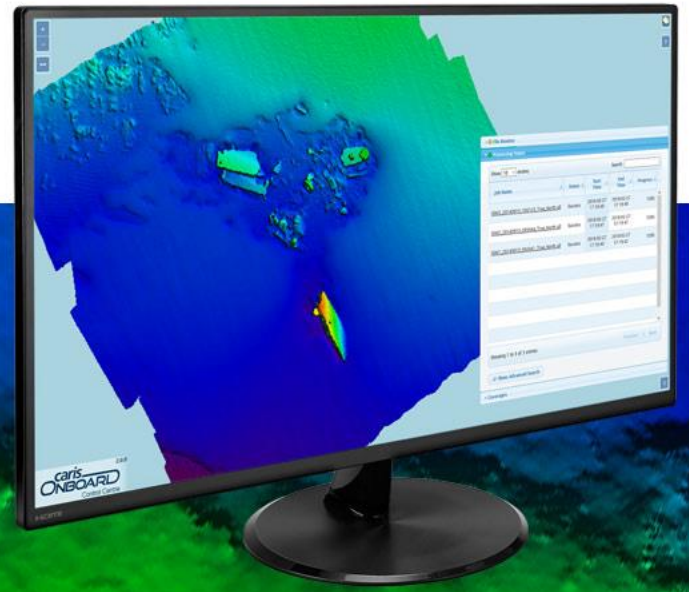
Automation

Innovating marine survey workflows



AUT 2019: An ocean of opportunities

Perth, Australia– October 23, 2019

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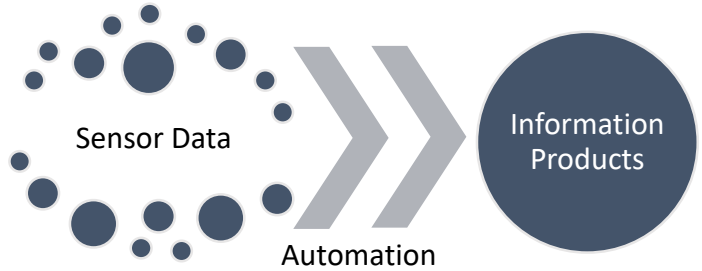
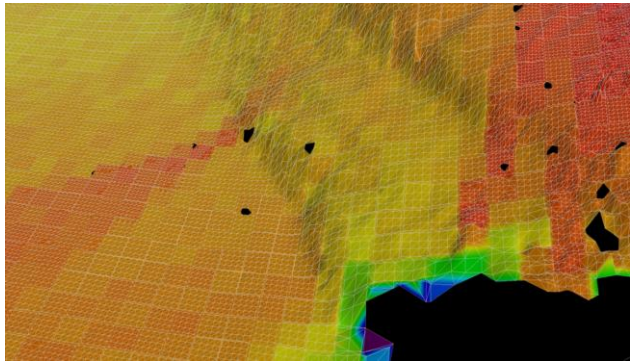




