Crowd Source Bathymetry and its potential for Merchant Mariners

Rear Admiral Nick Lambert
National Hydrographer
UKHO

Objectives

- What is Crowd Source Bathymetry?
- What Does the Hardware look like?
- What were the results of the trial?
- What do you get?
- What does this activity / data support?
- Why should passage sounding evolve now?
- What is the next step of the trial?
- Conclusion

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What is Crowd Source Bathymetry?

Definitions

Definition

- Crowdsourcing is a distributed problem-solving and production model.

Method

- Brings data gathering and crowd sourcing together, using vessels of opportunity to log depth and position data, which is then uploaded to the web for processing.

Objective

- More effective data gathering.
- To deliver better navigational situational awareness to areas of the world that are off the normal sea lanes of communications.

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What does the hardware look like?

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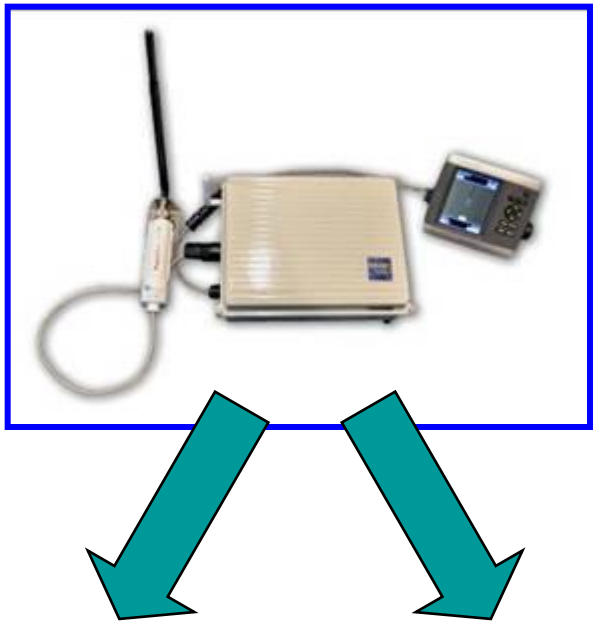
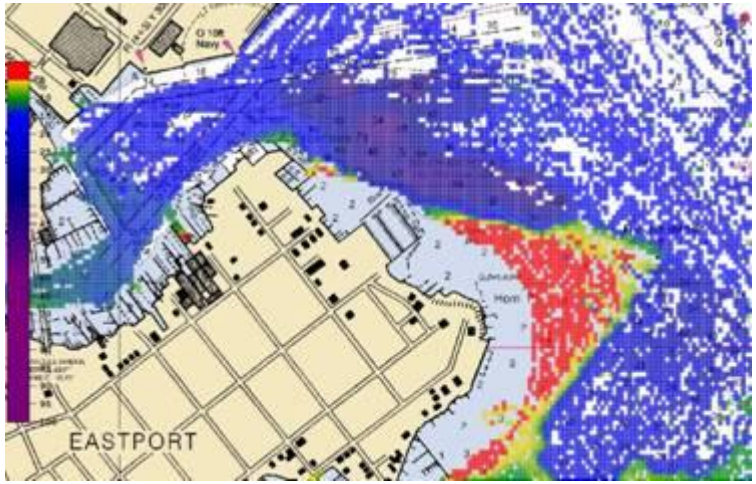
ARGUS™ Overview



- Onboard ARGUS unit connects to vessel GPS and Depth systems
- Autonomous, continuous processing of routine vessel activity – stationary (pier-side) and moving vessels
- Automatically offloads using extended-range marine WiFi , cellular, or satellite broadband
- Collective processing provides bathymetry profiles



~ Vessel operators never have to touch ARGUS ~
Completely autonomous throughput of data products to vessel fleets

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Results of the Trial

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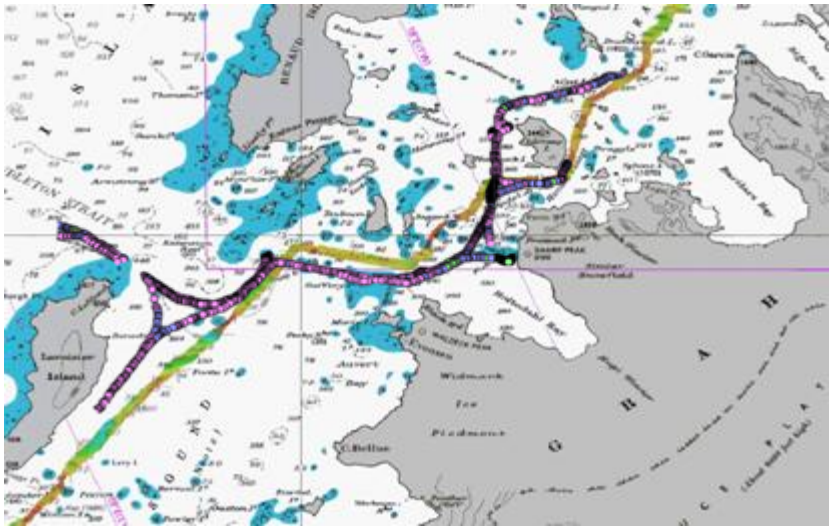
Trial Objectives and Results

