

# Multibeam Advisory Committee

*RVTEC - UNH - Durham, NH*

*2024 Oct 23*

*Kevin Jerram*

*Paul Johnson*

*Vicki Ferrini*

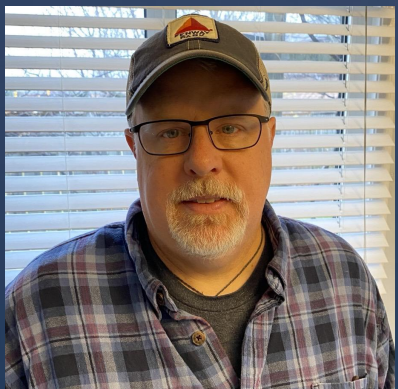
*[mac.unols.org](http://mac.unols.org)*

*[mac-help@unols.org](mailto:mac-help@unols.org)*



*MAC supported under NSF grant 1933720*





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**Emily Miller**  
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# The Multibeam Advisory Committee (MAC)



Established in 2011 with NSF funding to support collection of high-quality multibeam data across the U.S. Academic Research Fleet (USARF)

- **Standardized system testing workflows**
  - Sea Acceptance, Quality Assurance, Noise
- **On-board & remote support**
  - Flexible scheduling by ship request
- **Public reporting**
  - Technical reports and resources
  - Assessment tools, survey guidance
  - Non-USARF references

Website: [mac.unols.org](https://mac.unols.org)

Helpdesk: [mac-help@unols.org](mailto:mac-help@unols.org)

Wiki: [github.com/oceanmapping/community/wiki](https://github.com/oceanmapping/community/wiki)

	Ship Info	Sonar System Info
	Atlantis (WHOI)	Kongsberg EM124 (12 kHz, 150°, 1x1° 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 EM310

**Tech Reports**

Ship Sonar System ANT QAT SAT

**2024**

- 2024 R/V Sikuliaq EM304 MKII/EM710 SAT  
2024, EM304 MKII, EM710, MAC, QAT, Sikuliaq
- 2024 R/V Sally Ride EM712/EM124 QAT & Seapath 380-R3 SAT  
2024, EM124, EM712, MAC, QAT, Sally Ride, SAT, Seapath 380-R3
- 2024 R/V Revelle EM712/EM124 QAT  
2024, EM124, EM712, MAC, QAT, Roger Revelle
- 2024 R/V David Packard EM304 MKII SAT  
2024, David Packard, EM304 MKII, Non-MAC, SAT
- 2024 R/V Armstrong EM712/EM124 SAT  
2024, EM124, EM712, MAC, Neil Armstrong, SAT

**2023**

- 2023 R/V Thompson EM302 QAT Report  
2023, EM302, MAC, QAT, Thomas G. Thompson
- 2023 R/V Sikuliaq EM302/EM710 QAT Report  
2023, EM302, EM710, MAC, QAT, Sikuliaq
- 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 Kilo Moana EM122/EM710 QAT Report  
2023, EM122, EM710, Kilo Moana, MAC, QAT
- 2023 R/V Healy EM122 QAT Report  
2023, EM122, Healy, MAC, QAT



Lamont-Doherty Earth Observatory  
COLUMBIA UNIVERSITY | EARTH INSTITUTE



# Multibeam Systems Supported by the MAC

- 12 Vessels with MBES
  - 10 UNOLS Research Vessels
  - 2 Icebreakers
- 15 Deep water systems
  - EM710 / EM712 (40-100 kHz)
  - EM302 / EM304 MKII (30 kHz)
  - EM122 / EM124 (12 kHz)
- 2 Shallow water systems
  - EM2040 (200-400 kHz)
- +6 Systems (3 RCRVs) in 2025+
  - EM304s & EM2040s

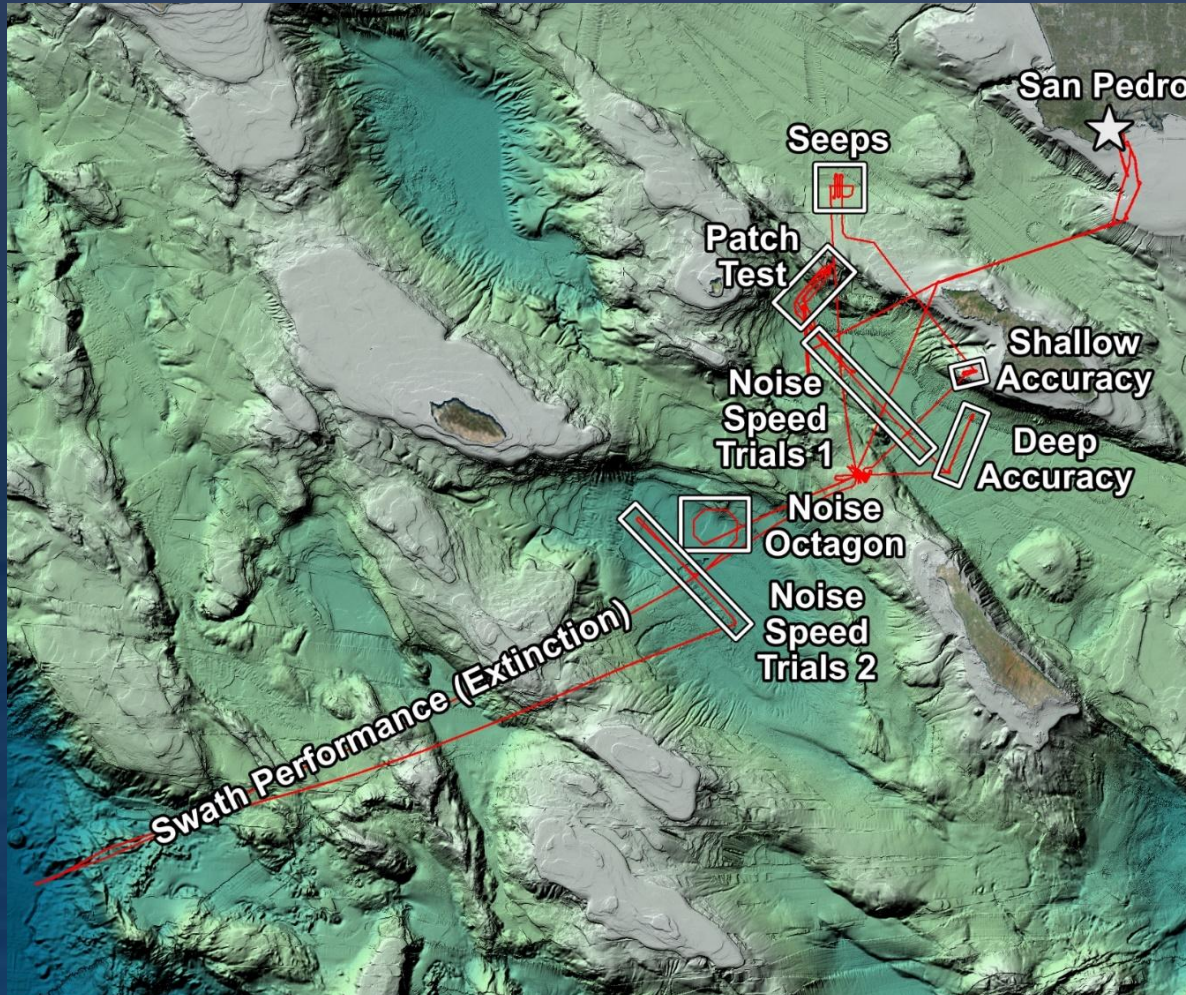


# Kongsberg Installations and Life Cycles

Ship	System(s)	Arrays	Life Cycle	MAC Support (Most Recent)	2024-25 Plans
<i>Atlantis</i>	EM124 (g)	2021	Early	SAT*, <b>QAT (2024)</b>	QAT
<i>Healy</i>	<i>EM122</i>	2010 / 2023 RX	Late	ANT, SAT*, <b>QAT* (2024)</b>	QAT
<i>Hugh R. Sharp</i>	<i>EM2040 (pending)</i>	2024	Early	QAT (2016), <b>SAT planning* (2024)</b>	EM2040 SAT
<i>Kilo Moana</i>	EM122 / EM710	2012	Late	ANT, QAT* (2023), <b>spares planning</b>	QAT
<i>Marcus G. Langseth</i>	EM122 (g)	2007 TX / 2010 RX	Late	ANT, QAT (2023), <b>spares planning</b>	QAT
<i>Nathaniel B. Palmer</i>	EM122	2015	Late	SAT, ANT, QAT (2015), <b>spares planning</b>	TBD
<i>Neil Armstrong</i>	<b><u>EM124 / EM712</u></b>	2024 (2016 710 RX)	Early	<b>SAT* (2024)</b>	QAT
<i>Rachel Carson</i>	<b><u>EM2040</u></b>	2024	Early	<b>SAT* (2024)</b>	QAT
<i>Roger Revelle</i>	EM124 / EM712 (g)	2020	Mid	SAT*, <b>QAT* (2024)</b>	QAT
<i>Sikuliaq</i>	<b><u>EM304 MKII</u></b> / EM710	2024	Early/Late	SAT, <b>SAT (2024)</b>	QAT
<i>Sally Ride</i>	EM124 / EM712	2016	Mid	SAT, <b>QAT* (2024)</b>	QAT
<i>Thomas G. Thompson</i>	<i>EM302</i>	2018	Mid	SAT, QAT* (2023), <b>spares planning</b>	QAT



# System Performance Testing



Early as possible

## Planning

1. Review of recent data, issues, etc.
2. Vessel + sensor offset survey (as needed)
3. Site selection + scheduling
4. Software + firmware updates

1-2 days

## Dockside

5. Configuration + offset review
6. Hardware health check
7. Test plan review with bridge (ongoing)

1-10 days

## At Sea

8. GNSS antenna calibration
9. Multibeam calibration ('patch test')
10. RX noise vs. speed / seas
11. Swath coverage (extinction)
12. Swath accuracy
13. Water column evaluation
14. Backscatter normalization

1-2 mos.

## Follow-Up

15. Data and configuration backup
16. Public reporting (MAC website)
17. Opportunistic testing

# SAT / QAT Checklist

Standardized (but flexible!) procedures in order of priority

Collaborative planning → data collection → follow-up

## 2024 RV Neil Armstrong

### Multibeam Advisory

#### EM124 SAT / EM712

Adapted from standard Multibeam Advisory

#### Purpose

This document provides an overview of typical SAT and QAT procedures performed by the Multi-Beam Echosounder Test Sites Database (EM124) and QAT procedures performed by the Multi-Beam Echosounder Test Sites Database (EM712) are critical for establishing baseline performance, identifying and resolving problems, and delivering high-quality data throughout the multibeam echosounder service life.

The outlines and time estimates provided below are commitments for each SAT and QAT depend on quality of survey reporting, test locations and sea conditions.

Detailed SAT and QAT reports for the UNOLS fleet are available at <http://mac.unols.org/>. Reports for similar testing are available for reference.

#### Quick Links

- [2024 SAT data transfer from ship](#)
- [2016 Armstrong EM122 / EM710 SAT report](#)
- [MAC survey report recommendations](#)
- [SmartMap: sound speed variability forecasts](#)
- [Sound Speed Manager \(plus WOA18 temp + sal\)](#)
- [Python multibeam assessment tools](#)
- [Ocean Mapping Community Wiki](#)
- [Multibeam Echosounder Test Sites Database - Bahamas EEZ Boundaries - MRGID 8404](#)
- [EM124 cal Blake Nose international \(if not allowed\)](#)
- [EM122 calibration Mytilus Seamount](#)
- [EM122 calibration Physalia Seamount](#)
- EXAMPLE Kongsberg SIS 5 navigation config
- Selecting active navigation sources in SIS - M

#### Planning Call Mar 5, 2024

- MAC will provide remote support (at least 2 weeks)
- Returning to Woods Hole instead of Charleston
- Departure date still March 13 0900, arrive 13 1800
- Data collection not allowed in Bahamas (if not allowed)
- Survey report updates
- Added EM712 cal site (AR0103)
- MAC can support / process / report only on US waters
- Noise testing in combination with Tim G

#### Next Steps and Follow-Up

##### March 12:

- Set Time system in SIS to Time Datagra coming from Seapath (Attitude 1) "ARW Seapath 380R install manual".
  - Selecting active navigation sources in SIS
  - <https://github.com/oceanmapping/seapath380r>
- Confirm IMU and MGC reported location is available with diagrams
- Update all EM and Seapath configs with Navigation Reference Point for all mapping
- Update [ARMSTRONG\\_offset\\_review](#)
- Run Seapath antenna calibration docks [swap back to surveyed/non-cal numbers](#)
  - Reapply survey results if they agree
  - If not, need to discuss and consider
- Provide bow/stern draft readings and add to the Waterline Worksheet. [ARMSTRONG](#)

##### March 13:

- Seapath antenna updates / cal results available
- Question: are both Seapath and POS M secondary nav source in Qimera calibration

#### Overview from 2016 SAT report



Figure 2. Calibration and accuracy testing sites south of suitable seafloor features in the operational depth range (acoustic extinction) data were collected up and down



#### 1. DONE: Pre-dockside

- Survey report / system geometry review
- HAT review as available
- Firmware / software updates

#### 2. DONE: Dockside

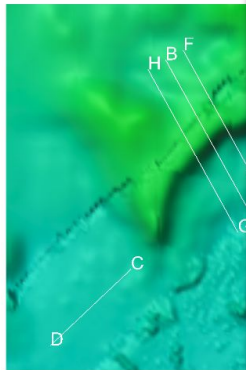
- Complete HAT
- Prelim noise / impedance testing
- Seapath antenna calibration / verification

#### 3. DONE: Speed-noise testing in deep water

- Requires deep water (>1000 m)
- Confirm no new noise limitations
- RX Noise vs. speed in calm seas
- RX Noise vs. swell direction in elevated seas
- [RX Noise testing instructions](#)

