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Crowd Source Bathymetry

Potential and Use



Definition of CSB

■ Definition

- Crowd sourcing 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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CSB Trial 2011-2012



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Hardware



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

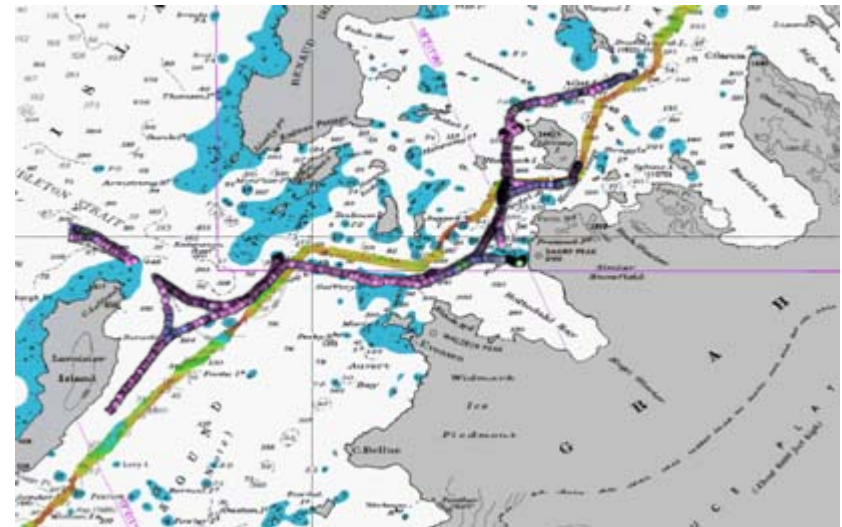


~ Vessel operators never have to touch ARGUS ~
Completely autonomous throughput of data products
to vessel fleets



Trial Objectives

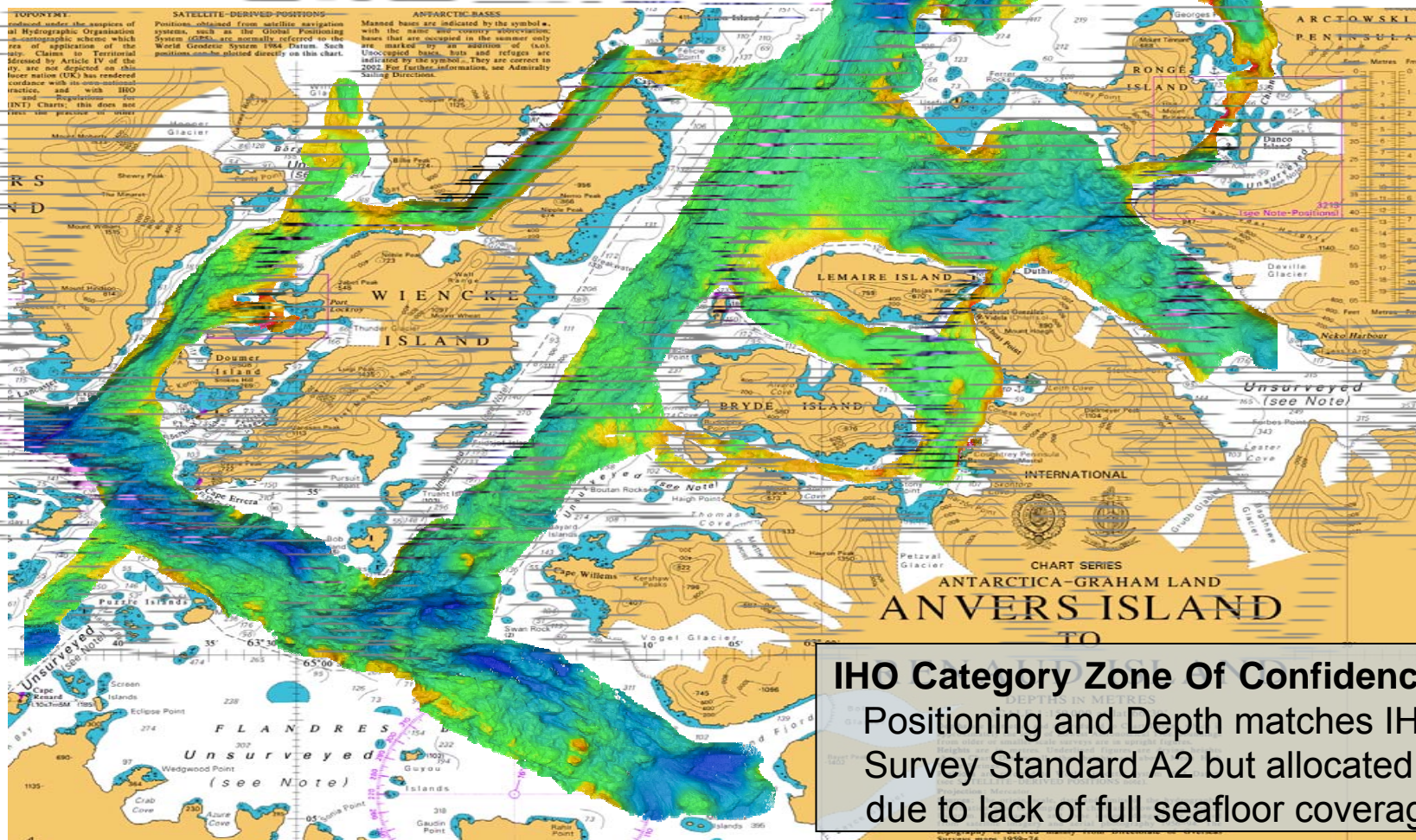
- Installation of SURVICE ARGUS equipment onboard – *Completed by ship's crew*
- Transmission of data back from National Geographic Explorer (NGEX) to CARIS for processing – *Achieved by INMARSAT*
- Accuracy of CSB data in comparison with data held by UKHO – *Good agreement between new NGEX data and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





