

# Multibeam Advisory Committee

*RVTEC - UNH - Durham, NH*

*2024 Oct 23*

*Kevin Jerram  
Paul Johnson  
Vicki Ferrini*

## *Breakout Session: Assessment Tools*

*mac.unols.org  
mac-help@unols.org*



MAC supported under NSF grant 1933720



# *Test Planning Timeline*

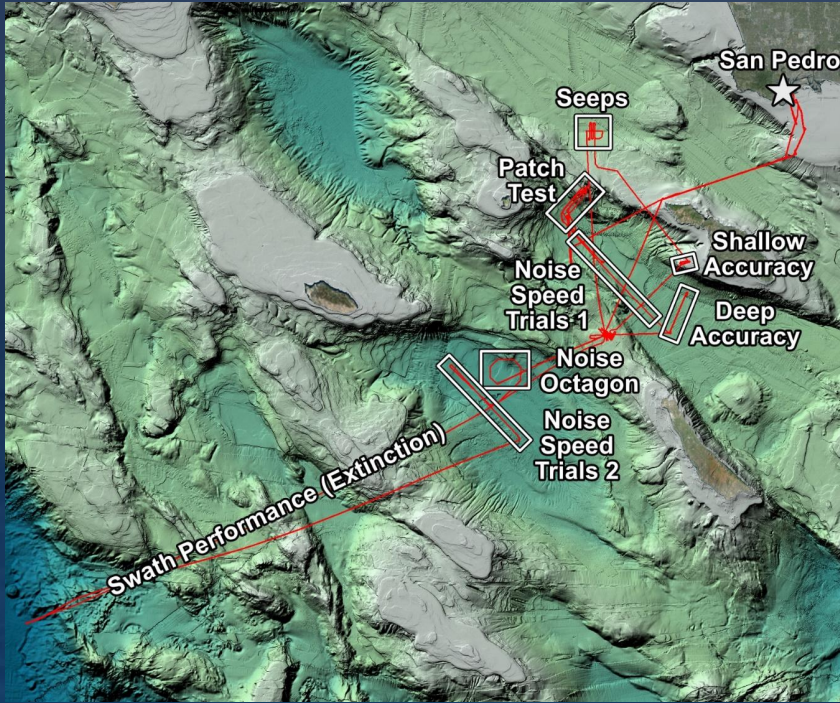


MAC supported under NSF grant 1933720





# 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

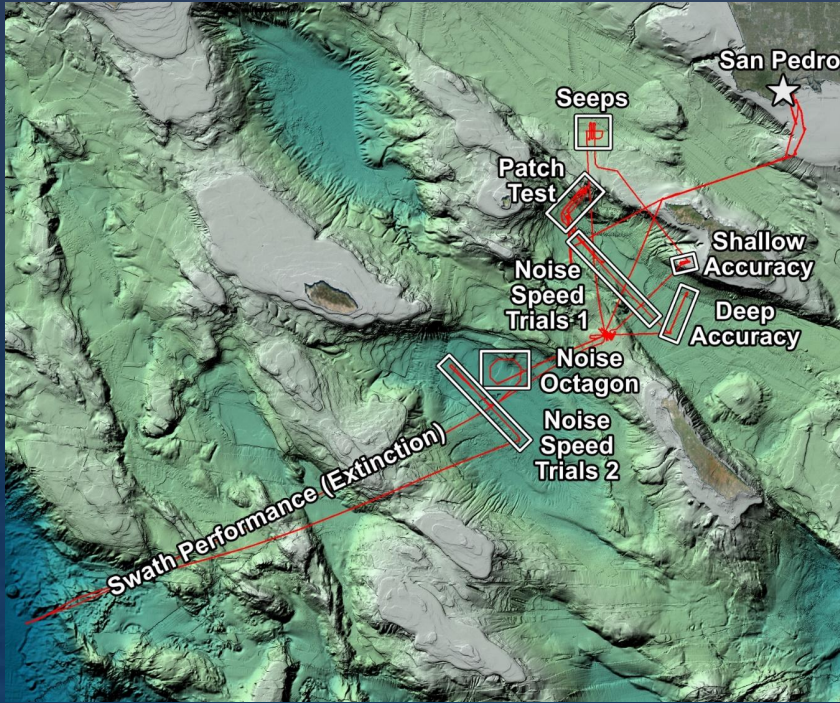
1-2 mos.

