

Multibeam Data Contributions from  
U.S. Academic Research Fleet:  
*Coordinated Data Stewardship, and Efforts  
to Optimize Data Quality*

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# Multibeam Sonar Data Continuum



Data  
Acquisition

Data  
Documentation  
& Preservation

Data  
Reduction &  
Synthesis



**MAC**  
2011



**R2R**  
2009



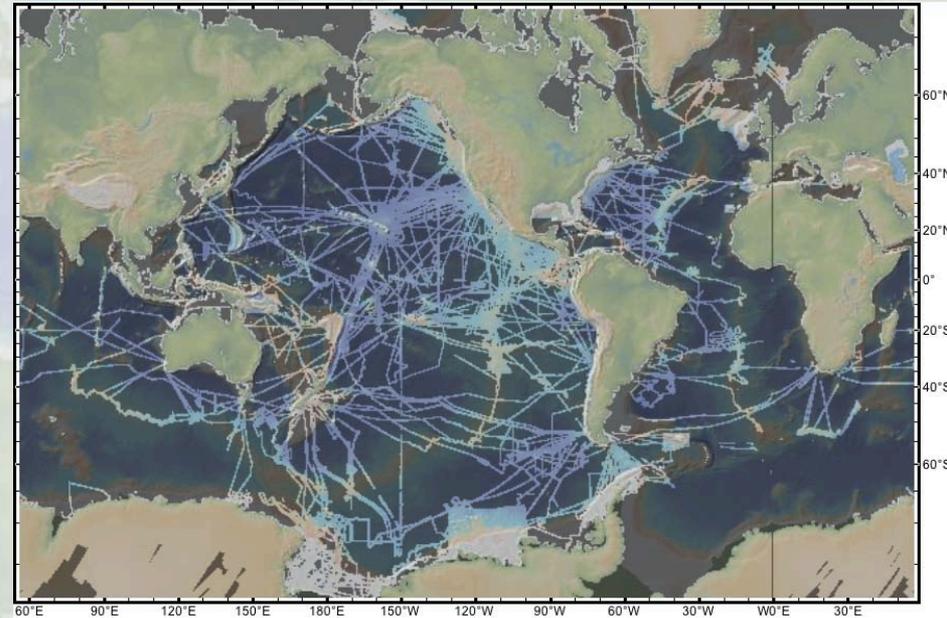
**GMRT**  
1992

**GOAL:** *Well-documented high-quality publicly available data*

# Global Multi-Resolution Topography

- **1992** – Ridge Multibeam Synthesis Project
- **2003** – Expanded to include US-funded data from Southern Ocean
- **2004 – present** -- Expanded to include public domain data from throughout global oceans
  - ongoing growth by > 60 cruises/yr