- Installation of SURVICE ARGUS equipment onboard – Completed by ship's staff.
- Transmission of data back from National Geographic Explorer (NGEX) to CARIS for processing – Achieved by INMARSAT.
- Accuracy of CSB data in comparison with data held by UKHO – Good agreement seen between new NGEX data and MBES data gathered by HMS ENDURANCE.



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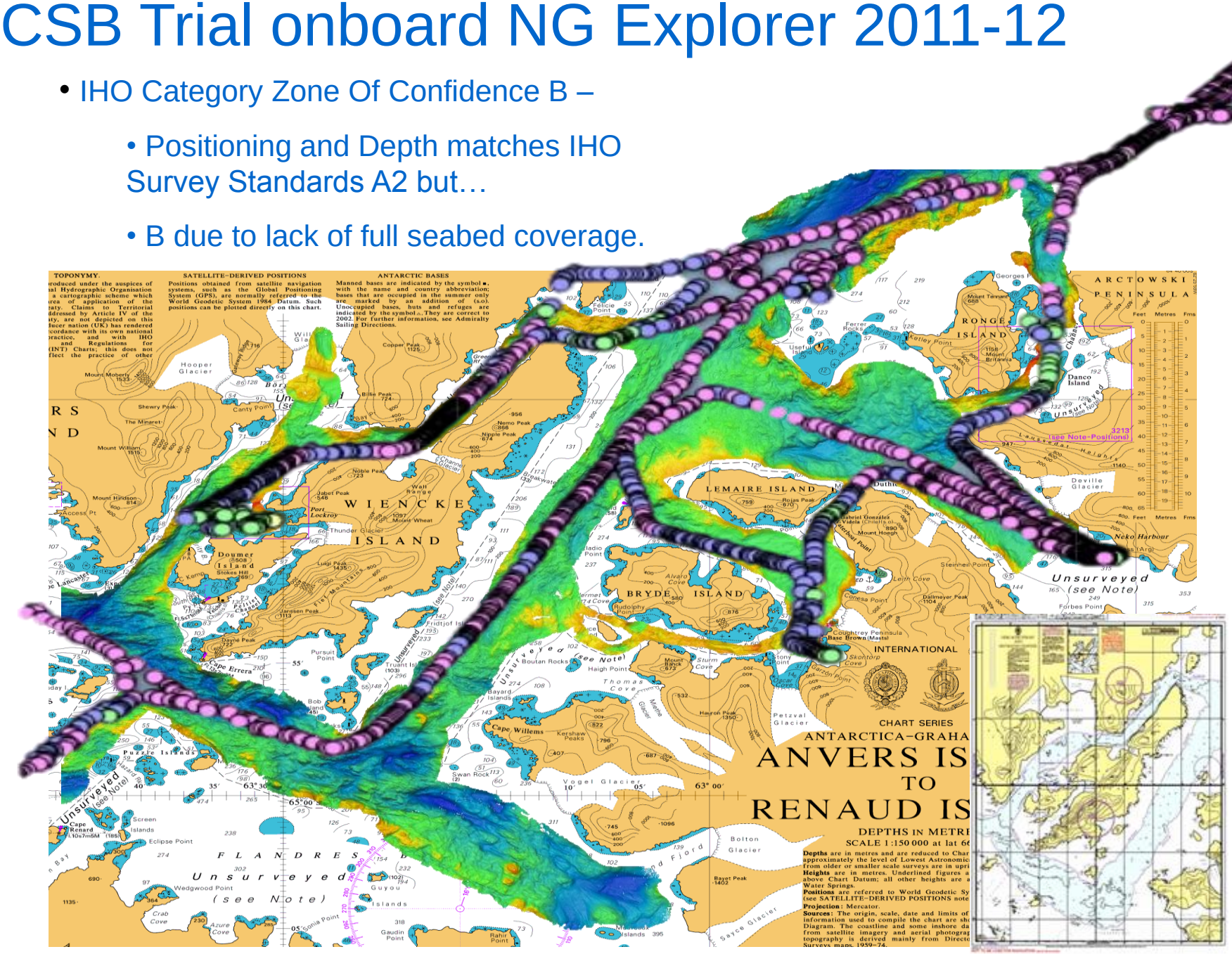
CSB Trial onboard NG Explorer 2011-12

- IHO Category Zone Of Confidence B –
  - Positioning and Depth matches IHO Survey Standards A2 but…
  - B due to lack of full seabed coverage.



