

HSRP Technology Working Group--Update

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Washington DC

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HSRP Technology Working Group Update

1. ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH: Summary Update and Report of Future Technologies Transfers
2. ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH: Future Technologies Transfer
3. Part 3: ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH:
4. Planned topics for next bi-monthly dial-ins and New Orleans

ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH and Government: Summary Update and Report of Future Technologies Transfer.

Background and why it matters

- Demonstrates a measurable ROI of taxpayer monies that directly benefit the public financially via safe navigation
- Demonstrates a measurable ROI of taxpayer monies that directly stimulates industry activity to \$100M's annually
- Industrial Partnerships with the University of New Hampshire Center for Coastal and Ocean Mapping Joint Hydrographic Center (UNH CCOM JHC).
- The NOAA Charting Backlog program, along with its industry partners and various R&D/Innovation initiatives at UNH CCOM JHC, have combined to be the leading technologies creators, developing Multibeam Echo Sounder (MBES) and related applications and improvements *that have ultimately been adopted and applied, and which have extensively benefitted industry applications.*
- Its all about applying these benefits to enhance the Blue Economy (paraphrasing Adm. Gallaudet)
 - critical, life-saving tools, based on fundamental science, environmental observations and forecast, and others ensure strong conservation and restoration of our ocean and coastal resources.
 - Major commercial beneficiaries of these activities are the seafood supply chain, maritime shipping, offshore energy and mineral exploration, coastal tourism and recreation businesses.
 - NOAA has a major role to play in exploring, mapping and characterizing our ocean. We are examining ways to expand activities relate to mapping of our Exclusive Economic Zone, and we are partnering with industry and other ocean nations on Seabed 2030, the international project to map the global sea floor by 2030.

“NOAA’s support for a healthy and productive marine environment is fundamental to the growth of the Blue Economy”

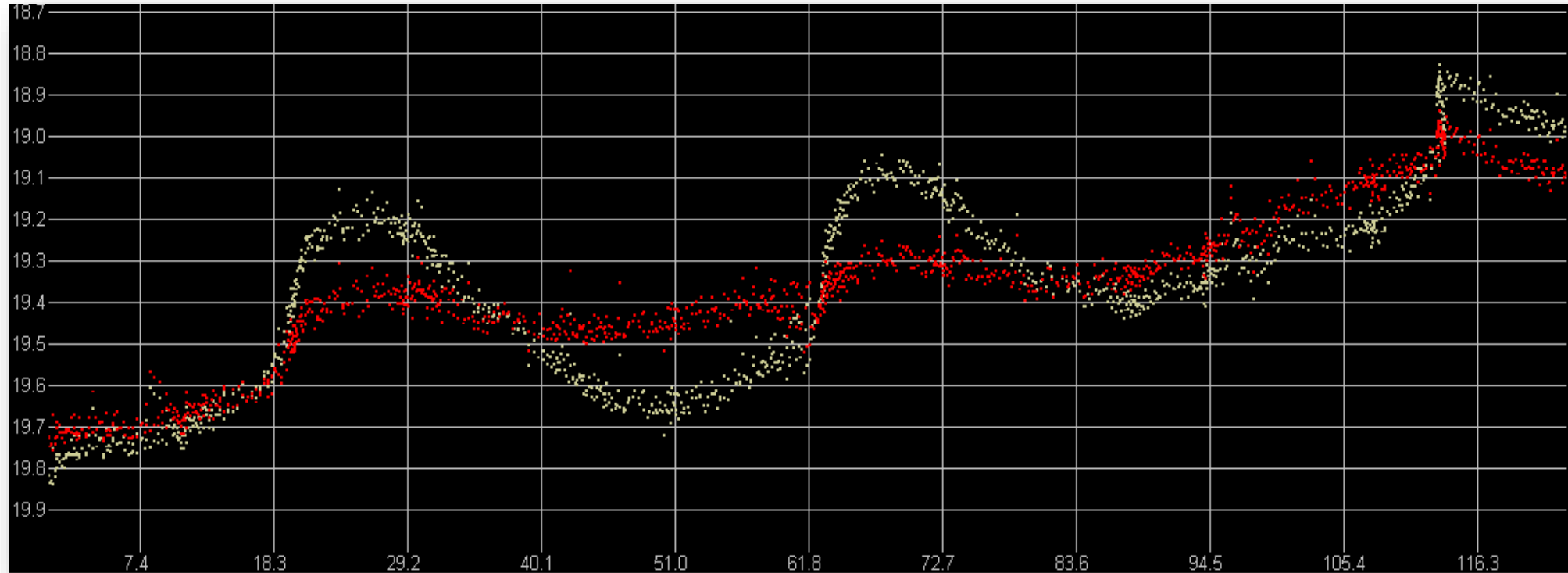
Part 1): ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH (and others): Summary Update and Report of Future Technologies Transfer.

Since the early 2000s a small sampling list of such applications includes:

- True Heave
- CUBE
- MBES Backscatter
- MBES Water Column
- MBES Water Column Data Compression
- Satellite Derived Bathymetry (GEBCO Cookbook)
- Crowd Sourced Bathymetry
- Public Access to all NOAA Data

True Heave[®]

An advanced processing algorithm, which uses both past and present vertical motion data, to compute a significantly improved heave estimate