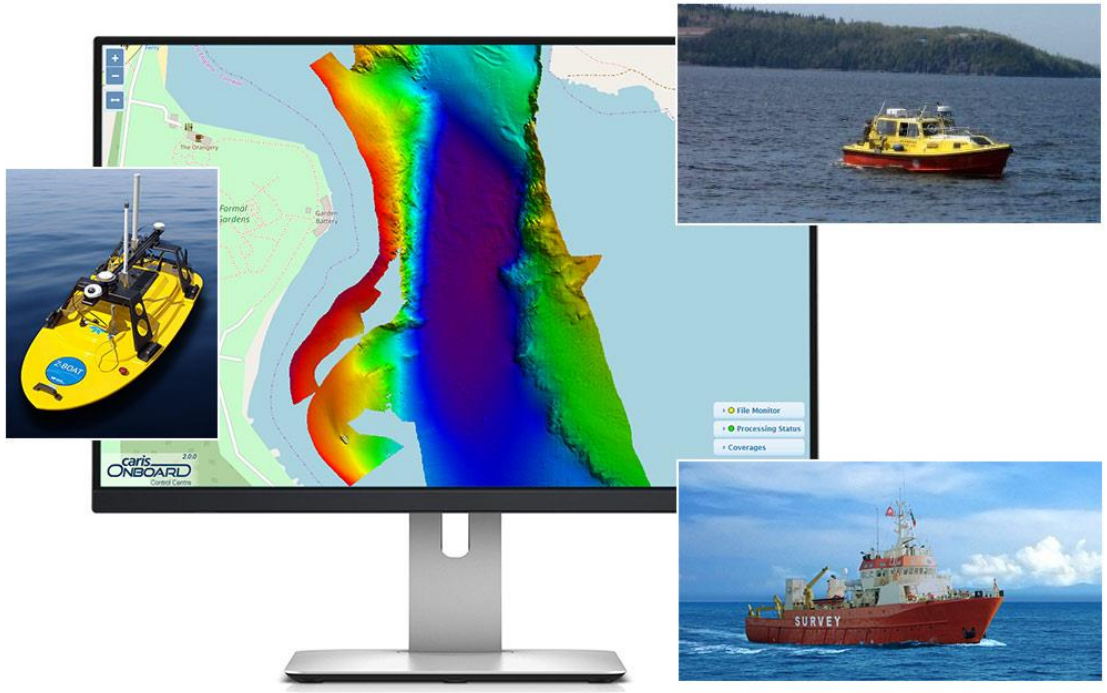
Automation: CARIS Onboard

- A web application 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

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

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

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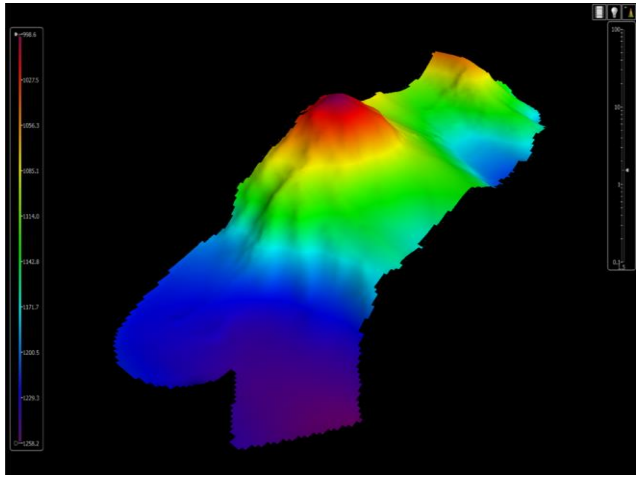
CARIS Onboard Example: AUV operations

- 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 continues to be 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 2019 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

Machine Learning

Good at:

- Pattern recognition
- Prediction

Top trend in recent years across industries

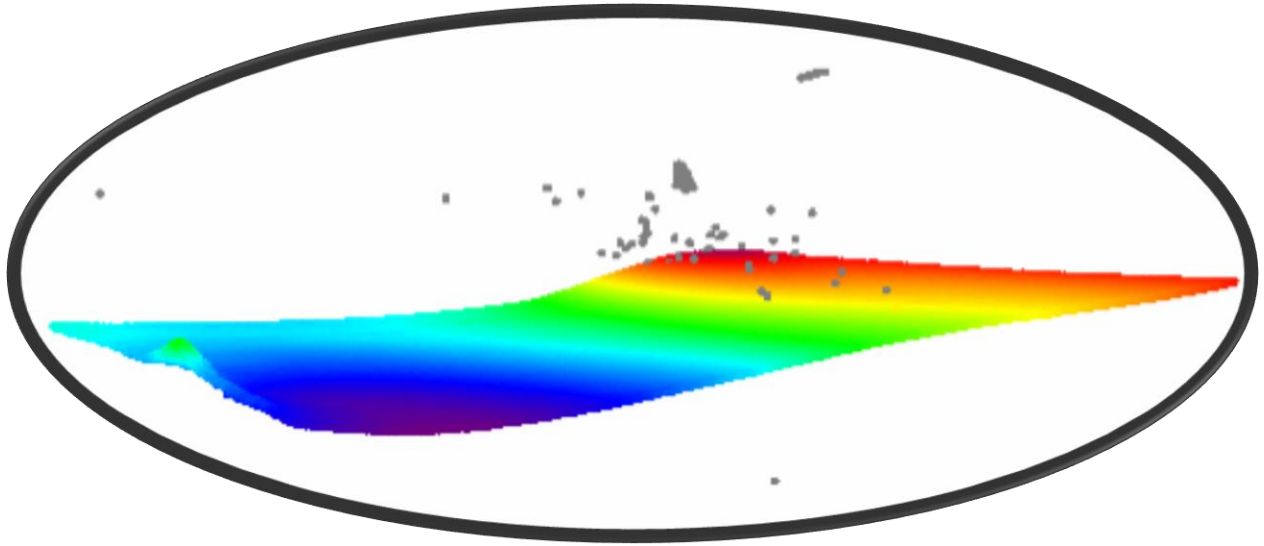
Google

NVIDIA

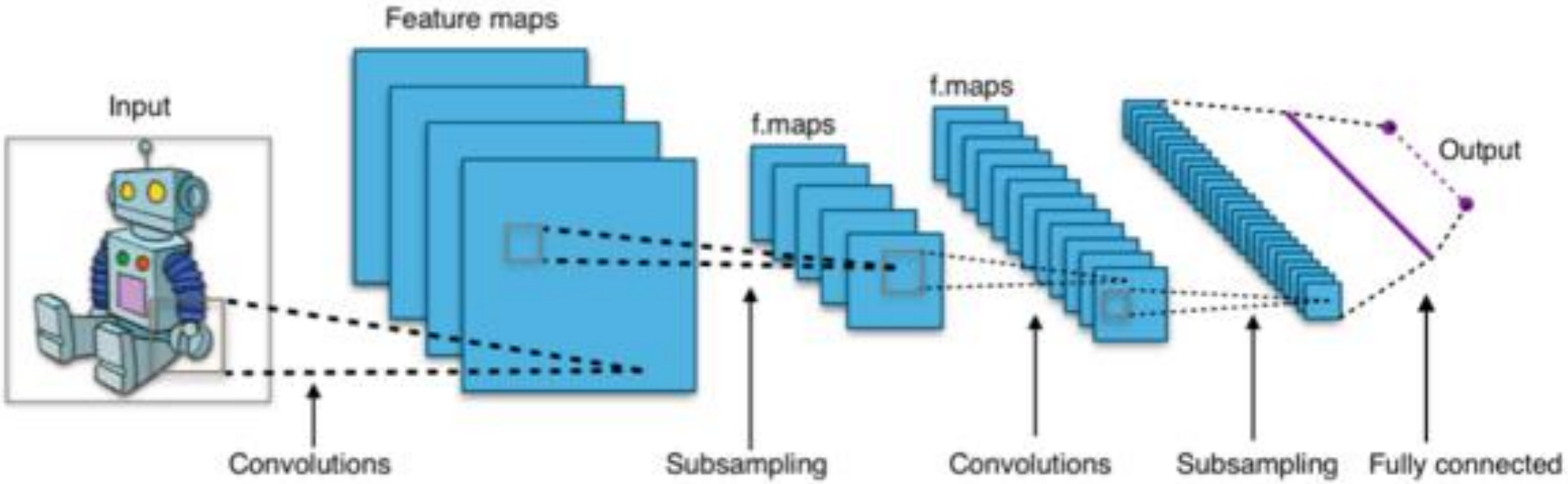
Applying machine learning to noise removal

Noise cleaning remains a significant bottleneck in post-processing and is labor-intensive.

A human operator recognizes noise patterns. An AI can be trained to do the same.