Trial Summary

Ships trial initiated 2012

- Lindblad Expeditions
  R/V National Geographic Explorer
  January 2012
  12.5 million soundings
- *M/V Carnival Pride*
  June 2012
  2.5 million soundings

US coastal testing initiated 2010

- 30 commercial tow boats and recreational trawlers
- 35 million soundings

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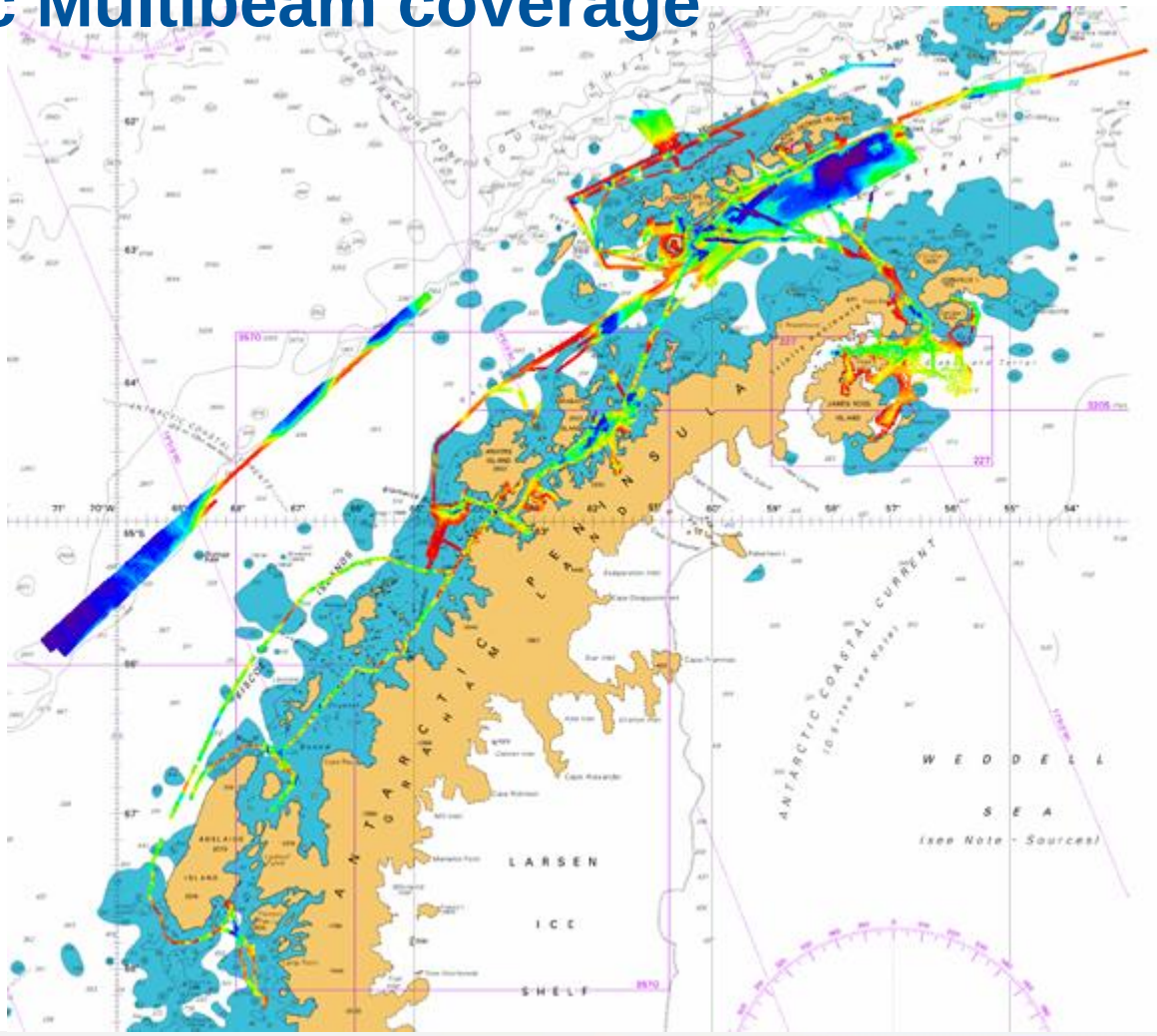
Antarctic Multibeam coverage



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What does this activity / data support?

