

Title:

Trends in hydrography empowering marine knowledge; Automation for marine survey, and products and possibilities through S-100

Speaker:

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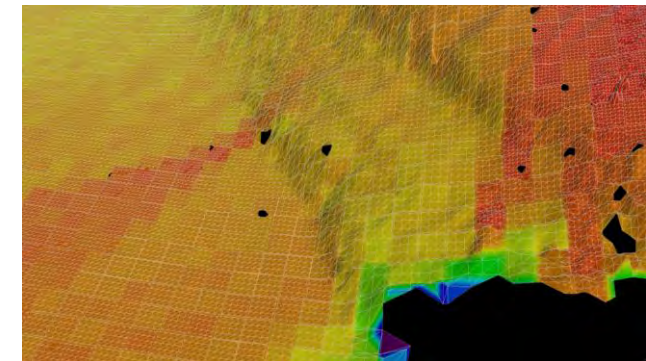
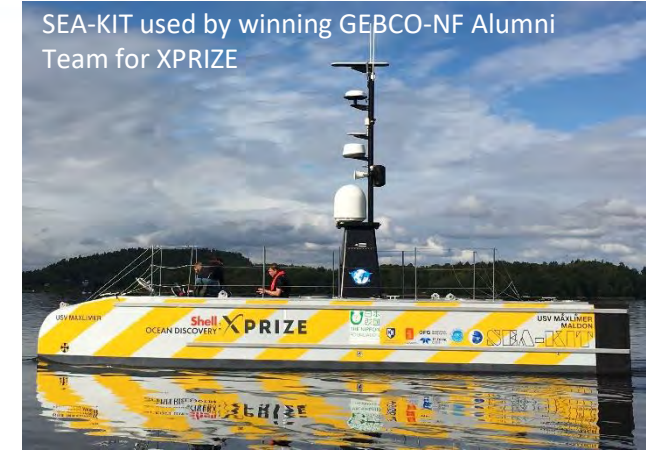
Date:

18 & 19 November 2019



Content

- Force multiplication, and increased survey capacity
- Automation for marine survey
 - Process automation
 - Artificial Intelligence (AI)
- Geospatial solutions for S-100
 - S-100 products
 - S-100 Data as a Service
- Conclusions



Force multiplication

- Multiple platforms utilized to increase capacity for marine survey
 - Staffed and autonomous platforms
- Surface and subsea vehicles configured with various sensors and payloads
- Greater number of vehicles and sensors are contributing to an increase of high resolution data
- New approaches are needed to keep pace with the volume of data



Why Automation?: Applications and benefits



AUV

- Data automatically processed during the mission
- Results available for download and review upon vehicle recovery
- Facilitates rapid redeployment



USV and staffed platforms

- Data automatically processed during the mission
- Results remotely available for real-time QC
- Improves operational decisions



Scientific and Crowdsourced

- Data automatically processed during the mission
- Workflow configured by trained surveyor to improve quality
- Minimizes any processing backlog

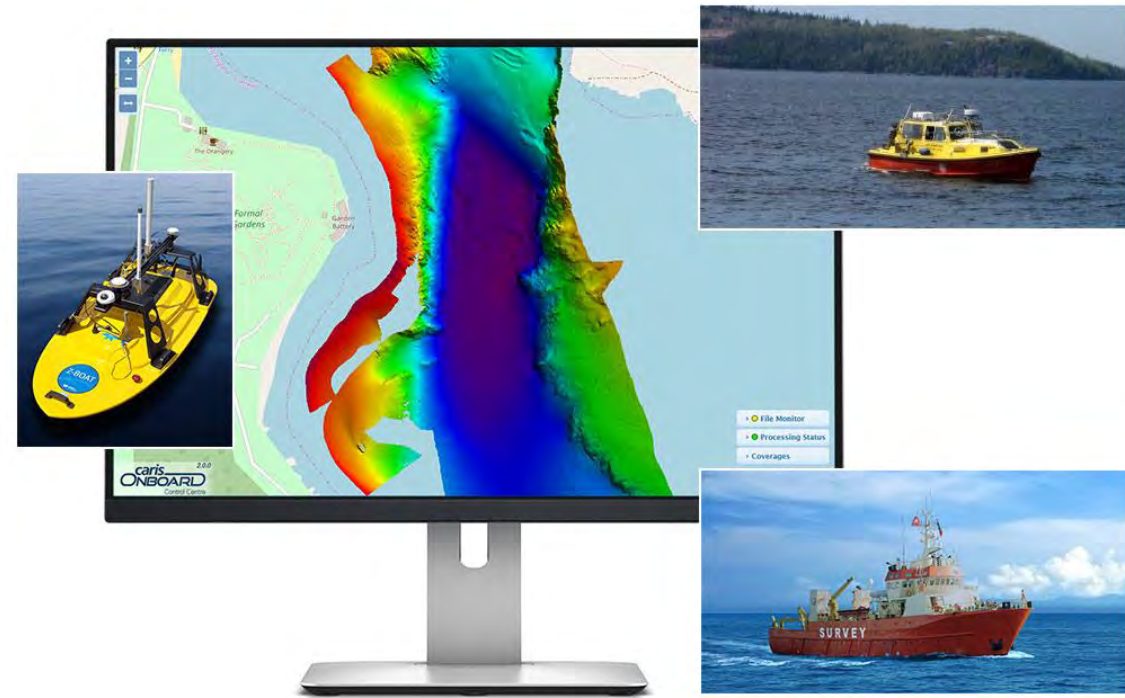


Office environment

- Automate processing of accumulated backlog
- Workflow pre-configured for consistent processing
- Create additional information outputs

