



Oceanic Engineering Society Newsletter

VOLUME XXXXI

NUMBER 2

EDITOR: FREDERICK H. MALTZ

SPRING 2006

(USPS 420-910) ISSN 0746-7834

MTS • IEEE
2006
OCEANS
BOSTON

Revolutionizing
Marine Science
& Technology

September 18-21, 2006 • Hynes Convention Center, Boston, Massachusetts

The banner features a large, stylized wave graphic in shades of blue and green. On the right side, there are three small inset images: a city skyline, a harbor scene, and a person in a white uniform playing a drum.



IEEE OCEANIC ENGINEERING SOCIETY

President

JAMES T. BARBERA
13513 Crispin Way
Rockville, MD 20853
+1 301 460-4347
+1 301 871 3907 (FAX)
j.barbera@ieee.org

Secretary

STEPHEN M. HOLT
11950 Grey Squirrel Lane
Reston, VA 20194
+1 703 610 2000
+1 703 610 1767 (FAX)
sholt@mitretek.org

Assoc. Newsletter Editor

JOHN W. IRZA
Bluefin Robotics Corp.
237 Putnam Ave.
Cambridge, MA 02139
(work) 617-715-7072
(home) 978-470-1276
(cell) 781-648-2144
jirza@ieee.org

Vice President

Technical Activities

STANLEY G. CHAMBERLAIN
22 Heritage Road
Barrington, RI 02806
(401) 245-8914
s.chamberlain@ieee.org

Treasurer

JERRY C. CARROL
411 Country Club Drive
Picayune, MS 39466
jerrycoetz@charter.net

Newsletter Editor

FREDERICK H. MALTZ
821 Runningwood Circle
Mountain View, CA 94040
+1 650 967 5092
+1 650 969 9390 (FAX)
f.maltz@ieee.org

Vice President,

Professional Activities

JAMES S. COLLINS.
Dept. of Elec. & Comp. Engineering
University of Victoria
P.O. Box 3055
Victoria, B.C. CANADA V8W 3P6
+1 250 595 6928
+1 250 595 6908 (FAX)
j.s.collins@ieee.org

Journal of Oceanic

Engineering Editor

CHRISTIAN DE MOUSTIER
Center for Coastal and
Ocean Mapping
Chase Ocean Engineering Lab
University of New Hampshire
24 Colovos Road
Durham, NH 03824-3525
Phone: 603-862-3434
FAX: 603-862-0839
email: cpm@ieee.org

Vice President

Conference Development

JOSEPH R. VADUS
Global Ocean Inc.
8500 Timber Hill
Potomac, Maryland 20854
+1 301 299 5477
+1 301 983 4825 (FAX)
jvadás@erols.com

IEEE Newsletters

PAUL DOTO
445 Hoes Lane
Piscataway, NJ 08855-1331
+1 732 562 3945
+1 732 981 1855 (FAX)
p.doto@ieee.org

Vice President

Conference Operations

RENE M. GARELLO
GET - ENST Bretagne
CNRS UMR 2872 TAMCIC -
Equipe TIME
Dept Image et Traitement de
l'Information
Technopôle Brest Iroise - CS
83818
29238 BREST Cedex -
FRANCE
Tel : +33 (0) 229 00 13 71
Fax : +33 (0) 229 00 10 98
rene.garello@enst-bretagne.fr

Web Coordinator

& Publicity
ARCHIE TODD MORRISON III
Nobska Development
Corporation
Falmouth, MA 02540 USA
+1 508 360 2393
+1 508 539 0808 (FAX)
atmorrison@ieee.org

Jr. Past President

THOMAS F. WIENER
2403 Lisbon Lane
Alexandria, VA 22306-2516
+1 703 768 9522
t.wiener@ieee.org

Sr. Past President

GLEN N. WILLIAMS
Engineering Program Office
Texas A&M University
College Station, TX 77843-3112
979 845 5485
g.williams@ieee.org

Membership Development

KENNETH FERER

Nominations

CLAUDE P. BRANCART

Chapters

JAMES S. COLLINS

Journal Editor

CHRISTIAN DE MOUSTIER

Awards and Fellows

DAVID WEISSMAN
Dept. of Engineering
104 Weed Hall
Hofstra University
Hempstead, N.Y. 11549
516 463 5546
516 463 4939 (Fax)
eggdew@hofstra.edu

Publications Review Board

GLEN N. WILLIAMS

Newsletter Editor

FREDERICK H. MALTZ

Pace

JAMES S. COLLINS

TAB Engineering Research and

Development Policy Committee

JOSEPH R. VADUS

Student Activities Coordinator

NORMAN D. MILLER
2644 NW Esplanade Drive
Seattle, WA 98117-2527
206-784-7154, fax 206-784-0478
colmiller@comcast.net

EX-OFFICIO

ELECTED ADMINISTRATIVE COMMITTEE

ROBERT T. BANNON, President
Bannon International Consulting
301 Willow Run
East Stroudsburg, PA 18301-8591
rtbannon@ieee.org
570 619 5430
570 619 5107 (Fax)

DR. ENSON CHANG
Dynamics Technology, Inc.
21311 Hawthorne Blvd. Suite 300
Torrance, CA. 90503-5602
Tele : (310)543-5433 (x229)
Fax: 543-2117
echang@dynatec.com

ELIZABETH CREED
Institute of Marine & Coastal Sciences
Rutgers University
71 Dudley Road
New Brunswick, NJ 08901-8521
Tele: (732)932-6555 (x531)
Fax: (732)932-8578
creed@marine.rutgers.edu

RENE GARELLO
(see Chapter Chairman, France)

PAMELA J. HURST
Lockheed Martin Maritime Systems &
Sensors
17 Danielle Avenue
Westerly, RI 02891
Cell 401-481-3828
pamela.hurst@lmco.com

WILLIAM M. CAREY
(see Journal Associate Editor)

PROF. DIANE E. DIMASSA
Massachusetts Maritime Academy
Engineering Dept. Harrington 215A
101 Academy Drive
Buzzards Bay, MA, 02532
508-830-5000 x1212
ddimassa@maritime.edu

FERIAL EL-HAWARY
(see Chapter Chairmen)

MALCOM L. HERON
Professor of Physics
Director, Marine Geophysical Laboratory
James Cook University
TOWNSVILLE Q 4811
Telephone: 07 4781 5067
Facsimile: 07 4781 5880
mal.heron@jcu.edu.au

FREDERICK H. MALTZ
(see Newsletter Editor)

MILICA STOJANOVIC
MIT E38-376
Cambridge, Ma 02139
e-mail: millitsa@mit.edu

DR. ROBERT C. SPINDEL
Director Applied Physics Laboratory
University of Washington
1013 NE 40th Street
Seattle, WA 98105
Tele: (206) 543 1310
(Home) (425) 641 9928
spindel@ieee.org

DANIEL D. STERNLICHT
SAS Business Director
Dynamics Technology Inc.
21311 Hawthorne Blvd., Suite 300
Torrance, CA 90503-5602
Tele: (310)543-5433
Fax: (310)543-2117
dsternlicht@dynatec.com

ARCHIE TODD MORRISON III
(See Web Coordinator & Publicity)

TAMAKI URA
Underwater Technology Research Center
Institute of Industrial Science
University of Tokyo
4-6-1, Komaba
Meguro, Tokyo 153-8505 Japan
+81-3-5452-6487
ura@iis.u-tokyo.ac.jp

JOSEPH R. VADUS
(see Vice President International Activities)

ROBERT L. WERNLI
11775 La Colina Road
San Diego, CA 92131-1413
Tel: (858) 553-1948
Fax: (858) 553-1915
rwernli@san.rr.com

IEEE Oceanic Engineering Society Newsletter (ISSN 0746-7834) is published quarterly by the Oceanic Engineering Society of the Institute of Electrical and Electronics Engineers, Inc. Headquarters: 3 Park Avenue, 17th Floor, NY 10017-2394. \$1.00 per member per year (included in Society fee) for each member of the Oceanic Engineering Society. Printed in U.S.A. Periodicals postage paid at New York, NY and at additional mailing offices. Postmaster: Send address changes to IEEE OCEANIC ENGINEERING SOCIETY NEWSLETTER, IEEE, 445 Hoes Lane, Piscataway, NJ 08854

©2006 IEEE

Permission to copy without fee all or part of any material without a copyright notice is granted provided that the copies are not made or distributed for direct commercial advantage, and the title of the publication and its date appear on each copy. To copy material with a copyright notice requires specific permission. Please direct all inquiries or requests to IEEE Copyrights and Permissions Office.

Table of Contents

<i>The President's Corner</i>	3
<i>Meet the New IEEE/OES AdCom Members 2006-2008</i>	4
<i>Thank You Letter for IEEE/OES Donation to Scott Aquarium.</i>	6
<i>From the Editor</i>	6
<i>Recent Additions to OES Technology Committees.</i>	6
<i>Answers to 10 Questions by the two Candidates for 2007 IEEE President-elect</i>	7
<i>Underwater Wireless Communications: Current Achievements and Research Challenges.</i> . . .	10
<i>Advanced Program – US/EU-Baltic International Symposium</i>	14
<i>Conference Calendar</i>	18
<i>OCEANS 07 Aberdeen, Scotland</i>	19

President's Corner

As I write this column, the Excom is preparing to go to the Offshore Technology Conference held annually in Houston. The society has been one of the sponsors for this event for an extended period of time. The attendance at this event is on the order of 50,000. The Excom will be addressing the near term conferences, future venues, updates to our policies and procedures and other business that may be pertinent to the welfare of the organization.

