Maximizing the Value of Autonomous Surveys

IHO HSSC-7 Open Session

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Busan, Republic Of Korea

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- Introduction
- Survey platforms and force multiplication
- The data processing challenge
- An alternative approach
- Use cases
- Conclusions

- The volume of autonomous survey operations have increased over the past 5 years
  - Not only Autonomous Underwater Vehicles (AUVs), but also Unmanned Surface Vehicles (USVs)
- The potential benefits are clear
  - Lower capital and operating costs, rapid deployment/recovery, and the ability to work closer to the intended target
- Traditionally, the platform would be sent on a pre-defined mission and gather hydrographic data
  - Data stored internally until recovery when it would be processed
- As power sources improve the operating times extend
  - But little has been done to address the data bottleneck / processing backlog

Survey platforms and force multiplication

- Becoming widely adopted survey platforms
- They serve as a force multiplier for survey operations

Survey platforms and force multiplication

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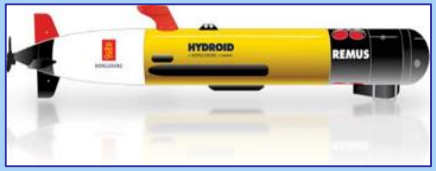
Mission Duration

Short - term

Persistent

Sub Surface



Surface

Manned / Autonomous

The data processing challenge

- Increased number of platforms = increased data volume to be processed
- Data volumes are significantly increasing
  - Improved power sources for autonomous vessels
  - Multi platform/sensor survey ships
  - Improvements in sonar technology (watercolumn, interferometric, multi detect etc.)
- The traditional method for handling data is dependent on the type of acquisition platform:

MANNED PLATFORM
(Survey Ship / Motor Boat)

1. Acquire data
2. Process data offline (Either at sea or upon return to shore)

UNMANNED PLATFORM
(AUV / ASV)

1. Acquire data
2. Log data to internal HDD
3. Process data upon recovery

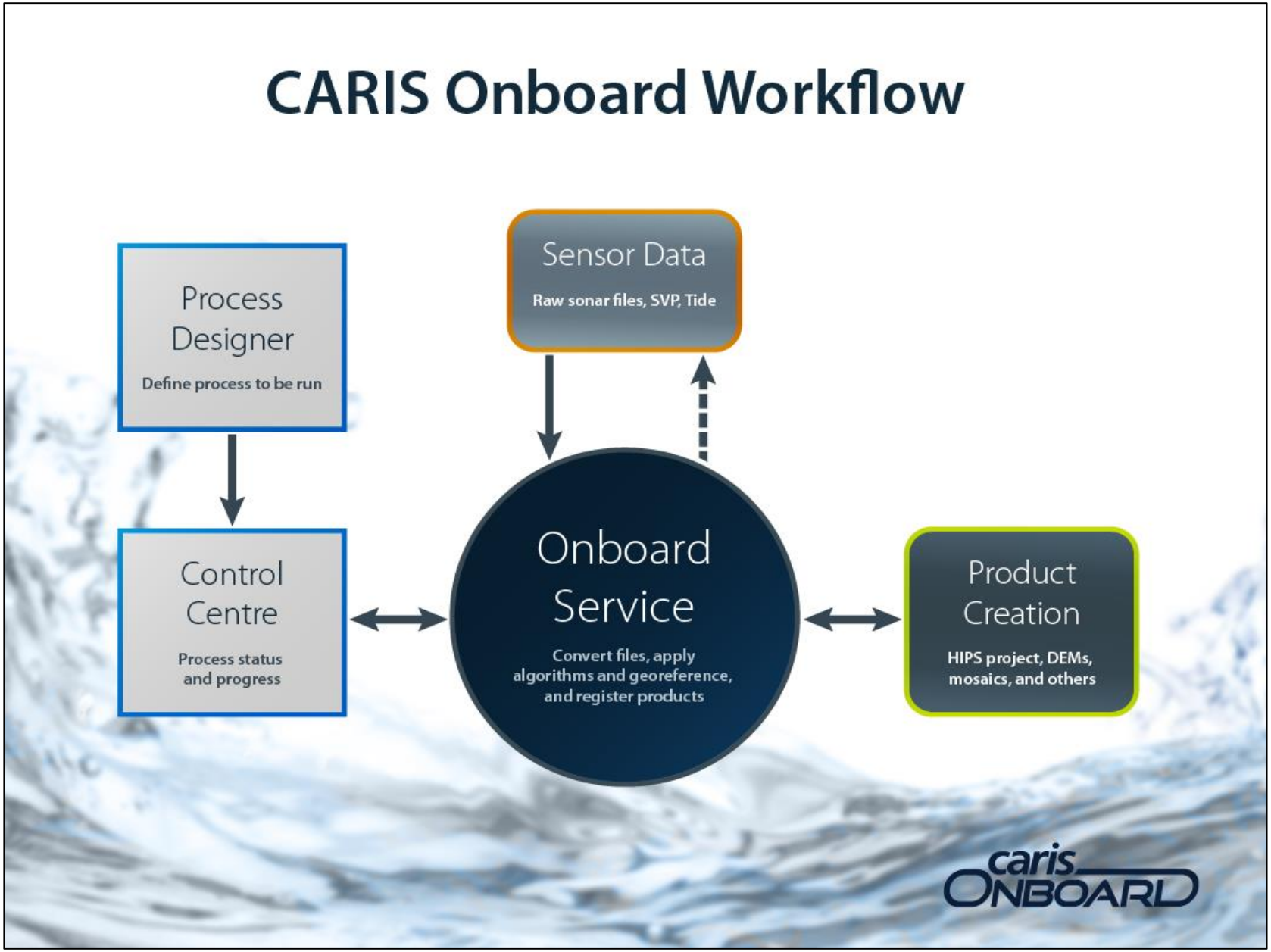
- This approach results in two main problems for the hydrographic surveyor:

1. The surveyor cannot make informed real-time decisions based on the quality of the data until it is processed

2. For autonomous platforms with limited or no communications, the surveyor has no way to tell if the data meets the required specification until recovery

An alternative approach

- By automating hydrographic data processing ‘Onboard’ the autonomous or staffed survey platforms:
  - Make processed results available to the surveyor during operations
    - Available results are bandwidth dependent
    - If no bandwidth available, an almost final dataset can be reviewed immediately after survey
  - Obtain repeatable results and real-time QC
  - Make decisions how to proceed with the survey in the most efficient manner
  - Done with minimal human intervention during processing to optimize use of human resources
  - Means to reduce data collection to product time, and processing backlogs


CARIS Onboard Workflow
Process Designer
Define process to be run
Sensor Data
Raw sonar files, SVP, Tide
Control Centre
Process status and progress
Onboard Service
Convert files, apply algorithms and georeference, and register products
Product Creation
HIPS project, DEMs, mosaics, and others
caris ONBOARD

An alternative approach

- CARIS Onboard will perform the automated tasks as defined by the surveyor
  - Completing 80-90% of the processing workflow

- This leaves the following steps in a typical multibeam workflow:
  - Manually review and edit navigation
  - Apply final sound velocity
  - Apply final tide files or post processed height (ERS surveys)
  - Manually review sounding data / gridded surface

