



**OCEANS '09**  
**IEEE Bremen**

11-14 May  
Bremen  
Germany



## Final Program

# OCEANS '09 IEEE Bremen

Balancing technology with future needs

May 11<sup>th</sup> – 14<sup>th</sup> 2009 in Bremen, Germany



Max Planck Institute  
for Marine Microbiology

Hochschule Bremerhaven

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## WELCOME FROM THE GENERAL CHAIR



In the Earth system the ocean plays an important role through its intensive interactions with the atmosphere, cryosphere, lithosphere, and biosphere. Energy and material are continually exchanged at the interfaces between water and air, ice, rocks, and sediments. In addition to the physical and chemical processes, biological processes play a significant role.

Vast areas of the ocean remain unexplored. Investigation of the surface ocean is carried out by satellites. All other observations and measurements have to be carried out in-situ using research vessels and special instruments. Ocean observation requires the use of special technologies such as remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), towed camera systems etc. Seismic methods provide the foundation for mapping the bottom topography and sedimentary structures.

We cordially welcome you to the international OCEANS '09 conference and exhibition, to the world's leading conference and exhibition in ocean science, engineering, technology and management. OCEANS conferences have become one of the largest professional meetings and expositions devoted to ocean sciences, technology, policy, engineering and education. They include participants from government, industry, and academia.

OCEANS '09 addresses scientists, engineers and representatives from authorities and companies, who are active in marine research and technological development. The main topics cover new methods and technologies in ocean exploration.

A number of lectures, organised as special topic sessions, will provide an overview of the latest technological and scientific approaches in ocean research, including recent issues on basic research, and utilisation of natural resources. This is supplemented by an international marine technology exhibition, where leading companies present their products and services.

The technical programme will be complemented by a variety of professional tutorials: Expert presentations partly accompanied by practical exercises offer the opportunity to gain deeper insight into specific technologies and applications.

Furthermore, part of the program will address the future generation of scientists and engineers: university students, undergraduates and Ph.D. students.

# Welcome

In addition, during one of the OCEANS '09 Workshops a forum will be given to discuss the future impact of climatic changes on mankind.

We are looking forward to meeting you in Bremen and wish you a pleasant stay.



Prof. Gerold Wefer  
General Chair  
Oceans'09 IEEE Bremen

## WELCOME TO BREMEN, GERMANY

Bremen, home of the world famous Bremen Town Musicians, is widely known as the vibrant, multifaceted heart of north-west Germany. The 1200 years old Hanseatic city has an exceptional quality that ensures a unique metropolitan city experience. With its sister city of Bremerhaven Bremen forms the smallest state in the German Federal Republic. Main industries are automotive engineering, aerospace technology, food, port management, marine and offshore business.

### Bremen – City of Science

Bremen and Bremerhaven have long been fostering a lively exchange of science and industry. Within the last couple of years the City of Bremen has developed into one of the central locations of marine research and technology in Germany and in Europe.

The major research institutions are the MARUM – Centre for Marine Environmental Sciences, which belongs to the University of Bremen, the Jacobs University of Bremen, the Alfred Wegener Institute for Polar Research (the largest marine research institution in Germany) and the Max Planck Institute for Marine Microbiology, which is spearheading the investigation of micro organisms in the ocean environment. Overall around 1,500 people are now working in the field of marine research in the state of Bremen.

### Bremen – City of Marine Industry

Bremen plays a leading role in marine and offshore technology in Germany. Highly specialized shipyards and suppliers of components for offshore industry and for the German Navy form the economic cornerstone for the successful, worldwide maritime branch of local industry.

## PLENARY SESSION

Tuesday, May 12, 2009

09h00 - 09h10

**Opening remarks by the organisers and the president of the IEEE Oceanic Engineering Society**

Jerry C. Carrol

09h10 - 09h25

**Welcome by the city of Bremen - Minister for Economic Affairs and Ports of the state of Bremen**

Minister Ralf Nagel

Ralf Nagel is Minister for Economic Affairs and Ports of the State of Bremen since June 2007. He graduated in 1985 and started working as a scientific employee for the Member of the Bundestag Gunter Huonker. After different positions in the field of Building and Urban Affairs within the Social Democratic

09h45 - 10h05

### **The impact of underwater acoustic on ocean research and surveillance**

François-Régis Martin- Lauzer, Director NURC

Dr. François-Régis MARTIN-LAUZER joined the NURC in November 2006 as Director, the senior manager at NURC. He provides executive, technical, and scientific direction in the performance of NURC's mission of planning, managing and executing naval science and technology research for NATO. Acting as Chief Operating Officer of the NURC from 1 October 2008, he works closely with NURC's Chief Scientist, with the NATO Research and Technology Board and the NATO Naval Armaments group of the Conference of NATO national armaments directors in the identification, prioritization, and support of specific areas of science and technology development.

10h05 - 10h25

### **The role of ocean technology in marine research**

Chair of the German Marine Research Consortium KDM, Prof. Gerold Wefer

Gerold Wefer is currently Director of the Research Centre MARUM at the University of Bremen. He received his diploma and PhD degree in Marine Geosciences from the University of Kiel/ Germany in 1973 and 1976 respectively. After two stays as a visiting researcher at SCRIPPS Institution of Oceanogra-



phy he became Full Professor of Geosciences at the University of Bremen in 1985. As one of the first faculty members of the newly established Department of Geosciences he was one of the driving forces during the establishment of today's well known DFG Research Centre MARUM. He has acted in a number of functions for instance as the speaker for DFG priority programs, the head of the DFG Senate for Oceanography, member of the Consortium German Marine Science Institutions (KDM, since 2007 President), Coordinator "Stadt der Wissenschaft" Bremen/Bremerhaven, Member SASEC, IODP, Member Senate Leibniz Gemeinschaft, Head of Steering Committee Wissenschaft im Dialog, Chairman of the Geo-Commission of the Deutsche Forschungsgemeinschaft and on a number of other committees.

10h25 - 10h45

### **The strategy of the German government in regard to ocean and maritime technology**

Maritime coordinator of the German Federal Government, Undersecretary of economy Dagmar Wöhr

In November 2005 Dagmar Wöhr was appointed Undersecretary of economy at the Federal Ministry of Economy and in November 2006 Maritime coordinator of the German Federal Government. She started her political career as a member of the local government of the City of Nuremberg. Since 1994 Ms. Wöhr is Member of the German Bundestag. Between 2002 and 2005 she has been spokeswoman for economy issues of the Christian Democratic Party.

## **WORKSHOP ON OCEAN OBSERVATORIES**

Added value of the global integration of ocean observatories

13h30 - 14h00

Transforming Ocean, Earth and Life Sciences with Distributed Submarine Sensor Networks Wired to Next-Generation Internet

John R. Delaney, School of Oceanography, University of Washington

14h00 - 15h00

Scientific and technical objectives of current ocean observatory initiatives -  
Presentations by representatives of OOI, NEPTUNE- Canada, ES  
ONET etc.

15h00 - 16h00

Discussion on global integration aspects and possible road maps

16h00 - 17h00

Get-Together with snacks sponsored by MARIPRO

## TUTORIALS

### **T5 - HIGH-FREQUENCY OVER-THE-HORIZON RADAR APPLICATIONS IN OCEANOGRAPHY** **Salon Danzig**

During the last decade, High-Frequency (HF) radar remote sensing of oceanographic parameters became more and more important. These radar systems are able to monitor large areas of the ocean, far behind the horizon. HF radar networks are currently being installed along the East and West Coasts of the US to contribute to the future monitoring systems (NOAA's IOOS program). This tutorial is split into three parts:

#### **A. Basic Physics of HF Radar:**

Electromagnetic wave propagation, both ground wave and sky wave, dependency on ionospheric conditions, scattering processes at the ocean surface, algorithms to derive surface current maps, ocean wave spectra, and wind direction.

#### **B. Technical Solutions:**

Range resolution by Frequency Modulated Continuous Wave (FMCW) modulation and by pulses, azimuthal resolution by beam forming and by direction finding; advantages and limitations of the different technologies; algorithms to reduce the impact of Radio Frequency Interference (RFI).

#### **C. Application of HF Radar Monitoring Systems:**

How to set up a monitoring system by combining fine-scale ocean current models with HF radar measurements by data assimilation as demonstrated within the European project "European Radar Ocean SEnsing" (EuroROSE); algorithms required for HF radar networks; application of HF radars for ship detection and tracking.

### **Presenter's Bio - Klaus-Werner Gurgel**

Klaus-Werner Gurgel (IEEE M'94) received the diploma in electrical engineering from the University of Hannover, Hannover, Germany, in 1980 and the Ph.D. in geosciences from the University of Hamburg, in 1993.

From 1980 to 1985, he was responsible for the technical development and deployment of the University of Hamburg's HF radar during numerous experiments, which at that time was based on NOAA's Coastal Ocean Dynamics Applications Radar (CODAR). From 1985 to 1993, he was working on a ship borne version of the CODAR for applications at the Arctic Front. In 1996, he developed a new HF radar system called Wellen RADar (WERA) within the European Union (EU)funded project "Surface Current And Wave Variability Experiment" (SCAWVEX), which was later on used within the EU funded projects "European Radar Ocean SEnsing" (EuroROSE) and "Weather Information



Network, Guidance, and Supervision onboard Ships” (Wings-for-Ships). After a technology transfer to industry, WERA is now commercially available and applied by several Universities and Institutions worldwide.