## Follow-Up

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



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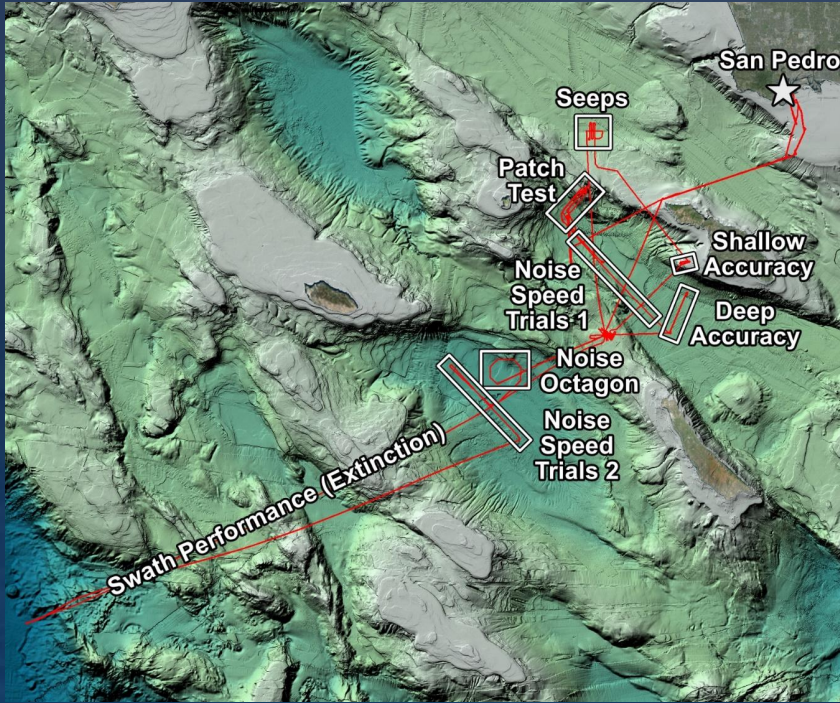
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Lamont-Doherty Earth Observatory  
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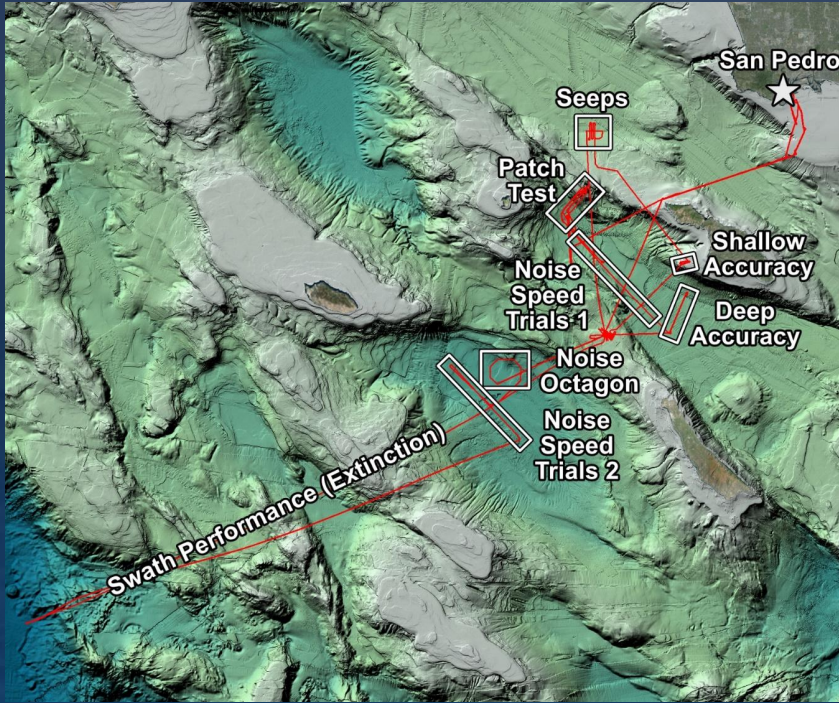
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# *Test Planning Resources*



MAC supported under NSF grant 1933720



# MAC (and other) Test Reports



~80 reports on MAC website to provide context, comparison, etc.

