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Members are encouraged to submit copy highlighting 1) Chapter Events, 2) People & Company News, 3) Student & Young Professional News, 4) Technology Updates, or 5) other material of broad interest to the OES. Please send to Beacon Editor-in-Chief, Harumi Sugimatsu <harumis@iis.utokyo.ac.jp>. Word format, 1-1/2 space; Photos (always encouraged): jpg, 300 dpi preferred. Material becomes property of IEEE-OES. Please send e-mail or physical address corrections or updates to the EIC.

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From the President

As you probably know this is my last editorial as President of the OES. These four years as President were the best of time for me as a volunteer for the society. There is still much too achieve in order to bring the society towards its aim and goals, i.e. as stated in my last editorial, to increase the impact of the IEEE Oceanic Engineering Society (OES) in its field of interest. For that a number of relatively general goals have been determined: • Grow the OES membership

- Extend the OES international activities and impact
- Introduce new means of dissemination of knowledge in the field of interest of OES

In our last Administrative Committee, during Oceans'16 in Monterey, CA in September, we adopted the **Strategic Planning**, (see further in this Beacon issue). In order to achieve our ambition, we'll still have to implement this plan, which will be the next task of the Administrative Committee members until June next year. Since the last time I addressed you, several elections or ballots have taken place. The most important of them was the attempt to modify the IEEE constitution which was fortunately rejected. Internally to the OES, we had elections for several officer positions:

- **VP Technical Activities**: Malcolm Heron (first term). I'd like to express here my deepest thanks for the outgoing Vice-President, Kenneth G. Foote, for his strong and dedicated commitment over the past 4 years.
- VP Conference Operation: Diane di Massa (second term)
- Secretary: Marinna Martini (second term)

Ross Chapman, Editor in Chief, anticipated his resignation which triggered an election process at our AdCom meeting. **Mandar Chitre** agreed to stand for election and was approved unanimously as Editor in Chief Elect to begin a three-year term as Editor in Chief starting 1 January 2018.

(continued on page 24)

From the OES BEACON Editors

Harumi Sugimatsu and Robert Wernli

Welcome to the December issue of the OES Beacon. And for those members who celebrate, we wish you a Merry Christmas and a Happy Holiday Season.

We continue to encourage all of our OES members to contribute to the Beacon. As you can see in this issue we have articles on technical research by our members, awards—both OES awards and other awards received by our members—and the latest that our elected officers and members in general are up to. You've heard this before...it is your newsletter, use it.

In the previous issue was an article on the benefits of participating in our flagship OCEANS conferences. As you read this issue, with the reports on activities at the OCEANS conferences, awards, exhibits and networking in general, and especially the photos from past and recent conferences on the cover and throughout this issue, you have to be convinced that attending an OCEANS conference is an enjoyable experience. And... it adds to your professional knowledge and the network you need to successfully build your future.

And if you haven't noticed, OES has increased our efforts to be the premier society in the advancement of AUV technologies through the financial, technical and organizational support of many international robotic and AUV competitions from the U.S. to Japan to Singapore to India and to Europe. We just completed



Your Beacon Editors, Harumi Sugimatsu and Bob Wernli, in front of the OES exhibit at OCEANS'16 Monterey.

a successful AUV Workshop in Tokyo during 6–9 November. You can read their report in the March issue of the Beacon. You also can read "the three AUV boys story" in this issue (Member Highlights).

Producing your quarterly newsletter is a challenging task, which we enjoy doing. However, again, we need your input. Participate! And feel free to contact us with suggestions to make our issues even better. We're here for you. Enjoy.

Member Benefits—Did You Know?

Build Your Resume

IEEE ResumeLab is an online service that allows IEEE members to develop a resume or curriculum vitae using a wide array of resume templates. Members can also perform mock interviews using over 900 potential interview questions or develop letters, portfolios, and skills assessments to use during the interview process. Best of all, the information developed on IEEE ResumeLab is easily shared with potential employers, mentors, or colleagues via a personalized website. Go to the following link:

http://www.ieee.org/membership_services/membership/ resumelab.html

OES AdCom Demographics -vis-à-vis IEEE and OES

Kenneth G. Foote, Vice President for Technical Activities

This is an expanded version of the short study published in the September issue, which aims to answer the question of how representative the OES AdCom membership is of the electorate, namely the OES membership. At the time of the original publication, data were not available on the demographics of OES members. Thanks to Tina Cordeiro in the IEEE Technical Activities Department, it is now possible to incorporate demographic data on OES members as of 31 August 2016. This is done in the two tables below.



The reference numbers of members are 361,138 for IEEE, 1,739 for OES, and 18 for OES AdCom. The difference in composition of OES AdCom from 2016 to 2017 represents changes due to term limits and the annual election, which affects six seats each year.

If it is necessary to answer the question explicitly, it is that the current OES AdCom membership is reckoned to be representative of the OES membership, recognizing the effect of small numbers.

IEEE region	IEEE (%)	OES (%)	OES AdCom 2016 (%)	OES AdCom 2017 (%)
1-6 USA	62.4	48.0	38	55
7 Canada	4.3	5.8	6	11
8 Europe/Africa /Russia	14.0	18.7	22	17
9 Central/South America	3.9	2.6	6	0
10 Asia	15.4	24.9	28	17
Gender	IEEE (%)	OES (%)	OES AdCom 2016 (%)	OES AdCom 2017 (%)
Female	8	9	28	33
Male	92	81	72	67
Unspecified		10		

VP for Professional Activities—In Search of Pokémon?

Bob Wernli, Vice President for Professional Activities

Now, I need to start by admitting that I've never played Pokémon or Pokémon GO. However, considering the popularity of these games, and the exponential increase in the number of players, maybe our society should follow the Pokémon lead. Why? Well, the game certainly manages to attract our youth (and I imagine a large number of seniors). Unfortunately, OES is having trouble increasing and retaining the number of student and Young Professional members.

In case you didn't know, IEEE has approximately 396K worldwide members. Of those members, 93K, or about 23%, are student members. Young Professionals (members with 15 years or less since obtaining their first professional degree), not counting graduate students who are also given YP membership, account for another 70K, or another 18% of the membership. Therefore, YPs and students make up 41% of IEEE.

Now, let's analyze our OES membership. We presently have 1,780 members. Of those, there are 51 student members. That's less than 3% of our membership. We have 263 YP members, or about 15% of our membership. If we assume about half of our student members are graduate students, who would also be YP members, then we have a total YP and student membership of around 288, or 16%. That's about 40% of the national level.

So what does all this mean? You tell me. We have been trying various meth-



ods of outreach to our YP and student members but are getting little response. Fred Maussang, our YP chair, has recently issued invitations via email to our YP list. Obviously, social media outreach is what the younger generation uses, but we need the younger generation to work with us on developing these methods of outreach so that we are doing it right.

I guess we could develop a Pokémon membership game, where you can build your team and then try and beat the other teams. The winning team gets a special prize...maybe a trip to an OCEANS conference. Maybe we add a Pokémon GO type game to our exhibits where you have to find all the characters hidden around the conference. But I'm not sure IEEE insurance would cover all the attendees walking around the event with their eyes glued to their cell phones.

Actually, such competition might be the key to getting our YPs and students to become more active. As an example, it seems that scholarship money doesn't draw a crowd like it used to. But throw in something with a team competition and the participation definitely increases. So, OES is presently discussing changing our scholarship program to a type of international, on-line, team competition that will solve an engineering problem. Top teams would be given travel to an OCEANS conference to compete their designs and solutions. The two winning teams would then be funded to develop and demonstrate their hardware at the next OCEANS conference, while the new teams also present their designs for the next round of competition.

In search of Pokemon? OES GO?? Maybe we'll have a competition to name the competition. We're open to suggestions as we discuss this concept. And we're looking for YPs and students to help us expand our outreach to our younger professional community.

For our YP and student members, there are many ways for

you to participate in IEEE and OES—ways for you to network and build your career on our shoulders. Get involved.

In my VPPA report in the December 2015 issue of the Beacon, I provided a detailed description of the VPPA activities and areas where we can always use more help. Participate. Help make your society a success and it will return the favor.

If you have any interest in participating, or comments in general, please send an email to me at wernli@ieee.org.

From the Editor's Desk

N. Ross Chapman—Journal Editor-in Chief

First of all, a few words about Volume 41 of the Journal, which is now complete with the publication of the October issue. We are sustaining the increased level of publication, around 85 papers in this Volume and in Volume 40, an increase of about 20 papers from the volumes in previous years. The number of contributions from the traditional research areas—underwater acoustics, underwater communication and underwater vehicles—continue to be strong, with modest increases in other areas of oceanic engineering and ocean science, such as applications of High Fre-

quency radar. We are also featuring two new special collections in the October issue. These are the first two of several that are planned for the coming months in the next year.

As usual, the articles are published electronically on IEEE Xplore shortly after I give final approval to the recommendations from the Associate Editors. Readers should consult our Journal website on Xplore to find the list of Early Access papers. It is updated practically every second or third day with new arrivals (and the list of titles of recent papers is provided at the end of this message). We have started a new practice that I think provides a useful service to our authors. You will likely recall that I've said in previous messages that Xplore doesn't tell authors about the publication of Early Access papers. We now send out a letter to the corresponding author to advise him/her about the publication of their paper on Xplore. Early indications from the feedback from our authors tells us that the letters are really appreciated.

We have also collected an impressive list of 'outstanding reviewers', which will be published in the first issue next year. The high quality and technical correctness of our archive of technical papers depends on the help of researchers who volunteer their time to provide constructive criticism of papers that are submitted to the Journal. Sometimes a reviewer is asked to assess one and even two revisions in bringing manuscripts up to the standards of the Journal. The 'Outstanding Review' feature is our way of acknowledging the assistance of and showing our appreciation to reviewers who took special care in their reviews.

I'd like to introduce two new Associate Editors at the Journal who were appointed to three-year terms earlier this year, Drs. Barbara Nicolas and Rosa Zheng. Dr. Nicolas is an Associate Researcher at Centre national de la recherche scientifique (CNRS) in the University of Lyon, France, with expertise and



international recognition in acoustic signal processing. Dr. Zheng is a Professor of Electrical and Computer Engineering at the University of Missouri (Columbia) and a Fellow of the IEEE, with extensive experience previously as an Associate Editor in two other IEEE Transactions. These appointments strengthen our capacity on the Editorial Board to handle reviews in two heavily subscribed areas, underwater acoustics and underwater communications. Both of them are already engaged with reviews of manuscripts.

Sadly, I need to announce that one of our long

term Associate Editors, Dr. Shengli Zhou, is resigning his position with the Editorial Board to concentrate on other interests. I have appreciated greatly Dr. Zhou's advice and expertise in underwater communications, and I want to wish him well in his new ventures.

I'm really pleased to report that our first 'Author Education Workshop' at the OCEANS16 conference in Monterey went over very well, way beyond my expectations of success. We were just getting our feet wet with this first Workshop so there were many questions in my mind about how best to present it, and whether there would be sufficient interest. Suffice to say that the conference organizers were very patient in helping to set it up as a full session of 90 minutes on Wednesday afternoon. Surprisingly, most of the audience was early and midcareer researchers, with a few students, who came with lots of questions that filled out the entire time for the session. From the reaction to our first Workshop, I think there is a real appetite out there for the information we provided. Authors, especially the early career researchers and students, need to know the reasons why the peer-review process is important; they need to know how our review process works, and they need to know what we expect in manuscripts submitted for each type of contribution that we publish in the Journal. All indications are that we have an important message to deliver, and our members want to hear it. I intend to continue to present the Workshop at future venues of OCEANS conferences.

