

caris **ONBOARD**

Real Time Data Processing

Automating the Future of Hydrographic Survey

Ago. 2017

- 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 of autonomous surveying 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

- Onboard data processing allows agencies to obtain maximum value from autonomous and manned 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)

CARIS Ping-to-Chart Workflow

PROCESSING

CARIS
HIPS and SIPS

CARIS
Onboard

ANALYSIS

CARIS
Bathy DataBASE

CARIS
BASE Editor

CARIS
**Engineering
Analysis Module**

CARIS
LOTS

PRODUCTION

CARIS
HPD

CARIS
S-57 Composer

CARIS
**Paper Chart
Composer**

DISCOVERY

CARIS
**Spatial Fusion
Enterprise**

PROCESS AUTOMATION



Data Processing Challenge

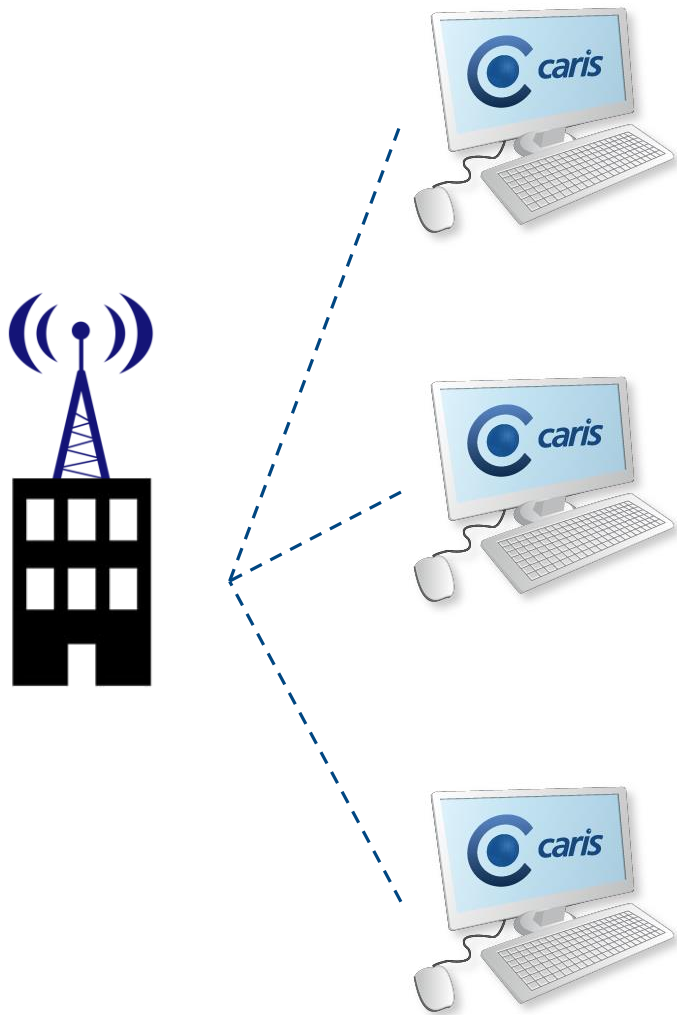


- Increased number of platforms = increased data volume to be processed
- Data volumes are significantly increasing
 - Improved power sources for autonomous vessels
 - Multi platform/sensor survey ships
 - Improvements in sonar technology (watercolumn, interferometric, multi detect etc.)
- The traditional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



