

Multibeam Advisory Committee Updates

RVTEC - Honolulu, HI

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MAC supported under NSF grant 1933720





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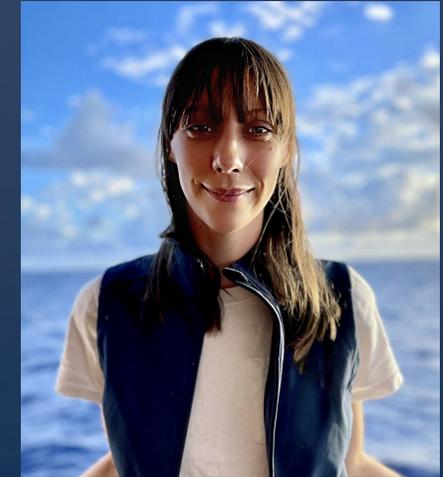
*GMRT, MGDS, Seabed 2030,
GEBCO, Explorers Club*



Kevin Jerram

Mapping Specialist
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*CCOM research,
MAC field support*



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*GMRT, MGDS, GEBCO
Seabed 2030*



The Multibeam Advisory Committee (MAC)

- Established in 2011 with funding from NSF to ensure the consistent collection of high-quality multibeam data across the U.S. Academic Research Fleet (USARF)
 - On-board and remote support for ships*
 - Standardize system performance testing*
 - Publish performance and share best practices*

- Technical Reports & Resources

- Sea Acceptance / Quality Assurance / RX Noise
- Host Non-USARF reports for reference
- Assessment tools, survey guidance

Website: mac.unols.org

Help desk: mac-help@unols.org

Wiki: github.com/oceanmapping/community/wiki



Ship Info	Sonar System Info
 Atlantis (WHOI)	Kongsberg EM124 (12 kHz, 150°, 1×1° beams)
 Blue Heron (UMN)	Reson SeaBat 8101 (240 kHz, 150°)
 Healy (USCG)	Kongsberg EM122 (12 kHz, 150°)
 Hugh R. Sharp (UDEL)	Reson SeaBat 7125 (200 kHz, 400kHz, 150°)
 Kilo Moana (UH)	Kongsberg EM122 (12 kHz, 150°) Kongsberg EM710

Tech Reports

Ship Sonar System ANT QAT SAT

2023

- 2023 R/V HLY23TA EM122 QAT Report
2023, EM122, Healy, MAC, QAT
- 2023 R/V Kilo Moana EM122/EM710 QAT Report
2023, EM122, EM710, Kilo Moana, MAC, QAT
- 2023 R/V Sally Ride EM124/EM712 QAT
2023, EM124, EM712, MAC, QAT, Sally Ride
- 2023 R/V Langseth EM122 QAT Report
2023, EM122, MAC, Marcus G. Langseth, QAT
- 2023 R/V Sikuliaq EM302/EM710 QAT Report
2023, EM302, EM710, MAC, QAT, Sikuliaq

2022

- 2022 Healy EM122 QAT Report
2022, EM122, Healy, MAC, QAT
- 2022 Kilo Moana EM122/EM710 QAT Report
2022, EM122, EM710, Kilo Moana, MAC, QAT
- 2022 Sikuliaq EM302 / EM710 Calibration Report
2022, EM302, EM710, MAC, QAT, Sikuliaq
- 2022 Nautilus QAT Report
2022, EM302, Nautilus, QAT

2021

- 2021 Sikuliaq QAT EM302 and EM710
2021, EM302, EM710, MAC, QAT, Sikuliaq
- 2021 Sally Ride EM124-SAT EM712-QAT
2021, EM124, EM712, QAT, Sally Ride, SAT



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Thank you, Jim!



Mapping Systems in the U.S. Academic Research Fleet

- **12 Vessels with MBES**

- 11 Research Vessels
- 1 USCG Icebreaker
- 10 Kongsberg EM-equipped

- **16 Deep water EM systems**

- EM710 / EM712 (40-100 kHz)
- EM302 (30 kHz)
- EM122 / EM124 (12 kHz)

- **2 Shallow water systems**

- Reson
- EM2040 (soon)

- **3 RCRVs (6 MBES) in 2023+**

- EM304s & EM2040s



System Performance Testing



SAT and QAT checklist

1. Hardware / software health
2. Sensor offset / config. review
3. Calibration ('patch test')
4. RX noise vs. speed/seas
5. Swath coverage (extinction)
6. Swath accuracy
7. Water column evaluation
8. Backscatter normalization
9. Public reporting (MAC website)

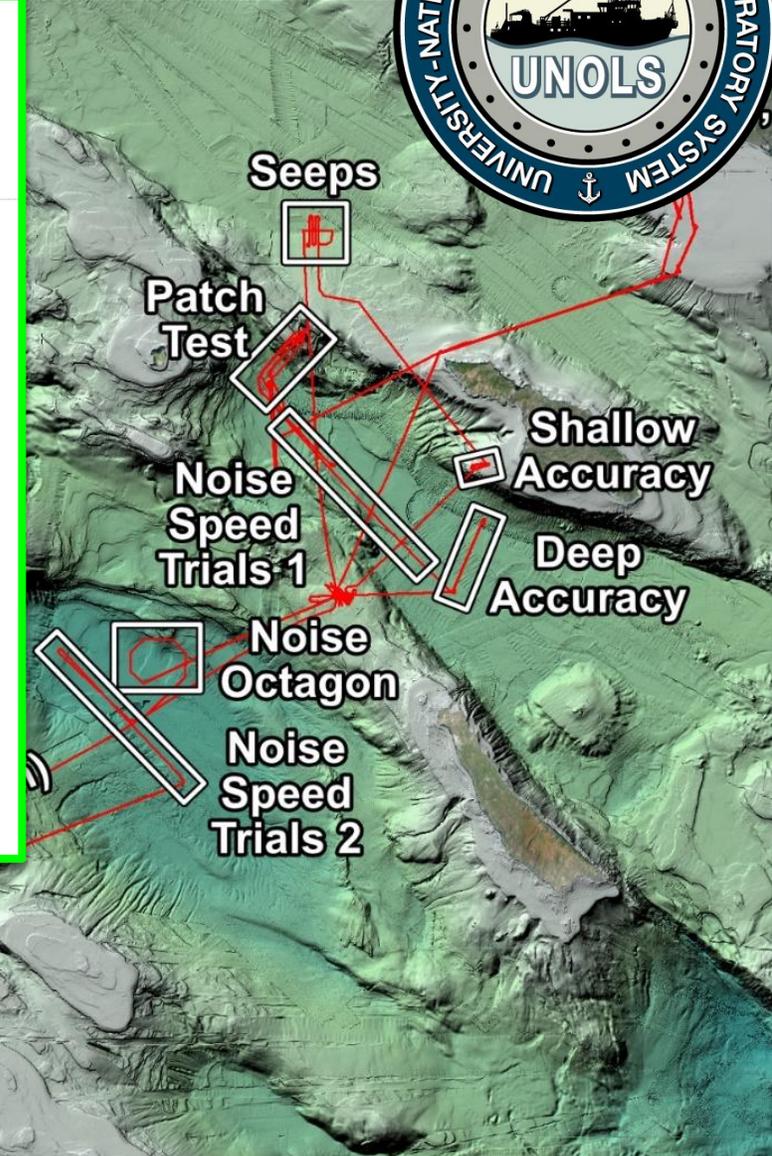
Post-SAT / Pre-SVC Review (Discussion)

These topics help to ensure an up-to-date understanding of the mapping system and adequate/complete plan for testing, taking into consideration any changes since the SAT or last QAT.

1. What has changed since the last MAC visit or...
 - a. Any sensors replaced, removed, and...
 - b. Any damage or repairs?
 - c. Any upgrades to hardware or software?
2. Is there any new documentation?
 - a. Updated survey of vessel and/or sensors
 - b. Updated guidance or service notes from...
 - c. Any performance notes from normal operations?
3. Is there any recent data that can be provided?
 - a. Ideally, these data would be collected during profiling, data covering a wide range of depths as an early indicator of performance
 - b. Any recent 'problem' datasets should be provided as appropriate

Recommended/Prioritized Post-SAT

1. EM124 updates
 - a. Kongsberg has released several software updates; **the EM124 should be updated**
 - i. Download links and Kongsberg instructions: <https://github.com/oceanmappers>
 - ii. Known issues with recent SIS version: <https://github.com/oceanmappers>
 - iii. Related: Update to Sound Speed Mapping: <https://www.hydrooffice.org/sound-speed>
 - b. Docksides testing and review
 - i. Prior to departure, the MAC is available
 - ii. Seapath and EM124 configuration review
 - iii. line plan review with operators
 - iv. pre-cruise system testing (e.g. patch test)
 - c. Antenna calibration
 - i. GNSS antenna baseline calibration according to [GNSS antenna baseline calibration](#) according to [GNSS antenna baseline calibration](#)
 - a. Seapath antenna calibration **if any available**
 - b. Antenna calibration is performed at least two hours per iteration
 - c. Antenna calibration is performed perpendicular to contours for establishing baseline
4. DONE! Swath coverage testing
 - a. Swath coverage data are collected in fully autonomous mode
 - b. Additional time should be planned to survey perpendicular to contours for establishing baseline
6. DONE! RX noise testing (data collected 20 July 2022)
 - a. For Kongsberg systems, RX Noise and RX Spectrum Build-In Self-Test (BIST) testing assesses the vessel, machinery, and flow noise characteristics as perceived by each multibeam echosounder, data acquisition generally follows the [MAC approach for routine noise testing](#)
 - i. Tested in 2021 (worthwhile to redo and compare to 2021 results)
 1. Noise vs. speed testing is performed over a wide range of speeds in calm seas, with typical engine configurations online, the vessel starts drifting and increases speed in 1-2 kt increments up to maximum speed (~1-2 hours, depending on number of speed steps and time to settle at each speed)
 2. This test should be repeated underway to ensure there have been no major changes to the vessel's noise environment since the SAT
 3. See 'Noise vs. Speed' section under [RX Noise Logging](#)
 - ii. Untested:
 1. Noise vs. heading testing is performed at eight headings (separated by 45°) relative to the prevailing swell, these tests are conducted at typical speed and engine configuration for normal mapping operations (~2 hours, depending on sea state and time to settle at each heading)
 2. This test requires deep water (>1000 m) and a slightly elevated sea state (3-5 ft or greater) to generate swell impact noise and bubble sweep, while remaining within the range of sea states where mapping ops would be expected/accepted
 3. See 'Noise vs. Azimuth' section under [RX Noise Logging](#)
7. PROPOSED: Overnight mapping / test survey in poorly mapped areas
 - a. There are large unmapped tracts nearby that would provide a useful demonstration survey and contribute to the global grids (blurry areas with wild single beam artifacts)



Kongsberg Systems in the U.S. Academic Research Fleet

Ship	System(s)	Arrays	Life Cycle	MAC Visits (Recent)	2024 Plans
<i>Atlantis</i>	<u>EM124 (g)</u>	2021	Early	SAT* (2021), QAT* (2022)	QAT
<i>Healy</i>	<i>EM122</i>	2010 / 2023 RX	Late	ANT, QAT/SAT* (2022-23)	QAT
<i>Kilo Moana</i>	EM122 / EM710	2012	Late	ANT, QAT* (2023)	QAT
<i>Marcus G. Langseth</i>	EM122 (g)	2007 TX / 2010 RX	Late	ANT, QAT (2023)	QAT
<i>Nathaniel B. Palmer</i>	EM122	2015	Mid	SAT, ANT, QAT (2015)	TBD
<i>Neil Armstrong</i>	<i>EM122 / EM710</i>	2016	Mid	SAT, QAT* (2020)	EM124 / 712
<i>Roger Revelle</i>	EM124 / EM712 (g)	2020	Early	SAT*, QAT* (2023)	QAT
<i>Sikuliaq</i>	<i>EM302 / EM710</i>	2014	Mid	SAT, QAT* (2023)	EM304 MKII
<i>Sally Ride</i>	<u>EM124</u> / EM712	2016	Mid	SAT (2021), QAT* (2023)	QAT
<i>Thomas G. Thompson</i>	<i>EM302</i>	2018	Mid	SAT, QAT* (2023)	TBD
<i>Hugh R. Sharp</i>	<i>EM2040</i>	2024	Early	QAT (Reson, 2016)	EM2040

(g) indicates gondola installation

*Indicates remote support

Underline = recent install (2021)

Italic = pending replacement (2023+)

Green = visited in last two years



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Ocean Mapping Community Wiki

github.com/oceanmapping/community/wiki

omcadmin@com.unh.edu or mac-help@unols.org

All mappers and managers are invited to contribute

Filters Labels 45 Milestones 0 [New issue](#)

8 Open 21 Closed Author Label Projects Milestones Assignee Sort

- CBMF 1: Timed out waiting for samples** #45 opened 3 weeks ago by kvonkrusenstiernOX
- Real-time coverage grid stops updating in Kongsberg SIS** #39 opened on Jun 13 by ejheffron
- Inmarsat C interference with POS MV GNSS antennas** #38 opened on May 25 by kjerram
- GSF issues/limitations** #37 opened on Apr 12 by ejheffron
- Helmsman Tool does not work in UTM Projection** #36 opened on Apr 6 by shoy-NOAA
- ALL USERS: Become a collaborator on GitHub for Issue tagging and notification options** #32 opened on Mar 27 by kjerram
- Qimera distances are always grid distances** #31 opened on Mar 24 by lindsaymbc
- ALL USERS: Clear the search bar to see ALL ISSUES!** #21 opened on Oct 19, 2022 by kjerram

Welcome

Welcome to the Ocean Mapping Community Wiki!

Thank you for contributing your expertise and experience.

As with the rest of the wiki, these Contribution Guidelines are in development to help establish a high degree of relevance and ease-of-use.

In all cases, we seek to follow the [Code of Conduct](#) and [GitHub Community Guidelines](#).

Scope

It is important to consider the scope of the wiki so its content is relevant and easily maintained. Suggested topics for multibeam and other systems have been added by the first contributors, highlighting some areas of common interest.

The intent is to point users, new and expert, toward the most helpful and up-to-date resources so they can make informed decisions about installation, operation, and processing. It is not meant to be prescriptive for any particular system or insist on any 'one size fits all' approach.

