Mapping the Gaps Through Process Automation

Map the Gaps

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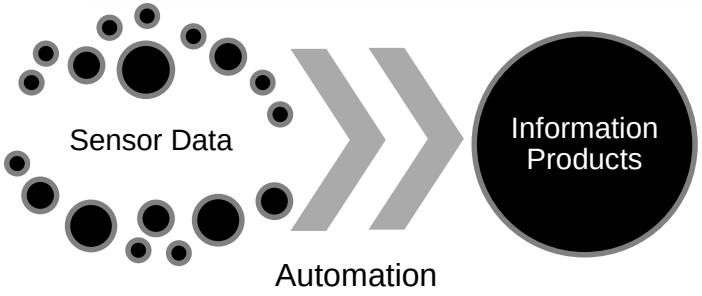
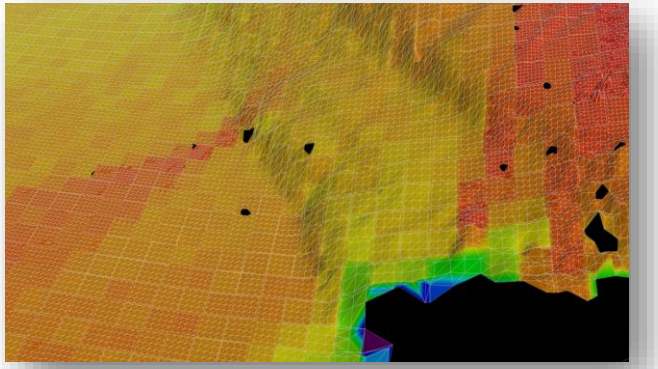