Real Time Heave

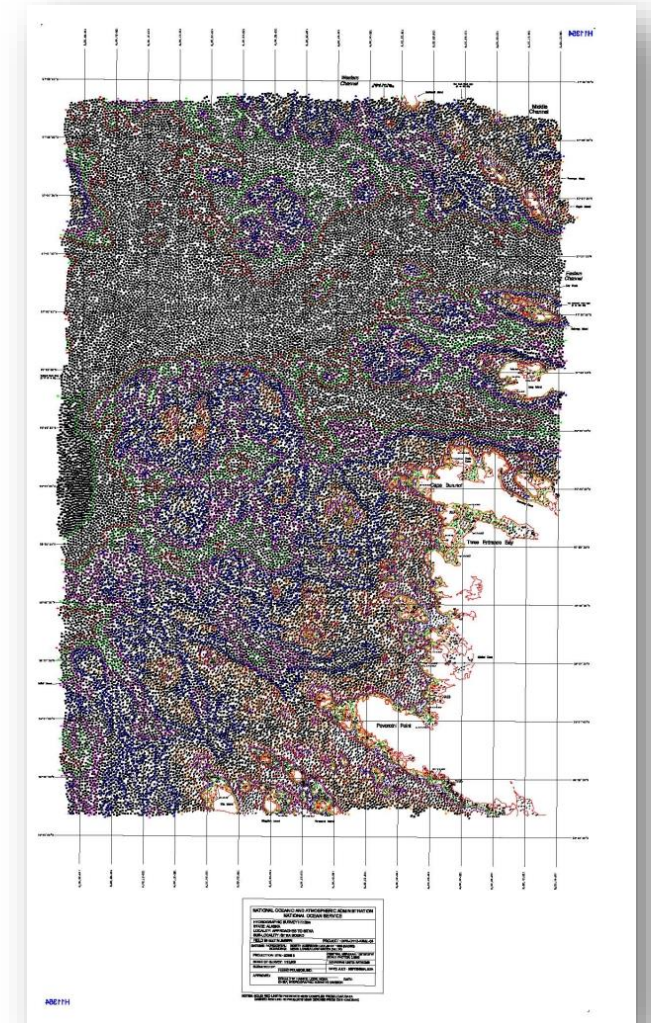
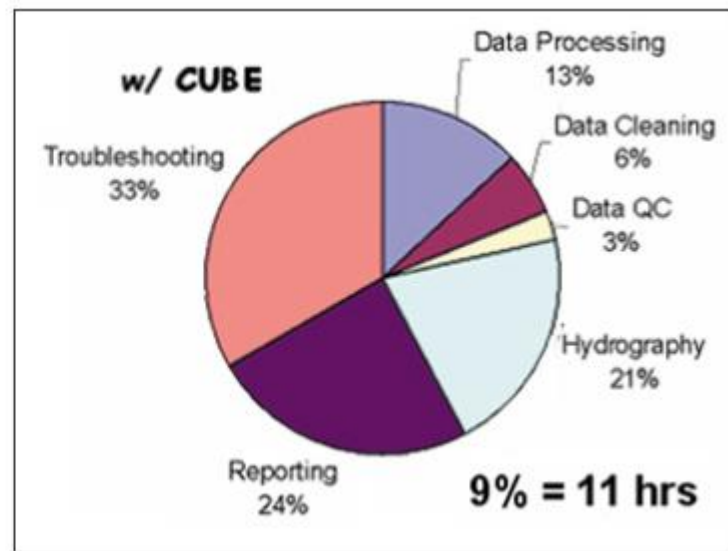
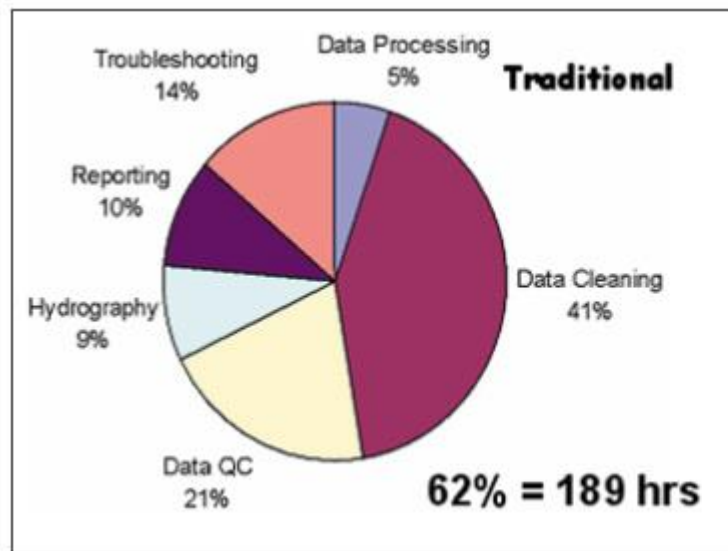


TrueHeave



CUBE – Combined Uncertainty and Bathymetric Uncertainty

An error-model based, direct DTM generator that estimates the depth plus a confidence interval directly on each node point of a bathymetric grid

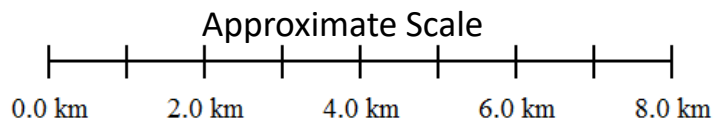
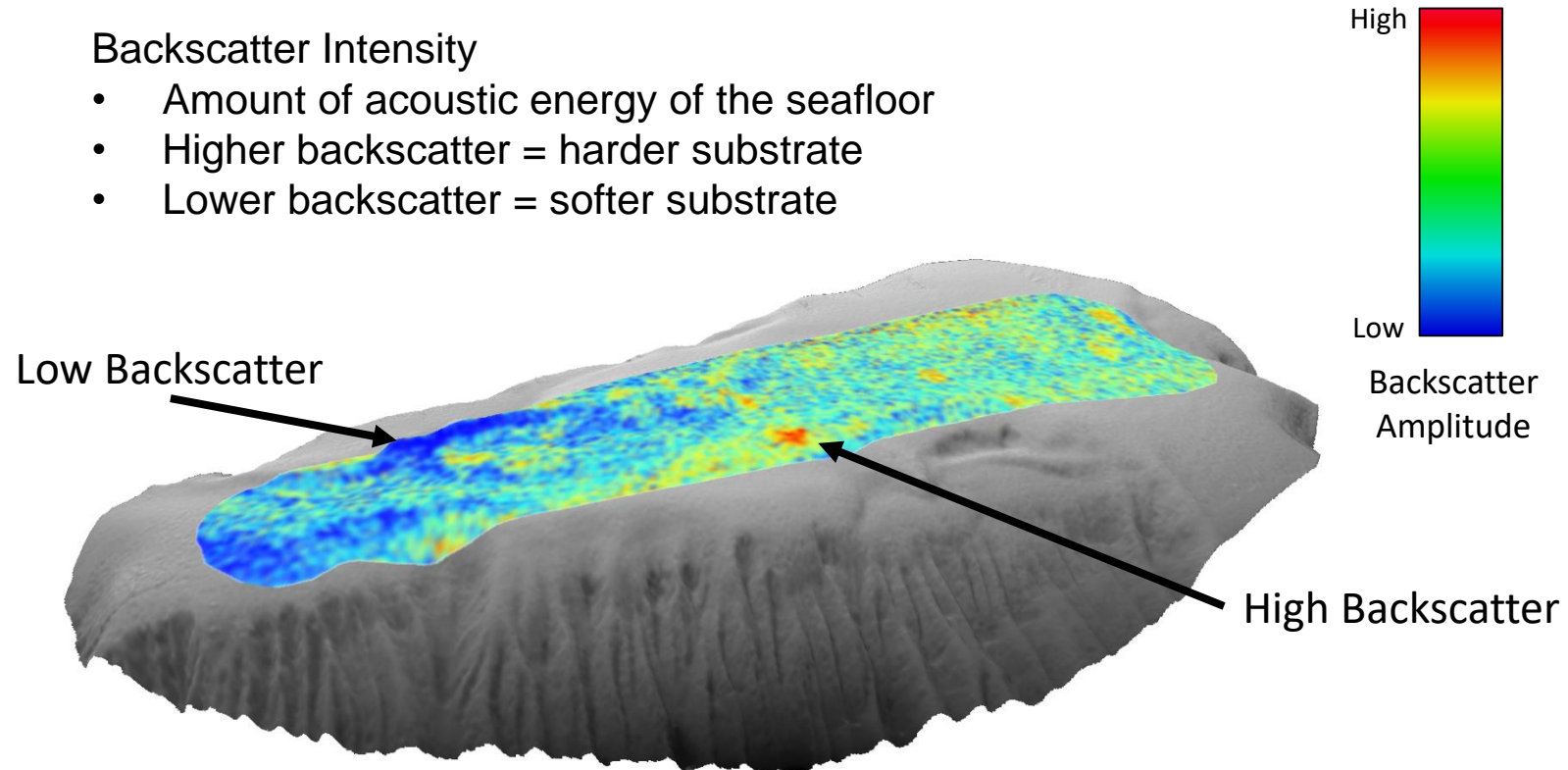


