# Autonomous survey operations driving data centric workflows

by Andy Hoggarth, CARIS

## MSDI WG Industry Demonstration
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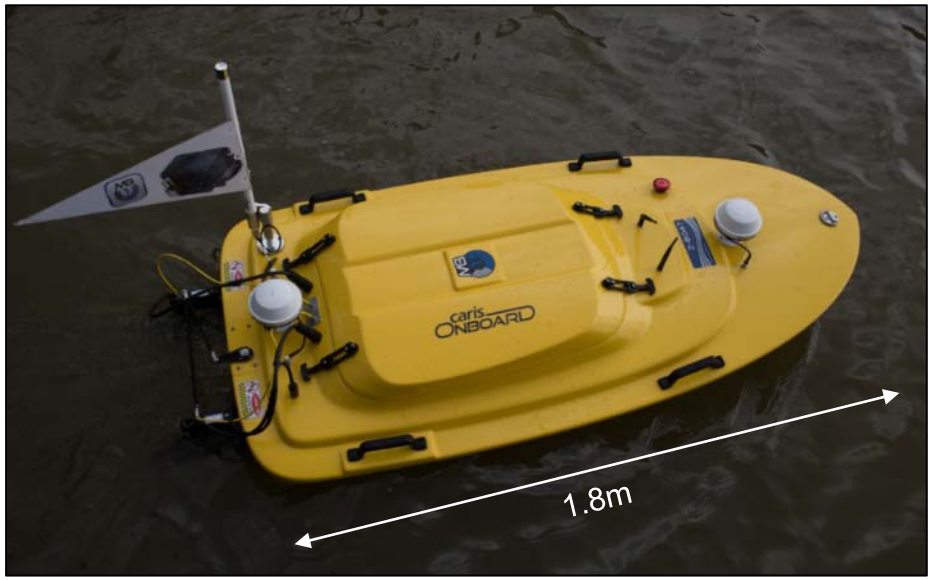
# Autonomous Surveys

- The availability of Autonomous Survey platforms has increased dramatically over the past 5 years, the market will grow by an order of magnitude
  - Not only AUVs, but also USVs
- The potential benefits are clear – lower capital & operating costs, rapid deployment/recovery and the ability to work closer to the intended target
- Currently, the platform is sent on a pre-defined mission to gather data, which is stored internally until recovery and then processed
- As power sources extend operating times, little has been done to address the data bottleneck



# Autonomous Platforms

Mission Duration

Short - term

Persistent

## Sub Surface




## Surface

## Manned / Autonomous

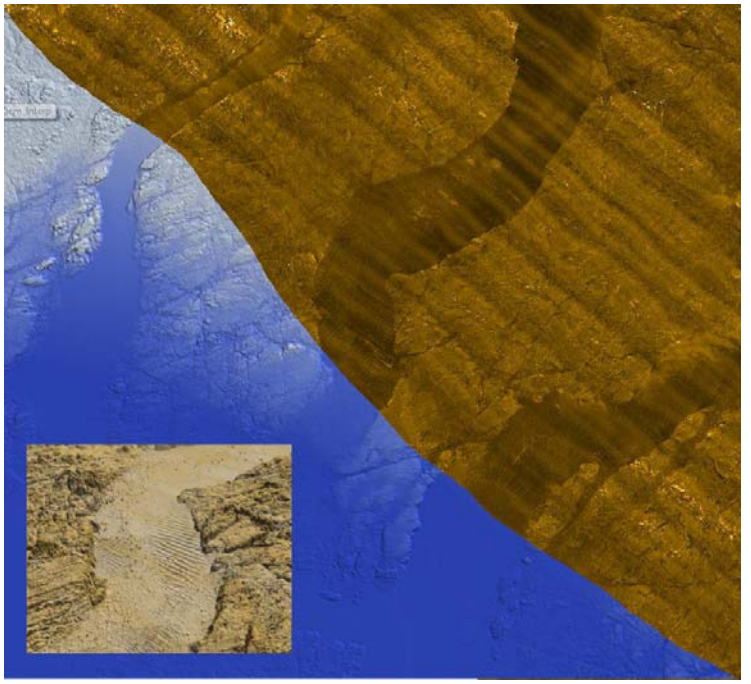
# Feedback Loop

- Autonomous platforms often lack the ‘human control’ in the feedback loop


- Data deliverables may be slower
  - Data typically has to be processed after download at end of mission (small real-time communications bandwidth)
  - Data could be incorrectly acquired due to lack of surveyor interaction with platform (no feedback loop)

# Surveys Driving Data Centricity

- Survey data is a foundation layer in a MSDI
  - Bathymetry
  - Seafloor geology
  - Water column
  - Oceanography



- Data volumes increasing dramatically
  - Higher resolution sensors
  - Crowdsourcing
  - Satellite derived
  - Autonomous survey platforms

- Can we cope with this influx of data and can we make use of it?

# Many hydrographic offices are thinking about data centric workflows and management

- To realize efficiencies
  - Quicker turn around of increasing volume of data
  - Better utilization of human resources
  - Desire for automation in processing and product compilation
- To cater for a broader customer base
  - New and ad hoc products and services
- Increased focus on providing data rather than just charts