Dr. Gurgel is currently a research scientist at the University of Hamburg, Institute of Oceanography, and involved within numerous projects on radar remote sensing. Since November 2004, he is Adjunct Professor at the Division of Meteorology and Physical Oceanography of the Rosenstiel School of Marine and Atmospheric Science, University of Miami, FL, USA. Dr. Gurgel is a member of IEEE Oceanic Engineering, Geoscience & Remote Sensing, and Antennas and Propagation Society.

## **T6 - THE STOCHASTIC MATCHED FILTER: APPLICATIONS TO DE-NOISING AND DETECTION**

**Salon Scharoun**

In several domains of signal processing, such as detection or de-noising, it may be interesting to provide a second-moment characterization of a noise-corrupted signal in terms of uncorrelated random variables. Doing so, the noisy data could be described by its expansion into a weighted sum of known vectors by uncorrelated random variables. Depending on the choice of the basis vectors, some random variables are carrying more signal of interest information than noise ones. This is the case, for example, when a signal disturbed by a white noise is expanded using the Karhunen-Loève expansion. In these conditions, it is possible either to approximate the signal of interest by keeping only its associated random variables, or to detect a signal in a noisy environment with an analysis of the random variable power. The purpose of this tutorial is to present such an expansion, available for both the additive and multiplicative noise cases, and its application to detection and de-noising. This noisy random signal expansion is known as the stochastic matched filter, where the basis vectors are chosen so as to maximize the signal to noise ratio after processing.

This tutorial is divided into three parts:

- The first part concerns the theory itself: the stochastic matched filter theory will be described for 1-D discrete-time signals and its extension to 2-D discrete-space signals. Furthermore, a study will be realized on two different noise cases: the white noise case and the speckle noise case.
- In the second part, the stochastic matched filter will be described in a detection context and this method will be confronted with signals resulting from underwater acoustics. The results obtained are then compared with those resulting from the classical matched filter theory.
- In the last part, the stochastic matched filter will be presented in a de-noising

context. The de-noising being performed by a limitation to order  $Q$  of the noisy data expansion, two criteria to determine  $Q$  will be introduced.

Experimental results on real SAS data are given to evaluate the performances of such an approach.

This tutorial is intended for people or scientists connected with 1-D/2-D signal or array processing, and interested to have a fly-over about these effective methods.

## **Presenter's Bio - Philippe Courmontagne**

Philippe Courmontagne was born in 1970. He received the Ph. D. degree in Physics at the University of Toulon (France) in 1997. In 1999, he became Professor in a French electronic engineering school: the Institut Supérieur de l'Électronique et du Numérique (ISEN Toulon, France), in the field of signal processing and image processing. He joined in 2001 the Provence Materials and Microelectronics Laboratory (L2MP UMR CNRS 6137), which is a unit of the French national research center (CNRS). In 2005, he obtained his Habilitation (HDR - Habilitation to Supervise Research) for his works in the field of noisy signal expansion. In 2007, he has been elected to the degree of IEEE Senior Member in recognition of professional standing for his works in the field of signal de-noising (SAR, SAS images), signal detection in noisy environment and signal transmission.

## **T7 - ACOUSTICAL UNDERWATER COMMUNICATION PRINCIPLES**

**Salon London**

The main objectives are to present fundamentals and state-of-the-art signaling and processing techniques suitable for acoustical underwater communications. Focus is on physical layer issues, but underwater networking issues are also covered. The whole range from biologically inspired signaling via information-theoretical inspired signaling to practical modulation schemes will be considered.

Outline of Material to be presented:

- Applications of acoustical underwater communications
- Channel characterization (channel measurement strategies, ray tracing, channel emulation, multipath propagation, delay spread, Doppler spread)
- Biologically inspired signaling (whale sounds)
- Information-theoretical inspired signaling (capacity bounds, superposition coding)
- Single-carrier transmission principles (PSK, QAM, CPM, error performance)
- Multi-carrier transmission principles (OFDM, generalized multi-carrier signaling)

- Synchronization and channel estimation
- Equalization
- Mobile underwater communications and adaptation to variable channel conditions
- Array processing (MIMO systems)
- Underwater networking

## **Presenter's Bio - Peter Adam Hoeher**

1986 Master Degree (Dipl.-Ing.) in Electrical Engineering, RWTH Aachen University, Germany

1990 Doctoral Degree (Dr.-Ing.) in Electrical Engineering, University of Kaiserslautern, Germany

1986-1998 Research Assistant and Project Leader, German Aerospace Research Establishment (DLR), Oberpfaffenhofen

1992 Post-Doc, AT&T Bell Laboratories, Murray Hill, USA

1998-1999 Teaching Positions at the University of Erlangen-Nuremberg (Satellite Communications) and Bochum (Digital Modulation and Channel Coding)

Since 1998 Professor for Information and Coding Theory, University of Kiel, Germany

Visiting Researcher at the Australian National University, Canberra, Australia (1994), Communications Research Centre, Ottawa, Canada (1997), and the City University of Hong Kong (2002, 2008)

More than 150 publications in international journals and conference proceedings, more than 2000 citations of the Top10 papers. More than 40 patents in 12 patent families

Associated editor for IEEE Transactions on Communications (1999-2006)

Vice-chairman of the German Chapter of the IEEE Commun. Society (since 2004)

Proponent and member of the excellence cluster "The Future Ocean" of the University of Kiel

Member of the VDE/ITG Expert Committee 5.1 (since 2004)

Member of the VDE/ITG Technical Committee "Algorithms for Signal Processing" and "Applied Information Theory" (since 1999 and 2003)

Managing Director of the Institute of Electrical and Information Engineering of the University of Kiel (2006-2008)

Co-founder and Managing Director of ComSupport GbR (since 2005)

Experience in continuing education in engineering and science since 1994 (Carl Cranz Academy, Oberpfaffenhofen)

## **T8 - AUV TECHNOLOGY AND APPLICATION BASICS**

**Salon Danzig**

AUV Application Basics is a short course that provides an overview of current AUV technologies and operations. The objective is to establish a basic understanding of what currently available AUV systems can provide and what are the best practices in use. The class is targeted at scientists interested in using AUVs for oceanographic applications. The attendee will gain basic understanding of AUV types, technologies, terminology, and navigation techniques, including discussion of the comparative strengths of AUVs and alternative methods of data collection. The attendee will also be provided an understanding of tradeoffs in AUV operations, including power estimation, endurance considerations, and mission structure to acquire the desired data sets. Key points are illustrated by applications and results from the Monterey Bay Aquarium Research Institute's (MBARI) Dorado AUV and other AUV operations. Topics include: Basic AUV technology, AUV at-sea Operation, Payload Considerations, Mission Planning, Upper and Mid-Water AUV missions, Benthic and Mapping AUV missions, Data Collection and Reduction, AUV Integration into Sampling Networks, and a look at coming AUV advances. The interactive format, using the materials provided, allows the attendee discussion time for relevance and demonstration purposes regarding real or potential AUV plans.

**Intended Participants:** This class is intended for scientists interested in applying AUVs to particular problems, persons interested in AUV applications and the impact of AUV technology, as well as graduates in oceanographic fields seeking a broad understanding regarding the application of AUV platforms.

### **Presenter's Bio - William J. Kirkwood**

Bill is currently the Associate Director of Engineering at the Monterey Bay Aquarium Research Institute (MBARI) located in Monterey Bay, California. Bill has a BS in Mechanical Engineering and a MS in Computer Science which he has applied to controls and automation of electromechanical systems and robotics since 1978. Bill has been with MBARI for 16 years as a lead mechanical engineer and program manager developing the Tiburon remotely operated vehicle and Dorado class autonomous underwater vehicles. Bill's focus currently is developing underwater instrumentation for science to look at hydrates and anthropogenic CO<sub>2</sub> ocean acidification issues.

## **T11 - APPLICATION OF MICROSENSORS IN THE MARINE ENVIRONMENT**

**Salon Franzius**

Microsensors have been developed to measure a wide range of substances and parameters. Microsensors have a minute tip diameter, typically only 1/10

of the human hair.

The small size gives the microsensors some extra-ordinary characteristics:

- they can penetrate into soft materials like seafloor sediment without disturbing the processes to be studied
- they can have a fast response (sub-second)
- they equilibrate with temperature very rapidly (sub-second)
- they consume very little analyte and are thus very insensitive to stirring
- they can work under extreme hydrostatic pressure (full ocean).

These characteristics make the sensors unique for a variety of applications in marine research and monitoring. The tutorial will explain in detail about

- The eddy correlation technique for oxygen flux measurements.
- Fast water column oxygen profiles. Fast profiling oxygen measurements in the water column require sensors with a fast response to oxygen and with a fast temperature equilibration.
- Microprofiling in seafloor sediments. Sediments are often highly stratified with layers with very different chemical conditions in close proximity.
- Ultra-low oxygen measurements. Some areas of the ocean have such a low oxygen concentration that it can be difficult to determine whether it is actually zero.

The target audience of the half-day tutorial is the marine environmental monitoring and research community. The tutorial will aim to provide the audience a basic understanding of the theoretical and practical aspects of microsensor technology, and the possibilities and limitations in the different applications will be discussed. Various in situ instruments carrying microsensors will be displayed. The tutorial will include a practical demonstration, which allows the audience to get hands-on experience with the technology.

## **Presenter's Bio - Lars R. Damgaard**

Lars R. Damgaard made his Ph.D. thesis at the Department of Microbiology, University of Aarhus, Denmark, in 1997. After two years in a post.doc. position, Lars became a co-founder of Unisense A/S. Unisense is a company dedicated to providing microsensor technology to the world-wide scientific community, and Lars is responsible for the development of the electronics and in situ research equipment used in conjunction with Unisense microsensors. Furthermore, Lars has been the PI for Unisense on the COBO project, which is a EU project concerned with coastal benthic observatories as well as on a national Danish research project, BIOFLOW.