Content should:

1. Apply broadly for mapping operations
2. Highlight examples of successful use cases
 - i. Show us how you did it!
3. Discuss limitations or caveats of an approach
4. Protect IT security and sensitive information
5. Respect the expertise of others and differences among programs

Troubleshooting steps are also of interest for solving common issues.

Adding and editing content

Through GitHub

Please contact us to be added as a GitHub collaborator.

1. Review the existing topics to see where your content fits.
2. Whenever possible, expand on existing topics and add sub-topics to existing pages.
 - i. As the site grows, we will reorganize as necessary to improve clarity or context.
3. Add or edit content directly with the GitHub wiki editing features
 - i. Check out GitHub's quick guides for [adding or editing wiki pages](#) and [basic syntax](#) to get started
4. Images require URLs; upload images from your computer to the wiki repository (Code --> Add file) to generate a URL
5. Wherever possible, link to resources (e.g., SOPs) hosted by others rather than uploading separate copies to the repository
 - i. This will simplify updates as new versions of these documents are released

Remember this is new for many of us and we are excited for your contributions!

Contact us

You don't have join GitHub to contribute. Please reach out to any of the [wiki managers](#) with the content or updates you'd like to see.

Support

Helpful resources from GitHub and others:

1. [Writing on GitHub](#)
2. [Using wikis](#)
3. [Markdown cheatsheet](#)
4. [Using GitHub Issues for troubleshooting](#)
5. [Resizing images in articles](#)
6. [Add other resources you like!](#)

Home

- Contributing
 - Contribution Guidelines
- Multibeam topics
- Other mapping topics
 - Mapping basics
 - ADCP resources
 - Midwater mapping
 - Subbottom profiling
 - Positioning
 - Helpful links
- Resources
 - Open-source data tools
 - Best practices
 - Helpful presentations
 - Multibeam Advisory Committee
- Contact us

Assessment Tools

Backscatter Normalization

Backscatter Processing

Calibration (Patch Test)

Contributing

Data Acquisition

Dimensional Control

Multibeam Data Processing

Sound Speed

Transit Mapping

Troubleshooting

Water Column Mapping

Ocean Mapping Community Wiki

github.com/oceanmapping/community/wiki

omcadmin@ccom.unh.edu or mac-help@unols.org

Sensors

Manufacturers define sensor reference points that must be interpreted correctly when configuring that sensor's software.

As with axis and sign conventions, misinterpretation of these definitions will cause data quality issues that cannot always be addressed in post-processing.

Reference points are presented below for several common sensors (alphabetical order). All units are meters unless otherwise noted.

TABLE IN DEVELOPMENT; GitHub-flavored Markdown experts welcome!

It is always recommended to confirm these conventions with the most recent manufacturer documentation. Sources are linked if publicly available; otherwise, please consult the manufacturer.

Transducer	Reference Point	Source
Kongsberg TX/RX arrays	Center of array face ¹	Kongsberg manual
Kongsberg EM2040 portable	[Pending review] ²	Kongsberg manual
Norbit		
Reson T20/T50	Sonar ref. point (see manual) ³	Reson T-Series manual
Reson 7125		
Reson 7160	Sonar ref. point (see manual) ³	Reson 7160 manual
R2Sonic	Acoustic centers of TX (horiz.) / RX (vert.)	R2Sonic knowledgebase
Simrad EK80	Center of array face	Simrad manual (?)
Motion Sensor	Reference Point	Source
Applanix IMU	Target on housing	Applanix manual ⁴
iXBlue PHINS IMU	Sensing center	
Seapath MRU 5+	Target on housing	Seapath manual ⁵
Antenna	Reference Point	Source
AeroAntenna	Notch 1.90 inch above base	Antenna 'notch' specification
Trimble (AeroAntenna) AT1675-540-TS	Phase center 57.75 mm above base	Antenna specification
Trimble GA830	Phase center 88.8 mm above base	Antenna specification
NovAtel GNSS-850	Phase center 51.7 mm above base	Antenna diagram ⁶
NovAtel GPS-702-GG	Phase center 66.0 mm (L1) above base	NovAtel GPS-702/701 User Guide
NovAtel GPS-702-GGG	Phase center 65.0 mm above base	
NovAtel GPS-713-GGG-N	Phase center 61.5 mm (L1) above base	Antenna specification
Waterline	Reference Point	Source
Kongsberg	WL from origin meters positive down	Kongsberg manual
PPS Output	Edge Configuration	Source
Applanix POS MV	Falling edge	Applanix manual
Seapath	Rising edge	Seapath 320 manual

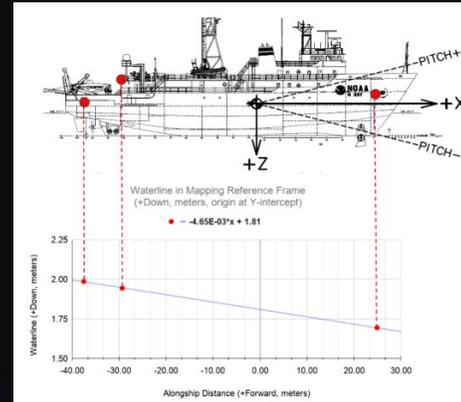
1. For all EM models, including most EM2040 (narrow beamwidths / large arrays); need to verify for arrays with ice protection
2. Need to verify whether all EM2040 models use separate array offsets or if some use a bracket location

Waterline

If survey data are to be referenced to the water level (regardless of later tide correction), then the waterline on the vessel must be measured and configured appropriately in the mapping system reference frame.

The conventions for measuring and configuring waterline vary, and waterline naturally changes with loading and location around the hull. For many applications, it is sufficient to estimate waterline using draft marks or sight tubes and converting these into a 'best-fit' water level around the vessel; this yields the waterline offset at the location required by the mapping system.

For instance, Kongsberg requires the Waterline parameter in meters, positive down from the origin. The example shows a best-fit line through water level measurements taken from surveyed benchmarks around the hull, yielding the waterline offset of +1.80 m at the mapping system origin.



The approach outlined above, translating water levels measured from benchmarks into the mapping system frame, is typically sufficient for deepwater mapping referenced to the water level. However, shallow water configurations may require more detailed waterline estimates with consideration for dynamic draft (if not referenced to the ellipsoid).

Survey reports

It is common for a single survey report to be referenced routinely for the entire service life of a multibeam mapping system. When sensors are moved or replaced, the original survey is used to re-establish the vessel frame and tie in new equipment.

Keeping this in mind, the costs of a high-quality initial survey and clear report are relatively small compared to the ship (and human) time spent acquiring and processing reduced-quality data. In some cases, the vessel must be dry-docked to repeat the survey for proper mapping system configuration.

Recommendations

The MAC developed a set of recommendations for mapping vessel survey reports based on a wide array of experiences interpreting these documents. This guide is intended to help the surveyor ensure that their final report can be easily and correctly interpreted by the vessel operator to reduce windows of opportunity for error in translation, as well as serve as a clear foundation for future vessel surveys in the years ahead.

The recommendations address a few common pitfalls:

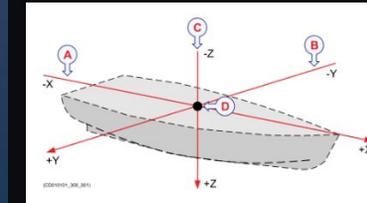
1. even 'good' survey results (meeting the manufacturer's requirements) are reported with ambiguous, inconsistent, or incorrect axis and sign conventions;
2. the mapping system reference frame and sensor reference points are not clearly identified;
3. the report lacks photos or diagrams of the measured locations, leading to errors in interpretation;
4. mapping systems are sometimes configured using 'draft' reports before errors are discovered (e.g., when a final report is not available before sea acceptance trials).

The MAC welcomes other user experiences and recommendations related to mapping system survey reports.

Axis and Sign Conventions

Manufacturers define axis and sign conventions that *must be applied correctly* when interpreting survey reports and configuring software. Misinterpretation of these conventions will cause data quality issues that cannot always be addressed in post-processing.

For example, the Kongsberg reference frame convention is presented below.



Axis and sign conventions are presented below for several hardware manufacturers (alphabetical order). All units are meters and degrees unless otherwise noted.

It is always recommended to confirm these conventions with the most recent manufacturer documentation. Sources are linked if publicly available; otherwise, please consult the manufacturer.

System	+X	+Y	+Z	+Roll	+Pitch	+Heading	+Heave	+Waterline	Source
Applanix	FWD	STBD	DOWN	PORT UP	BOW UP	COMPASS	DOWN	N/A	POS MV V5 Guide (Rev. 4) secs. 2-31, 5-8
iXBlue ¹	FWD	PORT	UP	PORT UP	BOW DOWN	COMPASS	N/A ⁴	N/A	PHINS Manual (Rev. Q) pp. 42-45
Kongsberg	FWD	STBD	DOWN	PORT UP	BOW UP	COMPASS	N/A ⁴	DOWN ⁵	EM Installation Manual p. 140
Reson ²	STBD	FWD	UP	PORT UP	BOW UP	COMPASS	N/A ⁴	UP ⁶	Teledyne PDS p. 117, Calibration p. 20
Seapath	FWD	STBD	DOWN	PORT UP	BOW UP	COMPASS	DOWN	N/A	MRU 5+ Installation Manual (Rev. 8) pp. 33, 146
Simrad ³	FWD	STBD	DOWN	PORT UP	BOW UP	COMPASS	N/A ⁴	DOWN ⁷	EK80 Manual, Transducer Installation
Software	+X	+Y	+Z	+Roll	+Pitch	+Heading	+Heave	+Waterline	Source
Caris HIPS/SIPS	STBD	FWD	DOWN	PORT UP	BOW UP	COMPASS	(needed)	(needed)	Caris HIPS/SIPS v8.1 manual
QPS Qimera	FWD	STBD	UP	PORT UP	BOW UP	COMPASS	DOWN	Draft and HADR ⁸	Qimera v2.5 manual

1. iXBlue alongship (X), athwartship (Y), and vertical (Z) axes are named '1', '2', and '3', respectively.
2. Reson conventions may differ between models and documents (e.g., T50 dual-head drawings are +X forward, +Y starboard, Z+ down)
3. Simrad rotations are assumed to follow the right-hand rule (as do Seapath and other Kongsberg products)



Ocean Mapping Community Wiki

github.com/oceanmapping/community/wiki

omcadmin@com.unh.edu or mac-help@unols.org

Discussions

Troubleshooting

Contributing

oceanmapping / community Public

Community Announcements and Awareness
Welcome to community Discussions!

Search all discussions

Categories: View all discussions, Community Announcements and Awareness, General, Ideas, MBCourse, Polls, Q&A, Show and tell, SIS 5, Troubleshooting

Discussions

- Recordings of TSCOM GEBCO Listening Sessions (Feb 27 - March 1)
- Standard Ocean Mapping Protocol (SOMP) DRAFT is open for public comment
- Multibeam Course: Outreach and Follow-up
- SIS 5 v5.9.3
- Requests for Wiki Content
- New Tools
- TESTING DISCUSSION WORKFLOW: Erik's Horns (Railroad Tracks)
- Welcome to community Discussions!

oceanmapping / community Public

Label issues and pull requests for new contributors

Filters: Search all issues

Issues

- EM304 mistracking up and down slopes
- No pings
- EM304 ping dropouts related to ship satellite network interruptions
- ALL USERS: Clear the search bar to see ALL ISSUES!
- EM122 soundings rejected for outer region of second swath
- EM2040 RX Unit BIST / power supply failure
- EM Processing Unit (PU) powers up but does not boot
- SIS Bugs (5.9.3 and 5.10.1)
- EM124 TXU periodically losing connection to PU
- Excessive BPDU packets on EM multibeam network
- Valeport surface sound speed format for SIS 5.7.0+
- Parameters windows (and other menus) not showing in SIS 5.9.3