<http://gmrt.marine-geo.org>

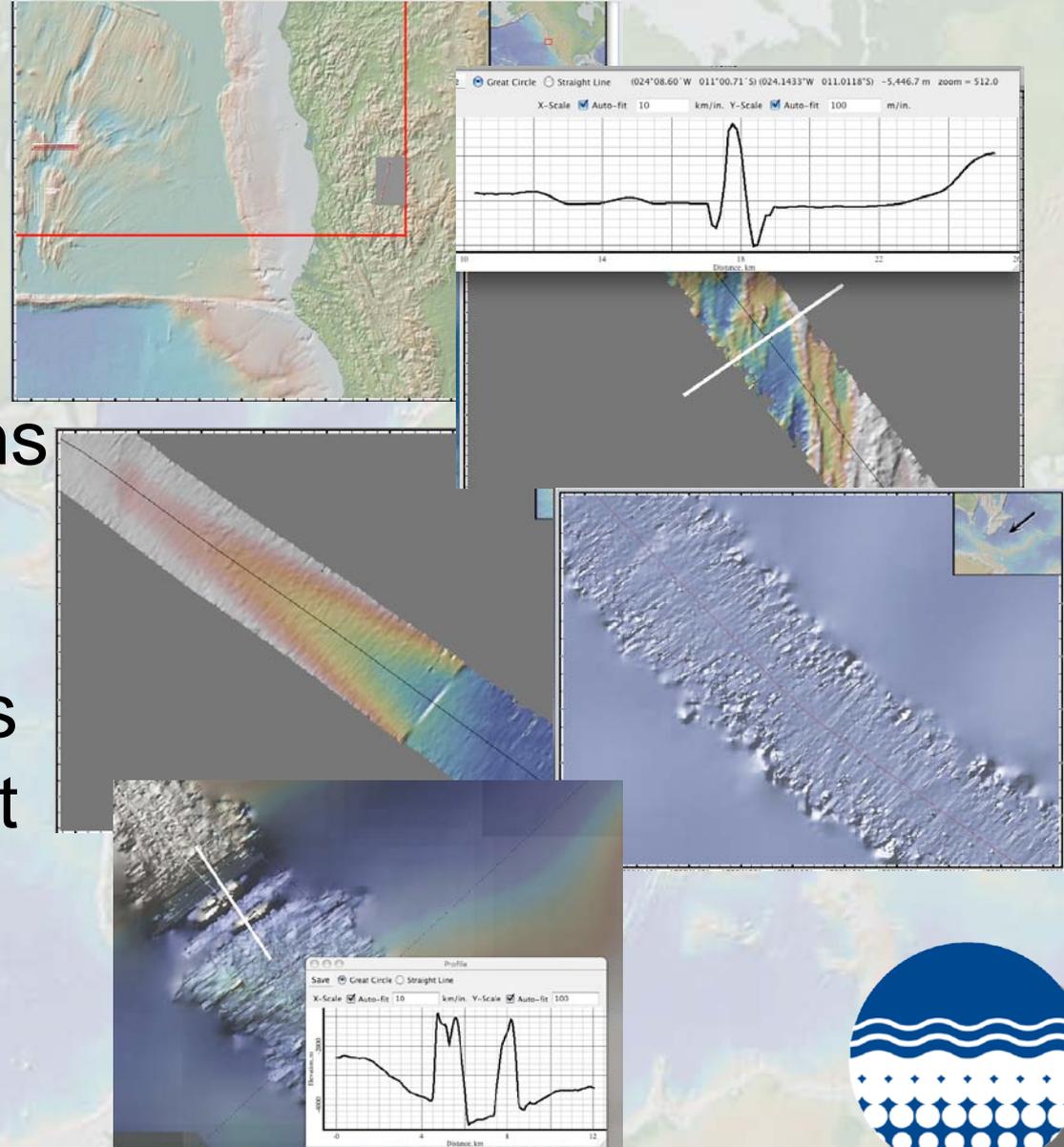


*GMRTv2.3 ~650 cruises (Oct 2012)*



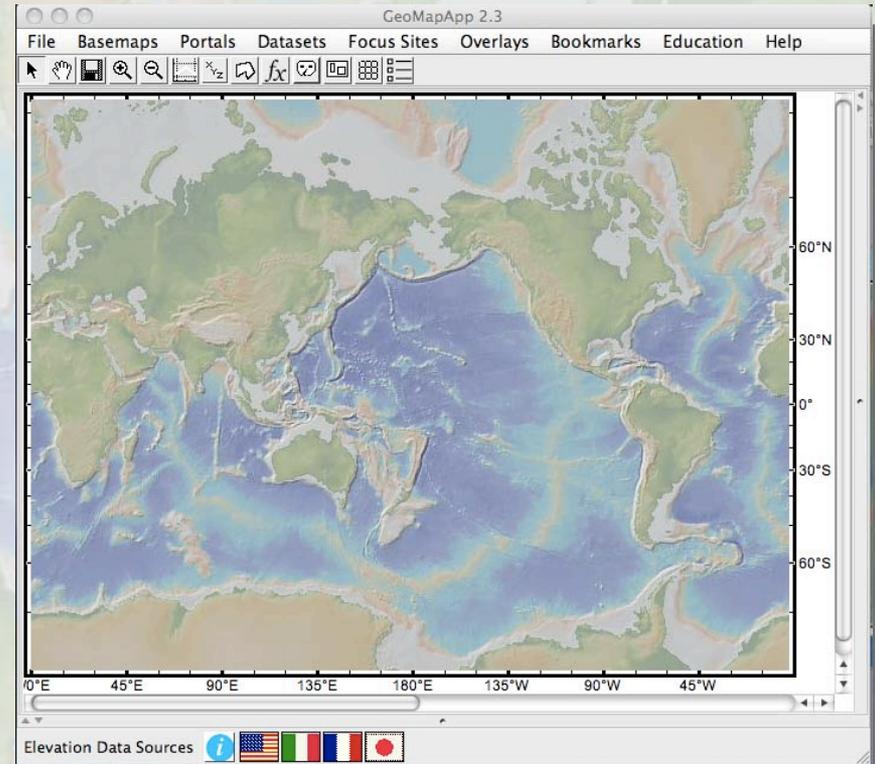
# GMRT: MB Data Reduction & Synthesis

- Bad navigation
- Noisy outer beams
- Attitude problems
- Bad soundings
- Instrument problems
- Bad weather
- Sound velocity
- Slow speed in turns
- Quality assessment for grid weighting and resolution