Convolutional Neural Networks (CNN)

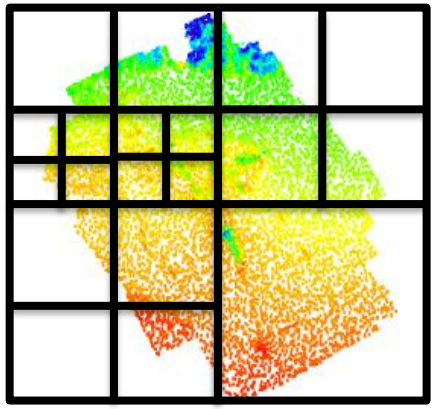


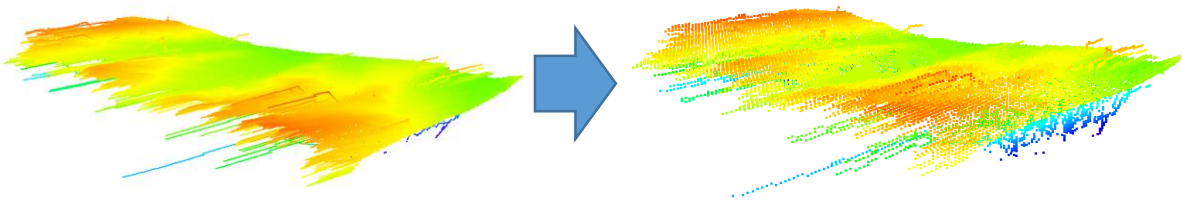
AI Deployment

- In-house: NVIDIA Titan RTX for training
- Flexible deployment:
  - **AWS cloud**
  - PCs with the minimum GPU card requirement

AI Classification Workflow

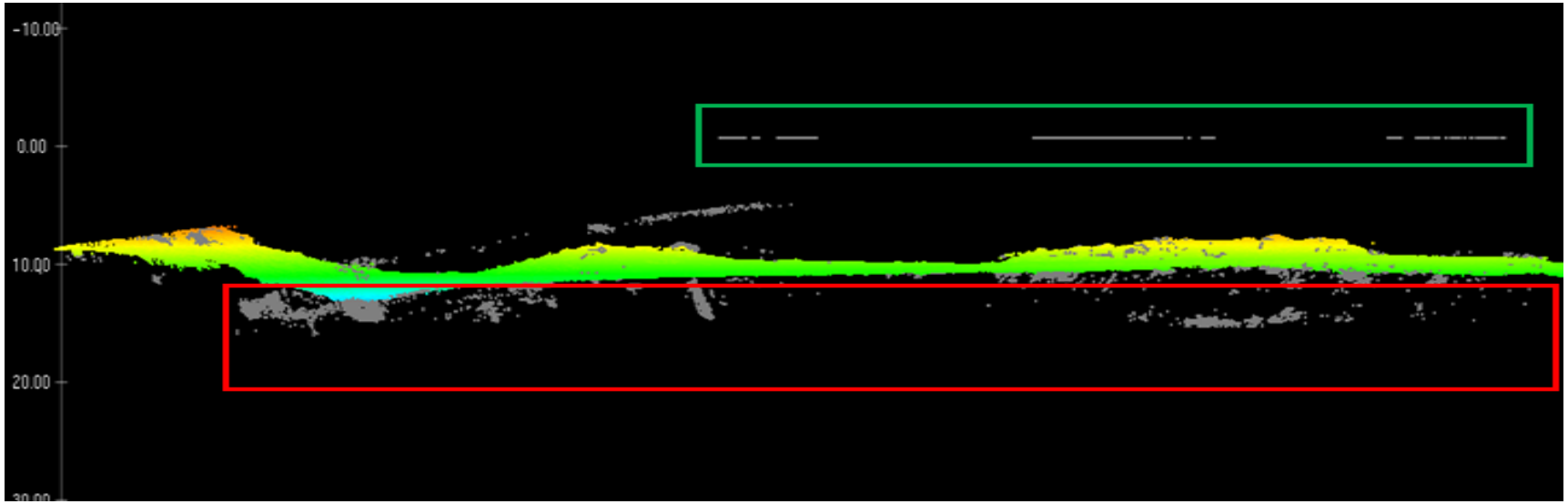
- Data is analyzed and divided into tiles (VR)
- Voxel grid calculated for each tile
- Send voxels to AWS
- Map response back to points