## T13 - PRECISE BATHYMETRY USING MULTIBEAM ECHO-SOUNDER

**Salon Scharoun**

The lecture gives an introduction to operations with multibeam echosounder, as well as the positioning with high precision GNSS-systems and the attitude determination with inertial measurement systems and GNSS multi antennae arrays. The integration of the positioning, attitude determination and depth measurements in a modular real time system, the error budget and limiting conditions will be presented using examples from actual projects at the Hafen-City University Hamburg (HCU). Additionally the lecture is focused on aspects related to data processing, modeling and visualization.

The examples present projects onboard the survey craft LEVEL-A of the HCU: With the length of 7.5m and a draft of less than 50 cm the boat is optimized to operate in shallow waters. The LEVEL-A is mainly used for education and research purposes. The equipment installed onboard of LEVEL-A offers best conditions for practical exercises: RESON Multibeam SeaBat 8101, INNOMAR Parametric Sub-Bottom Profiler SES-2000 fan incl. Side-Scan, IxSEA motion sensor Octans III, GNSS-Javad-Gyro-4 (GPS, GLONASS), Marine Magnetics Mini Explorer, RESON Sound Velocity Probe SVP 15 and other instruments. Software packages as PDS 2000, QPS Qinsy and Qloud, WinProfile, ISE for SES-2000, Geo++ ® GNNET-RTK and CARIS HIPS/SIPS/GIS are available for survey planning, measuring, and data analysis.

Despite the high accuracy of all used sensors (position, heading, heave, roll, pitch and sound velocity), the main problem is to integrate these complementary sensors with the sonar systems with reference to timing and their relative locations to obtain reliable Digital Terrain Models (DTM). The data delivered by the IMSS components (GNSS-Javad-Gyro-4, Motion Sensor OctansIII, IMU Inertial Measurement Unit) are integrated by the soft-ware GNNET-RTK developed by Geo++ GmbH, Garbsen.

The examples will be taken from measurements for archaeology, wreck search, sand wave and gas detection in shallow waters in Germany.

### **Presenter's Bio - Volker Böder**

Prof. D. Volker Böder was born in 1965 in Rotenburg/Wümme. He graduated in geodesy from the University Hannover in 1994. His doctoral thesis from 2002 at the University of Hannover is about the precise positioning and attitude determination in marine applications. He received his Assessor Degree from the Government of the Federal State of Lower Saxonia in 2005. Since 2005 he is professor for practical geodesy and hydrography at the HafenCity University, Hamburg (HCU). The M.Sc. Hydrography course at the HCU is English spoken. The course is certified with highest level Category A –academic- of the International Advisory Board of the FIG/IHO/ICA.



Volker Böder is board member of the German Hydrography Society (Deutsche Hydro-graphische Gesellschaft, DHyG) and editor of the “Hydrographische Nachrichten”. Additionally he is member of the working group AK3 –measuring methods and systems- of the DVW. In the last years as well as in 2009 Prof. Böder gave a one-week-lecture at the UPM Madrid, Spain. Each year he organizes the International Hydrography Summer Camp, which is free for all interested students.

## **T14 - APPLIED MODEL-BASED SIGNAL PROCESSING – CLASSICAL, MODERN AND BAYESIAN TECHNIQUES** **Salon Bergen**

In this course, we teach basic concepts in model-based signal processing using an applied approach. Participants are exposed to many simulation examples to reinforce the theoretical concepts introduced during the lectures. The student is assumed to have basic knowledge in linear systems, probability and random processes. The tutorial is designed to take the participant from stochastic model development through the heart of physics-based stochastic modeling - the Gauss-Markov state-space model. Estimation basics will be discussed including maximum likelihood and maximum a-posteriori estimators. The state-space model-based processor (MBP) or equivalently Kalman filter will be investigated in order to develop an intuition for constructing successful MBP designs using the “minimum error variance approach”. Practical aspects of the MBP will be developed to provide a reasonable approach for design and analysis. Overall MBP Design Methodology will be discussed. Extensions of the MBP follow for a variety of cases including nonlinear filtering using the classical extended Kalman filter the modern unscented Kalman filter and the current Bayesian particle filter. Applications and case studies will be discussed throughout the lectures. Practical aspects of MBP design will be discussed for “tuning” and processing.

In summary, this course not only provides the participants with the essential theory underlying model-based signal processing techniques, but applied design and analysis. Course Materials: Master copies of the viewgraphs will be provided to the participants.

### **Presenter's Bio - James V. Candy**

James V. Candy is the Chief Scientist for Engineering and former Director of the Center for Advanced Signal & Image Sciences at the University of California, Lawrence Livermore National Laboratory. Dr. Candy received a commission in the USAF in 1967 and was a Systems Engineer/Test Director from 1967 to 1971. He has been a Researcher at the Lawrence Livermore National Laboratory since 1976 holding various positions including that of Project

Engineer for Signal Processing and Thrust Area Leader for Signal and Control Engineering. Educationally, he received his B.S.E.E. degree from the University of Cincinnati and his M.S.E. and Ph.D. degrees in Electrical Engineering from the University of Florida, Gainesville. He has been an Adjunct Professor at San Francisco State University, University of Santa Clara, and UC Berkeley, Extension teaching graduate courses in signal and image processing. He is an Adjunct Full-Professor at the University of California, Santa Barbara. Dr. Candy is a Fellow of the IEEE and a Fellow of the Acoustical Society of America (ASA) and recently elected as a Life Member (Fellow) at the University of Cambridge (Clare Hall College). He is a member of Eta Kappa Nu and Phi Kappa Phi honorary societies. He was elected as a Distinguished Alumnus by the University of Cincinnati. Dr. Candy received the IEEE Distinguished Technical Achievement Award for the “development of model-based signal processing in ocean acoustics.” Dr. Candy was selected as a IEEE Distinguished Lecturer for oceanic signal processing as well as presenting an IEEE tutorial on advanced signal processing available through their video website courses. He was nominated for the prestigious Edward Teller Fellowship at Lawrence Livermore National Laboratory. Dr. Candy has recently been awarded the Interdisciplinary Helmholtz-Rayleigh Silver Medal in Signal Process/Underwater Acoustics by the Acoustical Society of America for his technical contributions. He has published over 200 journal articles, book chapters, and technical reports as well as written three texts in signal processing with a fourth in press. He was the General Chairman of the inaugural 2006 IEEE Nonlinear Statistical Signal Processing Workshop held at the Corpus Christi College, University of Cambridge. He has presented a variety of short courses and tutorials sponsored by the IEEE and ASA in Applied Signal Processing, Spectral Estimation, Advanced Digital Signal Processing, Applied Model-Based Signal Processing, Applied Acoustical Signal Processing, Model-Based Ocean Acoustic Signal Processing and most recently Bayesian Signal Processing for IEEE Oceanic Engineering Society/ASA. He has also presented short courses in Applied Model-Based Signal Processing for the SPIE Optical Society. He is currently the IEEE Chair of the Technical Committee on “Sonar Signal and Image Processing” and was the Chair of the ASA Technical Committee on “Signal Processing in Acoustics” as well as being an Associate Editor for Signal Processing of ASA (on-line JASAE). He has recently been nominated for the Vice Presidency of the ASA as well as the Administrative Committee of IEEE OES. His research interests include Bayesian estimation, identification, spatial estimation, signal and image processing, array signal processing, nonlinear signal processing, tomography, sonar/radar processing and biomedical applications.

## TECHNICAL PROGRAM

**Tuesday, May 12 (13h30 – 15h10)**

**Focke-Wulf Saal**

### **10.4-1 Autonomous underwater vehicles 1**

Co-Chairs: António Pascoal, Instituto Superior Tecnico (IST), Lisbon, Portugal

Exploring Beneath the PIG Ice Shelf with the Autosub3 AUV

Stephen McPhail, National Oceanography Centre, Southampton

Air Launched Platforms - a new approach for underwater vehicles

Peter Stevenson, National Oceanography Centre, Southampton

Comparison between results obtained with Thetis, a real-time multi-vehicles hardware-in-the-loop simulator, and results obtained during sea trials

Olivier Parodi, University of Montpellier, LIRMM

Towards AUV docking on sub-sea structures

Szymon Krupinski, Cybernetix SA

**Tuesday, May 12 (13h30 – 15h10)**

**Lloyd Saal**

### **BRE3-1 Ocean Observing Systems and Strategies 1**

Co-Chairs: Alan Chave, Woods Hole Oceanographic Institution  
Toshihiko Kanazawa, The University of Tokyo

Development of Compact Ocean Bottom Cabled Seismometers System for Spatially Dense Observation on Sea Floor and First Installation Plan

Toshihiko Kanazawa, The University of Tokyo

The IEO Coastal Observing System at the Southern Bay of Biscay, new real-time development: The ocean-meteorological AGL buoy.