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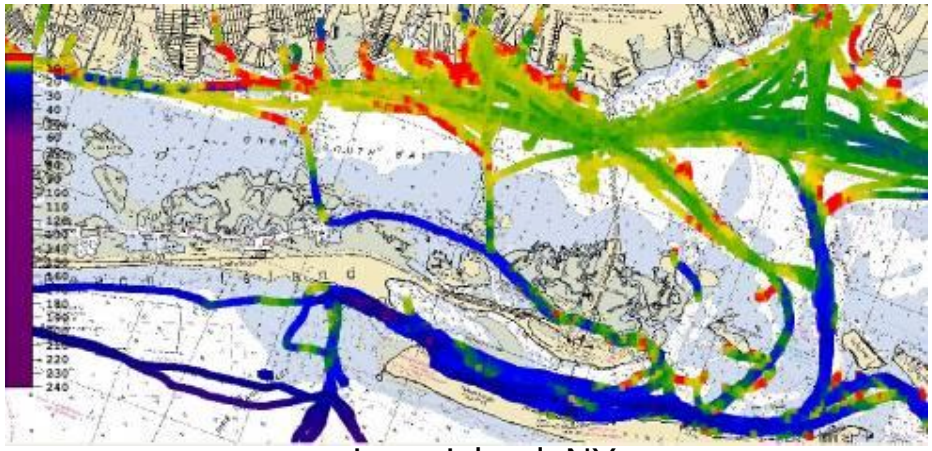
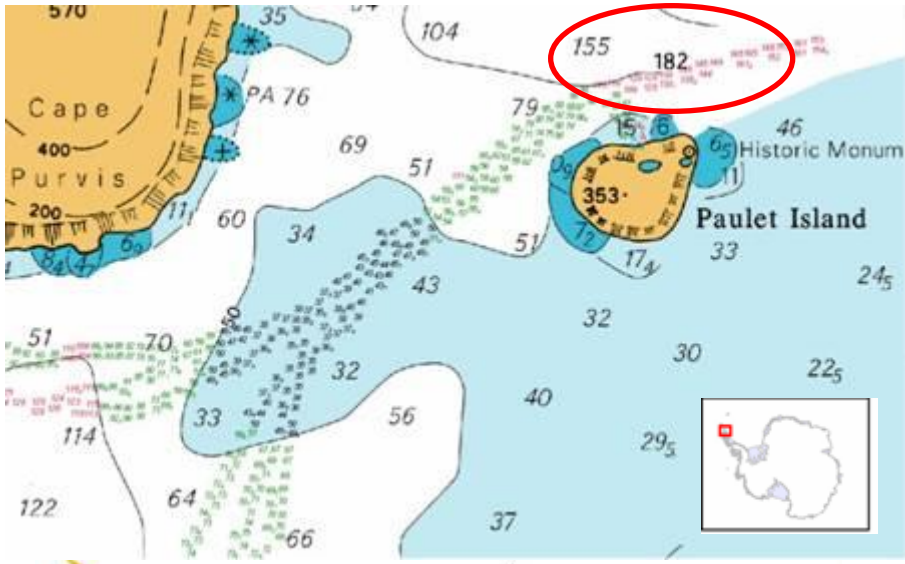
Charting and Navigation Awareness

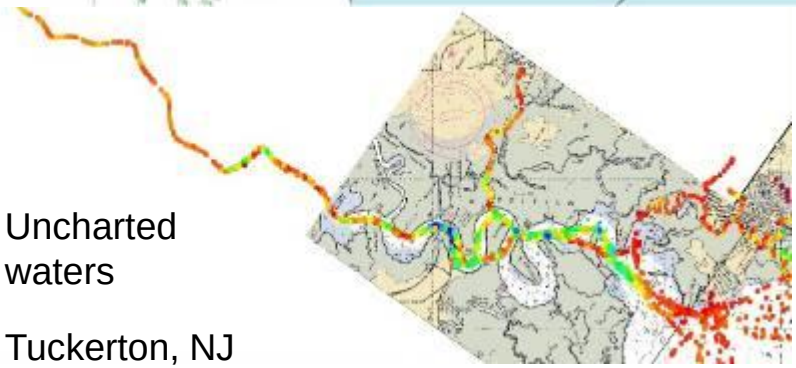


Long Island, NY

"Shoreline surveys not keeping pace with rate of shoreline change" - HSRP

Chart Comparison Paulet Island, Graham Land Antarctica.