oceanmapping / community Public

Contributing

Welcome

Contribution Guidelines

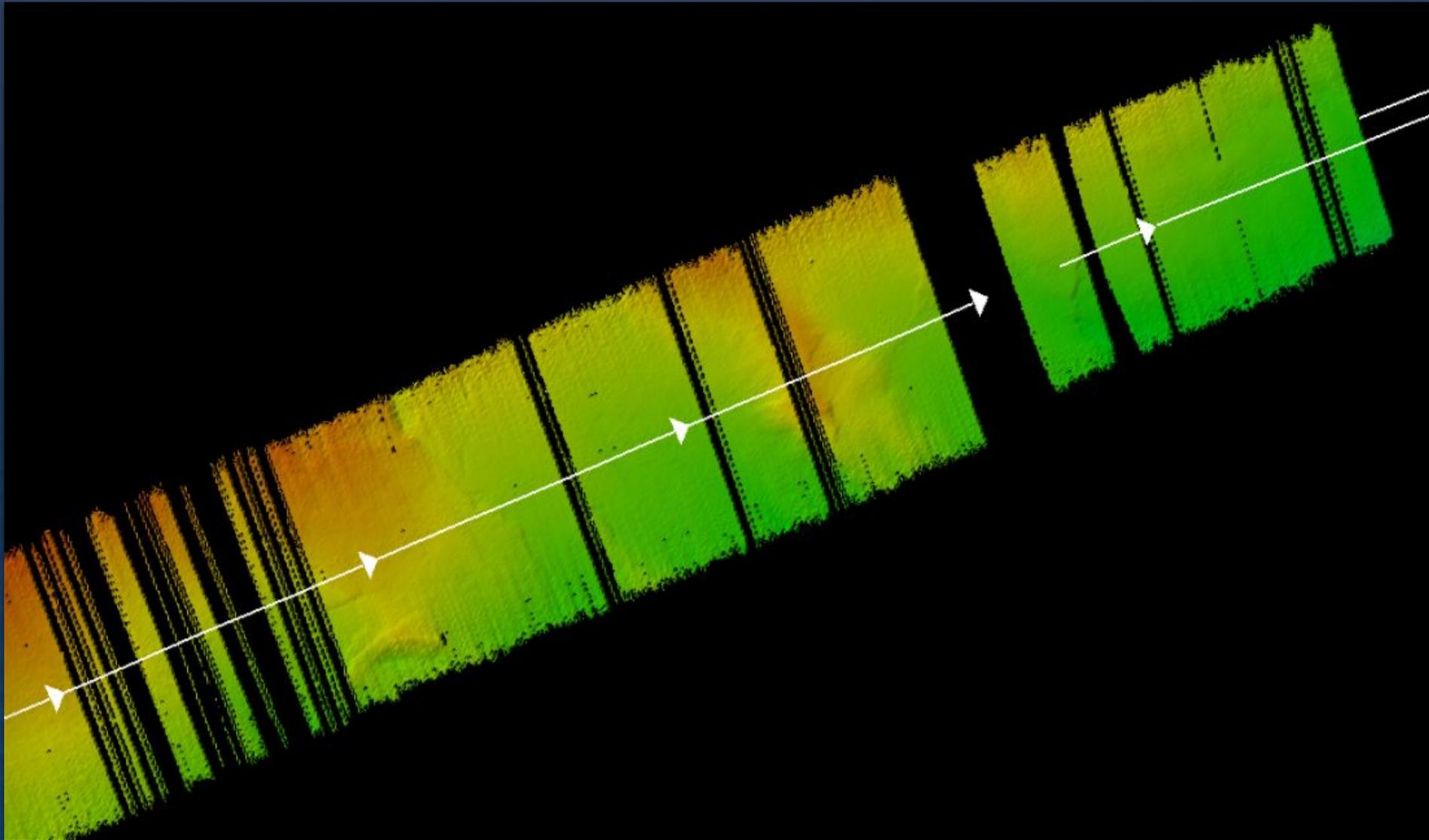
Wish list

- Recommendations for backscatter processing: tips, tricks, workflows, processing guides...
- Bathymetry processing - what's on your mind?
 - Guidelines for gridding approaches / expectations for data quality
 - When to worry about IHO compliance / relevance
 - Approaches for 'fixing' 'bad data'
- Expanding the GitHub Issues base with troubleshooting examples from more users
- Multibeam data acquisition recommendations
 - Synchronization - when is it needed?
 - Grid chart of system combinations, color-coded by interference (present / not present / uncertain)
 - Water column mapping resources
 - Target strength (sphere) calibration guides
 - When, why, and how to do these?
 - Table of spheres required for each frequency range
- Amazing data examples!
 - Every page --> highlight exciting data examples / new and unexpected uses for mapping systems
- Recommendations on how to improve the wiki workflow

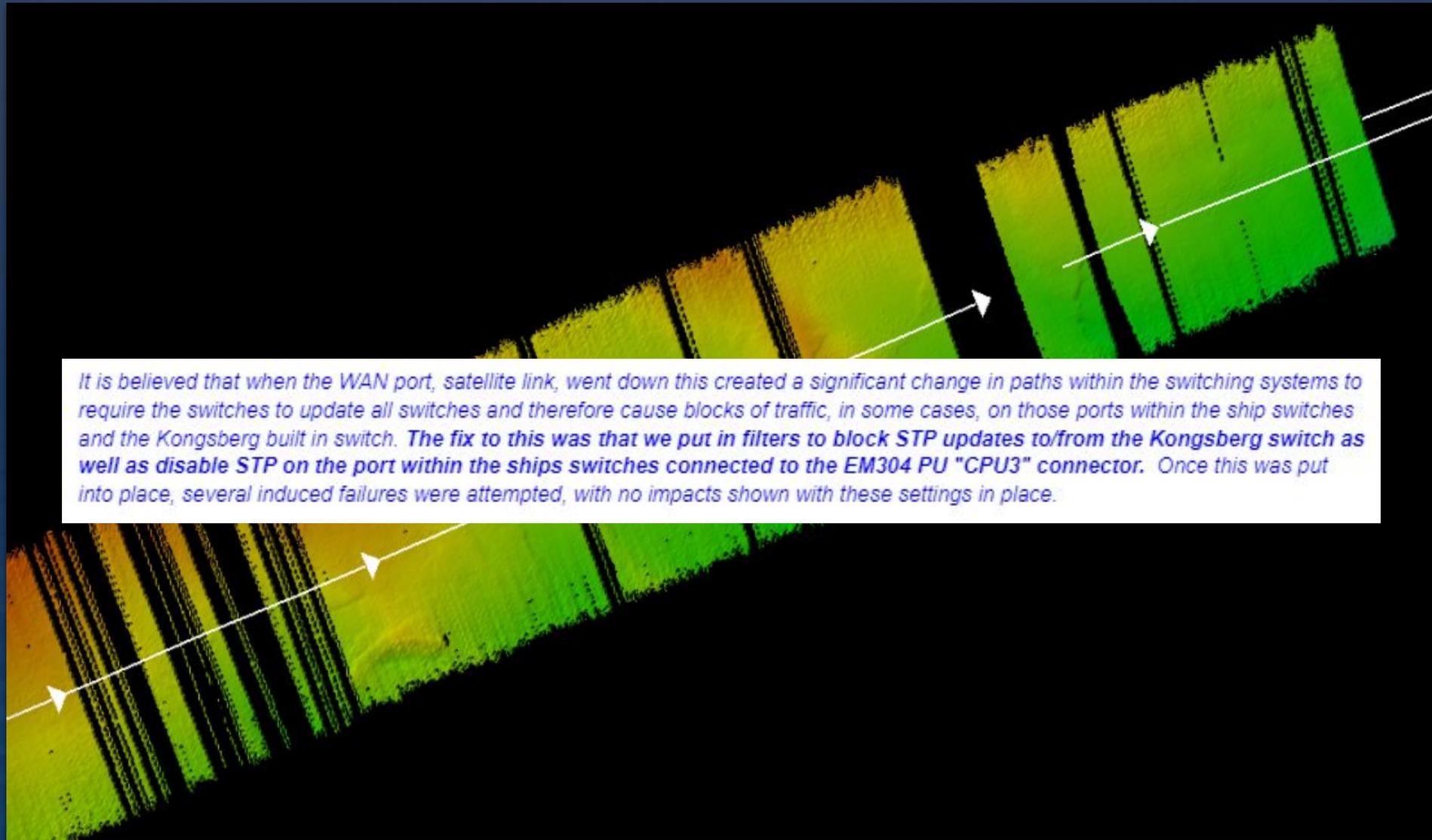


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Example from the Wiki: EM304 Dropouts



Example from the Wiki: EM304 Dropouts



Example from the Wiki: EM304 Dropouts

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Edit Pins Unwatch 10 Fork 1

Code Issues 1 Pull requests Discussions Projects Wiki Security Insights Settings

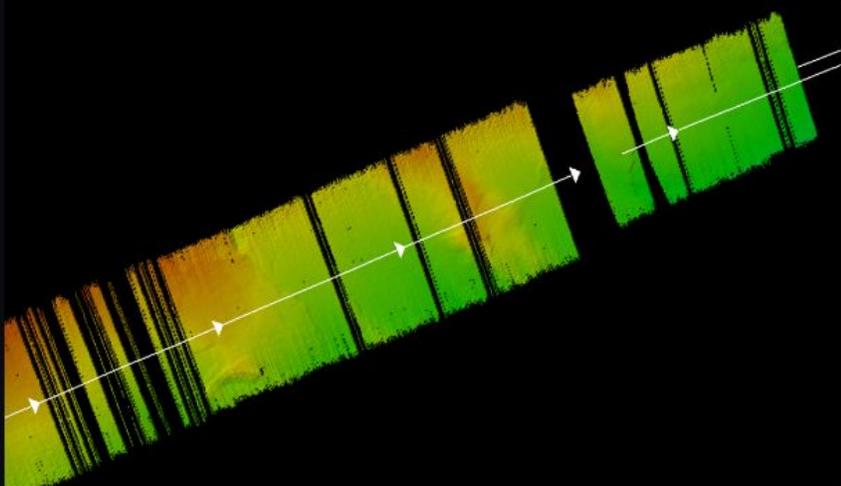
EM304 ping dropouts related to ship satellite network interruptions #22

Closed kjerram opened this issue 6 minutes ago · 0 comments

kjerram commented 6 minutes ago · edited Member

Context:
NOAA Ship Okeanos Explorer with EM304 MKII and POS MV/Seapath navigation inputs.

Symptoms:
The EM304 intermittently and unpredictably stops pinging / tracking seafloor, leaving large data gaps of variable duration. Logging continues as normal (no file increment).



Troubleshooting:
Extensive troubleshooting was conducted by the EX team on board in communication with Kongsberg support in Norway. Multiple software and firmware updates were applied with no improvement.

The PU ethernet switch firmware was updated to v1.40 to address an issue with excessive BPDUs (#15)

EM dropouts were found to correlate with brief VSAT satellite internet outages, suggesting a broader ship network interruption impacting the EM network.

Solution:
The relationship between VSAT interruptions and EM network dropouts was traced to the on-board network's spanning tree protocol (STP).

Assignees: kjerram

Labels: data quality, em304, hardware, kongsberg, ship network, sis5

Projects: None yet

Milestone: No milestone

Development: Create a branch for this issue or link a pull request.

Notifications: Unsubscribe

1 participant

Lock conversation

Transfer issue

Convert to discussion

Delete issue

Excessive BPDUs on EM multibeam network #15

Closed kjerram opened this issue on Jul 5, 2022 · 1 comment

kjerram commented on Jul 5, 2022 Member

Information provided by Mary Huey (SIO).

Context / symptoms:

1. The ship's networks experienced excessive traffic of BPDUs originating from the CPU3 port on the PU (EM124 on Sally Ride).

kjerram added bug, kongsberg, sis5, ship network labels on Jul 5, 2022

kjerram self-assigned this on Jul 5, 2022

kjerram commented on Jul 5, 2022 Member Author

Solution provided by Mary Huey (SIO) after discussion with Kongsberg technical support.

1. Make sure EM switches have latest firmware (v1.40). Earlier versions may have a bug that allows settings to be wiped.
2. Go to C:\Program Files\Kongsberg Maritime\EMSystem\K-Controller\PU\EM124\Update\Support\Vada_Tech and follow the setup guide for CP219.

Kongsberg technical support can provide a PDF of how switches should be set up.

kjerram closed this as completed on Jul 5, 2022

kjerram mentioned this issue on Nov 3, 2022

EM304 ping dropouts related to ship satellite network interruptions #22

Ocean Mapping Community Wiki

COMING SOON: better interface and address!

Advantages in testing...

1. Multi-user editing
2. Easy login and attribution
3. Intuitive editors and previews
4. Accessible for broader user base

The screenshot shows the 'Top 10' page on the Ocean Mapping Community Wiki. At the top, a red box highlights the editing toolbar with options like Paragraph, Bold, Italic, Link, Cite, Insert, and Save changes... The main content features a Star Trek meme with the text 'THIS IS WHY WE CAN'T HAVE NICE PINGS' overlaid on a picture of Captain Picard. Below the meme is the section 'Top 10 common issues' with a list of ten items, each with a sub-list of specific details. At the bottom, there are navigation icons for home, search, and user profile.

The screenshot shows the editing interface for the 'Top 10' page. A red box highlights the navigation and administration menu on the right, which includes options like Main page, Recent changes, Random page, Help about MediaWiki, Special pages, Upload file, Administration, and Manage this wiki's core settings. Below this, the editing toolbar is visible with options like Bold, Italic, Link, and Special characters. The main editing area contains the same text as the previous screenshot, including the meme and the list of common issues. At the bottom, a red box highlights the 'Summary' field, a 'This is a minor edit' checkbox, a 'Watch this page' checkbox, and the 'Save changes' button.

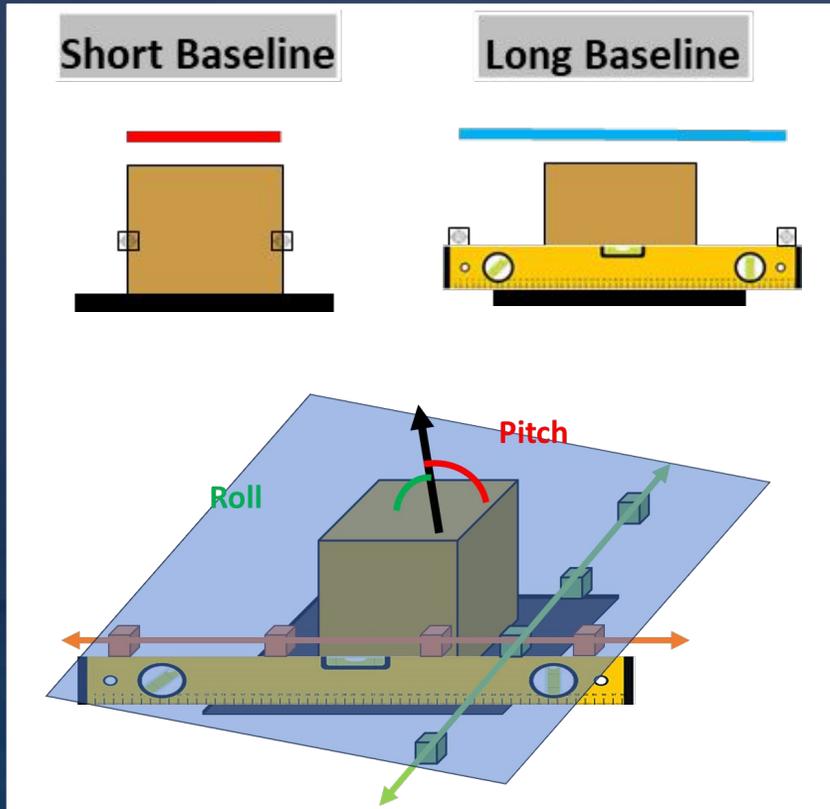
Next steps...