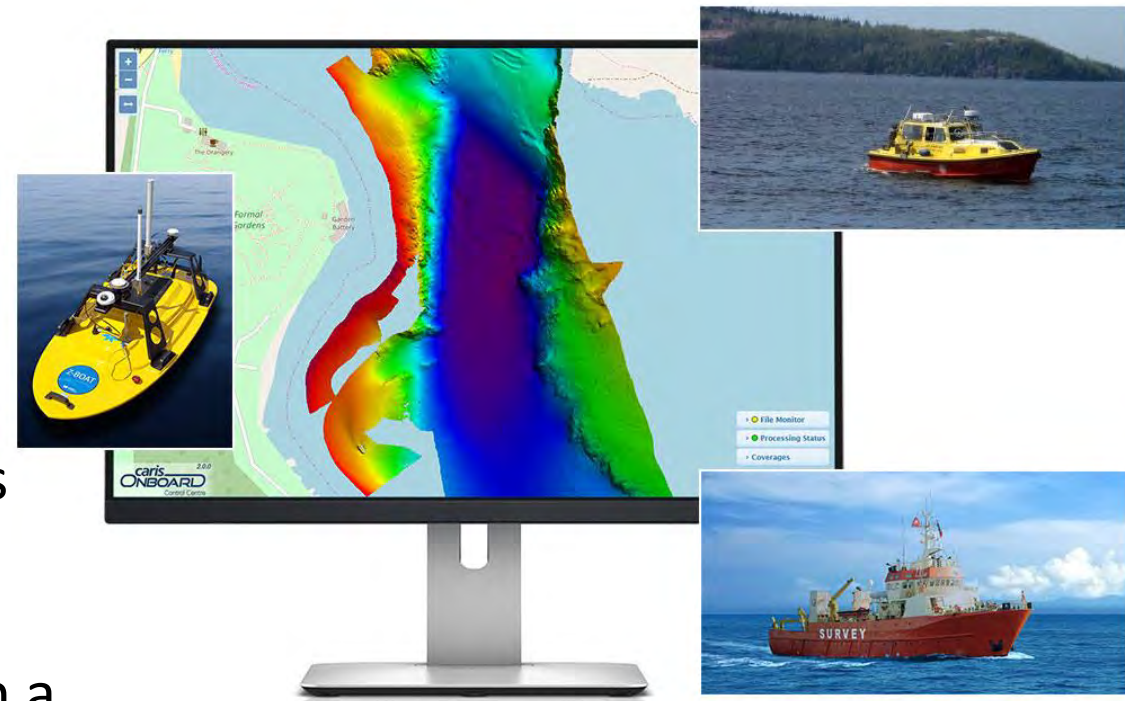
Automation: CARIS Onboard

- A web based processing service is installed on each survey platform
 - Autonomous or staffed platforms
- The surveyor designs a processing workflow before deployment, which is set to run on the sensor data as it is acquired
- Data processing is automated during the survey
- It also allows processed results to be viewed and remotely monitored through web map for QC



Automation: CARIS Onboard

- Users can reduce risks and costs by remotely monitoring survey results via web interface
- Real-time QC allows for problems to be identified and corrected during the survey
- Provides a single point of access for quality checks between vessels
- Remote QC and visualization can be achieved with a low bandwidth connection
 - 150Kbps to 1Mbps

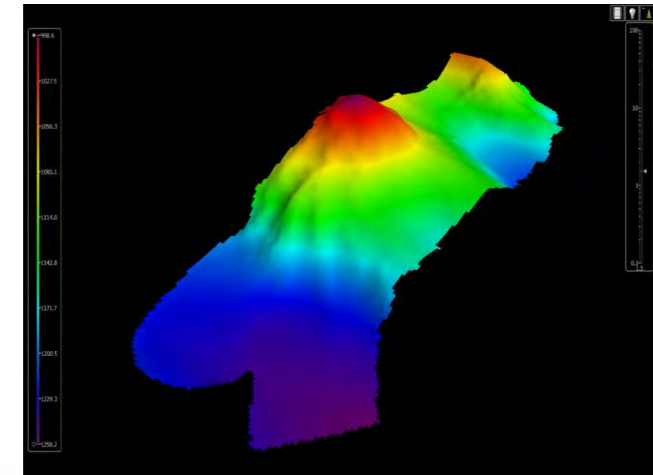


CARIS Onboard 2.1

Scaled Bandwidth
for Remote Survey Monitoring

Automation: CARIS Onboard example for AUVs

- CARIS Onboard trial with JAMSTEC and their deep-sea AUV “URASHIMA”
- Traditionally it was several hours for a decision to transit or redeploy the AUV after recovery
- Automated bathymetry processing on the AUV during the trial allowed:
 - Access to processed results immediately following AUV recovery
 - Survey quality and coverage confirmed within 15 minutes
- Operational cost and time savings
 - Minutes vs. hours