MBES Backscatter

Computed by measuring the amount of sound that is reflected by the sea floor and received by the sonar to help us understand the characteristics of the sea floor

Backscatter Intensity

- Amount of acoustic energy of the seafloor
- Higher backscatter = harder substrate
- Lower backscatter = softer substrate

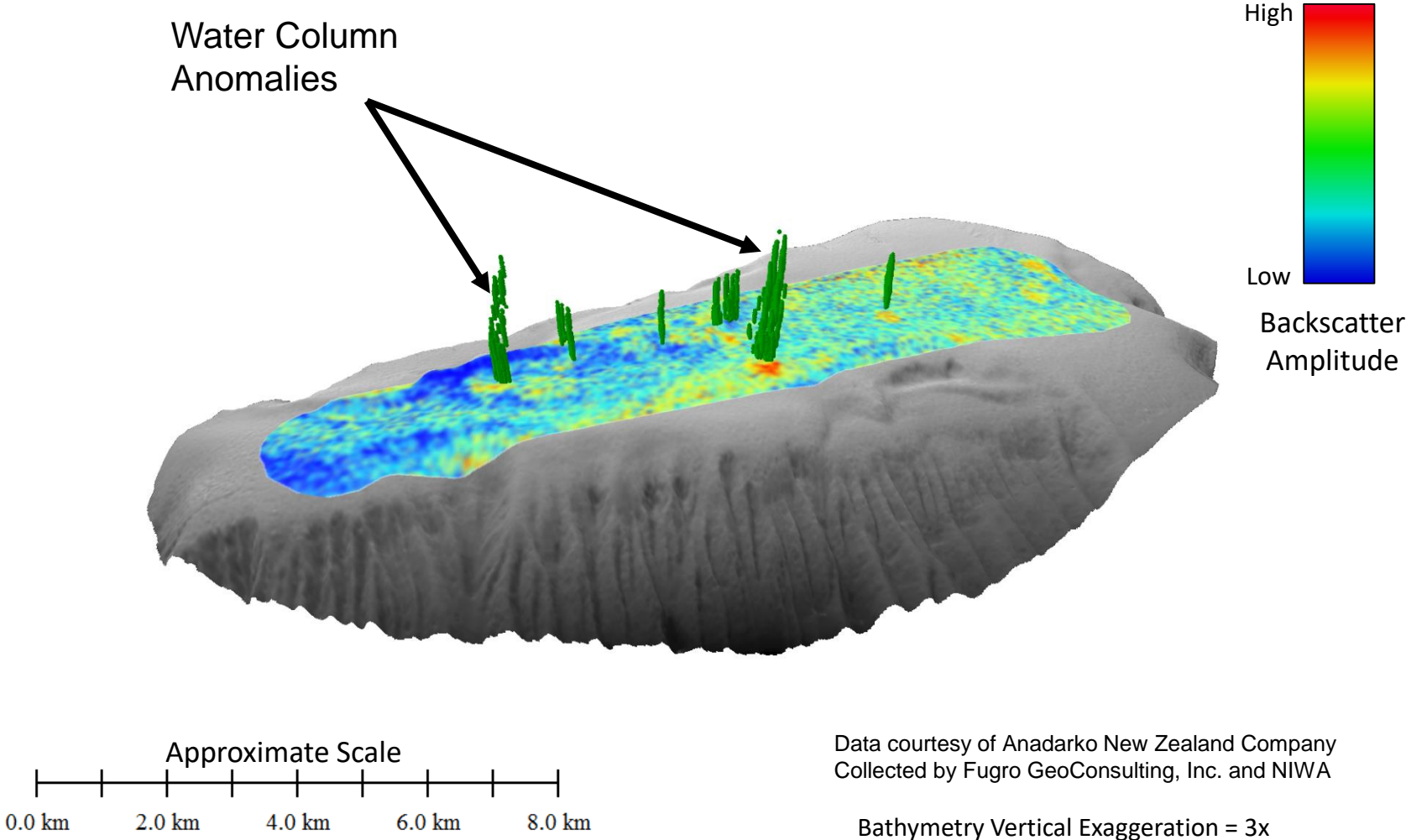


Data courtesy of Anadarko New Zealand Company
Collected by Fugro GeoConsulting, Inc. and NIWA