1. Set up issue tracking
2. Move content from GitHub
3. Announce new web address
 - a. It's pretty great...
4. WIKI LOGO CONTEST

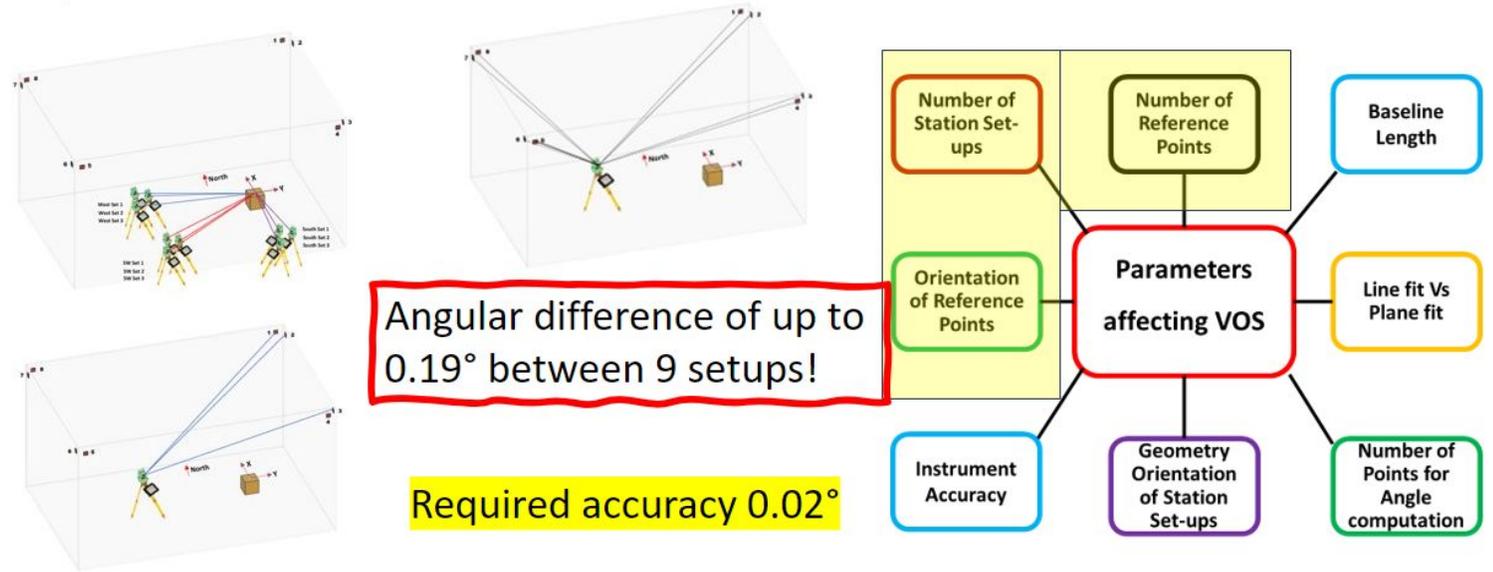


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Survey Accuracy Improvements by Anand Hiroji



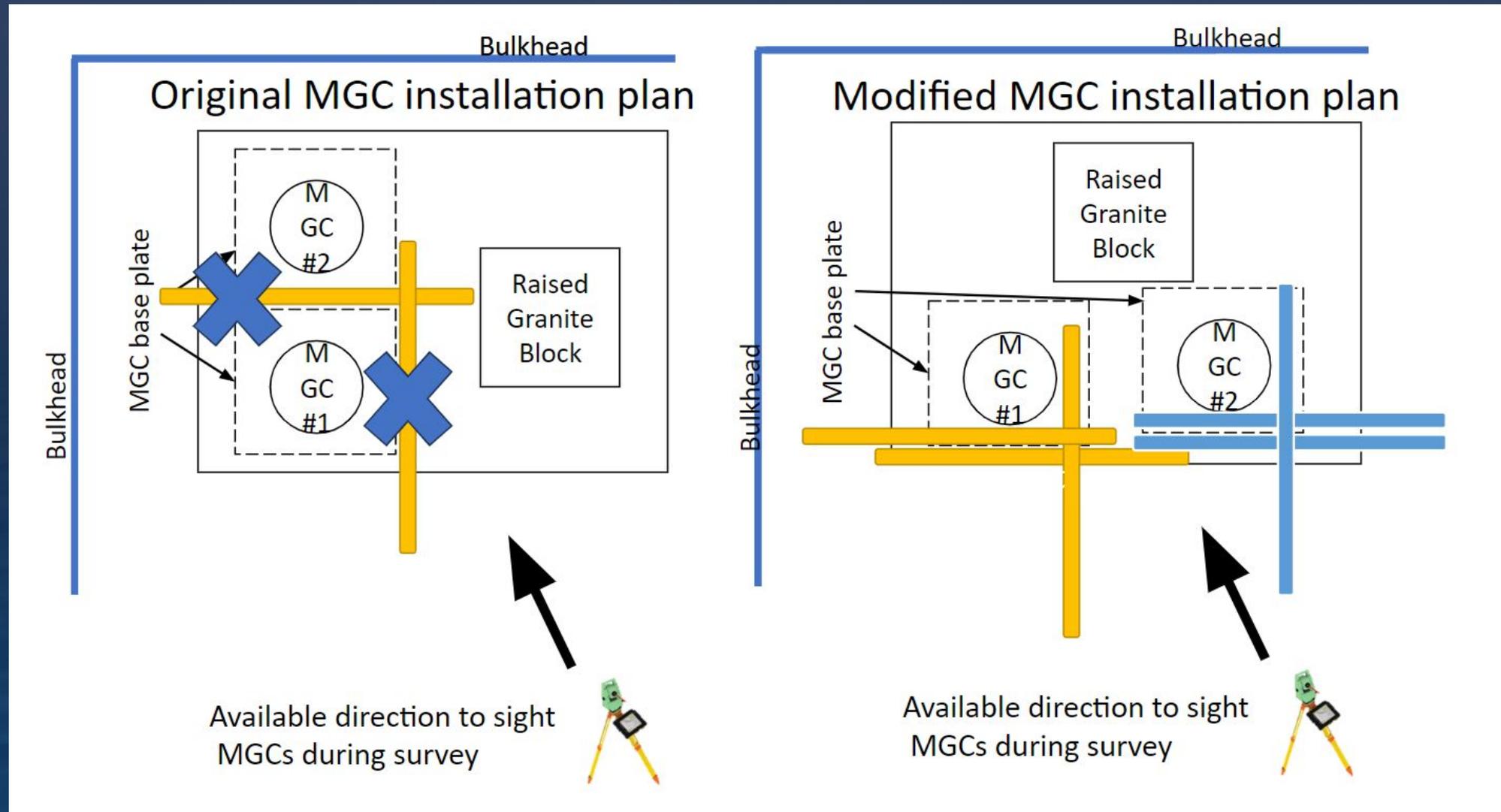
Experimental setup 1: Results



Having more reference points, number of station setups, and verity of orientations provides redundancy and helps identify/minimize/reduce the absolute error.

1. Longer baselines reduces effect of random errors on computed angles
2. Plane fitting provides redundancy and helps to minimize the absolute error
3. Accuracy calculated (not estimated) for QC and reporting

Implementation: Seapath MGCs on RCRVs



Offset Surveys and Reports V2

Recommendations for Multibeam Echosounder Mapping System Offset Surveys and Reports

Survey reports directly impact data quality for years
 Improve survey benchmarks, accuracy, and clarity

Recommendations for Multibeam Echosounder Mapping System Offset Surveys and Reports



Multibeam Advisory Committee
 www.mac.unols.org | mac-help@unols.org
 Supported under NSF grant no. 1933720



1. **Origin** of survey reference frame
2. **Axes** of survey reference frame
3. **Sign conventions** of survey results
4. **Images** of surveyed points and sensors
5. **Sigma / standard deviation or uncertainty**
6. **Second review** before submission



1. Origin of the survey reference frame

2. Axes of the survey reference frame

3. Sign conventions of the survey reference frame

4. Images

5. Sigma / uncertainty of the survey results

6. Second review before submission

Example table of mapping sensor results

The ultimate purpose of the report is the confident and correct interpretation of the survey data for mapping system configuration. Building on criteria #1-6 presented above, this is best addressed with a simplified table of results for the relevant sensors using the chosen MBES manufacturer's reference frame and sign conventions. This table may be presented at the beginning or end of the report and only summarizes, rather than replaces, the more detailed survey data throughout.

Table 1. Example mapping sensor offsets from a chosen origin using consistent axis and sign conventions. This table summarizes the more detailed survey results presented elsewhere in the report. While these final numbers may be used directly for configuration, the reader must still carefully consider how the offsets will be applied among the sensor software packages to avoid doubling or canceling the offsets. The items in the left column are examples only, and the final offsets required for configuration may differ by system; this should be clarified by the client. For example, manufacturers of higher-frequency echosounders may require a transducer bracket 'reference point' instead of the center of each array face; the client and surveyor must identify these items in planning the survey. Installations on adjustable rams or drop keels should include separate results for each standard position used for mapping (e.g., recessed and extended, plus any intermittent standard positions).

R/V	X	Y	Z	ROLL	PITCH	HEADING	Notes
Sign convention	Positive forward	Positive to starboard	Positive down	Positive with starboard side down	Positive with forward side up	Positive with forward side to starboard	
Units	meters	meters	meters	degrees	degrees	degrees	
Origin (chosen feature)	0.000	0.000	0.000	N/A	N/A	N/A	A clear, accessible, and permanent feature
TX array (center of array face)							
RX array (center of array face)							
GNSS antenna 1 (phase center)				N/A	N/A	N/A	Phase center height is _____ m above the survey point (source: _____)
GNSS antenna 2 (phase center)				N/A	N/A	N/A	
Motion sensor (survey target on sensor housing)							
Center of gravity (approx. loc. for heave filtering)							Required for POS MV configuration
Waterline							Waterline in normal trim
Additional sensors							

github.com/oceanmapping/community/wiki/Dimensional-Control



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Waterline Worksheet

Multibeam Advisory Committee Kongsberg Waterline Worksheet



Working draft; please contact mac-help@unols.org with feedback

Purpose / Warning

This worksheet (in development) is intended to help translate draft readings into the 'Waterline' parameter required by SIS.
Waterline is the vertical offset from the mapping system reference frame to the sea surface in normal trim.
The Waterline parameter is entered in **meters, positive DOWN** from the mapping system origin.
If the sea surface is above the origin, then the Waterline parameter is negative.
Errors in waterline directly affect reported depths as well as refraction correction (e.g., starting depth in sound speed profile)
More information at <https://github.com/oceanmapping/community/wiki/Dimensional-Control#waterline>

Instructions

All cells are protected, aside from those requiring input. Please contact mac-help@unols.org with any feedback.

Green sections: enter ship information Enter data based on your vessel / sensor offset survey and interpretation of the mapping system reference frame. Ensure correct units are applied.
Yellow cells: extra attention needed Review your vessel survey and mapping system configuration carefully!
Blue cells: waterline for SIS config Waterline value for SIS configuration (meters, positive DOWN from the mapping system origin)

Step 1: Consider how draft readings are taken and the current mapping system reference frame. Select the locations for draft reference and mapping system origin.		
Reference for vessel draft readings	Keel	This is the reference used for draft readings (e.g., typically the keel or other deepest part of the hull, but not always!)
Mapping system origin (where Z=0)	Motion sensor	This is the origin of the mapping system reference frame as configured (e.g., not necessarily the "vessel survey" reference frame)
Origin height different from draft ref.?	Yes. Review the mapping system ref. frame carefully. Enter the mapping system origin height ABOVE the draft ref. and add alongship position in Step 2.	

Step 2: Enter the mapping system origin height above the draft reference (not waterline!) and alongship distance from stern.						
Mapping system origin offsets from draft ref.	Height above draft ref. (decimal feet or m)	Distance from stern (alongship feet or m)	Units (select 'none' if not applicable)	Scale factor to meters	X	Z
Mapping system origin	9.55	38.78	m	1	38.7800	9.5500

Step 3: Enter draft readings and alongship distances from stern. Draft is estimated at mapping system origin.						
Draft readings in normal trim (average Port/Stbd readings at each location to estimate draft at CL)	Draft reading (decimal feet or m)	Distance from stern (alongship feet or m)	Units (select 'none' if not applicable)	Scale factor to meters	X (m) +FWD from stern	Z (m) +UP from draft ref
BOW draft reading	5.10	62.38	m	1	62.3750	5.1000
STERN draft reading	6.00	0.00	m	1	0.0000	6.0000
ESTIMATED draft reading at origin	5.44	38.78	m	1	38.7800	5.4404

Step 4: Calculate waterline at origin			
Waterline in mapping system reference frame	Waterline (SIS)	X (m) +FWD from origin	Z (m) +DOWN from origin
BOW draft reading in mapping frame		23.60	4.45
STERN draft reading in mapping frame		-38.78	3.55
Waterline for SIS (m, +DOWN at origin)	4.11	0.00	4.11

