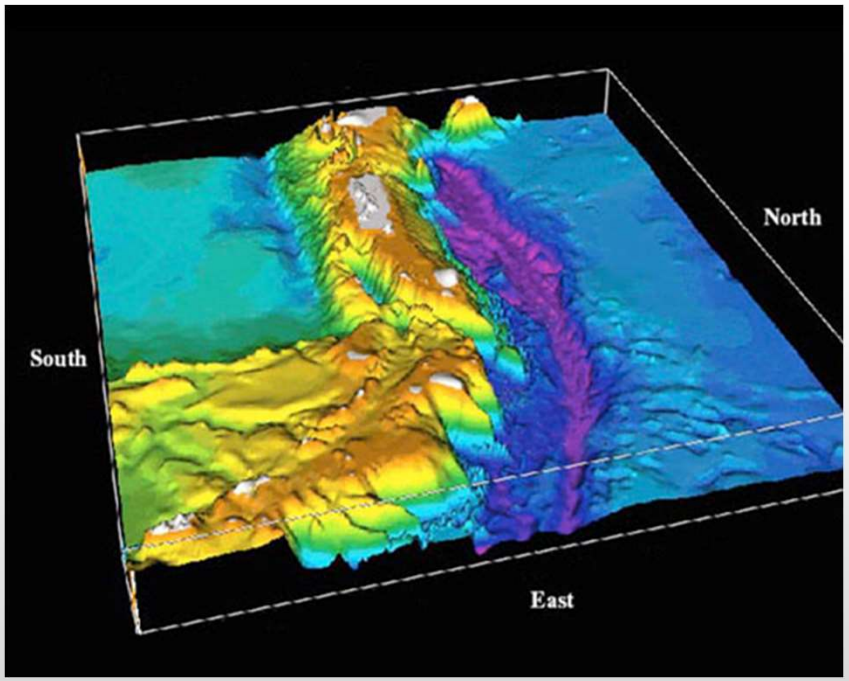
ORANGE FORCE MARINE

Crowd Sourced Bathymetry

great lakes observing system

Overview

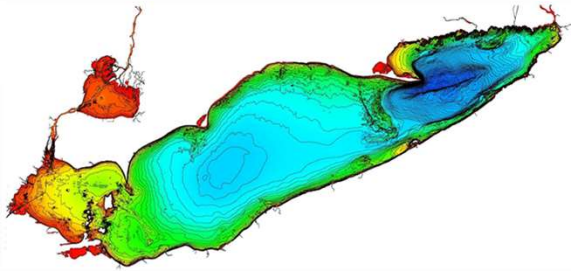
- Smart Great Lakes Initiative & Lakebed 2030
- Crowd Sourced Bathymetry (CSB)
- CSB “Mussel” Kit
- System Architecture
- Project Stages
- Next Steps



Smart Great Lakes Initiative

- Multiple Sensors throughout the Great Lakes
- Near Real-time Data Collection & Transmission
- Data publicly available via Portals
- “Seagull” Platform being rolled out
  - Bathymetry layer

Lakebed 2030



- Extension of Seabed 2030, but focussed on Great Lakes
- Only 6% of Great Lakes survey to any degree of accuracy
  - 100-2500m between soundings
  - Most surveys from the 1950-1960s
- Mapping via traditional survey means (MBES, LiDAR, SDB) has extensive cost ($130-$200M)
- Crowd Sourced Bathymetry as an alternative and additional option