Alicia Lavín, Instituto Español de Oceanografía, Santander

TasMAN: The Tasmanian Marine Analysis Network

Gregory Timms, CSIRO, Tasmanian ICT Centre

System Engineering at the edge of a cabled ocean observatory

Peter Phibbs, University of Victoria

# Technical Program

Cyberinfrastructure for the US Ocean Observatories Initiative: Enabling Interactive Observation in the Ocean

Alan Chave, Woods Hole Oceanographic Institution

**Tuesday, May 12 (13h30 – 15h10)**

**Salon Bergen**

## **10.1-1 Vehicle design 1**

Co-Chairs: Massimo Caccia, National Research Council (CNR), ISSIA  
Carolyn Lange, Deutsches Zentrum für Luft- und Raumfahrt

Development of a low-cost autonomous oceanographic observation vehicle  
Spartacus Castro, Technical University of Catalonia

A two-fold strategy for designing minimal fuel consumption, superior seakeeping highly maneuverable marine vessels based on ASAP HULL technology and SONTAG non-linear feedback stabilization

Joule Mikhael, Alexandria University, Faculty of Engineering

Transfer, Adaptation and Further Development of Terrestrial Ocean Vehicle Technology for the Exploration of the Jovian Moon Europa

Carolyn Lange, Deutsches Zentrum für Luft- und Raumfahrt

Prototype Development of the SQX-1 Autonomous Underwater Vehicle

David Shea, Marport Canada Inc.

An overall Pressure Tolerant Underwater Vehicle: DNS Pegel

Carl Thiede, Technical University Berlin

**Tuesday, May 12 (13h30 – 15h10)**

**Salon Danzig**

## **3.3-1 Oceanographic Instrumentation, buoys and cables 1**

Co-Chairs: Peter Linke, IFM-GEOMAR

Optical measurements of nitrate and H<sub>2</sub>S concentrations in Baltic waters

Ralf Prien, Leibniz Institute for Baltic Sea Research (IOW)

Cabled Observatory Technology for Ocean Acidification Research

William Kirkwood, Monterey Bay Aquarium Research Institute

# Technical Program

Development of a new Lagrangian float for studying coastal marine ecosystems

Alexander Schwithal, Technical University of Braunschweig

11,000m class Free Fall Mooring System

Takashi Murashima, JAMSTEC

Biofouling protection for marine underwater observatories sensors

Laurent Delauney, IFREMER

**Tuesday, May 12 (13h30 – 15h10)**

**Salon Franzius**

## **2.8-1 Acoustic Telemetry and Communication 1**

Co-Chairs: Andreja Radošević, University of California San Diego

Frequency-Domain Turbo Equalization for MIMO Underwater Acoustic Communications

Jian Zhang, Missouri University of Science and Technology

Receiver Comparisons on an OFDM Design for Doppler Spread Channels

Sean Mason, University of Connecticut

Divergent Beam Shaping for High Data-Rate Underwater Communications

Craig Benson, University of New South Wales

Cognitive Intelligence in UAC Channel Parameter Identification, Measurement, Estimation, and Environment Mapping

Sadia Ahmed, University of South Florida

Underwater Acoustic Sparse Aperture System Performance: Using Transmitter Channel State Information for Multipath & Interference Rejection

Lisa Burton, Massachusetts Institute of Technology

**Tuesday, May 12 (13h30 – 15h10)**

**Salon London**

## **BRE1 Ecology versus Economy**

Co-Chairs: Jan Schulz, Alfred Wegener Institute, Bremerhaven

Mara Schmiing, University of the Azores

# Technical Program

Geopolitical and eco-economical aspects of natural resources management in Baltic Sea region

Vladimir Anikiev, Russian Ecological Independent Expertise

Quantitative analysis of Omega-3 aliphatic acid from Schizochytrium grown under different spectral photo emissions

Jose Oclarit, Mountain View College

Cost Benefit Analysis in the era of Sustainable Development

Pedro Simal, University of Cantabria

Integrating recent and future marine technology in the design of Marine Protected Areas - the Azores as case study

Mara Schmiing, University of the Azores

**Tuesday, May 12 (13h30 – 15h10)**

**Salon Scharoun**

## **2.1-1 Sonar Signal Processing 1**

Co-Chairs: Andrea Caiti, University of Pisa, DSEA

Timothy Duda, Woods Hole Oceanographic Institution

Sensing the underwater sound field produced by a moving airborne signal source

Brian Ferguson, Defence Science & Technology Organisation

An Underwater Noise Reduction Algorithm using Frame-Based Wavelets

Hui Ou, University of Hawaii at Manoa

Variability of Available Capacity due to the Effects of Depth and Temperature in the Underwater Acoustic Communication Channel

Anuj Sehgal, Jacobs University Bremen

Toward in situ detection of algae species

Florent Colas, IFREMER

Sonar-based AUV localization using an improved particle filter algorithm

Francesco Maurelli, Heriot-Watt University

Pere Ridao, University of Girona



# Technical Program

**Tuesday, May 12 (15h40 – 17h20)**

**Focke-Wulf Saal**

## **10.4-2 Autonomous underwater vehicles 2**

Co-Chairs: James Ferguson, International Submarine Engineering Ltd.

GALATEA, a highly versatile autonomous underwater vehicle with bio-mechanical propulsion

Dick Simons, Delft University of Technology

Portability Investigation of Space Docking Techniques for AUV Docking

Francesco Maurelli, Heriot-Watt University

Cooperating AUV teams: Adaptive area coverage with space-varying communication constraints

Andrea Caiti, University of Pisa, DSEA

Measuring light attenuation with a compact Optical Emission Spectrometer and CTD mounted on a low cost AUV

Klaas Hartmann, CSIRO, Tasmanian ICT Centre

**Tuesday, May 12 (15h40 – 17h20)**

**Lloyd Saal**

## **BRE3-2 Ocean Observing Systems and Strategies 2**

Co-Chairs: Mal Heron, James Cook University

Developing the Ocean Networks Canada Centre for Enterprise and Engagement

Martin Taylor, Ocean Networks Canada

Autonomous Bathymetry for Risk Assessment with ROAZ Robotic Surface Vehicle

Hugo Ferreira, Instituto Superior de Engenharia do Porto

COSYNA, an Integrated Coastal Observation System for Northern and Arctic Seas

Rolf Riethmüller, GKSS Research Centre Geesthacht

# Technical Program

**Tuesday, May 12 (15h40 – 17h20)**

**Salon Bergen**

## **10.1-2 Vehicle design 2**

Co-Chairs: Stephen Wood, Florida Institute of Technology  
Cesar Peña Cortes, Univ. of Madrid and Univ. of Pamplona

Aluminum hull USV for coastal water and seafloor monitoring  
Massimo Caccia, National Research Council (CNR), ISSIA

Underwater parallel robot for oceanic measuring and observation - REMO I:  
Development and navigation control advances  
Rogue Saltaren, Technical University of Madrid

Design, simulation and experimental results of Taipan 300, a new Autonomous Underwater Vehicle prototype.  
Vincent Creuze, University of Montpellier, LIRMM

Empirically Computation of hydrodynamic derivatives of an AUV  
Mojtaba Barjasteh, Sadra HydroIndustry Co.

Development of a Multi-drive Submersible Platform for deep seabed research  
Tjasa Boh, University of Southern Queensland

**Tuesday, May 12 (15h40 – 17h20)**

**Salon Danzig**

## **3.3-2 Oceanographic Instrumentation, buoys and cables 2**

Co-Chairs: Peter Linke, IFM-GEOMAR

Heat flow measurements with the newly designed FIELAX Heat Flow Probe.  
Wiebke Nehmiz, FIELAX GmbH

Smart sensor metamodel for deep sea observatory  
Oussama Kassem Zein, Ecole Nationale Supérieure d'Ingénieurs

Underway CTD - A new tool for underway soundspeed profiling  
Jochen Klinke, The Oceanscience Group

New instruments to monitor coastal sea water masses according to European Water Framework Directive, Trophimatic project  
Michel Repecaud, IFREMER

# Technical Program

Lightframe On-sight Key species Investigation (LOKI) - The art of imaging tiny plankton species on-the-fly

Jan Schulz, Alfred Wegener Institute, Bremerhaven

**Tuesday, May 12 (15h40 – 17h20)**

**Salon Franzius**

## **2.8-2 Acoustic Telemetry and Communication 2**

Co-Chairs: Sean Mason, University of Connecticut

Wen Xu, Zhejiang University

Statistical Characterization and Capacity of Shallow Water Acoustic Channels

Andreja Radošević, University of California San Diego

Experimental studies of time-reversal underwater acoustic communications

Menglu Xia, Zhejiang University

On the use of interwoven order of oncoming packets for reliable underwater acoustic data transfer

Kebkal, EvoLogics GmbH

Implementation and Evaluation of Multihop ARQ for Reliable Communications in Underwater Acoustic Networks

Alvin Valera, Institute for Infocomm Research (I2R), Singapore

Distance Awareness Scheduling for Single-Hop Underwater Ad-Hoc Network

Omar Aldawibi, Newcastle University

**Tuesday, May 12 (15h40 – 17h20)**

**Salon London**

## **BRE5 Renewable Energy**

Co-Chairs: Oliver Zielinski, IMARE Bremerhaven

Innovative Wave Power Generation System Using Electroactive Polymer Artificial Muscles

Seiki Chiba, SRI International

Tidal Stream Power Technology - State of the Art

Jeremy King, Bristol University

# Technical Program

Cabled Observatory Technology for Ocean Renewable Energy Devices  
Harald Grob, OceanWorks, Canada

**Tuesday, May 12 (15h40 – 17h20)**

**Salon Scharoun**

## **2.1-2 Sonar Signal Processing 2**

Co-Chairs: James Candy, Lawrence Livermore National Laboratory

An Underwater Target Classification Scheme Based on Wigner-Ville Distribution and Gustafson-Kessel Clustering  
Hui Ou, University of Hawaii at Manoa