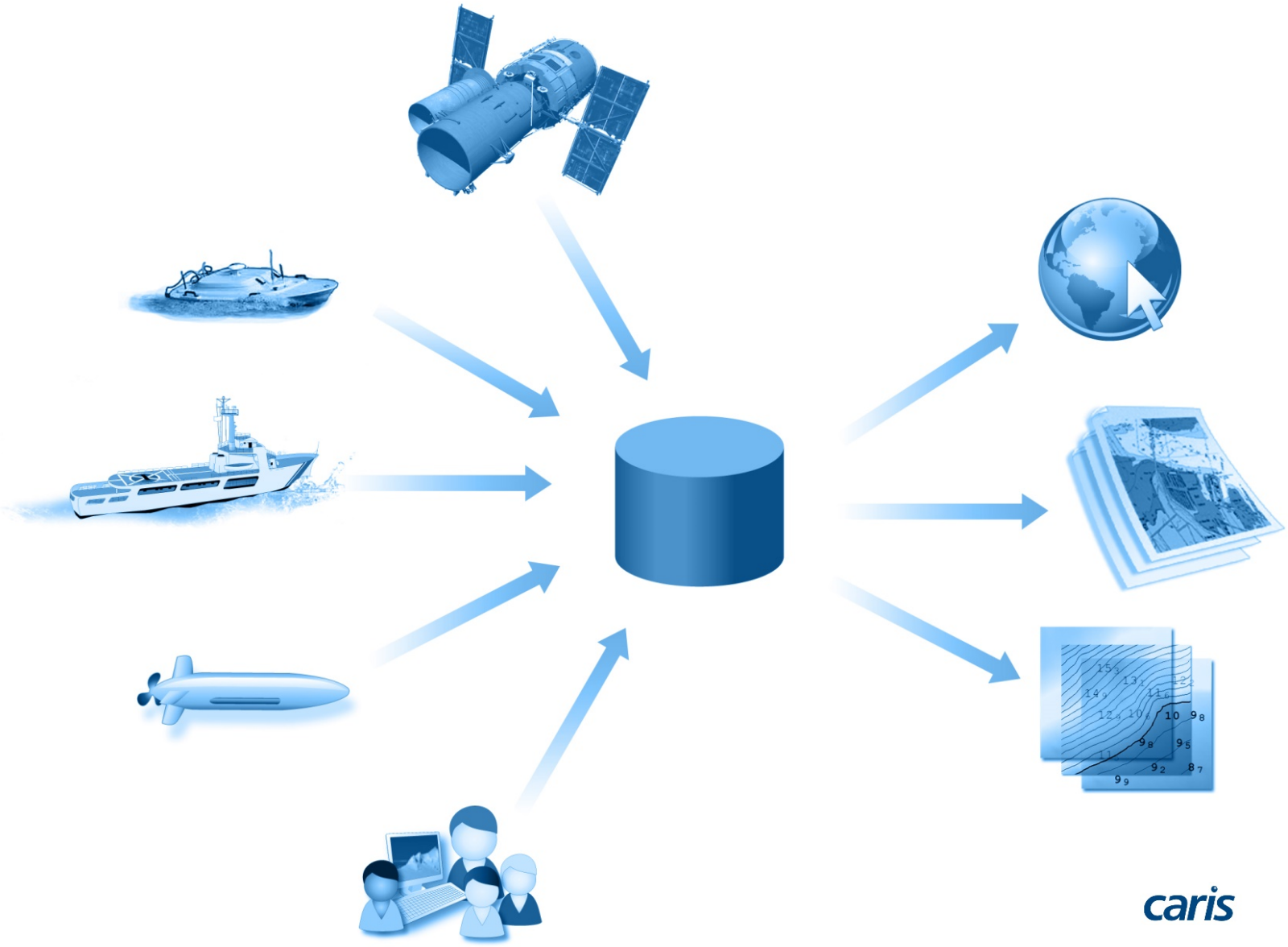
# Data centricity supports National and Regional Spatial Data Infrastructure initiatives

- Putting hydrographic data to work and realizing greater value from it
- To support broader user base
- In line with Open Government and Open Data policies
- Collect once and use many times

# What does data centricity mean to software industry

- A move to more service orientated systems
  - Open data storage
  - Connectivity to 3rd party tools
  - Extensive scripting capabilities
  - Cloud based processing services
  - Mobile data entry and access
- Process automation
  - Rules-based workflows
  - Survey processing and cartography
  - Faster and better quality results
  - Validation of data in field prior to loading into database

# Inputs and Outputs in a Data Centric Workflow



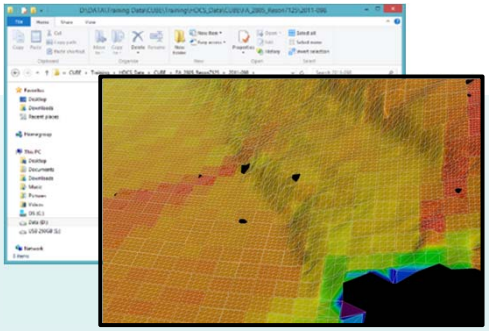
# On board Processing Scenarios

Different survey platforms and operations require different configurations and workflows.

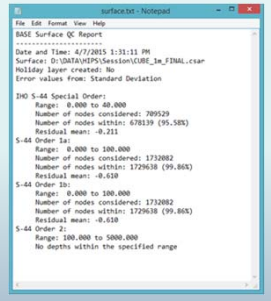
- AUV
- USV
- Manned platform remote supervision (survey launch)
- Crowdsourced bathymetry

# Autonomous Underwater Vehicle

Product(s)



Deployment

QA/QC
Product(s)