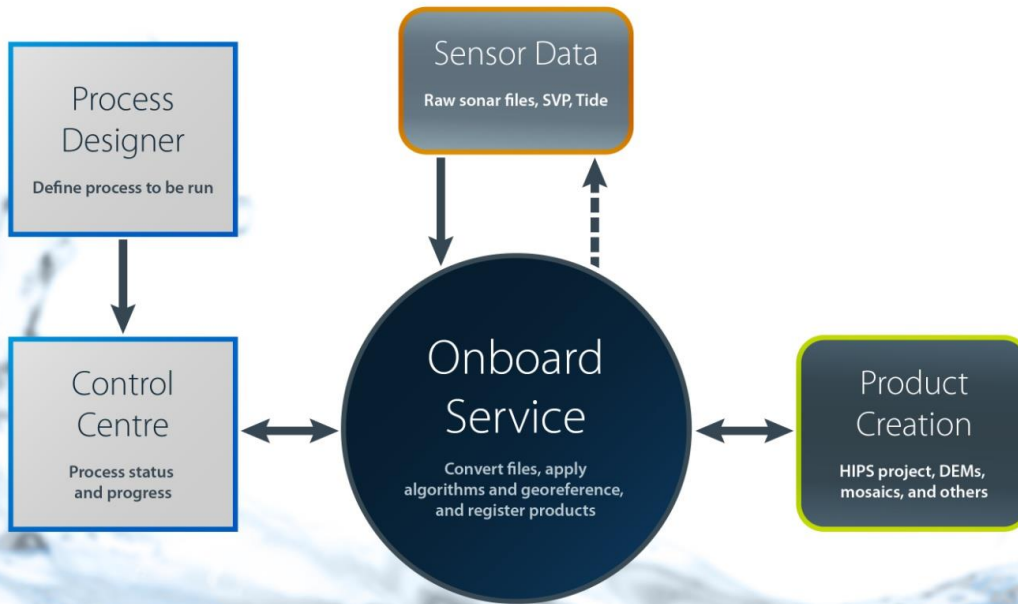
Configuration and workflow





- Multiple users can access the processed data for viewing and calculations data during collection
- Accessible through multiple CARIS products:
 - Easy View (freeware)
 - HIPS and SIPS
 - BASE Editor
- Evaluate, examine and use surfaces and products in real-time

CARIS Onboard Workflow



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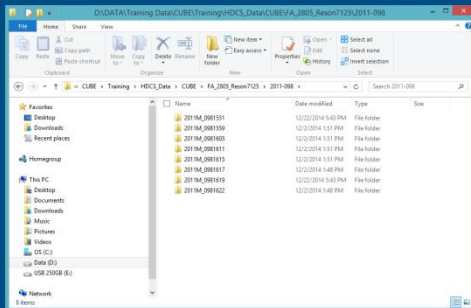
The screenshot shows the CARIS Onboard Control Centre web interface at localhost:8080/rest/jobs. The interface includes a navigation bar with 'caris ONBOARD Control Centre 1.0', 'Onboard Monitor: RUNNING', and links for 'Job Search', 'Job List', 'Configuration', and 'Help'. Below the navigation bar is a 'Job List' table with columns for Name, Status, Progress, Start Time, End Time, Elapsed Time, and Reprocess. The table contains 8 rows of job data, with 7 jobs marked as 'FINISHED' and 1 job marked as 'FAILED'. Below the table, it indicates '8 jobs found'.

Name	Status	Progress	Start Time	End Time	Elapsed Time	Reprocess
0017_20110308_200646.all	FINISHED	100%	2016-03-30 12:29:15 UTC	2016-03-30 12:29:24 UTC	00:00:09	
0016_20110308_200415.all	FINISHED	100%	2016-03-30 12:29:04 UTC	2016-03-30 12:29:12 UTC	00:00:08	
0015_20110308_200107.all	FINISHED	100%	2016-03-30 12:28:53 UTC	2016-03-30 12:29:02 UTC	00:00:09	
0014_20110308_195838.all	FINISHED	100%	2016-03-30 12:28:43 UTC	2016-03-30 12:28:52 UTC	00:00:09	
0013_20110308_195546.all	FINISHED	100%	2016-03-30 12:28:33 UTC	2016-03-30 12:28:41 UTC	00:00:08	
0012_20110308_195319.all	FINISHED	100%	2016-03-30 12:28:23 UTC	2016-03-30 12:28:31 UTC	00:00:08	
0011_20110308_195021.all	FINISHED	100%	2016-03-30 12:28:08 UTC	2016-03-30 12:28:21 UTC	00:00:13	
0010_20110308_194752.all	FAILED	100%	2016-03-30 12:26:39 UTC	2016-03-30 12:26:47 UTC	00:00:08	