Uncharted waters

Tuckerton, NJ

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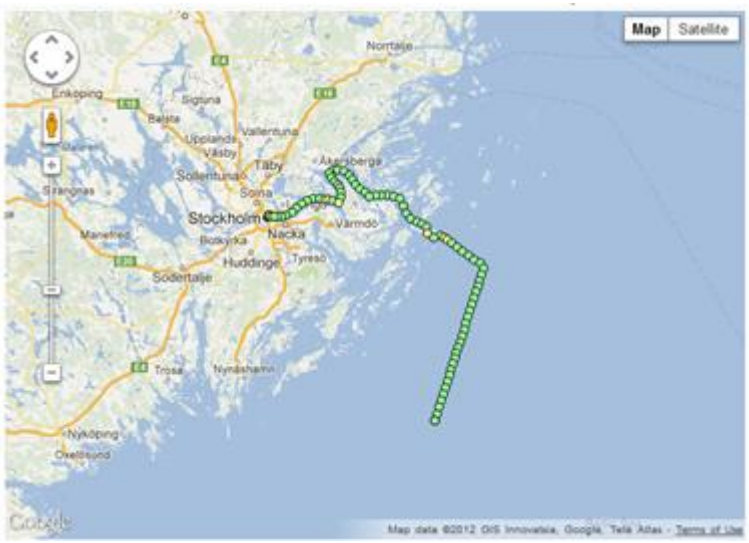
Standard Trial Outputs

- Real-time position and depth reporting
- Historical vessel tracklines
- Fleet/crowd solution sets for areas/ports of interest
- Web-based outputs, with no additional hardware or software to install



NG Explorer Position Report - Stockholm

Crowd Solution Set – Baltimore Harbor

What do you get?

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Fleet Services

- Autonomous logging/permanent cloud storage for all vessel activity
- No operator interaction required
- No hardware or software to buy, maintain, or upgrade
- No operating system restrictions or additional module requirements
  - Full bathymetric solution sets from an international hydrographic industry leader using state-of-the-art systems, tools, and processes
- “Monthly” service provides:
  - Hardware lease (includes lifetime maintenance, repair, upgrades)
  - Real-time vessel tracking (self and other vessels)
  - Vessel trackline histories
  - Area solution sets including data from all vessel traffic (crowd solutions)
  - Web browser product delivery with nautical chart layers
- In development
  - Continuous, real-time solution updates
  - Solution layers for ECDIS units and nautical charts
  - 3D visualizations through CARIS software
  - Data qualification for HO use

What will the UKHO use CSB data for?

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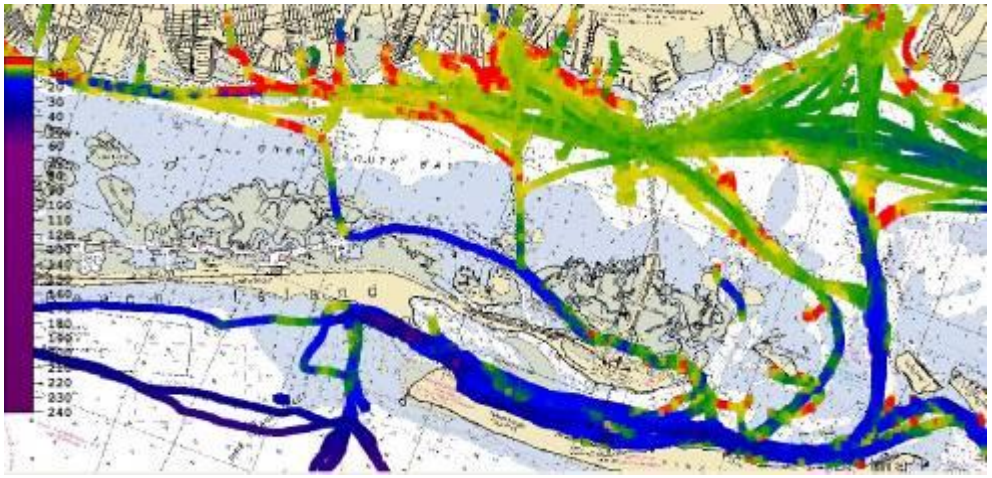
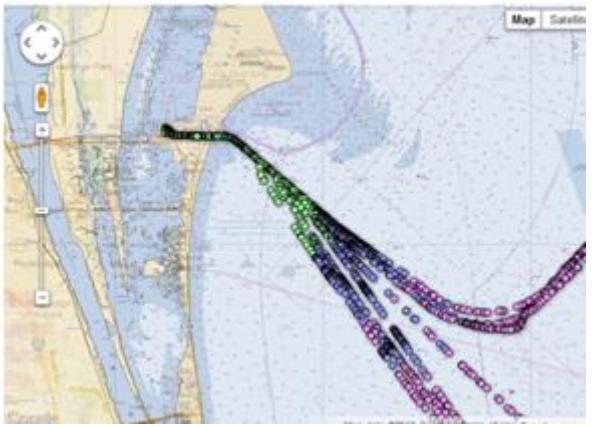
CSB contribution to Navigational Safety

- To confirm the quality of existing charts.
- To provide usage information to inform decisions to re scheme charts.
- Tidal analysis.
- Buoyage scheme analysis.