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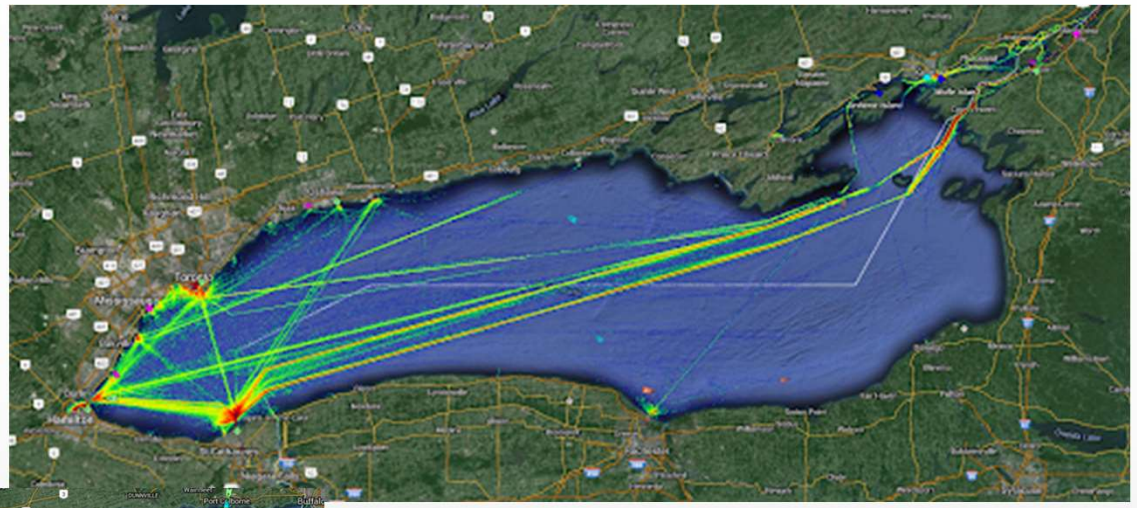
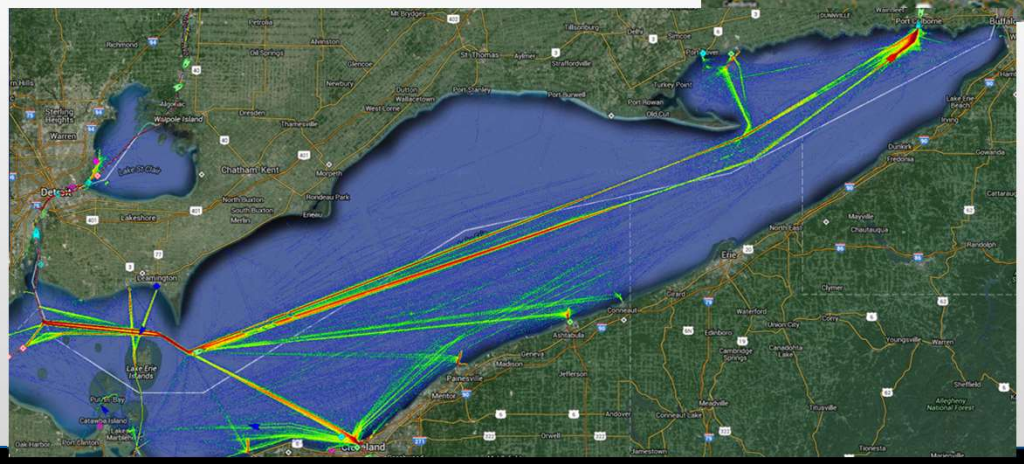
Vessel Traffic

great lakes observing system





Crowd Sourced Bathymetry

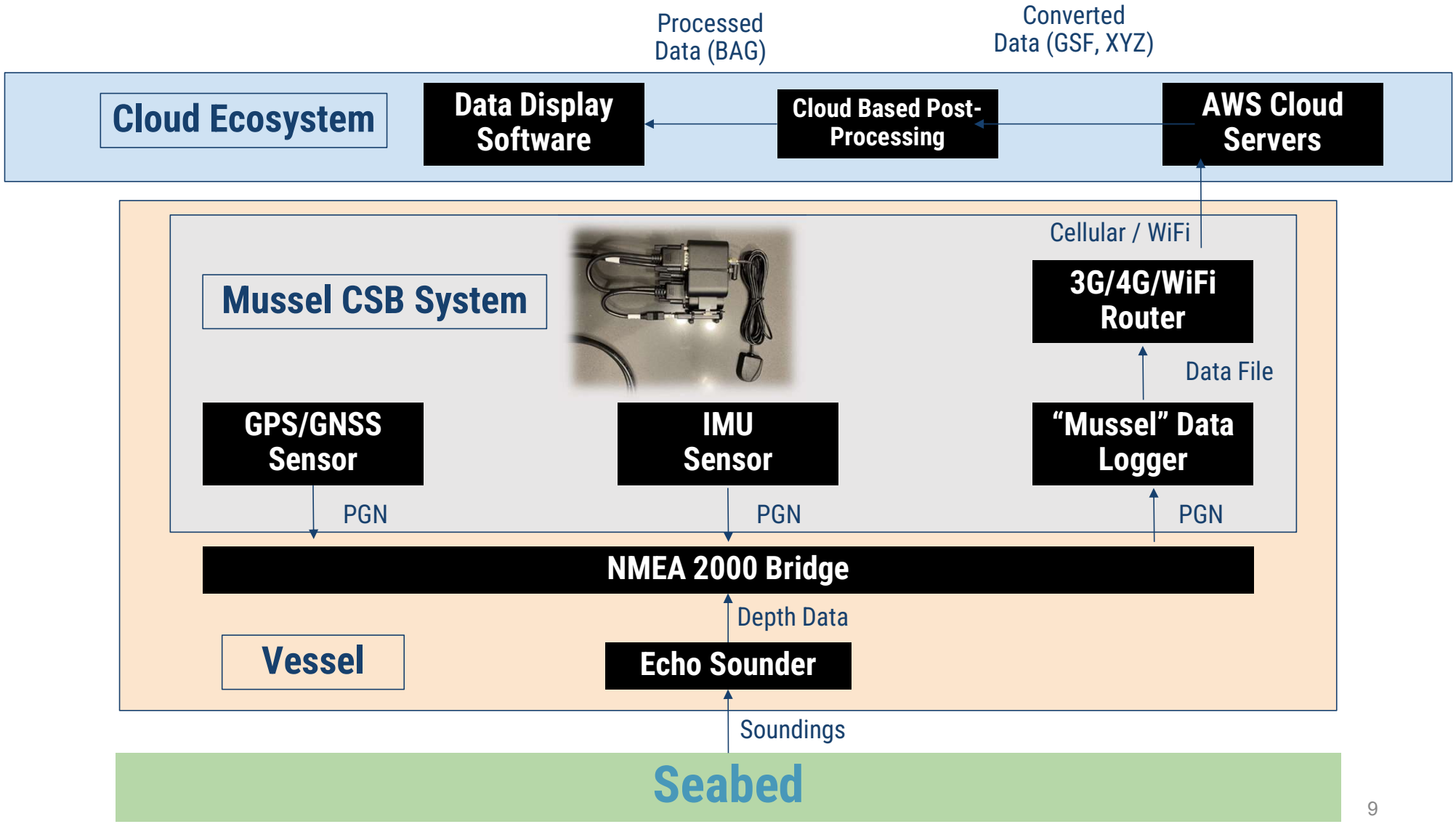
- Collection of bathymetric data by the public or distributed sources
- “Piggy-back” on existing vessel operations in a non-conflict posture
- Uses organic vessel sensors, not specialized survey gear
- **Challenge has always been getting the data ashore**