Finally, I'd like to give a 'thumbs up' to the OCEANS16 conference at Monterey. I thought the organizers generated very creative and innovative solutions to some really serious obstacles in running the meeting. Let's hear it for Food Trucks! And wine tasting!

As with previous messages, I am including the list of papers that were published as Early Access papers on IEEE Xplore over the past three months

"Influence of Sea State and Tidal Height on Wave Power Absorption," by V. Castellucci, J. García-Terán, M. Eriksson, L. Padman, and R. Waters

"Experimental Implementation of an Echo Repeater for Continuous Active Sonar," by S. M. Murphy, J.G.E. Scrutton, and P. C. Hines

"Automatic Detection of Marine Gas Seeps Using an Interferometric Sidescan Sonar," by A.E.A. Blomberg, T.O. Sæbø, R.E. Hansen, R.B. Pedersen, and A. Austeng

"Joint Power and Rate Control for Packet Coding Over Fading Channels," by R. Ahmed, and M. Stojanovic

"Frequency Striations Induced by Moving Nonlinear Internal Waves and Applications," by T.C. Yang, C.-F. Huang, S.H. Huang, and J.-Y. Liu

"A USV-Based Automated Launch and Recovery System for AUVs," by E.I. Sarda, and M.R. Dhanak

"Spatially Distributed MIMO Sonar Systems: Principles and Capabilities," by Y. Pailhas, Y. Petillot, K. Brown, and B. Mulgrew

"Three-Dimensional Target Reconstruction from Multiple 2-D Forward-Scan Sonar Views by Space Carving," by M.D. Aykin, and S. Negahdaripour

"Comparison of Spectral Estimation Methods for Rapidly Varying Currents Obtained by High-Frequency Radar," by W. Wang, E.W. Gill, and W. Huang

"Distortion of the Frequency Dependence of Bottom Attenuation $\alpha(f)$ Inverted From Modal Attenuation βm due to Bottom Model Mismatching," by J. Zeng, Z.D. Zhao, L. Ma, and E.C. Shang

"Dynamic Modeling, Analysis, and Testing of a Variable Buoyancy System for Unmanned Multidomain Vehicles," by M. MacLeod, and M. Bryant

"Ray-Based Model for Spatial Coherence of Ocean-surface-Generated Noise and Its Approximation in a Triplet Array," by K. Lee and W. Seong

"Parametric Analysis of Ship Noise Spectra," by F. Traverso,

T. Gaggero, G. Tani, E. Rizzuto, A. Trucco, and M. Viviani "Bounds for Low Probability of Detection for Underwater Acous-

tic Communication," by R. Diamant, L. Lampe, and E. Gamroth "Coherent Multipath Direction-of-Arrival Resolution Using

Compressed Sensing," by A. Das, W.S. Hodgkiss, and P. Gerstoft "ESO-based Line-of-Sight Guidance Las for Path Following

of Underactuated Marine Surface Vehicles with Exact Sideslip Compensations," by L. Liu, D. Wang, and Z. Peng

"Development of Wireless and Passive Corrosion Sensors for Material Degradation Monitoring in Coastal Zones and Immersed Environment," by R. Khalifeh, M. S. Yasri, B. Lescop, F. Gallée, E. Diler, D. Thierry, and S. Rioual

"Treatment of Variable Topography with the Seismoacoustic Parabolic Equation;" by M.D. Collins, and W.L. Siegmann

"Surface Current Characteristics in the Taiwan Strait Observed by High-Frequency Radars," by Y. Lai, H. Zhou, and B. Wen

"Control of an Unmanned Surface Vehicle with Uncertain Displacement and Drag," by W.B. Klinger, I.R. Bertaska, K.D. von Ellenrieder, and M.R. Dhanak

"Low-Complexity Adaptive Sonar Imaging," by J.I. Buskenes, R.D. Hansen, and A. Austeng

"An Autonomous Water Monitoring and Sampling System for Small-Sized ASVs," by F. Fornai, G. Ferri, A. Manzi, F. Ciuchi, F. Bartaloni, and C. Laschi

"Satellite-Based Offshore Wind Resource Assessment in the Mediterranean Sea," by T. Soukissian, F. Karathanasi, and P. Axaopoulos

"The Generalized Sinusoidal Frequency-Modulated Waveform for Active Sonar," by D.A. Hague, and J.R. Buck

"Ultrawideband Underwater Real-Time #-D Acoustical Imaging with Ultrasparse Arrays," by C. Chi, Z. Li, and Q. Li

> Ross Chapman Editor in Chief

Request for Nominations to the Administrative Committee Class of 2018

Jerry Carroll, OES Junior Past President

The IEEE OCEANIC ENGINEERING SOCIETY is governed by an Administrative Committee of 18 members. Six are elected each year to serve three-year terms. Members are limited to two consecutive terms, although they may be reelected after a lapse of one year.

The Nominations and Appointments Committee is chaired by the Junior Past President with the Senior Past President completing the Committee. They are charged with proposing a slate of nominees and with conducting the election, which is done electronically to the entire membership. The electronic election requires each member that wishes to vote to have an IEEE account. Therefore, visit IEEE.org to establish your account if needed.

Qualifications for Administrative Committee membership are membership in the IEEE and OES, and a willingness to serve the oceanic engineering profession. The Society wishes to have the Administrative Committee characteristics to reflect characteristics of the IEEE membership. I ask that each of you identify and nominate qualified candidates for the Administrative Committee. Self-nomination is encouraged.

The nomination Packet should include a Letter of Nomination accompanied by a one page biographical sketch of the proposed candidate with picture and one-page statement from the proposed candidate giving his or her views of the opportunities and challenges facing the Society and steps to be taken to advance the IEEE Oceanographic Engineering Society.

The election will be conducted in accordance with our Bylaws. You can read them by going to the Society's Web Site

(www.ieeeoes.org) and pointing to Bylaws under Governing Documents. The Bylaws specify that general nominations close on March 1, and nominations by petition close by April 15, 2017. Please submit nominations to the undersigned starting 1 January 2017. Please do not delay your efforts in finding and nominating qualified candidates. Send your nominations in 2017 to:

Rene Garello Chair, IEEE/OES Nominations and Appointments Committee rene.garello@telecom-bretagne.eu

Request for Nominations for DTAA and DSA 2017

Jerry Carroll, OES Junior Past President

Request for Nominations for The Distinguished Technical Achievement Award 2017

Request for Nominations for The Distinguished Technical Achievement Award 2017.

The IEEE Oceanic Engineering Society is hereby soliciting nominations for the society Distinguished Technical Achievement Award for significant accomplishments in oceanic engineering. A nomination form can be downloaded from the OES website under Professional Activities—Honors and Honorees—Award Forms. Nominations should be forwarded to the Awards Chair, Rene Garello at rene.garello@telecom. bretagne.eu. The deadline for nominations is 1 May 2017.

Request for Nominations for The Distinguished Service Award 2017

Request for Nominations for the Distinguished Service Award 2017.

The IEEE Oceanic Engineering Society is hereby soliciting nominations for the society Distinguished Service Award to honor an individual IEEE member for outstanding contributions toward furthering the objectives of the Oceanic Engineering Society. A nomination form can be downloaded from the OES website under Professional Activities—Honors and Honorees—Award Forms. Nominations should be forwarded to the Awards Chair, Rene Garello at rene.garello@telecom. bretagne.eu. The deadline for nominations is 1 May 2017.

Upcoming OES Sponsored Conferences, Symposia and Workshops

November 6–9, 2016 IEEE AUV 2016 Workshop Tokyo, Japan http://www.auv2016.org/

February 21–24, 2017 IEEE Underwater Technology 2017 (UT17) Busan, Korea http://ut2017.org

March 10–13, 2017 SAUVC 2017 Singapore http://www.sauvc.org/

May 1–4, 2017 OTC 2017, Houston Texas, USA http://exhibits.otcnet.org/otc2017/

June 19–22, 2017 OCEANS'17 MTS/IEEE Aberdeen Aberdeen, Scotland http://www.oceans17mtsieeeaberdeen.org/

July 25–27, 2017 RIO Acoustics 2017 Rio de Janeiro, Brazil http://www.rioacoustics.org/call-for-papers.html

September 18–21, 2017 OCEANS'17 MTS/IEEE Anchorage Anchorage, Anchorage, Alaska http://www.oceans17mtsieeeanchorage.org/

October 24–26, 2017 OTC Brazil 2017 Rio de Janeiro, Brazil http://www.otcnet.org

March 20–23, 2018 OTC ASIA 2018 Kuala Lumpur, Malaysia http://2018.otcasia.org/

May 28–31, 2018 OCEANS'18 MTS/IEEE Kobe/ Techno-Ocean'18 (OTO'18) Kobe, Japan http://oceans18mtsieeekobe.org/

October 22–25, 2018 OCEANS'18 MTS/IEEE Charleston Charleston, South Carolina, USA

OES Society Awards

Photos by Stan Chamberlain

The OES Society Awards Ceremony was held at the Wednesday Plenary at OCEANS'16 Monterey. We are honored to introduce the following 2016 OES award recipients. Congratulations!

2016 Distinguished Technical Achievement Award: John E. Ehrenberg

John E. Ehrenberg is presented the DTA for invention of the dual-beam and split-beam scientific echo sounders and contributions to the use of miniature acoustic tags in fisheries research.



John E. Ehrenberg receives the Distinguished Technical Achievement Award from OES president René Garello.

Over the past 45 years, John E. Ehrenberg has contributed to the advancement of fisheries acoustic research. In the 1970s while working as a research professor in electrical engineering at the Applied Physics Laboratory of the University of Washington, he developed the dual-beam and split-beam techniques for extracting fish target strength from acoustic echoes. Results from this work were presented at the then budding OCEANS conference (1971–1974) and these methods are now used worldwide for directly measuring the target strength of fish in situ. Miniature underwater acoustic tags attached on, or surgically implanted in fish have been a mainstay in fisheries research since their introduction in the early 1950s. In the early 1990s, John Ehrenberg and colleagues at Hydroacoustic Technology Inc. (HTI) developed high-frequency (300 kHz) miniature tags with encoding schemes that made it possible to track simultaneously and uniquely thousands of tags in 3 dimensions. Most recently, he has been working on innovative "digestible" underwater acoustic tags that help track a prey in the predator's guts.

President of HTI since 2007, John Ehrenberg was Director of Engineering & Information Technology at Boeing for 20 years, Vice-President and Chief Scientist at Biosonics Inc. for 4 years, Principal Engineer at the Applied Physics Laboratory and Research Professor in electrical engineering at the University of Washington for over 10 years. He earned a PhD degree from the University of Washington (1973), an MS degree from the Massachusetts Institute of Technology (1968), and a BS degree from Seattle University (1966), all in electrical engineering.