#### 4. DONE: EM712 calibration and verification

- Waypoints and settings: [Atlantic](#)
- Time estimate: ~10 hrs with buffer
  - Calibration: 5 hrs
  - Verification: 5 hrs
- Note updated settings for heading are now adjusted instead of the swath angle limits along the lines without the risk of



#### 5. POTENTIAL: EM124 initial calibration

- This is not in the intended depth range
- Waypoints and settings are the same as for EM712

#### 6. DONE: EM712 600 m accuracy / SAT contract demo survey

- Reference survey and crosslines over AR0103 600 m site
- Waypoints and settings: [Atlantic\\_Christianity\\_accuracy\\_600\\_m](#)
- Time estimate: ~8 hrs + buffer
  - Reference surface: 5 hrs +/- buffer for sound speed profiling
  - Crossline 1: 1 hr for Very Deep mode (two passes) + XBT or CTD
  - Crossline 2: 1 hr for Deep mode (two passes) + XBT or CTD
  - Crossline 3: 1 hr for Extra Deep mode (two passes) + XBT or CTD



#### 7. TRANSIT: Swath coverage testing on continental slope

- Unless conditions are terrible (e.g., massive bubble sweep issues), MAC requests the transit at 8 kn (count the extra time as SAT time if nec.) in order to get realistic survey coverage trends over this depth range (600-4000 m)
- EM712 and EM124 should be synced; EM712 may need to be secured at 2000-3000 m
- Other sonars can be run as long as they do not interfere (sync if possible in the same group to avoid slowing down the EM ping rate)
- [Swath coverage testing instructions](#)

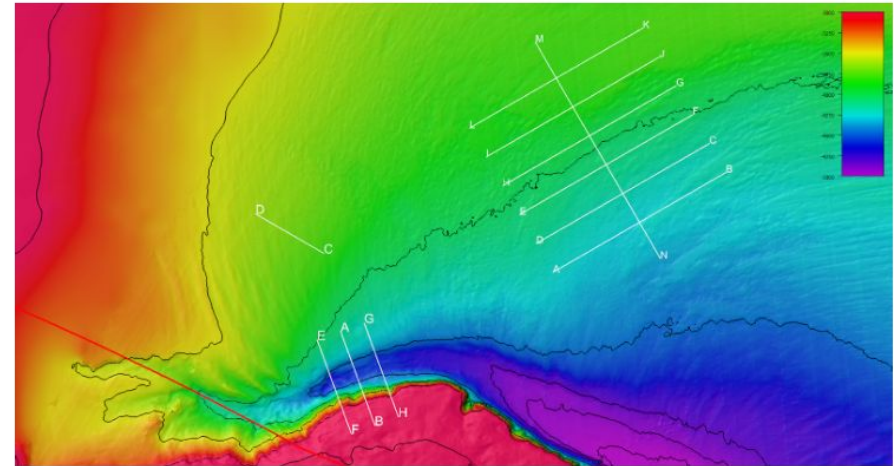
#### 8. DONE: EM124 calibration and verification

- ~11 hrs per calibration and verification; ~24 hrs for planning w/ buffer for proc., etc.
- New lines (black) planned for 2024 in international waters, if necessary (less ideal slopes)
  - 2016 lines (red) are 'proven' and preferred, but they cross into Bahamian EEZ (thick red border line)
- New waypoints and settings: [EM124 cal Blake Nose international](#)
  - Roll line is same location, oriented slightly differently for slopes observed in 2016
- Note updated settings for heading calibration lines: the port/sbd swath distance limits are now adjusted instead of the swath angle limits, this enables more uniform coverage along the lines without the risk of losing overlap in shallow regions due to angles



#### 9. DONE: EM124 accuracy / SAT contract demo survey near calibration site

- AR0103 5000 m accuracy site is in Bahamian EEZ and cannot be used
- New 4000 m accuracy site planned nearby in international waters
- Waypoints: [Atlantic\\_Christianity\\_accuracy\\_4000\\_m\\_international](#)
- Time estimate: 24 hours → RUN CROSSLINES FIRST IF WEATHER IS INCOMING
  - Reference surface: 14 hrs +/- buffer for sound speed profiling
  - Crossline 1: 5 hrs for Deeper mode (two passes) + XBT or CTD applied at start
  - Crossline 2: 5 hrs for Very Deep mode (two passes) + XBT or CTD applied at start



#### 10. Opportunistic: Coverage testing on continental slope

- Swath coverage trends are important indicators of noise or hardware limitations over the service life of the system (and help users plan survey line spacing)
- Collecting a baseline coverage curve is important for the new systems
- Transit at survey speed across a wide depth range, crossing contours perpendicularly (directly up and down the slope) to avoid slopes facing toward / away from the arrays
- [Swath coverage testing instructions](#)
- Line location is flexible around other SAT objectives; waypoints for a suitable swath coverage line can be provided during SAT

#### 11. Additional EM124 accuracy testing - to be planned near SBP test location / route to WHOI

- Need several depth ranges to verify all depth modes are functional
- Possible combination with Kongsberg SAT 'demo survey' for ONE MODE (see above)
- 24 hrs minimum typical time commitment for one mode in deep water (~4000-5000 m)

#### 12. Additional EM712 accuracy testing - to be planned near SBP test location / route to WHOI

- Typically need several depth ranges to verify all depth modes are functional
- Possible combination with Kongsberg SAT 'demo survey' for ONE MODE (see above)
- 12 hrs min. typical time commitment for one mode in deep water (~1000 m)

#### 13. Backup calibration sites along shelf break:

- PENDING (MAC will review other SATs conducted out of Norfolk, etc.)
- PENDING (possible Cape Fear Diapir calibration adjacent to SBP test plans)

#### 14. Backup EM124 calibration sites at New England Seamounts:

- [EM122 calibration Mytilus Seamount](#)
- [EM122 calibration Physalia Seamount](#)



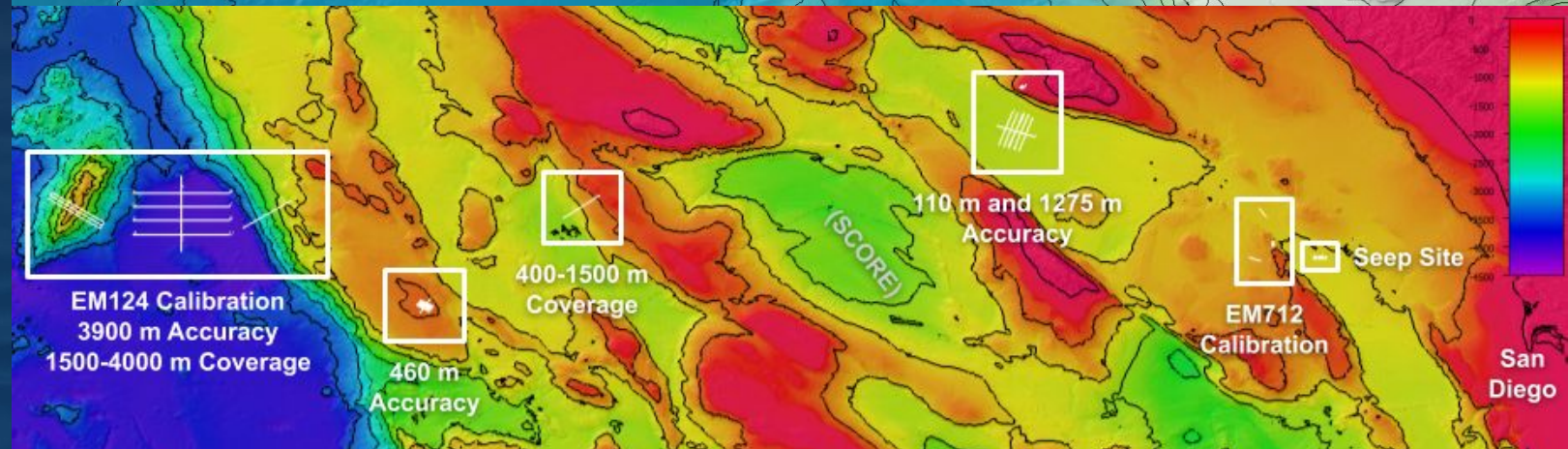
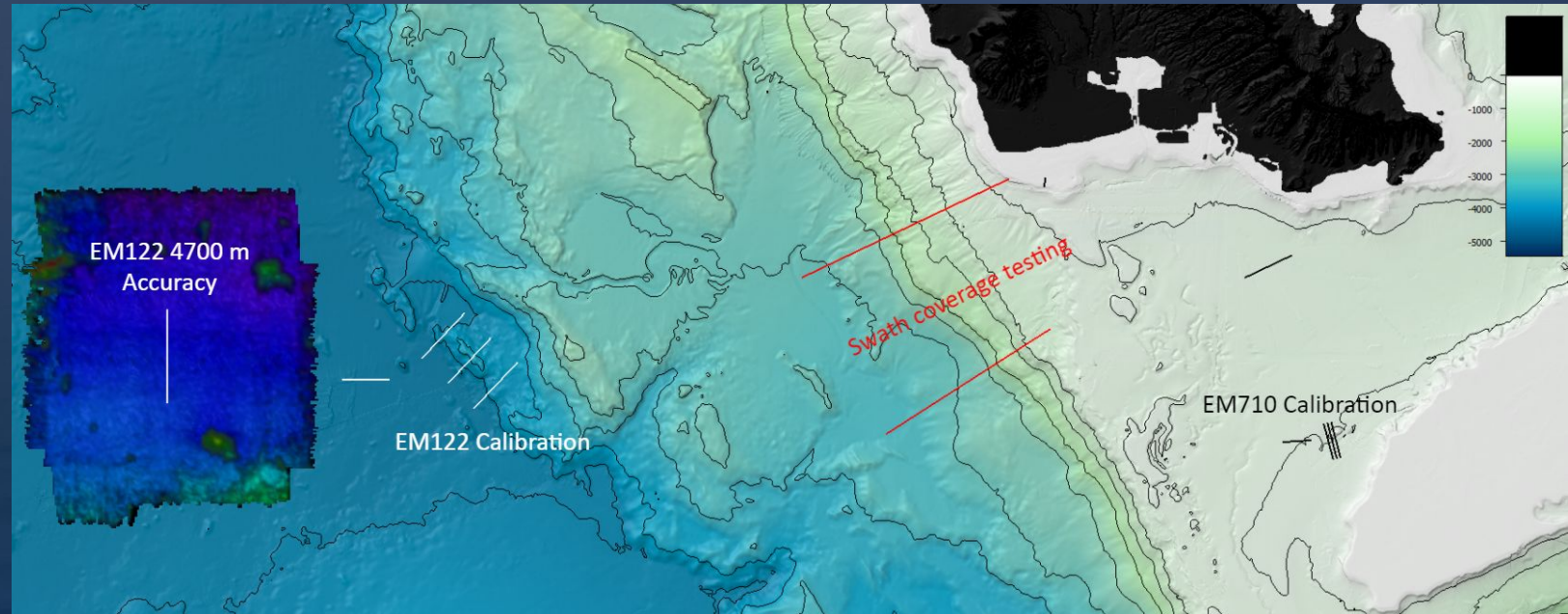
# Related Activities Since RVTEC 2023

## MAC-related projects:

- Ocean Mapping Community Wiki
- Sonar Test Site Database
- Sound Speed Manager
- GMRT tiling package
- Assessment tools
- Spares planning

## Non-MAC field work:

- *Okeanos Explorer* (QAT)
- *David Packard* (SAT)
- *Nautilus* (QAT)
- *Saildrone Surveyor* (planning)





# Ocean Mapping Community Wiki

[github.com/oceanmapping/community/wiki](https://github.com/oceanmapping/community/wiki)

[omcadmin@ccom.unh.edu](mailto:omcadmin@ccom.unh.edu) or [mac-help@unols.org](mailto:mac-help@unols.org)

The screenshot shows the home page of the Ocean Mapping Community Wiki. At the top, there is a navigation bar with a search box and various utility icons. Below the navigation bar, the page title "Home" is displayed, followed by a sub-header indicating the page was last edited by "kjerram" 4 days ago with 109 revisions. A large, colorful bathymetric map of the ocean floor is featured prominently. To the right of the map is a sidebar with a "Pages (19)" section, listing various topics such as "Home", "Announcements", "Contributing", and "Resources". Below the map, there is a paragraph describing the wiki as a collaborative space for sharing expertise. Further down, there are sections for "Announcements" and "Contributing", each with a brief description and links to relevant content. At the bottom, a "Recently updated" section lists ten recent updates, including new test plans, survey planning templates, and software updates. A note at the bottom left advises users to refresh their browser cache.

The screenshot shows the GitHub Issues page for the "oceanmapping / community" repository. The page is filtered to show "is:issue is:open". The top navigation bar includes a search box and various utility icons. Below the navigation bar, there are filters for "Labels (50)", "Milestones (0)", and a "New issue" button. The main content area displays a list of 11 open issues, each with a title, a list of assignees, and a comment count. The issues are sorted by "Open" status. The list includes:

- SIS 4 Grid Engine intermittently stopping** (em302, gridding, kongsberg, sis4) - #51 opened on Aug 27 by kjerram
- Major EM122 interference from unknown source** (data quality, dropout, em122, kongsberg, sis4, water column) - #50 opened on Aug 14 by kjerram
- SIS 5.12.1 upgrade from SIS 5.11.1 - not seeing water-column data** - #46 opened on Oct 29, 2023 by kvonkrusenstiernOX
- CBMF 1: Timed out waiting for samples** - #45 opened on Sep 1, 2023 by kvonkrusenstiernOX
- Real-time coverage grid stops updating in Kongsberg SIS** (gridding, kongsberg, sis4, sis5) - #39 opened on Jun 13, 2023 by ejheffron
- Inmarsat C interference with POS MV GNSS antennas** (applanix, dropout, gnss, hardware, inmarsat, pos mv) - #38 opened on May 25, 2023 by kjerram
- GSF issues/limitations** (data processing, em304, gsf, qimera) - #37 opened on Apr 12, 2023 by ejheffron
- Helmsman Tool does not work in UTM Projection** - #36 opened on Apr 6, 2023 by shoy-NOAA
- ALL USERS: Become a collaborator on GitHub for Issue tagging and notification options** - #32 opened on Mar 27, 2023 by kjerram
- Qimera distances are always grid distances** (bug, data processing, qimera) - #31 opened on Mar 24, 2023 by lindsaymbc

# Ocean Mapping Community Wiki

[github.com/oceanmapping/community/wiki](https://github.com/oceanmapping/community/wiki)

[mac@unh.edu](mailto:mac@unh.edu) or [mac-help@unols.org](mailto:mac-help@unols.org)

oceanmapping / community

Home

The Ocean Mapping Community Wiki is a collaborative space to share multibeam, split-beam, and sub-bottom expertise from the global ocean mapping community.