Due to the recently established society policy of implementing two OCEANS conferences on an annual basis, the society is in the process of having a series of web based tools developed. The first attempt was for the Brest conference this past June. They proved to be extremely valuable for the local organizing committee. However, since they are new some problems arose that have been addressed and modifications were made. The initial tool was an abstract review module that is proving to be time saving and efficient for the reviewers and the technical program chair. The module allows for electronic transfer of both the abstracts and the reviews in a timely and efficient manner. The technical committee now has a greater degree of flexibility in the review process. However, the reviewers still need to stay focused and review the abstracts in a timely manner. The process also allows for a more rapid production of the proceedings on a CD as the papers are all in electronic format and can easily be combined on the disc. A registration module is in development that will be tied to the abstract tool so that an author will see a seamless submission



and registration process. The plan is to have this available for OCEANS 06 –Boston. Kudos to Todd Morrison, Rene Garello, Stan Chamberlain, Sandy Williams and Veraprise.

You have all probably received the "member get a member" email from Mike Lightner. The IEEE is upgrading its web site and is adding new benefits. In 2006 you will see the launch of IEEE.tv, which, through streaming video, can place conference presentations, technical seminars, and other items of general interest directly on your desktop. There are also plans to launch a new, online member directory to help our members get in touch, and stay in touch with each other. Along with the present benefits this makes IEEE and OES membership more attractive. Get a colleague to join.

The society has numerous technical committees that address most areas of interest for ocean engineers. If you wish to become a part of any one of the committees contact Sandy Williams. He will explain what will be required of you and direct you to the committee that best fits your interests.

The newsletter welcomes articles of interest to oceanic engineering. Please forward such articles to Fred Maltz. In fact, you may be asked to author a column on the subject you have chosen.

I will close by encouraging all to get involved in the society happenings, as you will appreciate your membership more fully.

Jim Barbera, IEEE/OES President

Meet the New IEEE/OES AdCom Members 2006-2008

René Garello



René Garello (M'85; SM'96, F'06) was born in 1953. He received the Ph.D. degree in Signal Processing at the Institute National Polytechnique de Grenoble (INPG) in 1981. From 1982 to 1984 he worked as a Research Associate at Aeronomy Lab, National Oceanic and Atmospheric Administration (NOAA) at Boulder, Colorado (USA). He joined

the Ecole Nationale Supérieure des Télécommunications de Bretagne (ENST Bretagne), Brest, France in 1985. In 1988 he became Professor in this engineering school in the field of signal processing and image processing and in 1995, Prof. Garello obtained his Habilitation à Diriger les Recherches (HDR; Habilitation to Supervise Research).

Prof. Garello (together with Jean-Yves Jourdain, Thomson Marconi Sonar) has started a French IEEE/OES chapter in 1993 of which he became chairman in 1995. Since 1997 this chapter has been extended to all of Region 8 (except Norway), i.e. around 300 active members. He was in charge of the Student Poster Competition in the Organizing Committee for OCEANS'94, held in Brest, France. He has been co-organizing this competition (together with Norman Miller) for the following OCEANS' series of conferences. For OCEANS'98, held in Nice, France, he was co-chair of the Technical Program Committee, Chair of the publicity Committee and Chair of the Student poster Competition. He is also, since 1997, Associate Editor for Region 8 of the Journal of Oceanic Engineering.

Prof. Garello was an elected AdCom member from 1999 to 2001 and from 2003 to 2005. In the beginning of 2001, he headed the Committee on Conference Policies (CoCoPo) which was in charge of defining a new set of Conference Policies and Procedures in order to insure continuity between the successive OCEANS conferences. This committee jointly held with MTS members defined several new approaches and came up with the concept of two Oceans-a-year (every year in Northern America, every other odd year in Europe and every other even year in Asia-Pacific). In order to implement this plan a new committee was formed: the Joint Oceans Advisory Board or JOAB, of which Prof. Garello is the co-chair. The first actions consisted of implementing a permanent OCEANS Website facility with all the necessary tools for going ALL electronics (from abstracts/papers collection to CD/DVD Proceedings). The second action was the research of an "a la carte" contractor for handling all conference related items not supported by a given local organizing committee (ranging from hotel negotiation to registration supervision).

Prof. Garello was the General Chairman of the first OCEANS of the new Two-Oceans-a-year concept: Oceans'05 Europe held in Brest, France in June 2005. He was elevated to the grade of Fellow of the IEEE, class 2006.

Prof. Garello is also an active member of the IEEE/GRS (Geoscience and Remote Sensing) Society. His main research interests lie in Remote Sensing, 2D signal processing, statisti-

cal and spectral analysis applied to ocean surface features detection and characterization.

Malcom L. Heron



Mal Heron (S'71, M'71, SM'93) gained his Master of Science in Physics at the University of Auckland in New Zealand in 1967 and went on at the same university to complete a PhD in Radio Science in 1971. He was appointed to the Physics Department at James Cook University in 1971 and has had various positions before his

appointment as full Professor of Physics in 1984. He served a term in senior management at James Cook University as Pro-Vice-Chancellor for Science and Engineering 1989-1995.

Mal Heron joined IEEE in 1977 and is currently a Senior Member. He is member of the Ocean Engineering Society and the GeoScience and Remote Sensing Society. He has been a member of the executive committee almost continually since 1985 and was chair during 2001-2003. He is an Associate Editor of the Journal of Oceanic Engineering. He is a Fellow of the Institution of Engineers, Australia and a Fellow of the Australian Institute of Physics.

His fields of expertise are in experimental physics and management. He currently claims to be into the Physics of Remote Sensing with a background in electromagnetism, radio wave propagation, instrumentation. Data processing and electronics as applied to ionospheric physics, meteorology, and marine science and technology. He has managed research projects and consultancies and has had more than a fair exposure to university management.

Frederick H. Maltz



Frederick H. Maltz (A'86, M'87, SM'01) received his B.S. degree from the University of California at Los Angeles in General Engineering and M.S. degree from Stanford University in Statistics.

Mr. Maltz joined the IEEE Oceanic Engineering Society in 1986, first served as a member of the Administrative Committee in 1987 and became OES Newsletter Editor in 1989. He was the IEEE standards coordinator for the society for several years, and has chaired tutorial programs at AUV '96 and at the OCEANS Conferences in 1996, 1999, and 2000. He was presented the IEEE/OES Distinguished Service Award at the OCEANS 2000 Conference and was elected to the grade of IEEE Senior Member in 2001. He continues to serve as newsletter editor, and has recently chaired the tutorials program at the OCEANS 2005 Conference in Washington, DC.

Upon graduating from UCLA, he joined the Navy Research Lab's Sound Division to work on long range and high-resolution sonar. He then took a commission with the Navy and per-

formed his service in airborne radar surveillance. After receiving his degree from Stanford, he became a Research Scientist at the Lockheed Martin Advanced Systems Development Center in Palo Alto. He published extensively during this period and received an award from NASA for his work on the SEASAT remote sensing program. During this period, he did operations research for the Navy, and was also a visiting scientist on the POLYMODE deep ocean current measurement program at the University of Rhode Island Graduate School of Oceanography.

Mr. Maltz joined the Naval Underwater Systems Center in New London, CT in 1979, to lead system-engineering studies for passive submarine sonar. During this period he taught graduate courses in probability and statistics at the RPI Hartford Graduate Center and the URI College of Continuing Education in Rhode Island. In 1985 he joined Westinghouse Oceanic Division as Principal Engineer for surface ship ASW combat systems, and in 1987 returned to Lockheed as a principle investigator on an independent development project for Autonomous Underwater Vehicle side-scan sonar. He retired from Lockheed in 1993, and is currently a consultant.

Milica Stojanovic



Milica Stojanovic (S'90, M'93) graduated from the University of Belgrade, Belgrade, graduated from the University of Belgrade, Yugoslavia, in 1988, and received the M.S. and Ph.D. degrees in electrical engineering from Northeastern University, Boston, Massachusetts, in 1991 and 1993. Upon graduation, she was awarded a Postdoctoral Fellowship at the Woods Hole Oceanographic Institution, where she worked on the problems of high-speed underwater acoustic communications. She was subsequently a Visiting Professor at the Northeastern University, where she taught and developed courses on topics in digital communications. Currently, she is a Principal Scientist at the Massachusetts Institute of Technology, and also a Guest Investigator at the Woods Hole Oceanographic Institution. Her research interests include digital communications theory, statistical signal processing and communication networks, and their application to mobile wireless systems. She is currently working on several projects in the area of underwater acoustic communications, including the design of communication algorithms and network protocols for mobile underwater systems. Milica is an Associate Editor for Communications with the IEEE Vehicular Technology Society.

John Watson



Professor Watson (M'02) holds a Personal Chair in Optical Engineering at the Dept of Engineering of The University of Aberdeen, Scotland. From his PhD, on laser spectral analysis of reactor steels, in 1973, his professional career has been dominated by research activities in Lasers and Optical Engineering. After five years with the UK

Atomic Energy Authority in the north of Scotland he returned to the academic world in 1981, as a Lecturer in Electronic and Electrical Engineering, reaching his present post in 2004. During this time his research activities centered on underwater applications of lasers and optics. His research group has established an international reputation in underwater holography and its' application to measurement of plankton. Other activities include sub sea laser welding, laser induced breakdown spectroscopy, sub sea range-finding and underwater beam propagation. Joint research is undertaken with laboratories in Europe, USA and Russia.

He has published over 100 papers on laser-related research and is an Editorial Board member of several optics and lasers journals; has chaired many sessions, and presented invited talks at international laser/optics and sub sea conferences and has also served on the organizing committees of many of these. He is a Fellow of the (UK) Institute of Physics and holds Chartered Engineer (CEng), Chartered Physicist (CPhys) and Chartered Scientist (CSci) status. He joined the IEEE and OES in 2002.

Professor Watson is the Executive Chair of Oceans07 Europe, which will be held in Aberdeen, Scotland in June 2007: the first time "Oceans" will be in the UK. He is Co-Chair (European) of the Sub Sea Optics and Vision Technical Group of OES (formerly the Non-acoustic Image Processing Group).