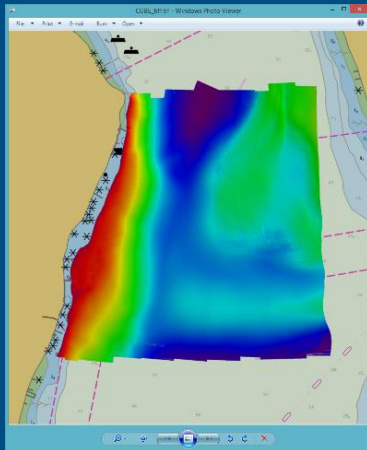
Below the web interface is a screenshot of a 3D bathymetry software window titled 'CARIS HIPS and SIPS - [CARIS_Onboard_Exercise.hips]'. The window shows a 3D visualization of a bathymetric dataset with a color scale from blue (deep) to red (shallow). The software interface includes a menu bar, a toolbar, a project tree on the left, and a properties panel on the right. The project tree shows a hierarchy of data files, and the properties panel shows settings for 'General', 'Colour', and 'Attributes - Line'.

- Examples of near real-time products

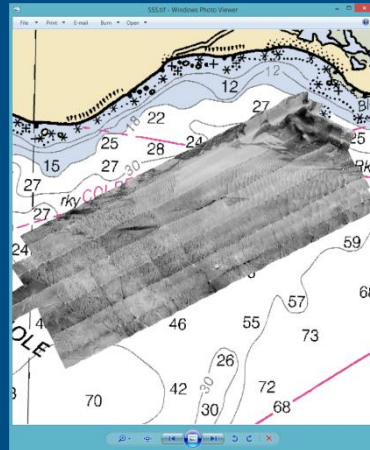
High Bandwidth



HIPS Project

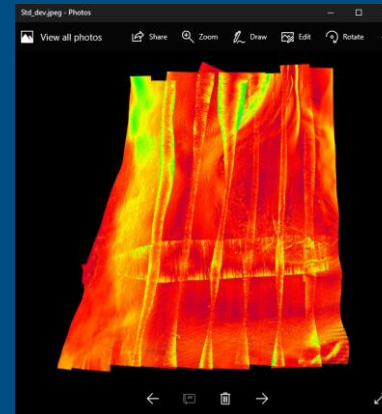


DEM



Mosaic

Low Bandwidth



Specific DEM layers to image

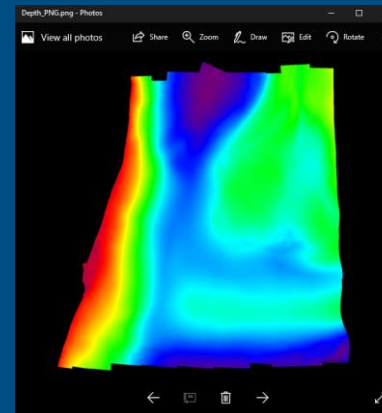


Image formats include:
JPEG
PNG
GeoTiff

- The CARIS Onboard workflow follows the traditional workflow, but with the processing steps automated.
- These steps are defined before deployment of survey to meet the needs of the job.
- As well as saving time, it aids in repeatability of processing ensuring consistency and compliance with the designated survey workflow