Resources, best practices, and 'lessons learned' are welcome with the aim of improving data quality for all. Please consider contributing in your area of interest or joining the public discussions and troubleshooting forums.

This effort is hosted by the [Multibeam Advisory Committee \(MAC\)](#) and partners from academia, government, and industry.

### Announcements

Check out the [Community Announcements](#) and [Awareness](#) section for non-commercial news from around the ocean mapping community.

### Contributing

We hope you'll [add your expertise](#) to the conversation and [provide feedback](#).

See the [Contribution Guidelines](#) to see who is contributing and how we are moderating the site content.

### Recently updated

1. Make a test plan with the [MAC Test Site Database](#) and [share your sites](#) with the world (EK calcs tool)
2. Check out the [Multibeam Survey Planning Template](#) to help science parties define their mapping goals
3. Help out your navigators with the [ECDIS Converter](#) for survey line plans
4. Share non-commercial news under the [Community Announcements and Awareness](#) section
5. Concatenate files in the [File Trimmer](#) (e.g., for patch test processing)
6. The [Swath Coverage Plotter](#) now tracks changes in multibeam settings and offsets
7. Added a [Wishlist](#) for priority topics - chime in!
8. Started a [Software Updates](#) page to easily find the latest versions of common mapping software
9. Added an informal list of [Top 10 Multibeam Issues](#) to highlight common complications (and solutions)
10. Made a new page for [Sea Acceptance Testing](#) (and Quality Assurance Testing) to discuss approaches

Note: Force-refresh your browser cache (e.g., F5) if links appear misdirected.

### Multibeam topics

A wide variety of topics have been suggested by partners in academia, government, and industry.

This list is **under development**; suggestions are welcome!

1. [Dimensional control](#) - sensor offsets and survey info required for system performance
2. [Calibration](#) - resources for calibrating multibeam sonars
3. [SAT/QAT approaches](#) - sea acceptance trials (SAT) and quality assurance testing (QAT)
4. [Sound speed](#) - recommendations for incorporating sound speed into survey operations

## Wish list

The topics below are high priority for development; some may have placeholders or suggestions for content.

Sections can start small and snowball, so reach out if you'd like to contribute!

1. Recommendations for [backscatter processing](#): tips, tricks, workflows, processing guides...
  - i. Guidelines for gridding approaches / expectations for data quality
  - ii. When to worry about IHO compliance / relevance
  - iii. Approaches for 'fixing' 'bad data'
3. Expanding the GitHub Issues base with [troubleshooting](#) examples from more users
  - i. Synchronization - when is it needed?
4. [Multibeam data acquisition](#) recommendations
  - a. Grid chart of system combinations, color-coded by interference (present / not present / uncertain)
5. [Water column mapping](#) resources
  - i. Target strength (sphere) calibration guides
    - a. When, why, and how to do these?
    - b. Table of spheres required for each frequency range
6. Amazing data examples!
  - i. Every page --> highlight exciting data examples / new and unexpected uses for mapping systems
7. Recommendations on how to improve the wiki workflow
  - i. What are the roadblocks to accessing / requesting / contributing helpful information?
8. GitHub experts - reach out with recommendations on how to better use this space!

## Support

Helpful resources from GitHub and others:

1. [Writing on GitHub](#)
2. [Using wikis](#)
3. [Markdown cheatsheet](#)
4. [Using GitHub Issues for troubleshooting](#)

oceanmapping / community

Qimera distances are always grid...

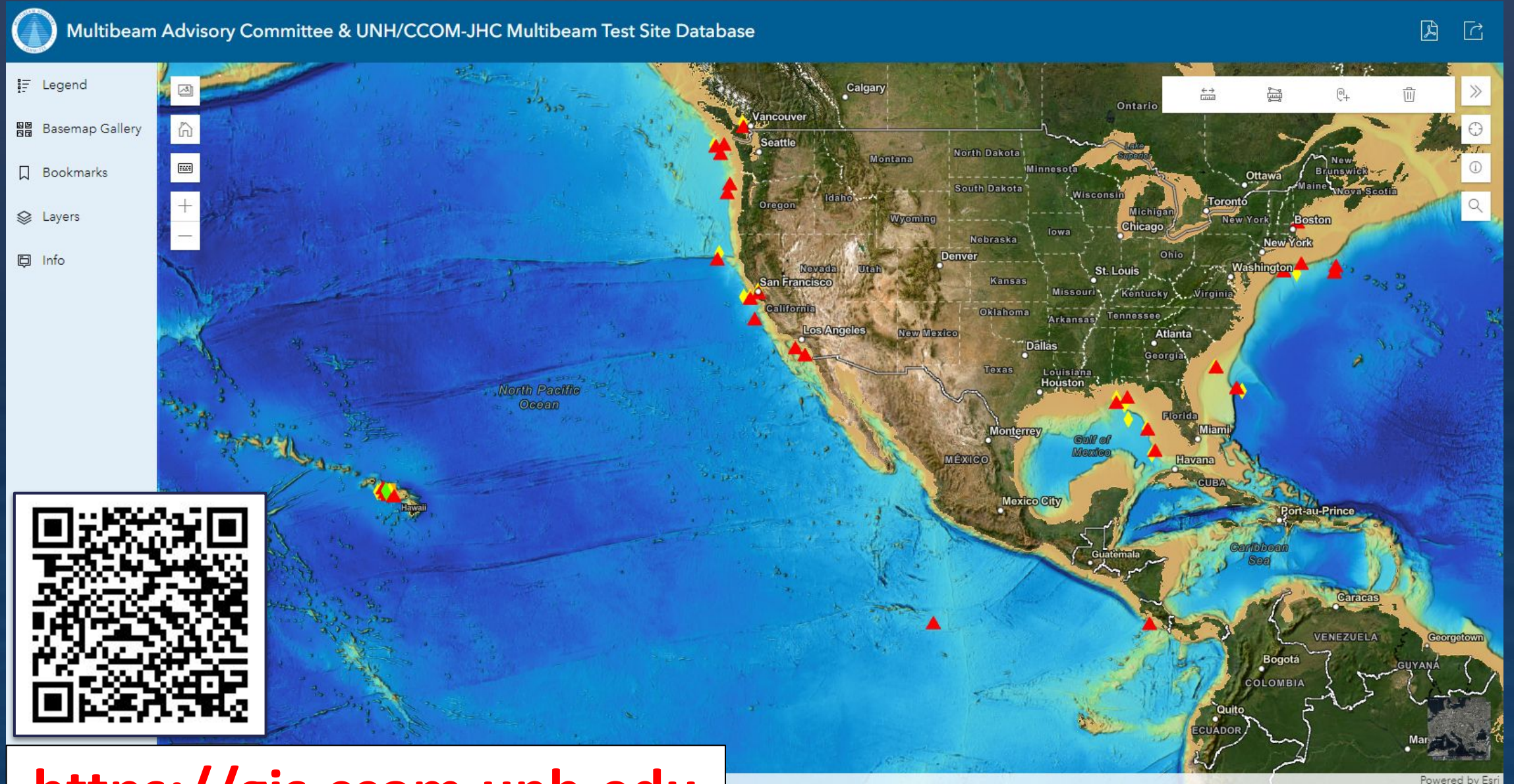
Labels: sis4, water column

Assignee: sis4

Sort: ...

Notification options

# Test Site Database – Work in Progress



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



# Test Site Database – Submission Form (EM, EK, Etc.)



Multibeam Advisory Committee & UNH/CCOM-JHC Multibeam

## Echosounder Test Site Submission

Please use this form to submit echosounder test sites for the [MAC Test Site Database](#).

Test sites are welcome for a variety of systems and purposes, including:

1. multibeam calibration ('patch test')
2. multibeam accuracy assessment
3. multibeam swath coverage test
4. multibeam backscatter calibration
5. EK60/80 target strength calibration

Please reach out to the Multibeam Advisory Committee at [mac-help@unols.org](mailto:mac-help@unols.org) with any questions, comments, or suggestions.



**General Info**  
Contact information is requested for follow-up during site submission and credit in the database, if desired.  
Email will not be listed in the test site database.

**Contact name \***  
Contact information is requested for follow-up and credit in the database, if desired.  
Your answer

**Contact email**  
Email is requested for follow-up but will not be included in the database.  
Your answer

**Test Site Name \***  
Please provide a working name of this test site. This will be used in the database and may be modified by the MAC to improve searchability in the database.  
The name should be specific to the location and test type in an echosounder test site. For example, an accuracy site in 200 m water depths near Seattle might be called 200 m or similar. This gives a sense of the ocean, a nearby port, to help a user quickly assess suitability for their echosounder and test type.  
Your answer

**Year (if known) of first plan / successful use of site**  
Your answer

**Nominal depth in meters (if known)**  
Your answer

**Describe the general quality of this site:**  
Good: This site worked well for the intended echosounder and test type under typical conditions  
Tentative: This site requires certain conditions for successful test results (e.g., state, vessel traffic, tide)  
Not recommended: This site is not recommended despite appearing suitable during planning (e.g., extreme slopes or vessel traffic)  
 Good  
 Tentative  
 Not recommended

**Multibeam Test Site Selection**  
Multibeam sites are organized by test type.  
See [Ocean Mapping Community Wiki: Sea Acceptance Testing](#) for examples.  
Select the multibeam test type: \*  
 Calibration  
 Accuracy  
 Coverage  
 Backscatter calibration  
 Other (please email [mac-help@unols.org](mailto:mac-help@unols.org) with more information)

**Multibeam Test Site Submission**  
Enter the latitude and longitude of the multibeam test site (multiple waypoints). \*  
Format should be decimal degrees, comma- or space-delimited, with negative signs for Southern and Western hemispheres. There is no minimum precision (e.g., 5-8 decimal places should suffice).  
Your answer

**Related Documentation**  
Help users find related reports and documentation from previous testing at this site.  
Please provide links to calibration reports or other test documentation that may be available for this site.  
Links will be shared publicly through the database.  
Your answer

**Select the echosounder type: \***  
 Multibeam  
 Scientific (e.g., EK60/80)  
 Other (please email [mac-help@unols.org](mailto:mac-help@unols.org))

**Please add any other comments you'd like to share about this site**  
Your answer

Back Submit Clear form

<https://forms.gle/5EdGwomMF116DprFA>



# Sound Speed Manager



A ready-to-go and free solution to ease the management of sound speed profiles for ocean mapping



POCs: Giuseppe ([gmasetti@ccom.unh.edu](mailto:gmasetti@ccom.unh.edu)),  
Barry ([barry.gallagher@noaa.gov](mailto:barry.gallagher@noaa.gov)),  
Chen ([chen.zhang@noaa.gov](mailto:chen.zhang@noaa.gov))

Available in

<https://www.hydrooffice.org/soundspeed/>



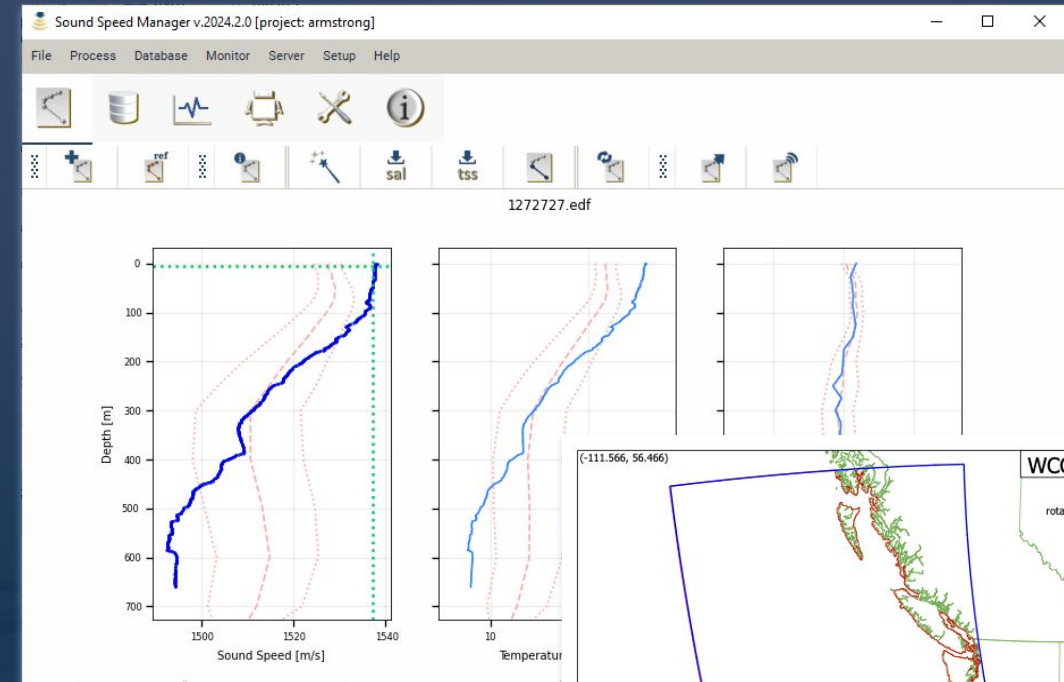
<https://svn.pydro.noaa.gov/Docs/html/Pydro/downloads.html>