Acoustic Wave Processing and target detection  
Hossein Shahbazi, Institute of Engineering Research

Finite Element Modeling of Sonar Domes with Noise for Transducer Arrays in Sea Environment  
Hind Mestouri, Institut Sup. de l'Electronique et du Numérique, Brest

Evolving Radial Basis Function Neural Network with Hausdorff Similarity Measure for SONAR Signals Detection/ Classification  
Hossein Peyvandi, Scientific Applied Telecommunication College

**Wednesday, May 13 (08h30 – 10h10)**

**Focke-Wulf Saal**

## **10.4-3 Autonomous underwater vehicles 3**

Co-Chairs: Stephen McPhail, Nat. Oceanography Centre, Southampton

UAV and AUVs Coordination for Ocean Exploration  
P.B. Sujit, University of Porto, Faculty of Engineering, LSTS

MR-X1 – An AUV Equipped with A Space Distributed CPU System and A Satellite Telecontrol Interface  
Hiroshi Yoshida, JAMSTEC

Sensor-based problems and techniques for Autonomous Underwater Vehicles  
Bernardo Maciel, University of Porto, Faculty of Engineering

# Technical Program

A Simulation Environment for Autonomous Underwater Vehicles  
Hans-Ulrich Kobialka, Fraunhofer IAIS

AUV docking system for existing underwater control panel  
Panagiotis Sotiropoulos, European Commission JRC, ISPRA

**Wednesday, May 13 (08h30 – 10h10)**

**Lloyd Saal**

## **BRE3-3 Ocean Observing Systems and Strategies 3**

Co-Chairs: Wilhelm Petersen, GKSS Research Centre Geesthacht  
José Pinto, University of Porto, LSTS

All the year round investigations of the current profiles variability near the Curonian Spit (South-East Baltic)  
Vladimir Gorbatsky, Krylov Shipbuilding Research Institute

Large Scale Data Collection Using Networks of Heterogeneous Vehicles and Sensors  
José Pinto, University of Porto, Faculty of Engineering, LSTS

FerryBox - Application of Continuous Water Quality Observations along Transects in the North Sea  
Wilhelm Petersen, GKSS Research Centre Geesthacht

Tsunami Observatory for South Korea  
Klaus Schleisiek, SEND Off-Shore Electronics GmbH

Installation method of high-quality seismic observation in the seafloor  
Sho Kaneko, JAMSTEC

**Wednesday, May 13 (08h30 – 10h10)**

**Salon Bergen**

## **10.2-1 Vehicle navigation 1**

Co-Chairs: Lutz Richter, German Aerospace Center, DLR  
Yoshitaka Watanabe, JAMSTEC

Terrain based localization for pinpoint observation of deep seafloors  
Takeshi Nakatani, The University of Tokyo

# Technical Program

A MOOS-Based Online Trajectory Re-planning System For AUVs  
Matko Barisic, University of Zagreb

Distance Keeping for Underwater Vehicles - Tuning Kalman Filters Using Self-Oscillations  
Nikola Miskovic, University of Zagreb

A tracking of AUV with integration of SSBL acoustic positioning and transmitted INS data  
Yoshitaka Watanabe, JAMSTEC

Subsea Positioning with Tight Coupling of Acoustic and Inertial Technologies  
Pierre-Yves Morvan, IXSEA

**Wednesday, May 13 (08h30 – 10h10)**

**Salon Danzig**

## **3.3-3 Oceanographic Instrumentation**

Co-Chairs: Ralf Prien, Leibniz Institute for Baltic Sea Research (IOW)  
Thomas O'Reilly, Monterey Bay Aquarium Research Institute

Automated Nucleic Biosensors – A Key to High Resolution Monitoring of Marine Phytoplankton  
Katja Metfies, GKSS Research Centre Geesthacht

Instrument interfaces for interoperable ocean sensor networks  
Thomas O'Reilly, Monterey Bay Aquarium Research Institute (MBARI)

PACT - a bottom pressure based, compact deep-ocean tsunameter with acoustic surface coupling  
Andreas Macrander, Alfred Wegener Institute, Bremerhaven

New Technology for Ecosystem-Based Management: Marine Monitoring with the ORCA Kilroy Network  
Eric Thosteson, Ocean Research & Conservation Association

Real-time procedures implemented within coastal HF radar system in the northern Adriatic  
Ivica Vilibic, Institute of Oceanography and Fisheries, Croatia



# Technical Program

**Wednesday, May 13 (08h30 – 10h10)**

**Salon Franzius**

## **2.8-3 Acoustic Telemetry and Communication 3**

Co-Chairs: Peter Hoeher, ComSupport GbR  
Pierre-Philippe Beaujean, Florida Atlantic University

Iterative Equalization for Underwater Acoustic Channels using Bit Interleaved Coded Modulation and Decision Feedback Equalization  
Chintan Shah, Newcastle University

Mitigation of Intercarrier Interference in OFDM Systems over Underwater Acoustic Channels  
Kai Tu, Arizona State University

Shallow water, multi-user navigation and telemetry, performance issues and practical demonstration  
Jonathan Davies, Sonardyne International Ltd

Adaptive Acoustic Underwater Communications based on Generalized Multi-Carrier Interleave-Division Multiplexing  
Peter Hoeher, ComSupport GbR

**Wednesday, May 13 (08h30 – 10h10)**

**Salon London**

## **BRE6 Advanced Technology for Resources Exploration**

Co-Chairs: Tim Freudenthal, University of Bremen, MARUM

High Resolution, Deep-tow Seismic Survey to Investigate Methane Hydrate-bearing Sediments, Nankai Trough, Offshore, JAPAN  
Eiichi Asakawa, JGI, Inc., Tokyo

Methane hydrate detection with marine electromagnetic surveys: case studies off Japan coast  
Tada-nori Goto, Kyoto University

Comparison of machine vision based methods for online in situ oil seep detection and quantification  
Bjoern Saworski, Institute for Marine Resources (IMARE) GmbH

# Technical Program

Detection and identification of hydrocarbons in marine waters using time-resolved laser-fluorescence: Set-up and first results of a new submersible sensor

Peter Rohde, Hochschule Bremerhaven

Shallow Drilling in the Deep Sea: The Sea Floor Drill Rig MeBo

Tim Freudenthal, University of Bremen, MARUM

**Wednesday, May 13 (08h30 – 10h10)**

**Salon Scharoun**

## **2.7 Sonar Imaging**

Co-Chairs: Philippe Courmontagne, Institut Supérieur de l'Electronique et du Numérique (ISEN), Toulon

An improvement on SAS image formation

Philippe Courmontagne, ISEN, Toulon

Acoustic Stereo Imaging (ASI) System

Hassan Assalih, Heriot-Watt University

GPU-based Simulation of Side-looking Sonar Images

Enrique Coiras, NATO Undersea Research Centre

Side Scan Sonar Image Resolution and Automatic Object Detection, Classification and Identification

Wolfgang Jans, Free University of Berlin, FWG

Source number estimation using eigenspace in direction of arrival (DOA) estimate and its application in sonar

WeiQing Zhu, The Chinese Academy of Sciences

**Wednesday, May 13 (10h40 – 12h00)**

**Focke-Wulf Saal**

## **10.4-4 Autonomous underwater vehicles 4**

Co-Chairs: Lutz Richter, German Aerospace Center, DLR

A New Concept for an Obstacle Avoidance System for the AUV

Mike Eichhorn, National Research Council, Canada

# Technical Program

Full Function Air Transportable AUV Joins the Fugro Fleet  
Donald Hussong, Fugro Seafloor Surveys, Inc.

Collaborative Mapping with Autonomous Underwater Vehicles in Low-Bandwidth Conditions  
Benjamin Johnson, University of Idaho

A Fuzzy Logic Resource Optimizer for a Fleet of Autonomous Vehicles in Low-Bandwidth Conditions  
Benjamin Johnson, University of Idaho

Multi AUV control in an operational context: a leader-follower approach  
Rudolf Haraksim, IFREMER

**Wednesday, May 13 (10h40 – 12h00)**

**Lloyd Saal**

## **BRE3-4 Ocean Observing Systems and Strategies 4**

Co-Chairs: Mal Heron, James Cook University

HF Radar Role in an Integrated Ocean Observing System  
Mal Heron, James Cook University

ROSE: development and demonstration of a 'Mobile Response Observatory' prototype for subsea environmental monitoring  
Jean Marvaldi, IFREMER

Precision Timing in the NEPTUNE Canada Network  
Stephen Lentz, Lentz Telecommunications Strategies LLC

Kilo Nalu Cabled Observatory: A Window into the Hawaiian Coastal Environment  
Geno Pawlak, University of Hawaii

**Wednesday, May 13 (10h40 – 12h00)**

**Salon Bergen**

## **10.2-2 Vehicle navigation 2**

Co-Chairs: Stephen Wood, Florida Institute of Technology  
Vincent Creuze, University of Montpellier, LIRMM

# Technical Program

Portable control console for autonomous ocean-going vehicles

David Hlavac, University of Porto, Faculty of Engineering, LSTS

Manoeuvre Based Mission Control System for Autonomous Surface Vehicle

Nuno Dias, Instituto Superior de Engenharia do Porto

Pose-Based SLAM with Probabilistic Scan Matching Algorithm using a Mechanical Scanned Imaging Sonar