Robert L. Wernli



Robert L. Wernli (M'97) received the B.S. degree in mechanical engineering from the University of California Santa Barbara in 1973 and the M.S. degree in engineering design from San Diego State University, San Diego, CA in 1985. He has worked in the field of underwater robotics research and development at the Space and Naval Warfare Systems Center (SSC) San Diego (formerly the Naval Ocean Systems Center) since 1973 until his retirement in 2005. His work there focused on the development of advanced undersea work systems, manipulators and tools for use to full ocean depths by both manned and unmanned vehicles. He is continuing to work in underwater robotics and fiction writing under his own company—First Centurion Enterprises.

He has been actively engaged in promoting the oceans, including the use of remotely operated vehicles, by creating and chairing the first 10 Remotely Operated Vehicle conferences (ROV '83-ROV '92), co-chairing OCEANS MTS/IEEE '95, and OCEANS MTS/IEEE '03 (San Diego) and Underwater Technology '04 (Taiwan) conferences. He has nearly 30 technical publications and was editor and co-author of the book Operational Effectiveness of Unmanned Underwater Systems, published on CD-ROM in 1999.

Mr. Wernli is a member of the American Society of Mechanical Engineers, the Institute of Electrical and Electronics Engineers' Oceanic Engineering Society, and a fellow of the Marine Technology Society (MTS). He is a recipient of the MTS Special Commendation and Award, the SSC San Diego Exemplary Service Award and the Navy Meritorious Civilian Service Award. In 2002 he received the prestigious Lauritsen-Bennet award for Excellence in Engineering from SSC San Diego.

Thank You Letter For IEEE/OES Donation to Scott Aquarium

On November 28, 2005, Sharon H. Walker, PhD and Administrator for the J.L. Scott Marine Education Center and Aquarium wrote:

I wish to take this opportunity to personally thank you for your contribution in the "rebirth" of the University of Southern Mississippi's (USM) and the Gulf Coast Research Laboratory's (GCRL) J.L. Scott Marine Education Center and Aquarium (MEC&A). The GCRL would also like to express its appreciation for your efforts in advancing the mission of the MEC&A. Your support—through the donation of \$5,000 to the Marine Education Center Relief Fund—will enable the MEC&A Staff to continue fostering an increased awareness and understanding of marine and aquatic environments, which will create a more knowledgeable citizenry capable of making responsible decisions about these fragile resources.

We also want you to be aware the MEC&A is temporarily relocated to the GCRL's Ocean Springs Campus in a 3,500 square-foot facility. In this vein, MEC&A Educators began taking its structured programs "on the road" the first week of November and all of the Center's spring and summer programs for teachers and students will be implemented at the "new" facility in Ocean Springs. Although it seems we are in a "time warp" in having to "start over," with many challenges before us, we are so grateful for the opportunities the Mississippi Gulf Coast Community and colleagues across this country are pro-

viding us from used computers; to multiple teacher resources (books, notebooks, canvas bags, posters, pens, and paper); to laboratory glassware; to microscopes; to living fish, spiders, and reptiles; to animal enclosures; to aquariums; to folding tables; to chairs; to filtration systems; to shells; to animal artifacts; to filing cabinets; to staff desks; to personal visits in helping us "begin again" offers; to cash donations; and much, much more! Further, the GCRL should receive its eight FEMA trailers next week and two 24' x 64' will be used for four, Scott Aquarium educational precollege classrooms. Research staff members will be using the remaining mobile classrooms for their scientific studies and/or graduate/precollege undergraduate students. Therefore, your gifts will be used in the MEC&A's precollege student and teacher classrooms or for its "on the road" program.

I am overwhelmed by the sheer volume of e-mails I have received with concern, words of encouragement, and offers to help rebuild the Center's programs. A simple thank-you seems totally inadequate.... but please know your donation and heartfelt kindness represent that "shot November 30, 2005 of adrenalin" the MEC&A Staff sorely needs. As for the future, the MEC&A will rebuild a large and much stronger facility to complement other coastal forms of economic development. However, we will always strive to maintain the highest quality in our educational programs. Again, we appreciate your continued support of the MEC&A.

From The Editor

Spring 2006 IEEE Panel of Technical Editor's Meeting

Below are some of the highlights I would like to share with you on this meeting held 31 March and 1 April in Montreal.

There is new IEEE emphasis given to innovation in Electronic Publishing. Barbara Lange described how new content format is being used, how services are being extended and new business models developed. Those interested can see the Website <<http://research.ieeexplore.ieee.org/>>

The Jan. 31 release 2.1.3 of IEEE Xplore has some new features. Gerry Greiner described the enhancements to search, browse and navigation. He also pointed out that future emphasis will focus on personalization, collaborative function-



ality and building of scholar communities. Check out IEEE Xplore at <<http://ieeexplore.org/>>.

In the Newsletter Breakout Session, Jacik Zurada requested that newsletter editors publish an interview of two candidates, Lew Terman and John Vig, for 2007 IEEE President-elect office. This interview is included in this issue (see page 7). Vote for one this September.

Another item discussed was that some newsletters want to go on Xplore with their technical content. Unlike magazines, the business model (income formula) does not exist for newsletters. There will be more discussion on this, so stay tuned.

Fred Maltz,
IEEE/OES Newsletter Editor

Recent Additions to OES Technology Committees

Since Stan Chamberlain's last editorial (winter 2005 OES newsletter), two new OES Technology Committees (TCs) have been formed, TC16 - Ocean Energy and TC17 - Global Earth Observing System of Systems, with Chairs Claude P. Brancart and Jay S. Pearlman respectively (back cover of this issue shows all the new Chairs, Co-Chairs, and Vice Chairs). As Stan indicated last year, Dr. Albert (Sandy) Williams 3rd is the new TCs Coordinator.

In this issue, starting on page 10, is a paper by Milica Stojanovic who along with Lee Freitag are provisional Co-Chairs of TC2 - Marine Communications, Navigation & Positioning. We plan to continue to draw papers from the TCs and would like to know how much technical content you the reader would like to see in the newsletter.

Please send your comments to the editor at <f.maltz@ieee.org>.

Answers to 10 Questions by the two Candidates for 2007 IEEE President-elect



Lewis M. Terman



John R. Vig

From Your Newsletters Editor's Desk:

IEEE Board of Directors selected Lew Terman and John Vig to be the two candidates for 2007 IEEE Pres-Elect. In an effort to better present their platforms and in connections with the upcoming elections, Lew and John, assisted by the TAB Newsletters Committee have prepared for the readers the following "Answers to 10 Questions by the two Candidates for 2007 IEEE President-Elect".

Lew Terman (www.terman.org) can be contacted at l.terman@ieee.org, and John Vig (www.JohnVig.org) can be contacted at j.vig@ieee.org.

QUESTION: What are IEEE's strengths?

Lew Terman: The volunteers are perhaps the most important strength; it is their enthusiasm, expertise, and time which is key to the success of the Institute.

Another major strength is the IEEE's generation and dispersion of high quality Intellectual Property, including archival publications, conferences/meetings, and standards. It is this IP which produces the revenue streams that financially enables the IEEE and create the information flow which is so valuable to the technical community. The IEEE publishes over 30% of the published material in IEEE's fields of interest, and its conferences/meetings around the world enable rapid dispersal of new results, as well as networking and face-to-face discussions.

A third major IEEE strength is globalization: RAB's structure of geographical based entities extends around the world in over 150 countries, allowing networking and the interchange of technical information at the local level.

Fourth, the IEEE has recovered from the recent downturn to a strong overall financial position. Reserves are at an all-time high, though some problems remain for specific O/Us. The financial performance of the Societies and Councils has been very important.

Finally, the IEEE has an excellent staff supporting the volunteers and working with them for the Institute and its goals.

John Vig: The IEEE's main strengths include:

1) That we are a non-profit membership organization; we have ~50,000 volunteers who contribute to the IEEE's >350 con-

ferences, >100 journals, >300 sections, >900 standards, >40 societies and councils, etc.

2) The breadth and quality of products & services: publications, conferences, workshops, standards, educational products and services, sections, chapters...

3) Our diversity – i.e., that we have ~360K members, in 150 countries. The membership includes not only engineers but also computer/IT professionals, scientists...; men and women; members of all cultures..., and that our activities transcend national borders.

QUESTION: What are the major challenges facing the IEEE?

Lew Terman: Membership has been essentially flat in recent years, and the number of higher grader members has been decreasing. A major problem has been the retention of new graduates, now below 25% three years after graduation. Society membership continues to decline, and the fraction of IEEE members without society membership is now over 43%. Much of this can be attributed to a perceived lack of value of IEEE membership relative to its cost. Increased support of member career development is important. IEEE membership will be 50% in Regions 7-10 within 10 years with current trends; the implications (and opportunities) need to be thoroughly examined. The long-term impact of IEL on membership could become significant.

Open Access is the major long-term question for publications - if all publications are available for free on the web, the IEEE publication business could collapse. Publication timeliness has been a problem, new publications are launched too slowly, and there is a strong need for practical publications to engage the practitioners/"bench-top engineers". Finally, there is the impact of going to full electronic publishing and on what schedule it might occur.

While the overall IEEE financial position is good, there are specific units with problems; further reduction of the infamous Infrastructure Charge is needed through continual evaluation of the efficiency of our operations. With the continuing growth of reserves, long term financial plans/goals for the reserves and their use must be developed.

Finally, the IEEE needs to react to new technologies faster

to claim leadership positions in these technologies as they emerge. We must continue our search for effective and fair governance.

John Vig: How to provide sufficient value to justify the membership dues is a major challenge. A growing number of members who work for institutions which provide “free” access to IEEE’s publications and conferences are asking, “I get everything I want from IEEE for free, so, why should I be a member?”