John Ehrenberg is a Life Senior Member of the IEEE Oceanic Engineering Society. He served as an Associate Editor for the IEEE Journal of Oceanic Engineering from July 1982 to January 2005. He was Editor of a special issue of the Journal devoted to "Ocean Acoustic Remote Sensing" V.11(1), 1986.

2016 Distinguished Service Award: Harumi Sugimatsu

Harumi Sugimatsu is presented the DSA for outstanding support of the Society through organization of international conferences, symposia and workshops.



Harumi Sugimatsu receives the Distinguished Service Award from OES president René Garello.

Harumi Sugimatsu has contributed to the expansion of the International Symposium on Underwater Technology around the Asia-Pacific Rim with 8 symposia held since 1998 in Japan, Taiwan (2004), China (2009), and India (2015), continuing with Korea in 2017. She was one of the key organizers of OCEANS'04 and'08 in Kobe, Japan. As a member of the OCEANS reconnaissance team, she helped bring the OCEANS conference to Korea (2012), Taiwan (2014), and China (2016). Her work organizing competitions of autonomous underwater vehicles (AUV) held by the University of Tokyo has expanded with the upcoming AUV 2016 workshop in Tokyo (Nov. 6-9, 2016). She worked on the 1998 foundation of the OES Japan Chapter whose activities have since led to the creation of OES Chapters in Korea, China, Taiwan, and India. In 2015 she became Editor-in-Chief of the OES Beacon Newsletter. She is a Senior Member of the IEEE Oceanic Engineering Society, and currently serves a 3-year term as an elected member of the OES Administrative Committee.

Harumi Sugimatsu is a Research Fellow at the Institute of Industrial Science of the University of Tokyo, Japan, specializing in whale and dolphin echolocation with application to cetacean observation systems. Her work on the international collaborative project to monitor Ganges River dolphins was featured in the May 2016 issue of IEEE Spectrum.

Harumi Sugimatsu earned a Master's degree from the Graduate School of Humanities, Gakushuin University, Japan. She is a member of the Marine Technology Society and the Japan Art History Society. She is also an accomplished artist credited with numerous exhibitions (http://homepage3.nifty. com/sugimatsu-artgallery/).

2016 Presidential Award: M.A. Atmanand

M.A. Atmanand is presented the Presidential Award with appreciation and thanks for the outstanding service to the Society as a volunteer.



M.A. Atmanand receives the Presidential Award from OES president René Garello.

Dr. M. A. Atmanand is a Senior Research Scientist at the National Institute of Ocean Technology, the premier institute in Ocean Technology in India, where he was Director for over 5 years. He was the general chair of the Underwater Technology conference, UT15 held in Chennai, India in February 2015. He founded the OES Chapter of the IEEE India Section and fostered the participation of OES Student Members from India in international activities sponsored by the Society. He is currently one of the Associate editors of the *IEEE Journal of Oceanic Engineering* and serves as Chair of the technology committee for Underwater Cables and Connectors.

2016 Emeritus Award: Frederick H. Maltz

Frederick H. Maltz is presented the Emeritus Award with appreciation and thanks for his long years of service as Editor of the Society Newsletter.

Federick H. Maltz is a consultant in Mountain View, CA. Previously, he was a Research Scientist at Lockheed Martin Advanced Systems Development Center in Palo Alto, CA, a Principal Engineer at the Westinghouse Oceanic Division, and at the Naval Underwater Systems Center in New London, CT. He earned an MS degree in Statistics from Stanford University, and a BS in Engineering from the University of California Los Angeles. Fred Maltz is a Life Senior Member of the IEEE Oceanic Engineering Society. He served as



Frederick H. Maltz receives the Emeritus Award from OES president René Garello.

Editor of the Society's Newsletter from 1988 to 2008. He served 6 terms as an elected member of the Society's Administrative Committee. He was the IEEE Standards coordinator for the Society for several years, and chaired tutorial programs at AUV'96 and at the OCEANS conferences in 1996, 1999, and 2000. He received the OES Distinguished Service Award in 2000.

2016 Company Award: MBARI

The Monterey Bay Aquarium Research Institute (MABRI) is presented the IEEE Oceanic Engineering Society's Company Award for their consistent presence and effort towards the goals of the society to advance ocean research for the science and technology community and for their support of the IEEE OES and OCEANS'16 Monterey.





Dr. Chris Scholin, President and CEO of MBAR, accepts the OES Company Award for MBARI.

Awards for OES Members

Contact the editors if you've received an award.



Lian Lian receives the Compass International Award from MTS president Ray Toll (R) and Amos Bussman (L) from Compass Publications, Inc.

Lian Lian Received the 2016 Compass International Award from the Marine Technology Society

Lian Lian (Shanghai Jiao Tong University) received the 2016 Compass International Award from the Marine Technology Society (MTS) for her outstanding contributions to the advancement of marine science and technology. The MTS awards ceremony was held at the Tuesday Plenary at OCEANS'16 Monterey. Congratulations!



Marinna Martini deploying a wave rider buoy in Cape Cod Bay. Image courtesy of the U.S. Geological Survey.

Marinna Martini Received the Outstanding Professional Achievement Award from the U.S. Merchant Marine Academy

IEEE OES Senior Member Marinna Martini was honored for Outstanding Professional Achievement at her 30th year class reunion at the United States Merchant Marine Academy. The Outstanding Professional Achievement Award is presented to an anniversary year graduate who best exemplifies the finest tradition of the Corps—Acta Non Verba—by attaining personal achievement in their chosen field thus lending honor and prestige to the United States Merchant Marine Academy. Congratulations!



OCEANS'17 MTS/IEEE Anchorage September 17–22, 2017, Anchorage, USA



Visit our website at http://www.oceans17mtsieeeanchorage.org/





Chapter News

Submit Chapter news to Beacon Co-Editors and OES Chapter Coordinator

IEEE OES Malaysia Chapter—Meeting Report

Compiled by Rosmiwati Mohd Mokhtar and Mohd Rizal Arshad

2nd Annual General Meeting 2016

The 2nd Annual General Meeting for IEEE OES Malaysia Chapter was held on 17 February 2016 at the Center of Artificial Intelligence & Robotics (CAIRO), Universiti Teknologi Malaysia (UTM), Kuala Lumpur, Malaysia. During the event, new executive committees for 2016 were elected. The meeting also agreed to appoint sub committees which will represent the institution they belong. This is hoped to increase more activities conducted by the IEEE OES members at various institutions and sectors.

2016 IEEE OES Malaysia Chapter Executive Committee				
Chair	Mohd Rizal Arshad			
Vice Chair	S. Saad Azhar Ali			
Secretary	Rosmiwati Mohd Mokhtar			
Treasurer	Zool Hilmi Ismail			
Committees	Ahmad Faisal Mohamad Ayob			
	Khalid Isa			
	Mohd Ikhwan Hadi Yaacob			
	Zainah Md Zain			

Chapter Meeting

Till September 2016, the IEEE OES Malaysia Chapter has conducted four chapter meetings.

Date	Meeting	
21 Mar 2016	5th IEEE OES MY Meeting	
	(CAIRO, UTM Kuala Lumpur)	
28 Apr 2016	6th IEEE OES MY Meeting	
	(MIMET, UniKL, Lumut, Perak)	
21 July 2016	7th IEEE OES MY Meeting	
	(UTP, Tronoh, Perak)	
21 Sept 2016	8th IEEE OES MY Meeting	
	(UPSI, Tanjung Malim, Perak)	

The next meeting is scheduled to be held on 7th October 2016 at USAINS, Pulau Pinang, Malaysia. The 5th meeting remarked unforgettable event as the chapter received visit from delegates of IEEE OES. Present in the meeting were Rene Garello (IEEE OES President), William (Bill) Kirkwood (IEEE OES Treasurer), Jerry C. Carrol (IEEE OES Junior Past President) and James Barbera (IEEE OES Senior Past President).

Meetings conducted by the chapter mainly focus on discussion of running activities for the year. In conjunction with the meeting, the chapter also organized technical talk, membership drive and visit to the laboratories. The organization of multi events for every meet up is seen to gain more knowledge and able to strengthen the networking among members. This is important especially when the chapter is looking forward in organizing an international conference (USYS'16) on the 13–14 Dec 2016.



5th meeting with OES delegates.



6th meeting @ MIMET.



7th meeting @ UTP.



8th meeting @ UPSI.

San Diego OES Chapter—The International Guest Speaker at the San Diego OES Chapter Kevin J Delaney, Chair—San Diego OES Chapter

Dr. R. Venkatesan, Director of the Ocean Observation Systems Group at India's National Institute of Ocean Technology (NIOT), spoke to the San Diego Chapter on "India's Ocean Technology Initiative" on October 20, 2016. Dr. Venkatesan outlined the many applications of ocean technology under development at NIOT, with an emphasis on sustainable use of the oceans. These technologies include ocean thermal energy conversion (OTEC), desalination and aquaculture. In addition, he discussed the challenges in developing a tsunami warning system for India's vast coastlines. He emphasized the important role of professional societies like the IEEE and MTS in developing the next generation of engineers. The event was held at Coleman University and cosponsored by the IEEE Aerospace and Electronic Systems (AES) chapter, as well as the local Marine Technology Society chapter.



Dr. R. Venkatesan of India's NIOT presents a plaque and ceremonial shawl to San Diego Chapter chair Dr. Kevin J. Delaney.



Dr. R. Venkatesan and meeting attendees with the Coleman University's student AUV, along with student project leader Nick Cantrell.

Chapter Report—Inputs for Beacon

R. Venkatesan, Chair—OES India Chapter

Awards

Dr. M.A. Atmanand, Scientist-G, National Institute of Ocean Technology and Chair, Madras Section was awarded with Institution of Electrical and Electronics Engineers Inc. (IEEE) Oceanic Engineering Society's (OES) "Presidential Award" for his outstanding services to the IEEE Oceanic Engineering Society as a volunteer on 21st Sep 2016 during the IEEE/MTS Oceans conference held at Monterey, USA. The award was presented by the IEEE OES President, Dr. Rene Garello.



Dr. M A Atmanand receiving the Presidential award.

During the IEEE day event organised by IEEE Madras chapter on Oct 15, 2016, Dr. *M A Atmanand*, Scientist-G, National Institute of Ocean Technology & Chair, Madras Section and Dr. R. Venkatesan, Chair IEEE-OES India Council & Chair- MTS India section were presented with certificates for their professional achievements by Dr. M. Anandakrishnan, Former Vice-Chancellor of Anna University, Chennai, India

Events

IEEE Oceanic Engineering Society (OES) India Council in association with National Institute of Ocean Technology (NIOT) and Marine Technology Society (MTS) India Section organized the 1-day Ocean Technology Student Camp (OTSC 2016) on 3rd September 2016 at NIOT Campus. More than 65 students from 15 schools participated in the camp. As part of the camp, a quiz competition on Ocean Technology was conducted for students, in which 15 teams participated. PSBB Millennium School, Thalambur bagged the first prize; BVM Global School, Chennai and Amalorpavam Higher Secondary School Pondicherry won the second and third prizes.

Dr. R. Venkatesan, Chair IEEE-OES India Council & Chair MTS India section gave the welcome address and Dr. G. A. Ramadass, Vice Chairman gave the introductory remarks. Former Director, NIOT & Chair IEEE Madras section Dr. M. A. Atmanand and Shri H R Mohan, Vice-Chair, IEEE Madras,



Introduction by the Chief Guest.