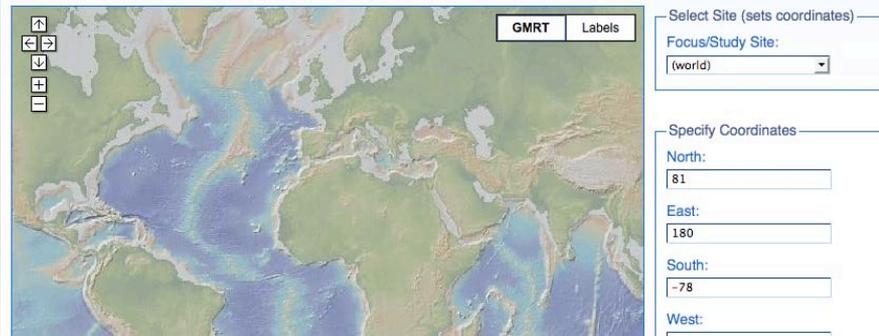
# GMRT: Access

- Images & gridded data
- Desktop Apps
  - GeoMapApp
  - Virtual Ocean
- Web App
  - CM&G
- Web Map Service
  - Images & Mask
- iPad/iPhone
  - Earth Observer



## Create Maps & Grids

Make your own maps and custom grids from our [Global Multi-Resolution Topography](#) compilation (Ryan et al., 2009) by selecting a geographic region or focus/study site below. View the list of [contributors](#) whose data have been incorporated into GMRT.



# GMRT: Attribution to Contributors



## GMRT Contributors

### Portal Links

- [Portal Home](#)
- [What's New](#)
- [Project Documents](#)
- [Related Links](#)
- [Contributors »](#)
- [Media Bank](#)
- [Tutorials](#)
- [GeoMapApp](#)
- [Virtual Ocean](#)

### Access GMRT

- [Create Map/Grid](#)
- [Download for GoogleEarth](#)

#### Multibeam Swath Surveys

#### Contributed Grids

Cruise	Contributor
<a href="#">981107RR</a>	David Checkley
<a href="#">A114-02</a>	Robert Pockalny
<a href="#">A118-22</a>	Jody Deming
<a href="#">AMLR90T</a>	William Turnbull
<a href="#">AMLR94</a>	Thomas Ruzsala
<a href="#">ARIA01WT</a>	Thomas Shipley
<a href="#">ARIA03WT</a>	Thomas Shipley
<a href="#">AT03-46</a>	Stephen Craig Cary
<a href="#">AVON02MV</a>	Hubertus Staudigel

Cruise	Contributor
<a href="#">A112-24</a>	Richard Hey
<a href="#">A118-21</a>	Stephen Hammond
<a href="#">A118-41</a>	Paul Johnson
<a href="#">AMLR92T</a>	Frederick Jones
<a href="#">AMLR95</a>	Thomas Ruzsala
<a href="#">ARIA02WT</a>	Peter Lonsdale
<a href="#">AT01-03</a>	Peter Lemmond
<a href="#">AVON01MV</a>	Peter Lonsdale
<a href="#">AVON03MV</a>	Stanley Hart

# GMRT: Attribution & Access to Source Data

GeoMapApp 2.6.0

File Basemaps Portals Datasets Focus Sites Overlays Bookmarks Education Help

Multibeam Bathymetry Sw...  
Close  
Detach Table  
 View All Expeditions  
EW9903

MARINE GEOSCIENCE DATA SYSTEM

Home About Tools & Services Data Portals Partners Contribute Data Education

### Field: Marine EW9903

View in Enlarged Map

Lead Scientists	Role	Institution	Award
Harding, Alistair	Scientist:Chief	SIO	OCE98-12612
		UCSB	OCE98-11948

Multibeam Bathymetric Data

MARINE GEOSCIENCE DATA SYSTEM

### MGDS - Data Download

Program: EW9903  
Data Type(s): Bathymetry:Swath

You may browse freely, but you may not circulate or publish materials you obtained from this site if you do not accept the terms of... adequate citation to the contributing scientists and MGDS (www.marine-geo.org).