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Trial Results



IHO Category Zone Of Confidence B
Positioning and Depth matches IHO Survey Standard A2 but allocated B due to lack of full seafloor coverage



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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

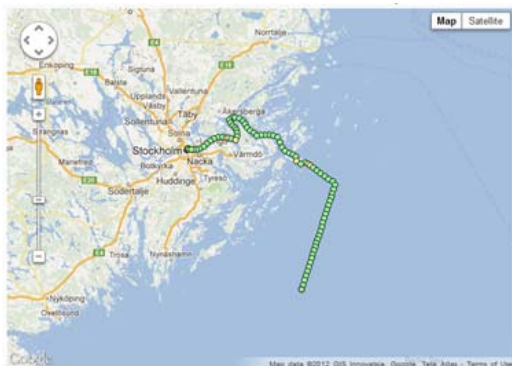
US coastal testing initiated 2010
30 commercial tow boats and recreational trawlers
35 million soundings





Standard Trial Outputs

- Real-time position and depth reporting
- Historical vessel track lines
- Fleet/crowd solution sets for areas/ports of interest
- Web-based outputs, with no additional hardware or software to install
- Depths recorded up to 750m during trial
- No tidal data recorded during trial



NG Explorer Position Report - Stockholm



Crowd Solution Set – Baltimore Harbor



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What use is CSB?