Bathymetry Vertical Exaggeration = 3x

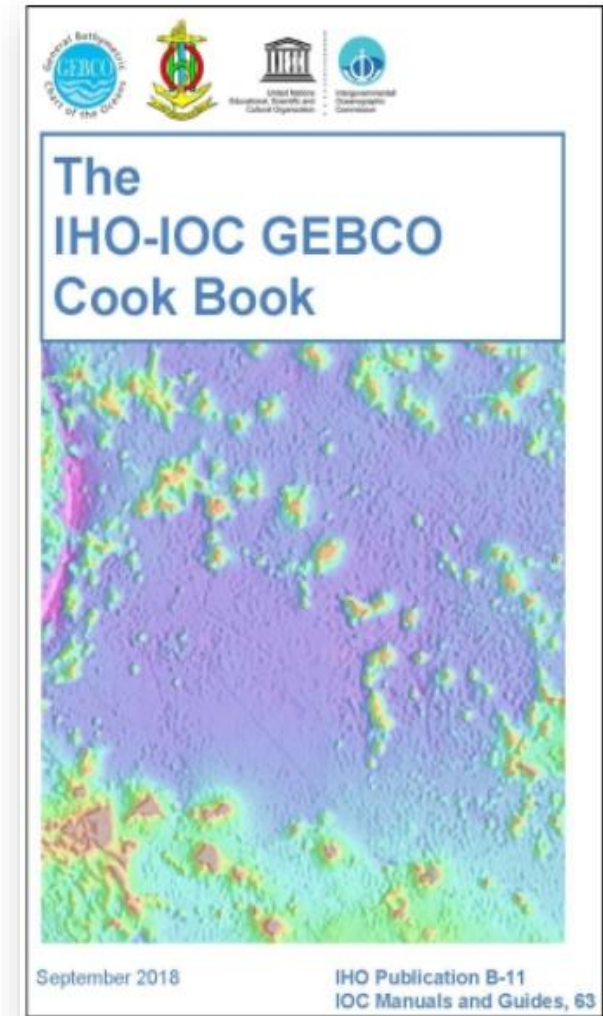
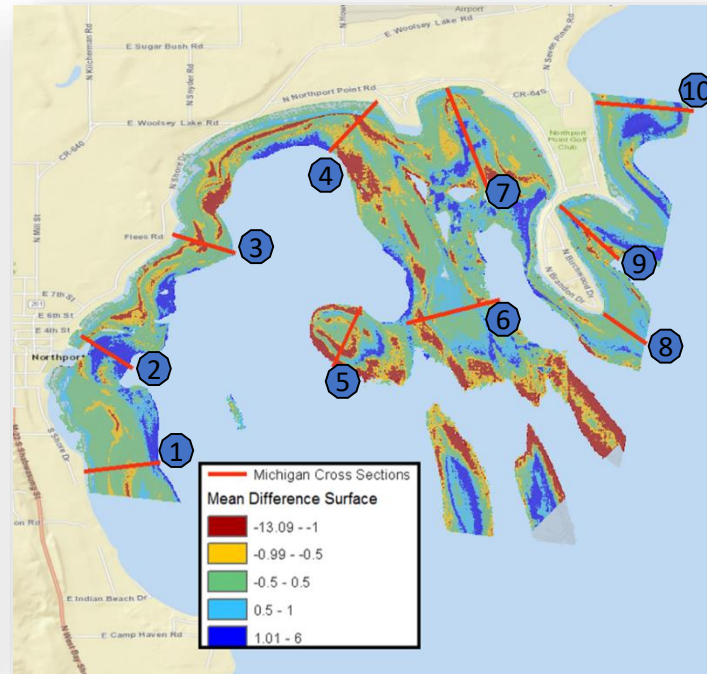
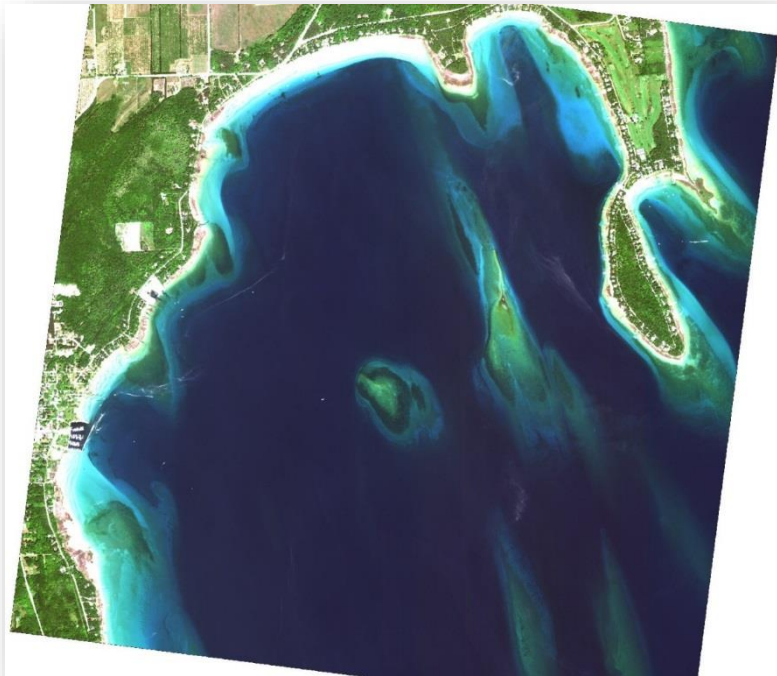
MBES Water Column

Acoustic remote sensing used to explore aspects of the marine environment that are found between the ocean surface and the sea floor. This can include gas bubbles, biology, and physical processes within the ocean



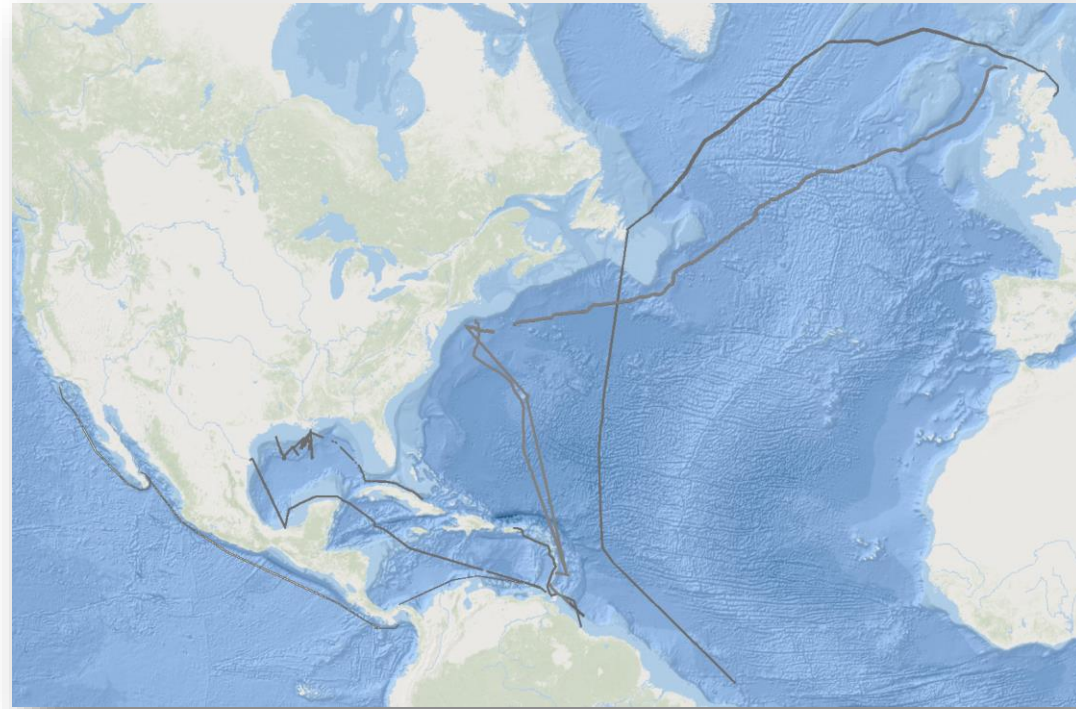
Satellite Derived Bathymetry (GEBCO Cookbook)

The development & documentation of algorithms related to the physical concept underlying the ability to estimate bathymetry from multispectral imagery (wavelength-dependent attenuation of light in the water column).

