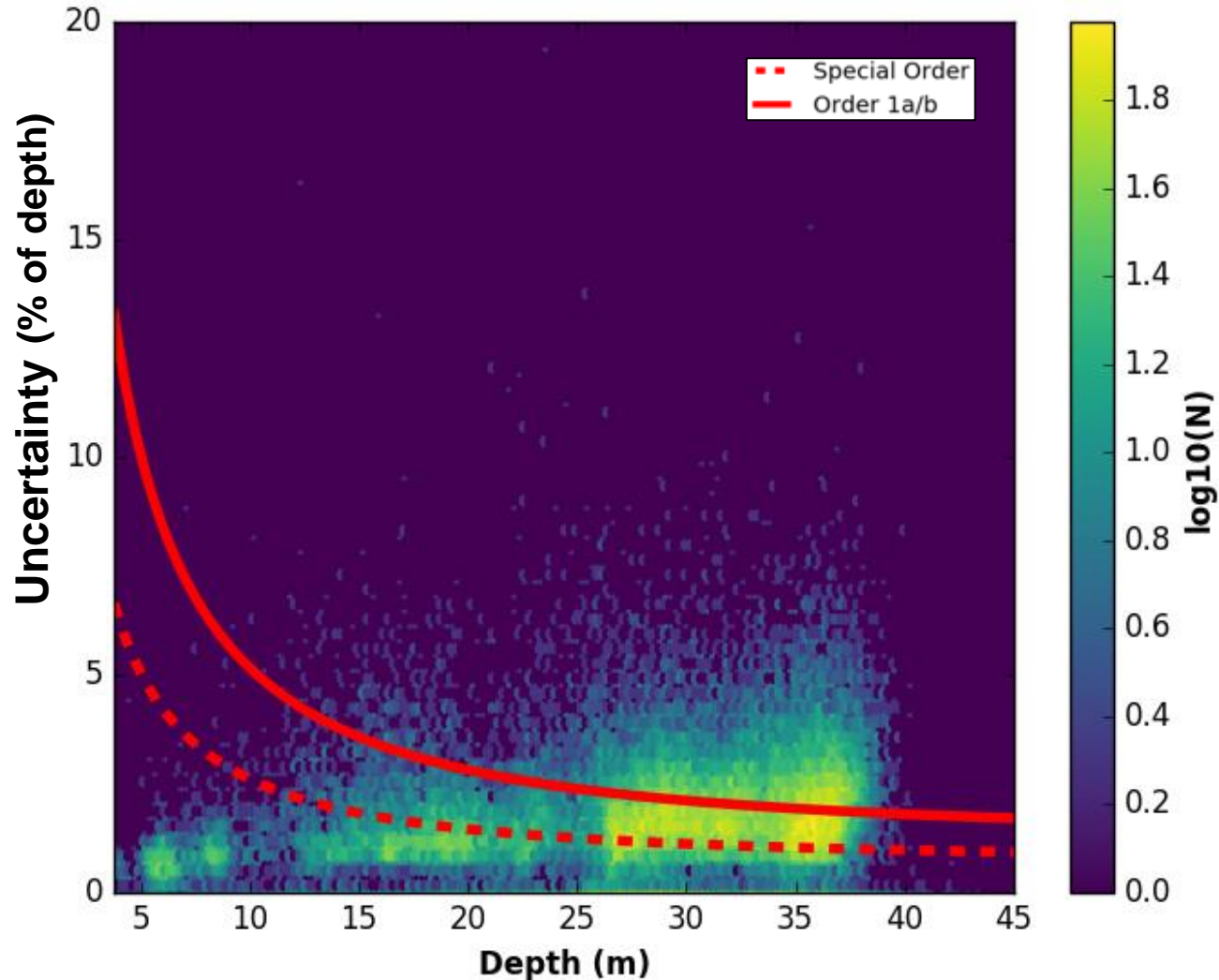
Data Reduction



Data Reduction



Results: IHO Standards



Next steps?

Direct comparisons

- SBES/MBES

Processing Improvements

- Tide, SSP, positioning
- Gridding (weighted, CUBE)

Customer data pilot project

Conclusions + Goals

Feasible to collect bathy data

- What can we do with it?
- Who is interested?
- CSB possibility?