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Antarctica - cruise ships





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Popular with cruise ships

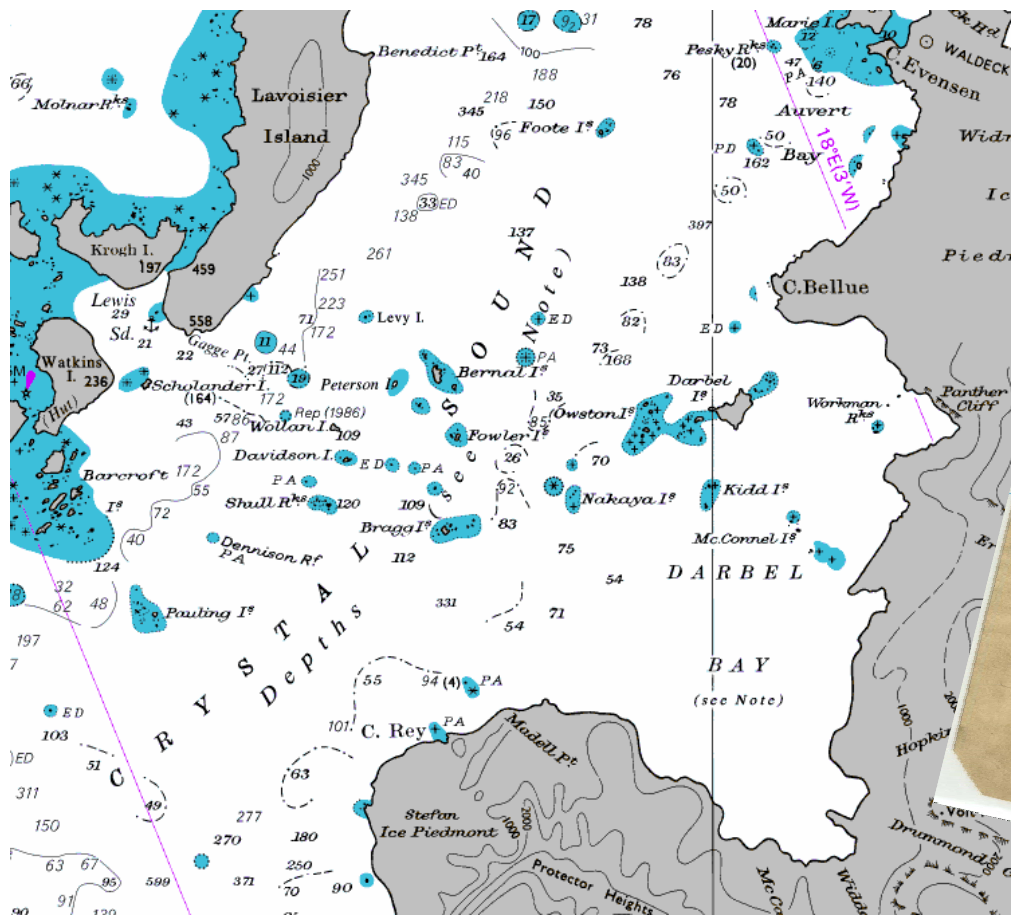


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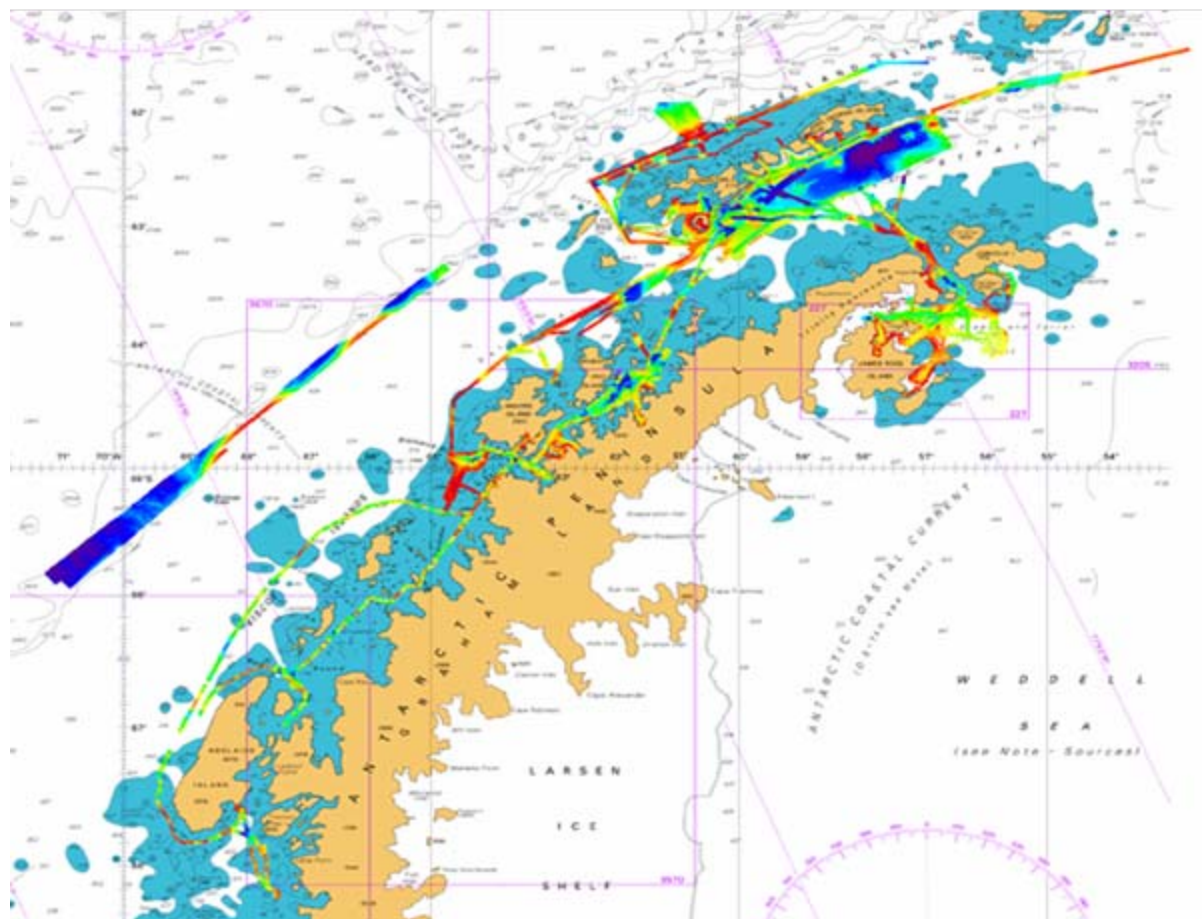
