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Underwater Acoustics 2010

Three Professional Development Courses

at the

National Physical Laboratory
Teddington, London

Basic Underwater Acoustics - September 13- 15

Prof Rodney Coates, Prof Victor Humphrey (ISVR), Stephen Robinson & Dr. Peter Theobald (NPL)

Advanced Underwater Acoustics - September 16 & 17

Prof Rodney Coates, Prof Victor Humphrey (ISVR) , Dr Richard Hazelwood, Dr. Robert Laws (Schlumberger)

Acoustic Monitoring of Marine Wildlife - September 16 & 17

Dr Paul Fernandes (Marine Scotland - Science) , Prof Rodney Coates, Stephen Robinson (NPL)

UNIVERSITY OF
Southampton
Institute of Sound and
Vibration Research

NPL 
National Physical Laboratory

BASIC UNDERWATER ACOUSTICS

September 13 - 15, 2010

Course Fee: £875

Lecturers: Prof. Rodney Coates, Seiche Ltd

Prof. Victor Humphrey, Institute of Sound and Vibration, University of Southampton
Stephen Robinson and Dr. Peter Theobald, National Physical Laboratory

Sunset

Mid-Atlantic

COURSE OBJECTIVES

This course provides an essential understanding of Underwater Acoustics. The mathematical content is kept to a minimum.

Delegates will acquire an excellent understanding of the mechanisms of sound propagation in the ocean, the impact of noise and reverberation produced by the ocean environment and the basic structure and performance of sonar equipment.

WHO SHOULD ATTEND?

This course will be of interest to all involved in the engineering development and application of sonar equipment for defence, environmental and scientific purposes, including contracting and research.

Navy personnel involved in the commissioning of new sonar equipment and in defence applications such as antisubmarine warfare, mine-hunting and battlefield tactics will find it useful. They will also find it an excellent precursor to the Advanced Underwater Acoustics course.

The course will be relevant to those with backgrounds in Fisheries, Environmental Science and Marine Biology, particularly if taken as the precursor to our course on Acoustic Monitoring of Marine Wildlife.

Finally, the course will be of interest to those working in the Offshore Industry concerned with marine seismics and sound propagation in the ocean.

COMMENTS FROM PREVIOUS PARTICIPANTS:

"Very interesting, knowledgeably presented course"

"Covers all domains of underwater acoustics"

"A very complete course"

"Well-organised and of great practical value"

"A complete course, well-illustrated and animated"

"Excellent tutorial material and worked answers"

"Clear and helpful presentations"

"A useful grounding for marine mammal monitoring"

Front cover image provided by Nia Jones, Marine Awareness North Wales. Bottlenose Dolphins (*Tursiops truncatus*) photographed during a marine mammal species survey off Point Lynas, Anglesey.

COURSE OUTLINE

1. OUTLINE OF SONAR SYSTEMS

- A brief history of sonar
- Oceanographic, industrial and navy uses

2. "BACK TO BASICS": PHYSICS

- Density and elasticity in sound propagation
- Sound speed and acoustic refraction
- Acoustic impedance and reflection loss
- International Standard Units (SI)

3. OCEAN NOISE

- Quantitative assessment of noise level
- Examples & spectrograms of ocean noise
- Comparison of noise sources

4. REVERBERATION

- Origins and effects of reverberation
- Estimating signal-to-reverberation ratio
- Reverberation versus noise

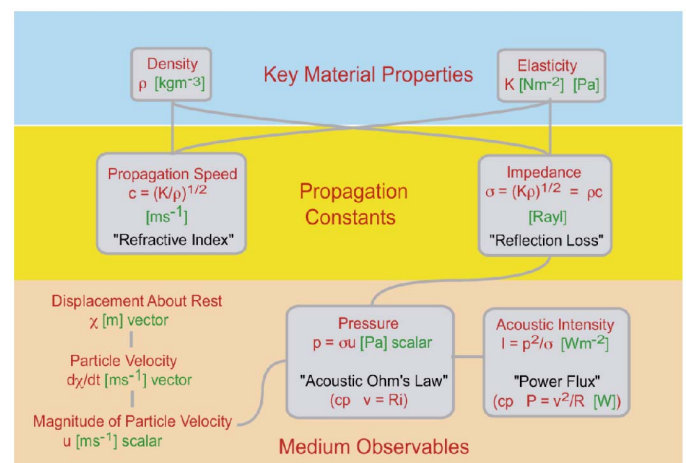
5. THE "SONAR EQUATIONS"