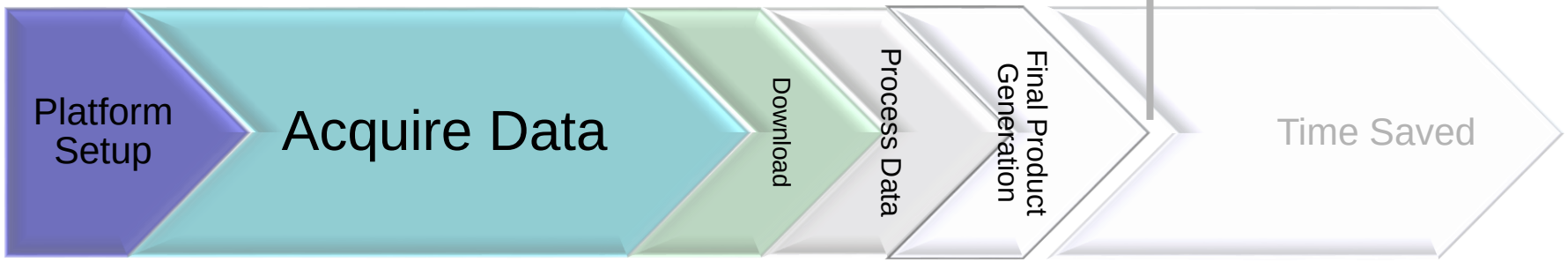
An alternative approach

Traditional Workflow

AUV Dives

AUV Recovered

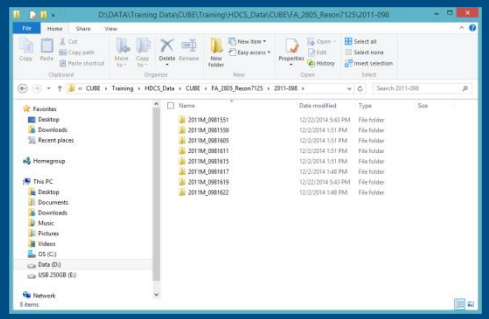
Final Product – asset ready for redeployment