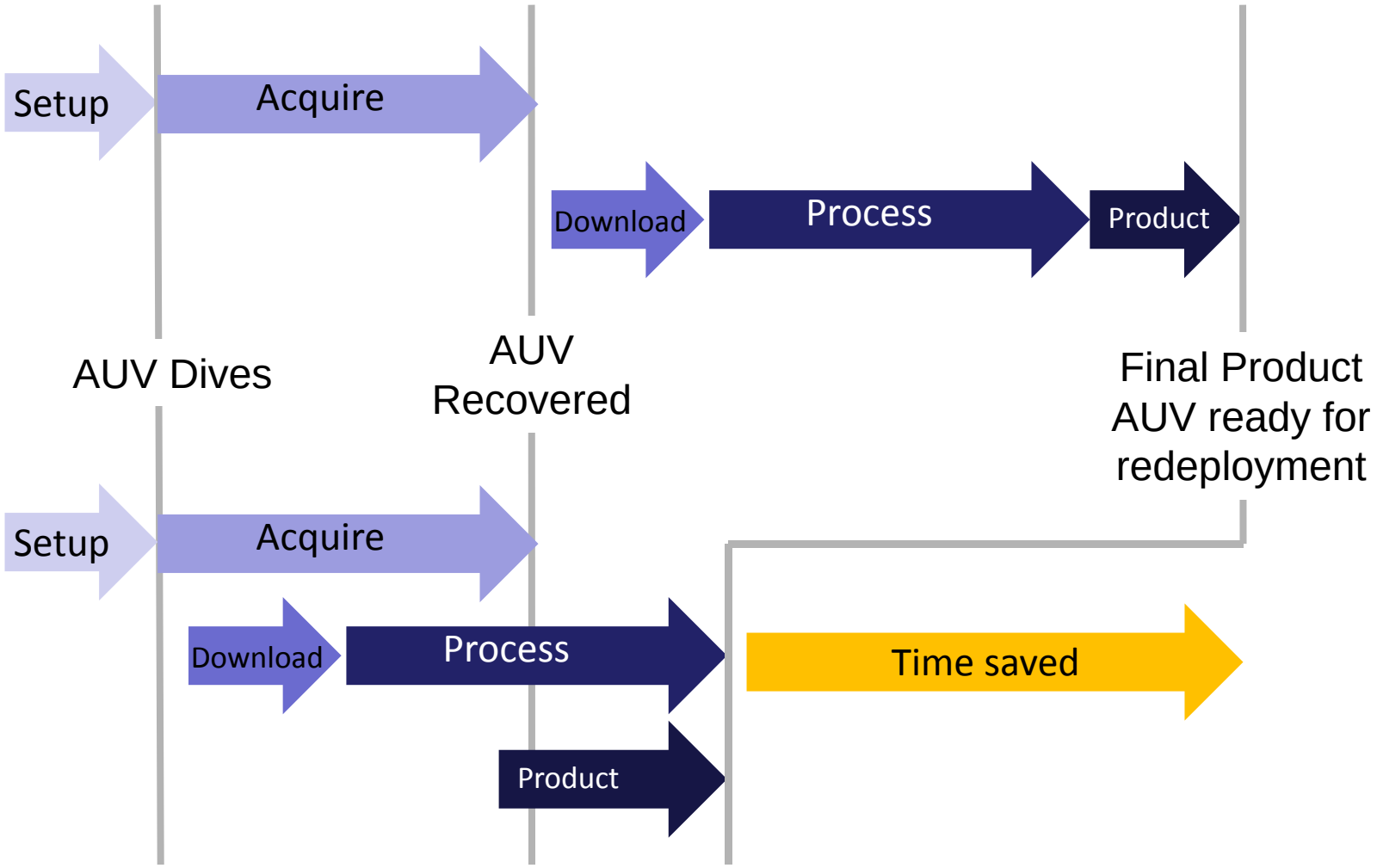
Data
Files

Store

Process

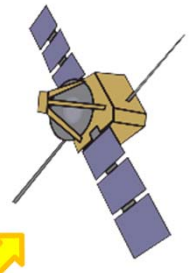
# Potential Time Savings for AUV

## Traditional Workflow



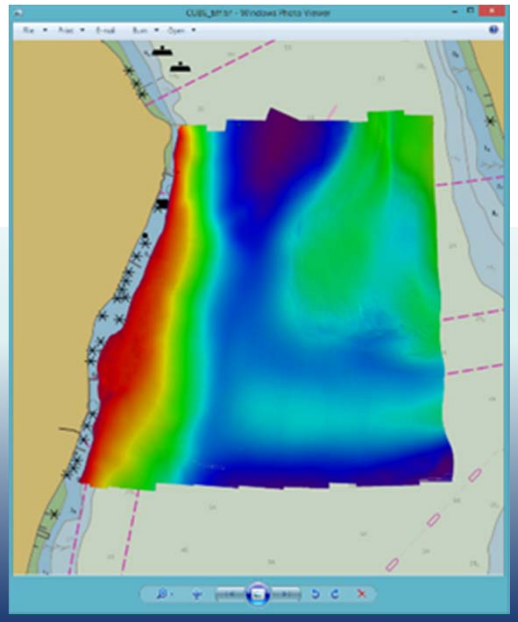

## CARIS Onboard Workflow

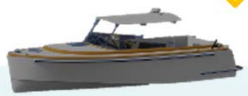
# Unmanned Surface Vessel



(Satellite Communications)

