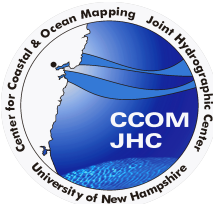


75th Multibeam Sonar Training Course **Bologna, Italy - May 21 to 26, 2018**



Co-hosted by
Istituto di Scienze Marine –
Consiglio Nazionale delle Ricerche
(ISMAR – CNR)

When: From 0800H Monday May 21, 2018
To 1600H Saturday May 26, 2018

Where: ISMAR - CNR
Via P. Gobetti, 101
40129, Bologna, Italy
[44°31'20.29"N 11°20'18.02"E]

Cost: The registration fee is \$3,800, which includes course materials and lunch for 6 days, but not accommodation.

Accommodation: The course venue is a short bus or taxi ride from the centre of Bologna and there are many hotels in the city. However, this is a busy time of year in Bologna and if you intend to attend the course it is recommended that you book your hotel soon. Some suggestions will be provided when participants register for the course.

For more details, do not hesitate to contact:

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Course Description and Outline

This six-day, 36-lecture course is designed to provide a theoretical and practical background in marine swath survey technology and techniques for hydrographic surveys, continental shelf boundary delimitation, offshore engineering, harbour dredging, fisheries habitat, route survey and scientific research, and provides overviews of:

- the technology and problems associated with shallow water multibeam surveys,
- processing and visualization techniques designed to address the complexities of swath mapping,
- constraints on using swath bathymetry to produce highest quality data.

Day	Lecture	Topic	Instructor	
Monday	INTRODUCTION AND REVIEW OF FUNDAMENTAL CONCEPTS			
	01	Historical Perspective and Course Overview	JHC	
	02	Underwater Acoustics A	TW	
	03	Oceanographic and Geologic Concepts	LM	
	04	Underwater Acoustics B	TW	
	05	Spatial Referencing Terms and Concepts	DW	
	06	Visualization Terms and Concepts	LM	
Tuesday	07	Hydrographic Performance Standards	DW	
	SWATH SONAR ISSUES			
	08	Sidescan Sonar Methods	JHC	
	09	Multibeam Sonar Methods	JHC	
	10	Bottom Detection Methods	TW	
	11	Sidescan / Multibeam Backscatter Imaging	TW	
	ANCILLARY SENSOR ISSUES			
	12	Multisensor Integration for Swath Bathymetric Systems	JHC	
	Wednesday	13	Sound Refraction in the Water Column	JHC
		14	Refraction Operational Limitations due to Watermass Variability	JHC
		15	Positioning Requirements: Horizontal, Vertical & Orientation	DW
16		Inertial and Acoustic Methods	DW	
17		GNSS Methods: Global Navigation Satellite Systems	DW	
18		Uncertainty Estimation in Swath Methods	LM	
Thursday	SEABED ACOUSTIC BACKSCATTER			
	19	Acoustic Seabed Interaction Theory	TW	
	20	Acoustic Backscatter Image Interpretation	JHC	
	21	Introduction to Seafloor Characterization	LM	
	22	Oblique Incidence Characterization Methods	LM	
	SURVEY DESIGN AND QUALITY CONTROL			
	23	Survey Design and Planning	LM	
	24	The Patch Test and Sensor to Ship Reference Frame Alignment	JHC	
Friday	25	Field Quality Control: Dynamic Error Recognition and Analysis	JHC	
	26	Achieving Decimetre Bathymetry via Ellipsoid-Referenced Surveys	DW	
	DATA PROCESSING			
	27	Swath Bathymetry Data Cleaning – Interactive and Automated	JHC	
	28	Data Reduction for Chart Compilation Purposes	JHC	
	29	The Swath Processing Pipeline	LM	
	30	Impact and Management of Dense Digital Bathymetry	DW	
	Saturday	CURRENT & FUTURE TECHNOLOGY		
		31	Midwater Mapping	TW
		32	Alternative Approaches for High Density Bathymetric Data Collection	LM
33		MBES Specifications	TW	
34		Operational Field Trials: Assessing Performance	JHC	
35		New Data Presentation Methods	LM	
36		Course Roundup and Discussion on Emerging Issues	ALL	

Instructors

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Advance preparation by attendees

This course is very intensive and fast-paced. Attendees come from various backgrounds and some have found they benefited from some pre-reading for the course. There is no mandatory preparation but we recommend the resources listed below be consulted by those feeling the need for such preparation.