- **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 EM710

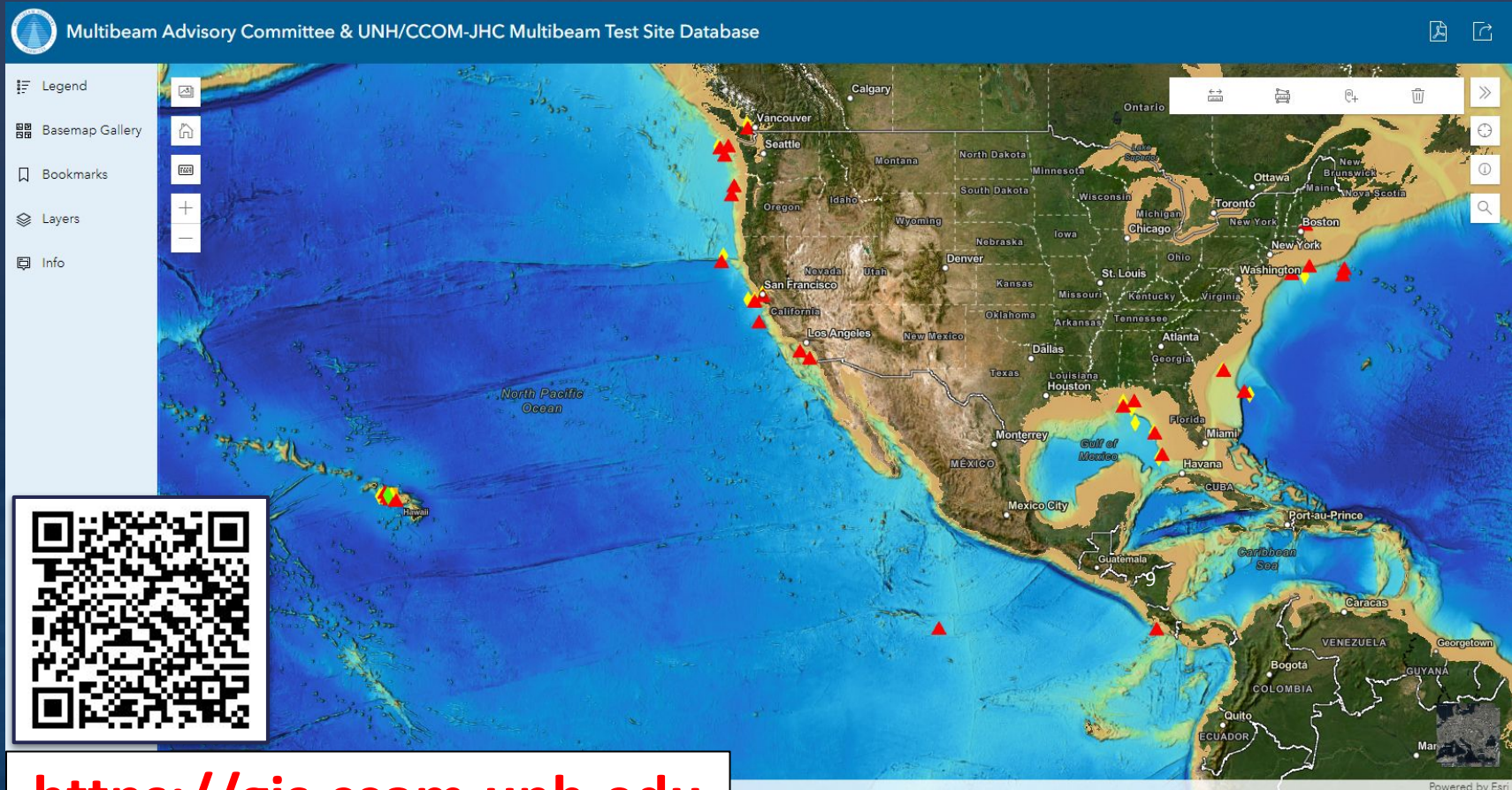


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# Test Site Database – Work in Progress