Benefits



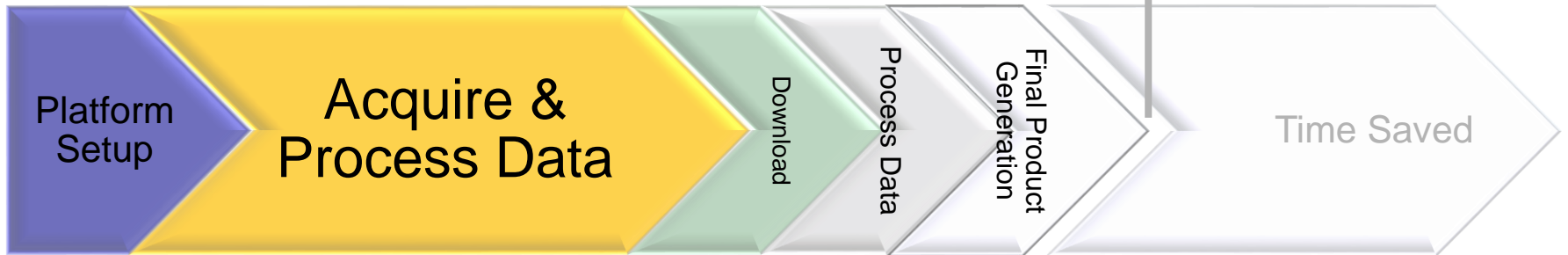
Traditional Workflow



AUV Dives

AUV Recovered

Final Product –
asset ready for
redeployment



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ONBOARD Workflow

- By automating hydrographic data processing ‘Onboard’ the autonomous or staffed survey platforms:
 - Make processed results available to the surveyor during operations
 - Obtain repeatable results and real-time QC
 - 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 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



Applications



Deployment



```
surface.txt - Notepad
File Edit Format View Help
BASIC Surface QC Report
-----
Date and Time: 4/7/2015 1:31:11 PM