Users are strongly encouraged to contact the original investigators responsible for data made available on this site. Where appropriate researchers are also encouraged to consider collaboration and/or co-authorship with original investigators.

This information is not intended for navigation purposes.

Selecting the **Accept** button below indicates that you have agreed to our [terms of use](#). Data download will begin upon clicking the

NOAA > NESDIS > NGDC > MGG > Multibeam Bathymetry  
NATIONAL GEOPHYSICAL DATA CENTER  
NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

#### EW9903 Data File List

These data are not to be used for navigation.

Downloads may take a long time, depending on file size and data transfer rate.  
[Download All Files](#) <---Click here to package and download all files---

File Name (click to view/download)	File Size
Multibeam Files ---- MBSystem_Cruise Summary	
Version 1 Full Resolution----	
9903hs.d069.mb21.gz	7.5 MB
9903hs.d070.mb21.gz	4.5 MB
9903hs.d071.mb21.gz	3.3 MB
9903hs.d072.mb21.gz	3.2 MB
9903hs.d073.mb21.gz	3.2 MB
9903hs.d074.mb21.gz	3.2 MB
9903hs.d075.mb21.gz	3.1 MB
9903hs.d076.mb21.gz	3.1 MB
9903hs.d077.mb21.gz	3.2 MB
9903hs.d078.mb21.gz	3.0 MB
9903hs.d079.mb21.gz	2.2 MB
9903hs.d080.mb21.gz	3.2 MB
9903hs.d081.mb21.gz	0.5 MB
9903hs.d082.mb21.gz	2.0 MB
9903hs.d083.mb21.gz	3.2 MB

cruise: EW9903, file: 9903hs.d093.gz

Elevation Data Sources

# MBES files from US Academic Fleet



# Multibeam Sonar Data Continuum



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**MAC**  
2011



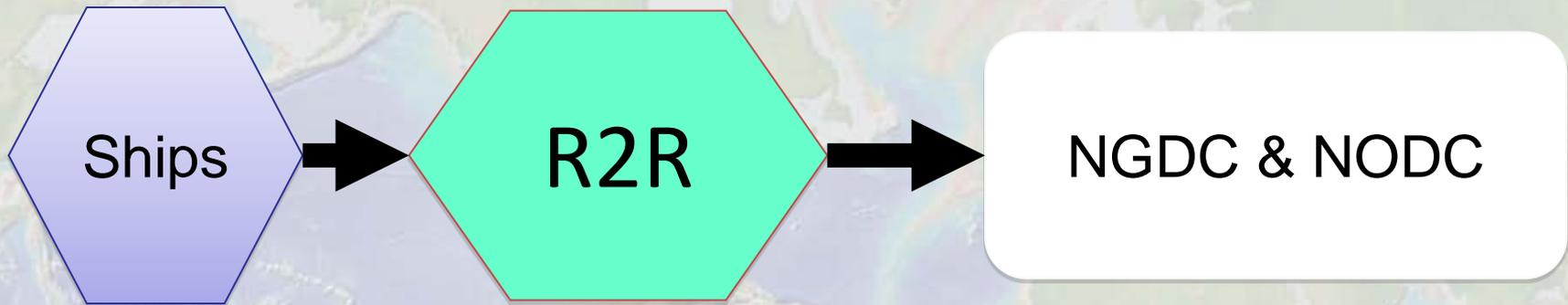
**R2R**  
2009



**GMRT**  
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**GOAL:** *Well-documented high-quality publicly available data*

# Rolling Deck to Repository (R2R)



- Ensure routine data documentation & delivery to National Data Centers (e.g. NGDC, NODC)
- Facilitate compliance with data policies



# R2R Data Stewardship

- Underway Data Types
  - Instruments permanently installed on ships
- Fleet-wide solution
  - Full range of vessels and classes
  - ~500 cruises/year
- Core Services
  - *Data documentation & preservation*
  - *Programmatic Quality Assessment*
  - Final Navigation
  - Event Logger & Real-time MET/TSG