Bathymetric Surface





USV gathering multibeam data, processing using CARIS Onboard

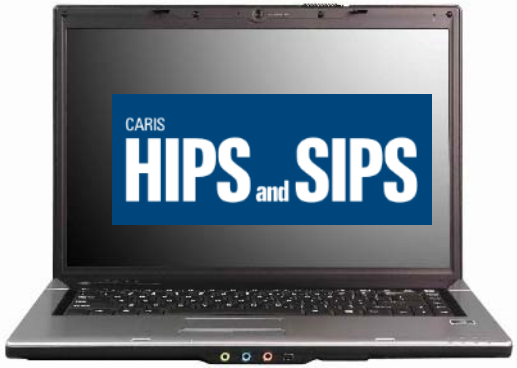
Shore Data Centre

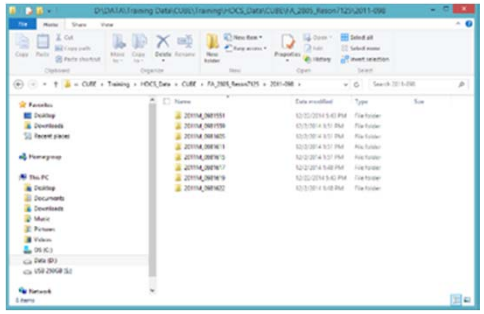
# Manned Vessel



Sonar Hardware

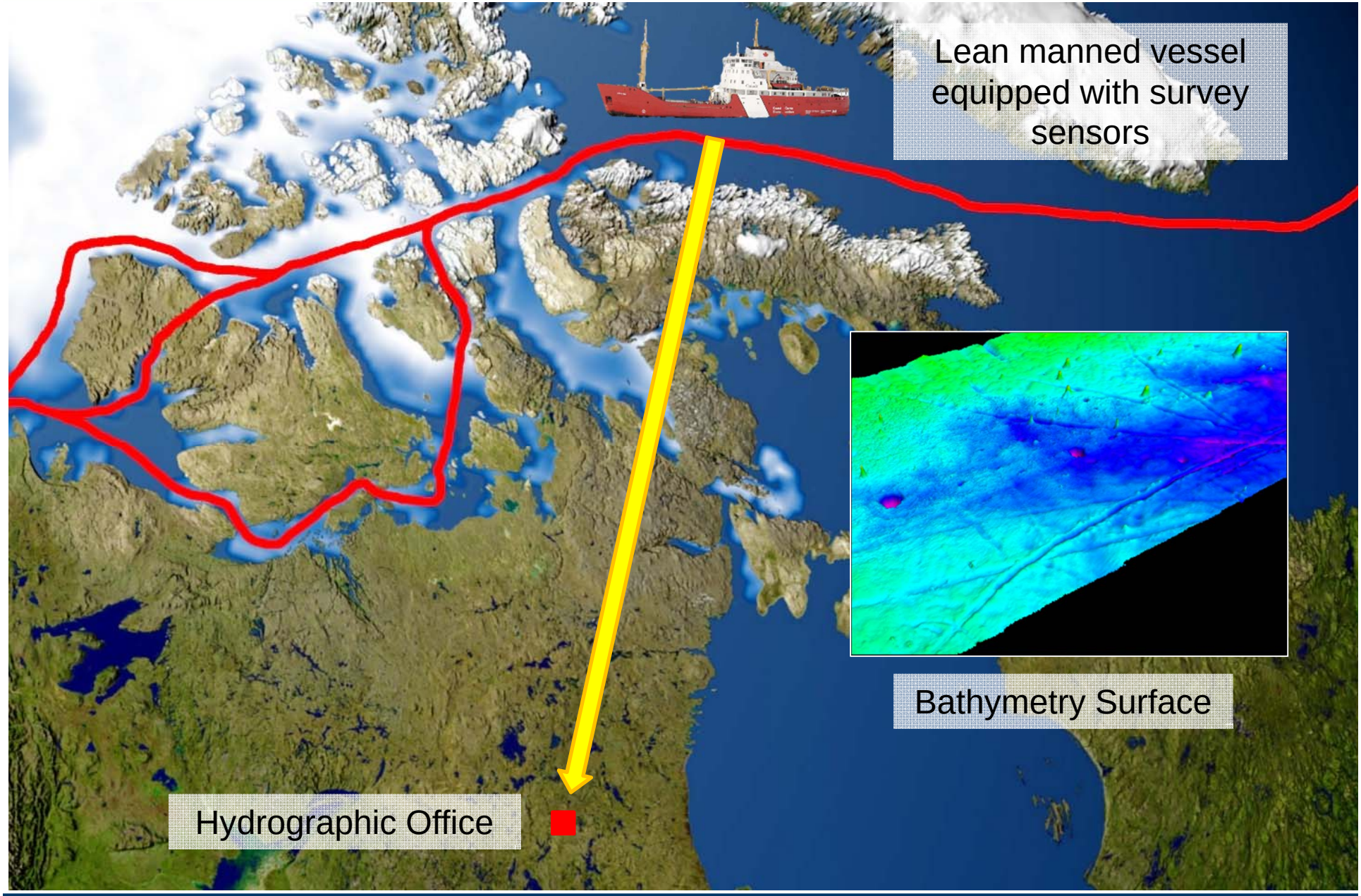
caris ONBOARD



CARIS Project

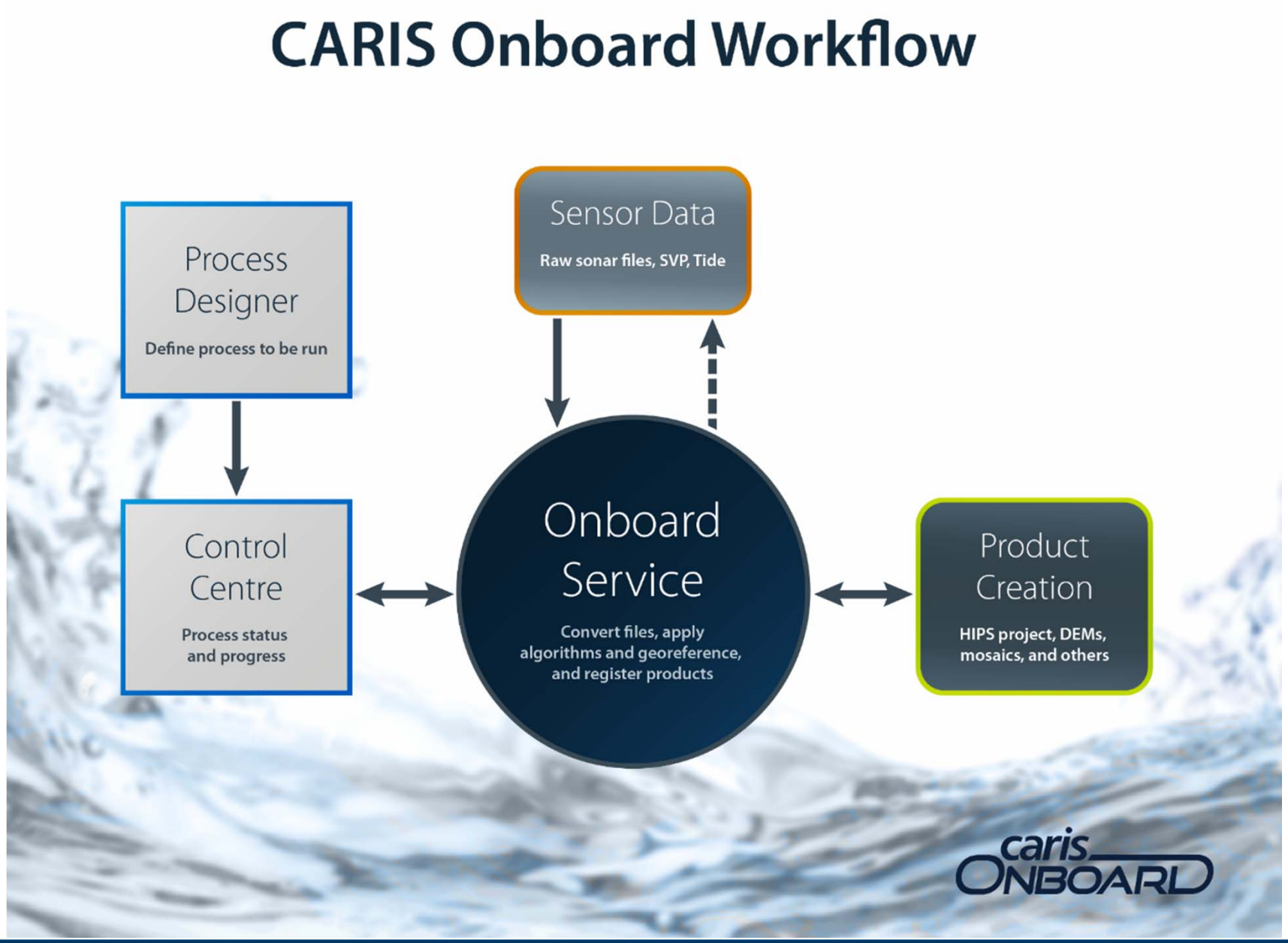
# Trusted Crowdsourcing



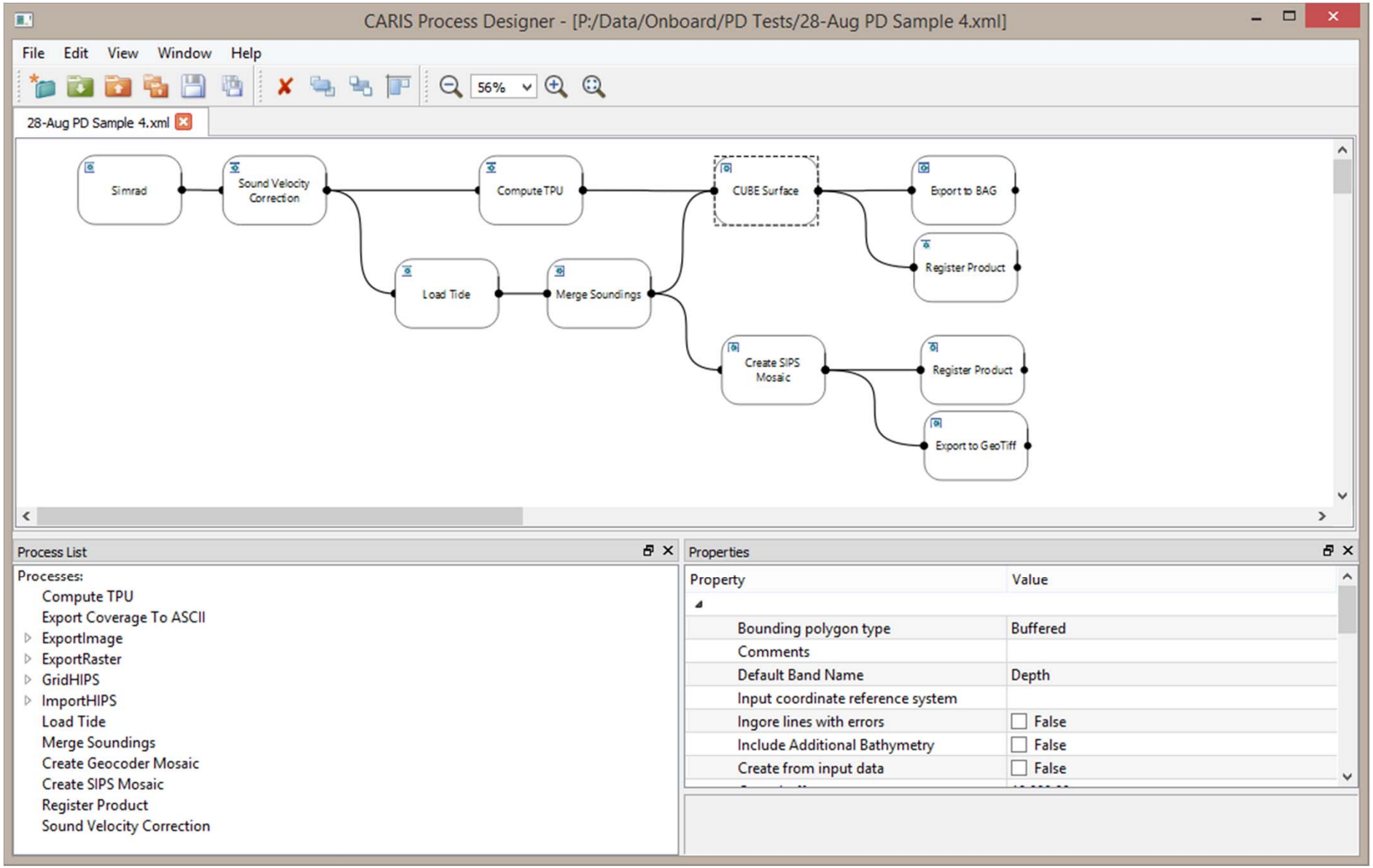
# The CARIS Onboard Workflow

- The CARIS Onboard workflow follows a similar path to the traditional workflow, but with key processing steps automated.
- These steps are defined before deployment of the platform, and are configurable by the surveyor to meet the needs of the survey.
- Not only does this save time, it aids in repeatability of processing ensuring consistency and compliance with the designated survey workflow