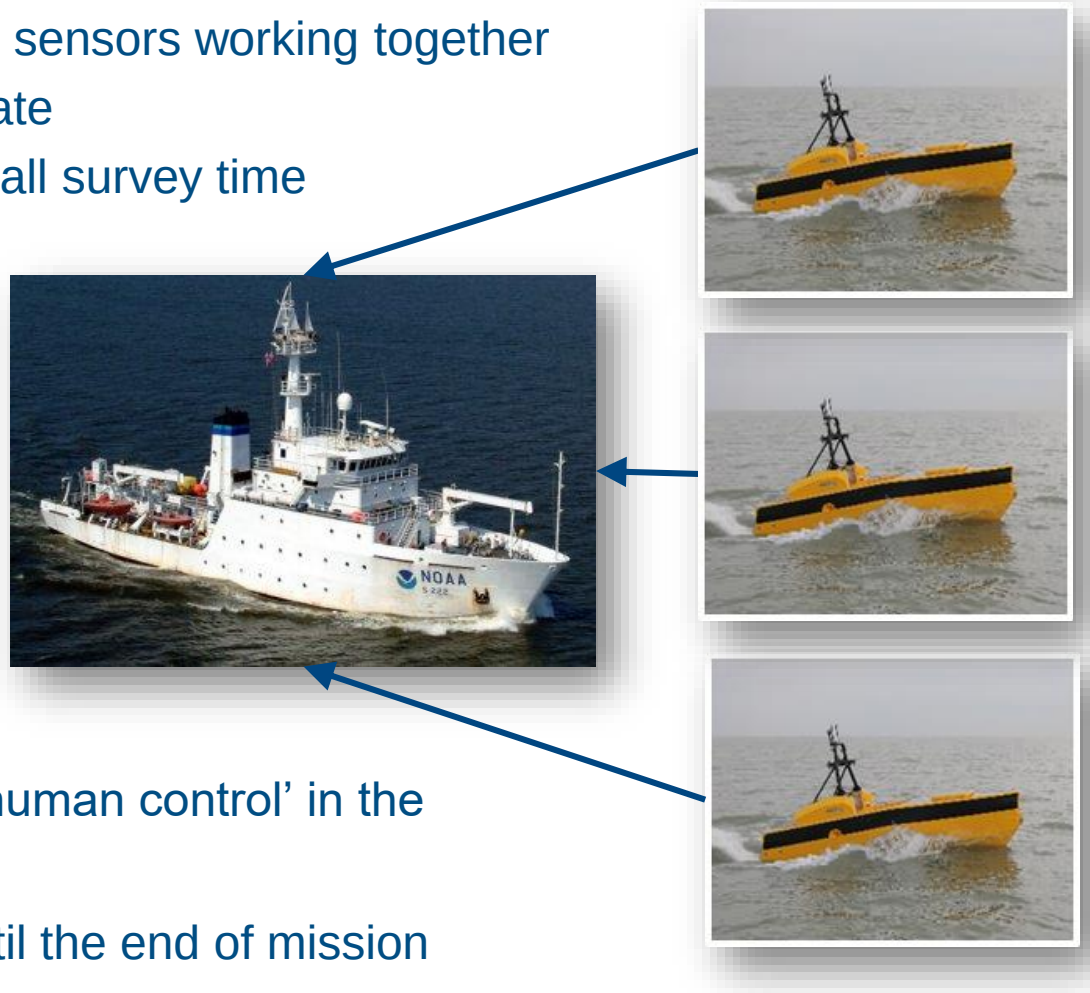


Force Multiplication

- Increased use of unmanned vehicles over the past 5 years; trend expected to continue for the next 5 years
- 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

Force Multiplication: Benefits and Challenges

- Benefits:
  - Multiple vehicles and multiple sensors working together
  - Provides an increased data rate
  - Facilitates a reduction in overall survey time



- Challenges:
  - Autonomous platforms lack ‘human control’ in the feedback loop
  - Results typically not know until the end of mission
  - Data could be incorrectly acquired

Process Automation

- There are currently three main approaches to handling data from autonomous platforms.

1. Wait until the vehicle has completed the survey; then recover, download and process the dataset.

2. Install a desktop application, and process through remote desktop (if communications are available).

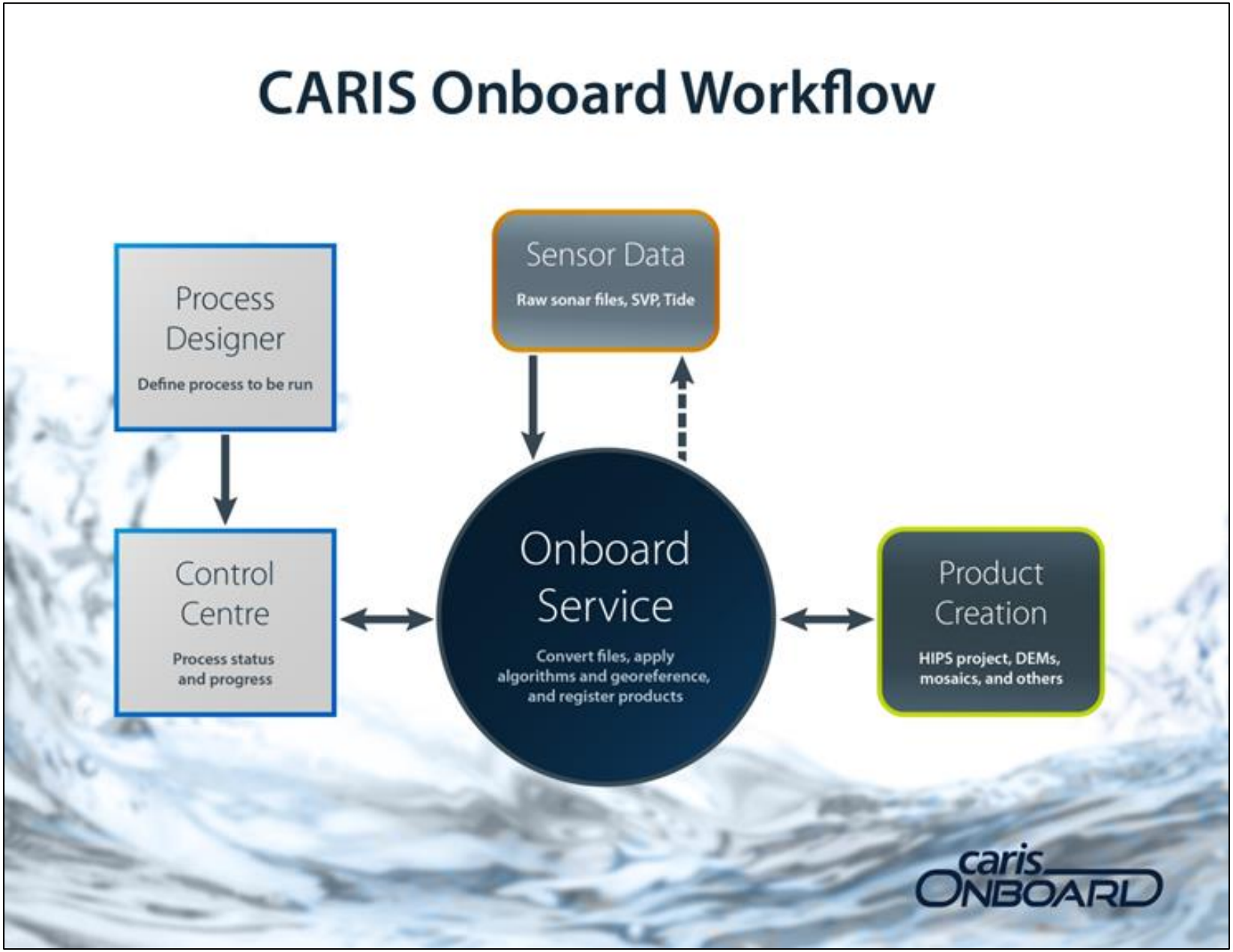
3. Automate data processing on the platform using a web application based processing service