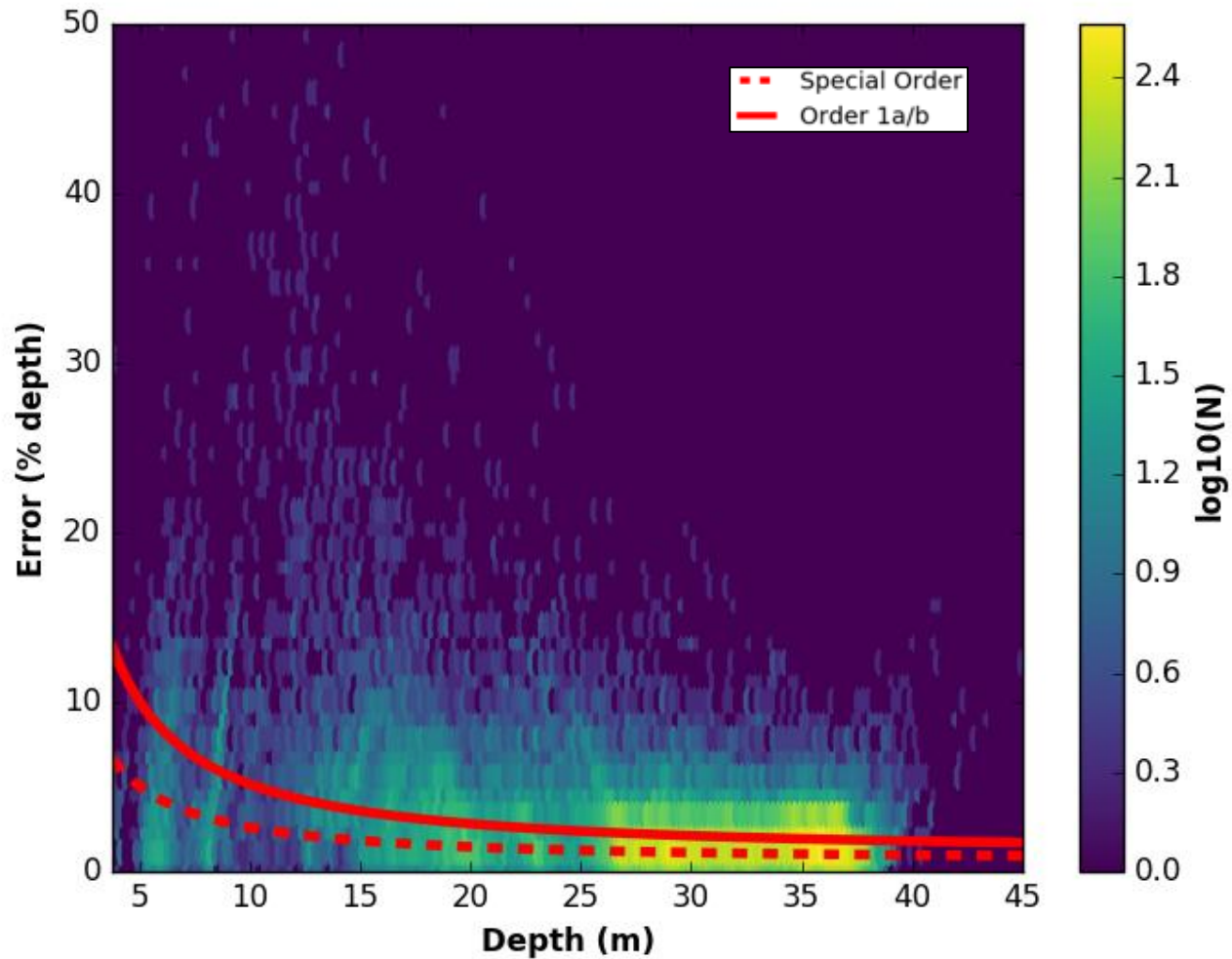
Including FLS bathy data – can we help?

Learn about data models, other CSB projects, etc.