About 80% of IEEE members don’t read IEEE journals on a regular basis. “The articles are by academics, for academics.” Half of IEEE members work in industry. Providing more practical content without diluting the quality of our publications is a major challenge.

Half of IEEE’s revenues result from the sale of publications. “Open access,” the worldwide movement to disseminate scholarly research literature online, free of charge, threatens these revenues.

QUESTION: What are the major changes IEEE needs to be making?

Low Terman: Membership: increase (and actively market) membership benefits around the world, broaden the base of membership such as aggressively moving into software, services, applications and solutions. Follow up the China initiative with similar efforts for India and Eastern Europe.

Publications: establish a faster track for new publications, pilot new publications that are more practically-oriented, and establish a reward system for reducing the submission-to-publication time. Develop the best search capability for technical material, and make it a membership benefit.

Education: the Expert Now program for continuing education is off to an excellent start; aggressively push it and make it available to members.

Financial: drive good financial behavior for Operating Units with reserves by giving them more access to those reserves – as the ratio of the O/U’s reserves to expenses increases, allow access to an increased percentage of the reserves. Continue to work on decreasing the Infrastructure Charge and increasing revenues, though not at the cost of making IEEE’s prime goal increased surpluses/reserves. Develop a long-term financial plan/goals for the IEEE reserves.

Governance: the current governance structure is not egregiously broken; continue to work towards streamlining operations and governmental efficiency.

Finally, work across the IEEE major Boards to establish a spirit of working together, understanding each others problems, and working with staff on identifying and solving tactical and strategic problems.

John Vig: To improve the IEEE’s agility, e.g., with respect to entering new technologies, I have proposed that we establish an IEEE Venture Capital Fund. Any person could propose an idea, and, if the idea is judged to be worthy, receive up to \$100,000 to implement, or show the feasibility of, the idea.

To provide practical content, I have proposed that we create a new category of peer-reviewed publications, “application notes” - which would include “how-to’s,” and case studies; and

that we digitize many of the ~600 IEEE Press books and make them available to members, and members only, for free.

The IEEE should be more willing to take prudent risks, and it should be more willing to terminate unsuccessful activities.

To explore new ideas, the IEEE should experiment more – with new membership models, dues structures, publication models (e.g., new forms of peer review), etc.

The IEEE needs to improve its communications with members. The Institute should become a real newspaper, i.e., it should report both the good and the bad, and it should publish controversial views, even when such views may displease the leadership.

The IEEE should join with other engineering and scientific organizations to establish a public relations campaign to improve the image of engineering and science.

QUESTION: What are some of the important challenges facing IEEE as a publisher in service to its membership?

Low Terman: Issues raised by Open Access will need to be anticipated and managed. A major implication is to at least maintain the revenue stream which our publications generate. IEEE needs to help members navigate the mass of data available from IEEE, other technical publications, and on the web. Practical publications need to be developed with the collaboration of RAB and TAB. Goals for article publication timeliness must be set, and rewards established for publications to meet or exceed the goals. Establish a fast approval track for new publications. Maintain the importance of peer review. Keep monitoring the possibility of going to all electronic publishing, and establish when or if it should occur well before any critical point occurs.

John Vig: Open access, the worldwide movement to disseminate scientific and scholarly research literature online, free of charge is a serious challenge because half of IEEE’s revenues result from the sale of publications. Google, at www.scholar.google.com and similar services, now make it easier to find the free copies of publications. Papers can be read without having to pay the publishers.

Delayed open access, e.g., making publications open access two years after publication, would not be as damaging. It would allow the IEEE to maintain most of its publication revenues while fulfilling its mission of being “for the benefit of humanity and the profession.”

A frequently heard criticism of IEEE publications is that they are primarily “by academics, for academics;” they are not useful for practitioners. About half of our membership is from industry. If our publications are not useful for the majority of our members, then we have a serious problem.

I have proposed three solutions to this problem. One is to ask authors to provide, voluntarily, a “practical impact statement” with their papers. The second is to create a new class of peer reviewed publications, “application notes,” and the third is to digitize IEEE Press books and make them available to the membership.

The mean time between an author’s submission and the date of publication of an article is too long for some of our journals; the delay for five of our journals has been >120 weeks. This must not be allowed to continue, and it need not continue, as

evidenced by the fact that the mean is <50 weeks for 31 of our journals.

QUESTION: Do you see IEEE in future years as an organization based on its strong membership base, or do you foresee other models?

Lew Terman: IEEE should remain a membership-based organization. Membership is critical – it is the members through whom we serve our technical communities, and who provide the volunteers that are critical to the success of IEEE. Members also provide a means of measuring how relevant we are to the technical world, and provide the mechanism for engaging emerging technical and geographic areas.

John Vig: I see the IEEE continuing to be a membership-based organization - with its tens of thousands of volunteers and its membership diversity as its pillars of strength.

I do, however, see a need to experiment with membership and dues models. Some members, for example, may be willing to receive Spectrum and The Institute electronically if the dues were lowered by the costs of producing the paper copy of those publications. We have >\$160M in reserves. Therefore, we can afford to experiment.

The success of our IEEE Electronic Library (IEL) is hurting membership recruitment and retention. (IEL subscribing institutions, which include many of the largest universities and corporations, provide “free” access to IEEE publications.) I hear more and more “I get everything I want from IEEE for free, so, why should I be a member?” Therefore, another experiment I would propose is to offer reduced dues to those working or studying at a few IEL organizations and measure the effects on membership numbers.

QUESTION: What changes in IEEE would you advocate in response to quick industrialization and potential IEEE presence in large Asian countries?

Lew Terman: The two major Asian countries of interest are quite different in technical environment and social structure. I believe the current China initiative is appropriate; we need to understand the environment and the current approach seems a good first step. We need a deeper understanding of the specific needs and opportunities and how to involve that community to effectively stimulate IEEE membership and volunteerism.

India is also a key growth area in the 21st century, and currently has more IEEE members than any country outside the US. We need to understand why they join, and focus on the appropriate member and technical services to support their interest. India has a strong university structure with which we should be working.

John Vig: IEEE’s presence in large Asian countries is actual, not just “potential.” For example, in 2005, we held 59 conferences in China, and a total of 129 in China, India, Japan and Korea. Our publication sales, in China alone, amounted to ~\$5M in 2005. Total sales to the four countries was ~\$20M. In 2005, our combined membership in these four countries was ~45K.

Although the IEEE has made inroads in China and India, it is a long way from realizing the potential presence in these and other countries. Membership is too expensive for many in Asia, Latin America, Eastern Europe... We need a membership strategy for potential members who can’t afford our dues, not just in Asia, but, throughout the world.

QUESTION: What do you see as the power of the IEEE President and how would you exercise this power?

Lew Terman: The IEEE President has three major responsibilities/opportunities:

- a) Running the Board and ExCom meetings effectively, including setting up the meetings. This is important as the members of the governing bodies of the IEEE meet for only a short time, and it is important the meetings be efficient for the most effective interaction.
- b) Providing leadership to the Institute: setting directions, establishing committees and study groups to get information and sift through alternatives, work with the staff, work with the IEEE Boards and governance levels. It is in this area that the President can have the most effect. I would focus on bringing the various groups in IEEE together, and on listening to their input, getting an open airing of issues and suggested solutions, and generating and following through on new ideas.
- c) “Showing the flag” around the world, to both IEEE geographies/groups and non-IEEE entities - geographical, technical and political. The interactions with IEEE groups are very important to generate mutual understanding, and the interaction with non-IEEE entities is important to present the IEEE and the technical community it represents, and to understand their needs, views, and to understand possible opportunities.

John Vig: The president’s duties are to: chair the meetings of the IEEE Board of Directors, Executive Committee and Assembly; perform ceremonial functions such as meeting with dignitaries, presentation of awards, opening remarks at conferences, etc.; promote the objectives of the IEEE; and be “the Chief Executive Officer of the IEEE.”

I would make maximum use of the presidency to advocate the IEEE’s agenda, both within and outside the IEEE.

I would set at least one lofty (man-on-the-moon-like) goal for the IEEE, aimed at inspiring and mobilizing the volunteers and staff.

The Board of Directors has been too inward-focused. I would propose the establishment of a council of advisors – consisting of prominent, mostly outside experts and leaders – to advise the IEEE leadership.

QUESTION: In the 2005 IEEE elections, only 14% of the membership voted. What, if anything, would you do to increase members’ participation in IEEE elections?

Lew Terman: I think what we are doing this year is pretty good – talking to the Regions and other entities which invite us (with Q&A sessions where time permits), sending these 10 questions

to the Newsletters, participating in the Philadelphia debate and making available recordings of the debate and presentations of the candidate platforms on the IEEE web site, and making additional information available on our personal web sites.

John Vig: In 1975-77, when a controversial candidate, Irwin Feerst, ran for IEEE president, 36% voted. In those days, the membership was more involved in IEEE issues than they are today.

Today, the membership is rarely informed of controversial issues. For example, last year, I received reports of meetings where readings from the Koran and Christian prayers were parts of the program. Why not report such events and ask the membership whether or not such religious expressions should be allowed as parts of IEEE events?

“THE INSTITUTE is the newspaper of the IEEE” claims The Institute’s website but, The Institute is more a “house organ” than a newspaper. As president, I would propose to the Board of Directors, and The Institute’s Editorial Board, that The Institute become a real newspaper of the IEEE.

The office holders in IEEE, especially the President and the other members of the Board of Directors, make decisions about matters that are important to the membership and the future of IEEE. Voting in the annual IEEE election is the chance members have to choose the decision makers. With only 14% voting, 7+% of the members can decide the fate of IEEE.

QUESTION: What have been your three most important contributions to IEEE?

Lew Terman: In the late 1990’s, I was instrumental in the conversion of the Solid-State Circuits Council to the Solid-State Circuits Society. This was very successful; the SSCS is now the 5th largest Society in the IEEE, and the Journal of Solid-State Circuits records the highest number of hits in IEL. I served as the first SSCS president elected by the Society.