Surface: D:\DATA\WSPS\Session\G08_1m_FINAL.csr
Holiday Layer created: No
Error values from Standard Deviation

240 S-44 Special Order:
Range: 0.000 to 40.000
Number of nodes considered: 78929
Number of nodes within: 67819 (95.58%)
Residual mean: -0.211

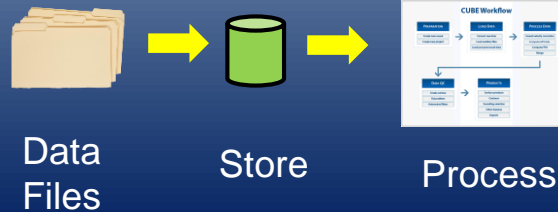
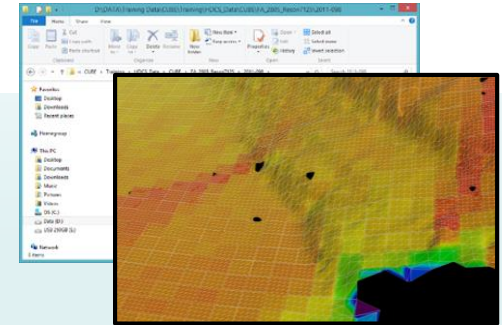
S-44 Order 1a:
Range: 0.000 to 100.000
Number of nodes considered: 172982
Number of nodes within: 172938 (99.98%)
Residual mean: -0.028

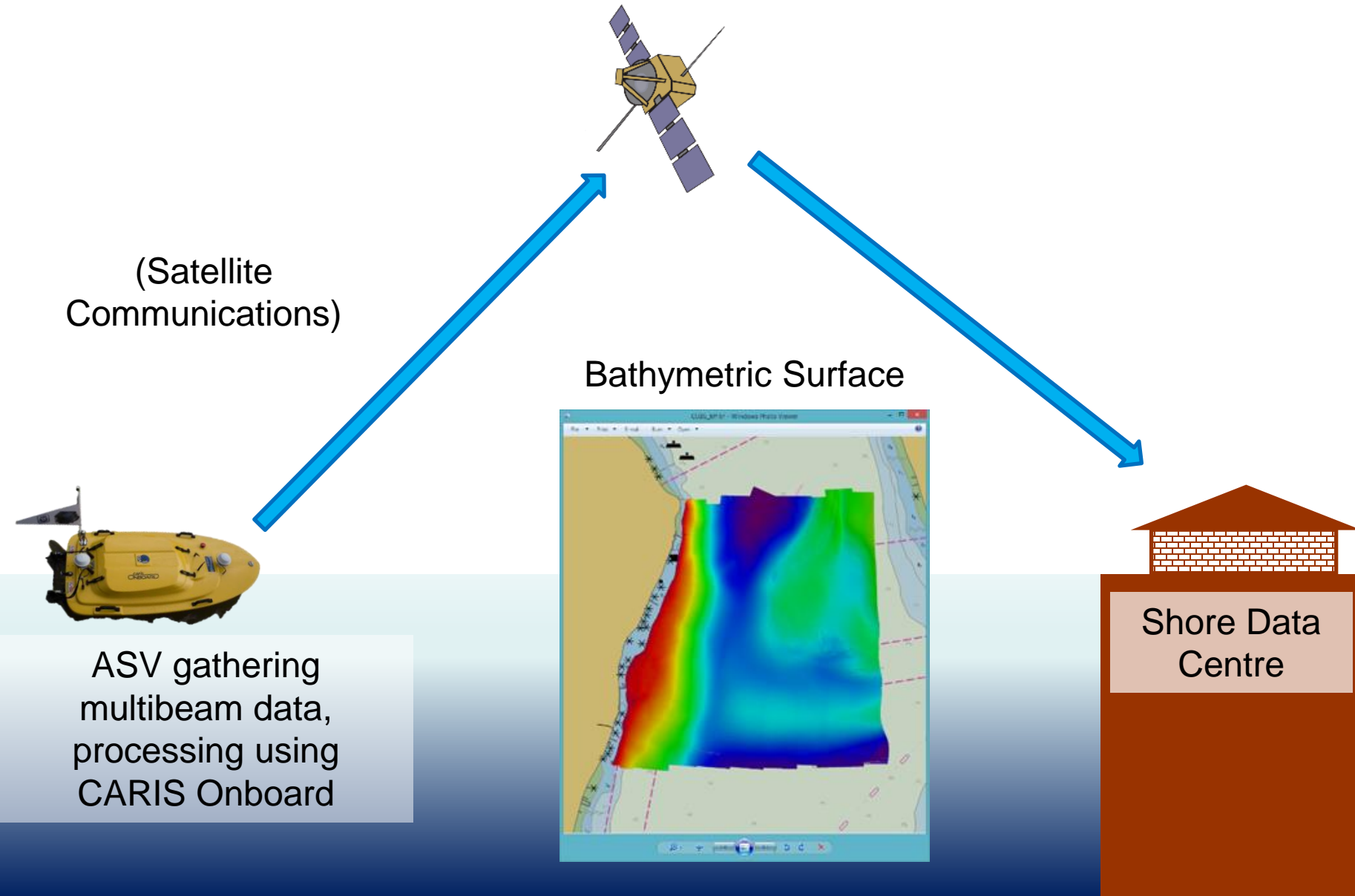
S-44 Order 1b:
Range: 0.000 to 100.000
Number of nodes considered: 172982
Number of nodes within: 172938 (99.98%)
Residual mean: -0.028

S-44 Order 2:
Range: 100.000 to 5000.000
No depths within the specified range
```