# MBES Data Delivery via R2R

- 491 filesets
- 413 cruises
- > 3 TB  
*as of Oct. 1, 2012*

**Cruise Catalog**

Home

**Cruise Catalog: Healy**

Operator: U.S. Coast Guard

Cruise ID	Start Date	Start Port	End Date	End Port
HLY07D	2007-06-20	Dutch Harbor	2007-06-26	Seattle

**Cruise Catalog: HLY0701**

Operator: U.S. Coast Guard

Cruise ID	Start Date	Start Port	End Date	End Port
2007-04-10	Dutch Harbor	2007-05-12	Dutch Harbor	

**Cruise File List**

http://www.ngdc.noaa.gov/mncd/cruises/results\_top\_0=1&v\_0=NEW907&e=10137&w=34&d=70&d=

National Geophysical Data Center (NGDC)  
NOAA Satellite and Information Service

**HLY0701 Data File List**

These data are not to be used for navigation.

Downloads may take a long time, depending on file size and data transfer rates.

Click here to package and download all files listed below

File Name (click to view/download)	File Size	Description
sb20071002100.mb41	20.1 MB	SeaBeam 2100 series vander format
sb20071002200.mb41	20.2 MB	SeaBeam 2100 series vander format
sb20071002300.mb41	11.3 MB	SeaBeam 2100 series vander format
sb20071010000.mb41	11.2 MB	SeaBeam 2100 series vander format
sb20071010100.mb41	11.4 MB	SeaBeam 2100 series vander format
sb20071010200.mb41	11.5 MB	SeaBeam 2100 series vander format
sb20071010300.mb41	11.6 MB	SeaBeam 2100 series vander format
sb20071010400.mb41	11.3 MB	SeaBeam 2100 series vander format
sb20071010500.mb41	12.5 MB	SeaBeam 2100 series vander format
sb20071010600.mb41	12.6 MB	SeaBeam 2100 series vander format
sb20071010700.mb41	18.3 MB	SeaBeam 2100 series vander format
sb20071010800.mb41	23.4 MB	SeaBeam 2100 series vander format
sb20071010900.mb41	23.2 MB	SeaBeam 2100 series vander format
sb20071011000.mb41	23.7 MB	SeaBeam 2100 series vander format
sb20071011100.mb41	23.3 MB	SeaBeam 2100 series vander format
sb20071011200.mb41	23.2 MB	SeaBeam 2100 series vander format

Click here for vessel details.    \*-(data submitted to)

rvdata.us

# R2R: Quality Assessment

- Programmatic post-cruise review of data
  - Identify “suspicious” data
  - Feedback to Operators
- Distributable Code
  - Leverage existing tools where possible (for MBES data: MB-System)
  - Customizable thresholds
- Generate QA Report
  - Document QA procedures
  - Provide info for downstream data use



# R2R: QA Dashboard

- By Cruise
- By Ship
- By Instrument
- By Test

Rolling Deck to Repository (R2R)

Home About R2R Cruise Catalog News Contact Us Internal

### R2R QA Dashboard

#### All Filesets for RR0903

Cruise Title: *Global Ocean Repeat Hydrography, Carbon, and Tracer Measurements*  
Vessel: Roger Revelle  
Raw Filesets: 10

Rating	Device	Cruise	Vessel	QA Summary	QA Configuration	File Manifest
	gravimeter <i>Bell BGM-3</i>	RR0903	Roger Revelle	<a href="#">QA Summary</a>	<a href="#">QA Configuration</a>	<a href="#">File Manifest</a>
	multibeam <i>Kongsberg EM120</i>	RR0903	Roger Revelle	<a href="#">QA Summary</a>	<a href="#">QA Configuration</a>	<a href="#">File Manifest</a>

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### R2R QA Dashboard

#### All Filesets for Roger Revelle

Raw Filesets: 385

Rating	Device	Cruise	Vessel
	gravimeter <i>Bell BGM-3</i>	RR0901	Roger Revelle
	gravimeter <i>Bell BGM-3</i>	RR0902	Roger Revelle
	gnss <i>Furuno GP-90D</i>	RR0902	Roger Revelle
	gravimeter <i>Bell BGM-3</i>	RR0904	Roger Revelle