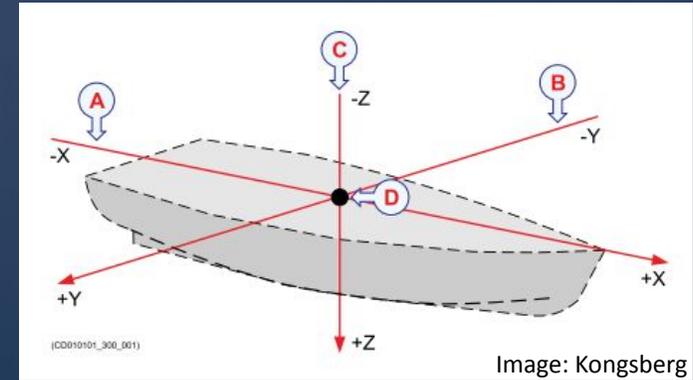


Image: Kongsberg

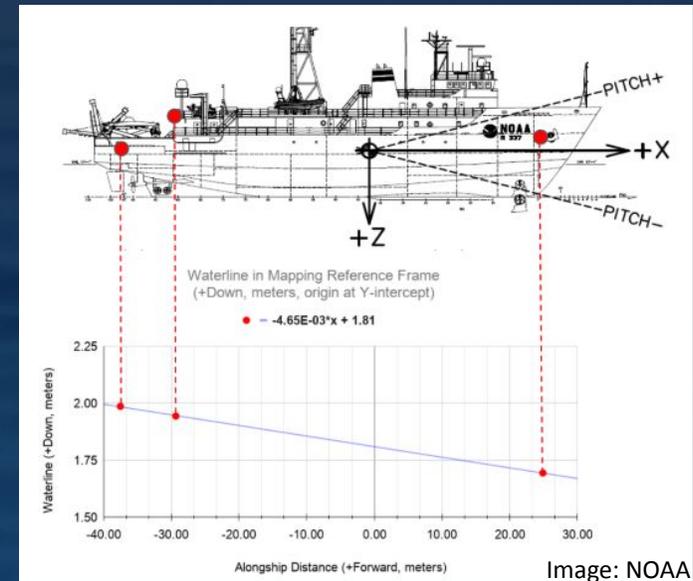


Image: NOAA

github.com/oceanmapping/community/wiki/Dimensional-Control

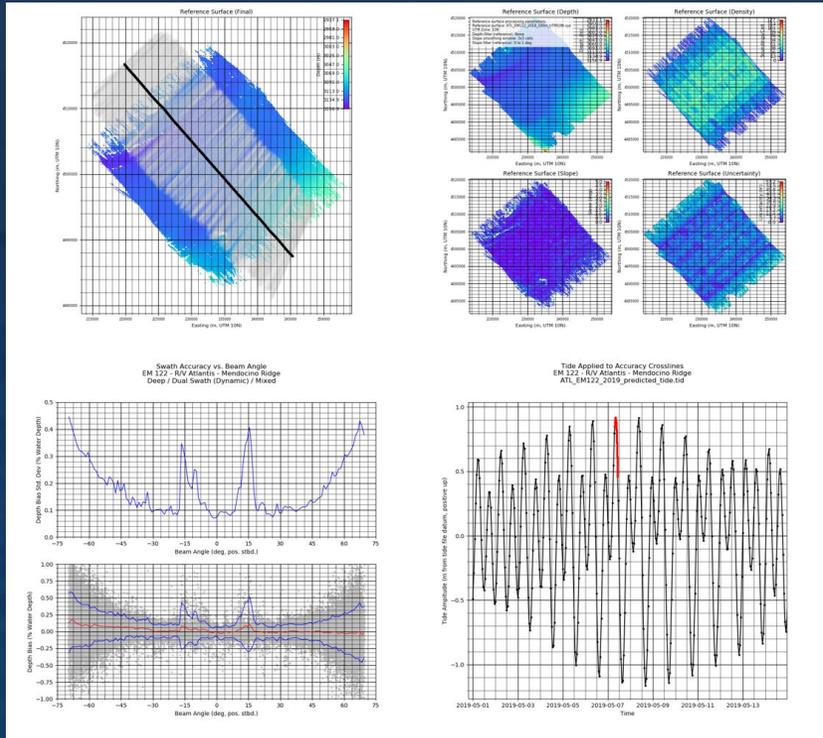
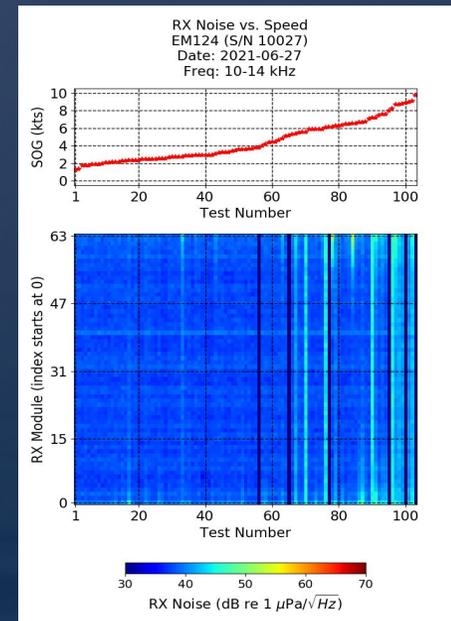
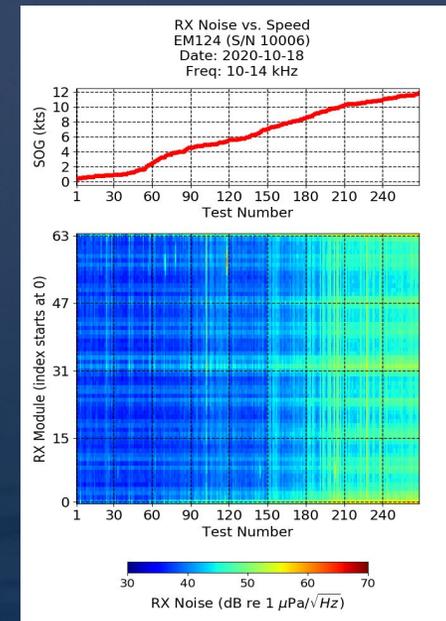
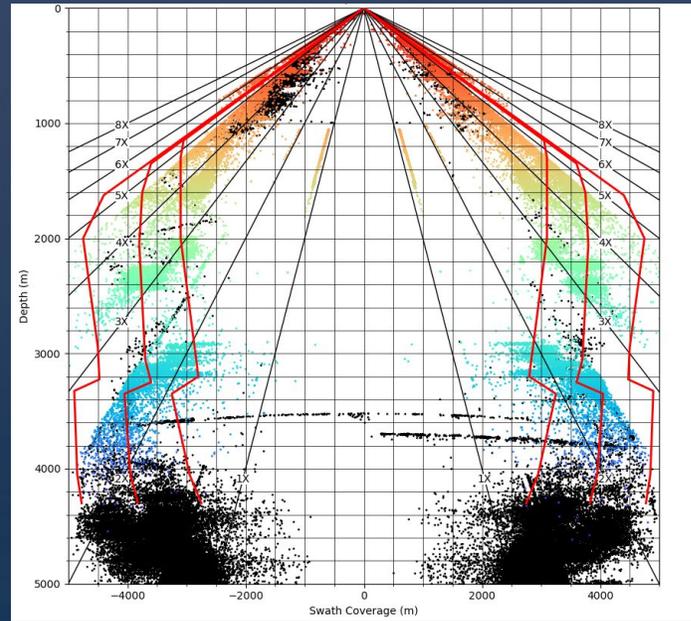
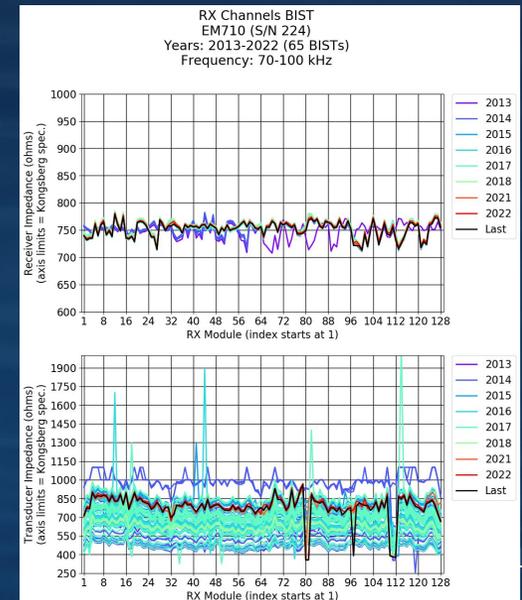
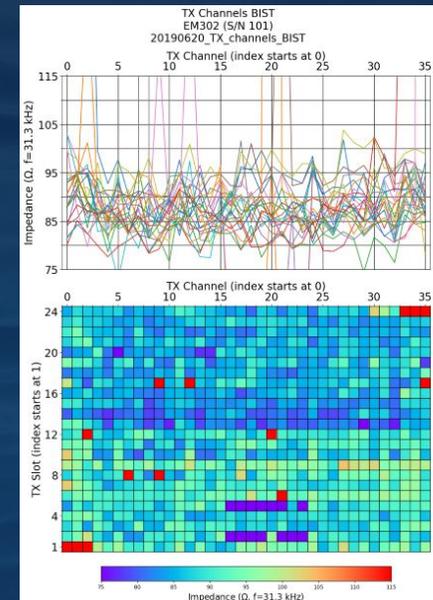


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Assessment Tools

github.com/oceanmapping/community/wiki/Assessment-Tools

1. File Trimmer
2. BIST Plotter
3. Swath Coverage Plotter
4. Swath Accuracy Plotter
5. ECDIS Converter

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Ocean Mapping Community Wiki

github.com/oceanmapping/community/wiki

omcadmin@ccom.unh.edu or mac-help@unols.org

Assessment Tools

kjerram edited this page on Apr 6 · 40 revisions

Overview

Multibeam assessment tools described here include:

1. Swath Coverage Plotter v0.2.3
2. Swath Accuracy Plotter v0.1.0
3. BIST Plotter v0.2.2
4. File Trimmer v0.1.5
5. ECDIS Converter v0.0.3

Distribution

The standalone Python apps are available through several avenues for different users:

1. **Typical users:** each app is packaged with all libraries and zipped for easy download on [Google Drive](#) (with version notes).
 - i. Just download, unzip, and run the .exe (similar to Sound Speed Manager).
 - ii. The zipped packages are not available through GitHub due to file size limits.
2. **GitHub users:** apps and libraries are packaged in the [multibeam_tools_distribution](#) repository.
 - i. Due to GitHub's file size limits, these are not zipped and may be more cumbersome to download for normal use.
3. **Python folks:** source code is available in the [multibeam_tools](#) repository.

Using the tools

These tools are intended to give users the same plotting and reporting functions used by the MAC for routine performance testing (e.g., sea acceptance trials and quality assurance testing). Currently, only Kongsberg data formats are supported.

Hint: Most of the app features include tooltips; just hover over a button, list, or checkbox to get more information!

Instructions for data acquisition and processing are presented in the following sections. Suggestions are welcome for improving the workflow in each application.

Swath Coverage Plotter

The swath coverage plotter extracts the outermost soundings (flagged 'valid') and plots these with a variety of filtering and plotting options. Currently only .all and .kml are supported.



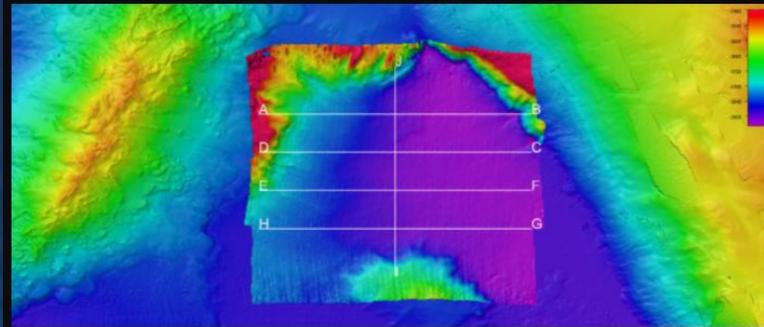
Reference survey acquisition

The reference survey should be planned over relatively flat, benign, homogenous seafloor with slopes no greater than a few degrees. Because the selected depths will likely be used for testing several different modes, the area may also be suitable for backscatter normalization across those modes [wiki development: add link to BS normalization section when complete].

The reference survey lines are planned with a few key considerations:

1. Orientation orthogonal to the crossline (or as a 'grid' if time allows)
 - i. This reduces alignment of any swath biases in the reference grid with the crosslines
2. Narrow spacing (e.g., 1 WD) to achieve very high sounding density
3. Length sufficient to cover the full crossline swath width (e.g., 6-8 WD, with buffer for ship handling)
 - i. Typically 6-10 reference lines at 1 WD spacing, depending on depth, to yield several hundred crossline pings
4. Number of reference lines to accommodate desired crossline length

Small regions of steeper slopes may be filtered during processing, if present (e.g., the 3900 m reference site off San Diego, below). Likewise, the number of lines may be adjusted to fit the terrain and the schedule.

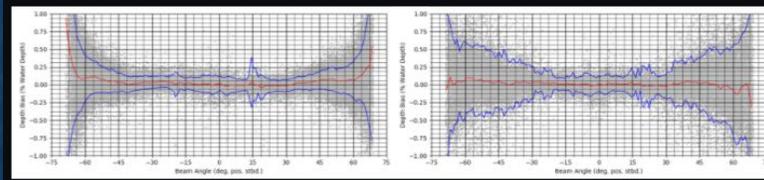


Crossline data acquisition

The primary crossline setting of interest should be the same used for the reference survey; ideally, this is a setting that would be selected automatically by the multibeam system for this depth. This provides a consistent comparison between the 'routed' bathymetry created from a dense survey and the single-pass crossline(s) for the mode that is intended for this terrain.

As discussed in the [planning constraints](#), there may be several modes of interest that have been grouped for this reference surface depth. Additional crosslines are added as needed and allowed by the ship schedule.

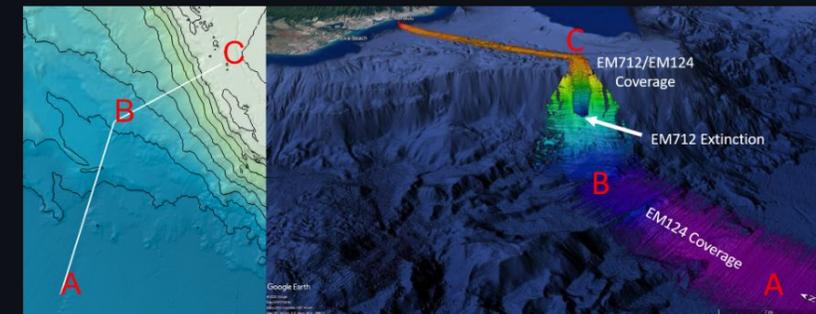
Crosslines are typically run in 'pairs' on opposite headings for each mode to assess any heading-dependent impacts, such as sea state (example below shows accuracy heading with seas and into seas shown on top and bottom, respectively). When seas are calm, this approach also supports deep roll verification using pairs of lines with the same mode and settings on opposite headings over the flat terrain.



Data collection

Ideally, swath coverage test data is collected under vessel operating parameters (e.g., speed, engine lineup, active sensors) that reflects 'typical' mapping configurations. For example, transit data collected at 12 kts with additional engines or generators online may not reflect the flow and machinery noise environment present at a typical mapping speed of 8 kts. Additional acoustic sensors (e.g., a bridge Doppler speed log) may cause interference and outliers in the coverage data that do not represent the standard mapping configuration with those sensors secured. Likewise, highly elevated sea state may not represent suitable mapping conditions.

The MAC recommends acquiring coverage test data at typical mapping speeds (e.g., 8-10 kts) and crossing contours at perpendicular angles wherever possible. Maintaining the ship heading directly up and down the slope is important for reducing coverage biases on either side of the swath that may result from the slope facing toward or away from the system. A coverage test line off HI for the R/V *Roger Revelle* EM124 / EM712 SAT is shown as an example of transiting 'up' and 'down' the major seafloor slopes in order to reduce port / starboard coverage biases across a wide depth range (~100-4000 m). In this example, the transit from waypoint A toward port was routed through waypoints B and C to cross contours more perpendicularly; this small amount of additional transit time produced much more useful data for coverage assessment.