- Spreading and absorption
- Reflection from targets
- Estimating signal-to-noise ratio
- Developing performance estimates

6. TRANSDUCERS

- Piezoelectric transmitters
- Hydrophones
- Survey sources: sparker, boomer, airgun
- Array construction and behaviour

"All You Need To Know About Underwater Acoustics ...". Well, not quite, but here are all the key elements underlying the basic physics. (From the course text "Basic Underwater Acoustics")



ADVANCED UNDERWATER ACOUSTICS

September 16 & 17, 2010

Course Fee: £590

Lecturers: Prof. Rodney Coates, Seiche Ltd

Prof. Victor Humphrey, Institute of Sound and Vibration, University of Southampton

Dr. Richard Hazelwood, R & V Hazelwood Associates LLP

Aircraft Carrier
HMS Illustrious

INTRODUCTION

Following from the earlier module Basic Underwater Acoustics, this course provides an authoritative account of advanced topics in the subject. Although involved mathematical treatments are avoided, delegates should have an understanding of algebra, simple trigonometry and elementary calculus.

COURSE OBJECTIVES

Delegates will gain a full understanding of localised and ambient noise in the ocean. A formal approach to system design will be developed. This will provide a clearly defined rule-set by means of which sonar equipment may be specified. A detailed analysis of naval sonar will be given. Advanced propagation modelling methods will be introduced.

COURSE STRUCTURE

The course will involve the use of computer based presentations which take advantage of modern authoring tools including Director, Mathematica and Quicktime. Delegates will receive full course texts covering the material delivered during the presentations.

WHO SHOULD ATTEND?

This module will be particularly suitable for delegates working in industry who need to respond to "tender specifications" for commercial and military projects.

Navy personnel involved in writing such specifications will find the course invaluable in

COURSE OUTLINE

1. SEA NOISE: SOUNDS & SPECTROGRAMS

- Ambient versus localised noise
- Animated sound spectrograms
- Man-made sounds: ships, machinery, seismics
- Environmental noise: rain, hail, snow, waves
- Biological noise: crustacea, fish and mammals
- Explosive, concussive and vibrational Sources
- Environmental Impact Assessment; mitigation

2. INSTRUMENTS, COMMS and NAVIGATION

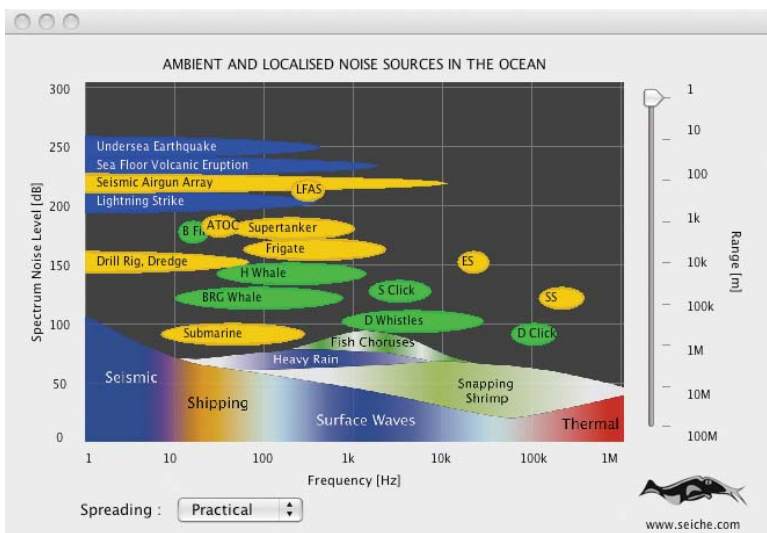
- Acoustic instruments: velocimeters, ADCP ...
- Acoustic navigation & positioning
- Acoustic communications