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### R2R QA Dashboard

#### Multibeam Filesets

Raw Filesets: 310

Rating	Device	Cruise	Vessel	QA Summary	QA Configuration	File Manifest
	multibeam <i>Kongsberg EM120</i>	RR0903	Roger Revelle	<a href="#">QA Summary</a>	<a href="#">QA Configuration</a>	<a href="#">File Manifest</a>
	multibeam <i>Seabeam 2112</i>	AT15-42	Atlantis	<a href="#">QA Summary</a>	<a href="#">QA Configuration</a>	<a href="#">File Manifest</a>
	multibeam <i>Seabeam 2112</i>	AT15-44	Atlantis	<a href="#">QA Summary</a>	<a href="#">QA Configuration</a>	<a href="#">File Manifest</a>
	multibeam <i>Seabeam 2112</i>	AT15-45	Atlantis	<a href="#">QA Summary</a>	<a href="#">QA Configuration</a>	<a href="#">File Manifest</a>

*Planned release late 2012*

# R2R: MB Quality Assessment



Rolling Deck to Repository

Home

About R2R

## R2R QA Dashboard

### All Filesets for RR0903

Cruise Title: *Global Ocean Repeat Hydrography, Carbon,*

Vessel: Roger Revelle

Raw Filesets: 10

Rating	Device	Cruise	Ves
	gravimeter <i>Bell BGM-3</i>	RR0903	Rog
	multibeam <i>Kongsberg EM120</i>	RR0903	Rog
	gnss <i>Furuno GP-90D</i>	RR0903	Rog
	gnss <i>MX Marine MX421</i>	RR0903	Rog

## QA Summary Info

Cruise: RR0903

Vessel: Roger Revelle

Device Info: multibeam (Kongsberg E

## QA Tests



Across track slope: *0.58 deg*  
minimum: -.5 deg  
maximum: .5 deg



Has minimum metadata



Has surface sound veloc



Number of sound veloc  
total\_mb\_days: 30  
minimum\_number\_for\_  
expected: true  
days\_per\_svp: 2



Percent expected data f  
percentage: 100  
number\_files\_found: 14  
number\_files\_expected:

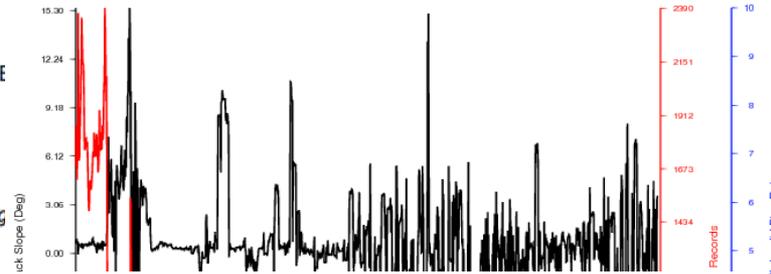


Percent files all valid alt  
minimum: 0 m  
maximum: 12000 m  
percentage: 80

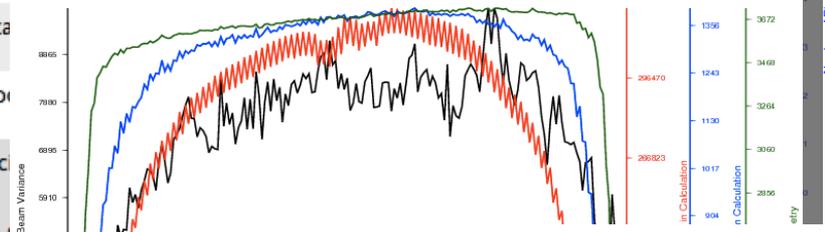


Percent files all valid navigation:  
minimum\_longitude: 18.199900 deg  
minimum\_latitude: -35.183607 deg  
maximum\_longitude: 115.749498 deg  
maximum\_latitude: -30.379563 deg  
percentage: 80

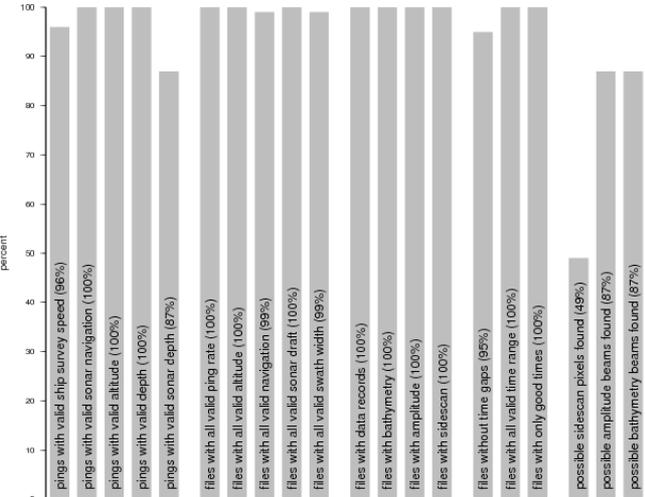
Multibeam File Level QA (Cruise RR0903 File Set 100000515)