“Mussel” CSB Kits

- OFM developed assembly & software
- “Hands off”, Automated and Non-Intrusive
- “Plug and Play” (**NMEA 2000** & 0183)
- Integrated Inertial Measurement Unit & GPS
- WiFi and Cellular connectivity
- **Near Real Time Data Transmission Ashore**

“Mussel” Installation

- Pre-configuration by OFM
- Placement in ideal location (for IMU, Cellular, wiring)
- Non-permanent
- Plug into existing electronics suite and integration with existing sensors
- Measuring of Vessel Offsets (GPS to Sounder to IMU)
- Less than 1 hour for installation


Processed
Data (BAG)
Converted
Data (GSF, XYZ)
Cloud Ecosystem
Data Display Software
Cloud Based Post-Processing
AWS Cloud Servers
Cellular / WiFi
Mussel CSB System
3G/4G/WiFi Router
Data File
GPS/GNSS Sensor
IMU Sensor
"Mussel" Data Logger
PGN
PGN
PGN
NMEA 2000 Bridge
Depth Data
Vessel
Echo Sounder
Soundings
Seabed

Data Collection

- System automatically on / off with vessel electronics
- Logging of all navigation data across the NMEA network
- Compression and encryption of data
- Transmission ashore (WiFi, Cellular, storage)
- Uploaded and stored on AWS S3 servers
- Processing of Bathymetric data
- Data displayed on GIS Software
  - Option for anonymous data provision
  - Option for collector usage of data (CSV, GSF, XYZ)

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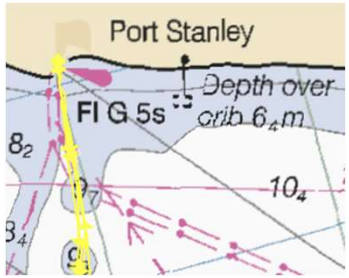
DATA VALIDATION