Attendees at previous courses recommended that we provide access to some course materials in advance of the course. Hence, a download link is included in the receipt for payment of course fees, for binder 1 of 3 (we recommend looking at the first 7 lectures in particular). Printed copies will still be provided at the course.

Available at no cost:

International Hydrographic Organization Publication C-13 *Manual on Hydrography* (2005, corrected Feb 2011), particularly chapters 2, 3, 4 and 7

http://www.iho.int/iho_pubs/CB/C13_Index.htm

International Hydrographic Organization Special Publication S-44 *IHO Standards for Hydrographic Surveys*, 5th Edition, February 2008

http://www.iho.int/iho_pubs/standard/S-44_5E.pdf

L3 Seabeam's *Multibeam Sonar Theory of Operations Manual* (2000) at

<http://www.mbari.org/data/mbsystem/sonarfunction/SeaBeamMultibeamTheoryOperation.pdf>

US Army Corps of Engineers *Hydrographic Engineer Manual* (2013-11-30)

particularly chapters 3, 6 and 7, and appendices D and F (example projects appendices H to Q). download at http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1003.pdf

de Jong, Lachapelle, Skone & Elema (2003) *Hydrography* Second Edition, e-book with corrections (2010)

354 pp. ISBN: 90-407-2359-1. Particularly Chapter 11 *Sounding Methods*. Free download from http://www.ucalgary.ca/engo_webdocs/SpecialPublications/Hydrography_2ndEdition_eBook_2010.pdf

The MB-System Cookbook (version 2006-02-16)

<http://www.mbari.org/data/mbsystem/mb-cookbook/index.html>

FIG Guide on the Development of a Vertical Reference Surface for Hydrography (2006), FIG Pub. No. 37.

<http://www.fig.net/pub/figpub/pub37/pub37.pdf>

Lurton & Lamarche (Eds) (2015) *Backscatter measurements by seafloor-mapping sonars. Guidelines and Recommendations*. GeoHab Backscatter Working Group Report. 200p.

<http://geohab.org/wp-content/uploads/2014/05/BSWG-REPORT-MAY2015.pdf>

Available for purchase:

Xavier Lurton (2010) *An Introduction to Underwater Acoustics: Principles and Applications* Second Edition,

(Particularly Chaps 2, 5, 6, 7, 8) 480 pp. Springer Verlag ISBN13: 978-3-540-78480-7 \$419
<http://www.springer.com/earth+sciences+and+geography/oceanography/book/978-3-540-78480-7>

R.J. Urick (1983) *Principles of underwater sound*, 3rd Ed. Peninsula Publishing, ISBN 0-932146-62-7 \$74

http://peninsulapublishing.com/index.php?main_page=product_book_info&cPath=16&products_id=18

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Instructions:

Download free Acrobat Reader <<http://www.adobe.com/go/reader>>. Open this document and fill in under Acrobat. Save and **email to <mbcinfo@hydrometrica.com>**

Name:

Company:

Address:

Phone:

Mobile:

Official E-mail (which, in some organizations, may restrict document downloads):

Personal E-mail (for download of the course materials):

Briefly describe your past experience with Multibeam Sonar Systems; and/or

future plans for work with Multibeam Systems.

Upon receipt of registration, we will email you an **invoice** with payment & accommodation info. Upon receipt of payment, we will email you a **receipt**, with download link for course binders.