Process Automation: CARIS Onboard

- A web application based processing service is installed on each survey platform
- 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 QC'd remotely

Reference: Leveraging Near Real-time Data Processing to Safely Increase Hydrographic Production; Kalman Czotter and David Dodd, Canadian Hydrographic Service, and Travis Hamilton, Teledyne CARIS Inc.; Proceedings of Canadian Hydrographic Conference 2016

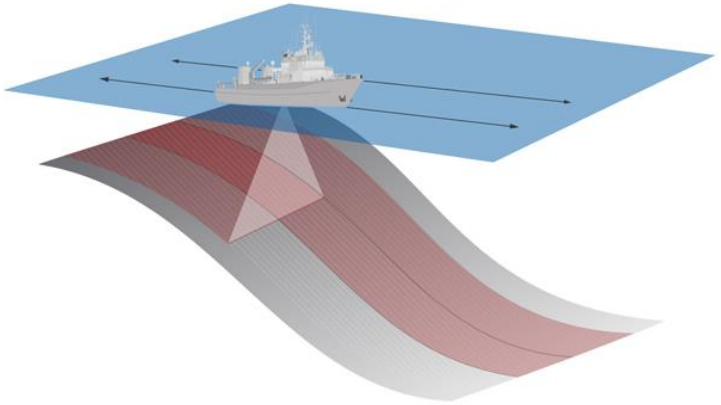
Process Automation: CARIS Onboard



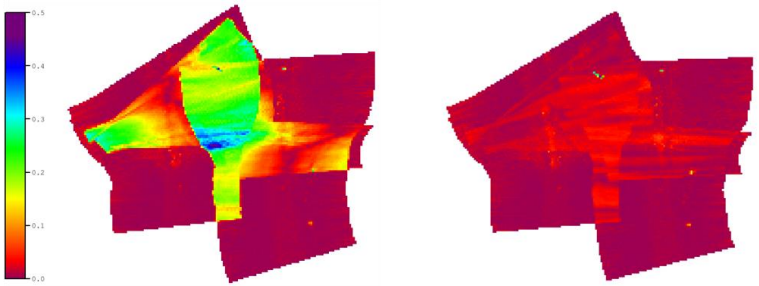
Process Automation: Sensor Calibration

- Process automation used to simplify, and save time and costs for sensor calibration

- Automatic Boresight Calibration for Multibeam-IMU*
  - Fully automated method for objective and repeatable results
  - Provides quality indicators on the results
  - Requires fewer survey lines than traditional multibeam patch-test (4 vs. 5-6)



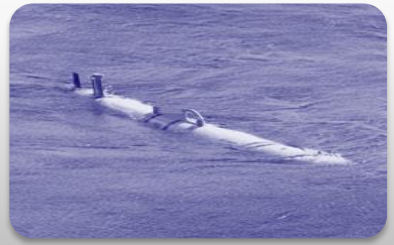
New survey pattern



RMS Error before (left) and after (right)

*Based on work of Nicolas Seube and Rabine Keyetieu, Multibeam Echo Sounders-IMU Automatic Boresight Calibration on Natural Surfaces".