Old charts and surveys!





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Antarctic MBES Coverage



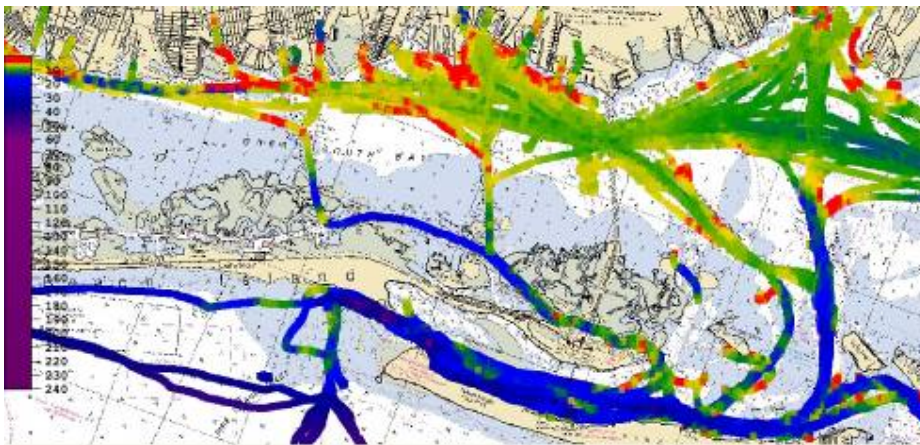
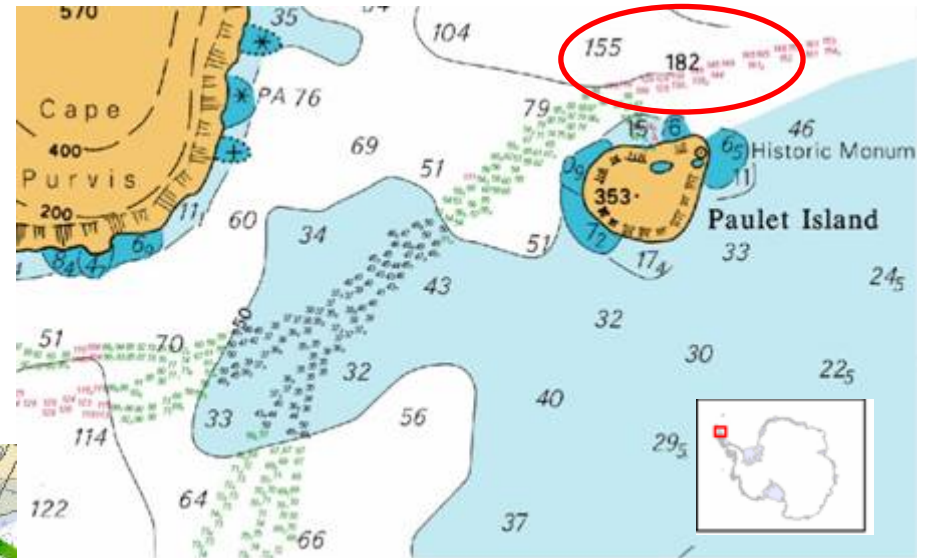
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Chart & Navigation Awareness