Lamont-Doherty Earth Observatory  
COLUMBIA UNIVERSITY | EARTH INSTITUTE

# SSM Updates for v2024.2.0

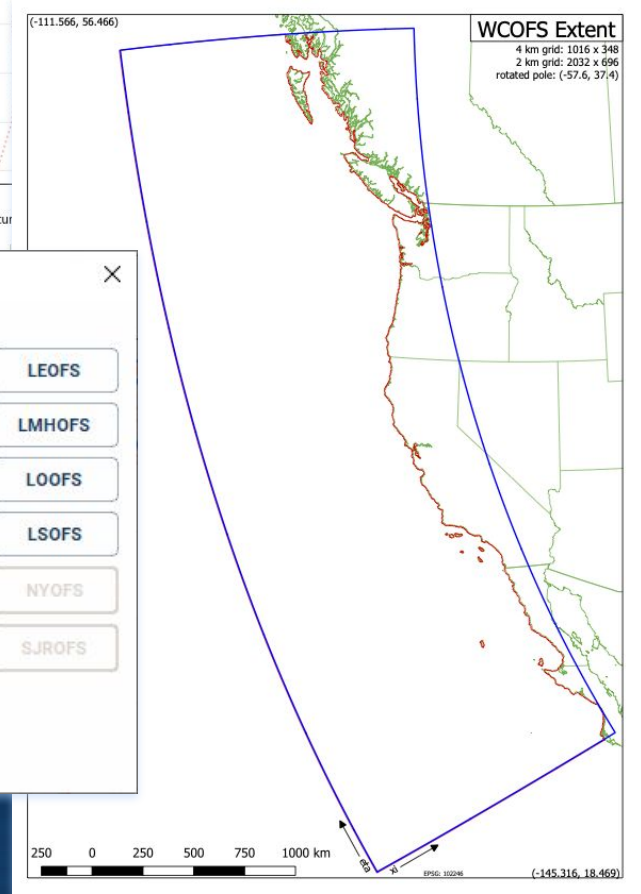
- Improved integration with **Kongsberg SIS** and **Hypack**
  - Dedicated **#SSM** datagram from SIS 5.14+
- Enhanced **Server Mode**
- Extended/improved **supported formats**
  - Sea & Sun
  - Valeport (miniSVP, RapidSV, RapidSVT, SWiFT CTD)
  - Sippican (XBT T-6)
  - CSIRO
  - PDS2000
- Extended **OFS support**
  - LEOFS
  - LMHOFS
  - LSOFS
  - NGSOFS2
  - SSCOFS
  - WCOFS



The screenshot shows the SIS\_SETUP / USER\_SETTINGS dialog box. A red crown logo is overlaid on the top left. The dialog contains various settings for the system, including a table of parameters and their values.

Parameter	Value
Too big difference between sound speed at transducer from profile and probe	5
Big difference between sound speed at transducer from profile and probe	3
SVP age warning in hours	24
SVP age error in hours	72
Minimum valid SV speed limit	1430
Maximum valid SV speed limit	1580
Use WOA for svp extensions	<input type="checkbox"/>
WOA database Salinity file	
WOA database Temperature file	
Sound Speed Manager (SSM) IP and port (ip:port)	127.0.0.1:16103

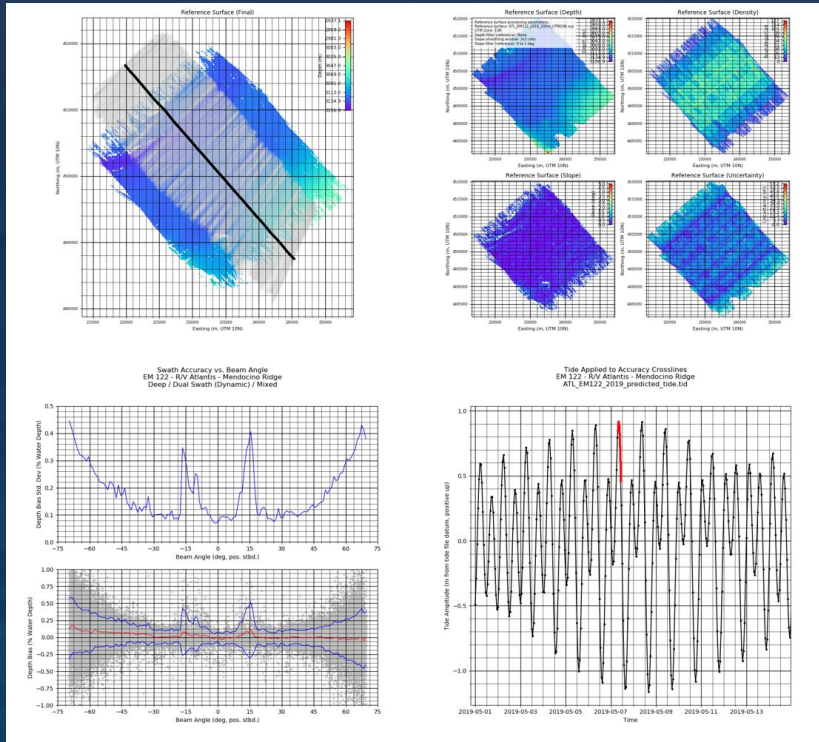
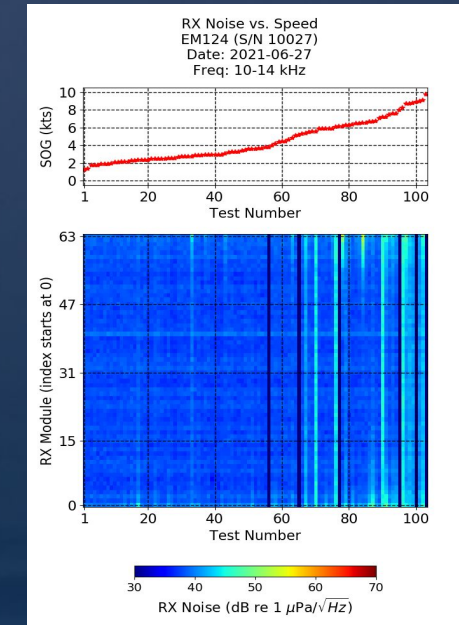
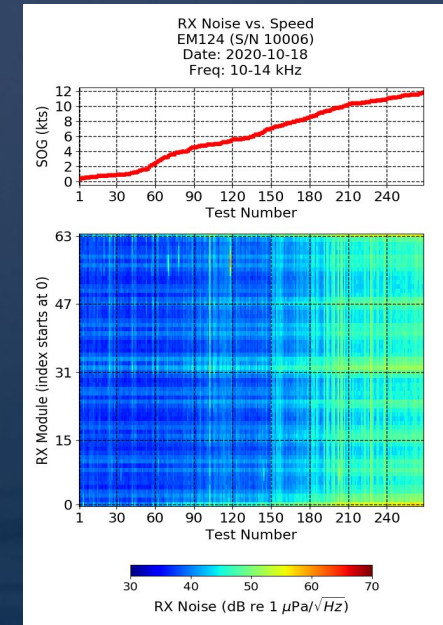
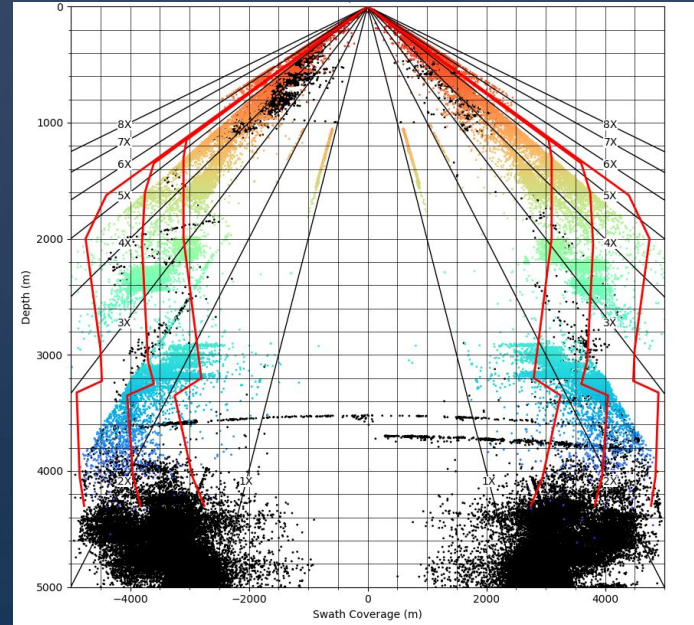
The screenshot shows the Input data dialog box. It has two main sections: 'Import file:' and 'Retrieve from:'. The 'Import file:' section contains buttons for various data sources: AML, AOML, CARIS, Castaway, CSIRO DTC, Digibar Pro, Digibar S, ELAC, Hypack, Idronaut, ISS, Kongsberg, MVP, OceanScience, RBR, SAIV, SeaAndSun, Seabird, Sippican, Sonardyne, Turo, UNB, and Valeport. The 'Retrieve from:' section contains buttons for: Project DB, CBOFS, LEOFS, SIS, SSCOFS, LMHOFS, Seabird CTD, DBOFS, LOOFS, WOA09 DB, GoMOFS, LSOFS, WOA13 DB, NGSOFS2, NYOFS, WOA18 DB, SFBOFS, SJROFS, OFS .nc, WCOFS, RTOFS, and TBOFS. The WCOFS button is highlighted.



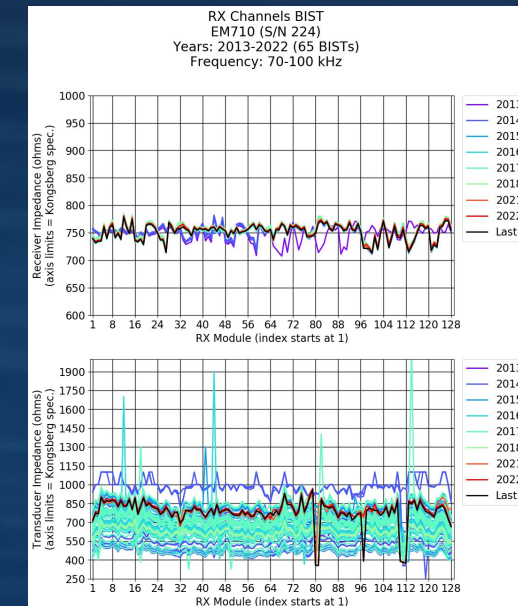
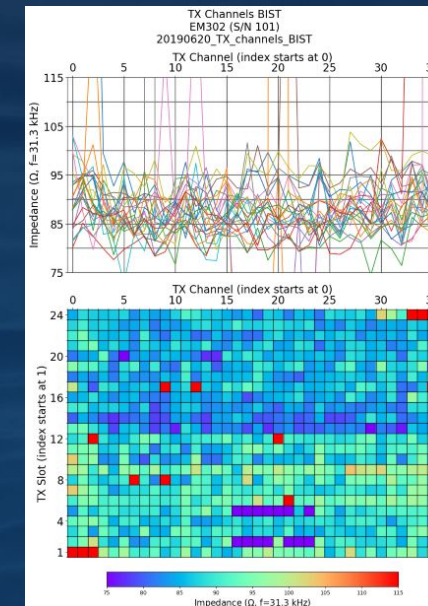
# Assessment Tools

[github.com/oceanmapping/community/wiki/Assessment-Tools](https://github.com/oceanmapping/community/wiki/Assessment-Tools)

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



File Trimmer v.0.1.3 software interface. The Sources list includes various raw data files from the MAC UNOLS/THOMPSON directory. The Processing Path is set to QPS Qmra. The File Control section includes options for adding files, directories, and removing files. The Activity Log shows a list of trimmed files and their sizes. The current output directory is C:/Users/kjerram/Desktop/MAC UNOLS/RVTEC/2020/TRIMMED\_TEST.