Process 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/or Staffed Platforms

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

Crowdsourced and Opportunistic

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

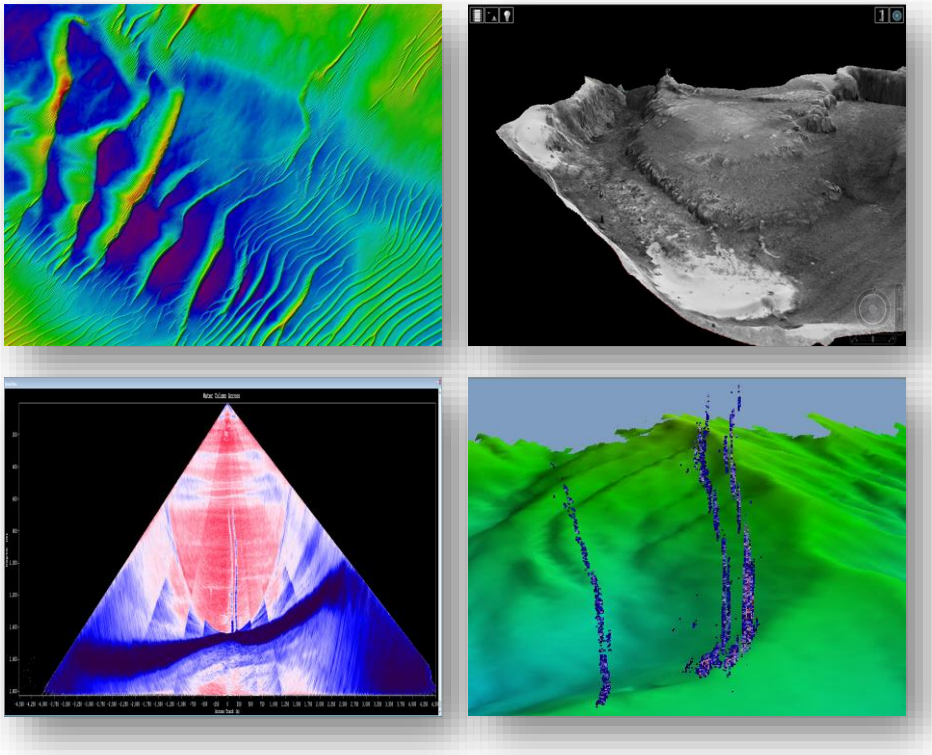
Office Environment

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

Information Products for Ocean Mapping

- Survey data products are fundamental for ocean management:
  - Bathymetry
  - Seafloor geology
  - Water column
  - Oceanography

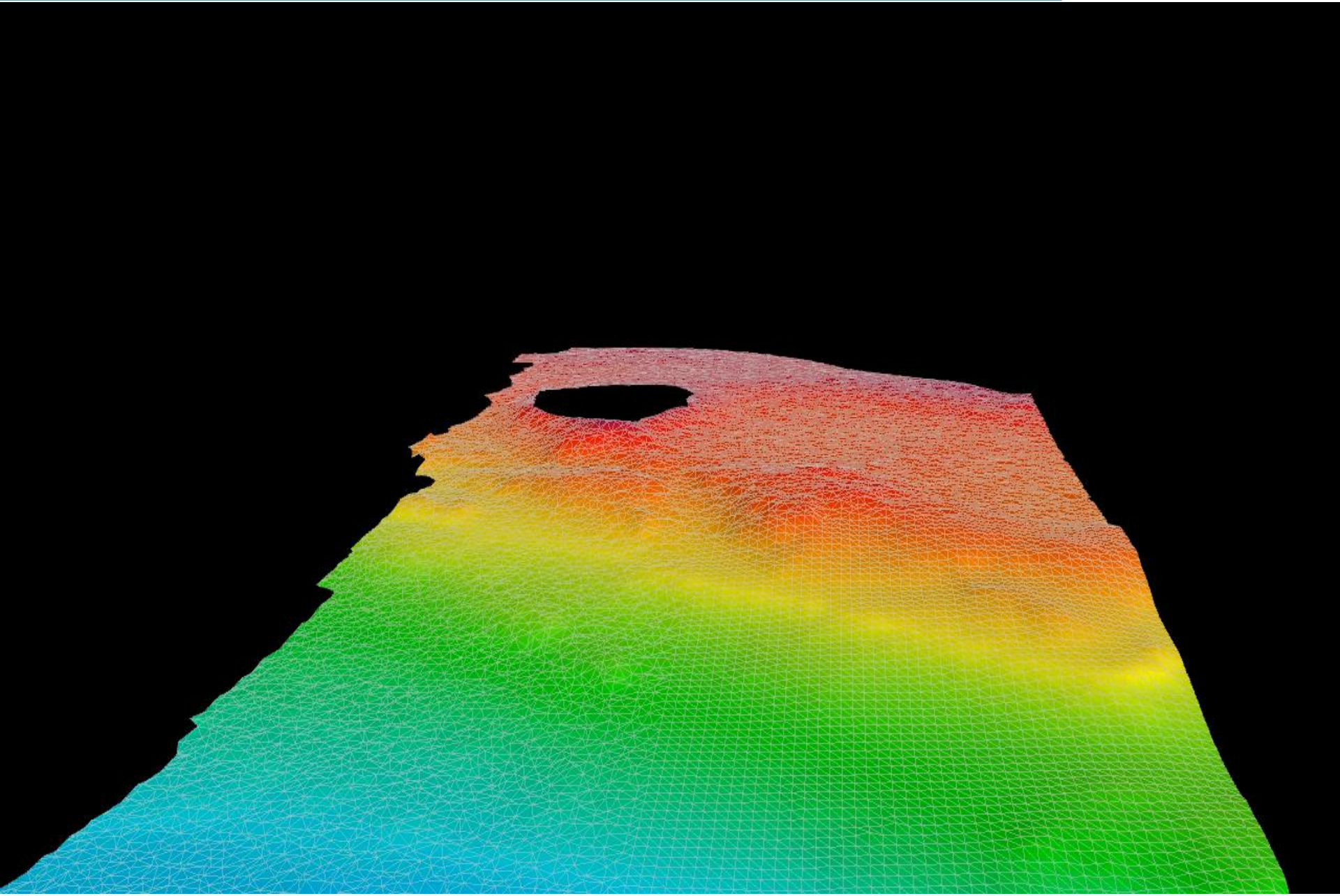
- Through process automation we can:
  - Turn around larger datasets
  - Improve utilization of human resources
  - Efficiently create additional products and new data services