Prizes presented to the teams.



Dr. M A Atmanand



OTSC 2016-Group Photo.

Chair, IEEE CS & PCS and IPP also addressed the gathering. Mr. M. Arul Muthiah, Treasurer IEEE-OES India Council introduced Prof. M. Ravindran, Chief Guest and Founder Director of NIOT.

Prof. M. Ravindran founder Director, NIOT delivered the guest lecture to the students on the importance of Ocean Technologies. He mentioned about the history of the oceans, ocean technology activities undertaken in India and insisted on the need for the students to get in to the field of ocean technology. He also highlighted that the importance of oceans should be taken to young generation, especially to students community.

A visit to Chennai Port was also arranged for the students in the afternoon session and the students were explained about the port facilities, handling of ships inside port, berthing and port related activities. The students were greatly impressed with various ocean technologies pursued in India.

Lectures

Dr. M A Atmanand, Scientist-G, National Institute of Ocean Technology & Chair, Madras Section delivered a lecture on Ocean Energy programs undertaken in India at IEEE-OES, University of Rhode Island, USA on 12th September 2016.

Dr. R. Venkatesan, Chair IEEE-OES India Council and Chair- MTS India section, delivered a IEEE-OES organised talk on the Indian Ocean technology initiatives on 20th Oct 2016 at Coleman University, San Diego.



Dr. R. Venkatesan delivering a talk at San Diego.

Singapore Chapter—Chapter Activity Report For the Year 2016

Prepared by Ken Teo Hoe Eng Ken & Venugopalan Pallayil

The IEEE Oceanic Engineering Society (OES), Singapore Chapter, has organized a number of technical talks, IEEE distinguish lecture and a seminar series with the support of the local academia and industry in the year 2016. A report on the chapter activities for 2016 prior to this report has been given in the BEACON Newsletter June 2016. This included the SAUVC 2016 event, technical talks and the IEEE distinguished lecture. We have organised so far six technical events in this year and we hope to have two more technical talks before the end of the year.

The Chapter organised a half-day technical programme on 01 Nov 2016. The objective of this technical programme was dissemination of some of the emerging technologies for use at sea. This technical meeting was open to academics as well as industry leads and was well attended. There were representations from many local industries such as Thales Asia, Nortek AS, ST Electronics (InfoCom), Precision Technologies Ltd., Seamap Pte Ltd etc. The programme started with the chapter chair Ken Teo welcoming the speakers and participants. He also shared the chapter's mission and goals as well as summary of the chapter activities for the year 2016. This was followed by the IEEE OES membership promotion talk by Venugopalan Pallayil.

The highlight of the technical meeting was two talks in the areas of underwater robotics. The first talk was on 'Design of a

Hybrid Submersible UAV for Target Location and Surveillance' by Dr. Daniel T. H. New, Asst. Professor, School of Mechanical and Aerospace Engineering, Nanyang Technological University (NTU). In this talk Prof. New described the challenging work being done at NTU towards the development of a hybrid vehicle, which can fly, land on the sea surface and then dive into the sea. The second talk was given by Mr. Vinoth Viswanathan, Research Scientist, Centre for Environmental Sensing and Modeling (CENSAM) from Singapore-MIT Alliance for Research and Technology (SMART). The topic of his talk was 'Buoyancy Driven Autonomous Profiling Float for Shallow Waters', which are cheaper alternatives to Argos floats for shallow water application. These vehicles can do up to 300 profiles for a water depth of 100 m and is ideal for local waters. The event drew more than 40 attendees from across industry, academia, research institutions and other organisations. The level of interest and engagement of the participants was evident from the extensive questions and answers session that followed. The participants stayed over for more than an hour over a high tea reception, which provided a great avenue for interactions. The feedbacks received from participants were very encouraging and we expect more people to join the IEEE OES community in the coming year.

The Annual General Body meeting of the Chapter was also organised alongside the above technical event to ensure maximum participation from the members. The main agenda of the general body meeting was to select the new office bearers of the Chapter for the year 2017. We have recommended that most of the past committee members would continue for the next year with some new members inducted into the executive committee. The names of the new committee members would be made available after the same is cleared by the polling officers at the IEEE Singapore Section.

The meeting also discussed the progress made towards the organisation of MTS/IEEE OCEANS'20 conference to be held in Singapore as well as the next underwater robotic competition, The Singapore AUV Challenge 2017.

The Singapore AUV Challenge 2017—Updates

There are 12 student teams registered so far and we expect more teams to join as we approach the deadline for registration, 15 Nov 2016. Apart from IEEE OES, one of the regular sponsors of this event, we were successful in getting support from some of the local industries and institutions. Please see www.sauvc.org for details of the sponsors so far. Along with the SAUVC 2017, we are also organising a workshop where some of the leading professionals in the field of underwater robotics will be sharing their experiences with the students. Dr. William Kirkwood from MBARI, who will also be the guest of honor and IEEE OES representative, will be delivering a talk on his recent work on AUVs. We also plan to organize talks by Prof. Stefan Williams from the University of Sydney and Prof. Nikola Miskovic from the University of Zagreb, Croatia, two other well-known experts in the field of underwater robotics.

Chapter Website and Membership

The IEEE OES Singapore Chapter has launched a new website, www.ieeeoessg.org, from late this year. The website captures the details of all the events and also serve as a platform to advertise IEEE OES events including OCEANS conferences.



Asst. Prof. New delivering his technical presentation on hybrid UAVs.



Vinoth giving his presentation on shallow water floats for profiling applications.



Interaction and discussions by the participants during the high-tea session.



Group photo of the participants who attended the technical sessions.

Despite the economic downturn and sharp fall in oil prices, it is important to note that the Singapore Chapter has maintained its membership count this year. We have currently 32 members, which is a very healthy number considering Singapore is such a small community of ocean scientists.

Spanish Chapter—Martech Workshop 2016

Marc Carreras, CIRS lab, University of Girona, Spain

The Spanish Chapter of the Oceanic Engineering Society sponsored the 7th International Workshop on Marine Technology—Martech Workshop 2016, which took place in Barcelona (Spain) on October 26–28, 2016, in the Instituto de Ciencias del Mar (CSIC). The workshop was organized by the Consejo Superior de Investigaciones Cientícas (CSIC) and the Universitat Politècnica de Catalunya (UPC). The main goal of this workshop is to show the latest investigations and to exchange information and points of view on current research in MARine TECHnology. Martech Workshop brings together a diverse set of researchers who are jointly committed to developing technology, not just for its own sake, but to generate innovation in the field of maritime technologies.

Martech Workshop 2016 brought together 50 contributions, which were presented orally in two parallel sessions, and can be categorized in 10 different topics: Operational Oceanography; Instrumentation, Metrology, Signal processing; Remote sensing; Seafloor observatories and sensor networks; Marine Robotic perspective: ROVs, AUVs, ASVs, Gliders, Crawlers; Underwater imaging and communication; Seafloor and Water Column characterization; Costal, regional, and offshore research vessels and platforms; Technology for Marine Biology and Aquaculture; Marine Geophysics technology and solutions; Citizen Science applications and interfaces; Perspective for Space Research; Polar Research. Companies exhibiting in the workshop also offered tutorial sessions.

Prof. Paolo Favali (INGV, Rome, Italy) was the first invited speaker, with his talk about the European Multidisciplinary and Water-Column Observatory—European Research Infrastructure Consortium (EMSO ERIC). Dr. Nicole Biebow (Alfred Wegener Institute, Germany) gave the second talk entitled "Towards a Better Use of Arctic Marine Infrastructure: EU-PolarNet, EUROFLEETS2 and ARICE".

Next edition of the Martech Workshop will take place in Porto (Portugal) in 2018, and it will be organized by the Porto University. For more information visit: http://www.martech-workshop.org/



Prof. Paolo Favali at Martech 2016 in Barcelona (Spain).

Australia Chapter—Chapter Report Mal Heron, Chapter Chair

The Australia Chapter works under the supervision of the Australia Council and members of the Chapter are drawn from six geographically separated Sections. This means that technical meetings are invariably jointly sponsored by the Chapter and one of its participating Sections.

Dredge Monitoring: Technical Meeting

Australia is an island nation with a critical need to maintain and develop shipping infrastructure. It also has an imperative to maintain its relatively pristine coastal ecosystems. The impact of dredging on the coastal marine environment is under increasing scrutiny and the monitoring of turbidity around dredge sites was explained at an OES Australian Chapter meeting by Dr James Whinney from the Marine Geophysical Laboratory (MGL) at James Cook University in Townsville in October. The meeting was jointly sponsored by the OES Chapter and the Northern Australia Section.

Dr Whinney described the scale of MGL involvement from large projects at Barrow Island on the North-West shelf oil and gas province and the coal loading port at Hay Point in Queensland where about 8 million cubic metres of sediment was moved in each case,



Mathew Whelan, Chair Northern Australia Section (right) welcomes James Whinney to the venue.



Dr James Whinney working on a turbidity sensor at James Cook University.

to small projects like marinas and ferry terminals where less than 500,000 cubic metres are moved. As well as this service to industry, the MGL are developing sensors and researching better ways to optimise the deployment of instruments to identify zones affected by turbidity, and to monitor specific preservation sites like coral reefs and seagrass beds. One of the issues discussed by Dr Whinney is the separation of turbidity due to dredging and that due to natural resuspension by waves and currents. This talk led to a lively open discussion about the sensors, and about policies and practices used by regulators to set operating parameters for dredging operators.

Unmanned Vehicles

At OCEANS16 Monterey, the most popular topic was Unmanned Underwater Vehicles and the OES Australia Chapter brought some insights to Flinders University in Adelaide in September with a presentation by Professor Oleg Yakimento from US Naval Postgraduate School in Monterey California, titled "Unmanned Vehicles—State of the Art and Future Challenges". This technical meeting was jointly sponsored by the South Australia Section and the OES Australia Chapter. Attendance was at 40 people from universities, industry and the Defence Science and Technology Organisation (DSTO) laboratories in Adelaide. This represents the strong commitment of the South Australian Marine Science and Engineering community as the Australian Government plans expansion of its submarine capability over the next decade.

HF Radar

A presentation by OES Distinguished Lecturer Professor Mal Heron from PortMap Remote Ocean Sensing Pty Ltd., Townsville, Australia was hosted by the Student Branch at Melbourne University in November and jointly sponsored by the OES Australia Chapter, the Victorian Section, and the Student Branch. Professor Heron was the Foundation Director of the Australian Coastal Ocean Radar (ACORN) facility under the Australian Integrated Marine Observation System (IMOS) and the talk represents the maturity of HF



Gitansh Khirbat, Chair Student Branch, hosted OES Distinguished Lecturer Mal Heron at Melbourne University in November.



WERA HF radar receiver antennas at Munster with the Port of Rotterdam in the background.

radar technology in Australia. After a description of the underlying physics, Professor Heron went on to describe the interest of Rijkwaterstaat to use HF radar in its management capabilities at the Port of Rotterdam in the Netherlands. Anecdotes arising from the project to validate the performance of a newly installed WERA phased array radar raised interest and discussion, and the talk ended with some very graphic shipwreck scenes that underline the economic and social value of current mapping in port precincts.