Angelos Mallios, University of Girona

Vision Based Localization System for AUV Docking on Subsea Intervention Panels

Tomeu Palmer, Marexi Mediterranean

Coordinated Path following Control of Multiple Nonholonomic Vehicles

Xianbo Xiang, University of Montpellier, LIRMM

**Wednesday, May 13 (10h40 – 12h00)**

**Salon Danzig**

## **4.4 Coastal radars**

Co-Chairs: Thomas Helzel, Helzel Messtechnik GmbH

Eric Gill, Memorial University of Newfoundland

High resolution current and bathymetry information determined by nautical x-band radar in shallow waters

Katrin Hessner, OceanwaveS GmbH

Sharing our experience using wave theories inversion for the determination of the local depth

Stylianos Flampouris, GKSS Research Centre Geesthacht

Accuracy and Reliability of Ocean Current and Wave Monitoring with the Coastal Radar "WERA"

Thomas Helzel, Helzel Messtechnik GmbH

Sediment Modeling based on Radar Observed Surface Hydrodynamics

Stephan Sedlacek, GKSS-Forschungszentrum

# Technical Program

A Simulation Technique for High Frequency Doppler Spectra and Comparison with High-Bandwidth WERA Data

Jianjun Zhang, Memorial University of Newfoundland

**Wednesday, May 13 (10h40 – 12h00)**

**Salon Franzius**

## **2.8-4 Acoustic Telemetry and Communication 4**

Co-Chairs: Milica Stojanovic, Northeastern University  
Peter Hoeher, ComSupport GbR

Design of Receiver Front-End with 25kHz Carrier Frequency and 5 kHz Symbol Rate for Communication System

Seung-Geun Kim, Korea Ocean Research & Development Institute

Sparse Channel Estimation for Multicarrier Underwater Acoustic Communication: From Subspace Methods to Compressed Sensing

Christian Berger, University of Connecticut

High Bit Rate Communication Through Metallic Structures Using Electromagnetic Acoustic Transducers

David Graham, Newcastle University

A Performance Study of the High-Speed, High-Frequency Acoustic Uplink of the HERMES Underwater Acoustic Modem

Pierre-Philippe Beaujean, Florida Atlantic University

**Wednesday, May 13 (10h40 – 12h00)**

**Salon London**

## **6.5 Marine life, ecosystems, and pollution monitoring**

Co-Chairs: Melanie Beck, University of Oldenburg  
Todd Morrison, Nobska

Development of Ballast Water Treatment System Based on Electrochemical Disinfection Technology

Eun-Chan Kim, Korea Ocean Research & Development Institute

Issues and Preliminary Results in Oil Spill Detection Using Optical Remotely Sensed Images

Linda Corucci, University of Pisa

# Technical Program

Topic-based habitat classification using visual data

Oscar Pizarro, Univ. of Sydney, Australian Centre for Field Robotics

An approach for tracking oil slicks by using active contours on satellite images

Sandra Robla, University of Cantabria

Marine biological baseline study in Igaliku fjord, Greenland

Fredrik Søreide, Norwegian University of Science and Technology

**Wednesday, May 13 (10h40 – 12h00)**

**Salon Scharoun**

## **2.7A Sonar Imaging ATLAS**

Co-Chairs: Arne Kraft, Atlas Elektronik GmbH

Ursula Hölscher-Höbing, Atlas Elektronik GmbH

On the Influence of Positioning Errors on Tomography-Based Sonar Imaging Systems

Fritz Boschen, Bergische Universität Wuppertal

Quality assessment of synthetic aperture sonar images

Christian Debes, Technical University Darmstadt

Fast High Resolution Sonar Imaging using High Bandwidth Transducers and Frequency Domain Compounding

Robert Lemor, Fraunhofer IBMT

3D-Sonar Image Formation and Shape Recognition Techniques

Dieter Kraus, Hochschule Bremen

Multi-Beam/Multi-Aspect Image Processing for AUV Application

Ursula Hölscher-Höbing, Atlas Elektronik GmbH

**Wednesday, May 13 (13h30 – 15h10)**

**Focke-Wulf Saal**

## **10.4GA Atlas GREX A**

Co-Chairs: António Pascoal, Instituto Superior Tecnico (IST), Lisbon

Jörg Kalwa, Atlas Elektronik GmbH



# Technical Program

Obstacle Avoidance for Multiple Unmanned Marine Vehicles (MUMVs) in Close Formation

Thomas Glotzbach, Ilmenau University of Technology

Relative positioning of multiple underwater vehicles in the GREX project

Robert Engel, Atlas Elektronik GmbH

Cooperative Autonomous Marine Vehicle Motion Control in the scope of the EU GREX Project: Theory and Practice

António Pascoal, Instituto Superior Tecnico (IST), Lisbon

**Wednesday, May 13 (13h30 – 15h10)**

**Lloyd Saal**

## **BRE7 Estuary systems and Wadden Seas**

Co-Chairs: Götz Flöser, GKSS Research Centre Geesthacht

Observatory in the Wadden Sea: Nutrient cycling and export to the North Sea

Melanie Beck, University of Oldenburg

Monitoring river estuaries and coastal areas using TerraSAR-X data

Stephan Brusch, German Aerospace Center (DLR),

Automated measuring stations in the German Wadden Sea

Götz Flöser, GKSS Research Centre Geesthacht

**Wednesday, May 13 (13h30 – 15h10)**

**Salon Bergen**

## **10.2-3 Vehicle navigation 3**

Co-Chairs: Arne Hoof, IXSEA GmbH, Frankfurt

Full-depth ROV ABISMO and its transponder

Takao Sawa, JAMSTEC

Doppler Water-Track Aided Inertial Navigation for Autonomous Underwater Vehicles

Oyvind Hegrehaes, Kongsberg Maritime

# Technical Program

Preventing Extended Kalman Filter Instabilities During Two Transponder Long Baseline Navigation with Real Time Fuzzy Logic Parameter Adjustment  
Jesse Pentzer, University of Idaho

Path Planning for Multiple Marine Vehicles  
Andreas Häusler, Instituto Superior Tecnico (IST), Lisbon, Portugal

**Wednesday, May 13 (13h30 – 15h10)**

**Salon Danzig**

## **3.2 Current Measurement technology**

Co-Chairs: Albert Williams, Woods Hole Oceanographic Institution

High-Resolution Current Measurements From Space With TerraSAR-X Along-Track InSAR  
Roland Romeiser, University of Miami

The variable-buoyancy drifting DIMES Shearmeter instrument  
Timothy Duda, Woods Hole Oceanographic Institution

Measuring high and low waves with HF radar  
Lucy Wyatt, University of Sheffield

Current and Wave Measurements in Support of Shallow Water Environmental Modeling  
James Churchill, Woods Hole Oceanographic Institution

Simulation of tsunami signatures in ocean surface current maps measured by HF radar  
Anna Dzvonkovskaya, University of Hamburg

**Wednesday, May 13 (13h30 – 15h10)**

**Salon Franzius**

## **7.4 Marine optics technology and communication**

Co-Chairs: John Watson, University of Aberdeen

Studying the behaviour of Norway lobster using RFID and Infrared Tracking technologies  
David Sarrià, Technical University of Catalonia (UPC), SARTI

# Technical Program

Optical Communication for Underwater Wireless Sensor Networks: a VHDL-implementation of a Physical Layer 802.15.4 Compatible

Davide Brizzolara, University of Genoa

An Efficient Transmission Scheme for Underwater Sensor Networks

Soonchul Park, Kyungpook National University

A Data Link Layer in Support of Swarming of Autonomous Underwater Vehicles

Daladier Jabba Molinares, University of South Florida

**Wednesday, May 13 (13h30 – 15h10)**

**Salon London**

## **5.1 Data access, handling and visualization**

Co-Chairs: Benoît Pirenne, University of Victoria, NEPTUNE project  
Are Willumsen, Kongsberg Maritime

Biigle - Web 2.0 enabled labelling and exploring of images from the Arctic deep-sea observatory HAUSGARTEN

Jörg Ontrup, Bielefeld University

Keeping Pace with Technology Through the Development of an Intuitive Data Fusion, Management, Analysis & Visualization Software Solution

Tim Pauly, Myriax Software Pty. Ltd.

The Data Management System for the VENUS and NEPTUNE Cabled Observatories

Benoît Pirenne, University of Victoria, NEPTUNE project

The joys of smoothing

Are Willumsen, Kongsberg Maritime

**Wednesday, May 13 (15h40 – 17h20)**

**Focke-Wulf Saal**

## **10.4GB Atlas GREX B**

Co-Chairs: Jörg Kalwa, Atlas Elektronik GmbH  
António Pascoal, Instituto Superior Tecnico (IST), Lisbon

# Technical Program

GREX sea trials: first experiences in multiple underwater vehicle coordination based on acoustic communication

Lorenzo Brignone, IFREMER

The GREX-Project: Coordination and control of cooperating heterogeneous unmanned systems in uncertain environments

Jörg Kalwa, Atlas Elektronik GmbH

A communication infrastructure for cooperative operation of a fleet of heterogeneous autonomous marine vehicles: Concepts and developments within the GREX project

João Alves, Orange Energy Lda. and Blue Edge Lda., Portugal

**Wednesday, May 13 (15h40 – 17h20)**

**Lloyd Saal**

## **6.1 Ocean Sciences and Meteorology**

Co-Chairs: Nicolas Nowald, University of Bremen, MARUM

Measurements of high concentration sediment plume in the estuary with strong tidal currents

Hwa Chien, National Central University

In-situ sinking speed measurements of marine snow aggregates acquired with a settling chamber mounted to the Cherokee ROV