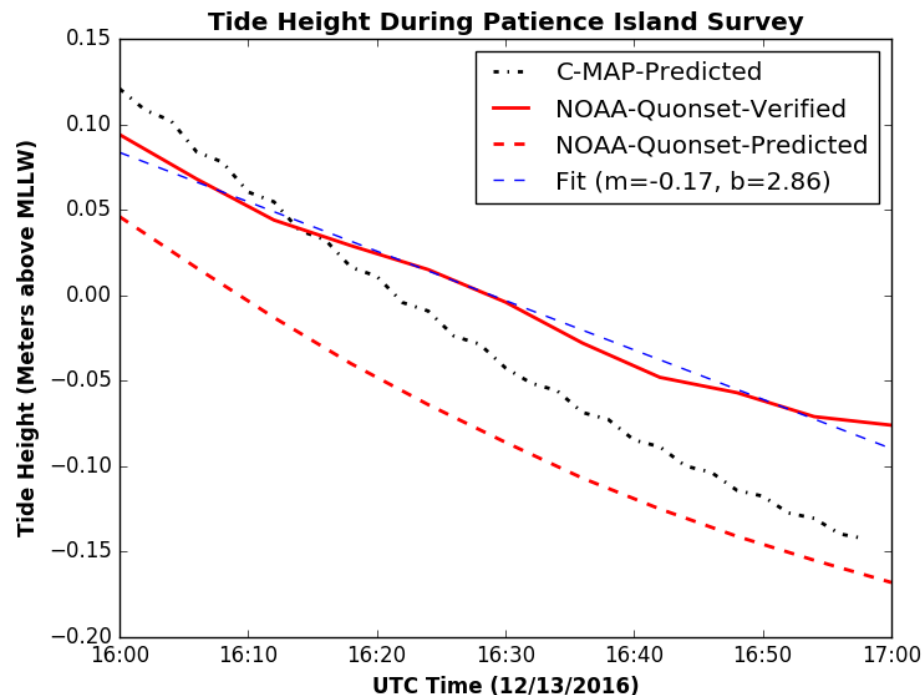
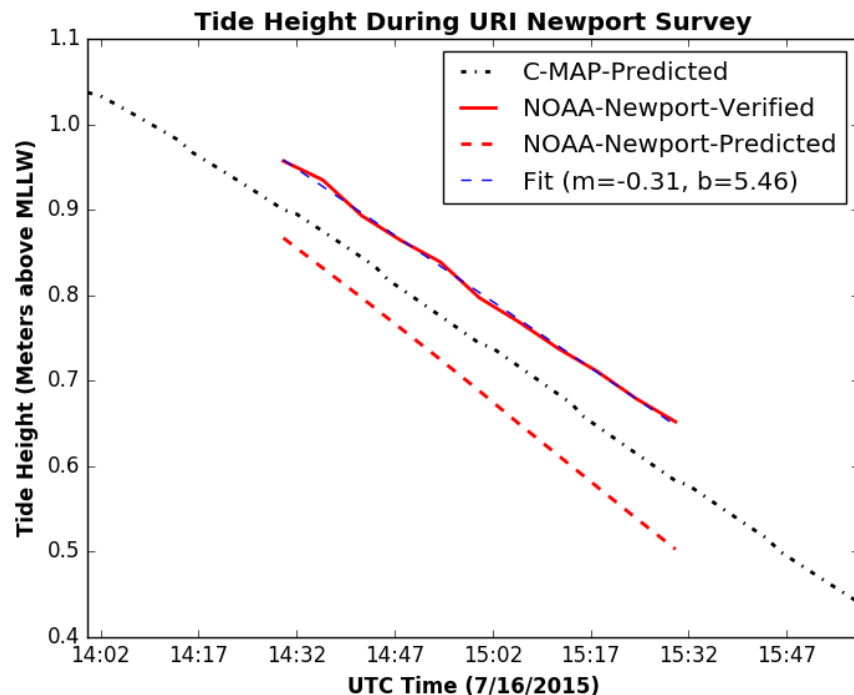


Questions?