Performance: Accuracy

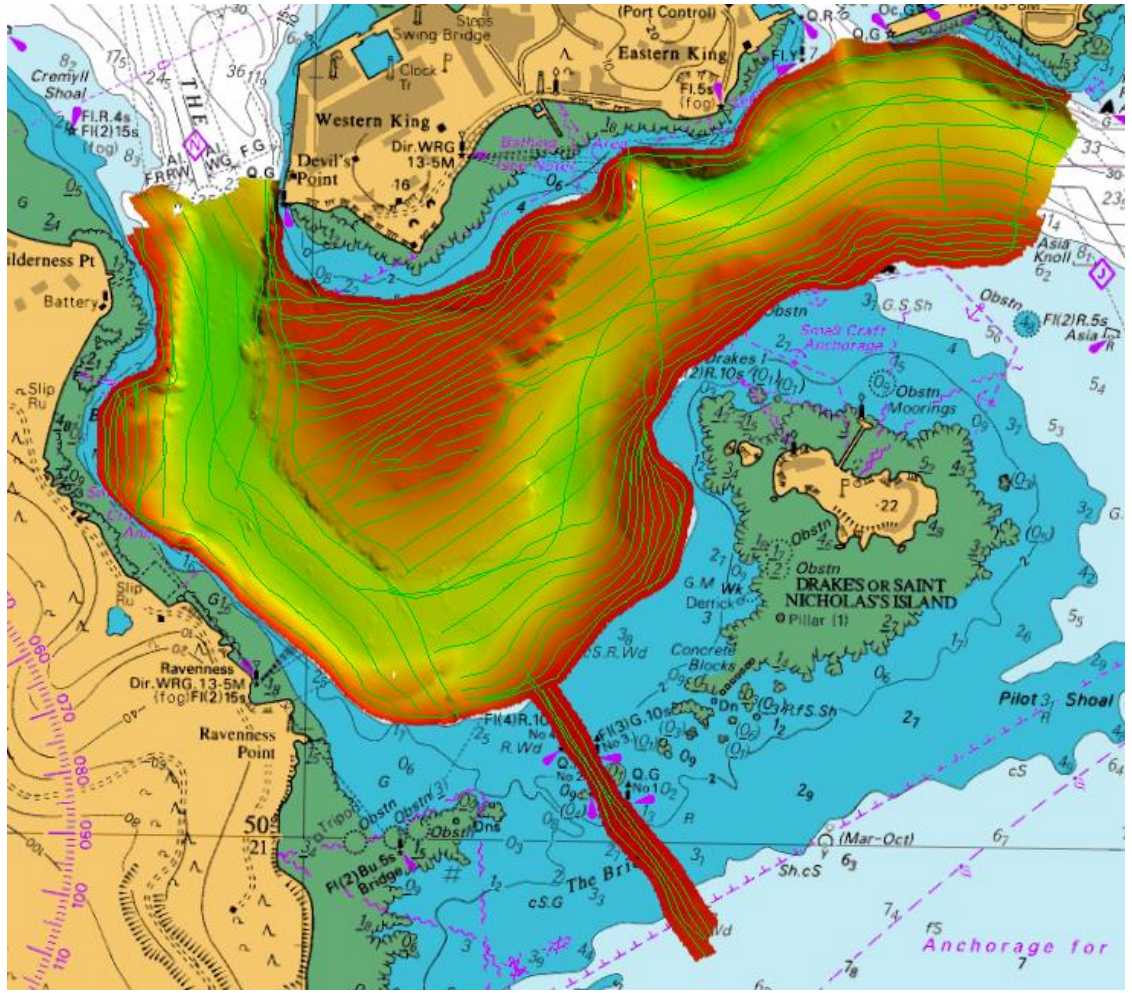
- > 99% “real” points
- ~92% noise points



AI Example: Reducing Processing Times

Shallow Survey 2015 Demo Dataset

- *Collected using Reson T20P*
- *Approx 175M soundings*
- *44 line km of survey*
- *Roughly 9 ½ hours online survey time*