QA/QC
Product(s)

Product(s)





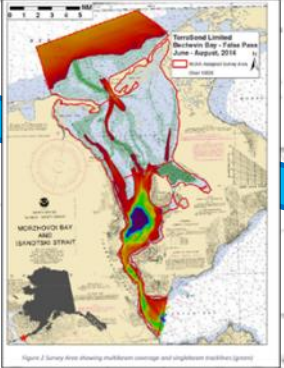
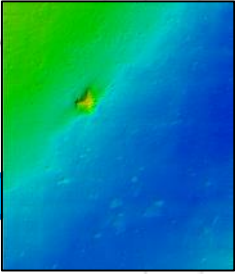
SOUNDINGS IN FATHOMS



SYNOPSIS	OPERATIONS
MISSION	SCOPE
OBJECTIVES	DELIVERABLES
OPERATIONAL PLAN	LOGISTICS
SAFETY	CONTACTS
CONTACTS	CONTACTS



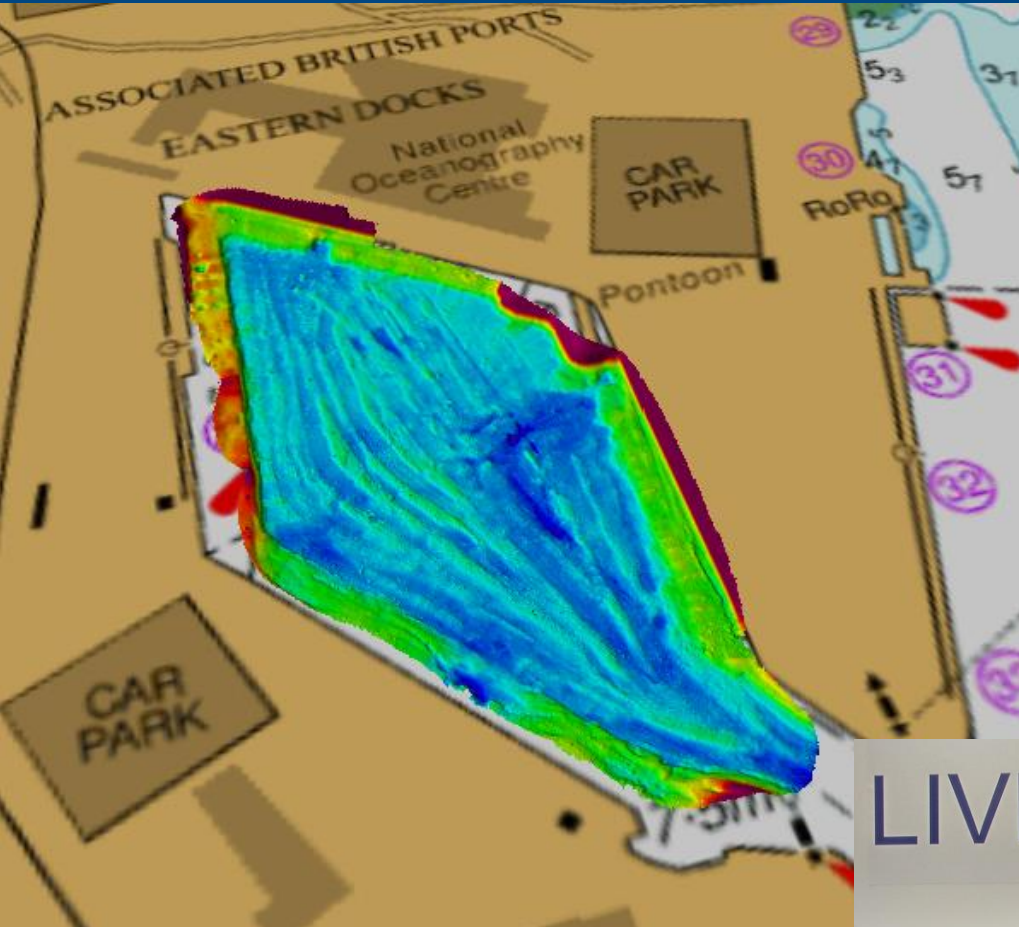
Surveyor in Charge on Mother Ship, monitoring survey launches remotely and directing operations