# CARIS Onboard Archictecture



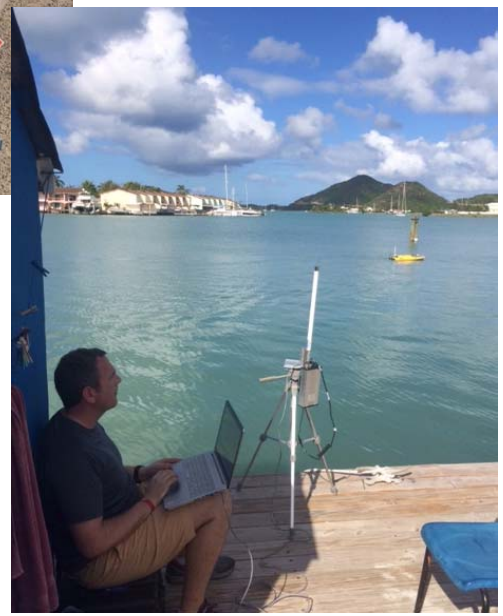
# CARIS Process Designer



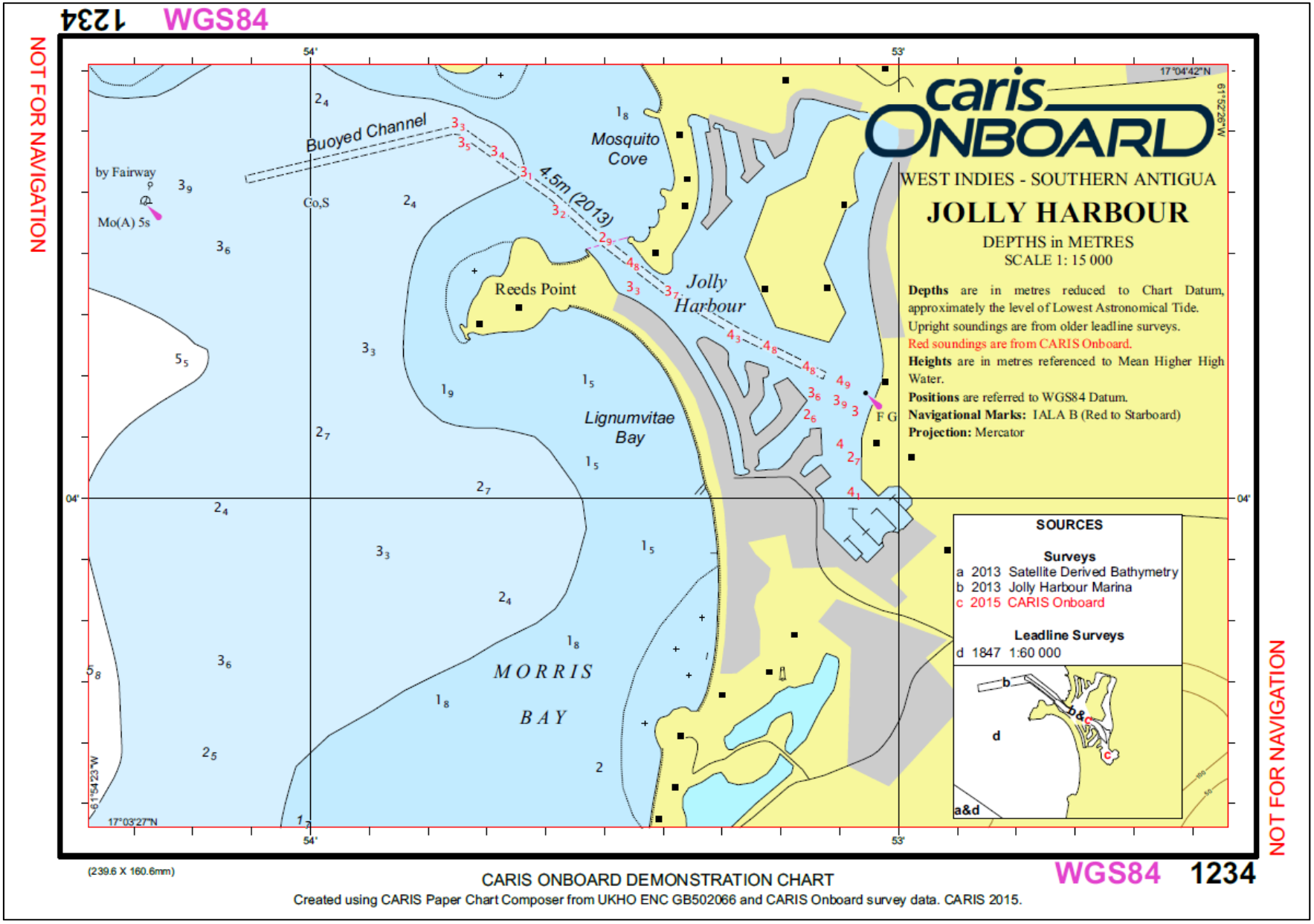
# Use Case 1 – USV Antigua

CARIS and Teledyne demoed a unmanned survey a the recent Meso American – Caribbean Sea Hydrographic commission meeting held in Antigua

- Teledyne Oceansciences ‘Z-Boat’
- Teledyne Odom MB1 multibeam
- Radio link / Wi-Fi for control
- CARIS Onboard used to:
  - Convert, clean and correct
  - Progress reviewed from the dock
  - Export soundings for charting
- 7 hours of data collection
- 500,000 multibeam soundings
- 15 mins of further data processing
- Chart created within 24 hours
- Bathymetry available as OGC layer