AI Example: Reducing Processing Times

- Time trials (N=1, HH:MM)

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
CNN	**00:20**	00:35	00:55	**1h/6m**

Conclusions

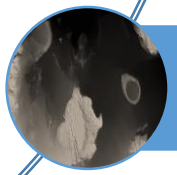
Multi-vehicle and autonomous surveys increase the availability of high resolution data

CARIS ONBOARD Automation

New approaches are needed to process the data, and ensure it is available in a timely manner

Through automation we can improve data quality and achieve operational efficiencies

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



By applying automation we can increase the rate of ocean information, and survey faster and with greater confidence

Questions?
Thank You!

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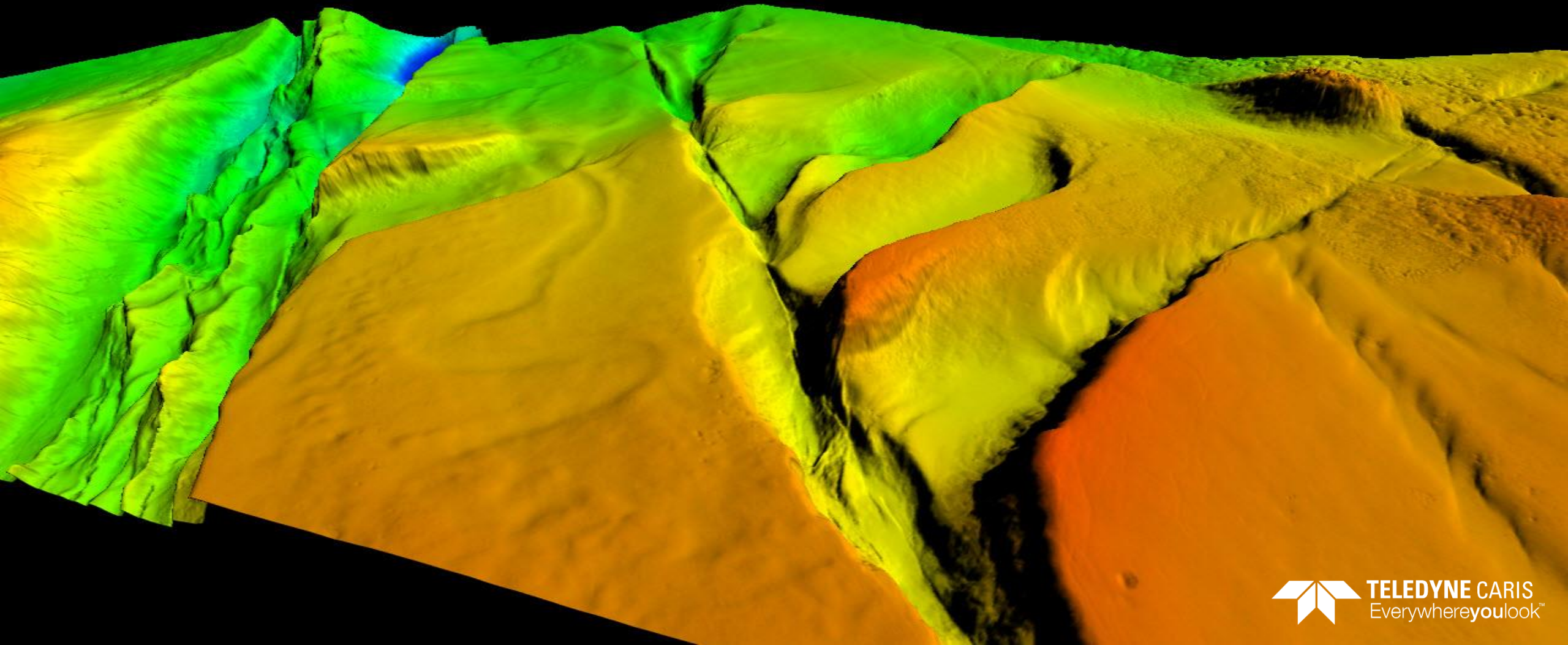

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