3. NAVAL SONAR

- Practical propagation models
- SONAR parameters
- Detection theory & operating characteristics
- Tactics, design & commissioning
- Strategies: Active versus Passive
- Equipment: HMS, LFAS, sonobuoy...
- Processing: BTH, LOFAR, DEMON, NB, FM ..

assisting them to provide realistic and achievable targets for contractors. Government defence research personnel and industrial contractors embarking on work in this area will find the course of benefit in upgrading a broad-based degree in engineering, mathematics or physics.

Biologists and environmentalists concerned with acoustic impact and its mitigation will find it particularly helpful to learn how modern Naval sonars operate.



The picture on the left has become an iconic image of ocean noise and its impact on the environment. It has appeared, during recent years, in numbers of official documents and on several websites.

It originated as a rather more general illustration in the Seiche Advanced Underwater Acoustics CD-ROM.

A simple animated version, offering range correction for all localised sources, is to be found on the Seiche website at www.seiche.com/ocean_noise

ACOUSTIC MONITORING OF MARINE WILDLIFE

September 16 & 17, 2010

Course Fee: £590

Dr Paul Fernandes, Marine Scotland - Science
Prof. Rodney Coates, Gillian Coates, Seiche Ltd
Stephen Robinson, National Physical Laboratory

Mola mola
Ocean Sunfish

INTRODUCTION

This year has seen a profound public appreciation of the impact of man's activities on the environment. Global warming, polar melting, vanishing fish-stocks ... the list increases Windfarms, tidal turbines, seismic exploration, and naval activity provide examples of how noise is generated to the detriment of marine wildlife. Disquiet over the plight of the oceans is leading to an insistence on Environmental Impact Assessment (EIA) prior to marine exploitation.

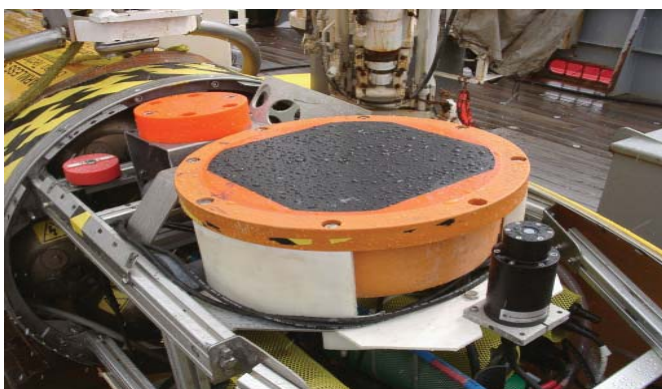
Measurement of underwater noise, consideration of its significance and mitigation of its effects are now key requirements in EIA. Marine mammal or fisheries observers capable of monitoring shipboard practice are in great demand. Personnel competent to handle these activities are urgently sought by employers engaged in defining or meeting EIA requirements.

COURSE OBJECTIVES

Comprehensive training for scientists involved in monitoring, EIA and similar activities. Clear, quantifiable scientific understanding of the impact of high-power acoustics on marine wildlife. Handling of shallow-water measurement and modelling. Descriptions of equipment used in conducting passive and active surveys in the marine ecosystem.

WHO SHOULD ATTEND?

This course will be of value to marine wildlife monitors and to developers and users of civil and military sonars. It will also be of importance to regulators and legislators concerned with EIA, with the conduct and supervision of seismic surveys, marine civil engineering projects, mineral extraction projects and major naval exercises involving high-power sonar. Delegates are strongly advised to attend the Basic Underwater Acoustics course prior to this one.