Seattle Chapter—Chapter Report

John B. Hager, Secretary, OES Seattle Chapter

Tutorial on Marine Slip Rings

At the October 20, 2016, monthly meeting of the OES Seattle Chapter, guest speaker Craig Bowers presented a tutorial on Marine Slip Rings, Fiber Optic Rotary Joints (FORJ), and Multiplexers. Mr. Bowers is Managing Director, Focal Technologies Corporation.

Slip rings continue to be a critical element in delivering power and signals in marine systems with rotating connections such as in ROV winches, both at the surface and subsea. As working depths, digital bandwidth and safety requirements have increased; these rotary products have continued to advance, including higher voltages and currents on the electrical side and from multimode to single mode fiber optics and increasing channel counts. Electronic and optical multiplexing is required for optimal fiber utilization for signals with aggregate bandwidths now in the terabits/s to support architectures increasingly based on Ethernet and HD video. Safety requirements have also increased with many applications demanding hazardous location certification.

Marine applications demand multi-discipline engineering expertise:

- Mechanical Design: 3D modeling and CAD, high pressure fluids and seals, FEA stress analysis.
- Electronic Design: FPGA/PLD multiplexing, Embedded and PC software, Analog and digital including high speed, Pressure treated electronics and optics.
- Optical Design: Optical modeling, Precision opto-mechanical design, Fiber optic communications.
- Electrical Design: High voltage, High current, Oil immersion, marine and hazardous environment.
- Marine Design: Materials, pressure compensation.

SIMRAD Tour and Technology Presentation

The April 21, 2016, monthly meeting of the OES Seattle Chapter was a tour of the Kongsberg SIMRAD facility north of Seattle, and a presentation on Technologies for Sustainable Fisheries.





Mr. Bowers presenting FORJ requirements and features.



The Multi-Discipline Engineering involved in Marine Slip-Rings.

This was hosted and presented by Mr. Mike Hillers, head of the Kongsberg Simrad Fisheries activity in the US.

In the quest for Sustainable Fisheries, the physical, technological, regulatory, and financial challenges to modern fisheries are formidable. The presentation introduced these, then focused

Trawl Sonar | Catch-Monitoring System.

on the current state of commercial fisheries electronics, encompassing sonars, sensors, and acoustic telemetry modules/systems.

The goal of fishermen is to catch the "right" fish. "Right" is defined as the right species and the right size. Capturing the right size is necessary, due in part to regulations, the processing machinery, and also the value to the fishermen. In commercial fishing size very much matters. The technology is currently readily available to discern fish size. The "right" fish also means the right species. Again value for the fisherman is in efficiently catching the target species. Regulatory penalties for catching the wrong species can shut down an individual fisherman as well as a fishing season for all involved. Even if the penalties are not financial, the waste in time and life is just that, a waste, and can be avoided. The technology to discriminate fish species acoustically is the "Holy Grail" of fisheries acoustics and has been achieved, from a scientific perspective, only anecdotally. However for commercial fishermen, anecdotal evidence is seen on a screen and then either avoided or subsequently caught. The more data that can be presented to the fisherman before the net is placed in the water increases the likelihood of the "right" fish being caught. Additionally acoustic measuring equipment combined with real-time video can increase the potential to release non-targeted species and size during the capture sequence. Releasing fish at depth significantly increases the survivability rate. The inefficiency in catching the "wrong" fish is costly and can, with today's technology, be avoided.

Victoria Chapter Listens to a Fish Counter N. Ross Chapman, Chapter Chair

The Victoria Chapter co-hosted Dr. Wu-Jung Lee who presented a seminar: 'Counting Fish with Sound: Modeling and Analyzing the Statistics of Sonar Echoes from Marine Organisms' at the University of Victoria (UVic) on Monday, September 12. Dr. Lee is at present a SEED (Science and Engineering Enrichment and Development) Postdoctoral Fellow at the Applied Physics Laboratory (APL) in the University of Washington. Her research career since graduating with a PhD from Woods Hole spans research in cetacean acoustics, fisheries acoustics and acoustics of bats. Her seminar at UVic was focused on deriving information to enable estimation of fish abundance from acoustic backscatter. The central thesis is that predictive echo statistics models provide a means for direct inference of the composition and numerical density of fish and marine organisms. Furthermore, echo statistics can offer critical information for interpreting echoes from mixed assemblages. Dr. Lee presented a convincing case for the use of echo statistics-they provide an additional and significant extra dimension of information complementary to conventional information from spectral and temporal echo features, and the analysis can be applied without the

need for absolute calibration of the system which is needed for use of spectral information.

The audience engaged in a lively discussion with Dr. Lee about the challenges in refining the techniques for inverting echo statistics to estimate fish numbers. There are questions about relating the inferred number densities to ground truth counts of actual fish numbers—always a fundamental question in using any inverse method. The issue of sorting out the backscatter from the components of the mixed assemblage of fish types is a fundamental problem, and there are significant questions about the appropriate parameters for modeling the echo statistics. In fact, Dr. Lee's visit was focused on discussions with other experts at UVic about appropriate measures to quantify the error in the model parameter estimates—and ultimately the error in the estimate of fish density.

Her talk concluded with a short glimpse of new work that she is doing at APL about the emission pattern of echoes emitted by echolocating fruit bats. Dr. Lee showed a fascinating comparison of video tracking of the bat's flight concurrent with the acoustic data of the echo signals as the bat closed on targets. More information about this work and the echo statistics research can be obtained from Dr. Lee's website at APL: http://www.apl.washington.edu/ people/profile.php?last_name=Lee&first_name=Wu-Jung.

Call for Beacon Associate and Contributing Editors



You'll note on the top of page 2 of the Beacon a list of our Associate and Contributing Editors. Is your country represented? Would you like to join our editorial team? Please contact your newsletter editors if you're interested. In particular, we would like to add some editors from **North America** to assist in reviewing our many international submissions to ensure typos and grammatical errors are corrected.



AUV Competitions in Japan

Kenichi Asakawa, Beacon Associate Editor, OES Japan Chapter

'16 Underwater Robot Convention in JAMSTEC

'16 Underwater Robot Convention in JAMSTEC was held at the Yokosuka Headquarters of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) from August 26 to August 28 of this year. A total of 379 participants participated in this vibrant convention in three days.

This convention included three divisions—AUV division (5 teams), free-style division (8 teams), and junior division (8 teams)—and a seminar on underwater robots that was held simultaneously.

The object of the junior division is the same as that of the 6th Underwater Robot Festival reported in another article in this Beacon. It targeted high school and junior high school students who will lead the future, and aimed to deepen their understanding and interest to marine and marine technologies.

For the participants of the junior division, we distributed parts and production manuals in advance, and instructed them to learn and assemble it by themselves before the convention. On the day of the convention, not only did the students complete their underwater robots according to the manual under the guidance by lecturers, we instructed each team to use their own ingenuity. Although it was a hard task for them, including programming for a micro-computer, fortunately, all teams were able to complete their underwater robots. On the next day, they competed with each other in a game to collect empty cans using the completed underwater robots. By providing obstacles simulating seaweed, the range of strategy was expanded. The game was full of young vibrancy with their strong commitment to victories and rankings.

In addition to the junior division, noticeable activity of high school students was seen even in the free-style division. The presence of junior high and high school students increased.

In the AUV division, participants brought in their own underwater robot and competed with each other for achievement within a limited time, tracing the lines drawn on the bottom of the water tank, getting through the gate and landing on the platform. The S.U.I. team from Okinawa Polytechnic College completed all the tasks and won the championship.

In the free-style division, participants created their own underwater robots, and competed for the idea and workmanship with each other. Various underwater robots including amphibious multi-legged robot, a modular underwater robot, a biomimic octopus robot using umbrella and a hull type robot were exhibited.

As a result of the competition, "Sakasatako," made by National Institute of Technology, Oyama College team, won the first prize, being evaluated for its unique idea and originality.

On the second day, the AUV division and the free-style division held a workshop in which the participants presented their own works and communicated with each other.

An underwater robot seminar, held on the second morning, was a new addition this year. Four experts gave lectures from different perspectives to about 60 participants.



Parts delivered to the junior division's participants.



Completed underwater robot for junior division.



Competition of the AUV division.





"Sakasatako" won the first prize in the free-style division.

Buoy-touch in the AUV competition.



Buoy-touch in the AUV competition.

This event was aimed specifically to increase the understanding and interest to marine and marine technologies by young people as mentioned above. In order to evaluate its impact, a questionnaire was provided to all participants. As a result, it was confirmed that the interest and understanding of almost all participants deepened. Particularly, most participants in the junior division enjoyed the challenging and difficult subjects and completing them. They also enjoyed the game. Following are the main questionnaire results.

Deepened of understanding?: very much 53%, deepened 44%, not 2%

Want to know more?: very much 55%, want to know 40%, not interested 4%

Difficulty of work class of the junior division: very difficult 29%, difficult 43 %, just good 29%, easy 0%

Understood the classroom?: very well 25%, almost 63%, not so much 3%

Enjoyed the workshop?: Very fun 67%, enjoyable 33%

There was encouragement by the Mayor of Yokosuka city, and the convention became feverish. The Nippon Foundation supported the purchasing expenses of parts for the junior division and travel expense of junior high school and high school students from distant places. In addition, this event was supported by many volunteers and many other organizations.

The details are shown at http://uwr.sakura.ne.jp/uwr2016/ (in Japanese).

The 6th Underwater Robot Festival

Educational Program for high school students

IEEE OES Japan Chapter held "The 6th Underwater Robot Festival "at the Kobe Port Island Sports Center from March



A lecture by Dr. Hiroshi Yoshida.

26th to March 27th with NPO Underwater Robot Network, the Marine Education Promotion Committee of the Japan Society of Naval Architects and Ocean Engineers, MTS Japan Section and Techno-Ocean Network.

In this festival, we held a competition and a classroom that targeted junior high school and high school students. It is because we wanted to convey the fun of underwater technology to young people who will make the future. Because designing and manufacturing pressure-resistant housings, and making and implementing control programs are not easy tasks for beginners, it is a big and important issue about how to make them understand the fun of making and handling underwater robots. Therefore,



Classroom

we organized not only an Underwater Robots Competition but also a classroom for students to build an underwater robot and rudimentary programming.

Six teams from four senior high schools participated in this festival.

On the first day, Dr. Hiroshi Yoshida from the Japan Agency for Marine-Earth Science and Technology gave a lecture introducing underwater robots in actual use at sea, and key points on their construction and operation.

After that, participants assembled a remotely operated underwater vehicle (ROV), Dolgore, and programmed it under the guidance of lecturers. They also designed and made their



Dolgore

own tools for picking up targets from the water tank's floor. Dolgore was designed and manufactured at Ishii Laboratory of Kyushu Institute of Technology. This ROV can freely be manipulated by controlling three thrusters via a notebook PC. By attaching a camera module and magnet modules, it is possible to pick up and collect the submerged mock resources on the water tank's floor while watching the underwater image on the notebook display. In each group, 2 or 3 students sharing the roles, programmed and assembled Dolgore.

On the second day, following the opening ceremony, a special lecture by specially appointed Professor Tamaki Ura, Kyushu Institute of Technology, was given. He introduced



Participants and the solar surface vehicle.

underwater robot's activities in the world and the attractiveness of underwater robotics engineering. The participants and visitors listened attentively.