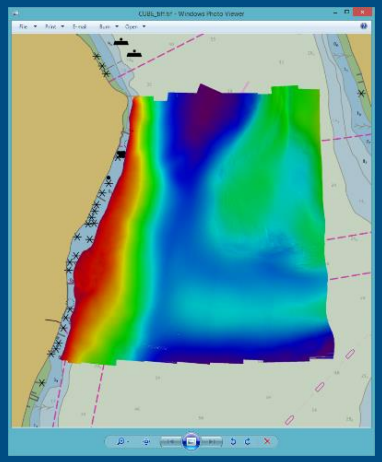
caris ONBOARD **Workflow**

- Examples of near real-time products

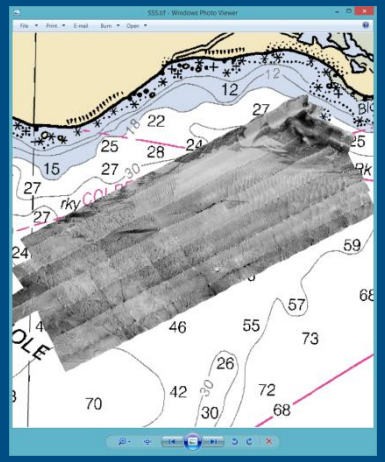
High Bandwidth



HIPS Project

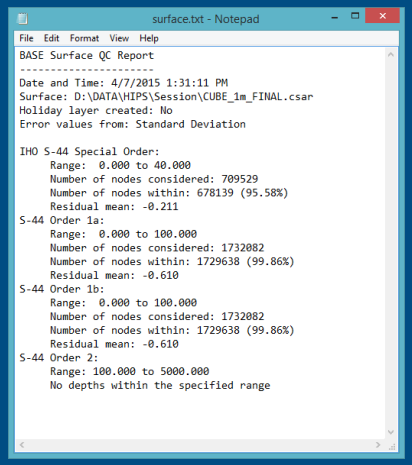


DEM

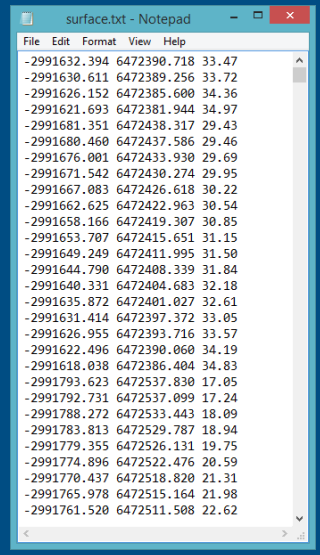


Mosaic

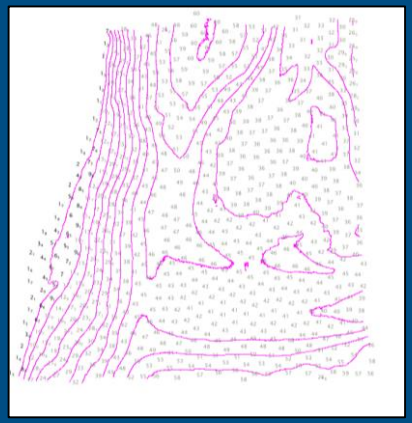
Low Bandwidth



Bathymetry surface QC report

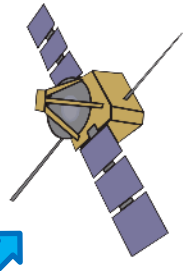


ASCII depths



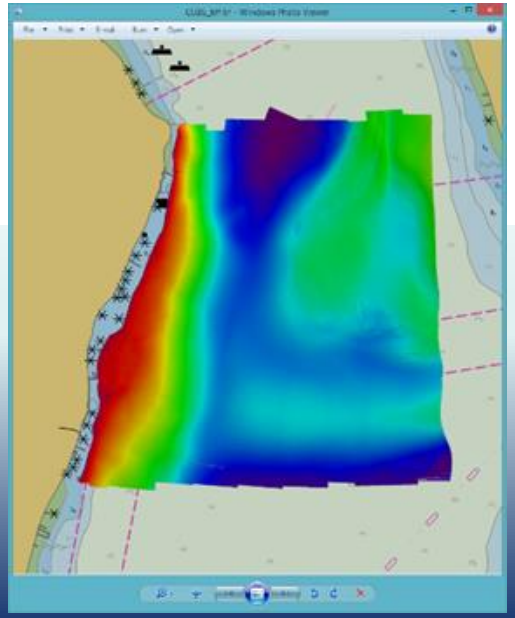
Sounding Surface

Use Cases – Unmanned Surface Vehicles



(Satellite Communications)

Bathymetric Surface

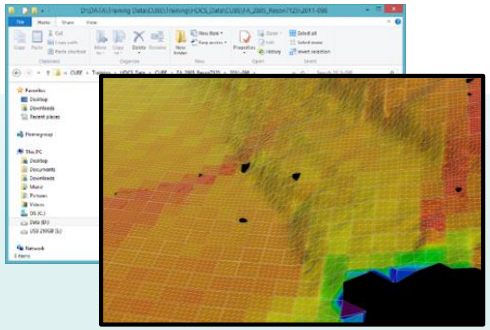


ASV gathering multibeam data, processing using CARIS Onboard

Shore Data Centre

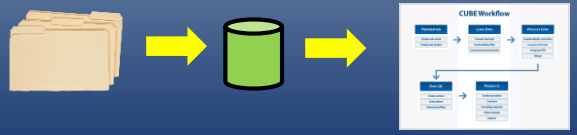
Use Cases – Autonomous Underwater Vehicle

Product(s)



Deployment

QA/QC
Product(s)