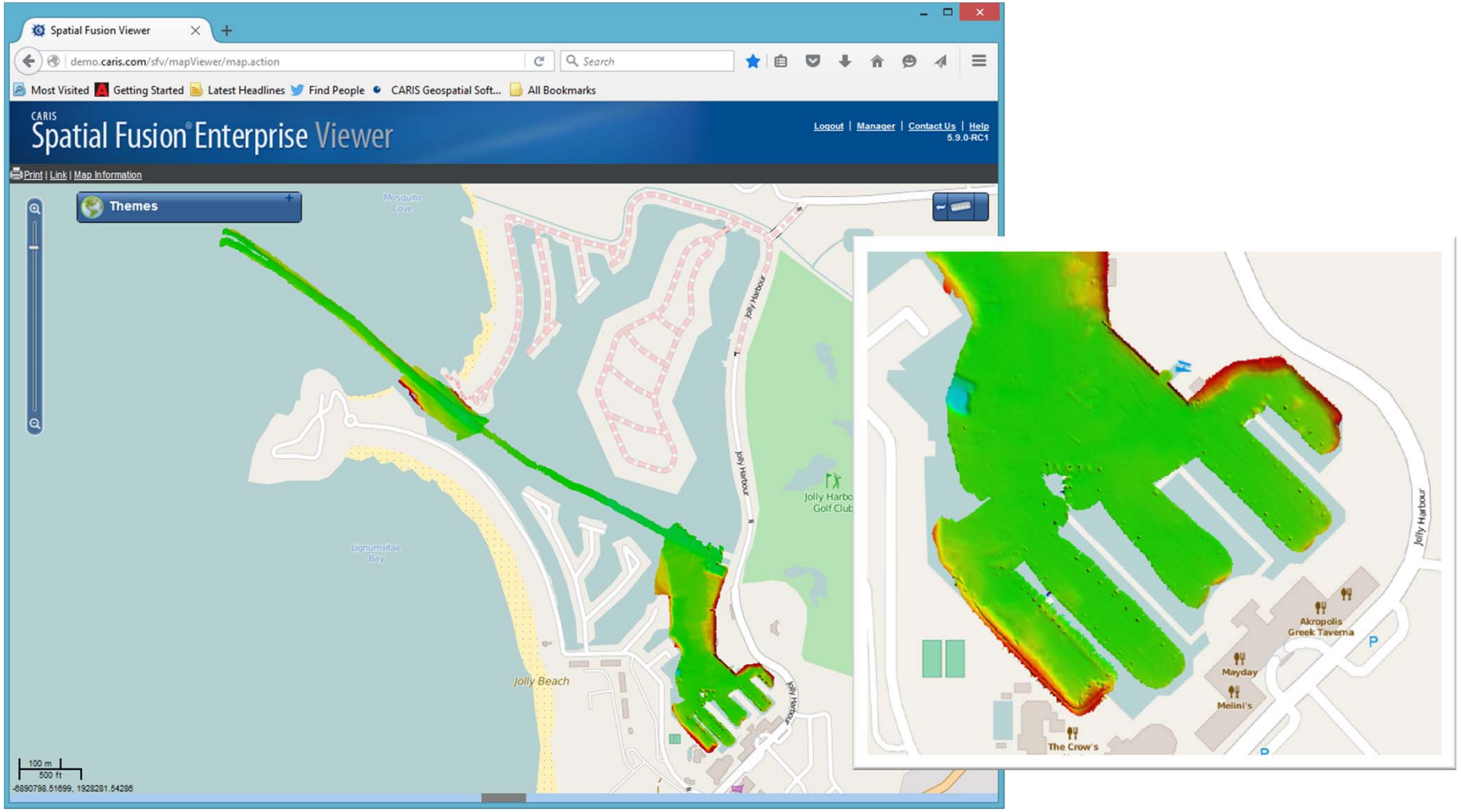


# Antigua Chart – Jolly Harbour

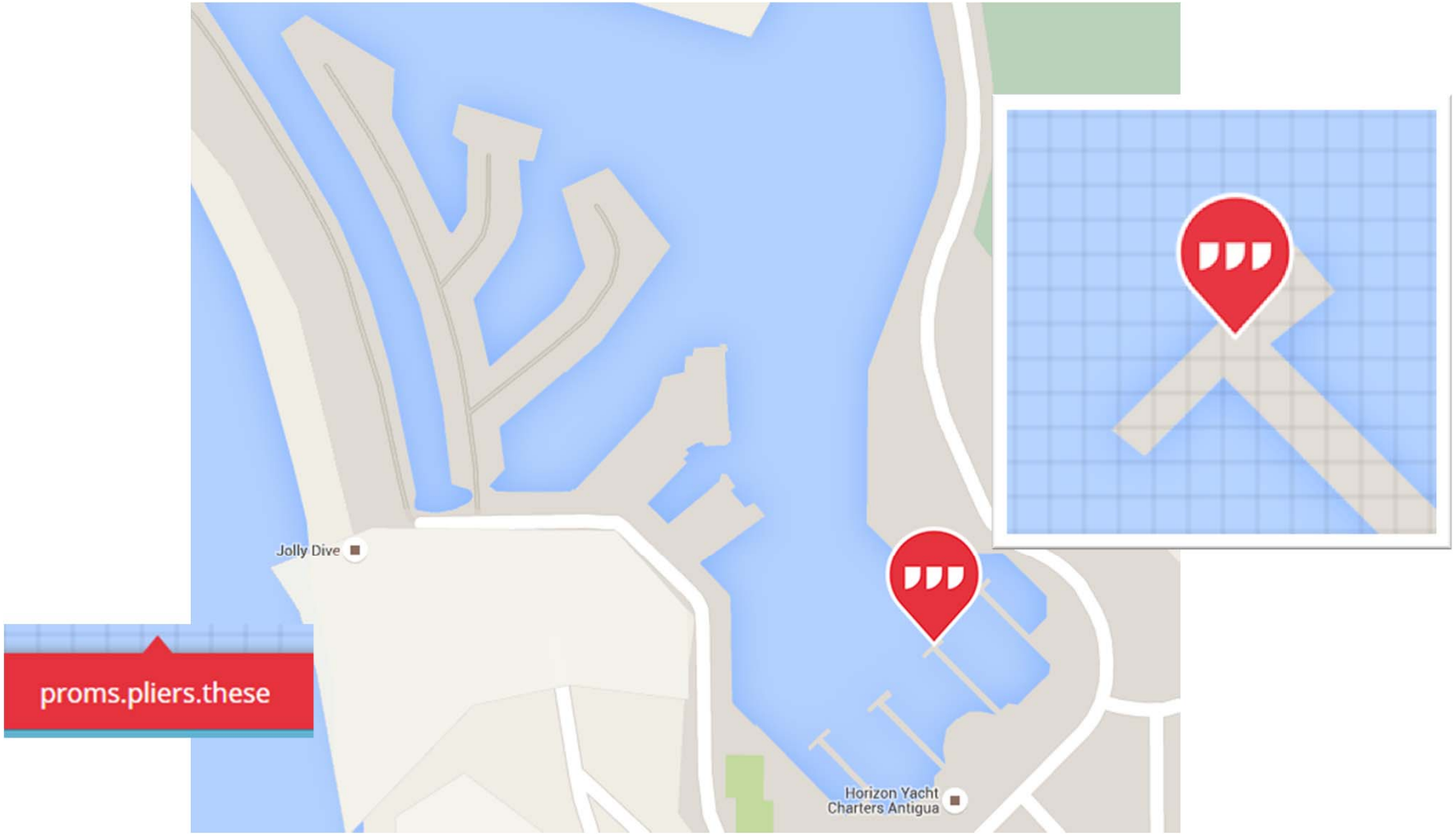


# Antigua Data in OGC viewer

The bathymetry from this survey can be easily shared as an OGC layer for display in standards based GIS software or Portals