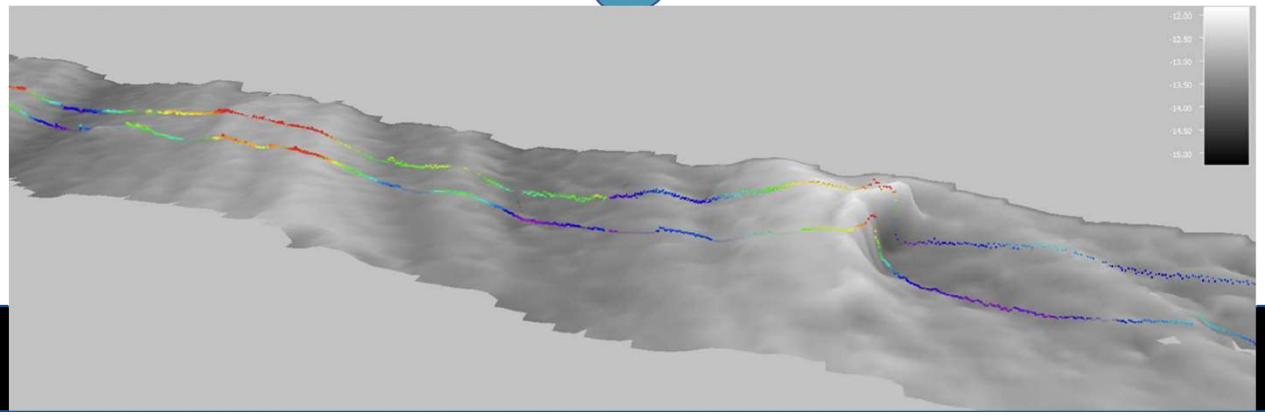
Data Collection



Step 1

Adjustment & Visualization

Step 2



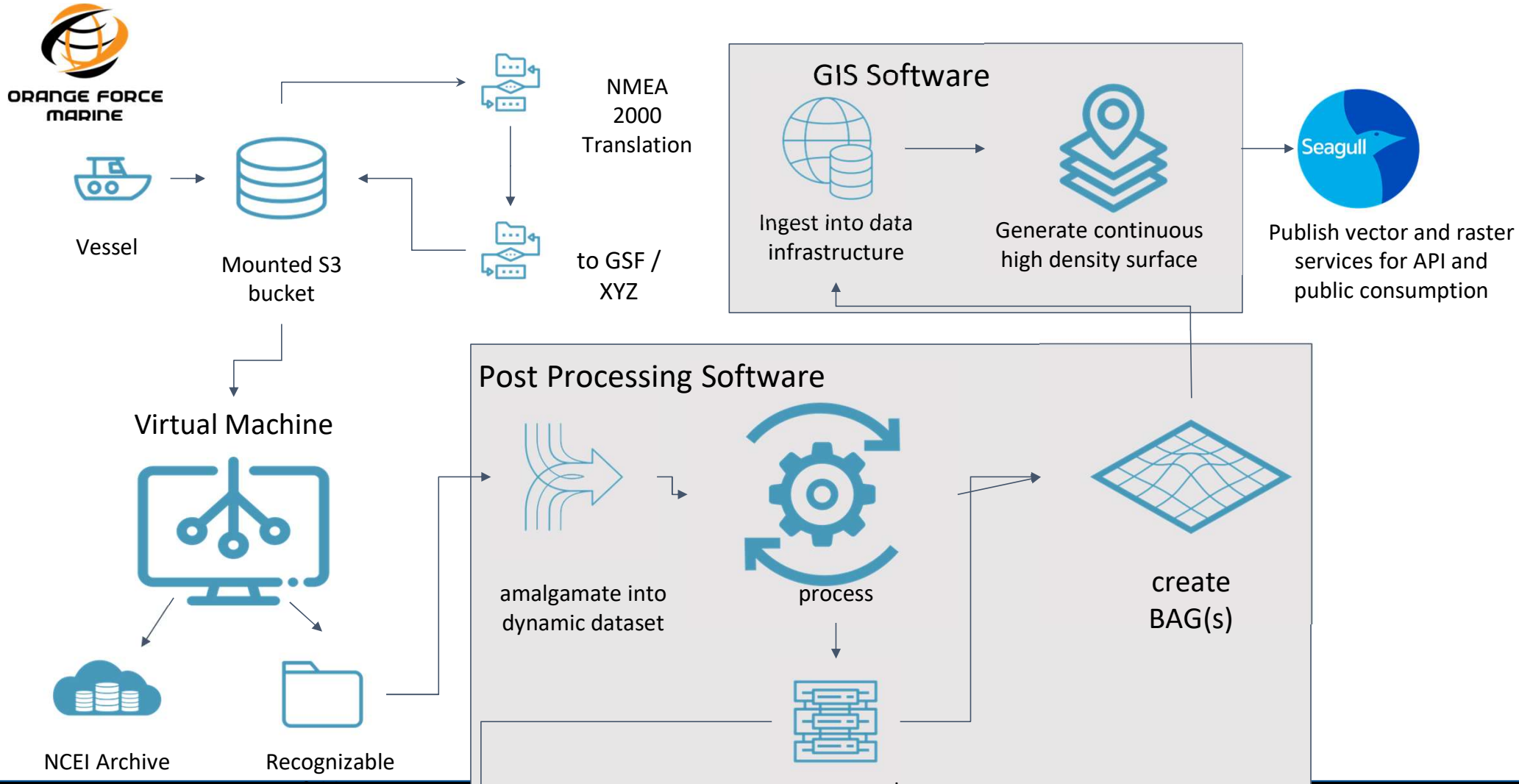
Surface-to-Surface Statistical Analysis & Point-to-Surface Statistical Analysis