Results: IHO Standards

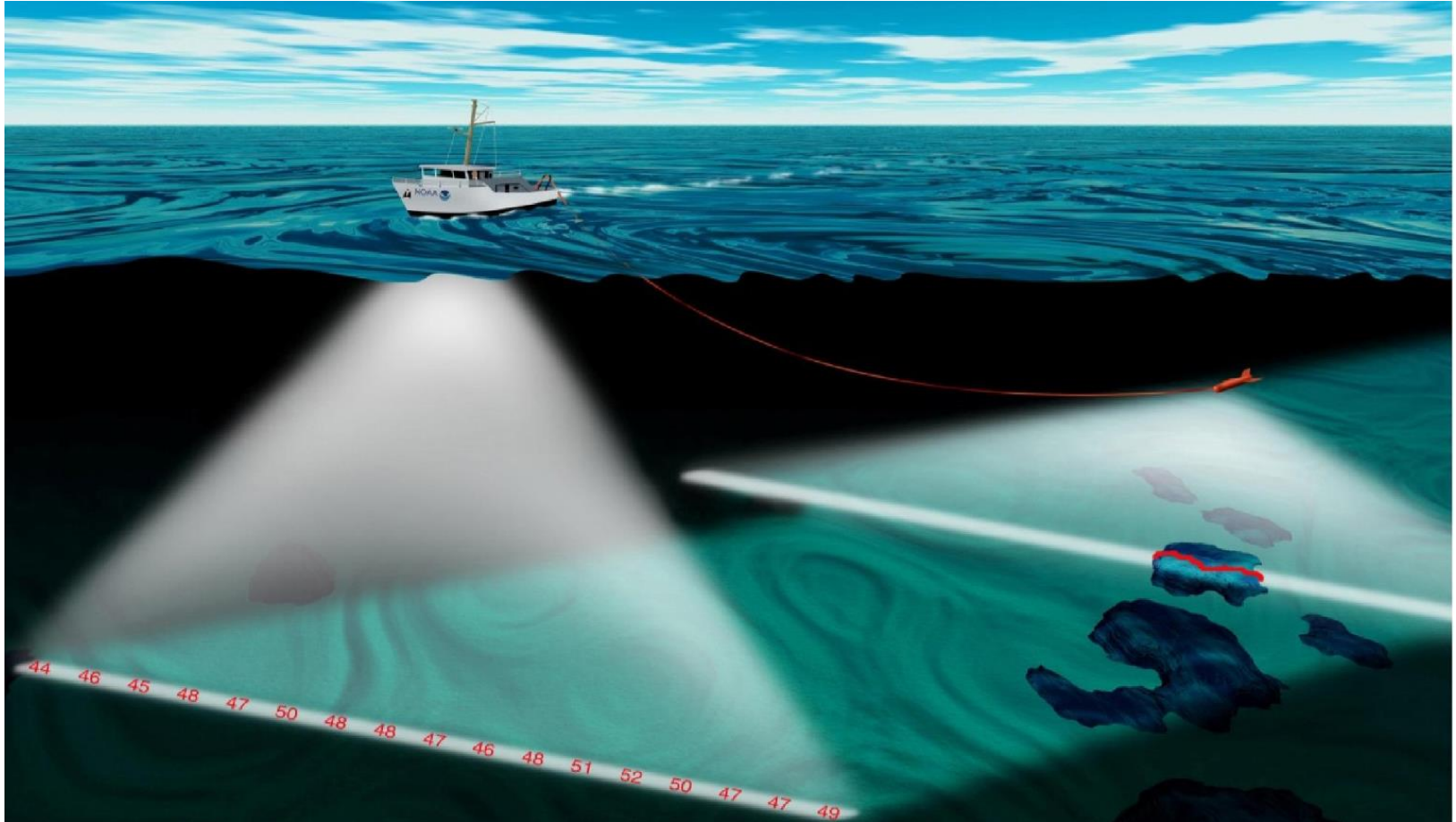


Procedure: Tide Correction



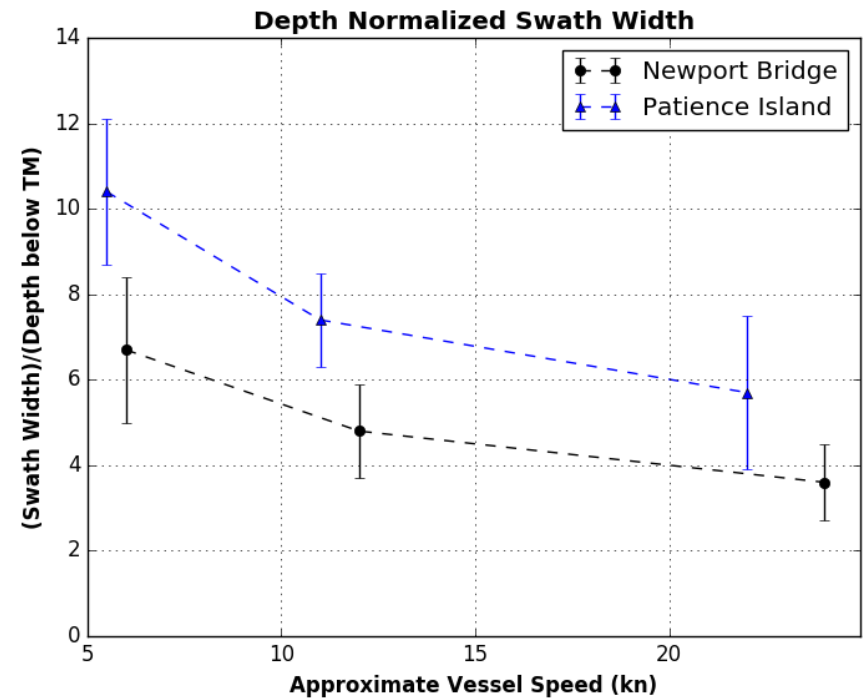
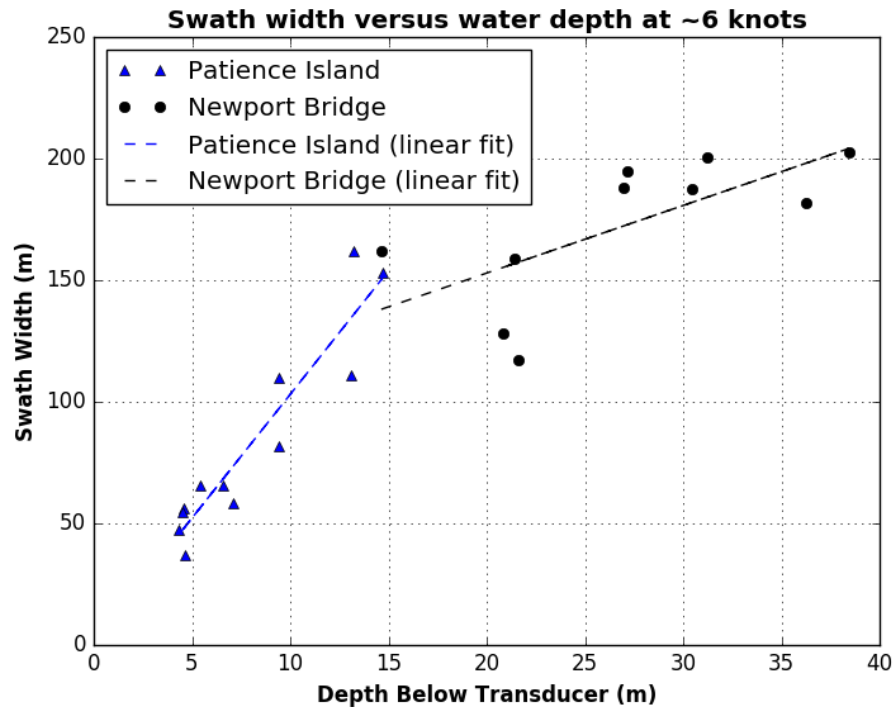
Predicted and verified tide height during the survey time data collection for both the Newport Bridge (left) and Patience Island (right) surveys used in this work.