Chart Comparison
Paulet Island, Graham Land
Antarctica



Long Island, NY
“Shoreline surveys not keeping pace with
rate of shoreline change” - HSRP



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How will UKHO use CSB?



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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

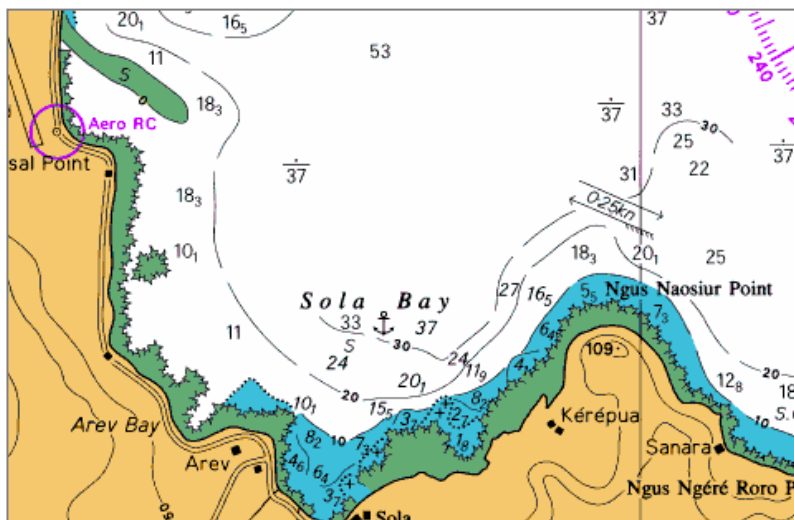
Note that due consideration will ALWAYS be given to the quality of the data set