Automation: AI for sonar noise removal

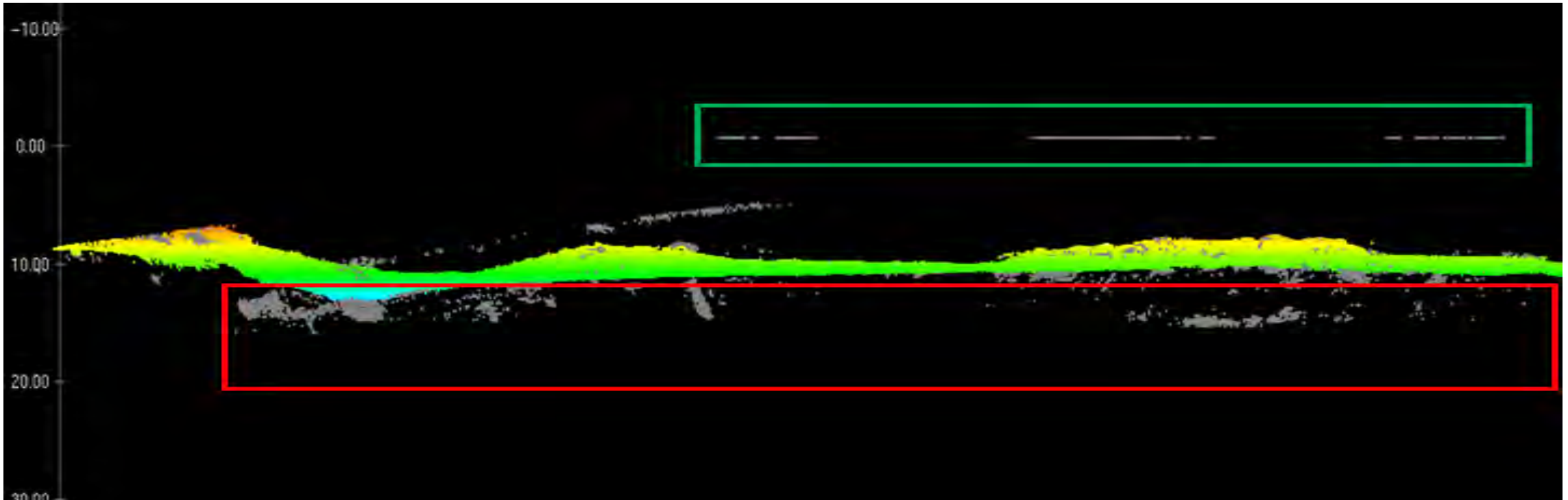
- Manual data cleaning is a bottleneck for many marine surveys
 - Modern sonars can still produce noise in challenging environments, or if not operated properly
 - Data requires manual cleaning/review even with algorithms like CUBE
- Noise that is apparent in acoustic sonar data often follows specific patterns
 - e.g. side-lobe noise or bubble sweep
 - AI algorithms are purpose built to find patterns in data
- In 2020 CARIS will offer an AI solution to:
 - Automatically classify and reject common types of noise in sonar surveys
 - Provide further operational cost savings for marine surveys
 - Improve utilization of resources and increase production rates



Image credit <https://phys.org>

Automation: AI for sonar noise removal

- Used to significantly reduce manual processing (i.e. data cleaning)
- Accuracy
 - > 97% accuracy for “real” points
 - ~95% accuracy for “noisy” points



Automation: AI for sonar noise removal

- Performance time trials example (HH:MM)

- RESON T20P dataset from Shallow Survey 2015

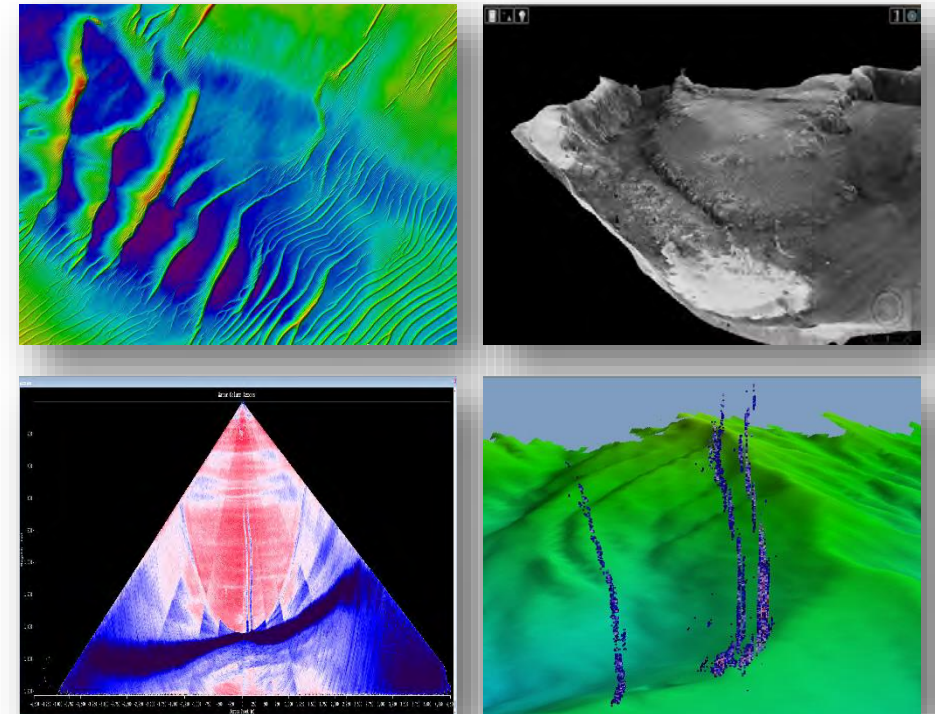
- ~9.5 hours of survey
 - ~175M soundings
 - 44 linear kilometers