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

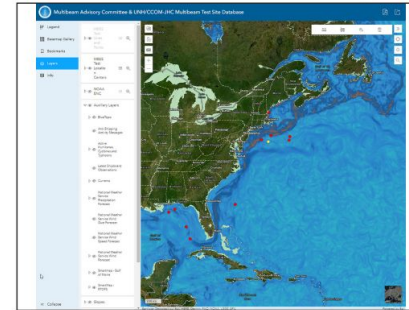


# Test Site Database – Planning Layers

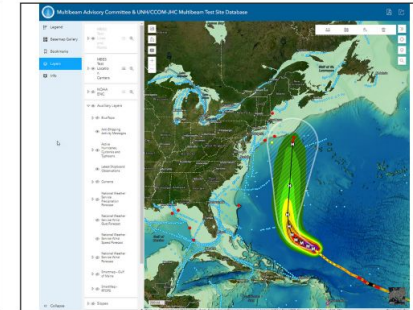
Accuracy - Kongsberg EM304	
Filename	Georgia_Basin_400m_accuracy_lines_hdg_270_deg_DDD
Test Type	Accuracy
Report URL	Coming Soon
Files URL	<a href="#">View</a>
Line ID	9
Ship	R/V Sikuliaq
Organization	UNOLS
MBES System	Kongsberg EM304
Year	2024
Test Depth	Medium
Test Quality	Good
Test Location	Georgia Basin
Ocean	North Pacific
Description	Crossline

Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, NRCCan, Peris Can. Powered by Esri

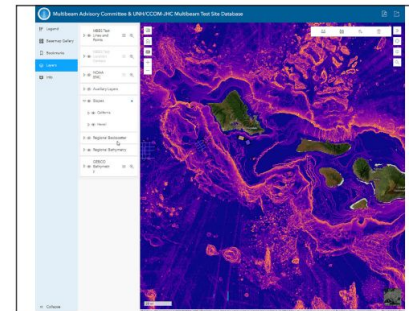
## Planning Information



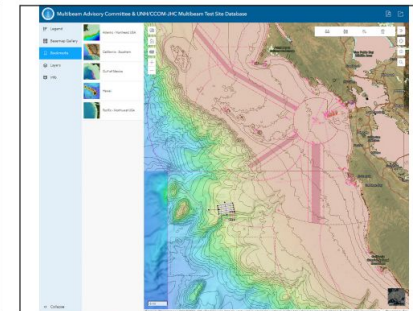
SmartMap Ocean Complexity



Ocean & Weather Conditions



Regional Bathymetry & Slope



Electronic Navigation Charts



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





# Test Site Database – Submission Form



Multibeam Advisory Committee & UNH/CCOM-JHC Multibeam Test Site Database

## 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.

Your answer: \_\_\_\_\_

Contact name \*

Contact information is requested for follow-up and credit in the test site database, if desired.

Your answer: \_\_\_\_\_

Contact email

Email is requested for follow-up but will not be included in the test site database, if desired.

Your answer: \_\_\_\_\_

**Test Site Name \***

Please provide a working name of this test site. This will be used to identify the site 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 area without including details of the vessel, personnel, or conditions. 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 site."

Your answer: \_\_\_\_\_

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

Your answer: \_\_\_\_\_

Nominal depth in meters (if known)

Your answer: \_\_\_\_\_

**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: \_\_\_\_\_

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



# 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)

## Assessment Tools

### Overview

Multibeam assessment tools described here include:

1. [Swath Coverage Plotter v0.2.3](#)
2. [Swath Accuracy Plotter v0.1.2](#)
3. [BST Plotter v0.2.3](#)
4. [File Trimmer v0.1.5](#)
5. [CCDS Converter v0.0.4](#)

### 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](#)).

1. 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.

1. Due to GitHub's file size limits, these are not zipped and may be more cumbersome to download for normal use. Versions may be lagging behind the Google Drive distribution due to (user) errors working with GitHub.

3. **Python folks:** source code is available in the [multibeam\\_tools](#) repository.