In the mid 90’s, IEEE and TAB were going through finan-

cial difficulties. I was appointed TAB treasure, stabilized the situation and improved the communication with TAB, and served a second term as Treasurer.

In 2001, I was on the Board as the bottom fell out of the IEEE financial situation. As part of a team effort, we were able to put in place a number of changes which arrested the slide.

John Vig: My three most important contributions are: The IEEE Sensors Council, i.e., I proposed it, shepherded it through the approval processes, and was elected its founding president, in 1999. In 2005, the Council’s journal published 1500 pages, and its conference had >500 registered participants.

Between 1999 and 2002, the IEEE’s reserves declined >\$50M (>40%), due, in large part, to the decline in the value of IEEE’s investments. Up to this point, the IEEE had no formal investment policy. I wrote the first draft of the Investment Operations Manual (IOM), then worked with investment professionals, volunteers and staff to finalize it and get it passed by the Board. Contained in the IOM is an investment policy which has reduced the risks and increased the transparency of IEEE’s investments.

I brought what is now the IEEE Int’l Frequency Control Symposium into the IEEE. I negotiated the takeover of this conference by an IEEE society (UFFC). This conference is now the premier international conference in its field.

QUESTION: What would be your single and most recognized contribution that will distinguish your IEEE Presidency from those of others?

Lew Terman: I would like my presidency to result in the elimination of any silos between IEEE operating units, and attacking IEEE problems with coordinated efforts across IEEE.

John Vig: The president under whose leadership innovation flourished in IEEE.

Underwater Wireless Communications: Current Achievements and Research Challenges

Milica Stojanovic
Massachusetts Institute of Technology
Sea Grant College Program

While wireless communication technology today has become part of our daily life, the idea of wireless undersea communications may still seem far-fetched. However, research has been active for over a decade on designing the methods for wireless information transmission underwater.

Human knowledge and understanding of the world’s oceans, which constitute the major part of our planet, rests on our ability to collect information from remote undersea locations. The major discoveries of the past decades, such as the remains of Titanic, or the hydro-thermal vents at bottom of deep ocean, were made using cabled submersibles. Although such systems

remain indispensable if high-speed communication link is to exist between the remote end and the surface, it is natural to wonder what one could accomplish without the burden (and cost) of heavy cables. Hence the motivation, and our interest in wireless underwater communications. Together with sensor technology and vehicular technology, wireless communications will enable new applications ranging from environmental monitoring to gathering of oceanographic data, marine archaeology, and search and rescue missions.

The signals that are used to carry digital information through an underwater channel are not radio signals, as electro-magnet-

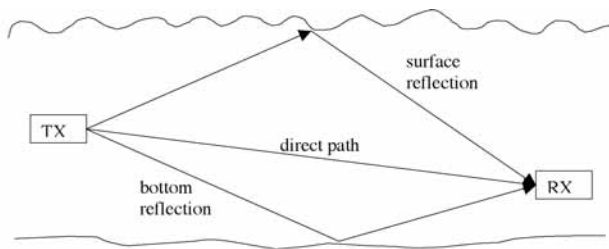


Fig. 1: Shallow water multipath propagation: in addition to the direct path, the signal propagates via reflections from the surface and bottom.

ic waves propagate only over extremely short distances. Instead, acoustic waves are used, which can propagate over long distances. However, an underwater acoustic channel presents a communication system designer with many difficulties. The three distinguishing characteristics of this channel are frequency-dependent propagation loss, severe multipath, and low speed of sound propagation. None of these characteristics are nearly as pronounced in land-based radio channels, the fact that makes underwater wireless communication extremely difficult, and necessitates dedicated system design.

Path loss that occurs in an acoustic channel over a distance d is given as $A = dka(f)d$, where k is the path loss exponent whose value is usually between 1 and 2, and $a(f)$ is the absorption factor that depends on the frequency f . This dependence severely limits the available bandwidth: for example, at distances on the order of 100 km, the available bandwidth is only on the order of 1 kHz. At shorter distances, a larger bandwidth is available, but in practice it is limited by the that of the transducer. Also in contrast to the radio systems, an acoustic signal is rarely narrowband, i.e., its bandwidth is not negligible with respect to the center frequency.

Within this limited bandwidth, the signal is subject to multipath propagation, which is particularly pronounced on horizontal channels. In shallow water, multipath occurs due to signal reflection from the surface and bottom, as illustrated in Figure 1. In deep water, it occurs due to ray bending, i.e. the tendency of acoustic waves to travel along the axis of lowest sound speed. Figure 2 shows an ensemble of channel responses obtained in deep water. The multipath spread, measured along the delay axis, is on the order of 10 ms in this example. The channel response varies in time, and also changes if the receiver moves. Regardless of its origin, multipath propagation creates signal echoes, resulting in intersymbol interference in a digital communication system. While in a cellular radio system multipath spans a few symbol intervals, in an underwater acoustic channel it can span few tens, or even hundreds of symbol intervals! To avoid the intersymbol interference, a guard time, of length at least equal to the multipath spread, must be inserted between successively transmitted symbols. However, this will reduce the overall symbol rate, which is already limited by the system bandwidth. To maximize the symbol rate, a receiver must be designed to counteract very long intersymbol interference.

The speed of sound underwater varies with depth and also depends on the environment. Its nominal value is only 1500 m/s, and this fact has a twofold implication on the communication sys-

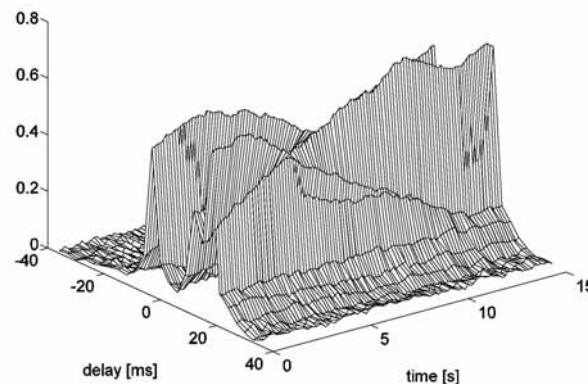


Fig. 2: Ensemble of channel impulse responses (magnitudes).

tem design. First, it implies long signal delay, which severely reduces the efficiency of any communication protocol that is based on receiver feedback, or hand-shaking between the transmitter and receiver. The resulting latency is similar to that of a space communication system, although there it is a consequence of long distances traveled. Secondly, low speed of sound results in severe Doppler distortion in a mobile acoustic system. Namely, if the relative velocity between the transmitter and receiver is $\pm v$, then a signal of frequency f_c will be observed at the receiver as having frequency $f_c(1 \pm v/c)$. At the same time, a waveform of duration T will be observed at the receiver as having duration $T(1 \pm v/c)$. Hence, Doppler shifting and spreading occur. For the velocity v on the order of few m/s, the factor v/c , which determines the severity of the Doppler distortion, can be several orders of magnitude greater than the one observed in a land-mobile radio system! To avoid this distortion, a noncoherent modulation/detection must be employed. Coherent modulation/detection offers a far better utilization of bandwidth, but the receiver must be designed to deal with extreme Doppler distortion.

Summarizing the channel characteristics, one comes to the conclusion that an underwater acoustic link combines in itself the worst aspects of radio channels: poor quality of a land-mobile link, and high latency of a space link. In addition, current technology offers limited transducer bandwidth (typically a few kHz, or few tens of kHz in a wideband system), half-duplex operation, and limited power supply of battery-operated instruments.

Acoustic modem technology today offers two types of modulation/detection: frequency shift keying (FSK) with noncoherent detection and phase-shift keying (PSK) with coherent detection. FSK has traditionally been used for robust acoustic communications at low bit rates (typically on the order of 100 bps). To achieve bandwidth efficiency, i.e. to transmit at a bit rate greater than the available bandwidth, the information must be encoded into the phase or the amplitude of the signal, as it is done in PSK or quadrature amplitude modulation (QAM). For example, in a 4-PSK system, the information bits (0 and 1) are mapped into one of four possible symbols, $\pm 1 \pm j$. The symbol stream modulates the carrier, and the so-obtained signal is transmitted over the channel. To detect this type of signal on a multipath-distorted acoustic channel, a receiver must employ an equalizer whose task is to unravel the intersymbol interference. Since the channel response is not a-priori known (moreover, it

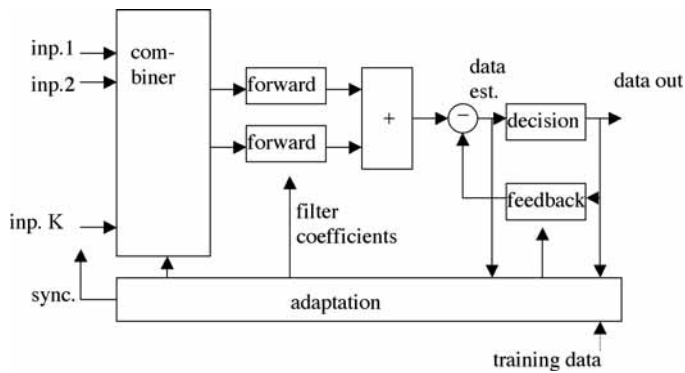


Fig. 3: Multichannel adaptive decision-feedback equalizer (DFE) is used for high-speed underwater acoustic communications. It supports any linear modulation format, such as M-ary PSK or M-ary QAM.

is time-varying) the equalizer must “learn” the channel in order to invert its effect. A block diagram of an adaptive decision-feedback equalizer (DFE) is shown in Figure 3. In this configuration, multiple input signals, obtained from spatially diverse receiving hydrophones, can be used to enhance the system performance. The receiver parameters are optimized to minimize the mean squared error in the detected data stream. After the initial training period, during which a known symbol sequence is transmitted, the equalizer is adjusted adaptively, using the output symbol decisions. An integrated Doppler tracking algorithm enables the equalizer to operate in a mobile scenario. This receiver structure has been used on various types of acoustic channels. Current achievements include transmission at bit rates on the order of one kbps over long ranges (10-100 nautical miles) and several tens of kbps over short ranges (few km) as the highest rates reported to date. On a more unusual note, successful operation was also demonstrated over a basin scale (3000 km) at 10 bps, as well as over a short vertical channel at a bit rate in excess of 100 kbps. The multichannel DFE forms the basis of a high-speed acoustic modem implemented at the Woods Hole Oceanographic Institution. The modem, shown in Figure 4, is implemented in a fixed-point DSP, with a floating-point co-processor for high-rate mode of operation. When active, it consumes about 3 W in receiving mode, and 10-50 W to transmit. The board measures 1.75 _ 5 in, and accommodates four input channels. The modem has successfully been deployed in a number of trials, including autonomous underwater vehicle (AUV) communications at 5 kbps.