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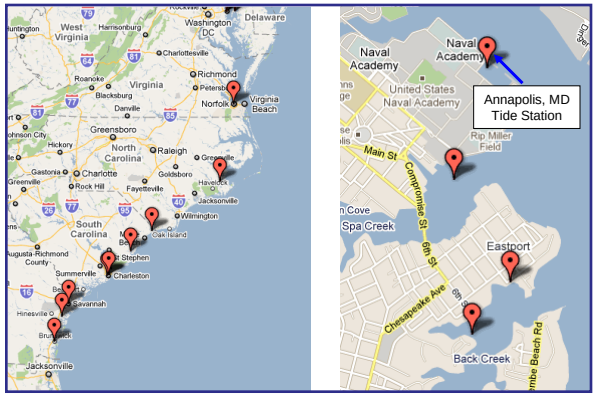
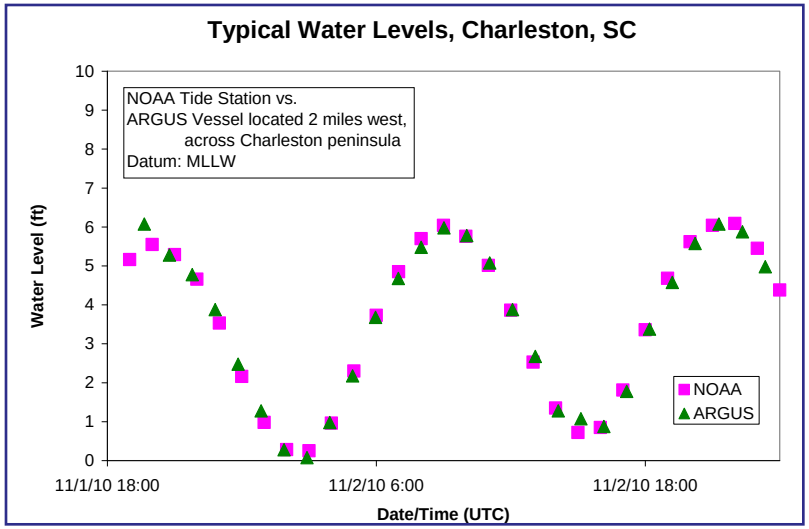
Tidal Prediction Analysis

Soundings from stationary vessels also contributes to tide corrections

Float data snippets range from minutes to consecutive days, weeks





Potential to extend and enhance current fixed-tide-station networks

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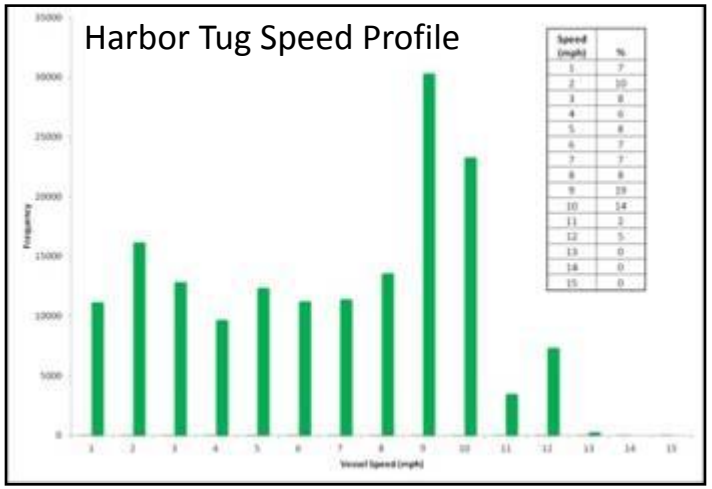
Vessel Diagnostics, Environmental Sensing