- Reduced 6 hours of manual cleaning to 20mins of AI processing + 35 minutes of cleanup

Workflow	Automatic	Manual	Total	Acquisition/Processing
Manual	00:00	05:52	05:52	1h/36m
CUBE as Filter	00:29	02:30	02:59	1h/20m
AI	00:20	00:35	00:55	1h/6m

Automation: Supporting products and possibilities

- Through process automation we can:
 - Turn around larger datasets with less time
 - Shorter time from Ping-to-Chart
 - Improve utilization of human resources
 - Focus on data review, QC and other tasks
 - Efficiently create additional products and new data services
 - Including those as part of IHO S-100...



IHO S-100 Universal Hydrographic Data Model

- IHO S-100 Working Group (WG) has objective to develop and extend the S-100 Universal Hydrographic Data Model and S-100 based products
 - To support a greater variety of digital data sources, products and customers
- Examples of CARIS' involvement in S-100 WG include:
 - Development of encoding and portrayal for S-100, including S-101 ENC's
 - Validation checks for S-101 ENC's (equivalent to S-58)
- ~92% of hydrographic offices use CARIS for all or part of their workflow
 - CARIS solutions have been, and continue to evolve to provide agencies with tools to transition to S-100

Geospatial solutions for S-100

- Today agencies can take a hands-on approach to working with S-100
 - S-102 Bathymetric Surfaces:
 - Support implemented in 2012 for Edition 1.0 April 2012
 - Edition 2.0 anticipated later in 2019 or 2020
 - S-101 ENCs
 - Support implemented in 2015 for the Draft specification
 - Support implemented in 2019 for Edition 1.0
 - Support for other product specifications underway
 - E.g. S-121 Maritime Limits and Boundaries



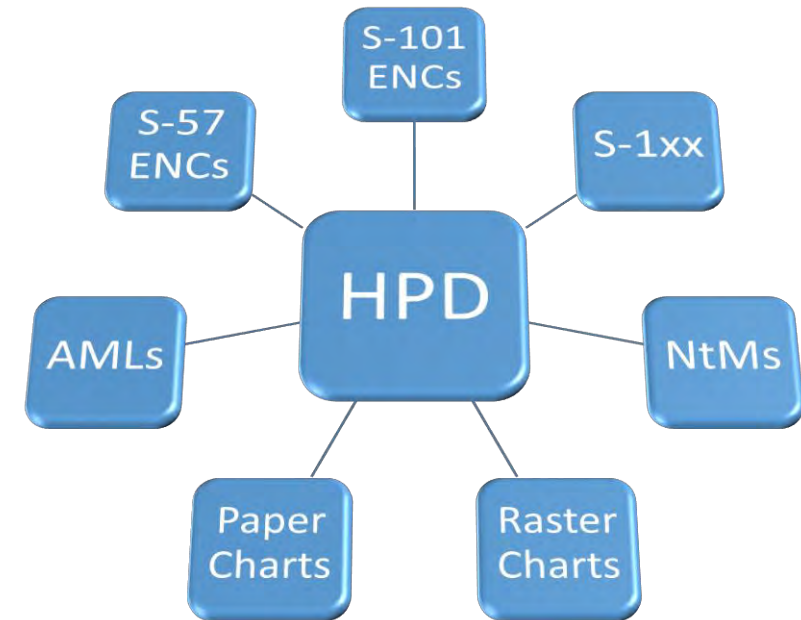
Geospatial solutions for S-100

- S-102 Bathymetric Surface Product production with Bathy DataBase:
 - Source bathymetry prepped and deconflicted into single surface
 - Tiling scheme applied
 - S-102 Ed. 1.0 metadata produced
- Production can be completely automated
 - Process models, Python API, etc.



Geospatial solutions for S-100

- HPD with S-100 Module provide users with:
 - Parallel production of S-101 ENC's, S-57 ENC's, and other products
 - Ability to reduce duplication of data and effort with a database driven approach and automation
- Solution to:
 - Meet current mandates and produce existing products
 - Produce new products and support new data users with the same resources



S-100 Data as a Service

- Hydrographic offices are moving from product centric to data centric workflows and services
- The Canadian Hydrographic Service, CARIS, and PRIMAR conducted a project to implement an innovative bathymetry data service to demonstrate the value of evolving S-100 data standards
- The project focused on the latest technological approaches to leverage key opportunities for tomorrow's hydrographic industry
- In 2020 CARIS will offer the Geospatial in the Cloud solution for S-100 Data as a Service



S-100 Data as a Service

What problems are being solved?