### Using the tools

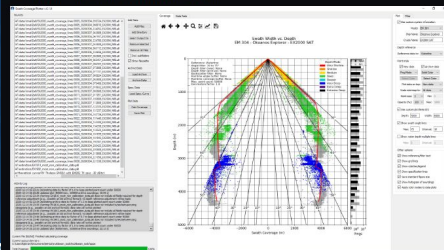
These tools are intended to give users the same plotting and reporting functions used by the MAC for routine performance testing (e.g., sea acceptance trials and quality assurance testing). Currently, only Kongsberg data formats are supported.

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 small are supported.



### Purpose

Swath coverage testing is intended to illustrate the maximum coverage achieved by a given multibeam system over a wide range of depths. The depth range of interest spans from the shallowest typical operating depth for the vessel down to the practical swath extinction limit (e.g., where the system may no longer track the seafloor, generally governed by attenuation of the transmitted signal, [noise levels](#) perceived by the multibeam, and reflectivity of the seafloor).

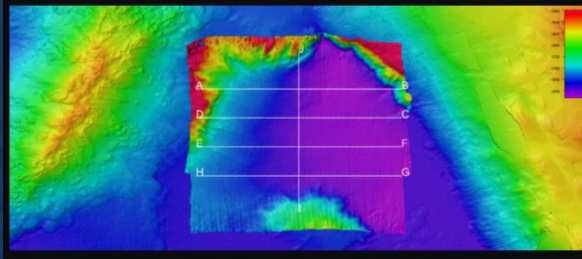
## Reference survey acquisition

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 (with 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)
4. Number of reference lines to accommodate desired crossline length
  - i. Typically 6-10 reference lines at 1 WD spacing, depending on depth, to yield several hundred crossline pings

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.

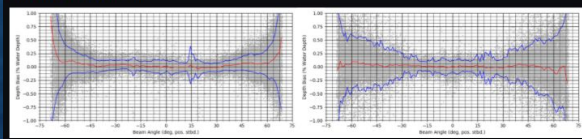


## Crossline data acquisition

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 'trusted' 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.

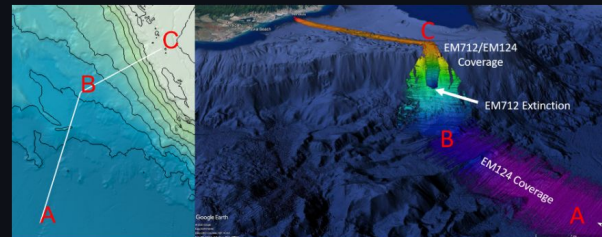
Crosslines are typically run in 'pairs' on opposite headings for each mode to assess any heading-dependent impacts, such as sea state (example below shows accuracy heading with seas and into seas shown on top and bottom, respectively). When seas are calm, this approach also supports deep roll verification 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 <sup>1</sup>
Max angles	75°/75°	70°/70° for some systems
Max coverage	Maximum	Varies by model
Depth limits	As needed	Adjust as needed <sup>2</sup>
TX power	Maximum	0 dB



# 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)

**Assessment Tools**  
 kperman edited this page 2 weeks ago · 49 revisions

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**Distribution**

Pages

- Home
- Assessment Tools
- Distribution
- Using the tools
- Swath Coverage Plotter
- BIST Plotter

## Using the tools

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Examples and use cases for these assessment tools have been presented at various workshops, including the **2023 INMARTECH MAC workshop** and **2024 RVTEC MAC breakout session** (demonstration, slides pending).

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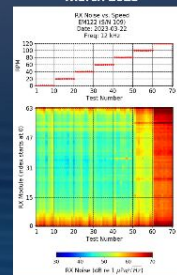
## Data collection

## Example from the Field: RX Noise Tracking

Diver inspection showing biofouling on/near arrays (April 2023)



March 2023



lineup, active sensors) on engines or piping speed of 8 kts. The coverage data that levated sea state may

rossing contours at be is important for r away from the system. transiting 'up' and lepth range (~100-4000 to cross contours more werage assessment.