Multibeam Variance (Cruise RR0903 File Set 100000515)



Multibeam Percents (Cruise RR0903 File Set 100000515)



Lead: S. O'Hara (LDEO)

# Meanwhile...



- 2010: recognition of fleet-wide issues with multibeam sensor performance
- Workshop Convened at NSF
  - Identified several operational and technical issues, impacting multibeam data quality
  - Strong need to coordinate *operational* and *technical* efforts across the fleet

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# Multibeam Advisory Committee

- Community of Stakeholders
- Fleet-wide Approach
  - Best Practices
  - Technical Resources
- Technical Teams
  - Shipboard Acceptance
  - Acoustic Noise
  - Quality Assurance
- Help Desk



The screenshot displays the website for the Multibeam Advisory Committee. The header features the committee's logo on the left and navigation links for 'About', 'Technical Teams', 'Contact Us', and 'News' on the right. Below the header, a 'Navigation' sidebar lists 'Help Desk', 'Tech Reports', 'Tech Resources', and 'Ship Visits'. The main content area is titled 'Overview' and contains two paragraphs of text. The first paragraph describes the committee's mission to ensure high-quality multibeam data collection across the U.S. Academic Research Fleet. The second paragraph details the focus of technical team activities on deep water systems and the committee's goal to facilitate knowledge exchange. A link to the 'MAC Help Desk' is provided at the bottom of the overview section.

**Multibeam Advisory Committee**

Navigation

- [Help Desk](#)
- [Tech Reports](#)
- [Tech Resources](#)
- [Ship Visits](#)

Overview

The Multibeam Advisory Committee (MAC) is a community-based effort with the goal of ensuring consistent high-quality multibeam data are collected across the U.S. Academic Research Fleet. Our strategy is to create a community of stakeholders including representatives from operating institutions, funding agencies, and key outside experts from the user and technical/engineering communities that can assist in providing guidance on a broad array of multibeam issues.

While MAC technical team activities are currently focused on deep water systems in the US Academic Research Fleet, the MAC recognizes that the community of stakeholders also includes operators and users of shallow-water systems. One of our primary goals is to facilitate the exchange of technical knowledge to promote the optimal performance of multibeam sonar systems used throughout the US Academic Research Community. We welcome contributions of technical information, best practice guidelines, lessons learned, and will do our best to provide suggestions and guidance wherever we can.

Please submit technical questions, comments or suggestions to the [MAC Help Desk](#)

*Co-Chairs:*

V. Ferrini (LDEO), J. Beaudoin (UNH), P. Johnson (UNH)

# MAC Accomplishments

- Test Reports Gathered and Posted
- Tools
  - SVP Editor Tool
  - SVP Mission Planning Tool
- Best Practice Cookbooks
- Ship visits
  - Acoustic Noise Testing
  - Quality Assurance
  - Sea Acceptance
- Assistance to Operators & Investigators



# Reports from Technical Teams

[About](#)[Technical Teams](#)[Contact Us](#)[News](#)

## Multibeam Advisory Committee

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### Navigation

- [Help Desk](#)
- [Tech Reports](#)
- [Tech Resources](#)
- [Ship Visits](#)

### Technical Reports

Title	Team	Post date
<a href="#">Langseth 2012 Quality Assurance Team Report</a>	QAT	08-2012
<a href="#">Kilo Moana 2012 Sea Acceptance Report</a>	SAT	07-2012
<a href="#">Kilo Moana 2012 Acoustic Test Report</a>	ANT	06-2012
<a href="#">Kilo Moana 2012 Quality Assurance Report</a>	QAT	06-2012
<a href="#">Thompson 2010 Sea Acceptance Report</a>	SAT	06-2012
<a href="#">Kilo Moana System Configurations (2012)</a>	QAT	05-2012
<a href="#">Kilo Moana 2010 Acoustic Test Report</a>	ANT	03-2012
<a href="#">Melville 2012 Acoustic Test Report</a>	ANT	03-2012
<a href="#">Atlantis 2011 Acoustic Test Report</a>	ANT	10-2011
<a href="#">Langseth 2011 Acoustic Test Report</a>	ANT	10-2011