Runtime parameters

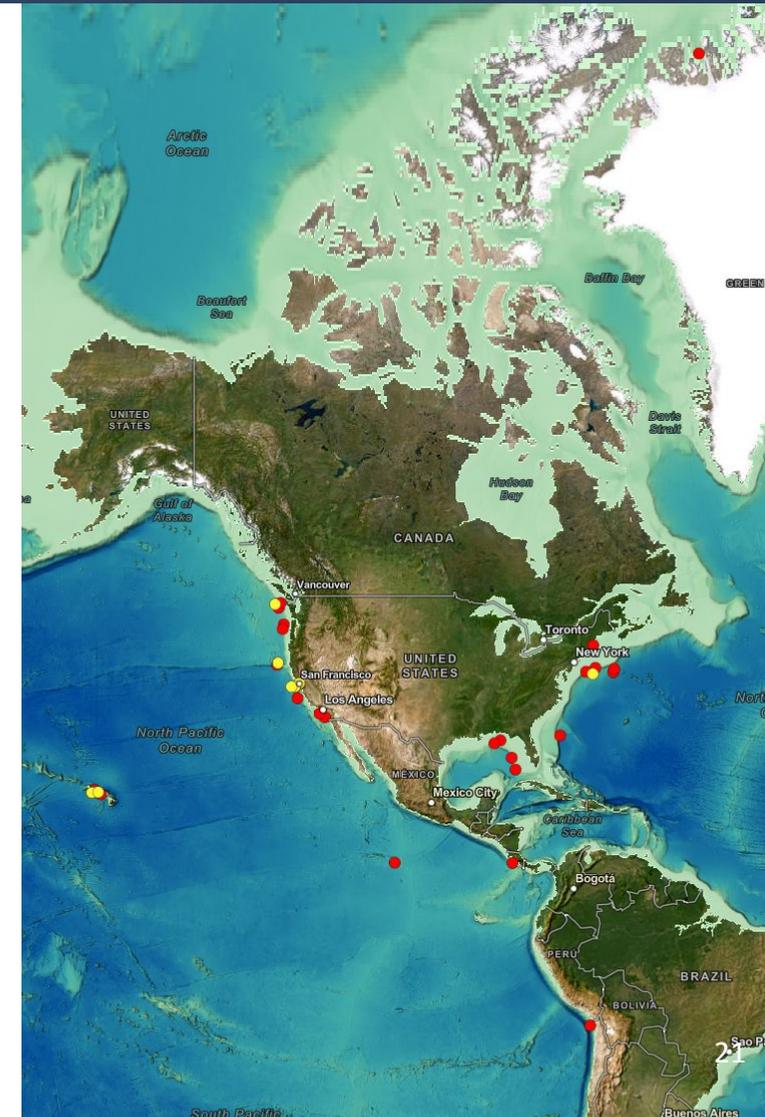
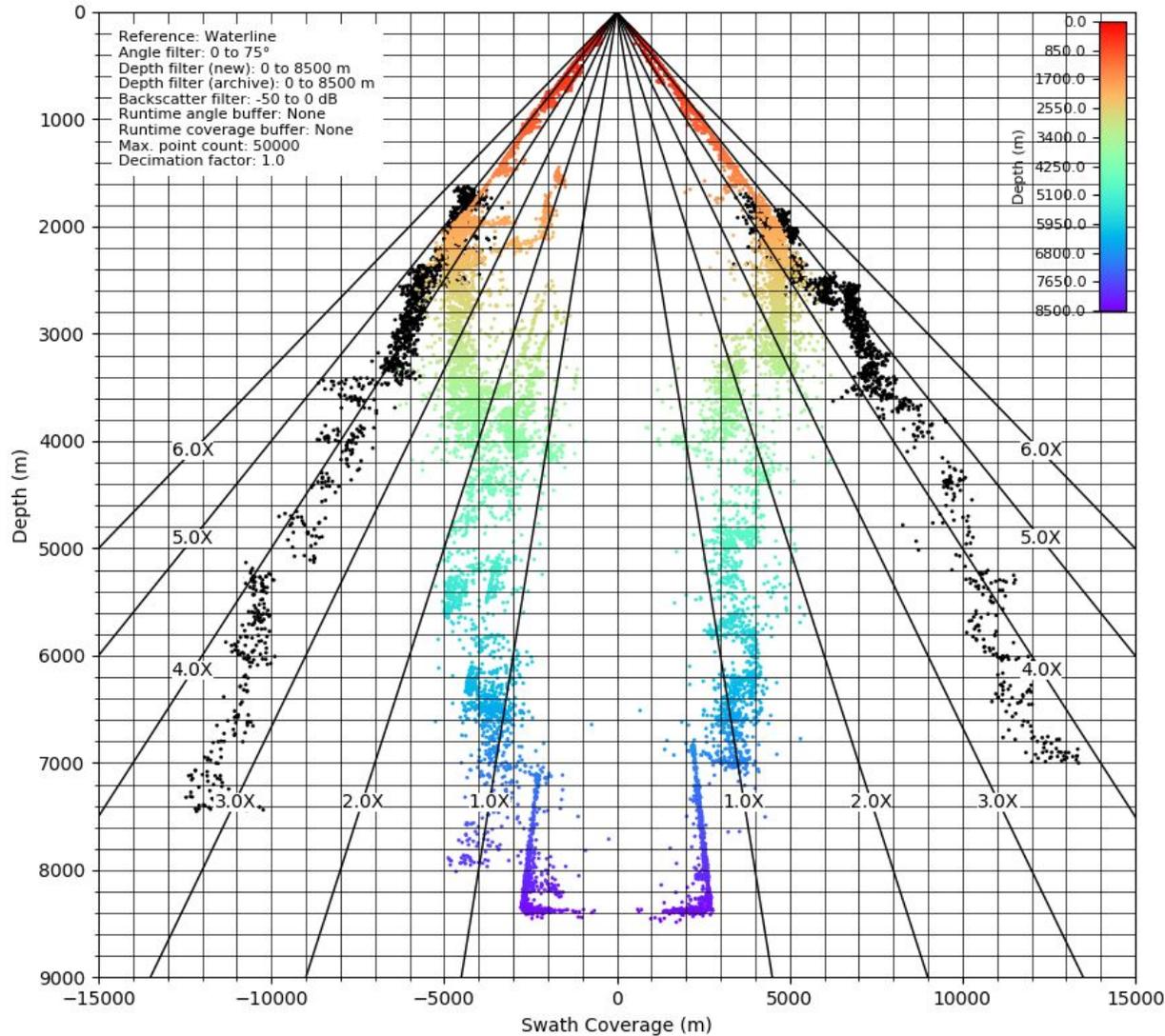
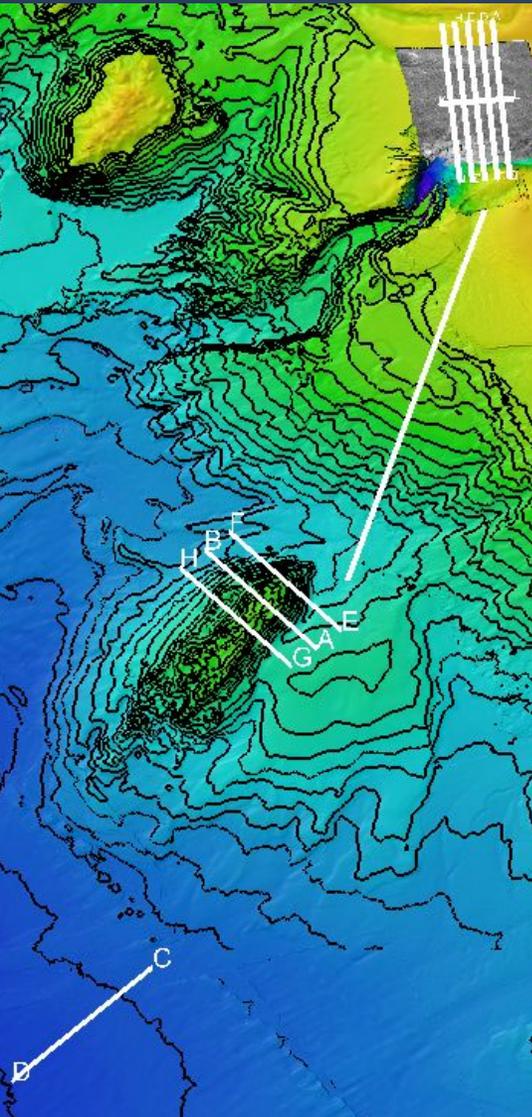
The purpose of testing is to let the multibeam system achieve its maximum coverage under the mode it selects automatically for the given depth.

The following settings are generally recommended for Kongsberg EM systems to best illustrate 'automatic' system performance. Vessels that use different parameters during routine mapping should apply those settings where appropriate, aside from the maximum angle, coverage, and depth gates that may inadvertently limit the coverage test data.

Parameter	Recommended	Notes
Depth mode	Automatic	
Dual swath	Dynamic	
FM Transmission	Enabled	Read checkbox carefully ¹
Max angles	75°/75°	70°/70° for some systems
Max coverage	Maximum	Varies by model
Depth limits	As needed	Adjust as needed ²
TX power	Maximum	0 dB

Multibeam Test Sites Database – Why is it needed?

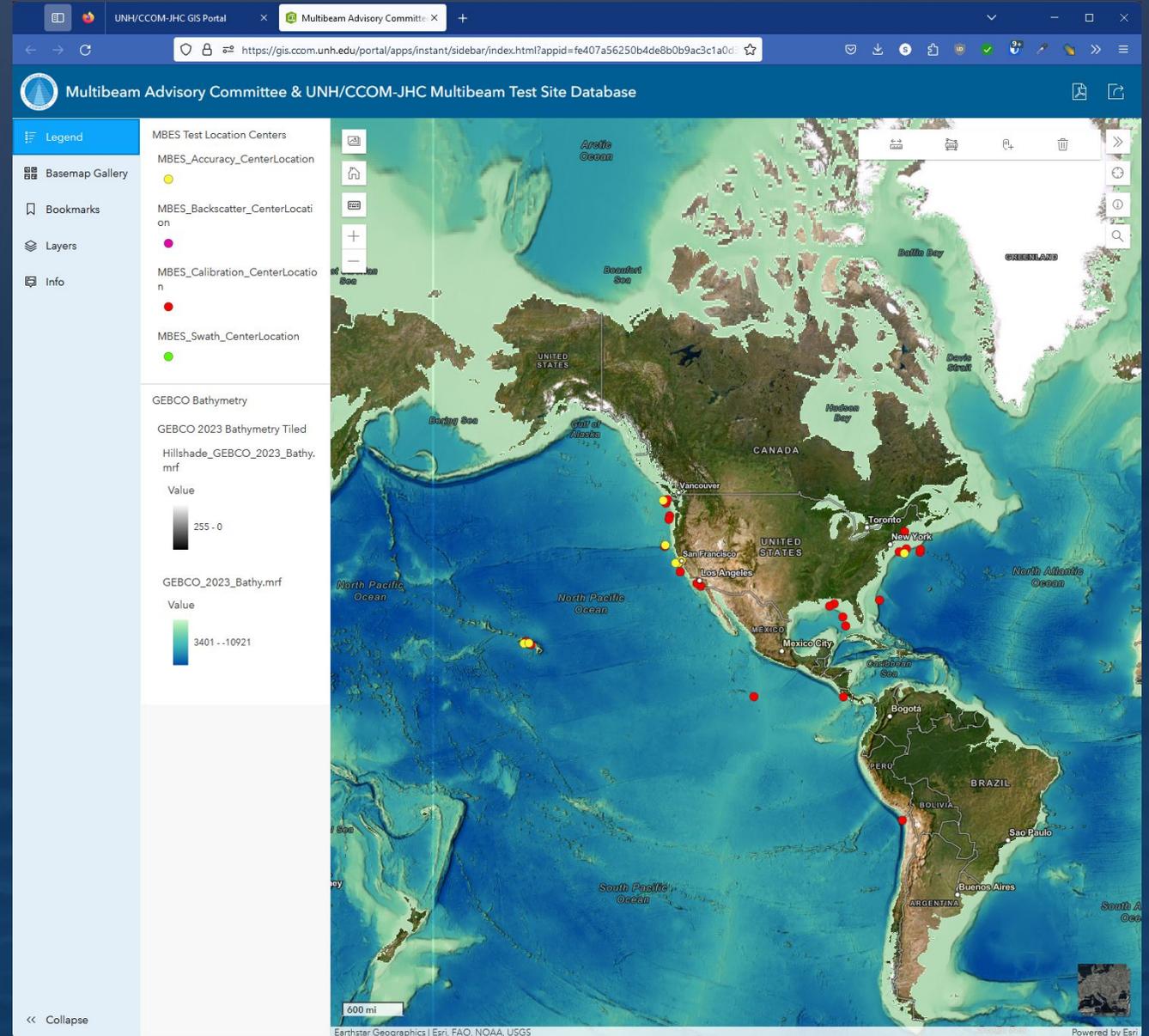
- Meaningful comparisons across ships / systems and more efficient use of ship time and personnel



Multibeam Test Sites Database – Prototype WebApp



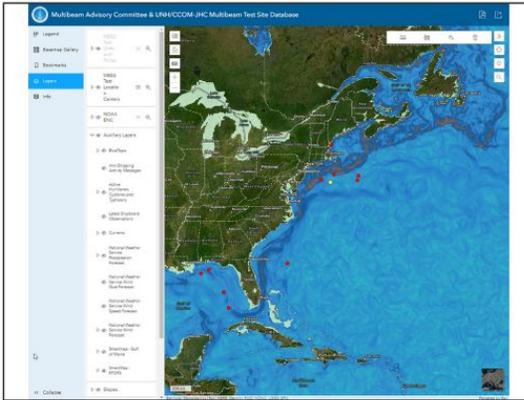
<https://ccom.unh.edu/gis/maps/TestSites>



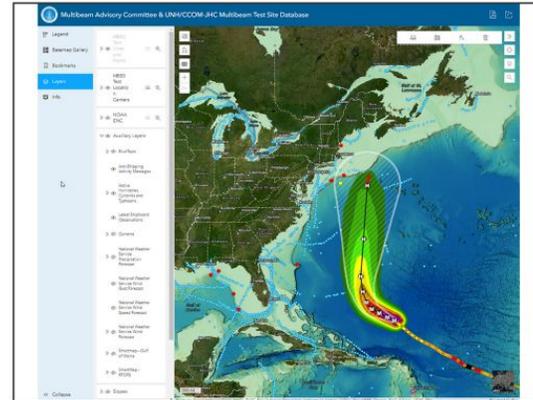
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Multibeam Test Sites Database – Planning Layers