The survey to bridge turn-around time

Efficiency and complexity of meeting the needs of multiple stakeholders

Operational preparedness for e-Navigation

Data integrity and security

What approaches are used for success?

Service orientated and Cloud based

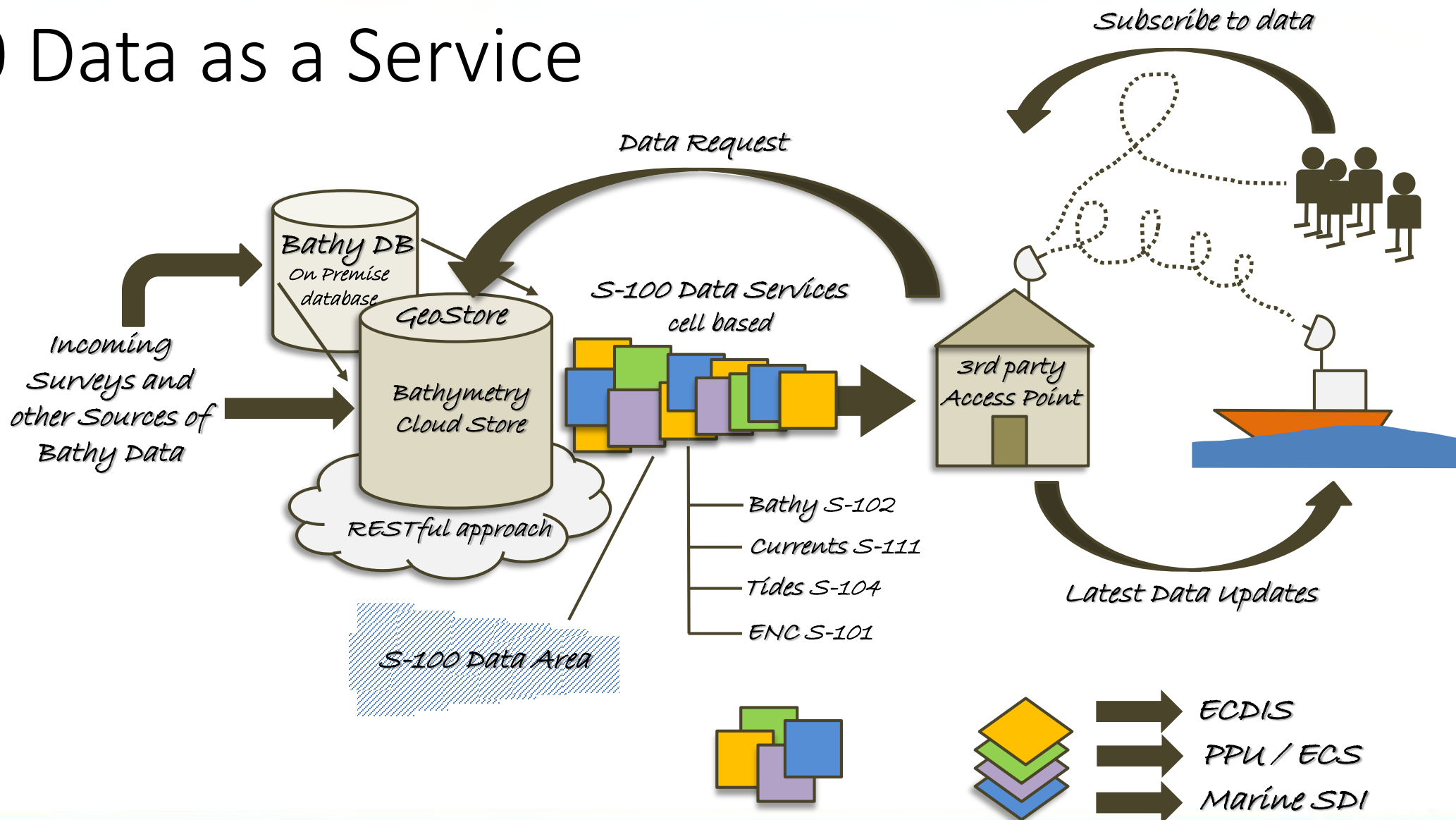
Bathymetry focused (chart features and other data to be addressed later)