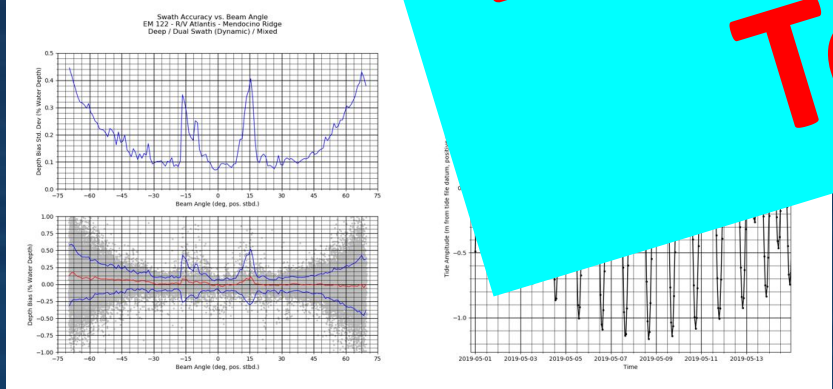
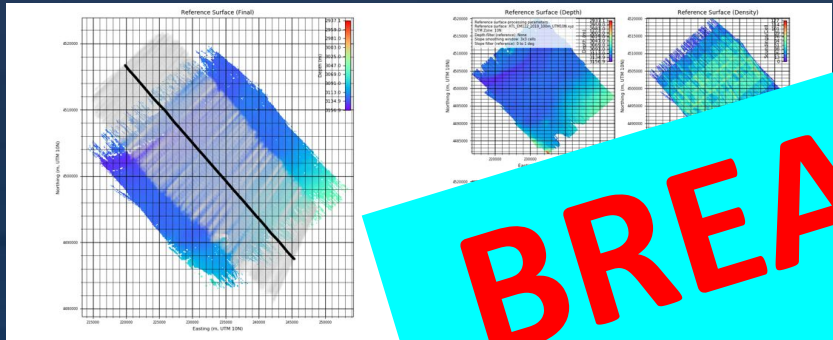
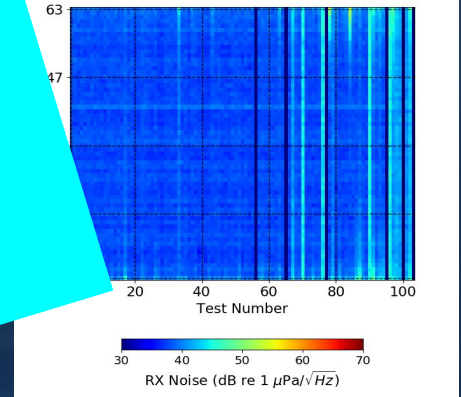
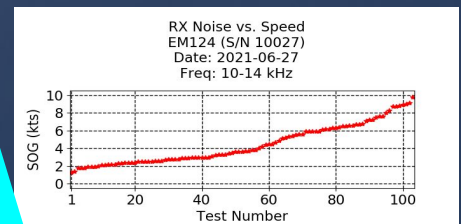
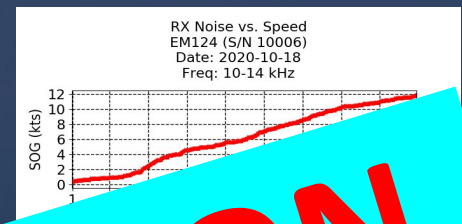
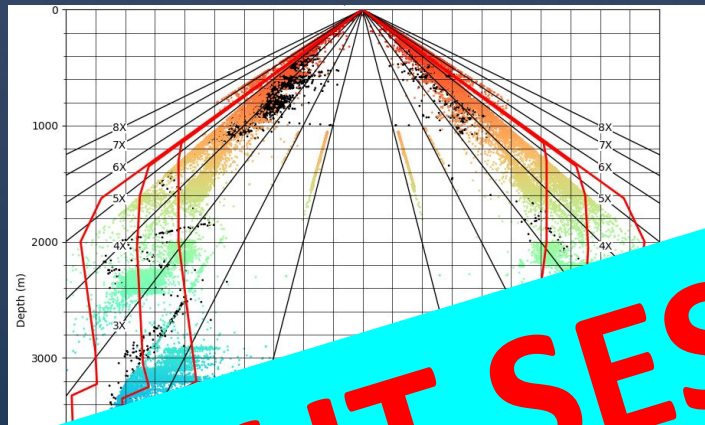
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# Assessment Tools

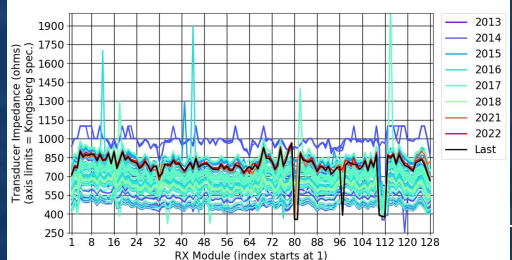
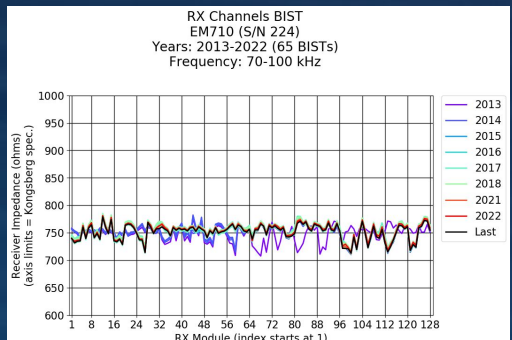
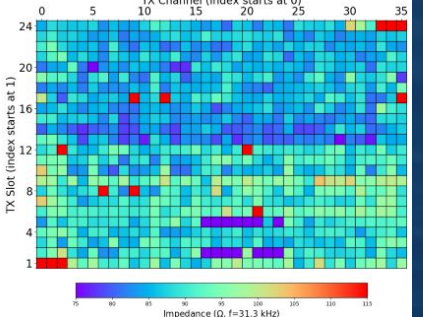
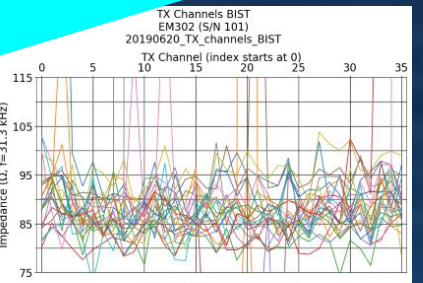
[github.com/oceanmapping/community/wiki/Assessment-Tools](https://github.com/oceanmapping/community/wiki/Assessment-Tools)

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

**BREAKOUT SESSION  
Today at 1 PM**



File Trimmer interface showing file selection and activity log. The interface includes buttons for 'Add Files', 'Add Directory', 'Select Output Dir.', 'Remove Selected', 'Remove All Files', and 'Trim Files'. It also has checkboxes for 'Advanced output options', 'Overwrite existing files', and 'Keep source filename'. The activity log shows a list of files being trimmed and the resulting file size reduction.



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# EM122 / EM302 Spares from USNS Pathfinder

Thanks to Rob Sparrock for recognizing UNOLS needs and navigating ONR transfers

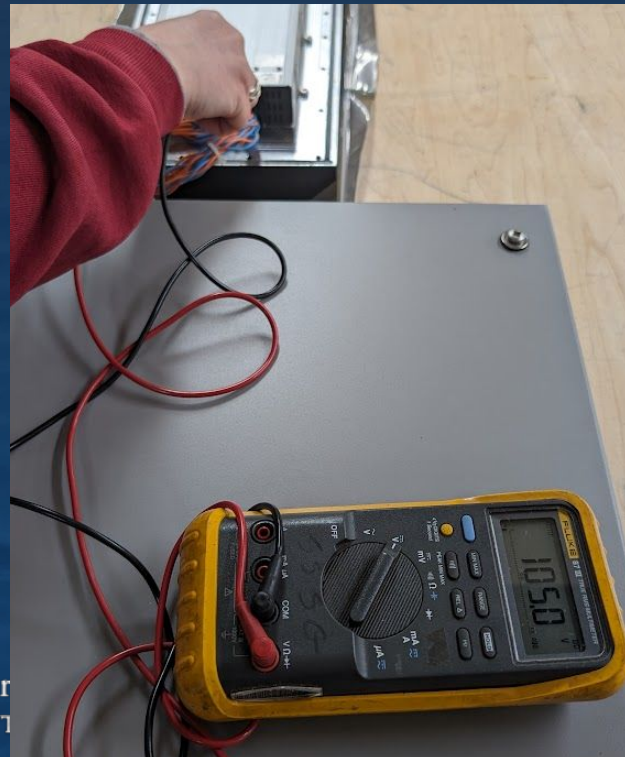
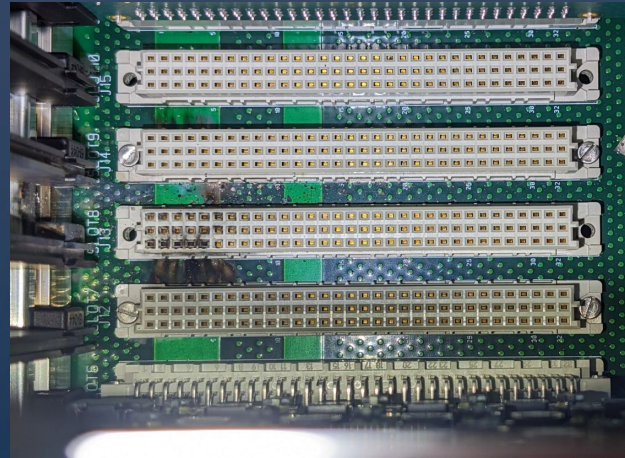
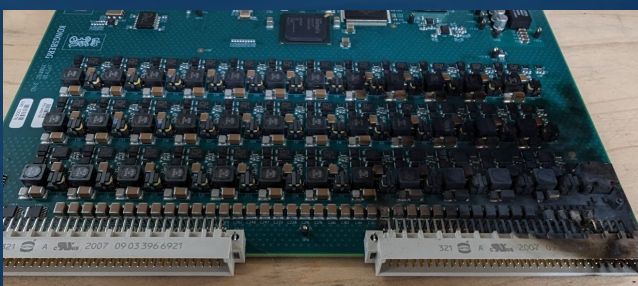
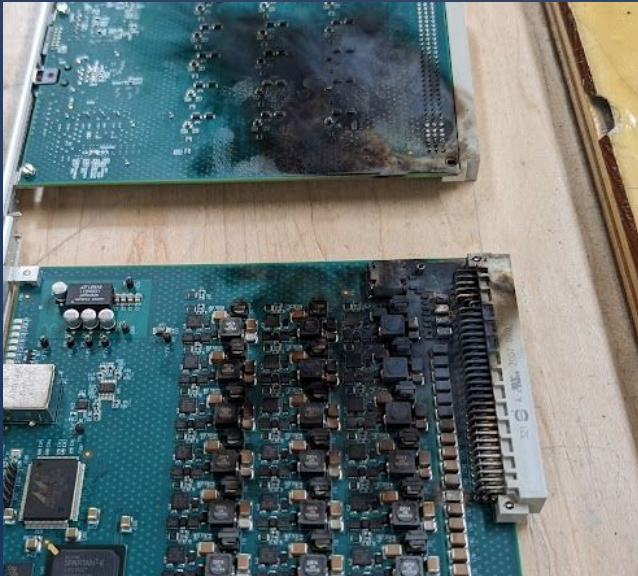
July shipment to WHOI (now at LDEO) augments R/V *Armstrong* spares at UH

Warning: Kongsberg 122/302/710 RX cards are becoming extremely scarce

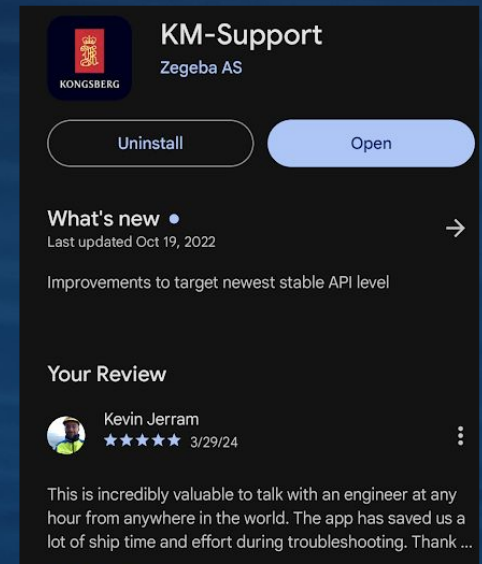
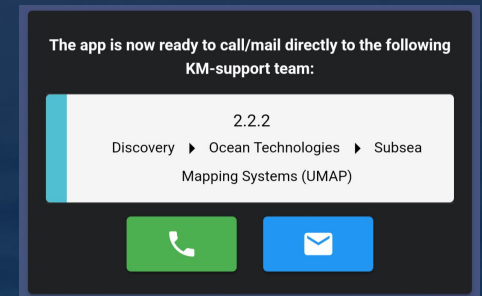
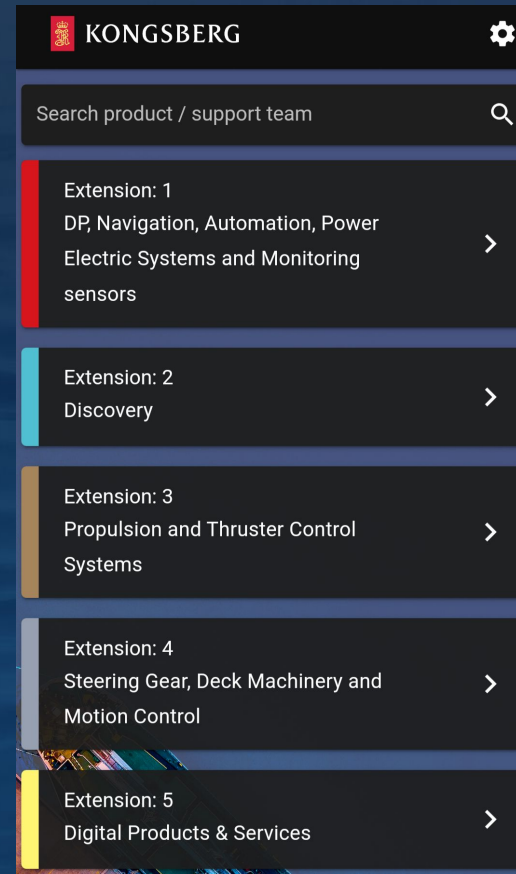
ONR SPARES INVENTORY AT LDEO (DOES NOT INCLUDE ARMSTRONG SPARES AT UH)						REQUESTS THAT MAY BE IN SPARES INVENTORY (COPIED FROM 2023 - UPDATE AS NEEDED)						Notes
List Num	Part Number	Description (packing list)	Description (Kongsberg)	Subsystem	Qty (list)	Langseth 2007-10 J. Gaytan	Healy 2010 STARC	Kilo Moanz 2012 M. Cremer	Palmer 2014-15 S. Walker	Sikuliaq 2014 E. Roth	Thompson 2018 B. Murphy	EM122 Manual Page Num. (Kongsberg #)
6	303694	Fan unit for TX and HV subrack	Fan unit for TX and HV subrack	High Voltage Unit	1							
7	306318	CAP PCB	Capacitor module, CAP PCB	High Voltage Unit	9							
8	306397	HVP RIO	HVP RIO 306397	High Voltage Unit	4				X, 1			92
9	306397	HV Interface	Interface card HV w/ bleeder, heater, remote on/off	High Voltage Unit	3							
10	307677	TX36LC	PCB TX 36	TX Unit	30	X, at least 2			X, 1-2			79
11	308085	Dual Preamplifier	PCB Dual Preamplifier EM 122	Preamplifier Cabinet	2							
12	308301	RX RIO	Interface card RX RIO	RX Unit	5				X, 1			73 (not sure this is correct item)
13	308879	CPU KONTRON	CPU Board Kontron KIT	RX Unit	4							
14	309057	RX32	PCB RX 32	RX Unit	2	X, need qty			X, 1-2			67
15	309082	Fan unit RX32	FAN Unit RX 32 Section	RX Unit	6							
16	309083	CPU Fan	FAN Unit CPU Section	RX Unit	2							
17	310231	BSP67B	PCB BSP67B	RX Unit	4			X, 1-2 (710 critical)	X, 1-2			60
18	316694	BSP RIO	Interface card RIO BSP	RX Unit	4				X, 1-2			75
19	338124 (not found in manual)	BSP67 CPCI	***PART NUMBER NOT FOUND***	RX Unit	7							
20	338124 (not found in manual)	Compact Switch	***PART NUMBER NOT FOUND***	RX Unit	4							
21	340384	CPU Concurrent	***PART NUMBER NOT FOUND***		1				X, 1 (not sure this is it)			55, 57? Two types...
22	290-213103	12V Power Supply Complete	12V Power Supply Complete	Preamplifier Cabinet	5							
23	303424C	TX RIO	Interface Card TX RIO ***only 303424 PN found***	TX Unit	12							
24	308301A	RX RIO	Interface Card RX RIO ***only 308301 PN found***	RX Unit	4				X, 1 (not sure this is it)			73
25	316694B	RIO	Interface Card RIO BSP ***only 316694 PN found***	RX Unit	1							
26	334138C	RIO Concurrent	***PART NUMBER NOT FOUND***		1							
27	382-098939	PSU-6V	Power Supply PSU-6V	Power Supplies	8	X, need qty			X, 1			66
28	382-099656	PSU-CPCI	Power Supply cPCI	Power Supplies	6				X, 1			53
29	382-22334E	BSP67B	***PART NUMBER NOT FOUND***	RX Unit	1							
30	719-098652	Serial PCB	***PART NUMBER NOT FOUND***		1							
31	719-098950	Ethernet Switch	Megabit Ethernet Switch	RX Unit	7					X (for 710?)		62, 64 Two types...
32	CABLES	None	NA		1							
33	NA	Power Switch	NA		1							
34	NA	Logger Interface	NA		1							