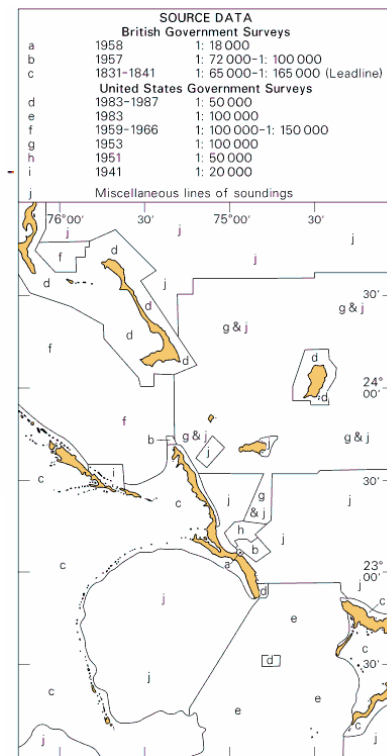
Navigational Safety

- To provide additional data in sparse areas



DEPTHS

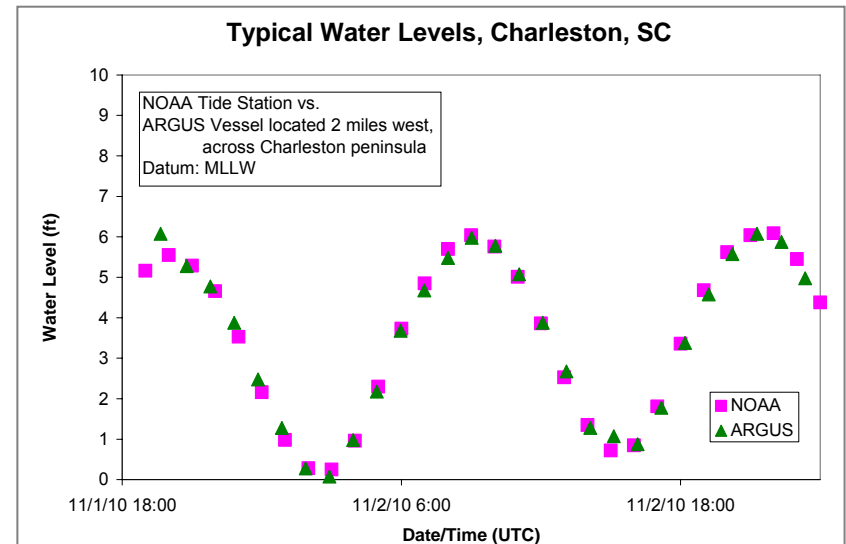
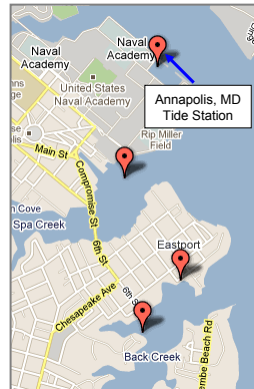
Much of this chart has **not** been systematically surveyed. Many depths are from miscellaneous lines of passage soundings or old leadline surveys. Uncharted shoals and patches of coral may exist. For further details, see the Source Data Diagram and The Mariner's Handbook which contains guidance on the use of charts based on old surveys.





Tidal Prediction Analysis

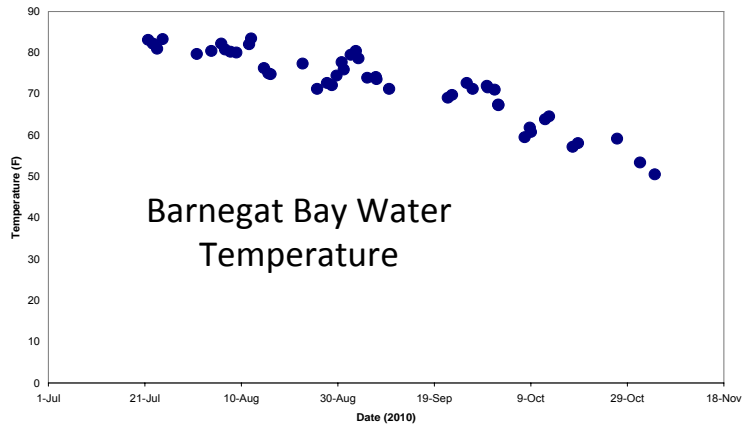
- Soundings from stationary vessels contribute to tide corrections
- Float data snippets range from minutes to consecutive days or weeks