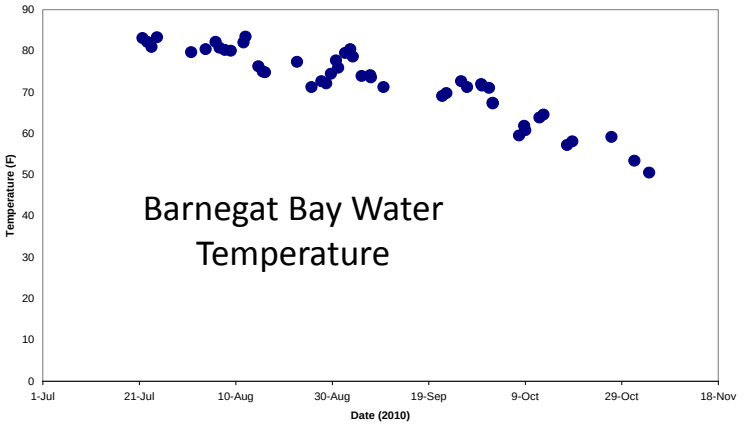


Time- and geo-referenced sampling

Weather Data
- True and apparent wind speed and direction
- Barometric pressure
- Relative humidity
- Air and wind chill temperatures

Water Quality
- Water temperature
- Salinity, pH, Conductivity, Dissolved oxygen

Vessel Systems
- Diagnostics
- Usage profiles
- Consumables tracking



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Why should passage sounding evolve now?

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Some Facts

Based on the US but a common thread world wide….

- U.S. coastal waters have ***never been completely surveyed.***
- approximately 50% of the sounding data shown on NOAA nautical charts is ***pre-1940***.
- it is expected to take NOAA and UK MCA ***over 100 years*** to survey the 500,000 square nautical miles (SNM) of navigationally significant waters using in-house and contract surveying vessels.
  - In 2008 alone, there were 322 recreational vessel groundings, resulting in 13 deaths, 241 injuries, and $3.4 million in property damage.
  - In 2004, the *Athos I* oil tanker struck a submerged object in the Delaware River, spilling 265,000 gallons of oil, costing $165 million, affecting 115 miles of shoreline, and having disastrous effects on marine life.

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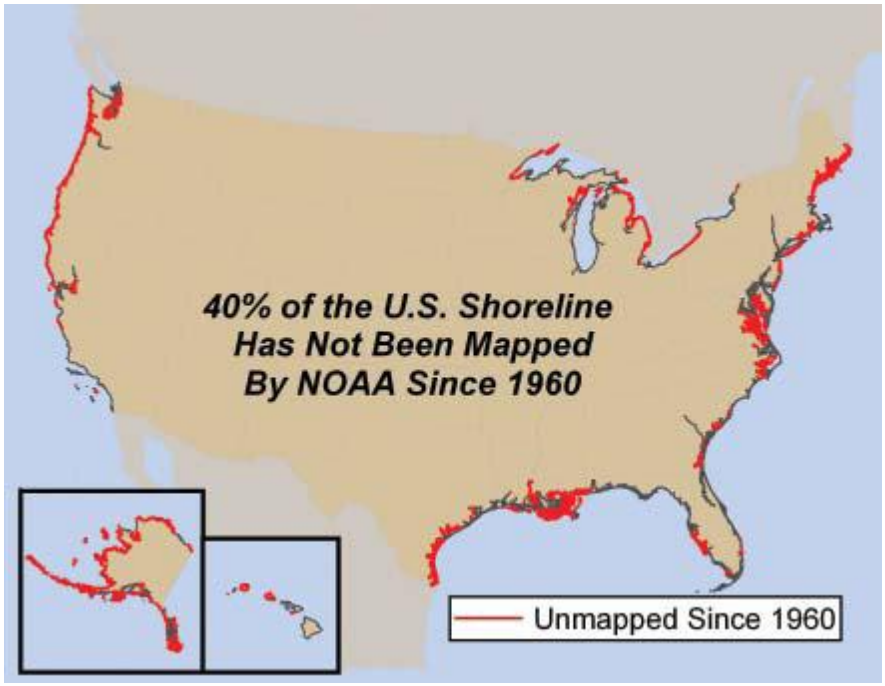
Current State of Surveying (United States – An Example)

What one vessel passes over, without knowing, or caring for that matter, is potentially of significance to any vessel with a deeper draft.



- NOAA finds new hazardous obstructions at an average rate of about 2.5 per day, but **only within the areas that NOAA surveys**.
- ARGUS-equipped vessels **routinely transit those same remote areas that have not been surveyed in over 70 years**, and for which there are no foreseeable plans or resources to survey.

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More Facts

- ARGUS provides cooperative hydrographic surveying of coastal and inland waterways… the potential for this capability has been proven in the Antarctic Peninsula.
- The resources for data gathering are reducing whilst the need is expanding.
- NOAA has lost 64% of it units in last 10 years
- More innovation required to support data gathering.

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What is the next step for the trial?