# EM124 TXU Failure: Takeaways + Thanks



1. Investigate all BIST failures
2. Check HV reduction (EM 304, 124)
3. Kongsberg Support app ★★★★★



# Armstrong EM124/712: Shipyard Visits

**Vessel Offset Survey Reports**

Survey reports directly impact data quality for years  
 Vessel and sensor offsets must be clearly documented  
 Vessel / sensor offset survey reports **MUST** include:

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

Recommendations for Reporting Vessel Geometry and Multibeam Echosounder System Offsets

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

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Short window to find surveyor; two MAC visits to support surveys

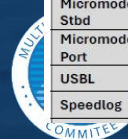
WHOI, Anand, others guided survey company to follow Kongsberg spec and MAC report recommendations

SAT results suggest excellent survey; new contractor to consider for future surveys

R/V Neil Armstrong	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	
Granite Block	0.000	0.000	0.000	n/a	n/a	n/a	
POS/MV IMU	-5.964	0.008	-0.071	-0.0565	0.0046	-0.3824	
MGC	-3.186	-0.002	0.002	0.0418	0.0194	0.0354	
TX 124	-1.467	-0.550	1.112	0.0064	0.0005	0.0069	
RX 124	-5.873	0.005	1.105	-0.0003	-0.0281	0.1171	
TX 712	-3.188	0.286	1.107	0.0182	-0.0024	-0.0183	
RX 712	-4.604	0.626	1.107	0.0031	0.0062	0.1762	
SBP	-1.407	-2.085	1.101	0.1019	0.1414	-0.0004	
ADCP 38 kHz	3.395	-1.217	1.110	0.2298	0.0051	n/a	
ADCP 150 kHz	3.037	-2.435	1.105	-0.0376	0.2280	n/a	
ADCP 300 kHz	2.730	0.611	1.108	-0.2668	0.1878	n/a	
EK80 18 kHz	-4.887	2.432	1.107	0.0491	-0.1373	4.2362	
EK80 38 kHz	-1.847	2.452	1.111	-0.4646	0.2902	1.2306	
EK80 70 kHz	-3.365	2.511	1.107	0.0107	-0.1344	0.7829	
EK80 120 kHz	-2.755	2.894	1.107	-0.0842	0.0474	-0.1197	
EK80 200 kHz	-2.755	2.208	1.109	-0.3820	0.2998	-0.5444	
Micromodem Center	-7.324	2.433	1.107	n/a	n/a	n/a	
Micromodem Fwd	-7.199	2.413	1.141	n/a	n/a	n/a	
Micromodem Aft	-7.449	2.453	1.145	n/a	n/a	n/a	
Micromodem Stbd	-7.305	2.558	1.126	n/a	n/a	n/a	
Micromodem Port	-7.344	2.308	1.094	n/a	n/a	n/a	
USBL	-7.322	0.608	1.362	0.1884	0.0254	0.4575	
Speedlog	3.937	0.616	1.110	0.0323	0.2214	n/a	



MGC Offsets	Roll	Pitch	Hdg.
Contractor (Laser Tracker)	-0.057	0.005	-0.382
MAC (Total Station)	-0.065	-0.020	-0.313



# Armstrong EM124/712: Shipyard Visits

## Vessel Offset Survey Reports

Survey reports directly impact data quality for years  
 Vessel and sensor offsets must be clearly documented  
 Vessel / sensor offset survey reports **MUST** include:

1. Origin of survey reference frame
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[github.com/oceanmapping/community/wiki/D](https://github.com/oceanmapping/community/wiki/D)  
 Lamont-Doherty Earth Observatory  
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## Recommendations for Reporting Vessel Geometry and Multibeam Echosounder System Offsets

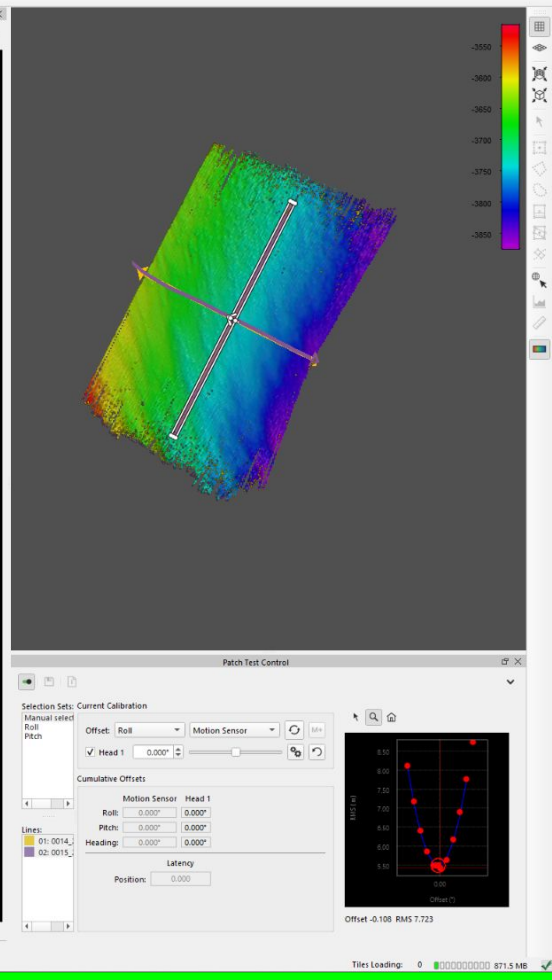
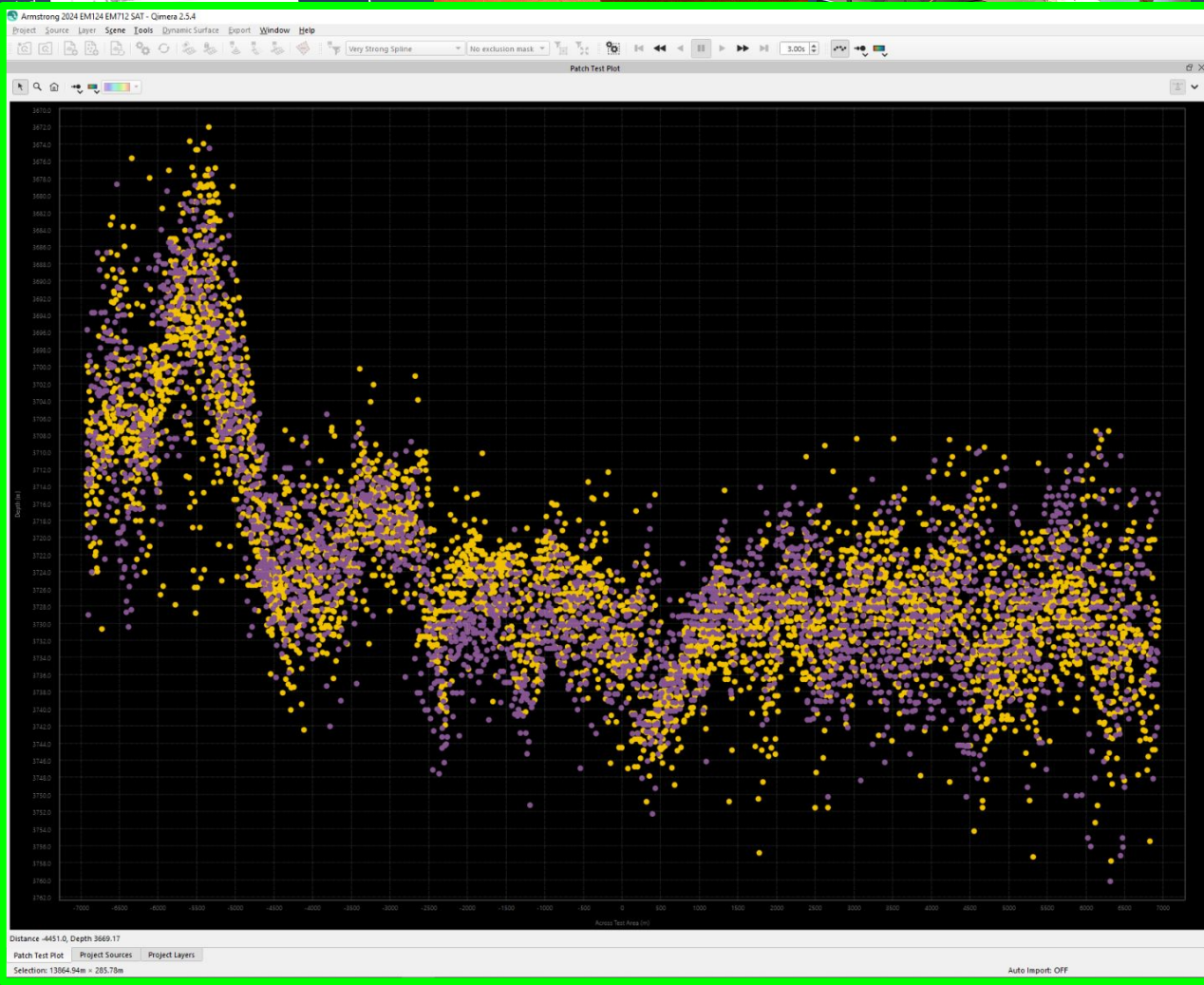
1. Origin of the survey reference frame
2. Axes of the survey reference frame
3. Sign conventions of survey results
4. Images of surveyed points and sensors
5. Sigma / standard deviation or uncertainty
6. Second review before submission



Short window to find surveyor; two surveys

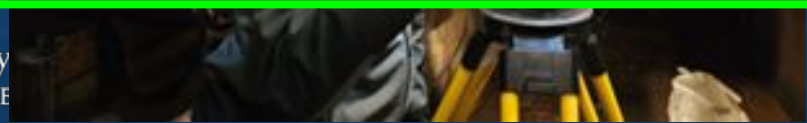
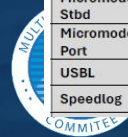
guided survey  
 berg spec  
 mmentations  
 cellent  
 r to consider

R/V Neil Armstrong	X	Y	Z			
Sign Convention	Positive forward	Positive to starboard	Positive down			
Units	meters	meters	meters			
Granite Block	0.000	0.000	0.000			
POS/MV IMU	-5.964	0.008	-0.07			
MGC	-3.186	-0.002	0.00			
TX 124	-1.467	-0.550	1.11			
RX 124	-5.873	0.005	1.10			
TX 712	-3.188	0.286	1.10			
RX 712	-4.604	0.626	1.10			
SBP	-1.407	-2.085	1.10			
ADCP 38 kHz	3.395	-1.217	1.11			
ADCP 150 kHz	3.037	-2.435	1.10			
ADCP 300 kHz	2.730	0.611	1.10			
EK80 18 kHz	-4.887	2.432	1.10			
EK80 38 kHz	-1.847	2.452	1.11			
EK80 70 kHz	-3.365	2.511	1.10			
EK80 120 kHz	-2.755	2.894	1.10			
EK80 200 kHz	-2.755	2.208	1.10			
Micromodem Center	-7.324	2.433	1.10			
Micromodem Fwd	-7.199	2.413	1.14			
Micromodem Aft	-7.449	2.453	1.14			
Micromodem Stbd	-7.305	2.558	1.12			
Micromodem Port	-7.344	2.308	1.094	n/a	n/a	n/a
USBL	-7.322	0.608	1.362	0.1884	0.0254	0.4575
Speedlog	3.937	0.616	1.110	0.0323	0.2214	n/a



Pitch	Hdg.
0.005	-0.382
-0.065	-0.020
-0.020	-0.313

MAC  
 (Total Station)