## Alternative addressing technology



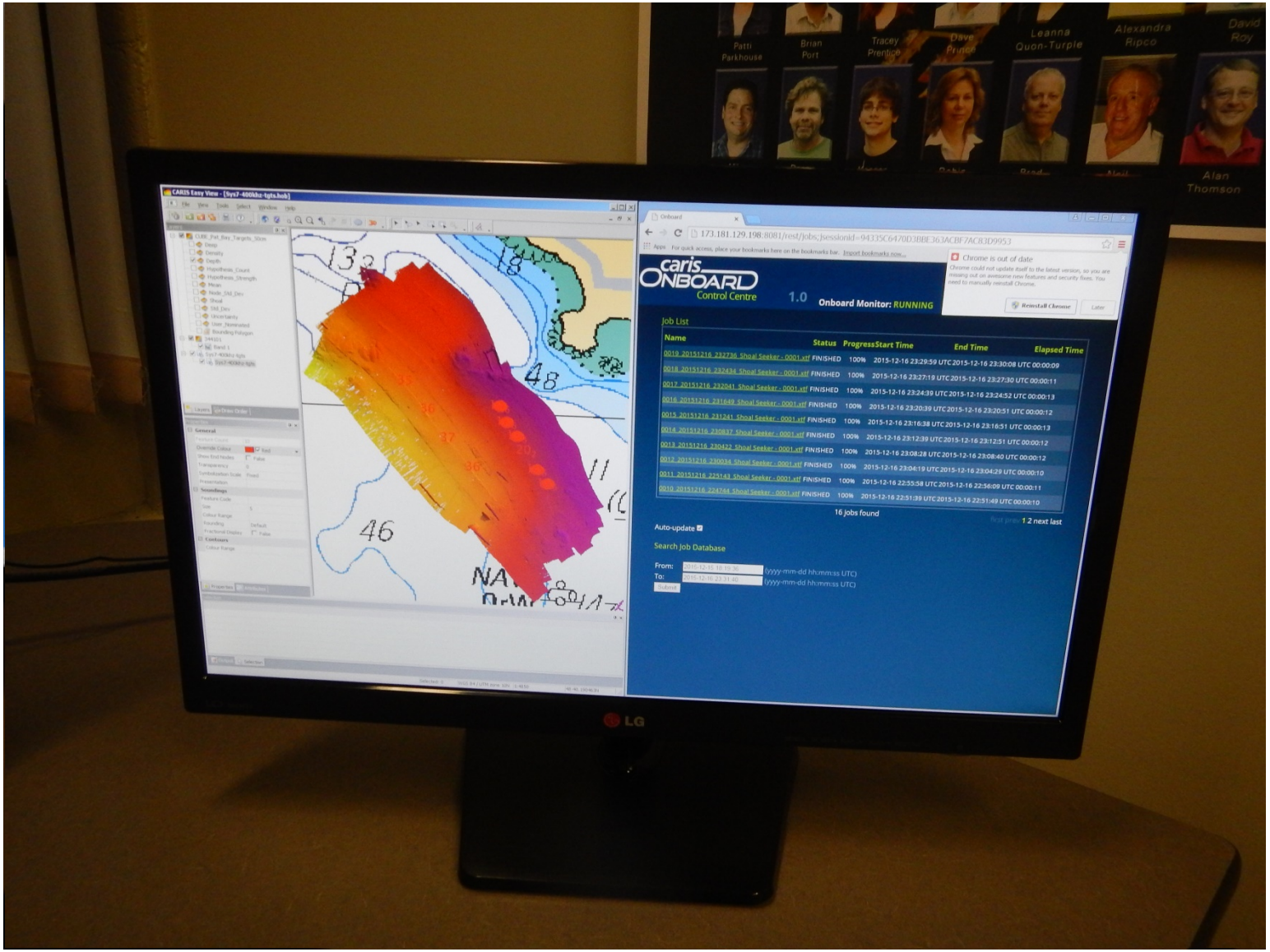
# Use Case 2 – Survey Launch, Vancouver Island

## Canadian Hydrographic Service – West Coast Trial to understand manned and unmanned potential for CARIS Onboard

- Survey Launch (Shoal Seeker)
- R2Sonic multibeam with Qinsy XTF
- Telus 3G phone network
- CARIS Onboard installed on launch
  - Convert, clean and correct
- Data also available in office in real-time
  - Remote quality control
- 1 hour of data collection
- 8,000,000 multibeam soundings
- Data loaded into Post GIS database
- Bathymetry available as OGC layer via URL
- Bathymetry available for download
  - BAG with ISO 19115 metadata