Step 3

IHO
International Hydrographic Organization

Result

3-16 cm Vertical Accuracy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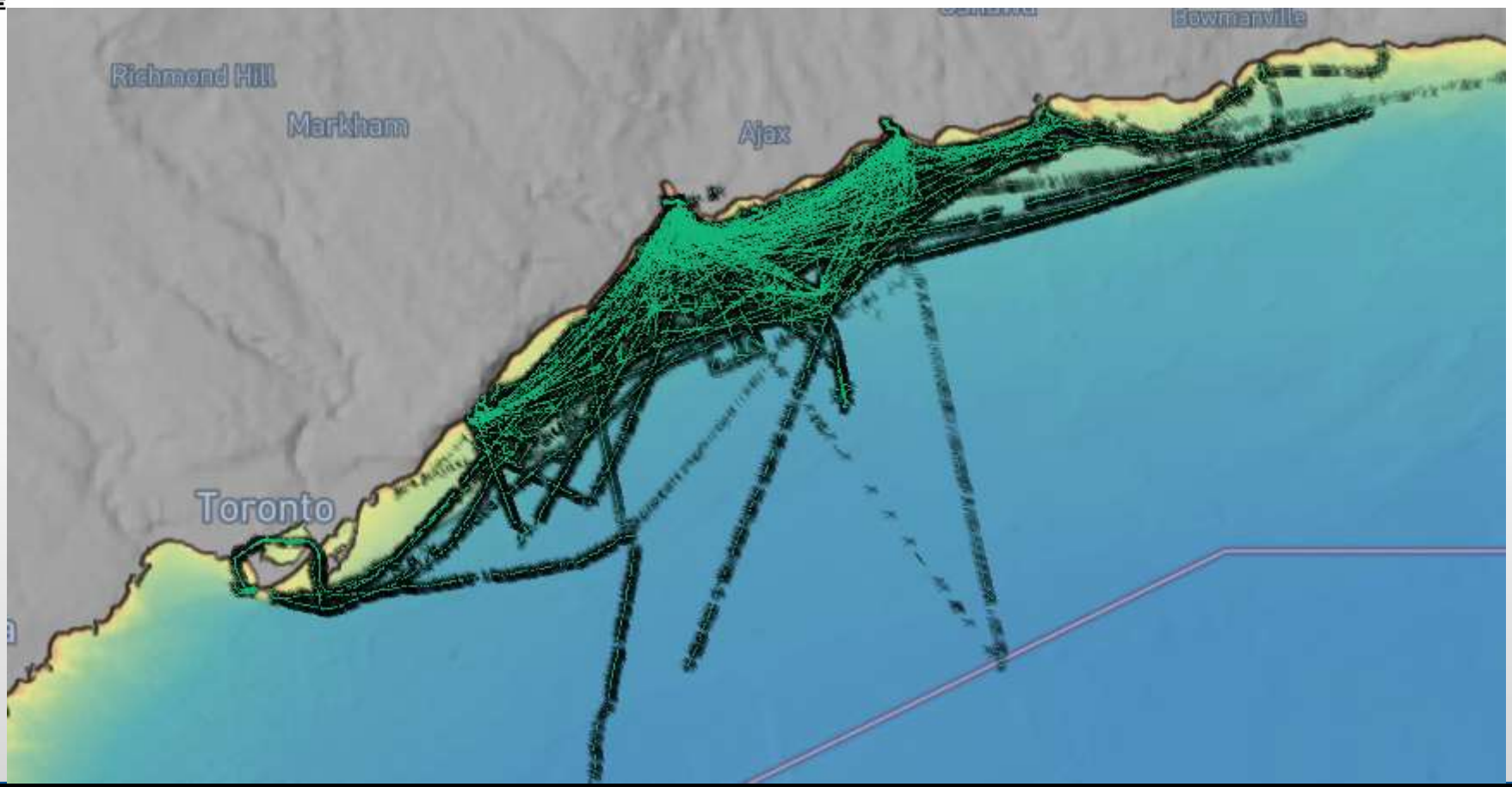
Vessel
Mounted S3 bucket
NMEA 2000 Translation
to GSF / XYZ
GIS Software
Ingest into data infrastructure
Generate continuous high density surface
Seagull
Publish vector and raster services for API and public consumption
Virtual Machine
Post Processing Software
amalgamate into dynamic dataset
process
create BAG(s)
generate metadata
NCEI Archive
Recognizable

