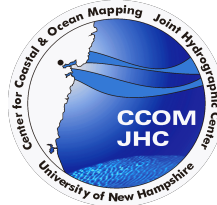


## **78th Multibeam Sonar Training Course Aberdeen, Scotland – 25 to 30 November 2019**



### **Co-hosted by The Hydrographic Society in Scotland**

**When:** From 0815H Monday 25 November 2019  
To 1600H Saturday 30 November 2019

**Where:** Doubletree by Hilton Aberdeen City Centre  
Beach Boulevard,  
Aberdeen, AB24 5EF

**Cost:** The registration fee is USD 3,800, which includes course material downloads and lunch for 6 days, but not accommodation.

**Accommodation:** A block of rooms is reserved for the course at £89.00 Bed & Breakfast at the Doubletree Hotel.

When you register we will provide further information to allow you to book rooms for the course.

**More Information:** Contact Lindsay Gee  
Email [lindsayjgee@gmail.com](mailto:lindsayjgee@gmail.com)  
Phone +1 603 957-1461

THSiS Contact Matthew Garratt  
Email [matthew.garratt@uk.bp.com](mailto:matthew.garratt@uk.bp.com)  
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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	<b>INTRODUCTION AND REVIEW OF FUNDAMENTAL CONCEPTS</b>		
	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	
Tuesday	06 Visualization Terms and Concepts	LM	
	07 Hydrographic Performance Standards	IWC	
	<b>SWATH SONAR ISSUES</b>		
	08 Sidescan Sonar Methods	JHC	
	09 Multibeam Sonar Methods	JHC	
	10 Bottom Detection Methods	TW	
	11 Sidescan / Multibeam Backscatter Imaging	TW	
	<b>ANCILLARY SENSOR ISSUES</b>		
	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		IWC	
16 Inertial and Acoustic Methods		IWC	
17 GNSS Methods: Global Navigation Satellite Systems		DW	
18 Uncertainty Estimation in Swath Methods		LM	
Thursday	<b>SEABED ACOUSTIC BACKSCATTER</b>		
	19 Acoustic Seabed Interaction Theory	TW	
	20 Acoustic Backscatter Image Interpretation	JHC	
	21 Introduction to Seafloor Characterization	LM	
	22 Oblique Incidence Characterization Methods	LM	
	<b>SURVEY DESIGN AND QUALITY CONTROL</b>		
	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	IWC	
	<b>DATA PROCESSING</b>		
	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	IWC	
	Saturday	<b>CURRENT &amp; FUTURE TECHNOLOGY</b>	
		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***John Hughes Clarke**

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*Course Schedule*

The standard daily schedule is:

0830-0930 – lecture	[Monday we start at 0815, to allow time for student introductions.]
0930-0945 - break	
0945-1045 - lecture	
1045-1100 - break	
1100-1200 - lecture	
1200-1330 - lunch	[If we run overtime in the morning, lunch starts as late as 1230]
1330-1430 - lecture	
1430-1445 break	
1445-1545 - lecture	[Saturday open-ended feedback session (Lect 36) starts after Lect 35]
1545-1600 - break	
1600-1700 - lecture	

## *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.

### **Course Introduction:**

Attendees at previous courses recommended that we provide access to some course materials in advance of the course. Hence, after the receipt of payment of course fees, access will be provided to the first seven (7) lectures that cover the course introduction.

### **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](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](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](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](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  
<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  
[http://peninsulapublishing.com/index.php?main\\_page=product\\_book\\_info&cPath=16&products\\_id=18](http://peninsulapublishing.com/index.php?main_page=product_book_info&cPath=16&products_id=18)

*Registration Form*

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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](mailto: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 this registration, we will send you an **invoice** by email, with payment instructions.  
Upon receipt of payment, we will send you a **receipt**, including a link for access to introductory lecture notes.