Nicolas Nowald, University of Bremen, MARUM

Application of a remote controlled hammering drill from space to deep sea

Lutz Richter, German Aerospace Center (DLR)

Physical controls of cold seep methane emissions

Peter Linke, IFM-GEOMAR

Deepwater archaeology - status and potential

Fredrik Søreide, Norwegian University of Science and Technology

**Wednesday, May 13 (15h40 – 17h20)**

**Salon Bergen**

## **10.2-4 Vehicle navigation 4**

Co-Chairs: Vincent Rigaud, IFREMER

# Technical Program

A Conical Laser Light-Sectioning Method for Navigation of Autonomous Underwater Vehicles for Internal Inspection of Pipelines

Unnikrishnan Viswambharan, The University of Tokyo

Terrain Referencing for Autonomous Navigation of Underwater Vehicles

Colin Morice, University of Southampton

Radar Based Collision detection developments on USV ROAZ II

Carlos Almeida, Instituto Superior de Engenharia do Porto

**Wednesday, May 13 (15h40 – 17h20)**

**Salon Franzius**

## **2.2 Array signal processing and array design**

Co-Chairs: Andrea Caiti, University of Pisa, DSEA

James Candy, Lawrence Livermore National Laboratory

Non-Perfect Channel Estimation in OFDM-MIMO-based Underwater Communications

Knut Grythe, SINTEF ICT, Trondheim

Non-linear, adaptive array processing for underwater source localization and sonar interference suppression

Elizabeth Hoppe, Virginia Polytechnic Institute and State University

True time-delay bandpass beamforming: A new implementation

Wen Xu, Zhejiang University

Synthetic Elements for Moving Line Arrays

Mary Johnson, Naval Underwater Weapons Center (NUWC), Newport

Distributed Underwater Source Location Estimation Using a Multi-Array Network

Michael Roan, Virginia Polytechnic Institute and State University

**Wednesday, May 13 (15h40 – 17h20)**

**Salon London**

## **5.3 Numerical modelling**

Co-Chairs: Shreenivas Londhe, Vishwakarma Institute of Information Technology, Pune

# Technical Program

Towards predicting water levels using artificial networks

Shreenivas Londhe, Vishwakarma Inst. of Information Tech., Pune

Development of a GIS-based oil spill risk assessment system

Sonia Castanedo, University of Cantabria

Introducing marine climate variability into life cycle management of coastal and offshore structures

Inigo Losada, University of Cantabria

Real time Sidescan Simulator and Applications

Yan Pailhas, Heriot-Watt University

Web-based GIS dedicated for marine environment surveillance and monitoring

Lukasz Kaminski, Gdansk University of Technology

**Wednesday, May 13 (15h40 – 17h20)**

**Salon Scharoun**

## **8.3-1 Marine law and policy 1**

Co-Chairs: Gerd Winter, University of Bremen

Douglas Burnett, Squire, Sanders, & Dempsey L.L.P.

Offshore Wind Farm Siting In Germany and the United States: Legal and Policy Impediments and Supports

Michelle Portman, Woods Hole Oceanographic Institution

Under-Ice Seabed Mapping with AUVs

James Ferguson, International Submarine Engineering Ltd.

Deep Sea Observatories and International Law

Douglas Burnett, Squire, Sanders, & Dempsey L.L.P.

Place of Refuge for Ships in Need of Assistance - Methodological Approach and Croatian Concept

Zeljko Bradaric, Hydrographic Institute of the Republic of Croatia



# Technical Program

Thursday, May 14 (08h30 – 10h10)

Focke-Wulf Saal

## 3.1 Automatic Control

Co-Chairs: John Potter, NATO/NUS

Nonlinear and adaptive robust control of the ship course with uncertainties on the model

Manuel Casado, University of Cádiz

Robotics Vision-based System for an Underwater Pipeline and Cable Tracker

Mehdi Narimani, Isfahan University of Technology

Condition monitoring and diagnosis for subsea control systems. A subsystem prototype

Edmary Altamiranda, VetcoGray a GE Oil & Gas Business

Automated Purge Valve

Joseph Farrell, Florida Institute of Technology

Formation Stabilization of Underwater Mobile Sensing Networks

Feng Zhengping, Shanghai Jiao Tong University

Thursday, May 14 (08h30 – 10h10)

Lloyd Saal

## 4.5-1 Spaceborne Ocean observing - colour and radar 1

Co-Chairs: René Garello, Telecom Bretagne

Céline Danilo, Telecom Bretagne

Turbidity Measurement from ALOS Satellite Imagery

Hwee-San Lim, Universiti Sains Malaysia (USM)

Monitoring of Water Quality in the Coastal Zone Using Optical Remote Sensing

Carsten Brockmann, Brockmann Consult

Regional objective analysis for merging MERIS, MODIS/Aqua and SeaWiFS Chlorophyll-a data from 1998 to 2008 on the European Atlantic Shelf at a resolution of 1.1Km

Bertrand Saulquin, Telecom Bretagne

# Technical Program

Chlorophyll Measurement from Landsat TM Imagery  
Hwee-San Lim, Universiti Sains Malaysia (USM)

**Thursday, May 14 (08h30 – 10h10)**

**Salon Bergen**

## 10.3 Vehicle performance

Co-Chairs: Gerrit Meinecke, University of Bremen, MARUM

Update on technological developments and operational feedbacks with underwater system at Ifremer  
Vincent Rigaud, IFREMER

System Verification of Autonomous Underwater Vehicles by Model Checking  
Levente Molnar, University of Southampton

Interoperability of agent capabilities for autonomous knowledge acquisition and decision making in unmanned platforms  
Pedro Patron, Heriot-Watt University

Modelling and Motion Simulation of an Underwater Glider with Independently Controllable Main Wings  
Masakazu Arima, Osaka Prefecture University

A Survey on Aerial Submersible Vehicles  
Paulo Junior, Federal University of Minas Gerais (UFMG), Brazil

**Thursday, May 14 (08h30 – 10h10)**

**Salon Danzig**

## 7.1-1 Imaging and vision 1

Co-Chairs: Frank Caimi

The Stereo Vision System for an Underwater Vehicle  
Shojiro Ishibashi, JAMSTEC

Towards real time vision based UUV navigation using GPU technology  
Jonathan Horgan, University of Limerick

Online video mosaicing through SLAM for ROVs  
Fausto Ferreira, National Research Council (CNR), IEIIT

# Technical Program

Online Generation of an Underwater Photo Map  
Heiko Buelow, Jacobs University Bremen

3D Reconstruction Based on Underwater Video from ROV Kiel 6000 Considering Underwater Imaging Conditions  
Anne Sedlazeck, Christian Albrechts University of Kiel

**Thursday, May 14 (08h30 – 10h10)**

**Salon Franzius**

## **2.3 Signal processing techniques**

Co-Chairs: Edmund Sullivan, Prometheus Inc.  
Frank Ehlers, NATO Undersea Research Centre

Superimposed chirped pulse parameter estimation based on the Extended Kalman Filter (EKF)  
Jan Olivier, Council for Scientific and Industrial Research (CSIR)

System Design and Fusion Techniques for Multistatic Active Sonar  
Frank Ehlers, NATO Undersea Research Centre,

Low Complexity Iterative MLSE Equalization in Highly Spread Underwater Acoustic Channels  
Hermanus Myburgh, University of Pretoria

Robust matched field processing for source localization using convex optimization  
Zhuan Xiao, Zhejiang University

Adaptive Model-Based Mine Detection/Localization using Noisy Laser Doppler Vibration Measurements  
Edmund Sullivan, Prometheus Inc.

**Thursday, May 14 (08h30 – 10h10)**

**Salon London**

## **5.5 Information management**

Co-Chairs: Janet Fredericks, Woods Hole Oceanographic Institution

Analysing the multidimensional wave climate with self organizing maps  
Fernando Mendez, University of Cantabria

# Technical Program

IMC: A Communication Protocol for Networked Vehicles and Sensors  
Ricardo Martins, University of Porto, Faculty of Engineering

Integrating QA/QC Standards into OGC Sensor Web Enablement  
Janet Fredericks, Woods Hole Oceanographic Institution

Playback System of Hemire ROV with Statistical Analysis on Exploration Data  
Bang-Hyun Kim, Korea Ocean Research & Development Institute

**Thursday, May 14 (08h30 – 10h10)**

**Salon Scharoun**

## **BRE9 Maritime security and surveillance**

Co-Chairs: Fritz Bekkadal, MARINTEK, Trondheim

Detection and Classification of Off Shore Artificial Objects in TerraSAR-X Images: First Outcomes of the DeMarine-DECO project  
Stephane Estable, EADS Astrium

Utilization of ASAR Wave Mode Data for Shipping Safety  
Xiaoming LI, German Aerospace Center (DLR)

Ship Surveillance by joint use of SAR and AIS  
Susanne Lehner, German Aerospace Center (DLR)

Maritime Surveillance and Monitoring using Autonomous Vehicles with Conditional Integrator-based Control  
Mernout Burger, Norwegian University of Science and Technology

Global Maritime Surveillance with Satellite-based AIS  
Stephan Holsten, OHB-System AG

**Thursday, May 14 (10h40 – 12h00)**

**Lloyd Saal**

## **4.5-2 Spaceborne Ocean observing - colour and radar 2**

Co-Chairs: René Garello, Telecom Bretagne  
Sarab Tay, Telecom Bretagne

Sea surface current retrieval using ASAR WVV acquisitions  
Céline Danilo, Telecom Bretagne

# Technical Program

Internal Wave Observations in the Northern South China Sea from Satellite Ocean Color Imagery

Chung-Ru Ho, National Taiwan Ocean University

Analysis of chlorophyll-A concentration around the South China Sea from ocean color images

Nan-Jung Kuo, National Taiwan Ocean University

New Concept of Passive Measure using GNSS Reflected Signals in Oceanographic Applications

Sarab Tay, Telecom Bretagne

**Thursday, May 14 (10h40 – 12h00)**

**Salon Bergen**

## **10.6-1 Remotely operated vehicles 1**

Co-Chairs: Volker Ratmeyer, University of Bremen, MARUM

Advances in developing telemanipulators for an underwater robot - REMO II

Cesar Peña Cortes, Technical Univ. of Madrid and Univ. of Pamplona

Workspace control system of underwater tele-operated manipulators on ROVs

Bong-Huan Jun, Korea Ocean Research & Development Institute

Europe's growing fleet of scientific deepwater ROVs: emerging demands for interchange, workflow enhancement and training

Volker Ratmeyer, University of Bremen, MARUM

Cable Laying ROV for Real-time Seafloor Observatory Network Construction

Katsuyoshi Kawaguchi, JAMSTEC

How to resolve the paradox of mental workload when navigating and operating underwater - Experiences on a new Human System Interface

Manfred Lueth, KOLPI S.A.S.