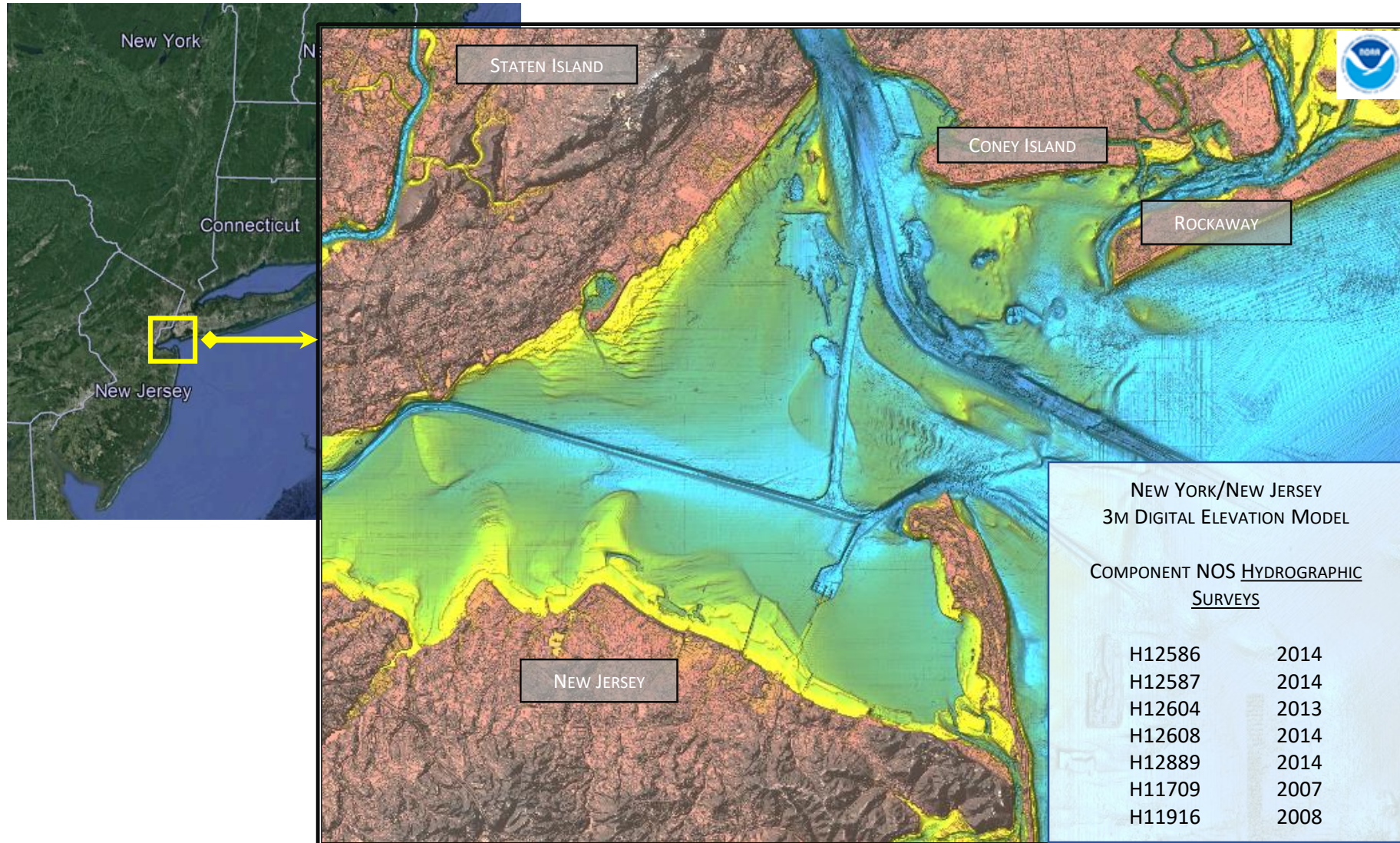


Crowd Sourced Bathymetry (CSB)

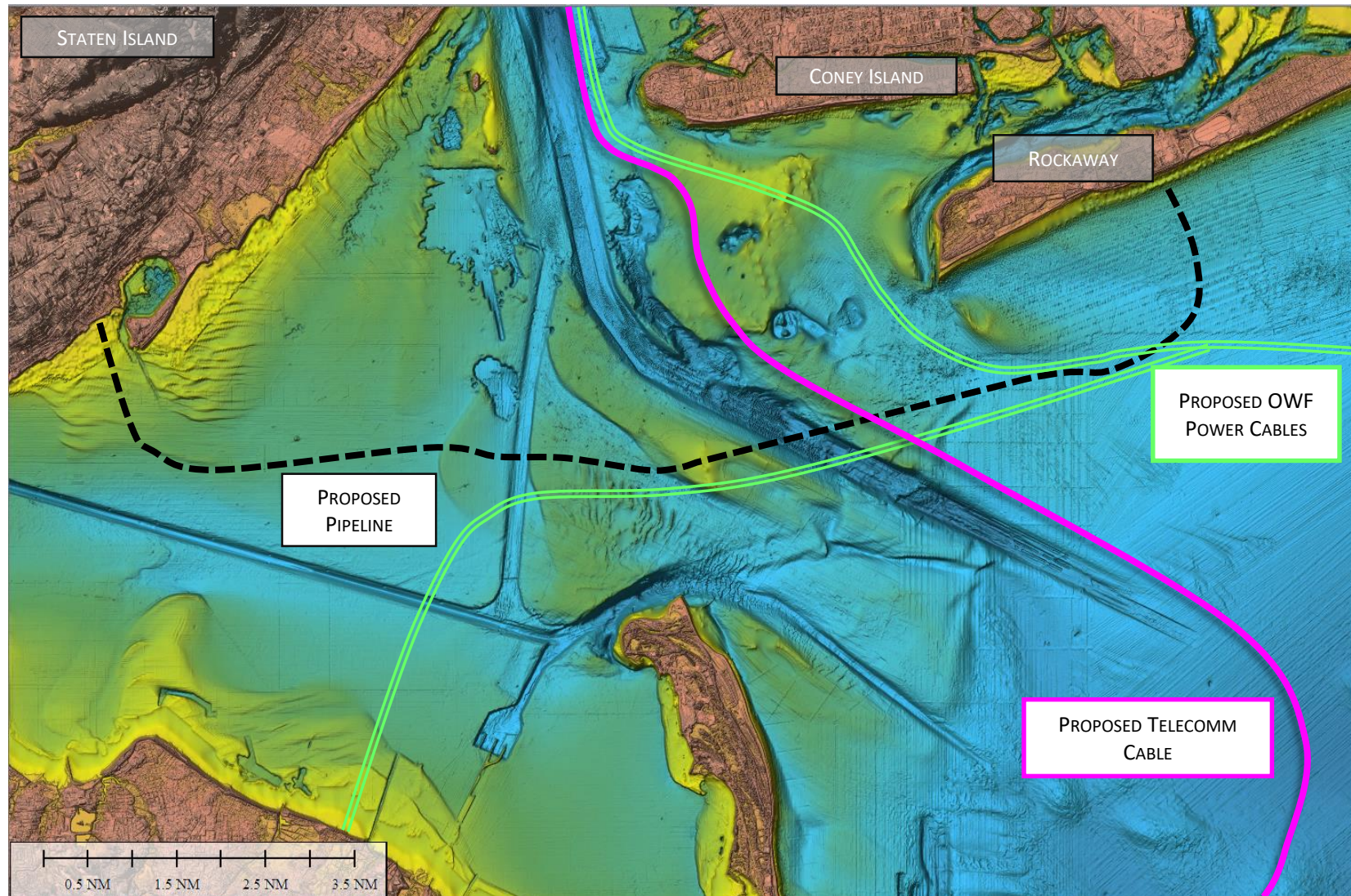
The collection of depth measurements from vessels, using standard navigation instruments, while engaged in routine maritime operations.