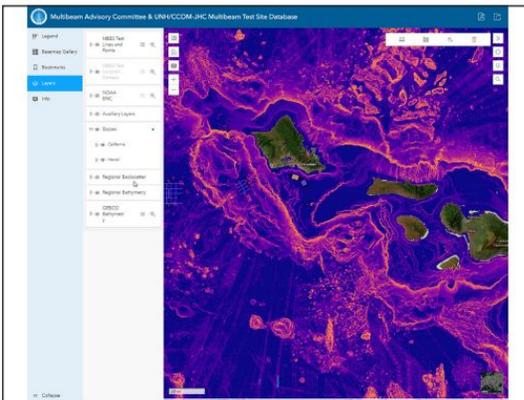
Planning Information



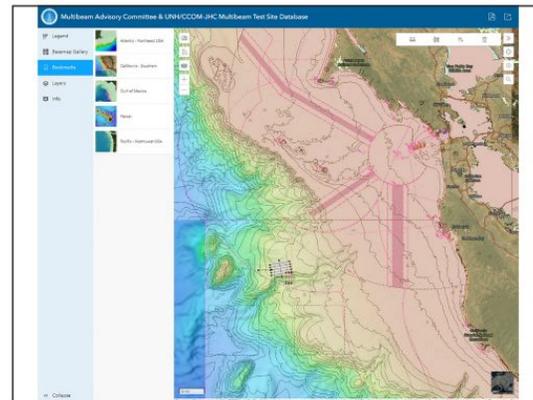
SmartMap Ocean Complexity



Ocean & Weather Conditions



Regional Bathymetry & Slope



Electronic Navigation Charts

MBES Test Lines - Calibration "Patch Test" - Kongsberg EM122

Filename	Test Type	Report URL	Files URL	Line ID	Ship
EM122_Mytilus_Seam...	Calibration "Patch Test"	Planning Only	https://universitysystem...	1	R/V Neil
EM122_Mytilus_Seam...	Calibration "Patch Test"	Planning Only	https://universitysystem...	2	R/V Neil
EM122_Mytilus_Seam...	Calibration "Patch Test"	Planning Only	https://universitysystem...	3	R/V Neil
EM122_Mytilus_Seam...	Calibration "Patch Test"	Planning Only	https://universitysystem...	4	R/V Neil
EM122_Physalia_Seam...	Calibration "Patch Test"	Planning Only	https://universitysystem...	1	R/V Neil
EM122_Physalia_Seam...	Calibration "Patch Test"	Planning Only	https://universitysystem...	2	R/V Neil
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EM122_Physalia_Seam...	Calibration "Patch Test"	Planning Only	https://universitysystem...	4	R/V Neil
FH_2020_EM2040_cali...	Calibration "Patch Test"	Not Available	https://universitysystem...	1	NOAA St
FH_2020_EM2040_cali...	Calibration "Patch Test"	Not Available	https://universitysystem...	2	NOAA St
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EX1810_v4_calibration...	Calibration "Patch Test"	https://mac.unols.org/w	https://universitysystem...	1	NOAA St



<https://gis.ccom.unh.edu>

Multibeam Test Sites Database – Future Work

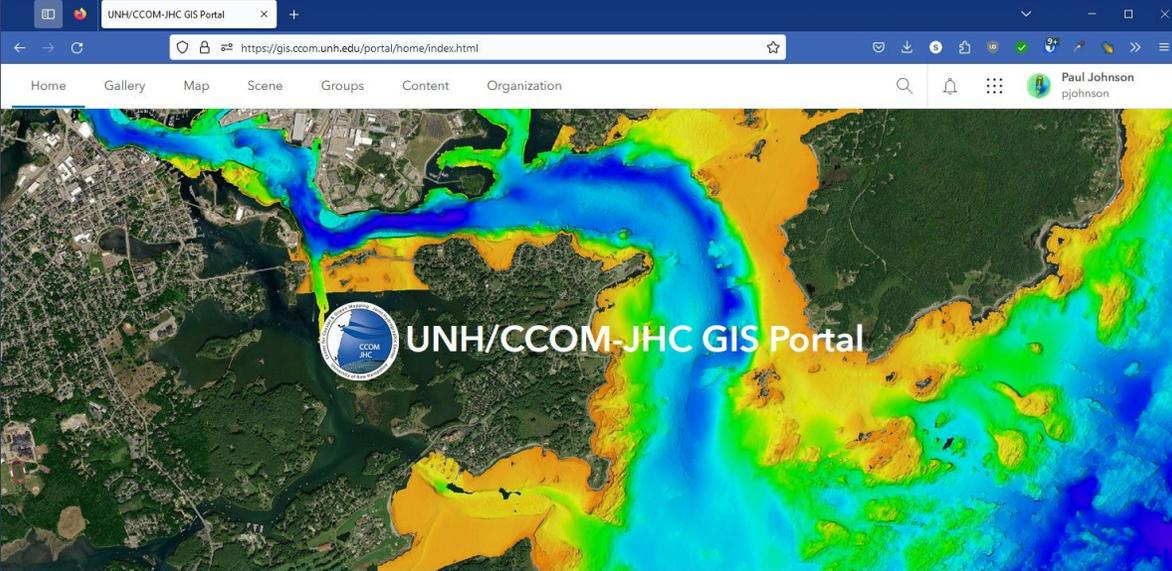
Now: Adding test sites

- UNOLS, NOAA, and industry partners
- More sites from RVTEC community!
- **Reach out at mac-help@unols.org**

Next: Standards for file submission

- Line files
- Bathymetry grids
- Operational parameters

Nice to have: Speed up the WebApp



The screenshot shows the UNH/CCOM-JHC GIS Portal website. The main content is a bathymetry map of a coastal area, with a color scale ranging from blue (deep) to red (shallow). The map is overlaid on a satellite image. The text "UNH/CCOM-JHC GIS Portal" is visible on the map. Below the map, there is a blue banner with white text describing the center's mission. Below the banner, there is a section titled "Featured Maps and Apps" with a sub-header "Recently updated WebMaps and data layers available from the Center." This section contains four cards, each representing a different application or map. The first card, "Instant App MBES Test Sites Database Web...", is highlighted with a red border. The other cards are "Instant App NHS Surficial Geology WebApp", "Instant App GEBCO 2023 Globe Bathymetry, elevation, TID, and Indirect Measurement mask with a 5x vertical exaggeration.", and "Web Experience WGoM, LI, SNE Bathymetry & B...".

The Center for Coastal and Ocean Mapping at the University of New Hampshire was founded with the objective of developing tools and offering training that would help NOAA and others to meet the challenges posed by the rapid transition from the sparse measurements of depth offered by traditional sounding techniques to the massive amounts of data collected by the new generation of multibeam echo sounders. The Center has since expanded its research objectives and now encompasses a broad range of ocean mapping technologies and applications, but at its roots, the Center continues to serve NOAA and the U.S. through the development of tools and approaches that support safe navigation, increase the efficiency of surveying, and offer a range of value-added ocean mapping products.

Featured Maps and Apps

Recently updated WebMaps and data layers available from the Center.

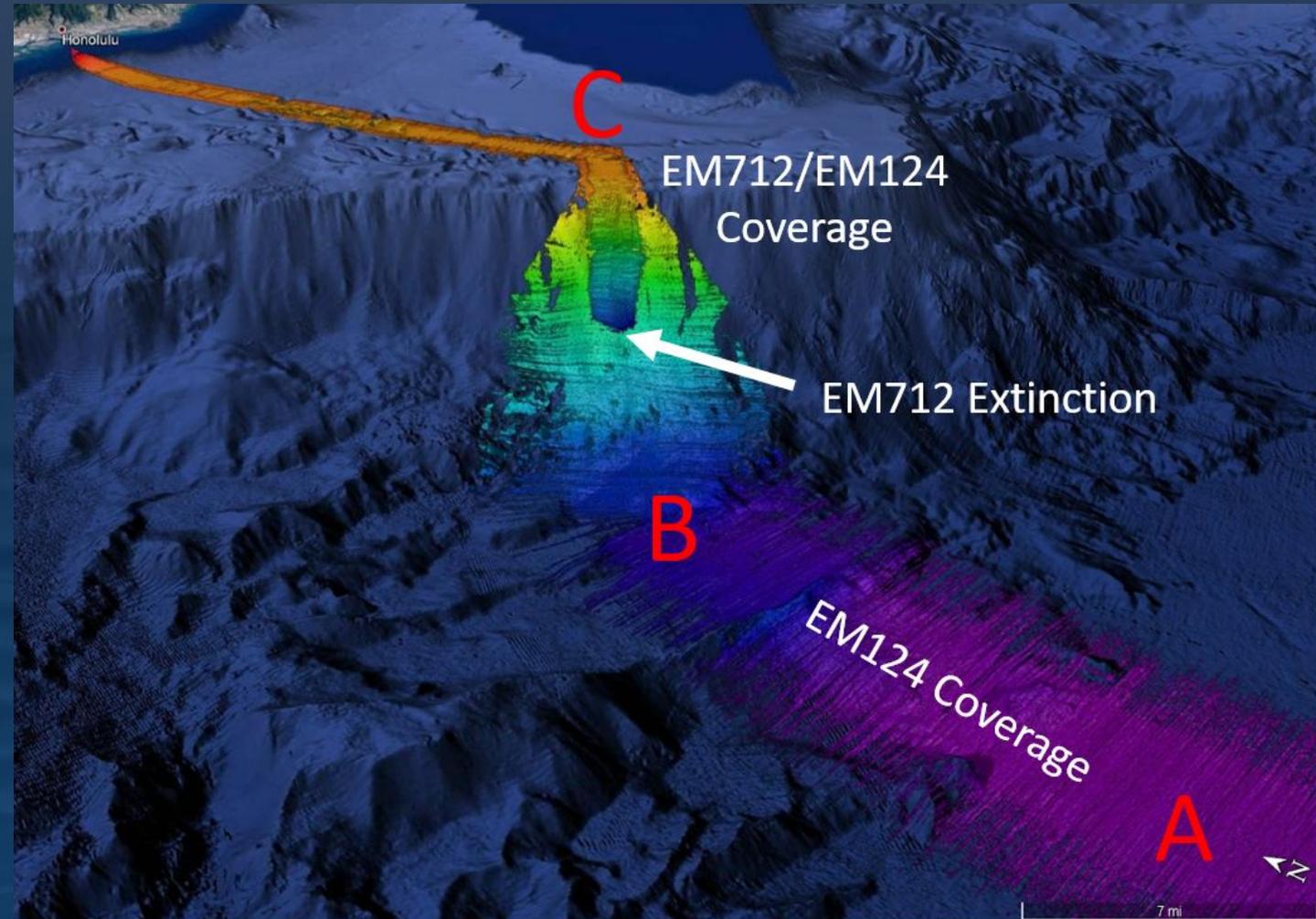
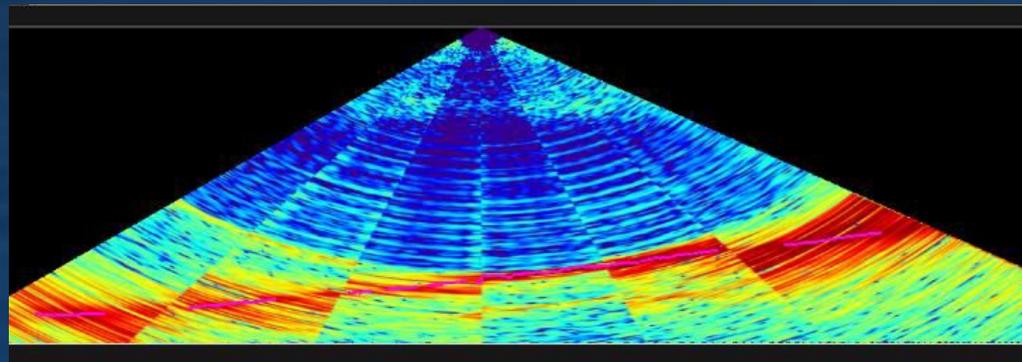
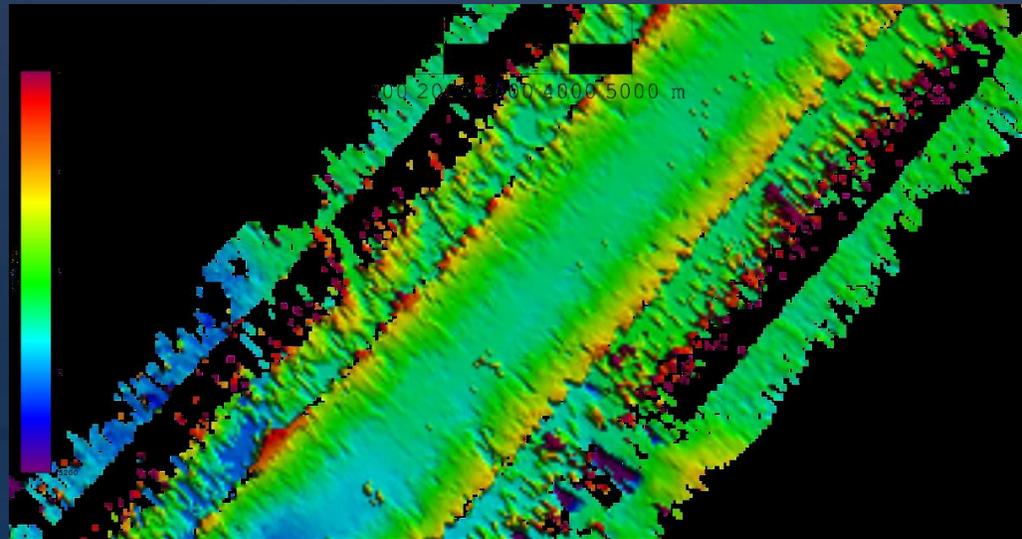
- Instant App MBES Test Sites Database Web...
- Instant App NHS Surficial Geology WebApp
- Instant App GEBCO 2023 Globe Bathymetry, elevation, TID, and Indirect Measurement mask with a 5x vertical exaggeration.
- Web Experience WGoM, LI, SNE Bathymetry & B...