On the same day, the solar surface vehicle SASV, developed by Osaka Prefecture University, and a commercially available OpenROV were demonstrated. SASV is an autonomous surface vehicle having solar panels, but also can be controlled with joystick and game controller. A lot of visitors from elementary school students to adults experienced controlling them and enjoyed themselves a lot.

In the afternoon, an underwater robot competition was hold by 6 teams using their own robots. They could easily go through the gate and came out to the seabed exploration area, but it seemed difficult for them to collect the ocean bottom mock resources. Collecting the mock crab gave high points, so the all team tried to pick them up, but the performance of the picking-up tools that they made influenced their results. Every time the robot collected the ocean bottom mock resources and put them in the basket, a great cheer rose from the hall.

The questionnaire survey, conducted at the end, revealed that despite most students participated in the underwater robot events for the first time, they could experience the difficulty and the fun of the underwater robots, and hoped to join again



A special lecture by Prof. Tamki Ura.

in the next festival. We think our purpose has been accomplished.

We have organized 18 underwater robot events in 10 years and have seen a gradually growing number of participants recently. We think this fact shows the importance of continuing our effort.

From the President (continued from page 3)

And of course, last, but not least, our new OES President for 2017–2018 was elected: **Christian de Moustier** (first term).

This 2016 year was highlighted by two very successful OCEANS conferences, in close collaboration with our partner MTS (Marine Technology Society). We also had a score of workshops on our main topics of interest: AUV, of course, which is one of the domains providing the most contribution to the Journal or the conferences, but also underwater communications, ocean sensors, ocean observing systems, ... As I've said before, this coming year (and probably a good part of the next) we'll be working on our Strategic Planning and its Implementation Plan covering the next 10 years. Please, don't be shy. Send us feedback on your expectations about the Society and what subjects you would like to be addressed.

You can address me (r.garello@ieee.org) or our new president (cpm@ieee.org), directly.

René Garello President



René Garello in his last address to the attendees at the plenary session (L), Two smiling Presidents (R).

IEEE OES SINGAPORE PRESENTS















IEEE OES International Symposium on **Underwater Technology 2017 Busan** *Homepage: http://ut2017.org*

February 21-24, 2017 / Novotel Ambassador Hotel (Haeundae, Busan, South Korea)



Topics

- Unmanned Surface Vehicles (USV)
- Unmanned Underwater Vehicles (UUV)
- Vehicle Performance
- Control / Navigation / Localization .
- Autonomy and Automation in Underwater
- Acoustics / Underwater Sensing
- Oceanic Renewable Energy Harvesting System
- Collaboration of Underwater Technology and **Ocean Science and Fishery**
- Marine Ecology and Living Resource, Marine related Climate Change
- Ocean Environment Monitoring

Important Dates

- Abstract Submission Page Open: October 1, 2016
- Deadline for Abstract Submission: November 18, 2016
- Notification of Acceptance: December 2, 2016
- Deadline for Full Paper Submission: January 13, 2017

Plenary Talks

- Prof. Tamaki Ura (Kyushu Institute of Technology, Japan)
- Dr. Pan-Mook Lee (KRISO, Korea)
- Prof. Stefan Williams (The University of Sydney, Australia)

Travel Information

- Haeundae Beach: Most well-known beach in Korea, famous for sunrise and moonrise
- Gwangan Bridge: Beautiful bridge with state-of-the-art lighting system
- Jagalchi Market: Largest seafood market in Korea



The Third IEEE Underwater Communications and Networking (UComms) Conference, Lerici, Italy, Aug 30 to Sep 1, 2016

João Alves and John Potter (UComms 2016 General Chairs)

Introduction

The 2016 edition of the IEEE UComms conference followed on from the previous two meetings held in 2012 and 2014. This conference series, organized by the NATO STO Centre For Maritime Research and Experimentation (CMRE) and supported by the Oceanic Engineering Society of the IEEE since its initial edition, is focused on working towards an adequate physics-based understanding of the propagation of communication signals underwater and the performance of necessary higher-level protocols with the objective of supporting the intelligent choice of standards, as a foundation for interoperability.

The conference focus also embraces diversity and heterogeneity, from the physical level (including not only acoustics but also optical and radio communications) to all other aspects of building efficient ad-hoc networks that are robust and tolerant to delays and disruptions.

Optical and Radio RF communications are specifically included, with a particular interest in performance modelling and their potential integration into hybrid Underwater (UW) communications systems.

The conference is organised in a series of structured sessions that are coordinated by key people in the field, aiming at gathering top quality contributions that can lead to a vibrant exchange of knowledge and increased common understanding of the stateof-the-art. The multiple sessions are handled in a single track.

This year, for the first time, the conference was convened at 'Villa Marigola' in Lerici, Italy. This magnificent villa is a traditional venue for CMRE conferences and continues to provide an excellent facility for meetings in a spacious, elegant environment.

The Conference: Format and Achievements

Eighty-five delegates participated in UComms 2016, representing institutions from fifteen different countries. Seventeen participants (20%) were from the USA, testimony to CMRE's capability to bridge the Atlantic in matters of maritime science and technology.

A total of sixty-four manuscripts were submitted in response to the call for papers. After a very strict review process (where each paper was independently and blindly reviewed by at least three reviewers—in most cases four) forty papers (62.5%) were invited for presentation. Special care was taken during the review process to ensure no conflict of interest, e.g. from session organisers managing or having sight of the review process for contributions for which they were an author.

The format of the conference remained as for previous years: Single track with a diversity of sessions, each organised by carefully-selected experts in specific areas of the UW (and maritime) communications field. These session organisers took the role of inviting papers, managed the reviews, ranked and selected the final presentations in coordination with the general chairs and conducted their session at the conference.

For UComms 2016 a total of eight sessions were set up:

- "Applications and requirements" had the objective to expose a wide range of communication requirements, not all strictly UW, from an end-user point of view to feed back into basic research.
- "Physical Layer in Acoustic Communications", which tackled all aspects of the acoustic communications physical layer, from acoustic propagation to channel equalisation and signal modulation.
- "Networking, Localisation and Scheduling", considered the upper layers of the communications stack as well as network-based services.
- "Simulation, Models and Test Beds", considered the development of models, simulation work and experimental testbeds.



Group photo of UComms 2016 participants in the gardens of Villa Marigola.

- "Interoperability and Standards", looked at this critical enabler for interoperability, in which underwater communications lags far behind in-air EM communications.
- "Non-Acoustic Communication Modalities", explored the hot topic of optical and RF modalities for UW communications.
- "Communication Architectures and Novel Stacks", gathered contributions on the development of non-traditional communications architectures and protocol stacks that are better tailored to the UW communications environment.
- "Security in Underwater Communications", tackled the challenges of securing UW links and providing trustworthy UW communications.

The conference was opened by the chairs with a very brief introduction, followed by an institutional welcome by CMRE's Director of Program, Dr. Alain Maguer.

The technical "kickoff" of the conference was provided by our distinguished guest speaker, Prof. Milica Stojanovic (Northeastern University, MA, USA) who delivered an entertaining and though-provoking keynote addressing achievements and trends in UW communications. Throughout the three days of the conference, pull-out quotes from her keynote repeatedly showed up in the technical presentations, underscoring the close connection between the "big picture" and the detailed views presented throughout the event.

All sessions were chaired by their respective organisers, who took in hand the task of engaging the delegates in dialogue. Judging by informal feedback, this was fully achieved



Prof. Milica Stojanovic during her keynote speech.



A view of the conference room during the technical sessions.

and all presentations provided excellent material for engaging discussions both during and after the sessions. As in previous years, generous breaks between sessions provided enhanced networking opportunities.

A novelty introduced for UComms 2016 was an "Off-the-Record" session where authors who were not comfortable publishing their work (due to IPR sensitivities or other reasons) but who still had strong contributions for which they would like to have feedback from the community, were welcome to submit their work. These contributions are excluded from the conference proceedings.

Considerable progress was evident since UComms 2014 across the board. Special emphasis is due to work on interoperability and standards, requiring wide community engagement. The UComms community has worked hard to develop solutions in this area and the progress is clear and valuable. Of particular note is the progress on JANUS, the digital UW communications standard developed by NATO, with growing acceptance by international modem producers. Both application cases and assessments of JANUS performance and coexistence with legacy technologies have been explored. Another important landmark was the presentation of Watermark: A realistic channel simulator from FFI that is being made available to the community.

The strong non-acoustic communications session provided a very welcome bridge between typically isolated domains. Different institutions presented their low-cost optical solutions for short range, high data rate communications. This will likely accelerate the development of multi-modality (optical and acoustic) communications solutions.

Besides the IEEE OES sponsorship, the 2016 edition of UComms had patron support by the following commercial and non-commercial institutions: NATO Allied Command Transformation (ACT), ONR, ONR Global, ASA, ATLAS Elektronik GmbH, Kongsberg Maritime, Fondazione Carispezia, Cassa Di Risparmio Della Spezia.

The IEEE OES sponsorship of UComms includes provision for publishing the proceedings immediately after the event in IEEE Xplore, a very appealing feature for authors. Additionally, a Special Issue of the IEEE Journal of Oceanic Engineering, with expanded versions of selected papers presented during UComms, is planned for publication in 2017. The Editorial Board for the special issue consists of the UComms 2016 general chairs João Alves and John Potter, joined by Ian Akyildiz (Georgia Tech).



The important networking moments during the coffee breaks.

Participants Feedback

A key aspect of shaping the evolution of UComms is gathering feedback from participants through anonymous online survey, a practice that was initiated with the first edition in 2012 and which we have continued.

The fifty-one responses collected to date show that:

- 82% of participants were "extremely satisfied" with the conference while 16% were "Moderately satisfied".
- 92% found the technical content to be "extremely strong" or "very strong".
- 90% found the networking opportunities to be "extremely useful" or "very useful".
- Overall satisfaction with the event was even higher than previous UComms.
- In terms of additions to the presented program, 62.5% suggested including panel discussion on selected relevant topics while 37.5% suggested to add a general discussion at the close of each session to explore and learn from the presentations in a wide context.
- Concerning format, schedule and periodicity, the vast majority agrees with keeping it a biennial event, single track, with 25 minutes per presentation to accommodate discussions over 3 days, which means maintaining the size at around 42 papers regardless of the number of submissions.

• In terms of location, most (60%) would like to see UComms 18 held in the same venue while 22% would like to see it somewhere else in Italy. The option of moving UComms within Europe was supported by 16%.

Future UComms Conferences

Building on the successes of UComms 2016, and based to a good extent on the feedback gathered, the next edition is now in the early planning stages.

Some sponsors have already verbally expressed their will to continue supporting UComms, which is very encouraging. There is the ambition to issue a first call for sponsorship in the spring of 2017. This may help to attract additional commercial interest, which could result in a small exhibition space, taking greater advantage of the possibilities offered by the Villa Marigola venue.

The UComms 2018 Call for papers will tentatively be issued in the fall of 2017.