Potential to extend and enhance current fixed tide-station networks



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

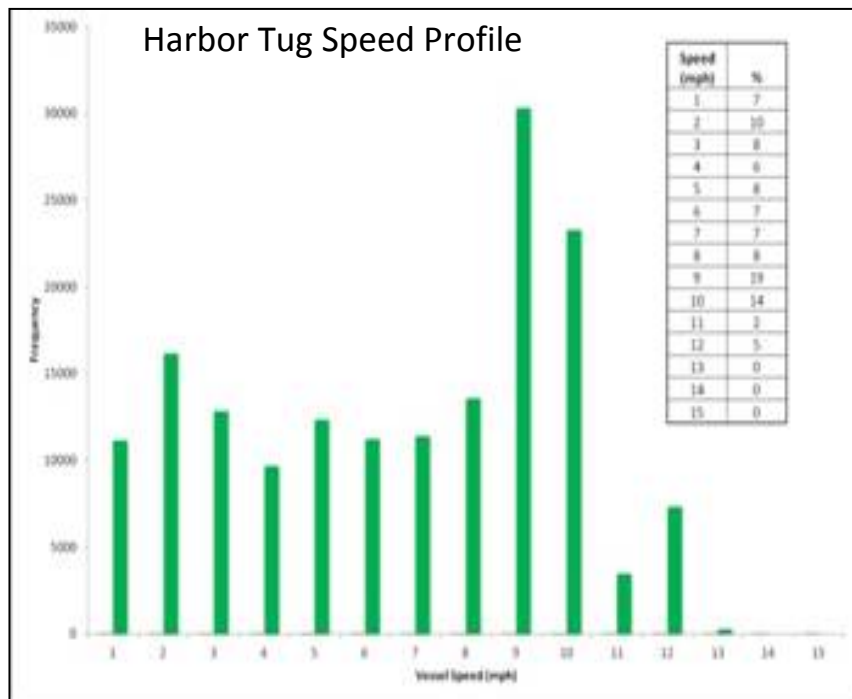
Water Quality

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





Vessel Diagnostics



Vessel Systems

- Diagnostics
- Usage profiles
- Consumables tracking



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Next Steps for CSB



Situational Awareness

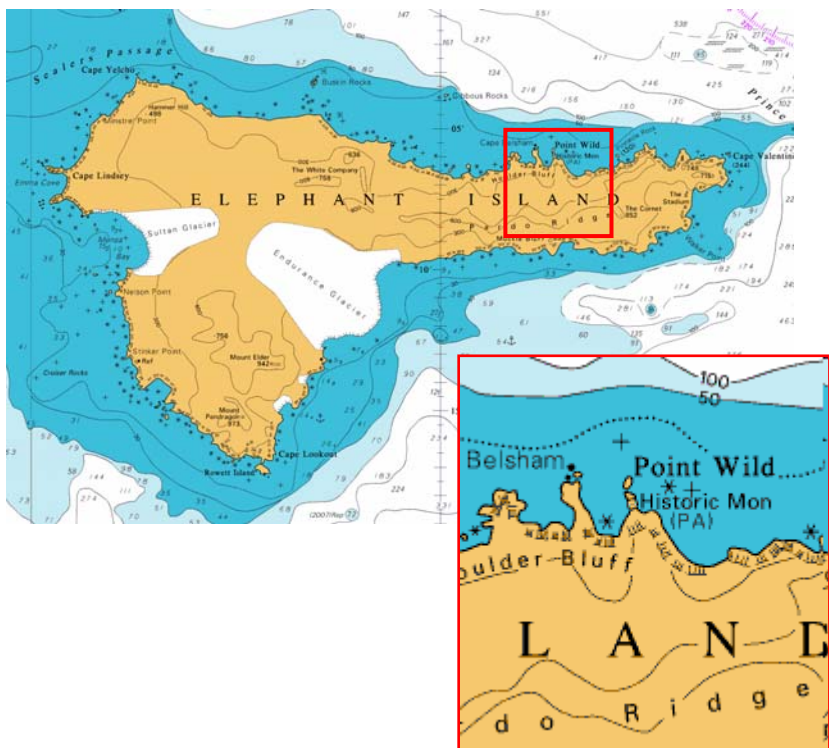
- **To develop the products and services that bring a real benefit to the Maritime community:**
 - Rapid turn around of CSB data for availability of other members in the crowd
 - Provision of a baseline for value added products that bring greater awareness of the maritime environmental challenges