Information Products for Ocean Mapping: Bathymetry

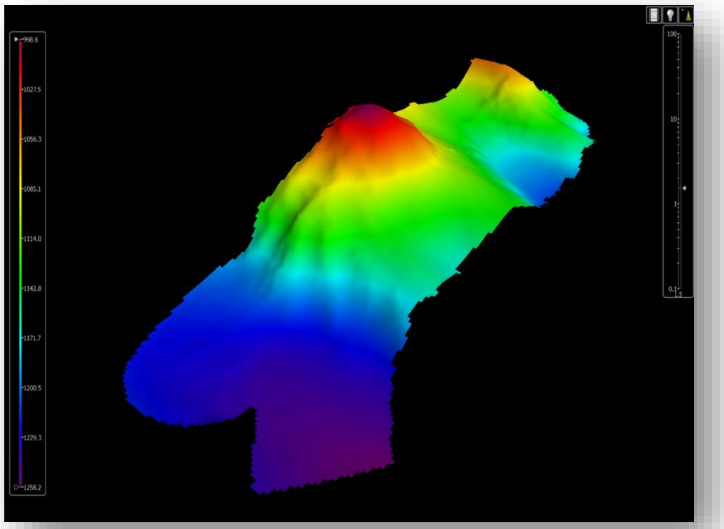
- Data from ocean mapping will be irregular
  - Density varies by sensor, scanning technique, range, etc.
- Bathymetry data needs to be modelled to support analysis
- Changes in data density are traditionally difficult to represent in a single model; may result in loss of detail
- Variable Resolution surfaces:
  - Provide a continuous model of different data densities
  - Better reflect the shape and details of the seafloor
  - Offer seamless and efficient visualization