With consistent IEEE OES support, UComms has been gaining credibility as a top quality international event, bridging Europe and the Americas, since the first edition in 2012 and is demonstrably gaining in prestige year by year. This was the first edition to attract also Asian participation. As noted by our keynote speaker and several other participants, the Special Issue JOE publication of expanded papers that follows each conference is an important and valuable service to the community, pushing the field forward with milestone collections of state-of-the-art papers. We are thus very grateful to OES both for the financial support that enables us to bring talented people together at reasonable cost, and for the academic recognition and dissemination opportunities offered by publishing the proceedings in IEEE Xplore and the potential of expanding papers for a Special Issue of JOE.

The mission for 2018 will remain one of delivering a top quality conference where the leading scholars of the field discuss their latest developments in a relaxed yet intellectually stimulating setting. The focus will remain on the fundamental understanding and collaboration necessary to design, test, select and promulgate standards that underpin interoperability of efficient, robust underwater communication systems.

Techno-Ocean 2016—Kobe

Koji Otsuka, General Chair of Techno-Ocean 2016

Techno-Ocean

2016

Kobe is located in the Kansai area, which can be called the "navel of Japan". The seascape of the Port of Kobe, which will celebrate its 150th anniversary in 2017, and the landscape of the Rokko mountainous create a very beautiful cityscape. The night view of Kobe looking down from the mountain is selected as one of the Japanese top-three night views. For the food of Kobe, beef is imagined at the very beginning, but Japanese sake is also



as a world popular sightseeing area too, because there are ancient cities such as Nara and Kyoto, and many world heritages including the Himeji Castle in the neighborhood in Kobe.

Techno-Ocean 2016 was held at Port Island in Kobe on October 6th through 8th. Having first been held in 1986, Techno-Ocean is now welcoming its 16th convention. As such, it has become recognized as an established event both within and

outside Japan among researchers and industry relating to the oceans. The Consortium of the Japanese Organization for



Very important persons performed tape-cutting at the opening ceremony.



From the technical sessions.



Dr. Svein Grandum, one of the keynote lectures, introduced a Sustainable Blue Bioeconomy.

Techno-Ocean 2016 (CJO) consists of TON (Techno-Ocean Network), IEEE/OES Japan Chapter, MTS Japan Section, JAM-STEC (Japan Agency for Marine-Earth Science and Technology), and KCVA (Kobe Convention & Visitors Association). Five national research organizations, JAXA (Japan Aerospace Exploration Agency), JOGMEC (Japan Oil, Gas and Metals National Corporation), FRA (Japan Fisheries Research and Education Agency), PARI (Port and airport Research Institute) and AICS (RIKEN Advances Institute for Computational Science), and the City of Kobe, have cooperated as technical co-sponsors.

The previous Techno-Ocean 2014 had "Mother Oceans" as its theme. This theme was part inspired by the experience of the Great East Japan Earthquake. The intent was to remind ourselves of the important blessings that our Mother Ocean yields to us, as well as to affirm the respect we hold for the seas. Wishing to continue to express these sentiments and to engage more people to pay attention to Mother Ocean, the theme of "Return to the Oceans" was chosen for 2016.

In the refreshing weather after pushing a typhoon to the north, Techno-Ocean 2016 was opened in the morning on October 6th, Thursday, by an opening ceremony held at the entrance of the Kobe International Exhibition Hall. Mr. Takashi Yamauchi, President of TON, and Mr. Noriyoshi Okaguchi, Deputy Mayor of City of Kobe, provided opening greetings, and Mr. Tsugumasa Horita, a counsellor of Headquarters of Ocean Policy, provided a



Student Poster Competition.



Student Poster Competition Awards Ceremony during the Banquet.

congratulatory address during the ceremony. Following his address, a tape-cutting was carried out by those speakers, keynote lecturers and very important persons from foreign countries.

Keynote lectures were held at the Kobe International Conference Center after the opening ceremony to officially begin the international conference. Prof. Tetsuro Urabe, Professor Emeritus of The University of Tokyo lectured on the "SIP Zipangu-in-the-Ocean



Over 90 companies, universities and research organizations attended as exhibitors (top two photos). Exhibitor's presentation was also demonstrated (bottom).

Project: Current Results and Future Prospect." Then, Dr. Svein Grandum, Counsellor of Royal Norwegian Embassy, Tokyo, and Dr. Bard Wathne Tveiten, Vice President of MARINTEK (The Norwegian Marine Technology Research Institute) presented "Feeding an Increasing Population—Developing a Sustainable Blue Bioeconomy." Unfortunately, another keynote lecturer, Prof. Taikan Oki, Professor of the University of Tokyo, was absent, because he became a Senior Vice President of the United Nations University just before the period of Techno-Ocean 2016. His lecture slides, entitled "Climate Change and World Water Resources," were introduced by a chairman of the Keynote Lectures.

The program had 28 Technical Sessions, consisting of 120 papers, which were also held at the Kobe International Confer-



"Kagamiwari", breaking open a ceremonial sake barrel in the beginning of the Banquet.



Techno-Ocean Awards winners and organizers.

ence Center. Participants in these sessions included 228 people from 13 countries, including Japan. In addition, 16 posters that passed severe selection among 50 submissions were, presented in the Student Poster Competition held at the Kobe International Exhibition Hall. The selected students, especially 5 students from foreign countries, had very good opportunities to visit Kobe, because they received the travel expenses from the organizers.

The Techno-Ocean 2016 Exhibition was also held at the Kobe International Exhibition Hall. The Exhibition, which included 92 companies, universities and research organizations, that held 144 booths, had very much vigor, because some organizations of the Japan Government, such as Japan Maritime Self-Defense Force, Ministry of Defense Acquisition, Technology & Logistics Agency, Japan Coast Guard, and Japan Meteorological Agency, participated in the exhibition this time, and a special stage for exhibitors' presentations or a special session was installed at the center of the exhibition venue. There was an Art Exhibition with 4,065 pictures painted by children at a corner of the venue. 58 selected children who painted excellent pictures were awarded at the special stage.

In the Banquet held at Kobe Portopia Hotel, many exciting programs were performed, for example, the barrelhead opening of the sake cask by foreign guests, the award ceremony of Student



Group photo of the Underwater Robot Competition attendees.

Poster Competition, and the juggling by members of conjuring tricks club of Osaka Prefecture University.

The Techno-Ocean Awards Luncheon was also held at the Kobe International Exhibition Hall. The winner of the Techno-Ocean Award 2016 was Dr. Hisaaki Maeda, Professor Emeritus of the University of Tokyo and Visiting Professor of Nihon University. Dr. Yuki Takahashi, Researcher of National Research Institute of Fisheries Engineering, and Dr. Katsunori Mizuno, Research Associate of the University of Tokyo, were awarded the Kenji Okamura Memorial Award for Pioneering the Ocean Frontier 2016. And Mr. Yasuhiro Koyama, Executive Producer of NHK Enterprises, was selected as a winner of the Techno-Ocean Special Award 2016, and he introduced many spectacular movies, such as swimming giant squid.

The Underwater Robot Competition was

held at the Port Island Sports Center. There were 18 excellent teams that battled in 3 categories—AUV (Autonomous Underwater Vehicle), Free-style and Junior classes—and 450 participants visited this competition. The winners of AUV, Free-Style and Junior classes were teams of The University Tokyo, National Institute of Technology, Tsuyama College and "WateroboyS," respectively. Most of vehicles, made with many ideas, showed good performance in the exiting games.

Public and children's programs were organized by the technical co-sponsors. The number of participants for these programs was 683 people in total. In addition, three vessels and vehicles of JAMSTEC, Deep Submergence Research Vehicle



JOGMEC, one of the technical co-sponsors held a children program.

"SHINKAI 6500", Deep Sea Cruising AUV "URASHIMA", and Support Vessel "YOKOSUKA" were open to the public at Nakatottei Kobe Port. Totally, 4,611 people visited, surpassing far our expectations.

The next Techno-Ocean will be held in May 2018 as OCEANS'18 MTS/IEEE Kobe/ Techno-Ocean 2018 (OTO'18). The theme of OTO'18 is "Ocean Planet—its our home." We hope that many companies, universities,



research organizations, and governmental offices from many different fields relating to the ocean will participate in the OTO'18.

CALL FOR PAPERS NOW OPEN! Submit Your Paper by 8 March 2017 at go.otcbrasil.org/submitpaper



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Dear Colleagues,

On behalf of the Offshore Technology Conference (OTC) Board of Directors and the supporting organizations, we invite you to become an integral part of OTC's tradition of excellence by sharing your latest findings in offshore exploration.

Gathering the brightest minds in the offshore industry, OTC Brasil will take place 24-26 October 2017 in Rio de Janeiro, Brazil. The conference creates an unparalleled opportunity to collaborate with E&P colleagues, exchange ideas, and discover solutions to the most pressing operational deepwater challenges.

Focused on "Transforming Today to Power the Solutions of Tomorrow," the OTC Brasil program will encompass offshore oil and gas exploration and development topics related to keeping offshore facilities operating safely and efficiently.

Submit a paper proposal by 8 March 2017. If your paper is selected, you will have the opportunity to present it at OTC Brasil and your paper will be added to OnePetro, the premier research and technical library for oil and gas professionals worldwide.

We are very excited about the 2017 conference, and the opportunity to share the latest international offshore technologies which are relevant in Brazil.

Best Regards, Felipe Matoso, Petrobras OTC Brasil 2017 Program Chairperson

Carlos Mastrangelo, SBM Offshore OTC Brasil 2017 Program Vice-Chairperson **AREAS OF INTEREST**

- Geology, Reservoir, and Exploration
- Drilling and Completion Challenges
- Subsea Production Systems
- Floating Production Systems and Topside

For a complete list of topics and to submit a paper proposal, visit go.otcbrasil.org/go/submitpaper.



P.O. Box 833868 Richardson, Texas 75083-3868 USA

Whisky prizewinner on the OCEANS'17 MTS/IEEE Aberdeen booth at OCEANS' Monterey

John Watson, Co-Chair MTS/IEEE OCEANS'17 Aberdeen



MTS / IEEE OCEANS '17 – Aberdeen, Scotland

A Vision for our Marine Future

The 2017 European OCEANS '17 Conference will take place in Aberdeen, Scotland from 19 – 22 June 2017.

Mark Barry of Pro Oceans was the happy winner of the Glen Garioch Malt Whisky awarded by Gemma Cruikshank of VisitAberdeenshire on the OCEANS'17 Aberdeen booth at OCEANS'16 Monterey.

. We hope to meet you in Aberdeen.

For more information, visit the Conference Website at

www.oceans17mtsieeeaberdeen.org/





We Need Your Help to Find Some OCEANS Memorabilia

Joe Czika, OES Past President



Drafts Submission Due: 1 February, 2017

MTS and OES/IEEE have decided to honor the 60th edition of the OCEANS conference at OCEANS'17 Aberdeen by publishing a brochure containing the essential history of OCEANS along with highlighting the contribution that OCEANS made in providing an information exchange forum for addressing the world's oceanic issues through advances in marine technology and oceanic engineering. Our working concept is to produce a "glossy" 8.5 by 11 inch brochure of about 44 pages in length.

In summary, the brochure will contain the following features or descriptions:

- Statement of each society's commitment to solving ocean problems.
- Brief infomercial about each society.
- Description of how the OCEANS conferences support the national and international maritime communities.
- OCEANS student poster program.
- Highlighting faithful support of government and industry sponsors.
- Recognizing the consistent support from conference attendees.
- Recognizing the role that OCEANS plays in honoring individual technical and industrial achievements.
- Honoring the service of the OCEANS leadership that have passed on.