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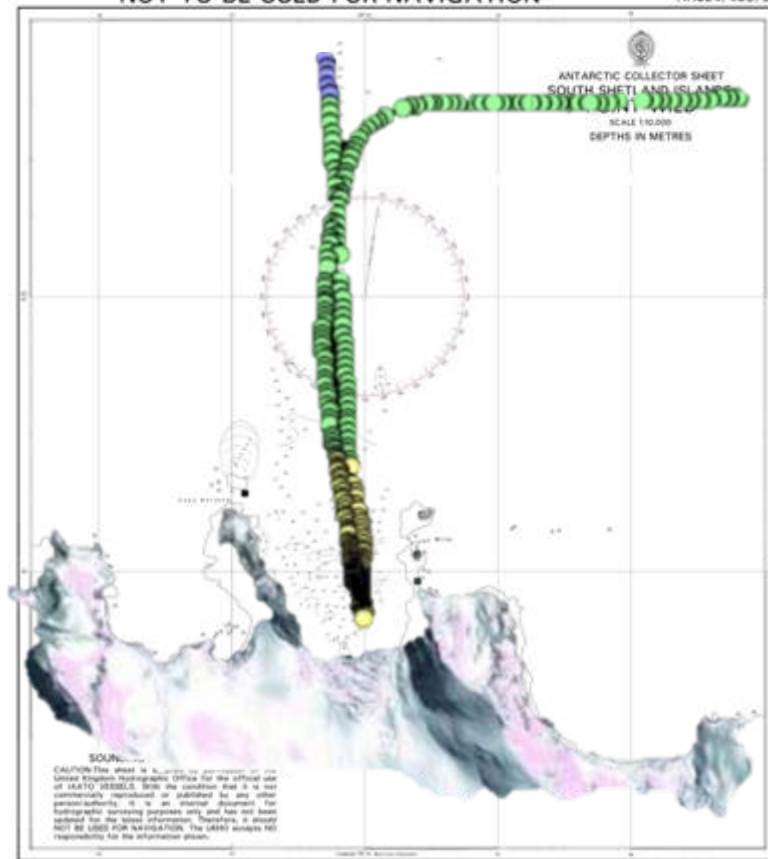
New Graphical Solutions

Point Wild - Existing Coverage



NOT TO BE USED FOR NAVIGATION

HH694/400/06

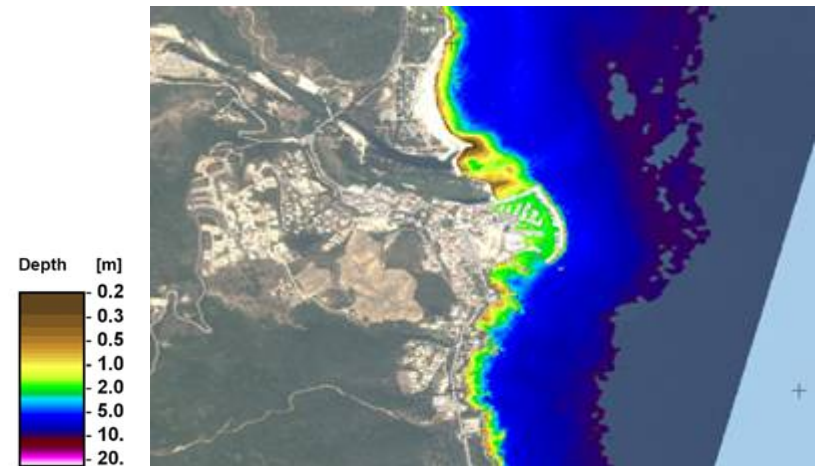


Proposed New CSB Sheet



Emergent Data Gathering

- Link with such data as Satellite Derived Bathymetry – CSB provides valuable ground truth data to improve the accuracy of new bathymetric products





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Wider Availability

■ Trial Limitations

- Not many vessels involved so benefits were perceived as limited

■ Proposal

- Upload data (with supporting metadata) to be included in GEBCO database in order to facilitate wider access

General Bathymetric Chart of the Oceans (GEBCO)

GEBCO consists of an international group of experts who work on the development of a range of bathymetric data sets and data products, including gridded bathymetric data sets, the GEBCO Digital Atlas, the GEBCO world map and the GEBCO Gazetteer of Undersea Feature Names.



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Conclusions



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Conclusions

- **Low cost**
- **Low impact on host vessel's 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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Thank you