With advances in acoustic modem technology, sensor technology and vehicular technology, ocean engineering today is moving towards integration of these components into autonomous underwater networks. While current applications include supervisory control of individual AUVs, and telemetry of oceanographic data from bottom-mounted instruments, the vision of future is that of a “digital ocean” in which integrated networks of instruments, sensors, robots and vehicles will operate together in a variety of underwater environments. Examples of emerging applications include fleets of AUVs deployed on collaborative search missions, and ad hoc deployable sensor networks for environmental monitoring.

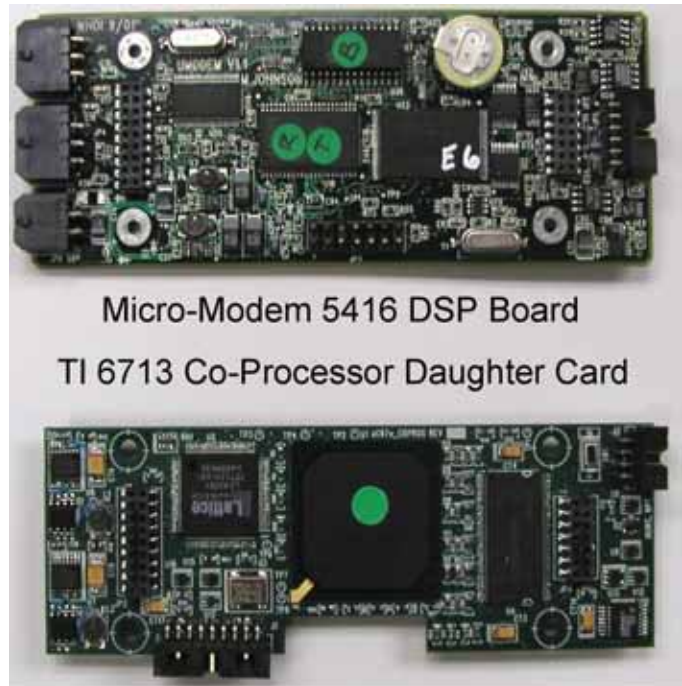


Fig. 4: The WHOI micro-modem has dual mode of operation: low rate FSK and high-rate PSK.

Depending on the application, future underwater networks are likely to evolve in two directions: centralized and decentralized networks. The two types of topologies are illustrated in Figure 5 and Figure 6. In a centralized network, nodes communicate through a base station that covers one cell. Larger area is covered by more cells whose base stations are connected over a separate communications infrastructure. The base stations can be on the surface and communicate using radio links, as shown in the figure, or they can be on the bottom, connected by a cable. Alternatively, the base station can be movable as well. In a decentralized network, nodes communicate via peer-to-peer, multi-hop transmission of data packets. The packets must be relayed to reach the destination, and there may be a designated end node to a surface gateway. Nodes may also form clusters for a more efficient utilization of communication channel.

To accommodate multiple users within a selected network topology, the communication channel must be shared, i.e. access to the channel must be regulated. Methods for channel sharing are based on scheduling or on contention. Scheduling, or deterministic multiple-access, includes frequency, time and code-division multiple-access (FDMA, TDMA, CDMA) as well as a more elaborate technique of space-division multiple access (SDMA). Contention-based channel sharing does not rely on an a-priori division of channel resources; instead, all the nodes contend for the use of channel, i.e., they are allowed to transmit randomly at will, in the same frequency band and at the same time, but in doing so they must follow a protocol for medium-access control (MAC) to ensure that their information packets do not collide. All types of multiple-access are being considered for the underwater acoustic systems. Experimental systems today favor either polling, TDMA, or multiple-access collision avoidance (MACA) based on a hand-shaking contention procedure that requires an exchange of requests and

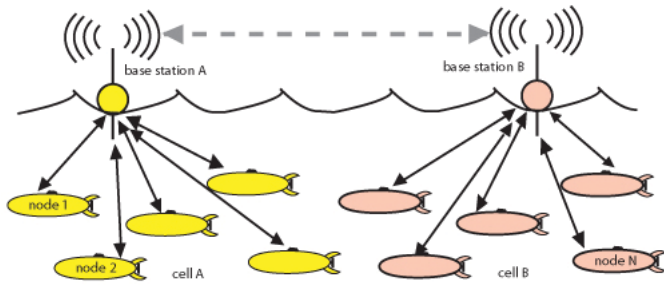


Fig. 5: Centralized network topology.

clearances to send (RTS/CTS). Intelligent collision avoidance appears to be necessary in an underwater channel, where the simple principle of carrier sensing multiple access (CSMA) is severely compromised due to the long propagation delay—the fact that the channel is sensed as idle at some location does not guarantee that a data packet is not already in transmission at a remote location.

One of the major aspects of the evolving underwater networks is the requirement for scalability. A method for channel sharing is scalable if it is equally applicable to any number of nodes in a network of given density. For example, a pure TDMA scheme is not scalable, as it rapidly loses efficiency on an underwater channel due to the increase in maximal propagation delay with the area of coverage. In order to make this otherwise appealing scheme scalable, it can be used locally, and combined with another technique for spatial reuse of channel resources. The resulting scheme is both scalable and efficient; however, it may require a sophisticated dynamic network management. In contrast, contention-based channel allocation offers simplicity of implementation, but its efficiency is limited by the channel latency. Hence, there is no single best approach to the deployment of an underwater network. Instead, selection of communication algorithms and network protocols is driven by the particular system requirements and performance/complexity trade-offs.

Research today is active on all topics in underwater communication networks: from fundamental capacity analyses to the design of practical network protocols on all layers of the network architecture (including medium access and data link control, routing, transport control and application layers) as well as cross-layer network optimization.

In addition to serving as stand-alone systems, underwater

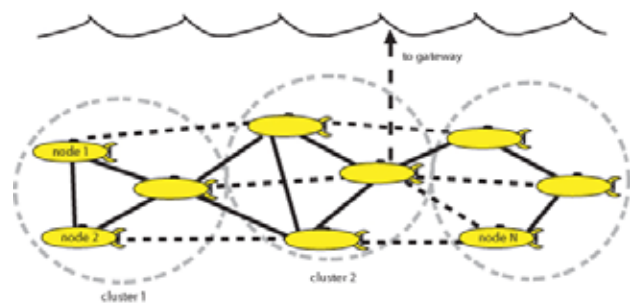


Fig. 6: Decentralized network topology.

acoustic networks will find application in more complex, heterogeneous systems for ocean observation. Figure 7 shows the concept of a deep-sea observatory. At the core of this system is an underwater cable that hosts a multitude of sensors and instruments, and provides high-speed connection to the surface. A wireless network, integrated into the overall structure, will provide a mobile extension, thus extending the reach of observation.

While we have focused on acoustic wireless communications, it has to be noted that this will not be the only way of establishing wireless communication in the future underwater networks. Optical waves, and in particular those in the blue-green region, offer much higher throughput (Mbps) albeit over short distances (up to about 100 m). As such, they offer a wireless transmission capability that complements acoustic communication.



Fig. 7: A deep-sea observatory.

Visit the OES online, link to the IEEE homepage:
<http://www.oceanicengineering.org>

ADVANCE PROGRAM



Attending Countries

Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden, Russia, Other EU Member States, US, Others invited

Sponsors



Center of Marine Research, Lithuania • US Office of Naval Research Global
US National Oceanic & Atmospheric Administration's National Ocean Service
Institute of Electrical and Electronic Engineers' Oceanic Engineering Society

Supporting Organizations

Klaipeda University • Kaunas University of Technology • Vilnius University
Lithuania
University of Delaware, U.S.A.

WELCOME

We welcome your participation in the second US/EU-Baltic International Symposium (May 23-25) and we encourage interaction for mutual benefits. Our program provides notable speakers and a cross section of papers from more than 20 countries including the nine Baltic countries that border the Baltic, other EU countries, and the U.S.A., to promote the exchange of science and technology information on Integrated Ocean Observation Systems (IOOS) and Global Ocean Observation Systems (GOOS). These systems can provide users with multiple benefits for sustainable development and eco-system based management. A few of the leading GOOS and IOOS experts are identified in the Plenary Session.