Public Access to NOAA Data



Public Access to NOAA Data



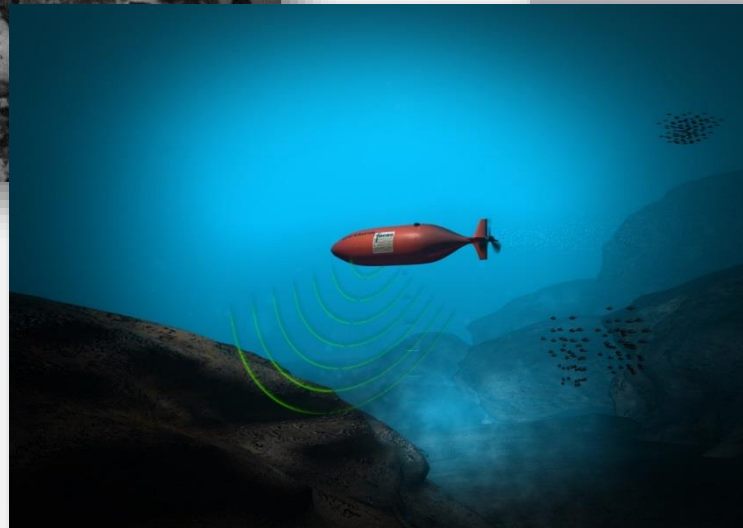
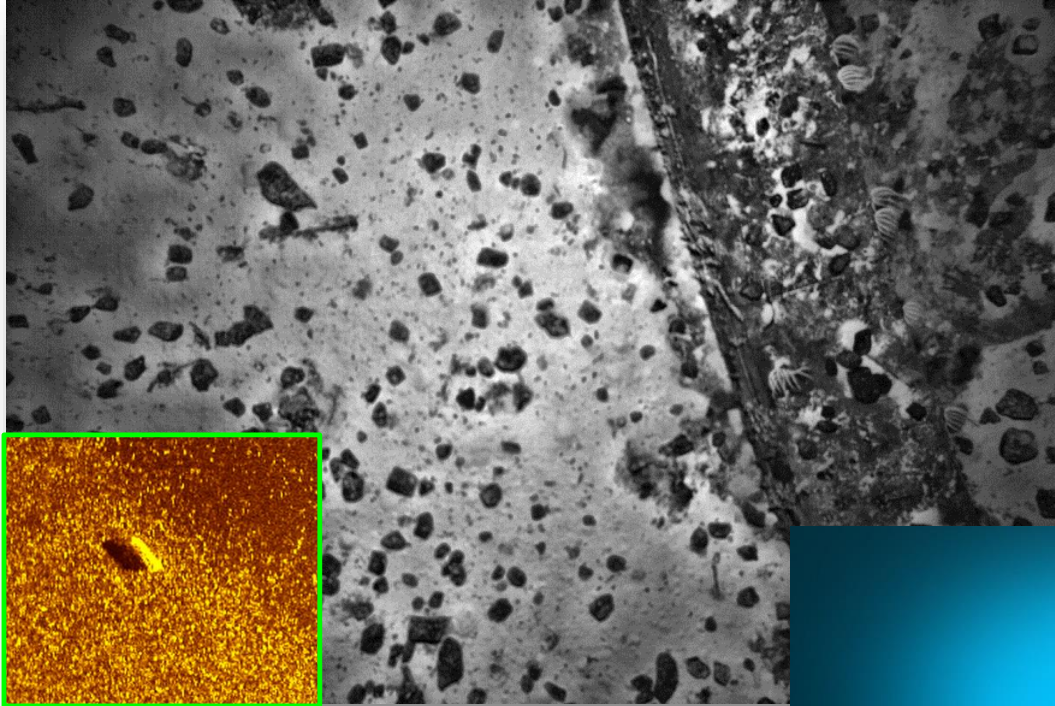
ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH and Government: Summary Update and Report of Future Technologies Transfer

Other Technology Transfer Between Other Government Agencies (ie DoD) and Industry (a few examples)

- AUV
- USV
- UAV
- ROCIS (Remote Ocean Current Imaging System)
- Coastal Eyes
- RAMMS (Rapid Airborne Multibeam Mapping System)