Recent trials of Onboard

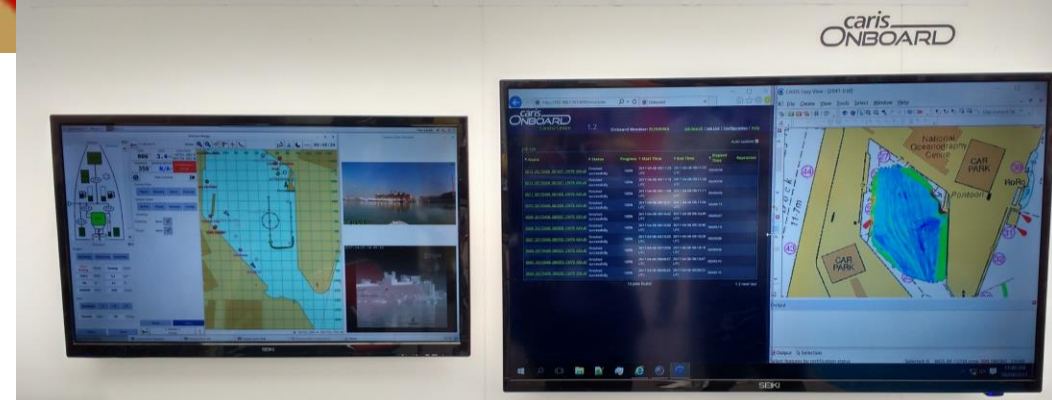




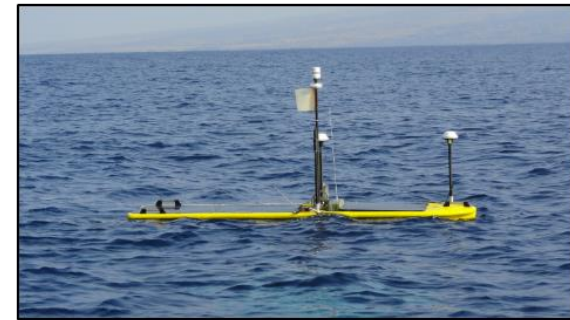
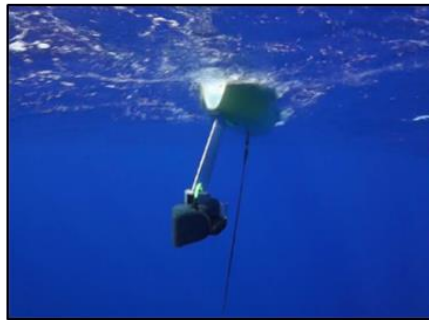
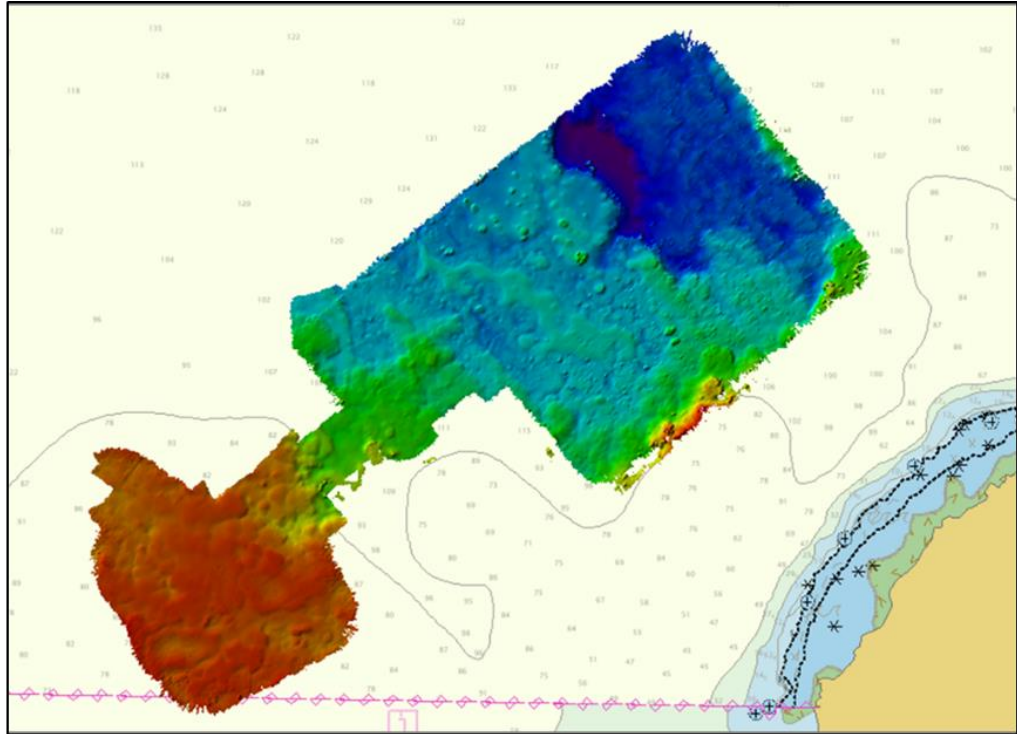
Ocean Business 2017 Live demo of:

- C-Worker 5,
- CARIS Onboard
- Kongsberg MBR

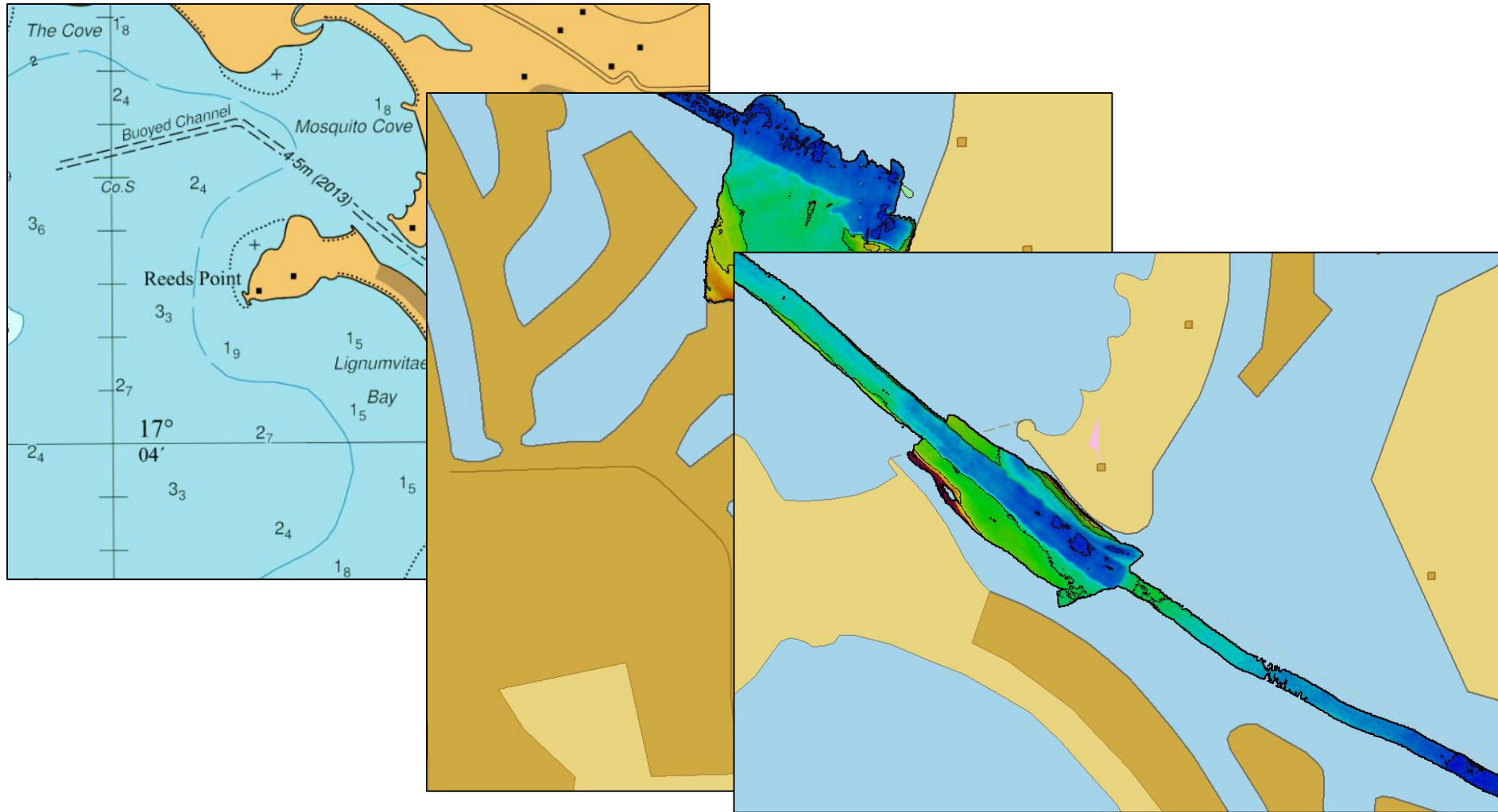
LIVE FEED DEMO



LIQUID ROBOTICS



Wave Glider SV3





Summary



- 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
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TELEDYNE CARIS
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