COURSE OUTLINE

1. NATURAL and MAN-MADE SOURCES

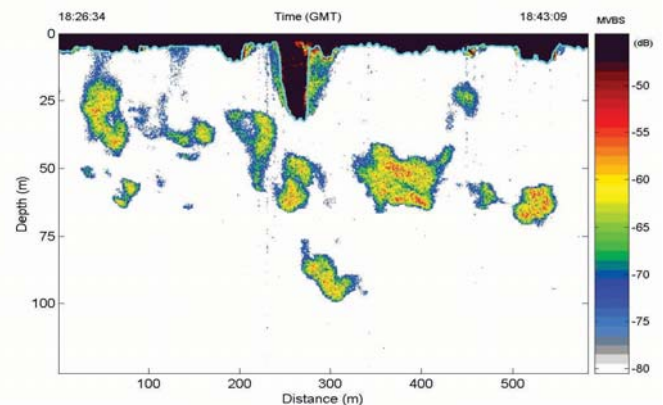
- Reference units, decibels and measurement
- Natural & man-made noise in the ocean
- Bio-noise: crustacea, fish, marine mammals
- Explosive, concussive, vibrational sources
- High-energy source mitigation
- Environmental Impact Assessment (EIA)
- Shallow water measurements & calculations

2. FISHERIES ACOUSTICS

- The Scientific Echosounder
- Acoustic properties of fish
- Abundance estimation

3. MARINE MAMMAL ACOUSTICS

- Passive Acoustic Monitoring
- Moored, Drifting & Towed Arrays
- Tags, Recorders and Landers
- Effects of sound on marine mammals
- Anthropogenic sound: risk and mitigation
- Bio Noise: Crustacea, Fish, Marine Mammals



38 kHz echogram showing krill swarms under sea-ice, Weddell Sea, Antarctica. The fine blue line is the ice-water interface.

These data were taken at a depth of 150 m using an upward-looking SIMRAD EK500 echosounder (left) mounted in AUTOSUB (right).

Images courtesy course lecturer Dr. Paul Fernandes; AUTOSUB Team, NOCS and Kongsberg Simrad.



THE LECTURERS

(www.seiche.com/lecturers.html)

Professor RODNEY COATES, FIEEE is Director of Seiche Ltd and is the principal speaker on the Basic and Advanced Underwater Acoustics courses.

Dr. RICHARD HAZELWOOD (Secretary, IOA) is a highly experienced civil-sector engineering consultant specialising in underwater acoustics.

Professor VICTOR HUMPHREY is a member of staff at the Institute of Sound and Vibration Research (ISVR) at The University of Southampton.

STEPHEN ROBINSON is Head of Underwater Acoustics at the National Physical Laboratory, Teddington and is an expert on transducers, calibration and measurement.

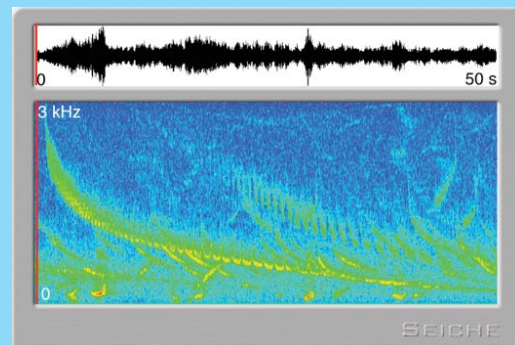
Dr. Peter Theobald is a member of the scientific staff of NPL and is an expert on acoustic emission measurement, interferometric optics and acoustic sensors.

Dr. PAUL FERNANDES heads the Fisheries Independent Methods Group at Fisheries Research Services, Aberdeen.

Dr. Robert Laws is a Geophysicist working for Schlumberger Cambridge Research Ltd. His expertise is in oil-industry seismics and acoustics

COURSE NOTES AND CD-ROM eTEXTS

Full-colour printed course notes plus tutorials, worked answers, supplementary notes and reference materials are provided for each delegate. CD-ROM eTexts accompany the printed notes. This image of a bearded seal and its animated, playable sound spectrogram is typical of the large number of sound samples to be found on the CD-ROM eTexts.