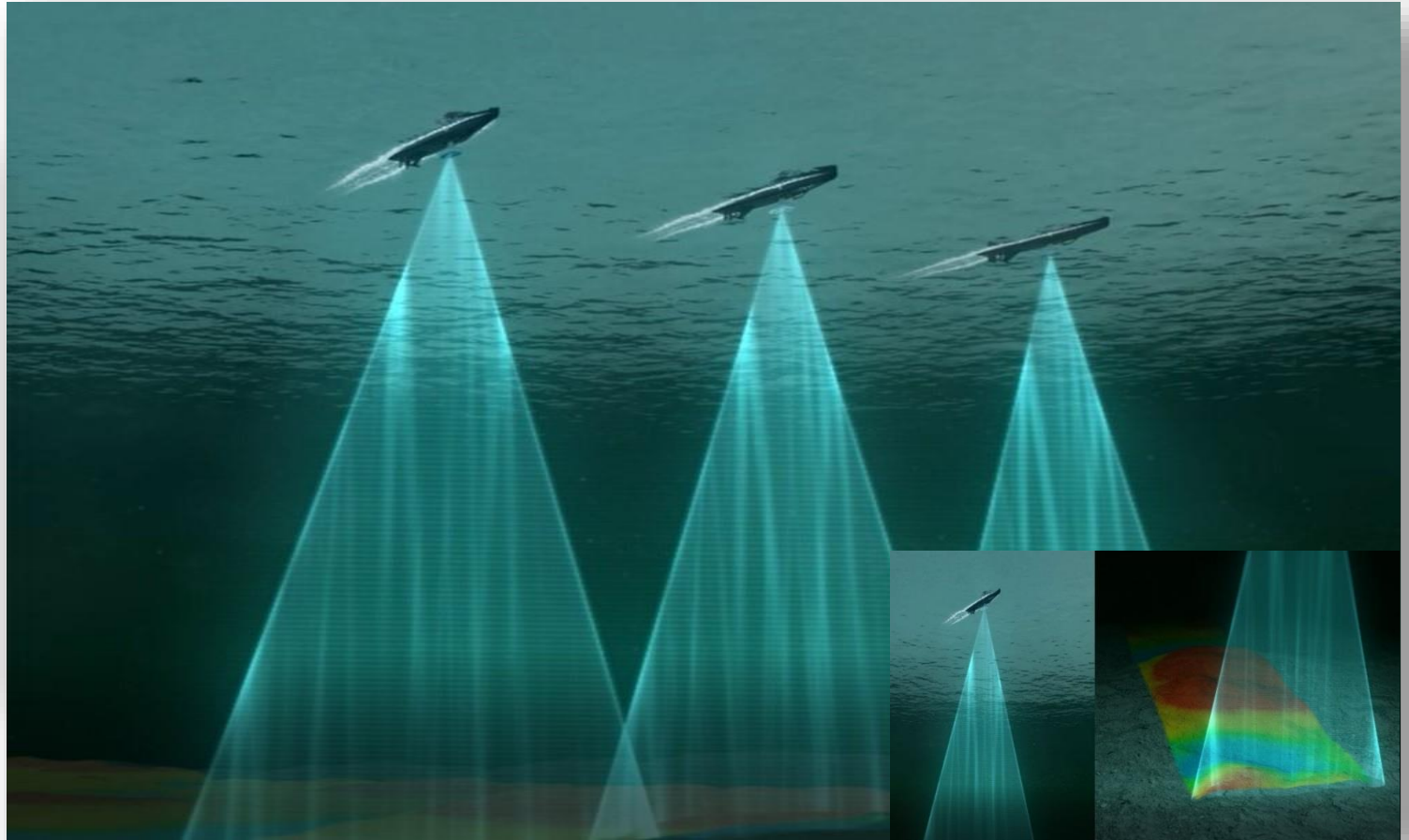
AUV – Autonomous Underwater Vehicle

An autonomous platform used for underwater survey missions such as detecting and mapping seabed features, submerged wrecks, seabed minerals and high resolution geophysical surveys



ASV – Autonomous Surface Vehicle

A vehicle that operates on the surface of the water (watercraft) without a crew and which can be used as a “force multiplier” in survey operations.



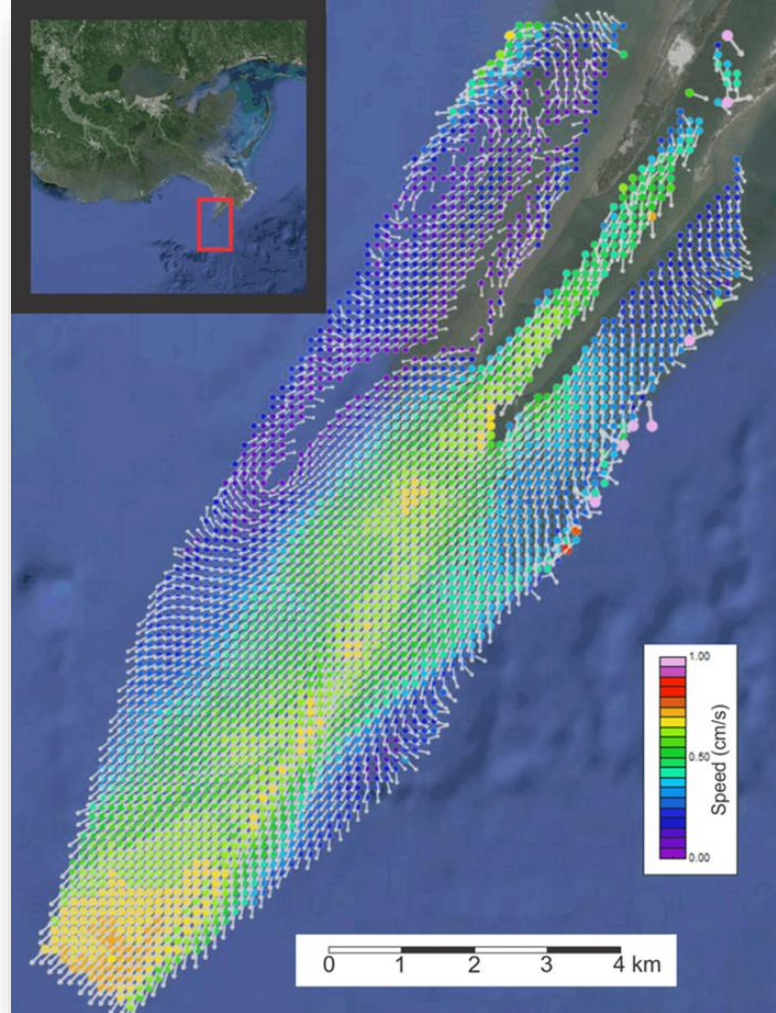
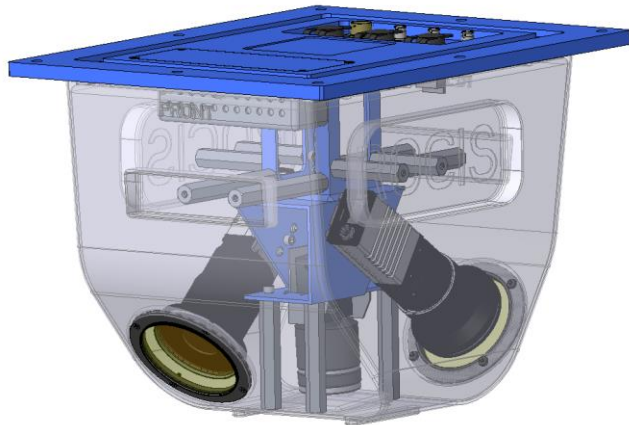
UAV – Unmanned Aerial Vehicle

Commonly known as a drone, a UAV is an aircraft without a human pilot aboard. UAVs are a component of an unmanned aircraft system (UAS); which include a UAV, a ground-based controller, and a system of communications between the two.



ROCIS – Remote Ocean Current Imaging System

An aerial survey payload to measure surface ocean currents, providing near real-time synoptic surface current data over a wide operational area, while retaining the ability to assess smaller scale current features of interest.

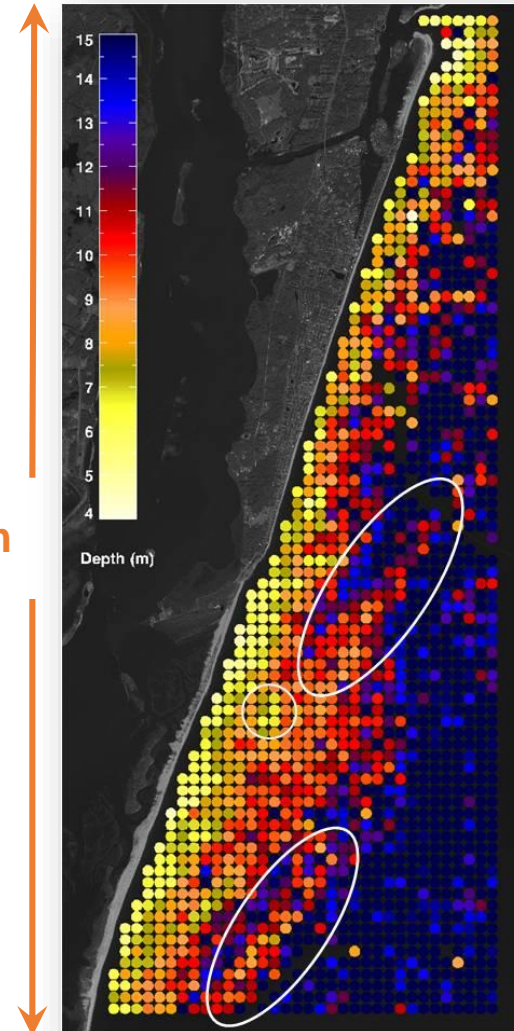


Remotely Sensed Bathymetry from Wave Dynamics

A recently de-classified technology which uses specific algorithms to analyze surface waves, in high resolution commercially available satellite imagery to produce seabed depth data