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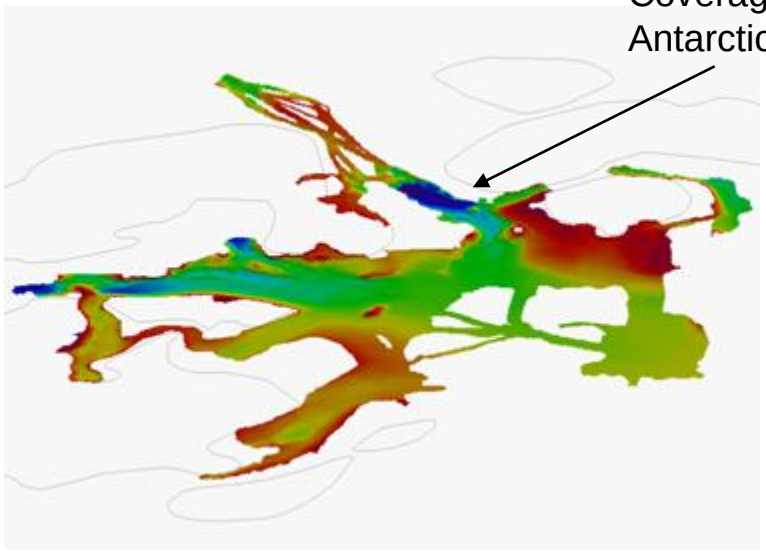
Developing Navigational Situation Awareness Products

- To develop the products and services that bring a real benefit to the Maritime community:
  - Rapid turn around of CSB data for availability of other members in the crowd.
  - Provision of baseline of value added products that bring greater awareness of the maritime environmental challenges.



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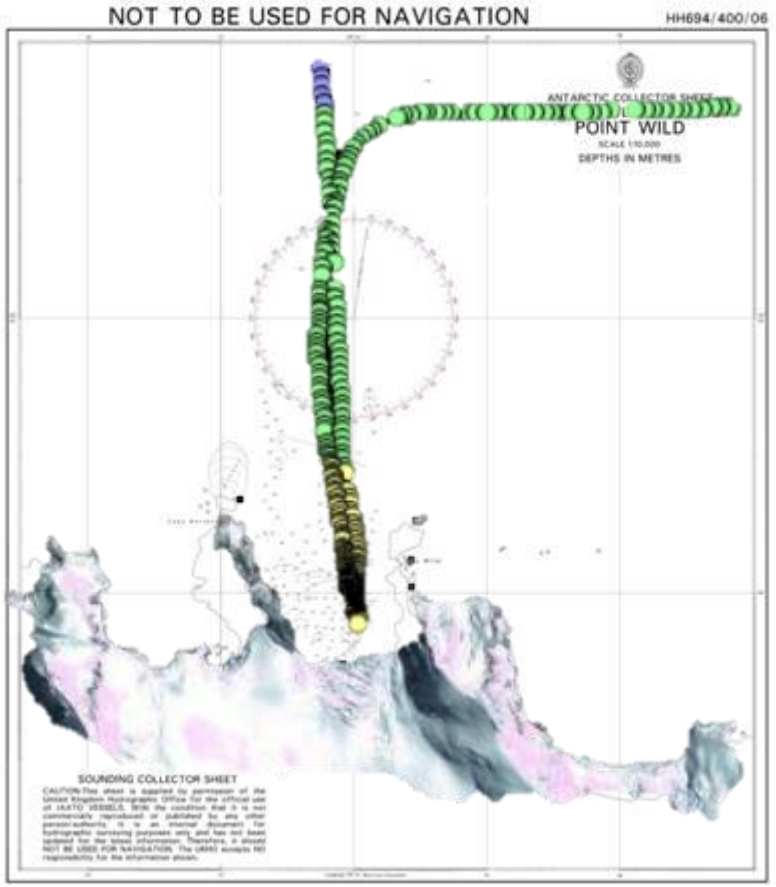
Proposed Point Wild Graphic

PROPOSED NEW CSB SHEET

EXISTING COVERAGE



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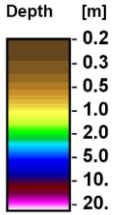
CSB in association with other emergent data gathering technology

• Satellite Derived Bathymetry – CSB provides valuable ground truth data to improve the accuracy of bathymetry products.



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Conclusions

- Low cost
- Low impact on host vessels operations
- Contributes to:
  - Safety of Navigation:
    - Validation of existing products.
    - Provides ground truthing for LIDAR and Radiometric Surveys.
    - Information of chart schema and scale.
- Contribution to local economies:
  - Improved charts enabling greater port access.
- Contributes to greater understanding of the Marine Environment

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Questions

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