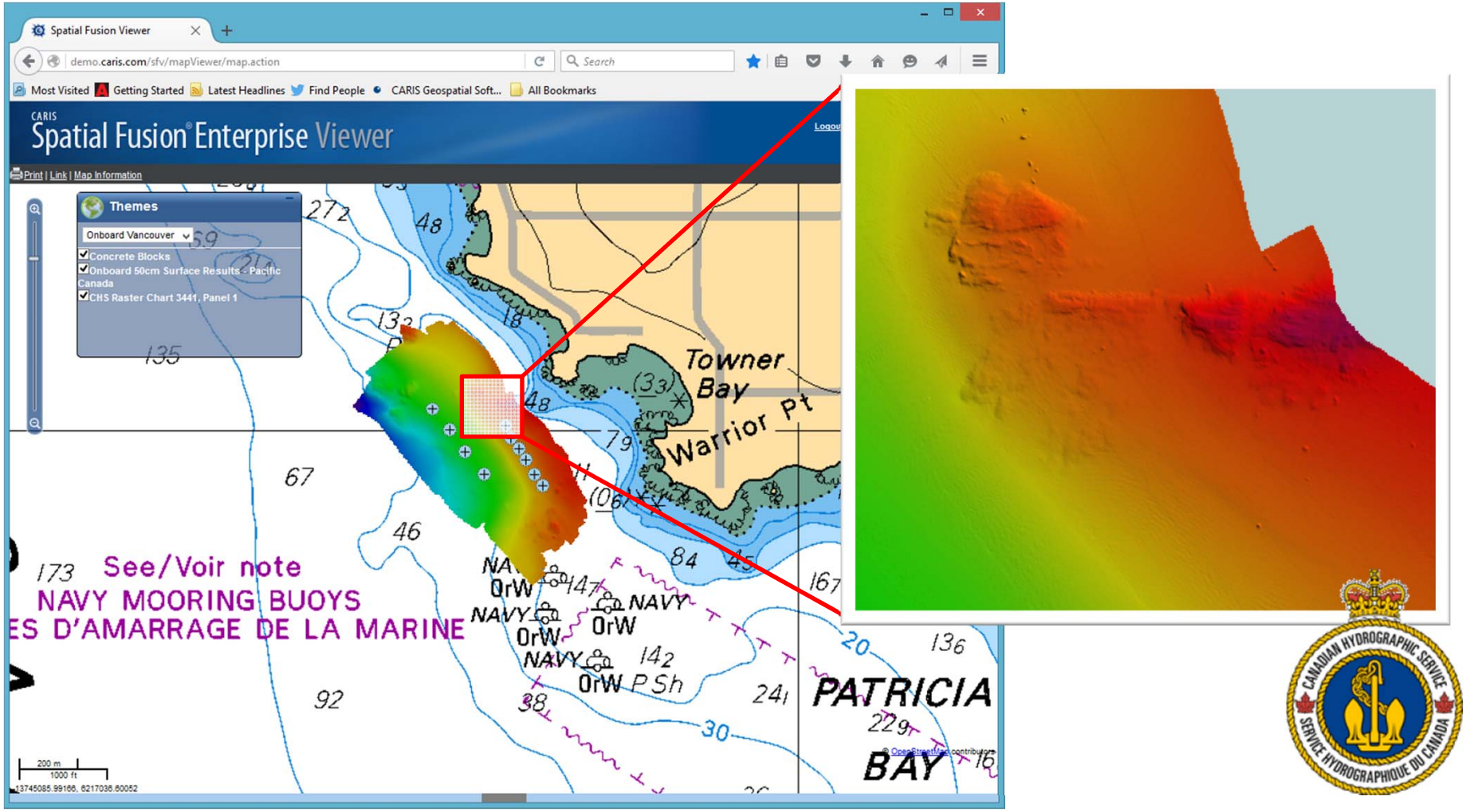
# CARIS Onboard on Vessel

# Real-time access to CARIS Onboard from Office via HTTP



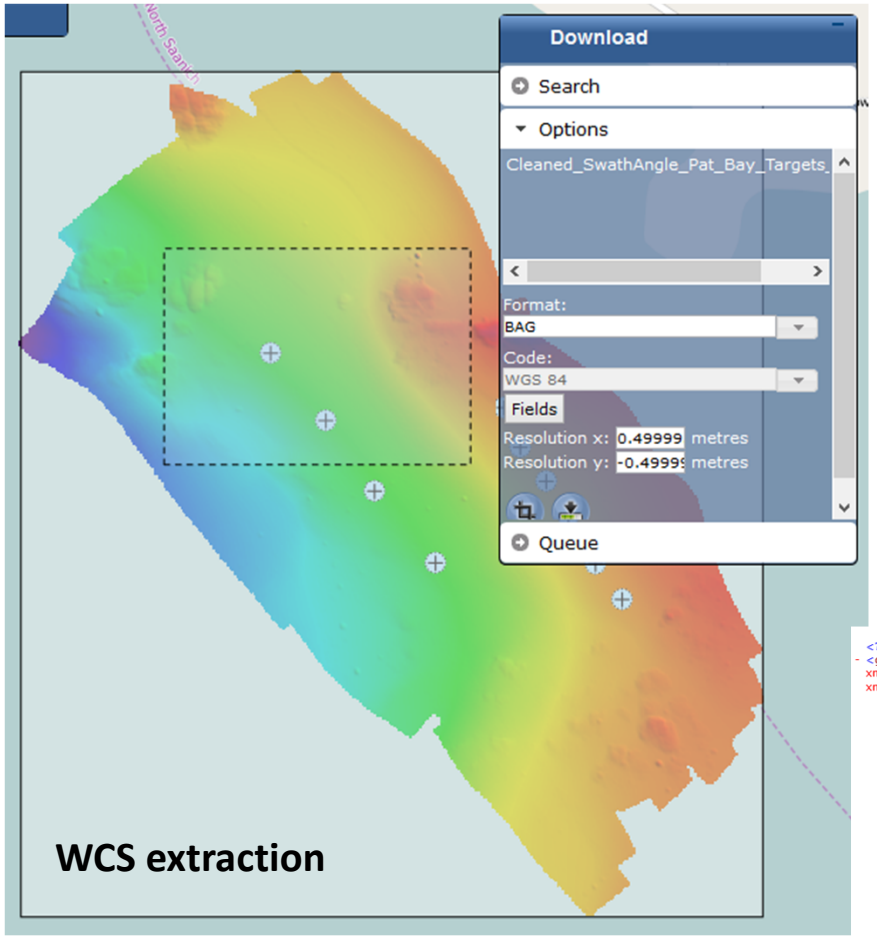
# Vancouver Island Data in OGC Viewer

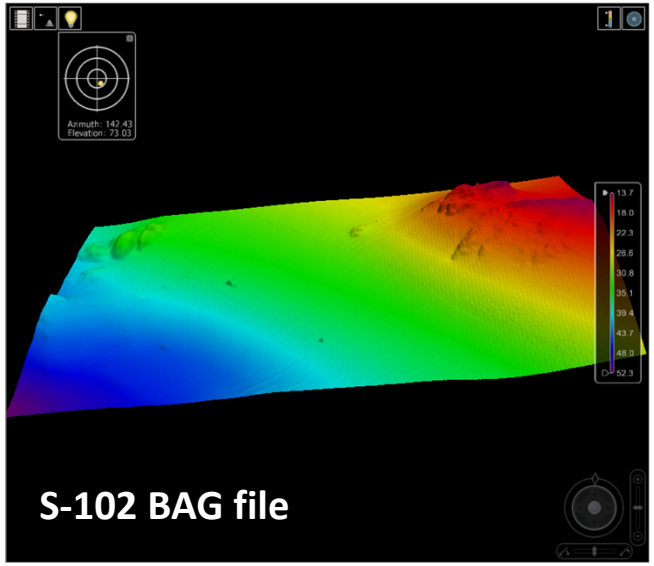
The bathymetry from this survey can be easily shared as an OGC layer for display in standards based GIS software or Portals



# Vancouver Island Data Download

The bathymetry from this survey can be quickly made available as an OGC WMS and WCS layer supporting view and download for integration into Spatial Data Infrastructures and use in GIS systems




**ISO 19115 metadata**

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xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gmi="http://www.isotc211.org/2005/gmi">
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```

## Conclusions

- Autonomous surveys are becoming more common
- This will increase the amount of data that can be potentially made available through Marine SDI initiatives
- Hydrographic offices are looking at Data Centric management practices to manage all this new source
- Tools like CARIS Onboard can help keep up with supply of survey data and populate databases in standard ways
- Human resources can spend more time on difficult hydrographic tasks and leave the number crunching to the computer software


Questions?