Results: Survey Swath Width

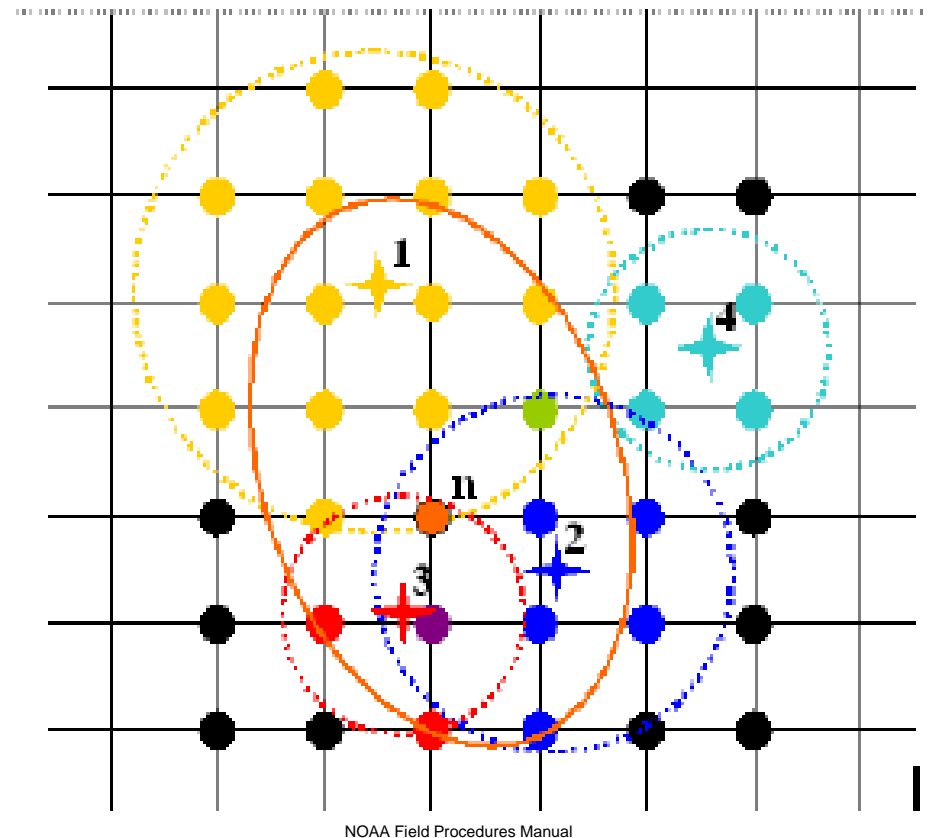
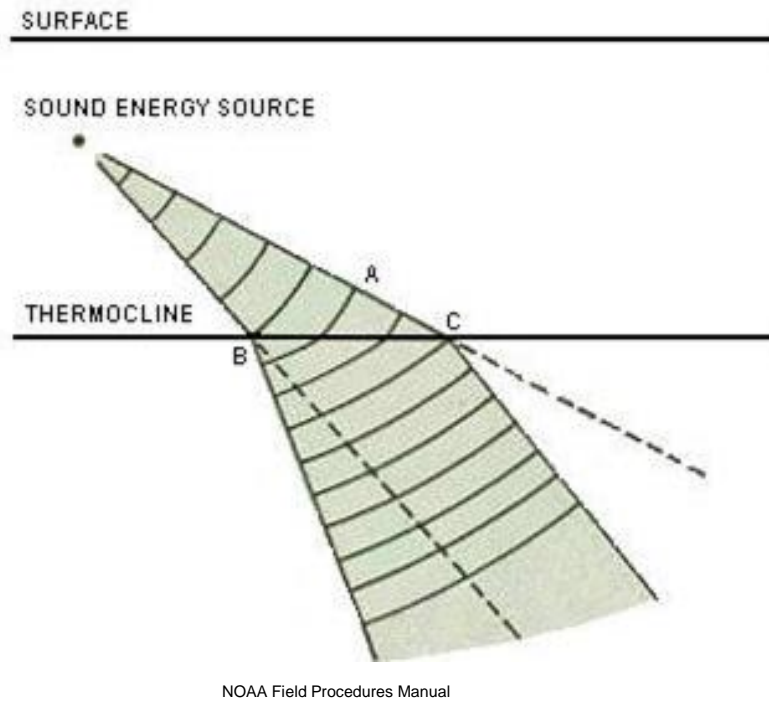


NOAA, "Bermuda: Search for Deep Water Caves," 2009. [Online]. Available: <http://oceanexplorer.noaa.gov/explorations/09bermuda>