# Sikuliaq EM304 MKII: Shipyard Visit



Independent verification survey of MGCs and laser scanning

Discussions with the survey team to confirm best practices

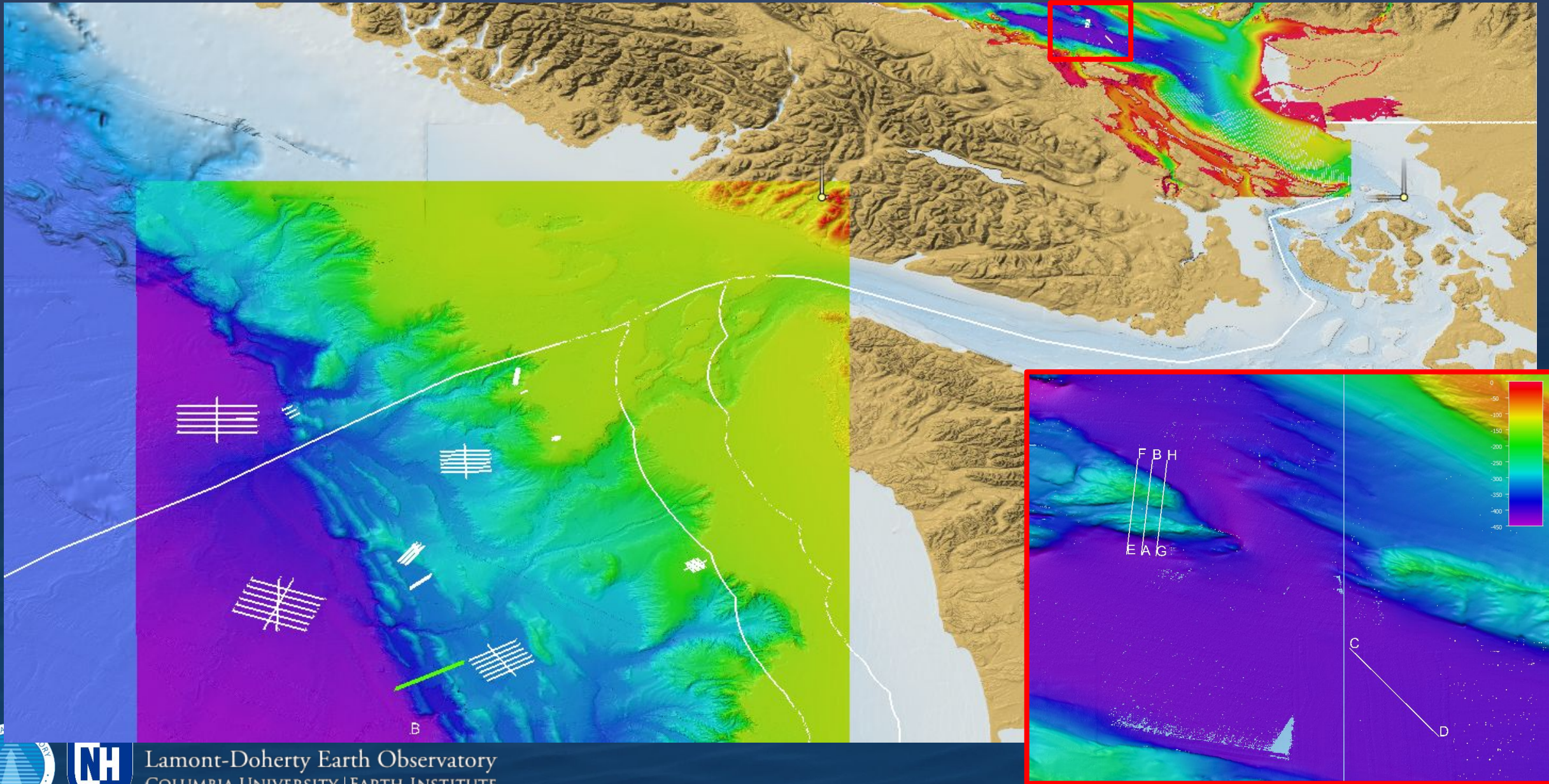
Experiments to improve methods, especially in low temps

3D point cloud



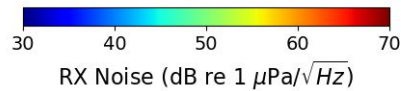
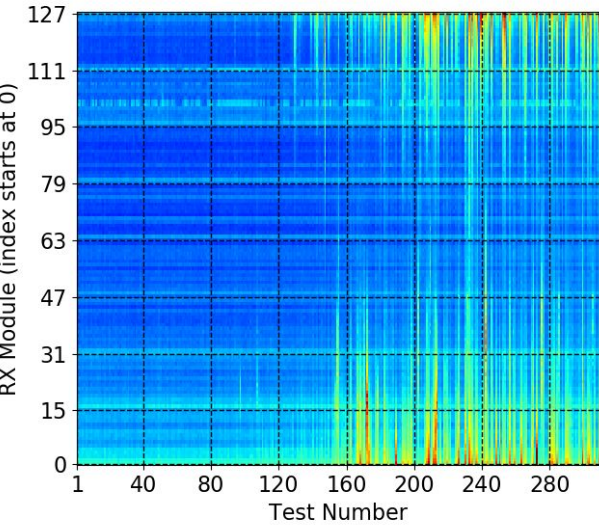
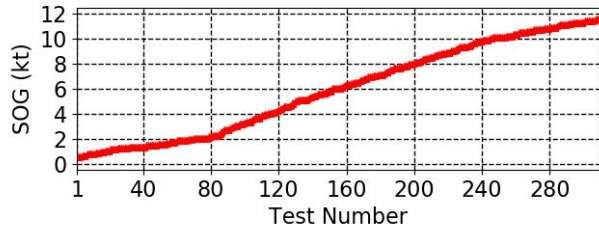
MGC Offsets (Total Station)	Roll	Pitch
Contractor	0.050	0.730
MAC	-0.022	0.789

# Sikuliaq EM304 MKII: Sea Acceptance Testing



# Sikuliaq EM304 MKII: Sea Acceptance Testing

RX Noise vs. Speed  
EM304 (S/N 11017)  
Date: 2024-03-07  
Freq: 20-32 kHz



SKQ\_2024\_EM304\_SAT\_EM710\_QAT - Qimera 2.5.4

Project Source Layer Scene Tools Dynamic Surface Export Window Help

Strong Spline No exclusion mask

Patch Test Plot

Distance -538.1, Depth 429.11

Job Activity Project Sources Project

Selection: 2138.82m x 1.47m

Patch Test Control

Selection Sets: Current Calibration

Manual select Roll Pitch

Offset: Pitch Motion Sensor

Head 1 0.000°

Cumulative Offsets

Motion Sensor Head 1

Roll: 0.000° 0.000°

Pitch: 0.000° 0.000°

Lines: 01: 0015

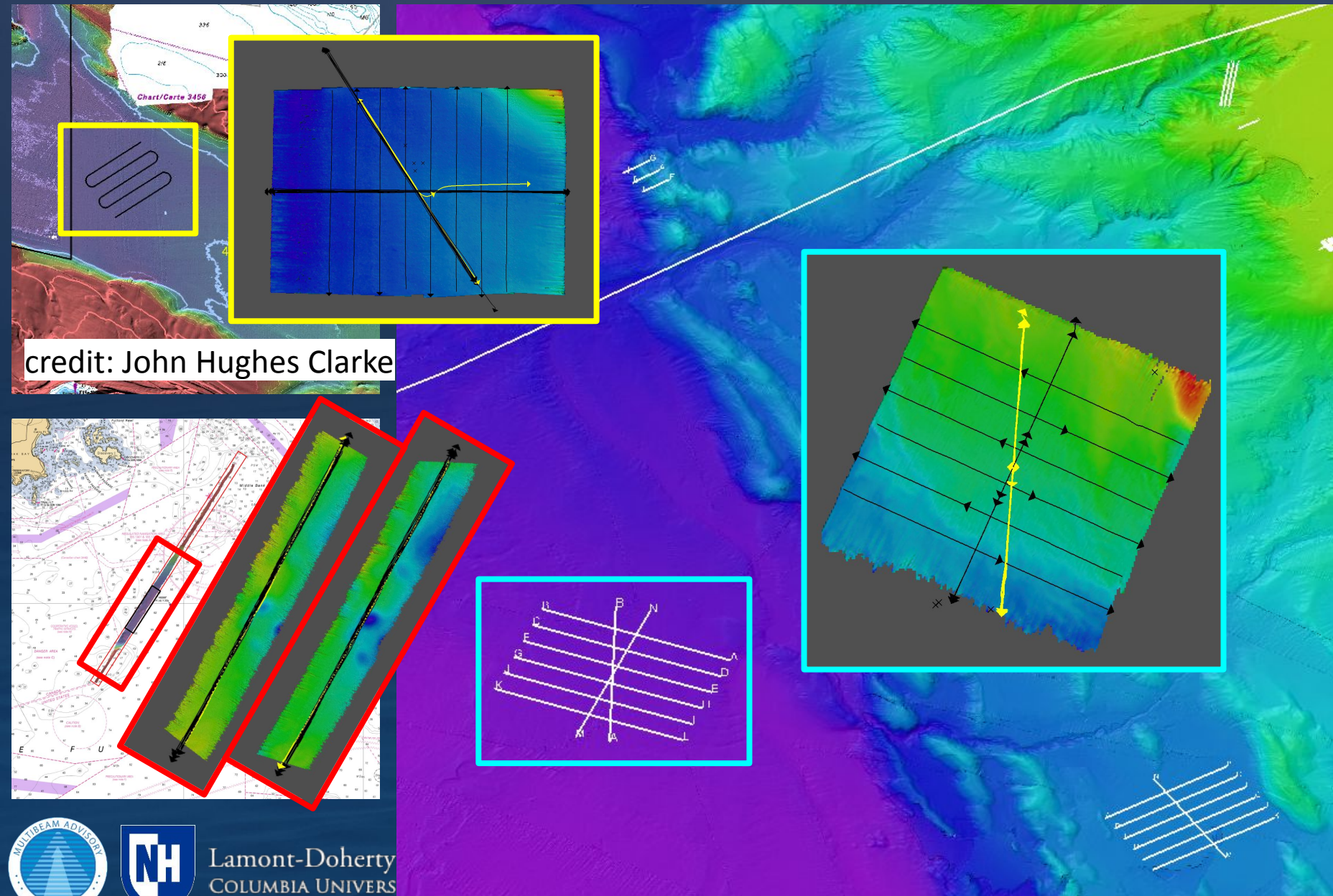
Offset 0.061 RMS 1.169

Tiles Loading: 0 00000000 1.9 GB

Attitude system 1				Attitude system name					
Name:	Attitude system name								
Location offset (XYZ)	-	0	+	-	0	+	-	0	+
Angular offset (RPH)	-	0.09	+	-	-0.01	+	-	0	+



# Sikuliaq Backscatter Calibration: 100, 400, 2400 m Sites



## EM304 Backscatter Calibration (400 m Georgia Basin)

- [Shallow](#)
- [Medium](#)
- [Deep](#)
- [Shallow \(again\)](#)
- [Deeper](#)
- [Very Deep](#)

## EM304 Backscatter Calibration (400 m) - Round 2

- [Medium - Extended JHC Line](#)
- [Deep - Extended JHC Line](#)
- [Shallow - Extended JHC Line](#)
- [Medium - Extended JHC Line \(again\)](#)
- [Deeper - Extended JHC Line](#)

## EM710 Backscatter Calibration (400 m)

- [Extra Deep - Extended JHC Line](#)
- [Extra Deep - East-West Line](#)
- [Very Deep - East-West Line](#)
- [Deep - East-West Line](#)
- [Medium - East-West Line](#)
- [Shallow - East-West Line](#)
- [Very Shallow - East-West Line](#)

## EM710 Backscatter Calibration (100 m)

- [Very Shallow](#)
- [Shallow](#)
- [Medium](#)
- [Deep](#)
- [Very Deep](#)

## EM304 Backscatter Calibration (2400 m)

- [Deeper](#)
- [Very Deep](#)
- [Extra Deep](#)
- [Deep](#)



# Sikuliaq Backscatter Calibration: 100, 400, 2400 m Sites

## Relative Backscatter Calibration Procedure for EM Multibeam Echo Sounders

Doc. ID:	496600
Revision:	B
Status:	This document is under configuration control at Kongsberg Discovery.

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## CHECKLIST

### Pre-Survey

- Finalize the table of mode combinations to be collected (with assistance from Customer Support).
- Verify the software has been updated.

### Pre-Acquisition

- Collect and apply CTD profile.
  - o *Set the Absorption coefficient source:* CTD profile
- Set the acquisition settings:
  - o *Angular coverage mode:* Manual at 65/65 unless otherwise specified
  - o *Beam spacing:* High density Equidistant
  - o *Coverage sector:* Normal (EM204X family only, single sector is not supported)
  - o *Dual swath mode:* Off, fixed or dynamic
  - o *Yaw stabilization:* Off
  - o *Pitch stabilization:* On
  - o *Tx Alongtrack:* 0
  - o *Depth mode:* one pair of lines collected in each mode combination
  - o *Frequency mode:* each mode combination
  - o *Beam intensity:* Use Lamberts law
  - o *Sector tracking:* **Off** (older systems, important!!)
  - o *Penetration filter:* off
  - o *Spike filter:* medium
  - o *Range gate:* normal
  - o *Phase ramp:* normal
- Start collecting data and verify the following:
  - o The survey area is flat with homogenous terrain across track.
  - o There is a constant seabed strength (low backscatter variation along and across track).
  - o Coverage is consistent across and along track.
  - o Seabed image in SIS is constant (sector stripes are acceptable, this is to be corrected).

### During Acquisition

- Collect two overlapping lines for each mode combination. **Do not log turns!**
- If there is any doubt about the quality of the data, contact Customer Support and/or send data files or images to support your questions.