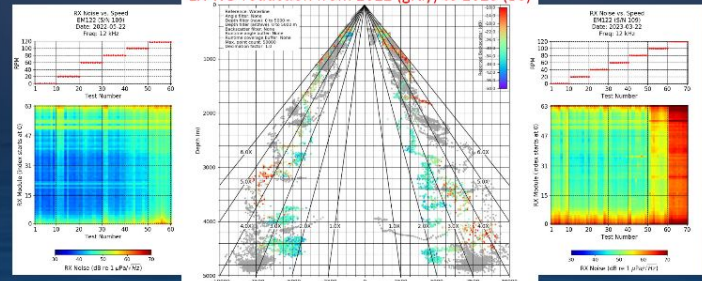
W124

W712 Extinction



## Example from the Field: RX Noise and Swath Coverage

1X WD reduction from 2022 (gray) to 2023 (BS)



de it selects

omatic systems ngs where appropriate, a test data.



plotting options. Currently only all and small are supported.

**Plotting**

- Filing
- Setting
- BIST Plotter
- Collecting BISTs
- SS 4
- Warnings
- SS 5
- Warnings
- Plotting BISTs
- TX and RX Channels
- SS 4 TX Channels Logging
- SS 5 TX Channels Logging
- RX Noise Level
- RX Noise vs. speed
- RX Noise vs. acimuth
- RX Noise vs. other parameters
- SS 4 RX Noise Logging
- Manual logging
- AutoBIST
- Logging procedure
- SS 5 RX Noise Logging
- Logging procedure
- Transient vs. steady state
- File browser
- Purpose
- Warnings
- Keeping source file names

**Purpose**

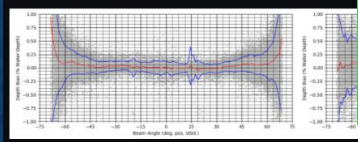
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TX power

Maximum 0 dB

# *Assessment Tool Demos*



MAC supported under NSF grant 1933720





# Questions? Answers? Reach out!

Ocean Mapping Community Wiki

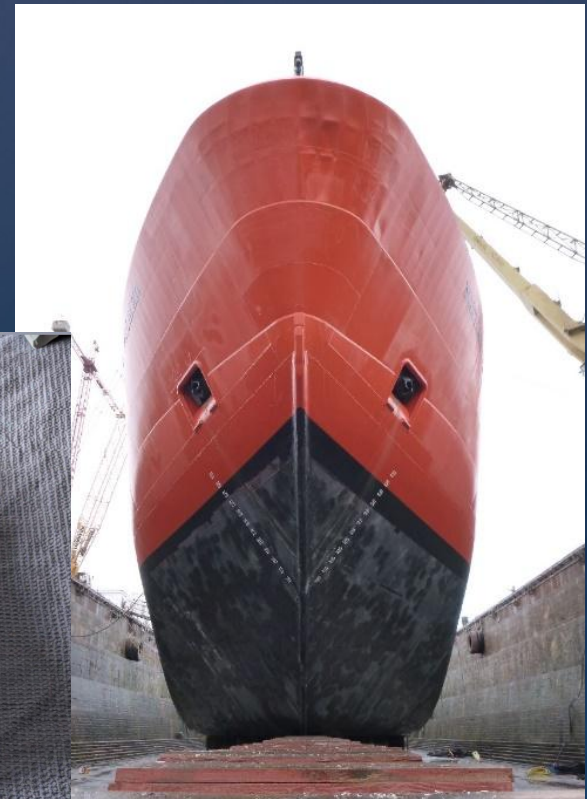
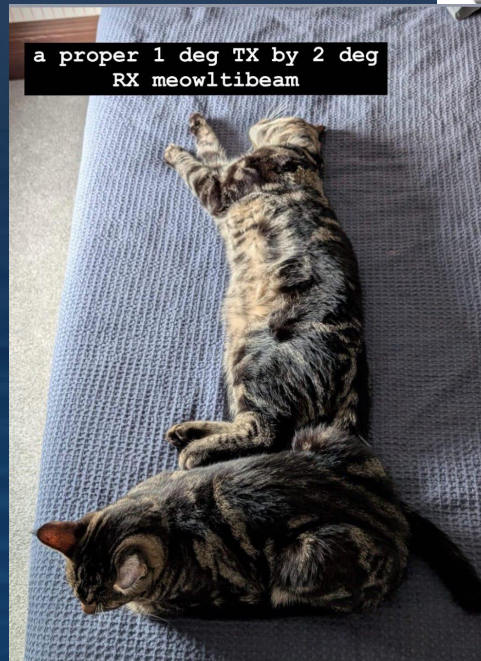
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