Latest open geospatial approaches

Latest computing techniques

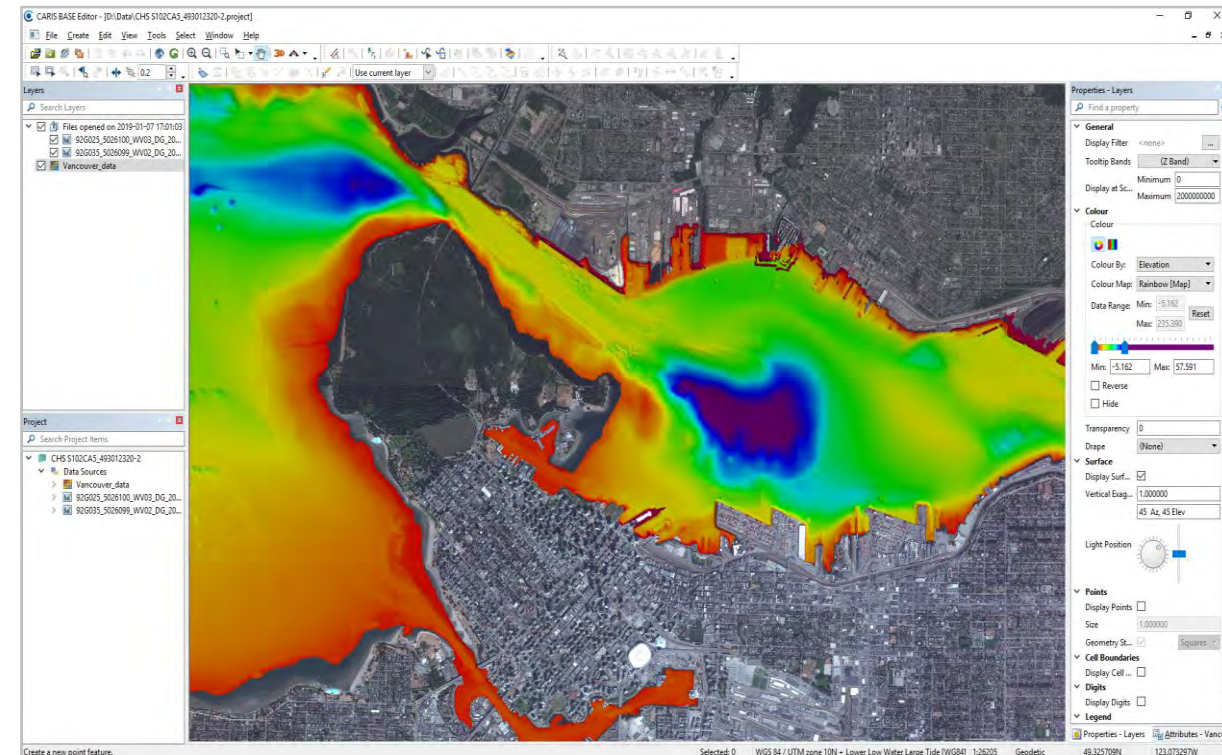


S-100 Data as a Service



S-100 Data as a Service: Demonstration scenarios for e-Navigation and MSDI

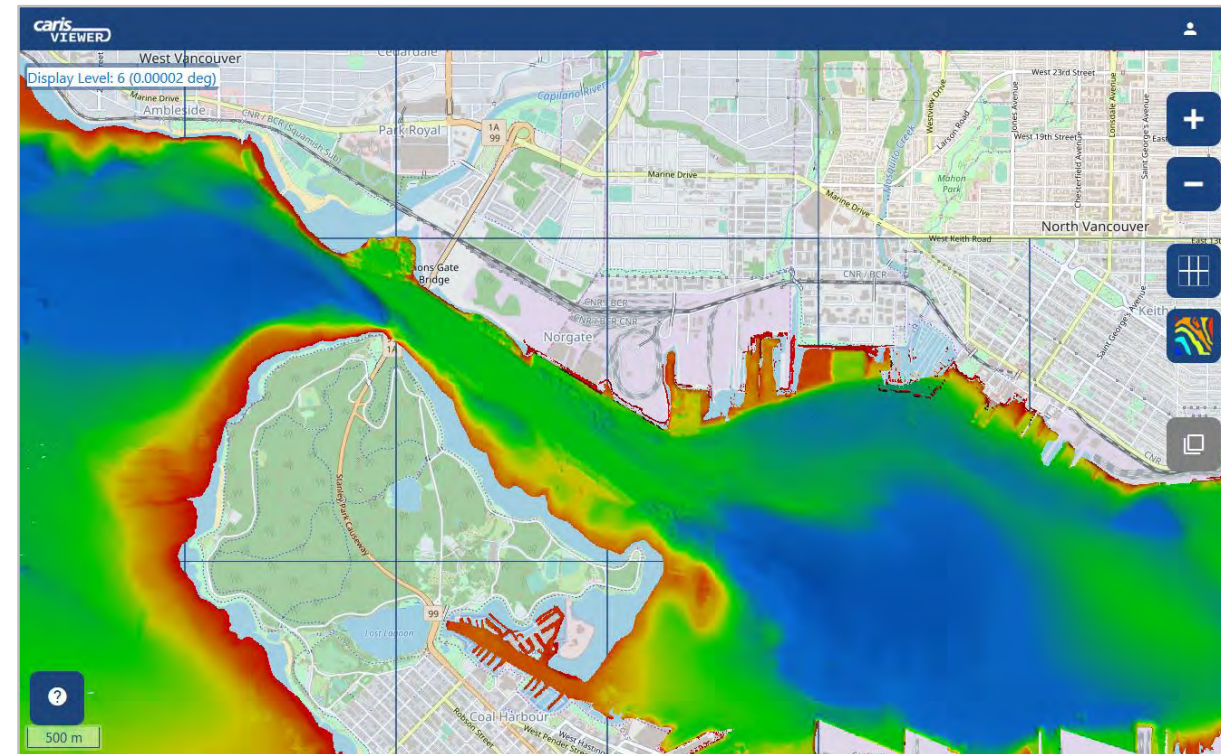
- Vancouver harbour bathymetry shown:
 - In CHS' on-premise Bathy DataBASE