### Post Acquisition

- Send data files and supporting documents, screenshots, reports and BIST to Customer Support.
  - o [support.umap@kd.kongsberg.com](mailto:support.umap@kd.kongsberg.com)

### EM304 Backscatter Calibration (400 m Georgia Basin)

[Shallow](#)  
[Medium](#)  
[Deep](#)  
[Shallow \(again\)](#)  
[Deeper](#)  
[Very Deep](#)

### EM304 Backscatter Calibration (400 m) - Round 2

[Medium - Extended JHC Line](#)  
[Deep - Extended JHC Line](#)  
[Shallow - Extended JHC Line](#)  
[Medium - Extended JHC Line \(again\)](#)  
[Deeper - Extended JHC Line](#)

### EM710 Backscatter Calibration (400 m)

[Extra Deep - Extended JHC Line](#)  
[Extra Deep - East-West Line](#)  
[Very Deep - East-West Line](#)  
[Deep - East-West Line](#)  
[Medium - East-West Line](#)  
[Shallow - East-West Line](#)  
[Very Shallow - East-West Line](#)

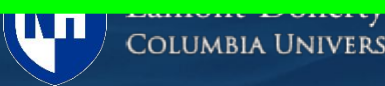
### EM710 Backscatter Calibration (100 m)

[Very Shallow](#)  
[Shallow](#)  
[Medium](#)  
[Deep](#)  
[Very Deep](#)

### EM304 Backscatter Calibration (2400 m)

[Deeper](#)  
[Very Deep](#)  
[Extra Deep](#)  
[Deep](#)

credit

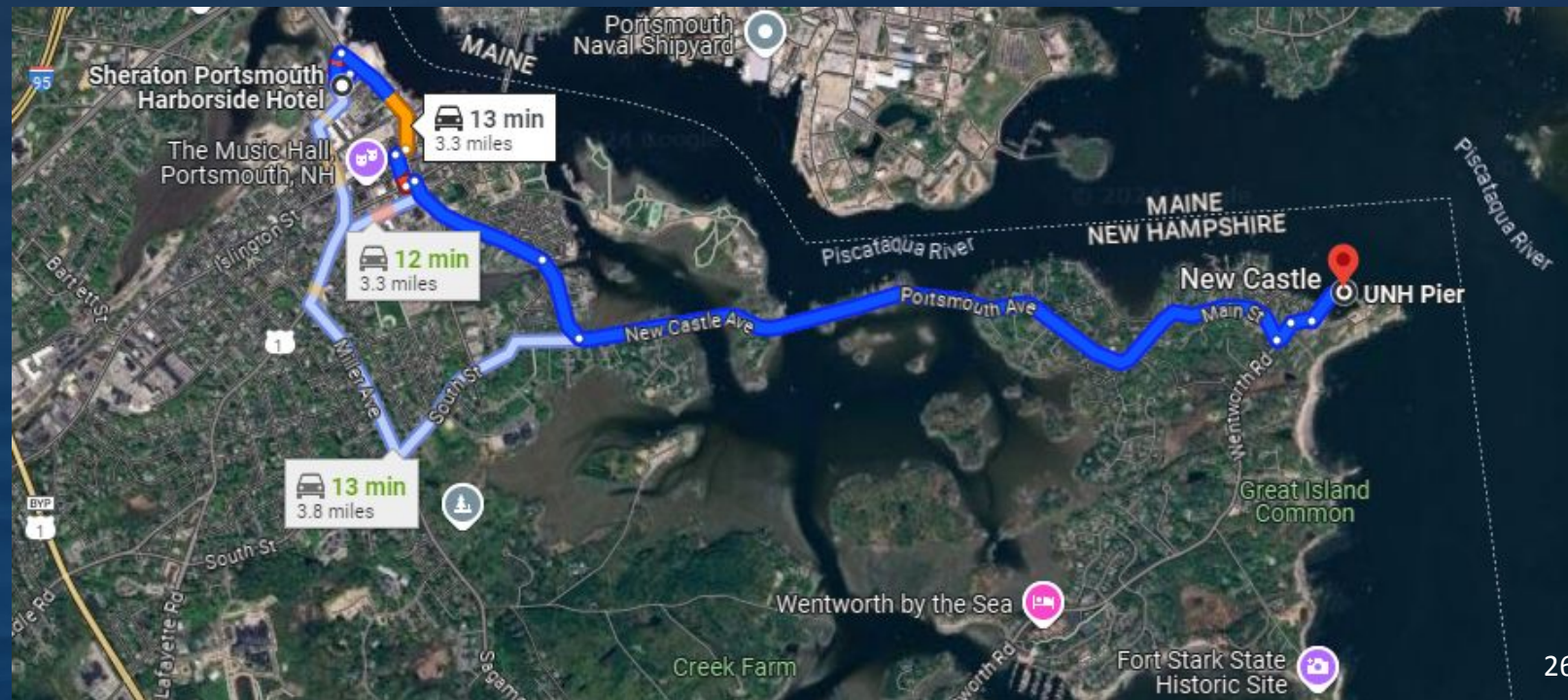
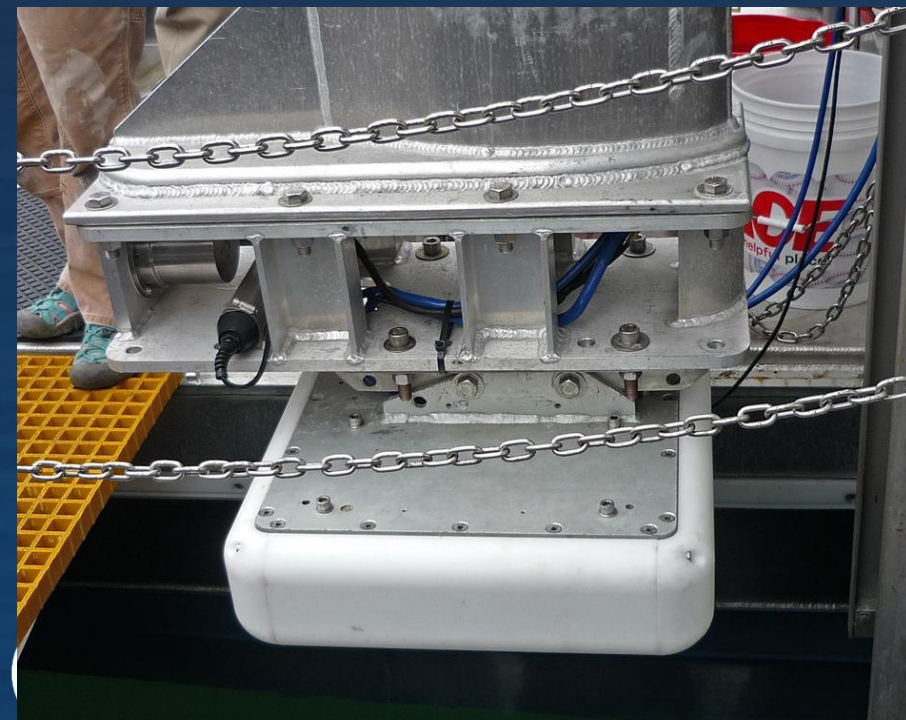
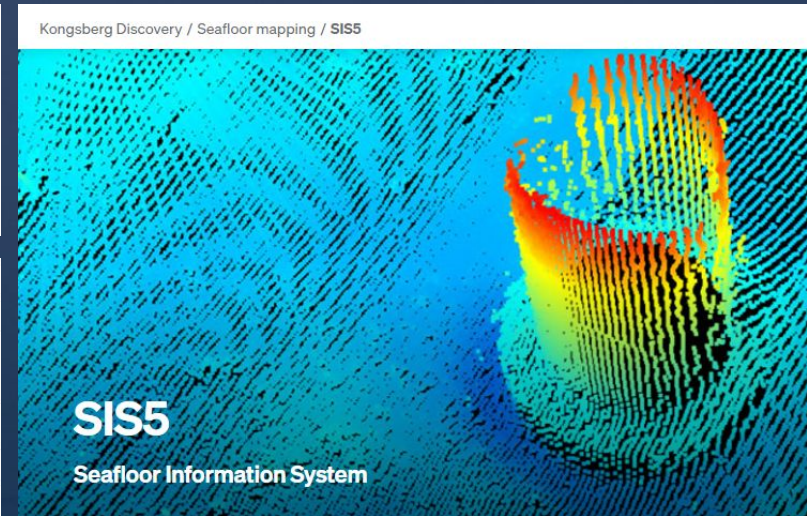


# Friday: Mini-MAC Visit + SIS 5.14 Workshop



2024 RVTEC Training  
 Multibeam Advisory Committee  
 R/V *Gulf Surveyor* EM2040 QAT Checklist  
 Adapted from standard Multibeam Advisory Committee [SAT / QAT checklist](#)

Approx. Schedule	Group 1	Group 2	Group 3	Group 4
8:00-8:30	Arrival			
8:30-10:15	R/V <i>Gulf Surveyor</i>	Free time	SIS Workshop Pier Facility Conf. Room	
10:15-12:00	Free time	R/V <i>Gulf Surveyor</i>		
12:00-1:00	Lunch			
1:00-2:45	SIS Workshop Pier Facility Conf. Room		R/V <i>Gulf Surveyor</i>	Free time
2:45-4:30			Free time	R/V <i>Gulf Surveyor</i>



# Questions? Answers? Reach out!

Ocean Mapping Community Wiki

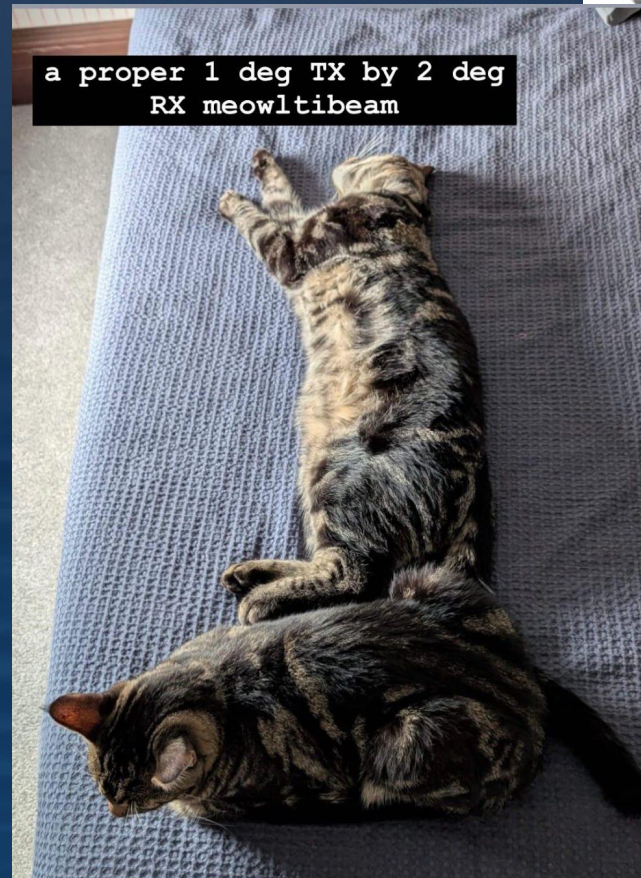
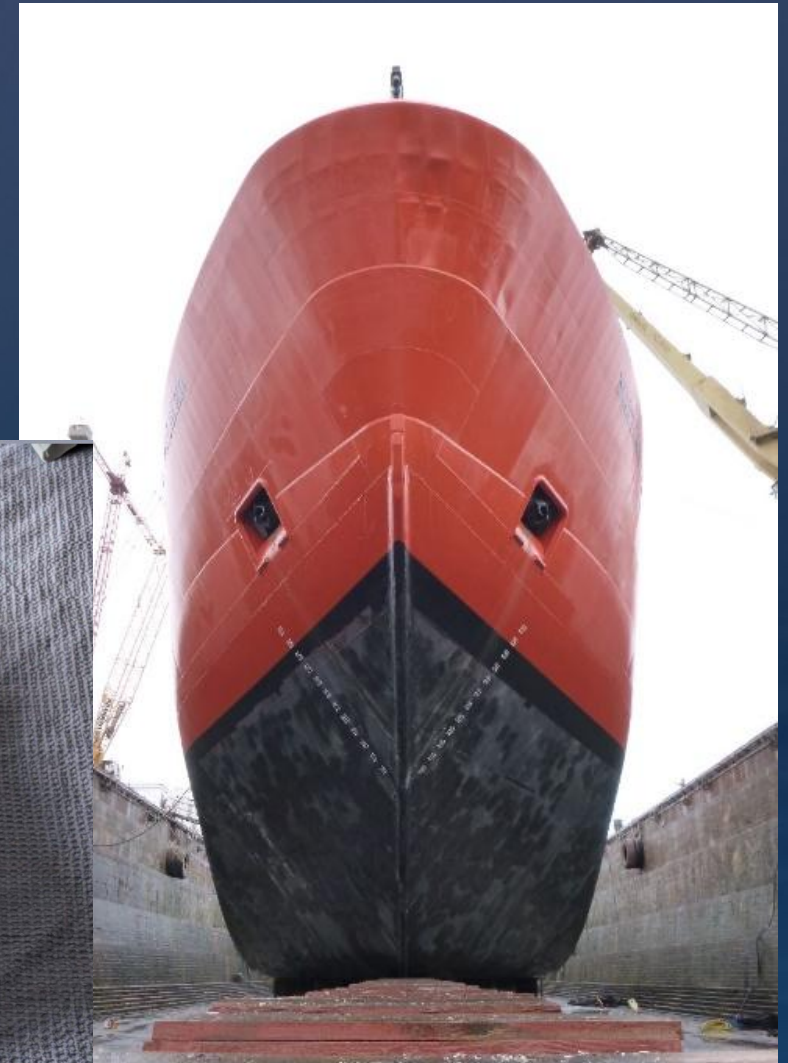
[github.com/oceanmapping/community](https://github.com/oceanmapping/community)

[omcadmin@ccom.unh.edu](mailto:omcadmin@ccom.unh.edu)

Multibeam Advisory Committee

[mac.unols.org](https://mac.unols.org)

[mac-help@unols.org](mailto:mac-help@unols.org)



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