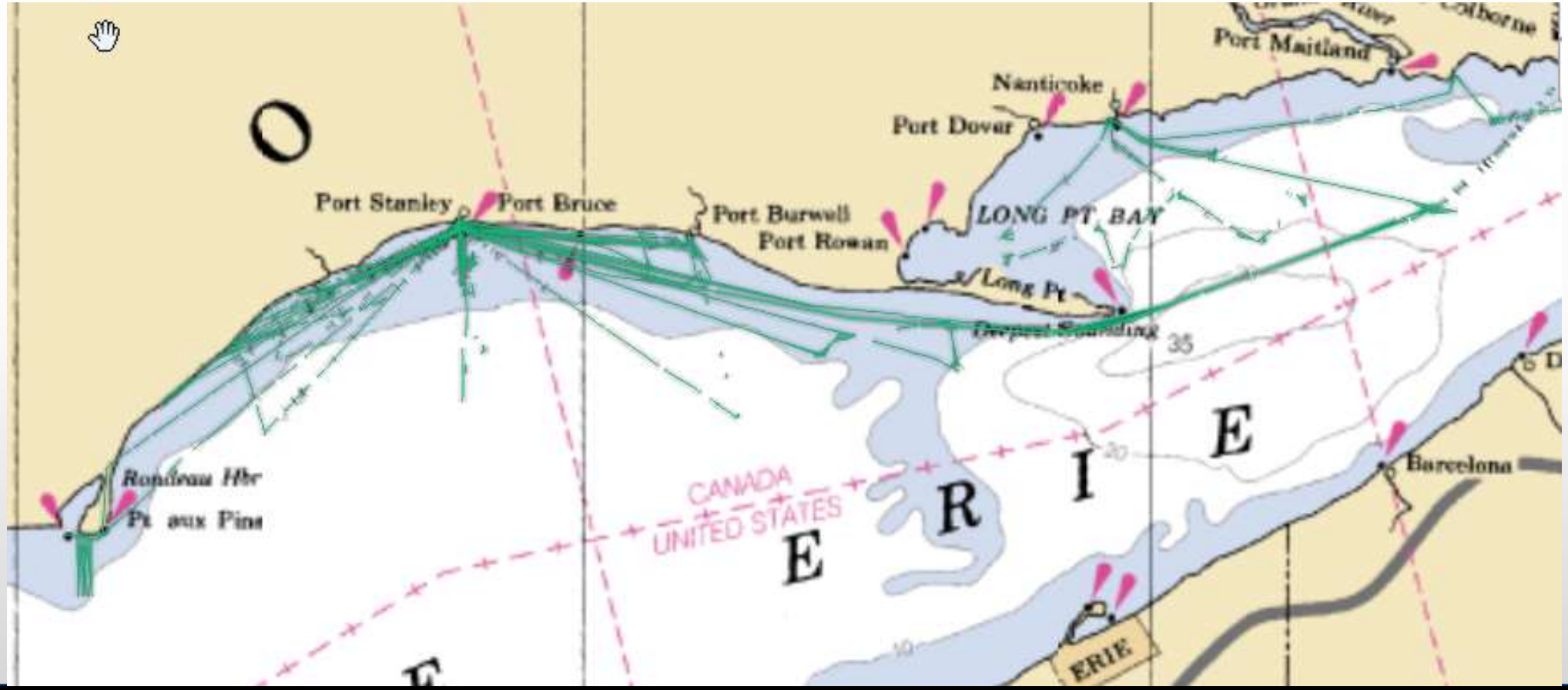
Project Stages to Date

- 2 x CSB Kits installed (Prototypes and Proof of Concept)
  - Operational since April 2021 on OFM vessels *(Phase 1)*
- 6 x CSB Kits installed in August 2021 *(Phase 2)*
  - Government, Research, Academica, First Responder vessels
- Further CSB kits to be installed for 2022 season *(Phase 3)*