Bathy DataBASE

S-100 Data as a Service: Demonstration scenarios for e-Navigation and MSDI

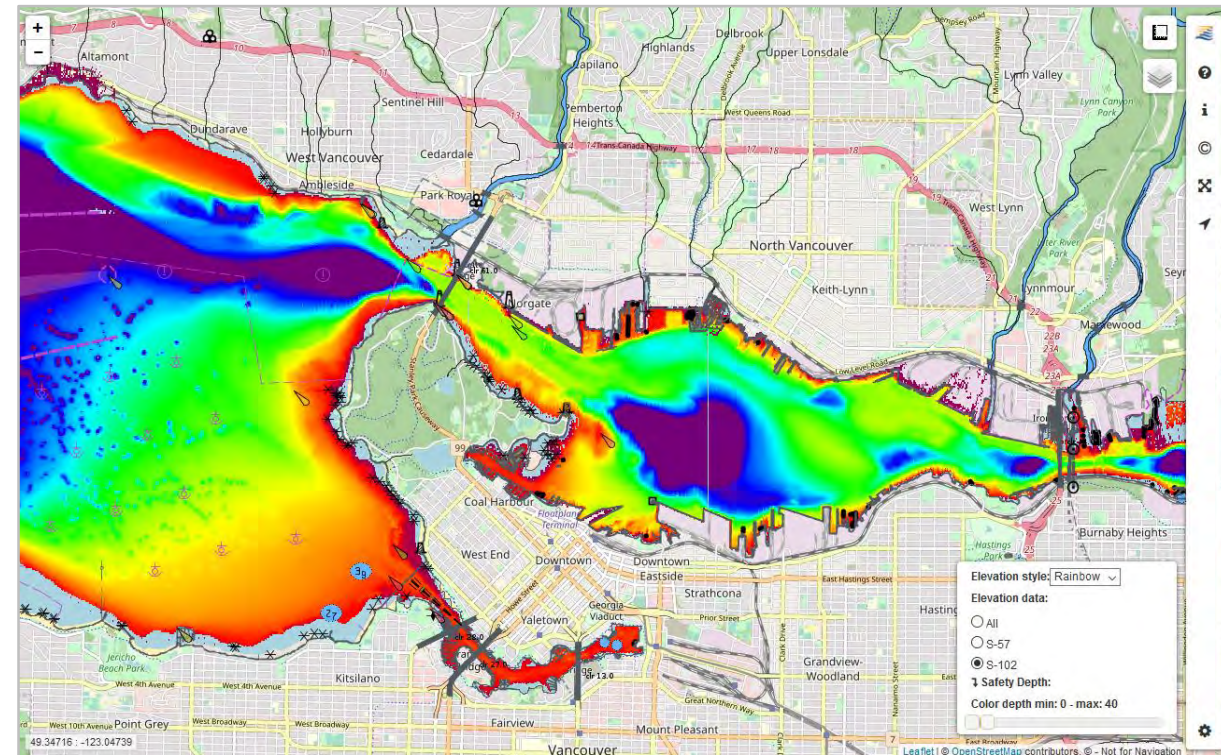
- Vancouver harbour bathymetry shown:
 - In CARIS Viewer from Geospatial in the Cloud using B2B connection



CARIS Viewer

S-100 Data as a Service: Demonstration scenario for e-Navigation

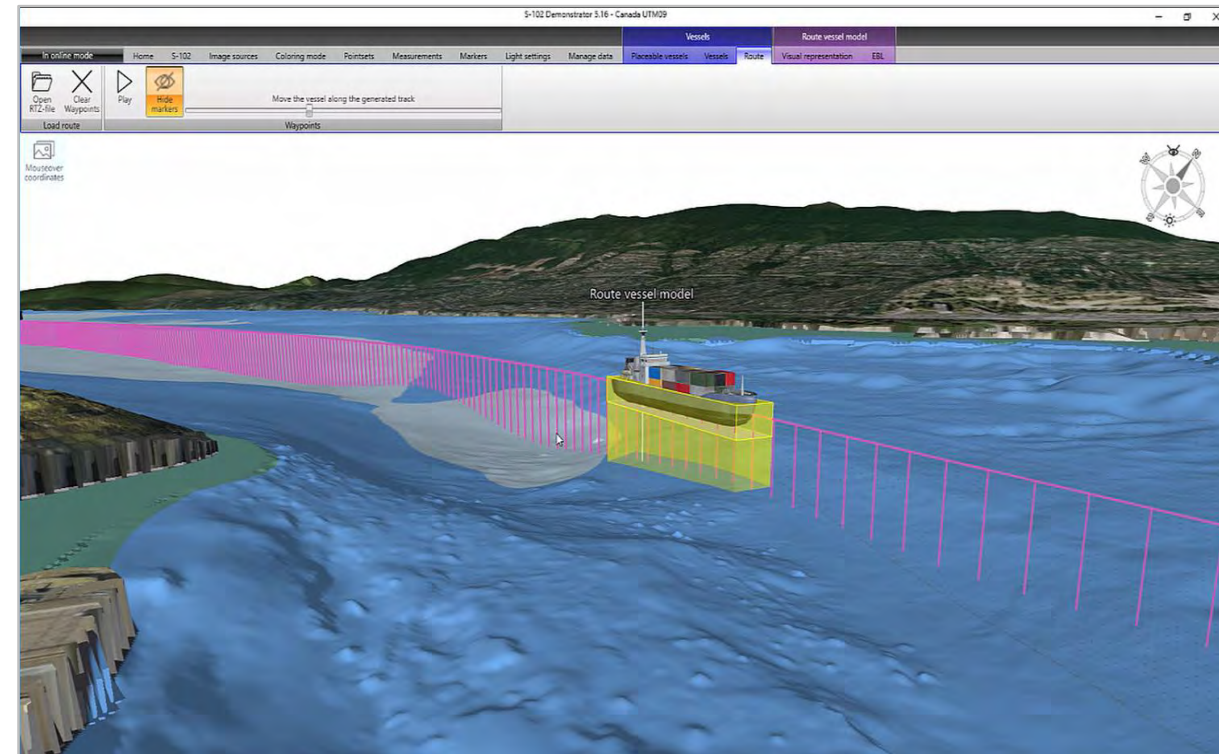
- Vancouver harbour bathymetry shown:
 - In PRIMAR Map Viewer from Geospatial in the Cloud using B2B connection