# Technical Resources

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## Multibeam Advisory Committee

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### Technical Resources

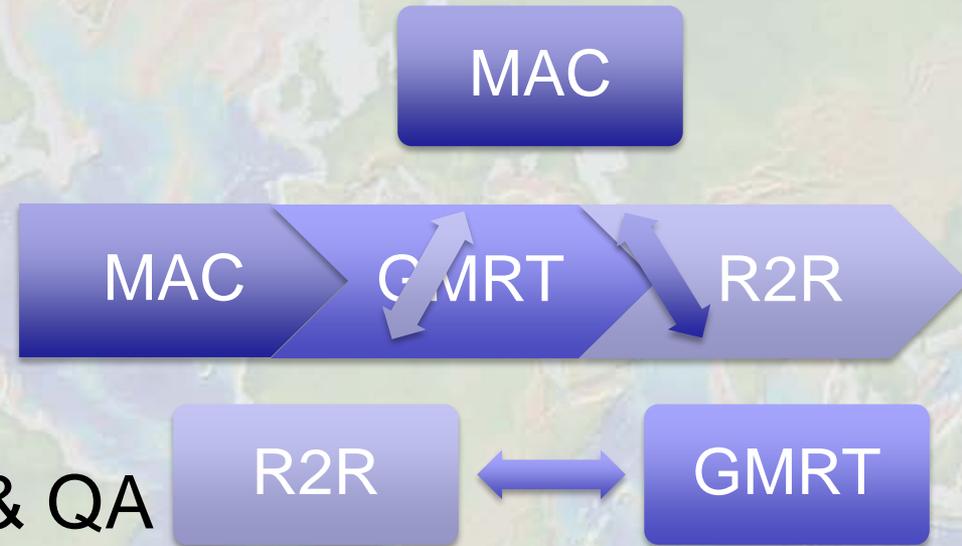
Title	Team	Post date
<a href="#">Tool: Sound Velocity Profile (SVP) Editor [v.1.0.3]</a>	QAT	09-2012
<a href="#">Cookbook: SIS Startup</a>	QAT	07-2012
<a href="#">NOAA Patch Test Documentation</a>	QAT	06-2012
<a href="#">Tool: Sound Velocity Profile (SVP) Mission Planning Toolkit [Preliminary]</a>	QAT	06-2012
<a href="#">Cookbook: SIS Configuration Backup</a>	QAT	05-2012
<a href="#">Cookbook: SIS Software Insalll</a>	QAT	05-2012
<a href="#">Cookbook: SIS Software Uninstall</a>	QAT	05-2012
<a href="#">Tool: Sound Velocity Profile (SVP) Editor [v.1.0.2]</a>	QAT	05-2012
<a href="#">MAC Help Desk</a>	QAT	04-2012
<a href="#">Cookbook: MB Processing with Caris</a>	QAT	03-2012

# Next Steps: Ongoing work & *Integrate*

- *GMRT Synthesis*
  - Ongoing Content
  - QC Reports

- *R2R*
  - Ongoing data delivery & QA
  - Rollout QA Dashboard

- *MAC*
  - Ongoing community engagement
  - Routinely review R2R MBQA Results
  - Provide device-specific info to R2R



# Acknowledgements

- *GMRT Synthesis*
  - LDEO: W.B.F Ryan, S.M. Carbotte, R. Arko, S. O'Hara, K. McLain + more...
- R2R
  - LDEO: S.M. Carbotte, R. Arko, J. Morton, S. O'Hara
  - SIO: S.P. Miller, K. Stocks, D. Clark, A. Sweeney
  - WHOI: A. Maffei, C. Chandler, L. Stolp
  - FSU: S. Smith, M. Bourasa
- MAC
  - UNH: J. Beaudoin & P. Johnson



**GMRT:**

<http://gmrt.marine-geo.org>



**R2R:**

<http://rvdata.us>



[rvdata.us](http://rvdata.us)

**MAC:**

<http://mac.unols.org>