Symposium Chairs: Joseph R. Vadus, Vice President, IEEE Oceanic Engineering Society ;**Dr. Algirdas Stankevicius**, Director, Center of Marine Research (CMR), Klaipeda ; **Finance Chair :** James T. Barbera, President, IEEE/OES; **Program Chair:** Prof. Victor Klemas, University of Delaware; **Co-Chair:** Mindaugas Vaisvila, CMR; **Symposium Contact :** m.vaisvila@jtc.am.lt ; Tel : +370 46 410 450 or 456

PLENARY SESSION

OPENING SPEAKERS:

H. E. Valdas Adamkus, President of the Republic of Lithuania (Invited)
Mr. Thomas P. Kelly, Deputy Chief of Mission, U.S. Embassy in Lithuania
Mr. Arnas Kundrotas, Minister of the Environment of the Republic of Lithuania
Mr. Vaclov Stankovic, Member of Parliament, Republic of Lithuania
Prof. Zenonas Rudzikas, President, Lithuanian Academy of Science

PLENARY SPEAKERS:

Dr. Richard M. Spinrad, Assistant Administrator for Research, National Oceanic and Atmospheric Administration, "The U. S. IOOS Program & Strategy", U.S.
Dr. Hans Dahlin, Director, EuroGOOS, "EuroGOOS – A GOOS Regional Alliance", Sweden
Dr. Erik Buch, Head, Centre for Ocean & Ice, Danish Meteorological Institute, "Baltic Operational Oceanographic System ", Denmark
Dr. Thomas C. Malone, Director, OceanUS Office for Integrated and Sustained Observations and **Distinguished Prof. Worth D. Nowlin Jr.**, Texas A & M University will Co-Author the paper, "The Role of GOOS Regional Alliances in Implementing the Coastal Module", U.S.
Dr. Yves Desaubies, French GOOS, IFREMER, France
Dr. Martin Holt, Chair, NOOS Steering Group "Operational Oceanography for the NW European Shelf: NOOS 2002-2006", United Kingdom
Mr. Edward Gough, Technical Director, Naval Meteorology & Oceanography Command, USA, "Operational Ocean Prediction in the U.S. Navy"
Dr. Tapani Stipa, Institute of Marine Research, Finland, Coordinator of the International Project "Modeling of Ecological Risks Related to Sea-Dumped Chemical Weapons - MERCW"
Dr. Andrew Clark, OceanUS, "U. S. Industrial Strategy for IOOS", U.S.

A SPECIAL ATTRACTION--- An excursion is planned to the rapidly developing seacoast resort, Palanga, and to the seaport of Klaipeda, with an opportunity to visit the US Navy Oceanographic Ship USNS HENSON (T-AGS-63). The Russian Oceanographic Ship PROFESSOR SHTOKMAN, based in Kaliningrad, will also come to the Port of Klaipeda and may also be available.

FIVE PROGRAM TRACKS & CHAIRS----140 PAPERS

Track 1- Hazardous Waste and Marine Pollution: Dr. Vadim Paka,
Shirshov Institute of Oceanology, Russia

Sessions:

Hazardous Waste (2)
Monitoring Hazards
Pollution Monitoring
Oil Spill Detection & Modeling
Chemical Oceanography

Track 2- Ocean and Coastal Observation Systems: Dr. Albert Williams, Woods Hole Oceanographic Institution, USA

Sessions:

Ocean Observation Systems
Coastal Observation Systems
Sea Surface and Benthic Observation
Benthic Studies
Marine Geology

Track 3- Remote Sensing and Coastal Management: Dr. Victor Klemas,
University of Delaware, USA

Sessions:

Remote Sensing of Oil Slicks

Remote Sensing of Marine Biology
Wetlands Remote Sensing
Port Security and Management
Coastal Resources Management

Track 4- Physical Oceanography and Marine Biology: Mr. Jerry Carroll,
US Naval Meteorology and Oceanography Command

Sessions:

Marine Biology
Coastal Biology
Biological Oceanography
Physical Oceanography (2)

Track 5 -Ocean Modeling and Wave Studies: Dr. Erik Buch, Danish Meteorological Institute

Sessions:

Wave Studies
Ocean Modeling
Coastal Modeling

The Symposium site is Hotel "Klaip_da".

Reservation: http://www.klaipedahotel.lt/index.php?s_id=7&type=f&lang=en

For discount write the password: US/EU-Baltic Symposium

Other hotels: <http://www.lithuanianhotels.com/cities/Klaipeda>.

Registration at the door using credit cards, Euros or Litas.

Information on the Symposium is available on the web site

<http://www.us-baltic2006.org>

THE BALTIC OPERATIONAL OCEANOGRAPHIC SYSTEM (BOOS) GROUP-- --ANNUAL MEETING

The BOOS Group, led by Dr. Erik Buch, Head, Centre for Ocean and Ice, Danish Meteorological Institute has arranged to hold their Annual Meeting in Klaipeda on May 22, the day before the Symposium begins. The BOOS Group includes members from the nine nations bordering the Baltic Sea and they are major contributors to the Integrated Ocean Observations System concept. Their strategy 2004-2010 is further integration of operational oceanography activities in the Baltic Sea to enable BOOS to provide an integrated service to marine users and policy makers in support of safe and efficient offshore activities, environmental management, security, and sustainable use of marine resources.

The BOOS Group has organized three sessions in the Symposium: Wave Studies, Ocean Modeling and Coastal Modeling. The BOOS Group provides a welcome addition in 2006, to be co-located with the Symposium.

PRESS RELEASE

U.S. Embassy Sponsors Reception



(Randolph Flay, Attache and Joseph Vadus, U.S. Chair, second and third from left)

The U.S. Embassy in Vilnius, Lithuania sponsored a reception on March 28 to discuss marine research cooperation and to introduce the US/EU -Baltic Symposium. Mr. Randolph Flay, Attache at the U.S. Embassy, organized the event and invited over 30

senior leaders from government, industry and academia. Several representatives of the regional Press were present to report on the meeting. Mr. Flay made opening remarks and introductions. Joseph Vadus, U.S. Chair and Dr Algirdas Stankevicius, EU Chair described the Symposium to be held in Klaipeda on May 23-24-25. Vadus stated that the theme of the symposium," Integrated Ocean Observation Systems (IOOS)"is a high priority topic of many nations and it's the reason that over 140 papers were offered. The symposium has attracted authors from over 20 nations, and it provides an excellent forum for exchange of research information and promotes cooperative ventures. Many papers discuss the problems of natural and man-induced hazards, including oil pollution and the many hazards caused by the thousands of tons of munitions of all kinds that were dumped after world War II. These include chemical weapons that are slowly deteriorating and exposing highly toxic chemicals to Baltic fisheries resources and endangering environmental health. Oil pollution from tankers and drilling platforms is of major concern in accidental spills. Pollution transported by river outflow into the sea is another topic of great concern. Baltic Nations are aware and their Research Centers continue monitoring to detect, control and mitigate risks. Integrated ocean observations provide a major role in dealing with such problems and providing data and information to assist in cooperative efforts in regional ecosystem management. Mr. Flay solicited questions to promote discussion with the Symposium chairs and with the Co-Chairs: Prof. Raimundas Jasinevicius of Kaunas University of Technology and Prof. Algimantas Juozapavicius of Vilnius University. It was noted that a U.S. Navy ship, the USNS HENSON T- AGS-63 is being routed to the port of Klaipeda to enable Symposium attendees to visit this fully equipped oceanographic ship, during the planned half-day excursion.

Upcoming Conferences

May 23-25, 2006 -
**U.S./European Union Baltic
 International Symposium,**
 Klaipeda, Lithuania
www.us-baltic2006.org

July 8-9, 2006 -
GEOSS Arch IV,
 Corte, Corsica, France
www.oceanicengineering.org

September 13-15, 2006 -
NSSPW '06, Cambridge, UK
www.oceanicengineering.org

September 18-22, 2006 -
Oceans 2006 MTS/IEEE,
 Boston, Massachusetts
www.oceans2006.org

October 9-13, 2006 -
TEHOSS 2006,
 Istanbul, Turkey
www.tehoss2006.org

October 18-20, 2006 -
AUV '06, Brest, France
www.auv06.org

December 9-13, 2006
RAE '06, New Orleans,
 Louisiana
www.estuaries.org

June 18-21, 2007 -
Oceans 2007 IEEE,
 Aberdeen, Scotland
www.oceans07ieeeeaberdern.org

Sept 29-Oct 4, 2007
Oceans 2007 MTS/IEEE,
 Vancouver, Canada
www.oceans07mtsieeevancouver.org

OCEANS '07 Aberdeen, Scotland

Marine Challenges: Coastline to Deep Sea 18-21 June 2007

A Major International Technology Conference and Exhibition

www.oceans07ieeeeaberddeen.org

Oceans '07 is the premier forum in 2007 for all international leading scientists, engineers, technologists, suppliers and end-users to meet.

State-of-the-art papers will be presented in all major areas of oceanic engineering, technology and science.

Some of the major topical themes that will be addressed include:

- Marine optics: light in the sea
- The biology/technology interface
- Marine renewable energy
- Challenges in the defence industry
- Oceans and climate
- Conservation, restoration & sustainability
- Emerging science and technology
- Deep water technology
- Global observing networks
- National and international marine policy and management
- Marine education
- Tutorials and Student Poster sessions

- Plus: A significant programme of social events exploring an array of the best of Scottish hospitality!
- Parallel scientific conference and exhibition of major ocean science and engineering companies and related technologies



OCEANS '07
ABERDEEN • SCOTLAND
18-21 JUNE 2007

Find out more and register
your interest on-line:

www.oceans07ieeeeaberddeen.org

Put these dates in your diary:

DATES TO REMEMBER:

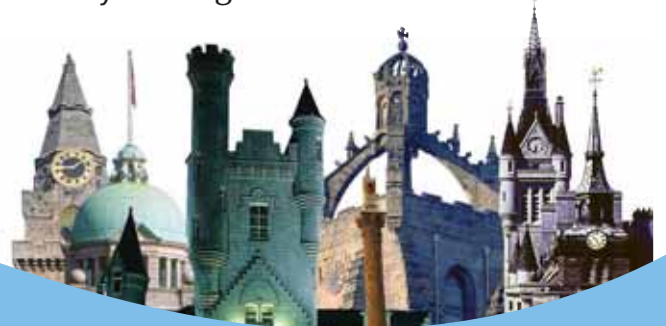
First Call for Papers: March 2006

First Call for Tutorial Sessions: June 2006

First Call for Student Posters: June 2006

Abstract Submission Deadline: December 2006

Earlybird Registration closes: 01 March 2007



SPONSORS:



UNIVERSITY
OF ABERDEEN

SUPPORTERS:



Institute of Physics



Aberdeen wishes you *Bon Accord* and *Ceud Mille Failte*

CHAPTER CHAIRMEN

Boston

John W. Irza
Sygnus Technology Inc.
Arlington, MA
781 648 2144
781 641 9974 (Fax)
jirza@sygnus.com

Canadian Atlantic

FERIAL EL-HAWARY
61 Bay View Road
Halifax Nova Scotia
Canada B3M 1N8
902 443 2400
902 445 5110 (Fax)
f.el-hawary@ieee.org

France

RENE M. GARELLO
GET - ENST Bretagne
CNRS FRE 2658 TAMCIC - Equipe TIME
Dept Image et Traitement de l'Information
Technopôle Brest Iroise - CS 83818
29238 BREST Cedex - FRANCE
(33) 98 00 13 71
(33) 98 00 10 98 (Fax)
rene.garello@enst-bretagne.fr

Hawaii

Mark ROGNSTAD
University of Hawaii at Manoa
School of Ocean and Earth Sciences and
Technology
Hawaii Institute of Geophysics and Planetology
1680 East-West Road Post 816B
Honolulu, HI 96822
808 956 8712
808 956 6530 (Fax)
markr@soest.hawaii.edu

Japan

JUNZO KASAHARA
Earthquake Research Institute
University of Tokyo
1-1-1, Yayoi, Bunkyo
Tokyo 113-0032 Japan
+81 3 5841 5713
+81 3 5689 7234 (Fax)
kasa2@eri.u-tokyo.ac.jp

Ottawa

SKAWOMIR B. WESOLOWSKI
+1 613 761 9782
s.wesolowski@ieee.org

San Diego

ARTHUR M. TERANISHI
858 455 5530
art.t@cox.net

Seattle

SHERI L. REES
Engenuity Development Networks, Inc.
116 NW 130th
Seattle, WA 98177
206 440 1455
206 440 1438 (Fax)
s.l.rees@ieee.org

Singapore

ARJUNA T. BALASURIYA
+65 679 06863
Fax: +65 67910 341
earjuna@ntu.edu.sg

Spain

DR. ROQUE J. SALTAREN PAZMINO
Universidad Politecnica de Madrid
ETSII-DISAM
Calle Jose Gutierrez Abascal, 2
Madrid, 28006, Spain
rsaltaren@etsii.upm.es

Taipei, Taiwan

DR. SHENG-WEN CHENG
Professor
Dept. of Engineering Science &
Ocean Engineering
National Taiwan University
No. 1, Section 4, Roosevelt Road
Taipei, 106 TAIWAN
886-2-33665772 (office)
886-937-049982 (mobile)
886-2-23929885 (office fax)
niccheng@ntu.edu.tw (office)

Toronto

SRIDHAR KRISHNAN
+416 979 5000
Fax: +416 979 5280
krishnan@ee.ryerson.ca

United Kingdom & Republic of Ireland

DR. YONG XUE
The Retreat
125B Cambridge Road
Great Sherford
Cambridge, England, CB2 5JJ
United Kingdom
y.xue@unl.ac.uk

Victoria

JAMES S. COLLINS
Dept. of Elec. &
Comp. Engineering
University of Victoria
P.O. Box 3055
Victoria, B.C. CANADA V8W 3P6
(604) 721-8610; (604) 721-6052 (FAX)
j.s.collins@ieee.org

Washington D.C./No. Virginia

JAMES BARBERA
13513 Crispin Way
Rockville, MD 20853
301 460 4347
301 871 3907 (Fax)

OES Journal Associate Editors

ARTHUR B. BAGGEROER

Dept. Ocean Eng.-Rm. 5-204
Mass. Inst. Technol.
Cambridge, MA 02139
+1 617 253 4336
abb@arctic.mit.edu

D. RICHARD BLIDBERG

Autonomous Undersea
Systems Institute
86 Old Concord Turnpike
Lee, NH 03924
+1 603 868 3221
Fax: +1 603 868 3283
blidberg@ausi.org

BRIAN CALDER

Center for Coastal and Ocean Mapping
University of New Hampshire
24 Colovos Road
Durham NH 03824 USA
Tel: (603) 862-0526
Fax: (603) 862-0893
email: brc@ccom.unh.edu

WILLIAM M. CAREY

The Kerry Group LLC
79 Whipoorwill Rd.,
Old Lyme, CT 06371
+1 860 434 6394
kerrygrp@ctol.net

CHRISTIAN DE MOUSTIER

Center for Coastal and Ocean Mapping
Chase Ocean Engineering Lab
University of New Hampshire
24 Colovos Road
Durham, NH 03824-3525
Phone: 603-862-3434
FAX: 603-862-0839
email: cpm@ieee.org

JOHN E. EHRENBERG

Boeing Phantom Works
P. O. Box 3999
MC 84-41
Seattle, WA 98124-2499
+1 253 773 1332
john.e.ehrenberg@boeing.com

FERIAL EL-HAWARY

B.H. Engineering Systems Ltd.
61 Bayview Road
Halifax, Nova Scotia B3M 1N8
Canada
tel: 902-443-2400
fax: 902-445-5110
email: F.El-harwary@ieee.org

DAVID M. FARMER

Institute of Ocean Sciences
P. O. Box 6000, 9860 West Saanich Rd.
Sidney, BC V8I 4B2 Canada
+1 250 363 6591
Fax: +1 250 363 6798
dmf@ios.bc.ca

RENE GARELLO

Telecom Bretagne
Dpt. ITI BP 832
29285 Brest Cedex France
33 2 98 00 13 71
Fax: 33 2 98 00 10 98
rene.garello@enst-bretagne.fr

MALCOLM L. HERON

Physics Dept.
James Cook Univ.
Townsville, Queensland 4811
Australia
61 77 81 4127

JOHN J. LEONARD

Ocean Engineering Department
Room 5-422
Mass. Inst. Technol.
77 Massachusetts Ave.
Cambridge, MA 02139
+1 617 253 5305
Fax: +1 617 253 8125
jleonard@mit.edu

TAMAKI URA

Underwater Technology Research Center
Institute of Industrial Science
University of Tokyo
4-6-1, Komaba
Meguro, Tokyo 153-8505 Japan
+81-3-5452-6487
ura@iis.u-tokyo.ac.jp

HISAAKI MAEDA

Institute of Industrial Science
University of Tokyo
7-22-1, Roppongi, Minatoku
Tokyo 106, Japan
81 3 3402 6231 X2255
Fax: 81 3 3402 5349
maedah@iis.u-tokyo.ac.jp

ARYE NEHORAI

Dept. Elect. Eng. and Computer Sci.
Univ. of Illinois at Chicago
851 S. Morgan St.,
Rm. 1120 SEO
Chicago, IL 60607-7053
+1 312 996 2778
Fax: +1 312 413 0024
nehorai@eecs.uic.edu

JOHN D. PENROSE

Centre for Marine Science and
Technology
Curtin Univ, Kent SL Bentley,
Western Australia 6102
Australia 61 9351 7380
tpenrosej@cc.curtin.edu.au

JOHN POTTER

Head, Acoustic Research Laboratory
TMSI and Elect. Eng. Dept.
National Univ. of Singapore
10 Kent Ridge Crescent
Singapore 117596
Fax: 65 874 2129
Fax: 65 874 8325
johnp@arl.nus.edu.sg

ROBERT C. SPINDEL

Applied Physics Lab.
Univ. of Washington
1013 N.E. 40th St.
Seattle, WA 98105
+1 206 543 1310
spindel@apl.washington.edu

RICHARD STERN

Applied Research Lab.
Penn State Univ.
P. O. Box 30
State College, PA 16804
+1 814 865 6344
rs@arl.vax.arl.psu.edu

DR. DAJUN (DJ) TANG

Applied Physics Laboratory,
University of Washington
1013 NE 40th Street,
Seattle, WA 98105
(206) 543-1290

IEEE OCEANIC ENGINEERING SOCIETY TECHNOLOGY COMMITTEE CHAIRS

Modeling, Simulation & Visualization - WARREN FOX

Marine Communication, Navigation & Positioning -
DAVID CHADWELL

Oceanographic Instrumentation - MICHAEL HARRIS
Current Measurements - STEVEN ANDERSON, ALBERT
(SANDY) WILLIAMS, SICCO KAMMINGA & MALCOM HERON

Underwater Acoustics - KENNETH FOOTE, RAYMOND
SOUKUP, MANELL ZAKHARIA & MASAHIKO FURUSAWA

Unmanned Underwater Vehicles - CLAUDE BRANCART,
& HAYATO KONDO
Air/Space Remote Ocean Sensing - DAVID WEISSMAN
& RENE GARELLO

Sonar Signal & Image Processing - JAMES CANDY,
EDMUND SULLIVAN, JEAN-PIERRE HERMAND & AKIRA ASADA
Subsea Optics & Vision - FRANK CAIMI, JULES JAFFE & JOHN WATSON

Neural Networks & Information Processing - WILLIAM PORTO

Environmental Technology - DANIEL HANES

Submarine Cable Technology, Commercial and Scientific -
ROBERT BANNON, PAMELA HURST, GARY WATERWORTH &
KENICHI ASAKAWA

Homeland Security Technology -
PAMELA HURST & BOB BANNON

Ocean Policy Technology - JOSEPH CZIKA

Environmental Acoustics Technology - TBA

Ocean Energy - CLAUDE BRANCART & WILLIAM CAREY

Global Earth Observing System of Systems -
JAY PEARLMAN, STEPHEN HOLT & CHRISTOPH WALDMANN
Technology Committees Coordinator - SANDY WILLIAMS