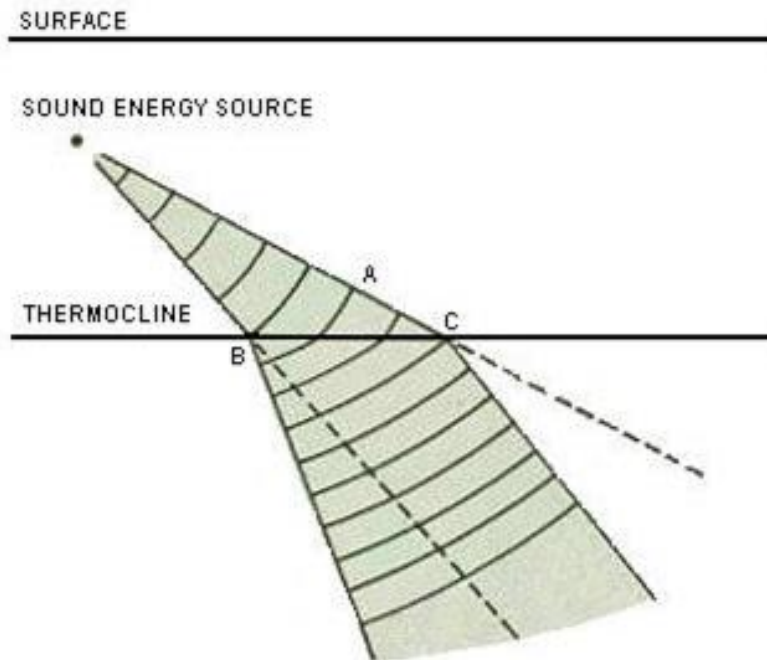
Results: Survey Swath Width



Results: Possible Improvements

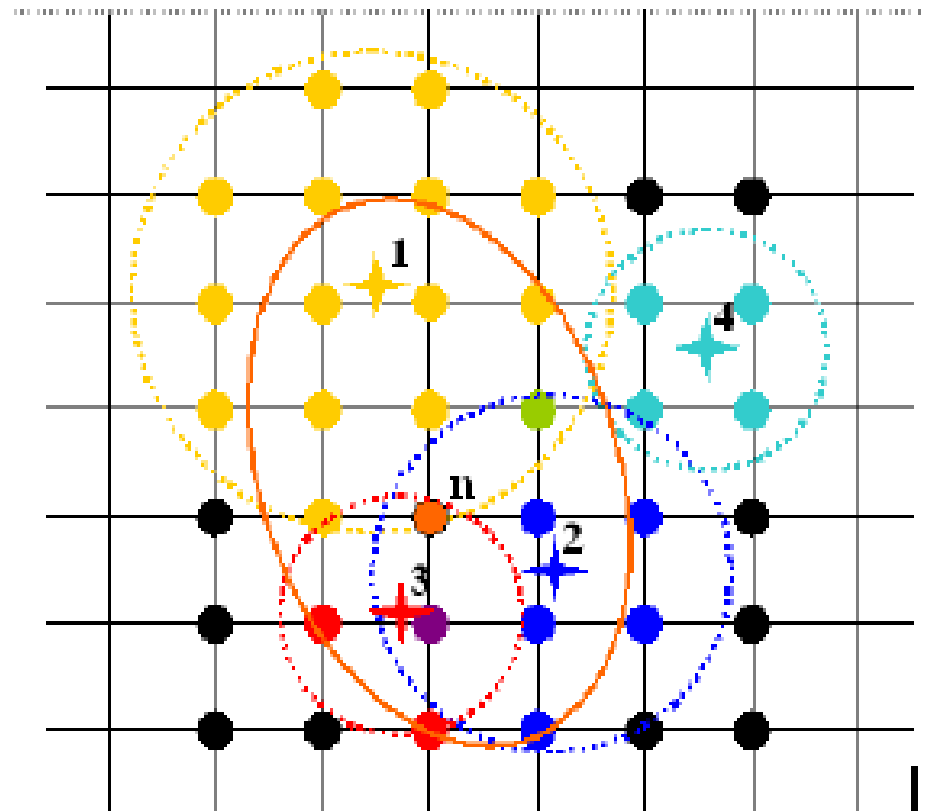


Results: Possible Improvements



NOAA Field Procedures Manual

- Additional corrections
 - Patch tests for roll/pitch calibration
 - Better positioning (RTK GPS)
 - Tide models/data/tide gauge



NOAA Field Procedures Manual