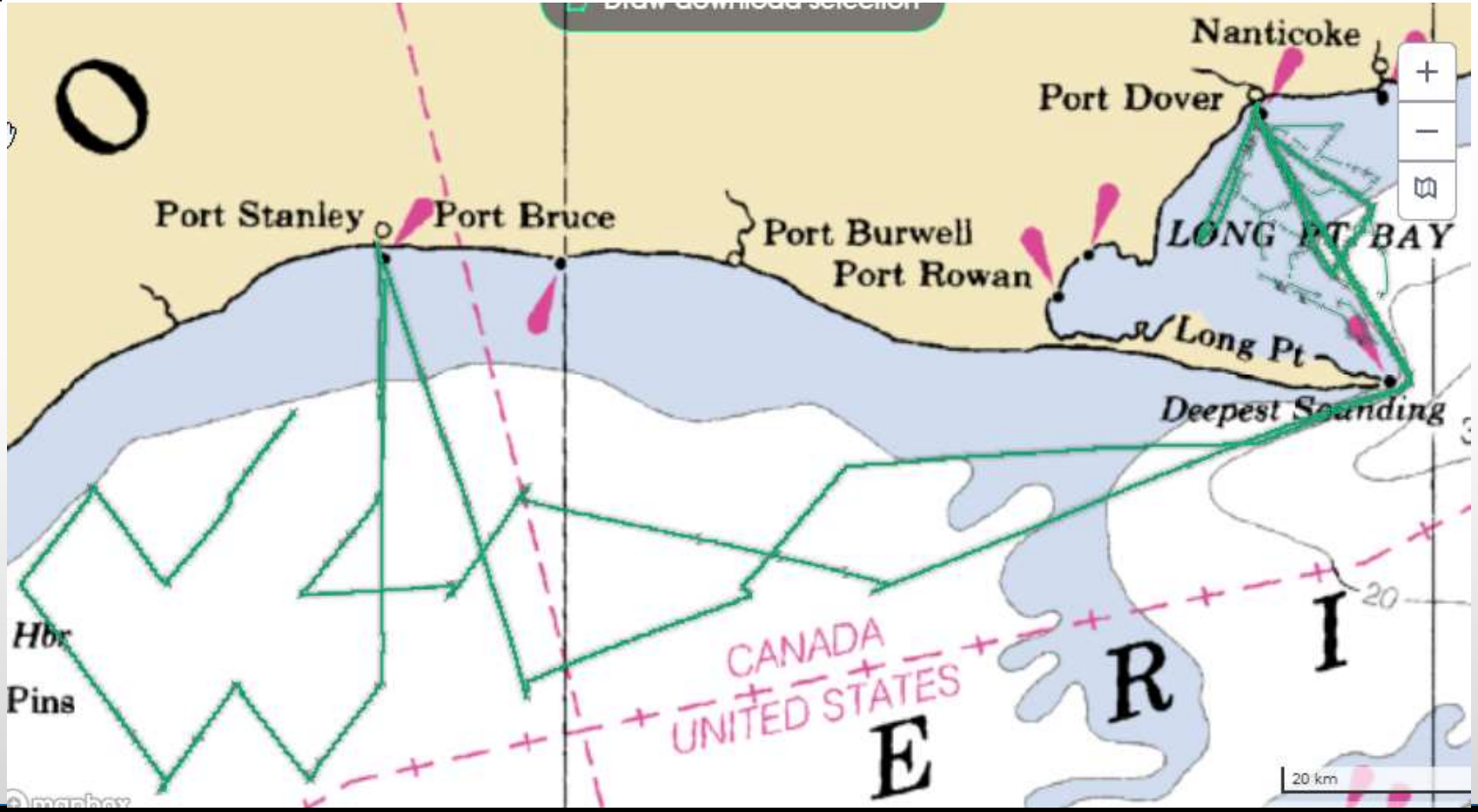
Crowd Sourced Bathymetry



Crowd Sourced Bathymetry



Crowd Sourced Bathymetry



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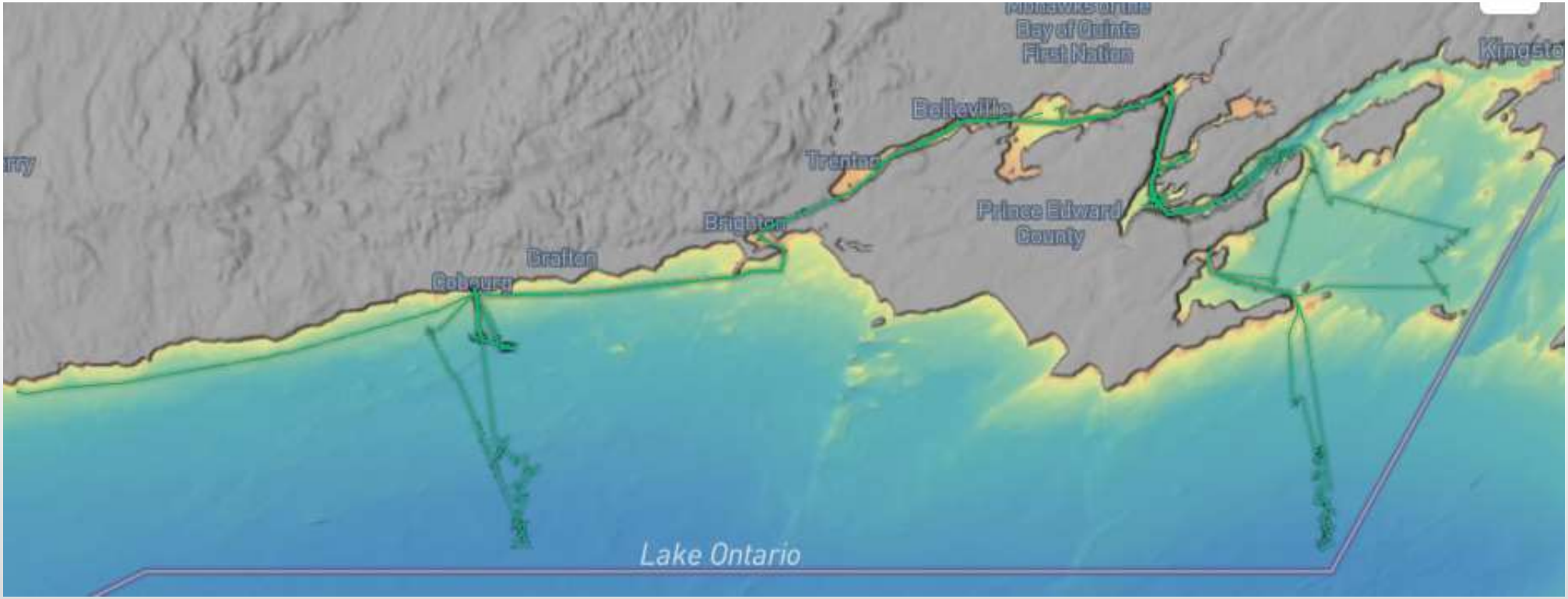


Next Steps

Expand Scale

Increase Exposure

Raise Funding

IHO Trusted Node