GENERAL INFORMATION

QUERIES AND REGISTRATION

Queries regarding registration and other administrative matters should be directed to:

Gillian Coates, Seiche Ltd., "Swallow Court", Trefor, Anglesey LL65 4TA, United Kingdom

Email: gacoates@seiche.com

Tel: +44 (0)1407 720 474

Fax: +44 (0)1407 720 980

Booking can be made by completing and mailing the booking form in this brochure to Gillian at the above address. Booking can also be made by e-mail, telephone, or fax using the above contact information. Credit card payment is possible, via our secure server account. For on-line secure payment visit www.seiche.com and follow instructions.

Detailed joining instructions, including a map, will be sent to all participants. Places on the courses are limited and early booking is advisable.

Queries regarding technical content or career relevance of the taught material should be addressed to:

Prof. Rodney Coates: rcoates@seiche.com

VENUE

The course will be held in the main auditorium of the National Physical Laboratory, Teddington, London. Information on NPL can be found at www.npl.co.uk

FEES

The course fees cover tuition, a comprehensive set of course notes, lunches and light refreshments but do not cover accommodation or travel. **Please note that all fees must be received before the course start date.**

CANCELLATION

A 10% administration fee will be levied for cancellation made by the participant, up to two weeks prior to the start of the course. Cancellation in the last two weeks will result in transfer to a future course or loss of the full course fee. Alternatively, another person may be substituted to attend the course if it is practical to do so.

Notice of cancellation by the participant must be given in writing by letter or fax. Action will be taken to recover, from the delegate or his/her employer, that proportion of the fee owing at the time of cancellation.

Seiche Ltd reserves the right to cancel or postpone the course because of reasons beyond its control; fees will be refunded in full. Seiche Ltd will endeavour to provide participants with as much notice as possible, should cancellation or postponement become inevitable. Seiche Ltd will not accept liability for costs incurred by participants or their organisations for the cancellation of travel and/or accommodation reservations as a consequence of the course being cancelled or postponed.

ACCOMMODATION

Delegates will be sent information on hotel and bed-and-breakfast accommodation close to NPL as soon as their registration has been received.

PLEASE PHOTOCOPY FOR
USE BY ADDITIONAL
APPLICANTS

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USE BY ADDITIONAL
APPLICANTS

REGISTRATION FORM

UNDERWATER ACOUSTICS COURSES 13 - 17 SEPTEMBER 2010

TITLE	FIRST NAME	SURNAME
JOB TITLE		
ORGANISATION		
ADDRESS		
POSTCODE	E-MAIL	
TEL	FAX	

<input type="checkbox"/> £875 BASIC UNDERWATER ACOUSTICS	ALL FEES MUST BE RECEIVED BEFORE THE COURSE START DATE OF 13 th SEPTEMBER 2010
<input type="checkbox"/> £590 ADVANCED UNDERWATER ACOUSTICS OR	
<input type="checkbox"/> £590 ACOUSTIC MONITORING OF MARINE WILDLIFE	
£ TOTAL	

PAYMENT OPTION 1: WE INVOICE YOUR COMPANY

COMPANY NAME	
ADDRESS (E.G. YOUR FINANCE OFFICE) TO RECEIVE OUR INVOICE	
FOR ATTENTION OF	TEL

PAYMENT OPTION 2.: CHEQUE (ANY CURRENCY) MADE OUT TO **Seiche Ltd**

PAYMENT OPTION 3: CREDIT/DEBIT CARD

We can take card details by telephone or e-mail and complete secure payment for you
Card details will NOT be retained by Seiche Ltd once payment has been processed

You may also pay on-line by navigating to www.seiche.com

Follow instructions for registration which will transfer you to our secure banking service provider

Please e-mail, mail or fax this completed form to

**Gillian Coates, Seiche Ltd., "Swallow Court", Trefor, Anglesey LL65 4TA, United Kingdom
Tel.: +44 (0)1407 720 474 Fax: +44 (0)1407 720 980 e-mail: gacoates@seiche.com**

We will ALWAYS contact delegates by e-mail, as soon as we can, after receiving a booking. For your peace of mind and particularly if you mail or fax the form, please also send us a confirmatory e-mail.

Please do not hesitate to telephone or e-mail for assistance or reassurance