Information Products for Ocean Mapping: Bathymetry

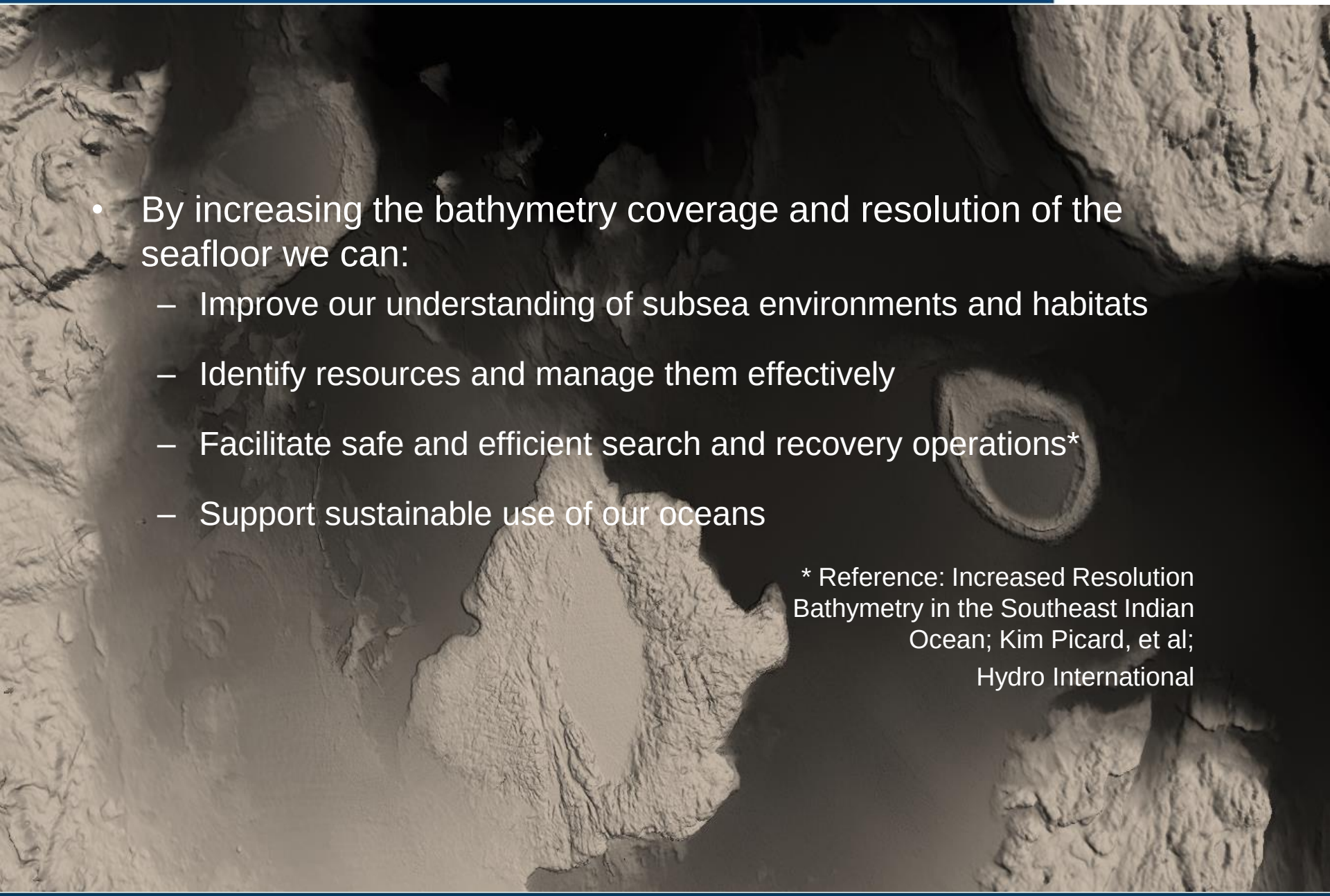


Examples of Process Automation: AUV Operations

- CARIS Onboard trial with JAMSTEC and their deep-sea AUV “URASHIMA”
- Traditionally it is several hours for a decision to transit or redeploy 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



Importance of Mapping the Gaps Faster



- By increasing the bathymetry coverage and resolution of the seafloor we can:
  - Improve our understanding of subsea environments and habitats
  - Identify resources and manage them effectively
  - Facilitate safe and efficient search and recovery operations*
  - Support sustainable use of our oceans

* Reference: Increased Resolution Bathymetry in the Southeast Indian Ocean; Kim Picard, et al; Hydro International

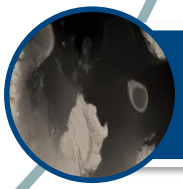
Conclusions

Autonomous surveys are becoming more common, and increasing the availability of high resolution data

New approaches are needed to process the data, and ensure it is available for effective ocean resource management

Through process automation we can improve data quality and achieve operational efficiencies during autonomous surveys

Utilization of human resources can also be improved by automating objective and repeatable processes



By combining autonomous vehicles and process automation we can increase the rate of ocean information, and map the gaps faster with greater confidence

Thank you!

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