PRIMAR Map Viewer

S-100 Data as a Service: Demonstration scenario for e-Navigation

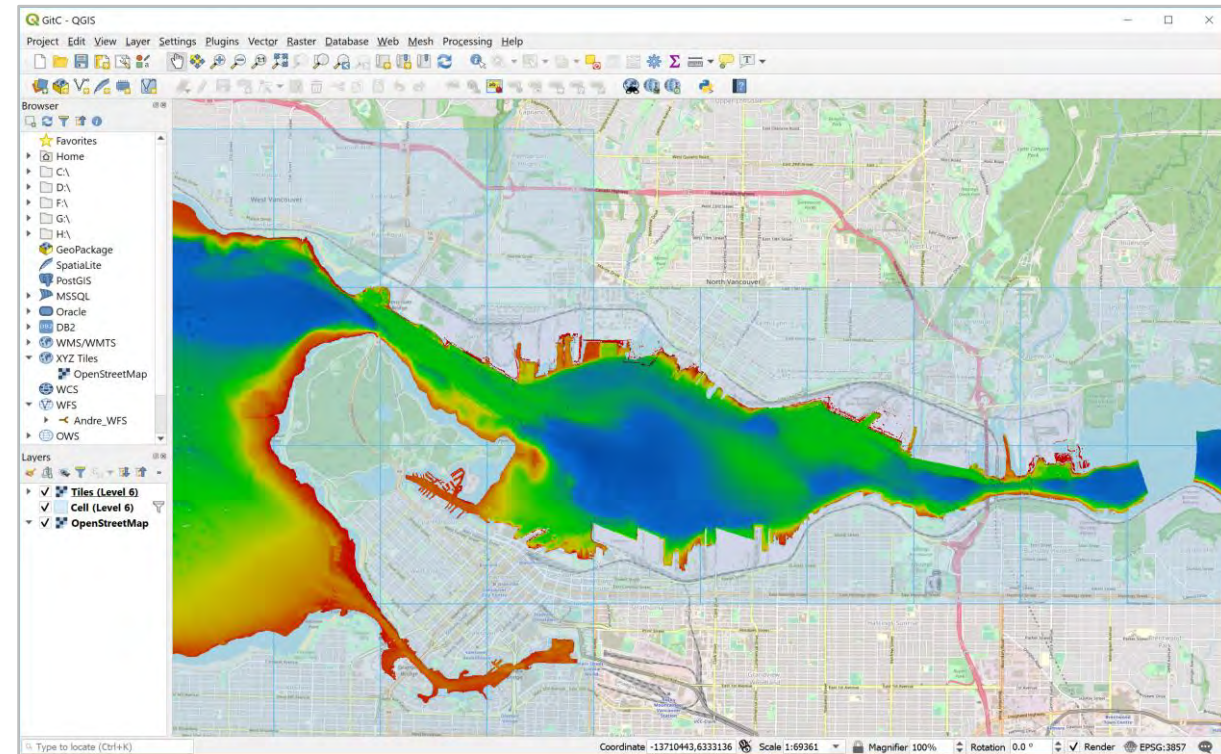
- Vancouver harbour bathymetry shown:
 - In Kongsberg S-102 Demonstrator from Geospatial in the Cloud using B2B connection



Kongsberg S-102 Demonstrator

S-100 Data as a Service: Demonstration scenario for MSDI

- Vancouver harbour bathymetry shown:
 - In QGIS (open source GIS) from Geospatial in the Cloud using OGC web services



QGIS

Summary

- Automation for marine survey provides:
 - Operational time and cost savings
 - Improves data quality
 - Reduces risks and costs during survey
- Geospatial solutions for S-100
 - Are available today to support familiarization and trials
 - A hands-on approach to S-100 now will help prepare for full implementation in future
- S-100 Data as a Service allows the latest available data to be efficiently provided for:
 - Future requirements for e-Navigation and autonomous shipping
 - MSDI

Questions?

Thank you and enjoy KL GeoHydro 2019!

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