<https://gis.ccom.unh.edu>

Takeaways from Edinburgh: Transit Mapping

System performance testing **before** 'real' mapping cruises



Call to Action: Acquire & Share Transit Data Whenever Possible!



- Technical resources & tools
 - Openly available tools
 - Best practices/SOPs
 - Remote acquisition
 - Data contribution



- Community assistance
 - Data preservation/access
 - Data processing/integration



- Cultural barriers can be overcome
 - Incentives
 - Equity and access

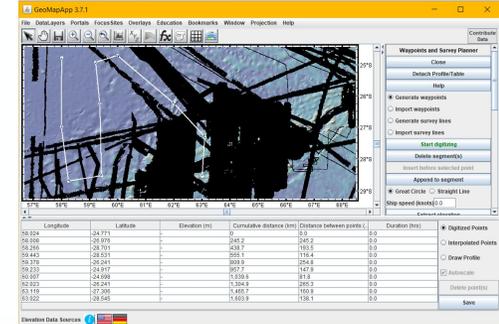


US Academic Research Fleet



- Comprehensive data stewardship
 - Delivers large volumes of data to public archives
 - Promotes transit data acquisition
- Increases return on investment in MBES capabilities
- Promotes data access *and* data accessibility

Identifying Data Gaps with GeoMapApp



Ship Info	Sonar System Info	MAC Resources
Atlanta (WHOI)	Kongsberg EM124 (12 kHz, 150°, 14° beams)	MAC Technical Docs
Blue Heron (UMN)	Reson SeaBat 800 (240 kHz, 150°)	Coming Soon!
Hoab (USCG)	Kongsberg EM122 (12 kHz, 150°)	MAC Technical Docs
Hugh R. Sharp (UDEL)	Reson SeaBat 7125 (200 kHz, 400kHz, 150°)	MAC Technical Docs
Kilo Niina (UH)	Kongsberg EM122 (12 kHz, 150°) Kongsberg EM710	MAC Technical Docs
Koor (retired)	SeaBeam 2112	

Providing access to and ensuring the preservation of national oceanographic research data.

The Rolling Deck to Repository (R2R) program provides fleet-wide management of underway data to ensure preservation of, and access to, our national oceanographic research assets.

With their global capability and diverse array of sensors, research vessels are essential mobile observing platforms for ocean science. Data collected on every expedition are of high value, given the high cost and increasingly limited resources for ocean exploration.

R2R catalogs and submits the underway environmental sensor data routinely acquired on research expeditions to long-term public archives, including the NOAA National Centers for Environmental Information (NCEI). Data from each cruise are submitted directly to R2R by the vessel operator, rather than by the science party.

Global Multi-Resolution Topography Data Synthesis

Create Custom Maps and Grids with GMRT MapTool
Now available in South Polar and North Polar Projection!

The Global Multi-Resolution Topography (GMRT) synthesis is a multi-resolution compilation of edited multibeam sonar data collected by scientists and institutions worldwide, that is reviewed, processed and gridded by the GMRT Team and merged into a single continuously updated compilation of global elevation data. The synthesis began in 1992 as the Ridge Multibeam Synthesis (RIMS), was expanded to include multibeam bathymetry data from the Southern Ocean, and now includes bathymetry from throughout the global and coastal oceans. GMRT is included in the ocean bathymetry in Google Earth since June 2011 and the GEBCO 2021 compilation. Learn more

GMRT v4.0 was released in January 2022 and includes 37,245,848 square kilometers of curated multibeam data from 1,206 cruises.

MGDS MARINE GEOSCIENCE DATA SYSTEM

Search Data, Contribute Data, Web Services

Related Resources

- GMRT Global Bathymetry
- GeoMapApp
- Atlantic Data (SUSAP-OC)
- IEDA

Recent Data Contributions

- NA131 Data: ROV Hercules Dive Reports from E/V Nautilus expedition NA131 (2021)
- PR1712 Data: 2017 AUV Sentry vehicle-corrected navigation and raw magnetic sensor data, Axial Seamount
- TN207 Data: 2015 AUV Sentry vehicle-corrected navigation and raw magnetic sensor data, Axial Seamount
- NA119 Data: Processed Gridded Acoustic Backscatter Data

Recent Citations

- Arlin et al., 2022. Phylogeographic Inference of Sumatran rapids bearing geomorphophorous tadpoles with regard to the Pleistocene drainage systems of Sundaland. *Sci Rep*, 12, doi:10.1038/s41598-022-14729-9
- Pertuiso, 2016. Geochemistry of Insular Shelves: Santa Maria Island, Azores, Portugal. Thesis
- Martin et al., 2022. Hydrothermal Alteration Within the Brothers Submarine Arc Volcanic, Kermadec Arc, New Zealand. *Geochimica et Cosmochimica Acta*

Acquisition

Preservation

Synthesis & Integration

Preservation, Provenance & Access

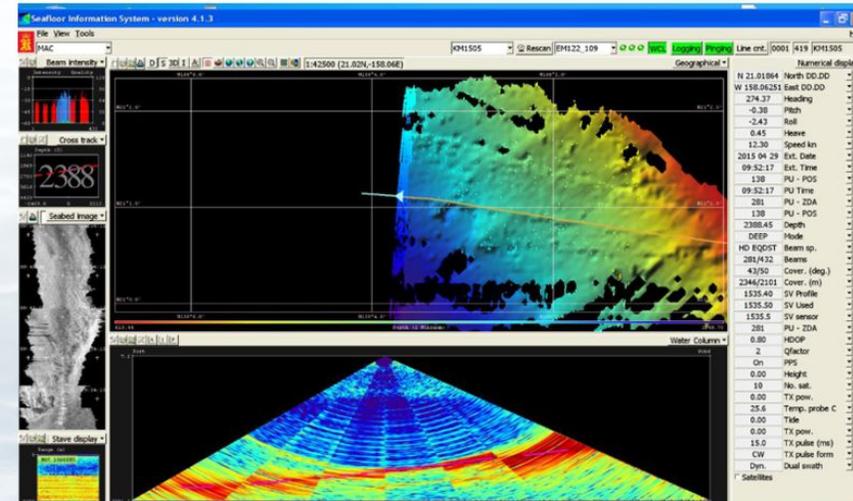
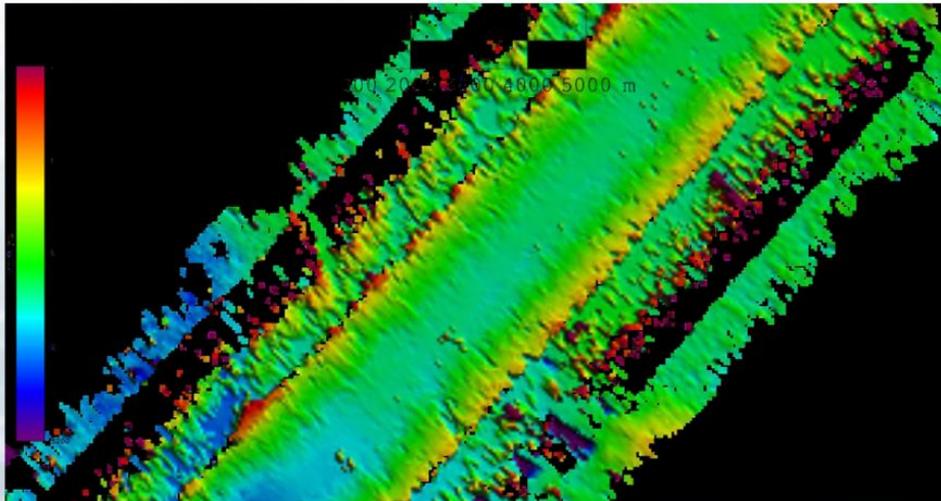
Supported by the US National Science Foundation





MAC Support of Transit Mapping

- Promote a **culture** of routine data acquisition
 - Supports science
 - Provides data for system monitoring
- Sound speed manager to help with SSP



MAC Breakout Session

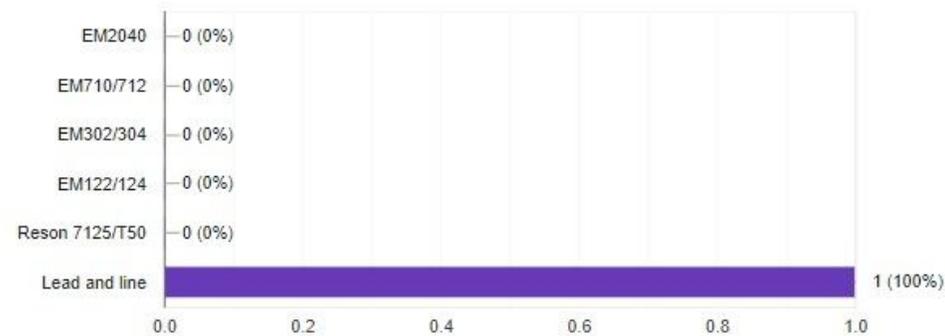
Sound Speed Smörgåsbord

1:00 PM in Pakalana

Which multibeam systems are available on your vessel?

Copy

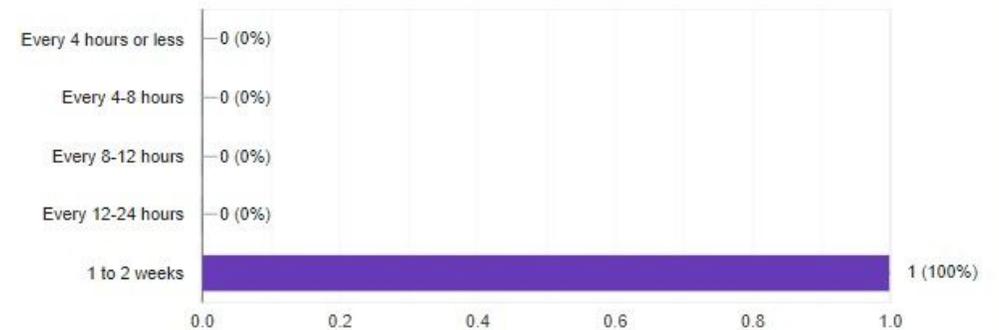
1 response



What is a typical interval between sound speed profiles collected during routine mapping operations in deep water (e.g., >500 m)?

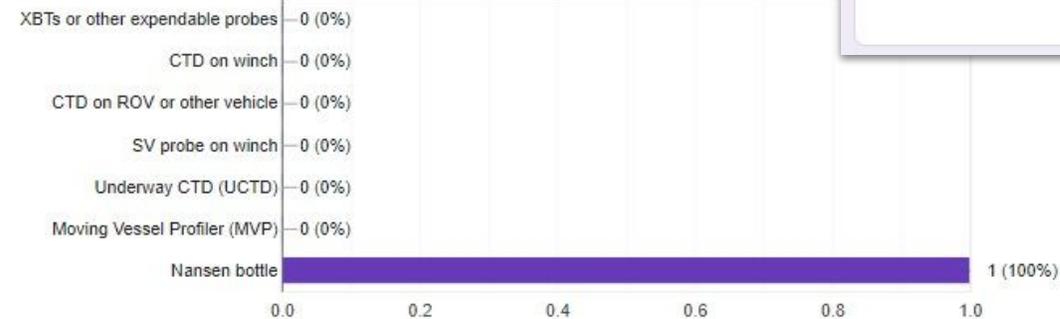
Copy

1 response



Which profiling system is used most frequently during multibeam surveys?

1 response



Lamont-COLUMBIA



Questions? Answers? Reach out!

Ocean Mapping Community Wiki

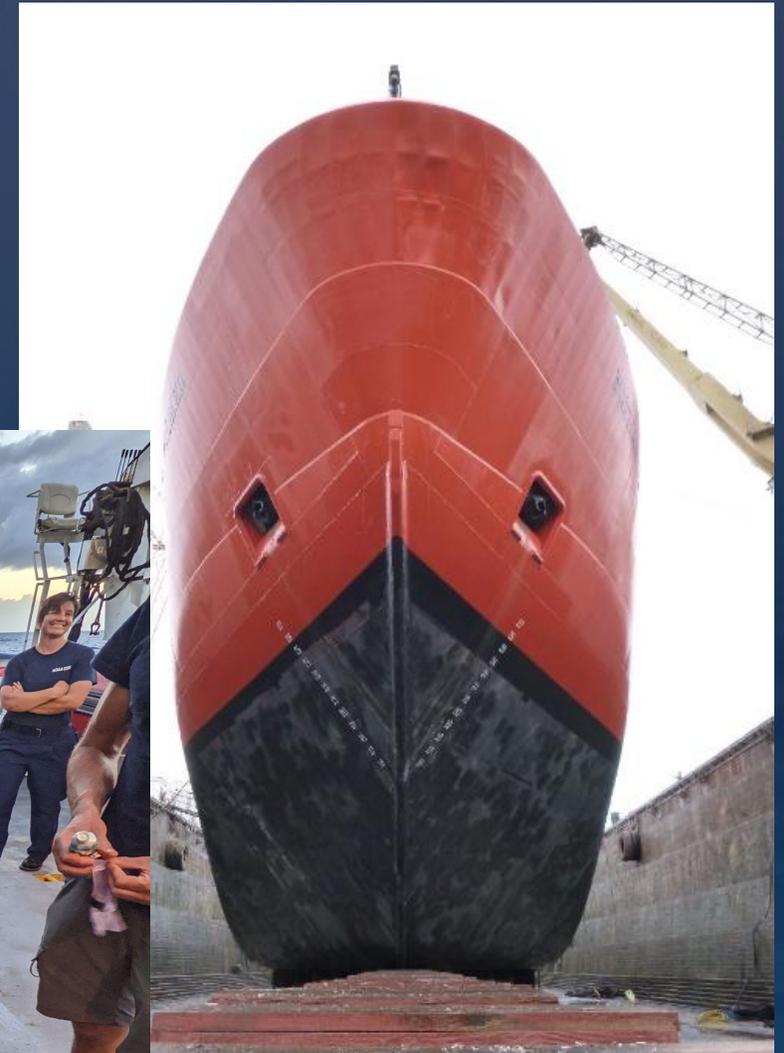
github.com/oceanmapping/community

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Multibeam Advisory Committee

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