**Thursday, May 14 (10h40 – 12h00)**

**Salon Danzig**

## **7.1-2 Imaging and vision 2**

Co-Chairs: Jean-Pierre Hermand, Université libre de Bruxelles

# Technical Program

Rotation estimation from noisy sonar images and distortion corrections for nonlinearities

Hisashi Shiba, NEC Corporation

A Bayesian Approach for Tracking Undersea Narrow Telecommunication Cables

Alberto Ortiz, University of the Balearic Islands

A new approach for Visual Underwater Mapping using Topological Shell Maps

Silvia Botelho, Fundação Universidade Federal do Rio Grande

A model-based method for reducing the sound speed induced errors in multi beam echo sounder bathymetric measurements

Mirjam Snellen, Delft University of Technology

3D Characterization of rain by means of static image processing with projected shadows

Luciano Rentería, University of Cantabria

**Thursday, May 14 (10h40 – 12h00)**

**Salon Franzius**

## **1.4 Acoustical Oceanography**

Co-Chairs: Zbigniew Lubniewski, Gdansk University of Technology

General Oceanographic Research Vessel Radiated Noise Curve

Pam Clark, Alion Science & Technology

Using MBES backscatter strength measurements for assessing a shallow water soft sediment environment

Kerstin Siemes, Delft University of Technology

The Integrated Marine Acoustic Controller System

Edward Thurman, University of Limerick

Acoustic monitoring of the Ushant Front: a feasibility study

Olivier Carrière, Free University of Brussels (U.L.B.)

Using multibeam echoes in seafloor classification

Zbigniew Lubniewski, Gdansk University of Technology



# Technical Program

**Thursday, May 14 (10h40 – 12h00)    Salon Scharoun**

## **8.5 Marine safety and security**

Co-Chairs:        Andrea Caiti, University of Pisa, DSEA  
                     Defu Liu, Ocean University of China

HISS: Harbour intrusion simulator system  
         Andrea Caiti, University of Pisa, DSEA

Prediction of Typhoon Triggered Sea Hazards in China  
         Defu Liu, Ocean University of China

Future Maritime Communication Technologies  
         Fritz Bekkadal, MARINTEK, Trondheim

A Three-Layered Architecture for Real Time Path Planning and Obstacle  
Avoidance for Surveillance USVs Operating in Harbour Fields  
         Giuseppe Casalino, University of Genoa, DIST

**Thursday, May 14 (13h30 – 15h10)**

**Salon Bergen**

## **10.6-2 Remotely operated vehicles 2**

Co-Chairs:        Volker Ratmeyer, University of Bremen, MARUM

Preliminary research on the thruster assisted crawler system for a deep-sea  
ROV  
         Tomoya Inoue, JAMSTEC

Hardware ROV Simulation Facility for the Evaluation of novel Underwater Ma-  
nipulation Techniques  
         Leif Christensen, DFKI, Bremen

Realtime Motion Compensation for ROV-based Tele-operated Underwater  
Manipulators  
         Marc Hildebrandt, DFKI, Bremen

Design and Operational Performance of a Standalone, Passive Heave Com-  
pensation System for a Work Class ROV  
         Andreas Huster, OceanWorks, Canada

# Technical Program

**Thursday, May 14 (13h30 – 15h10)**

**Salon Danzig**

## **9.4 Marine material sciences and marine structures**

Co-Chairs: Kenichi Asakawa, JAMSTEC

New Design Method of Ceramics Pressure Housings for Deep Ocean Applications

Kenichi Asakawa, JAMSTEC

An Economically Rational Selection of Submarine Hull Materials

Max Blanco, University of Southampton

Early Stage Research Vessel Design: Incorporating a Bulbous Forebody Shape to Minimize the Effects of Bubble Sweepdown

Pam Clark, Alion Science & Technology

Development of filler wire for underwater welding as a repair tool for adaptation on AUV

Yana Lizunkova, Leibniz University of Hanover

**Thursday, May 14 (13h30 – 15h10)**

**Salon London**

## **1.7 Ocean Noise and Seismo-Acoustics**

Co-Chairs: Timothy Duda, Woods Hole Oceanographic Institution,  
Olaf Boebel, Alfred Wegener Institute, Bremerhaven

Classification of Odontocete Buzz Clicks Using a Multi-Hypothesis Tracker  
Odile Gerard, NATO Undersea Research Centre,

Wave Energy and Underwater Noise: State of Art and Uncertainties  
Sofia Patrício, Wave Energy Centre, Lisbon

Seafloor receiver function analysis for hybrid dataset composed of both refraction survey and earthquake records  
Hitoshi Mikada, Kyoto University

Geophone Calibration by means of hyperbaric chamber  
Xavier Roset, Technical University of Catalonia

# Student Poster Program

SYSIF a new seismic tool for near bottom very high resolution profiling in deep water

Pierre Leon, IFREMER

Breaking Wave Study from in situ Experiments

Xavier Demoulin, MAREE Lorient, France

## STUDENT POSTER PROGRAM

The Student Poster Program and Competition has been an integral and important part of the OCEANS Conferences since 1989. The program is designed to foster and promote student involvement in technical societies and conferences and to provide a forum for students to interact with marine professionals.

It is open to engineering and science graduate and undergraduate students of any tertiary level university or college worldwide. The program is supported by a grant from the US Navy Office of Naval Research.

The posters will be judged by a panel of judges and prizes will be awarded at the Town Hall Reception. The posters will be on display in the Exhibition area throughout the OCEANS Conference. Students will be at their posters during breaks and free periods.

You are invited and encouraged to view the posters and talk with the students. The roster of students and poster titles are:

Backscattering of Sound from Salinity Fluctuations: Measurements off a Coastal River Estuary

Marcos Sastre, University of Massachusetts Dartmouth

Simulation of the Radar Observation of a Sea Patch using the TLM Electromagnetic Method

Thibaut Lurton, Telecom Bretagne

Control and acquisition system design for an Expandable Seafloor Observatory (OBSEA)

Marc Nogueras, Technical University of Catalonia (UPC), SARTI

Acoustic Modelling of Dolphin Sound Reception and Implications for Biosonar Design

Sabine Graf, University of Bath, Dept. of Mechanical Engineering

# Student Poster Program

Fast phytoplankton classification from fluorescence spectra: comparison between PSVM and SOM

Ismael Aymerich, University of Marine Technology (UTM-CSIC)

Large Scale Optical and Acoustic Sensor Integration for Visualization

Matthew Johnson-Roberson, University of Sydney

Visual Mapping of Internal Pipe Walls using Sparse Features for Application on board Autonomous Underwater Vehicles

Adrian Bodenmann, The University of Tokyo

Blue Whale B and D Call Classification Using a Frequency Domain Based Robust Contour Extractor

Shyam Kumar Madhusudhana, San Diego State University

Analysis of acoustic modem performance for long range horizontal data transmission

Grant Pusey, Curtin University of Technology

A voice recognition system for a submarine piloting

Valentin Soulenq, ISEN, Toulon

The influence of fixed pitch angles on the hydrodynamic performance of marine cross-flow turbines

Claudio Consul, Oxford University

Sensor Network based on IEEE1451 for ocean sensors

Marcel Farré, University of Bremen, MARUM

Designing high speed monohull small crafts (HSMSC) using neural networks guided CFD based optimization

Mohamed Abdel-Salam, Alexandria University, Faculty of Engineering

Developing an IDE interface for the SNAP module

Hermann Bertram, Bremen University, MARUM

WCLES: An innovative environmental friendly combustionless engine for marine applications based on low-current electrolysis technology

Saad Sharaf, Alexandria University, Faculty of Engineering



## Student Poster Program

Correction Method for Buoy Oscillation by Three GPS Receivers  
Midori Shimizu, Kobe University

Using a multi-beam autonomous portable laser equipment to study optical behaviors in shallow waters  
Valerie Robitaille, National Institute for Scientific Research

Forward modeling of paleo heat flow: a case study of Kristin Field, Mid-Norwegian continental shelf  
Yanzhe Fu, Jacobs University Bremen

Improvement for Detection Distance of Sonar by Flat Acoustic Reflector  
Yusuke Yamane, Kobe University

Offshore mussel aquaculture: new or just renewed?  
Tania Lado, University of Rhode Island



## Contact

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