256 m tiles
3 frames
 $\Delta t = 11$ s

~ 10 km



- Requirements
 - Long waves
 - Large tiles
 - Shallow slope
- Comparison with nautical chart

Rapid Airborne Multibeam Mapping System

RAMMS	Current Deep Water ALB
27,000 observations/second*	10,000 observations/second
1.6 points/m ² @ 300m altitude @140 knots	0.49 points/m ² @ 400m altitude @140 knots
Continuous cross-track acquisition	Individual observations
<10A current draw	>70A current draw
UAV-capable (now)	Non-UAV-capable
Multibeam alignment with full swath, full water column	Single point waveform limited

	Nov 2016 Grenada	Oct 2018 Belize
Field Staff	11 staff	2 staff
Data Density	<2pts/bin	12pts/bin
Survey Size	2,566 sq kms	2,575 sq Kms

- **First Project Belize 2017**
- **To date surveyed over 17,000 sqkm on 5 Hydrographic projects;**
- **> 1,100 flight hours on RAMMS in four Countries**
- **Achieving new UKHO requirement for 2 soundings in every 2m bin to 40m**

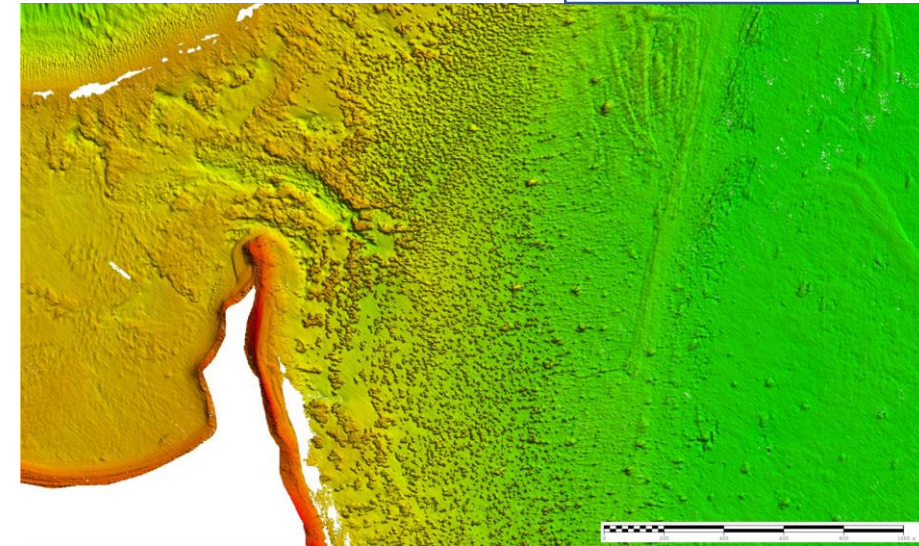
PILLS

- Detect surface and near surface moored mine
- Miniaturize Arete technology for UAV
- Developed for littoral bathymetry, detection and targeting



RAMMS

- Released April 2018 as a Hydrographic Sensor
- Deep water capability, 40X previous model point density
- Extremely light weight, Low-power for platform flexibility
- Full water column across swath



RAMMS primary sensor is 14kg or 22kg (UAV or Camera Port)

Part 2: ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH: Summary Update and Report

➤ Future Technologies Transfers (including Larry and Andy Presentation Points)

Subject Matter

- a) Autonomous Vehicles of all types: Underwater, Surface, Airborne
- b) Artificial Intelligence processing (multiple examples):
 - Reactive Behavior-Obstacle Avoidance, Smart Target Location, etc
- c) CUBE Applications to Hydrographic LiDAR
- d) Seafloor Characterization Habitat and Resource Mapping Tools
- e) Separating oil from gas at Taylor Energy leak
- f) Impact of Sonar on Marine Mammals
- g) Seabed 2030

Financial Benefits to Industry

- \$Billions
- \$Millions (X10)
- \$Millions/yr
- \$Millions/yr
- \$Millions (100)
- \$Millions/yr
- Immeasurable

Part 3: ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH:

Improving/evolving the process to transfer technology

- Types of organizations and companies that benefit –
 - hardware, software, system and services companies,
 - other government and research groups outside NOS.
 - different requirements of how and when they get the technology in the R&D cycle

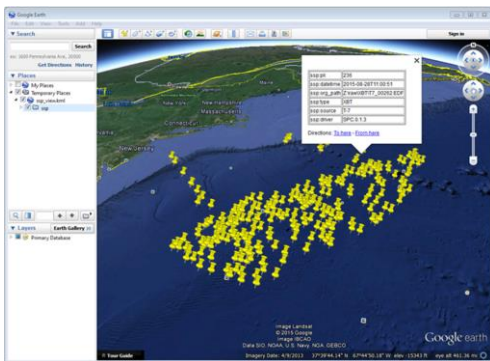
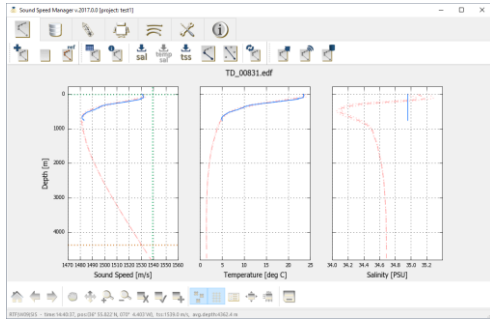
- CCOM Industrial Partnership
 - summary above of status of technology transfer, successes and benefits
 - some not getting transferred by partnership,
 - CCOM forced to find alternative transfer – HydOffice Sound Speed Manager

Part 3: ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH: Improving/evolving the process to transfer technology example



HydrOffice – Sound Speed Manager

- Collaborative development between by the CCOM, UNH and NOAA Coast Survey Development Laboratory (CSDL)
- Merged functionality NOAA Velocipy, MAC SVP Editor, and HydrOffice SSP Manager
- Not transferred to other commercial products, although used by many survey groups
- Suitable to transfer to sensor and sonar manufacturers and acquisition and processing software producers
- Provided under open source license - <https://www.hydrooffice.org/soundspeed/main>
- Open source allows ongoing development and configuration management
- Successful and better model for this type of transfer?
- How is this supported by NOAA and CCOM – CSDL or CCOM researcher?
- How is this support funded?



Part 3: ROI and Technology Transfer from NOAA NOS OCS and CCOM/NOAA-UNH:

Improving/evolving the process to transfer technology

- Broader community access to technology
 - Always goal to transfer as much as possible to provide maximum ROI into research.
 - Technology transfer should be priority and actively managed not just passive availability.
 - Recommend CCOM evolve technology transfer with more options outside partners, additional funding to improve and manage technology transfer process.

Part 4: Planned topics for next bi-monthly dial-ins and New Orleans

1. AUV Update
2. SeaBed2030 Update
3. How-To: NOAA Makes Charts
4. Other ideas....