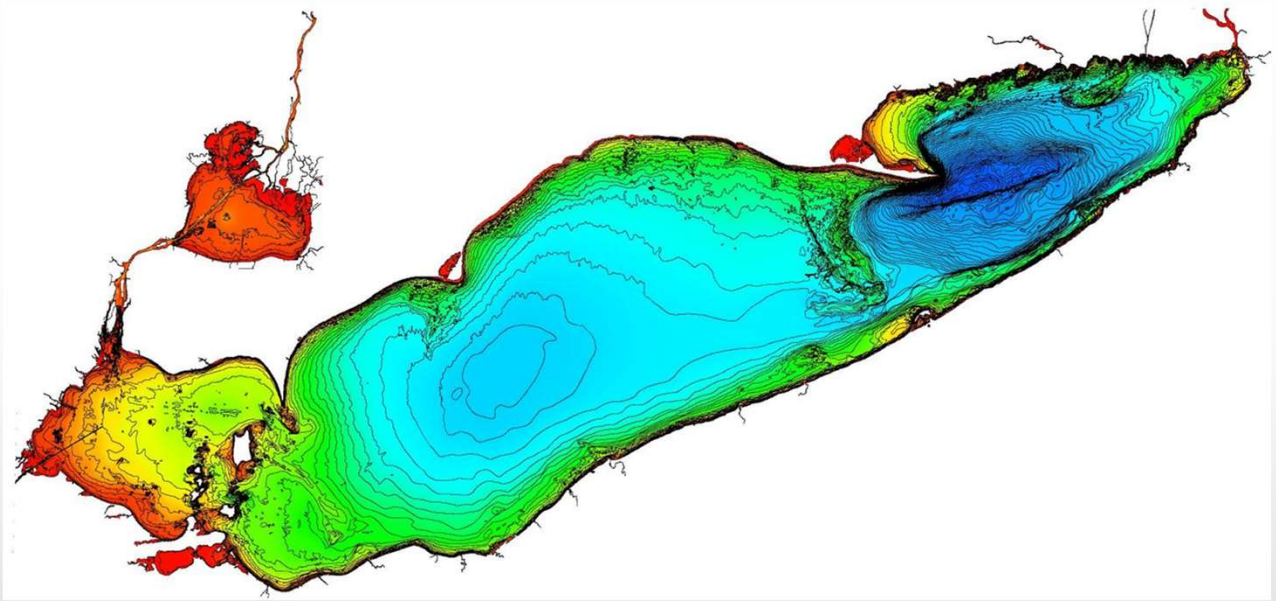
CSB Engagement

Automation

How to get involved?

- Identification of Participating Organizations & Vessels
- User Agreement & Project Engagement
- Acquisition & Installation of Equipment
- Sailing & Data Collection!

Questions & Thank You



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