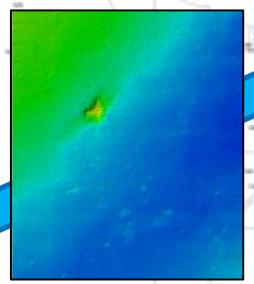
Data
Files

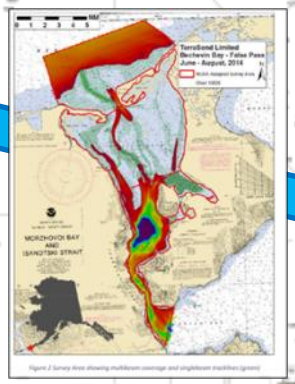
Store

Process

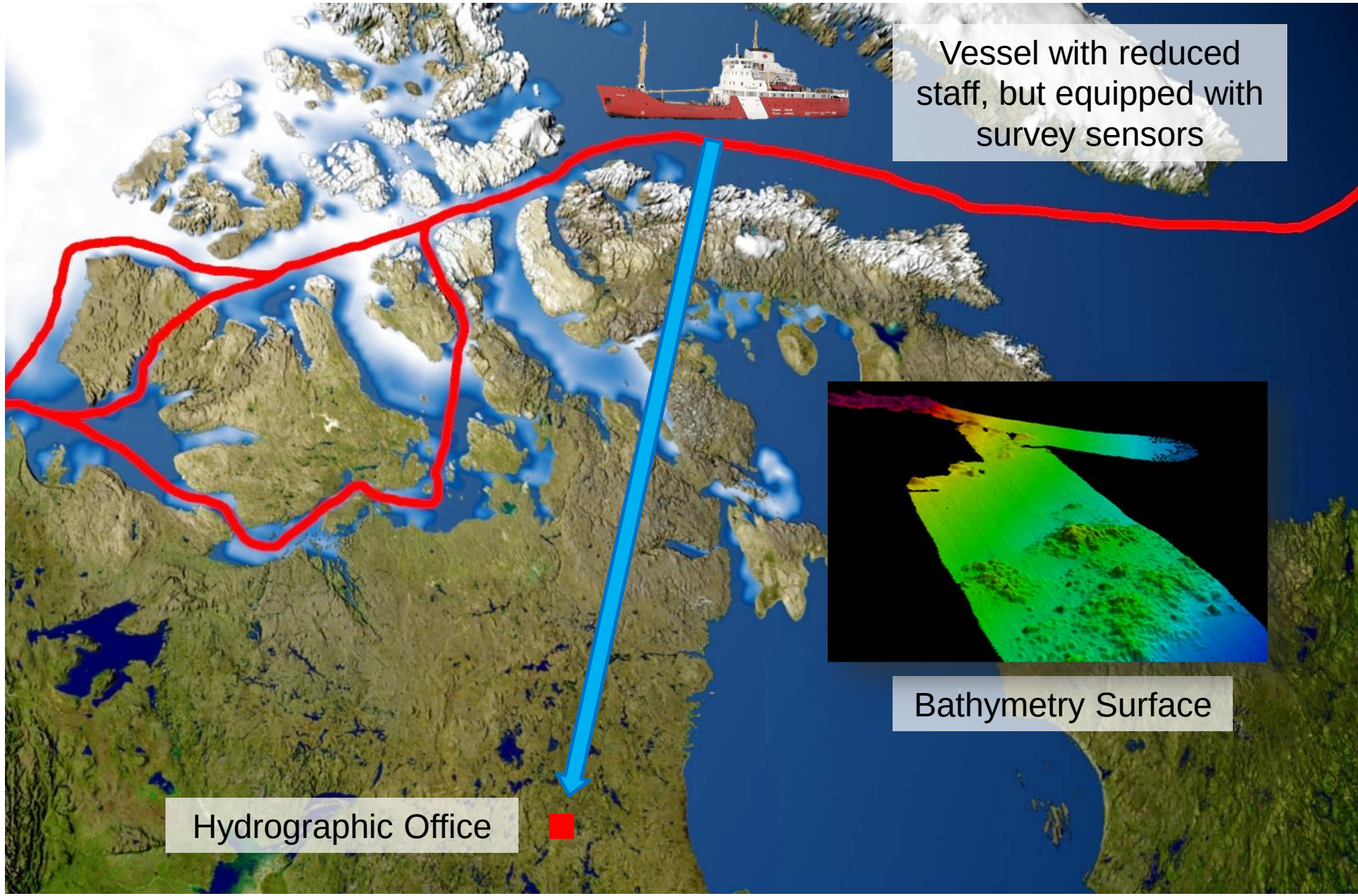
Use Cases – Staffed Platforms / Command and Control

Surveyor in Charge on Mother Ship, monitoring survey launches remotely and directing operations





Use Cases – Trusted Crowd-Sourcing / Crowd-Sourcing



- Onboard data processing allows agencies to obtain maximum value from autonomous surveys
  - Reduces overall collection to product time as data is ready for QC and use in deliverables at end of survey
  - Allows for remote transfer of meaningful data from your survey platform to prevent costly errors in data acquisition, and effectively manage remote assets
  - Allows survey personnel to focus on higher level hydrographic tasks
  - Results seamlessly passed into optimal hydrographic workflow (i.e. Ping-to-Chart Solution)

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