• Recognizing each and every OCEANS conference held since its first one in 1970.

In order to support the factual description of these features, we need the support of your personal archives. We especially need copies of the conference programs from 1970 to 2004. We will rely on the Library of Congress, IEEE and MTS for copies of the conference proceedings, but those largely contain technical papers of the presenters. In contrast to the proceedings, the conference programs, especially their covers, are usually the most iconic visual representations of that conference. In addition to the conference programs, we can use any OES Newsletters prior to 1998, photos of the conference, plenary programs, and other details not contained in the proceedings or the programs. So if you have any conference programs, early OES newsletters, photos or any other artifacts from the conferences in this period, please describe your material to me by email or phone. I will then advise you whether you should send the items to me with a return address so I can faithfully return them to you after scanning them into our database. If you cannot part with those items, please be so kind as to scan or copy the program covers or pictures and send them to me at: Joe Czika, 5018 Fleming Drive, Annandale VA 22003 or j.czika@ieee.org. Please send anything you have by 1 February 2017 (the earlier, the better), so we can incorporate your information into the brochure in time for publication in May 2017 and distribution at Aberdeen in June 2017. Thanks for your help!

A Blast from the Past

Bob Wernli, Vice President for Professional Activities

Is there fun at an OCEANS conference...see for yourself in this **Blast from the Past**!



Marinna Martini and John Watson-OCEANS'06 Boston.

Not convinced yet? Well here's more.



Sandy and Izzy Williams, Diane DiMassa—OCEANS'16 Shanghai.



Barbara Fletcher and Kevin Hardy-OCEANS'06 Boston.



Ross Chapman and the food trucks-OCEANS'16 Monterey.



Mal Heron, Bob Wernli and Brian Ferguson-OCEANS'06 Boston.



Diane DiMassa and the Massachusetts Maritime Academy Cadets—OCEANS'16 Monterey.



Tamaki Ura, General Chair OCEAN-Techno-Ocean '04 Kobe.



Tom Wiener, Joe Vadus and Tamaki Ura Opening Ceremony—OCEAN-Techno-Ocean'04 Kobe.

See photos from past OCEANS conferences at the OES website: http://ieeeoes.org/photos.cfm

IEEE-OES/MTS OCEANS'16 Monterey



Bill Kirkwood, General Chair, photos by Stan Chamberlain

OCEANS Monterey was very successful and an exciting as well as very active conference, with a number of new twists on the standard formula of OCEANS Conferences past.

First, by the numbers, OCEANS Monterey had close to 1400 attendees with 1296 registered. There were 6 tutorials, and 285 exhibitors passes. Monterey broke records with 799

abstracts submitted and 513 accepted. Perfect weather, a beautiful location and an exceptional technical program with outstanding exhibits made for a memorable time and impressive results for all who attended.

The Monterey team did face some challenges with the conference center going into construction just months ahead of the event.



The OCEANS '16 Monterey Team.



The Monterey Bay Aquarium.



Spector Dance and Le Club Hot Jazz Ensemble.



Kuki's Asian Cuisine Gourmet Food.



The Golden State Theater.

The result for the local organizing committee (LOC) was to have to think outside the box. The conference started with the Ice Breaker, which over the years has grown into an event of its own. The LOC set the tone for the week's meeting with 6 local wineries offering free wine tasting at the Monday Ice Breaker. The location was outdoors at the Custom House Plaza with a view of the bay while the sun was setting. The feedback from those who attended was outstanding and the LOC had accomplished its goal to kick things off in a way that set high expectations for the rest of the meeting.

The meeting itself started with 1 of 2 plenary sessions held at a beautifully restored Golden State Theater. The speaker line up was excellent with the 1st day being Jim Bellingham of Woods Hole Oceanographic Institution and Tom Curtin from the Uni-



The New Convention Center-Under Construction.

versity of Washington Applied Physics Laboratory. Day 2 featured Jon White of Ocean Leadership and Marcia McNutt as the newly elected President of the National Academy of Sciences. Each plenary session was followed by the society's business meetings and award presentations. Between the plenary talks and the business meetings a few very cute and fuzzy otters, as well as t-shirts, were launched into the audience. Lessons learned from this unique approach... first, a little difference was appreciated by the attendees and secondly, that more otters were needed.

The program itself got under way over the next 3 days with 93 concurrent sessions in 15 rooms. There were a number of affiliated events with demos and tours of facilities around the bay.

As a result of the construction, the meeting rooms and the exhibits were located in two adjacent hotels. It also forced a new approach to lunch—food trucks. These turned out to be very popular with 5 trucks each day offering a variety of menus from Mexican to Asian to Lobster Rolls and Vegetarian. Attendees were able to sit harbor side and connect and interact with new folks they met in the queue to place their orders.

The Gala Dinner was held at the Monterey Bay Aquarium with Julie Packard welcoming the attendees to Monterey and opening the event. The strolling dinner used the entire aquarium, both the inner and outer bay wings. After the student poster awards, the Gala had two entertainment sessions. First was a dance troupe called Spector, which did a demonstration of interpretive dance being used to communicate science to the public around the country. The second group was a local band playing soft jazz, a genre well known in the Monterey area.

All in all, a very successful event. The LOC is very grateful to the attendees, volunteers and both societies that made OCEANS Monterey 2016 possible. It's possible that sometime in the future Monterey might host OCEANS once again... but in a brand new and modern facility.

Student Poster Competition, OCEANS'16 MTS/IEEE Monterey

Philippe Courmontagne, Student Poster Contest Committee Chair, Photos by Stan Chamberlain

The Student Poster Program has been initiated by Norman Miller in 1989 and became an integral part of the OCEANS conferences in 1991. Since then, more than 700 students have participated in this program. This 38th Student Poster Program of the OCEANS Conferences was held at OCEANS'16 MTS/ IEEE Monterey, at the Monterey Marriott, from September 19 to September 23. As for the previous Student Poster Competitions, outstanding posters describe the work that the students were presenting and were particularly appreciated by the attendees of the conference. Moreover, the student participants greatly appreciated the opportunity to display, exchange and describe their research work to the community.

The program was organized by Liesl Hotaling as local coordinator and Philippe Courmontagne, SPC Chair, from IEEE OES. For this 38th edition, more than 100 abstracts were received, 18 were selected, not without difficulty given the high quality of the received abstracts, only 16 students were able to attend the conference. The students were from 6 countries, coming from schools in Europe, Asia and the USA. The program was supported by funding from the US Navy Office of Naval Research, which enabled the students to attend the conference.

The posters were judged by a team organized by IEEE OES and the local chair. The roster of students and their schools are (in order of appearance of the Program Book):









Keeping one eye on the students.



- Joshua Baghdady, Clemson University
- Carlos Gonçalves, INESC TEC/FEUP
- Jorge Pedro Matos, Instituto Superior Tecnico—University of Lisbon
- Antony Pottier, Telecom Bretagne
- Mohammad Haghighat, University of Miami
- Huai Huang, Missouri University of Science and Technology
- Zheng Jiang, Huazhong University of Science and Technology
- Conghui Zhang, Shanghai Jiao Tong University
- Jose Valente, Faculty of Engineering, University of Porto
- Manuel Silva, FEUP
- Niaz Ahmed, Missouri University of Science and Technology
- John McKay, Pennsylvania State University
- Joshua Mangelson, Perceptual Robotics Laboratory, University of Michigan
- Yu Zhang, The University of Tokyo
- Xinlong Lui, Memorial University of Newfoundland
- Yue Ma, Memorial University of Newfoundland

The judging was completed on Wednesday and the prizes were awarded during the Gala Dinner at the world-famous Monterey Bay Aquarium. Liesl Hotaling opened the awards ceremony and presented, with Philippe Courmontagne, each student with a Certificate of Participation in the OCEANS'16 MTS/ IEEE Monterey.

Then, René Garello, IEEE OES President, and Ray Toll, MTS President, presented the third place winner to Yue Ma, from Newfoundland. Next, they presented the second price to Mohammad Haghighat, from USA. The first price, the "Norman Miller's Price", has been presented by Ray and René, to Joshua Baghdady, from the Clemson University, for his



The awards ceremony.

poster entitled "Underwater Optical Communication Link Using Orbital Angular Momentum Space-Division Multiplexing".

The audience gave the students a big hand following the awards presentations. The session ended with a photograph session.

The roster of students and their poster titles are given below with an abstract of their paper.

Joshua Baghdady, Clemson University

Underwater optical communication link using Orbital Angular Momentum Space-Division Multiplexing





This work presents a novel and robust underwater optical communication link designed to address the growing need for high-bandwidth underwater communication systems. Space division multiplexing is demonstrated via Orbital Angular Momentum (OAM) using two laser sources over a link distance of 2.96 m and is shown to yield a collective data rate of 3 Gbit/s at an average bit error ratio (BER) of 1.76×10^{-4} , well below the forward error correction (FEC) threshold. Techniques are discussed for further broadening of the communications bandwidth via scalable expansion of the model developed herein.

Carlos Gonçalves, INESC TEC/FEUP

Design and development of SHAD—a Small Hovering AUV with Differential actuation

This paper presents the design and development of a new Autonomous Underwater Vehicle (AUV). SHAD, which stands for Small Hovering AUV with Differential actuation, is a torpedo shaped vehicle that was conceptually designed to navigate in challenging



volumes. It brings to the scene of submarine robotics a different model and new design of AUV. The small size, the light weight and the high maneuverability of this AUV were among the most important features that can make the SHAD an option to applications where other models have difficulties. This paper details the design and the development of SHAD and presents experimental results from sensors and actuators testing as well as vehicle navigation.

Jorge Pedro Matos, Instituto Superior Tecnico—University of Lisbon Robust Tracking of Vessels in Oceanographic Airborne Images



In this paper we present and evaluate an algorithm for tracking vessels in oceanographic airborne image sequences on the visible spectrum. Such sequences are challenging due to sun reflections, wakes, wave crests and fast motions, which significantly degrade the performance of general purpose tracking algorithms.

The proposed method is based on state-of-the-art correlation filter tracking complemented with an image segmentation and blob analysis stage. The purpose of this later stage is to re-center the target in the tracking window to compensate for drifts in the correlation filter. We evaluate our proposal using a known benchmark in the field and compare it with general purpose tracking algorithms. Results show that our method beats the general purpose state-of-the-art tracking algorithms in the airborne maritime scenario both in performance and in computation time.

Antony Pottier, Telecom Bretagne

Power-Efficient Spectrum Sharing for Noncooperative Underwater Acoustic Communication Systems

This paper aims at studying underwater acoustic OFDM communication systems interfering with each others in the same channel. We propose a decentralized spectrum sharing method that minimizes the total power consumed while satisfying a constraint related to their



information rate. The considered systems are supposed noncooperative, i.e. unable to communicate with each others so that they cannot agree on a fair resource sharing scheme. The problem is formulated within the framework of game theory and solved according to the Nash Equilibrium concept. Several results are presented and show that interfering UA systems can share the spectrum in a more efficient way, both in terms of energy consumption and information rate.

Mohammad Haghighat, University of Miami

Segmentation, Classification and Modeling of Two-Dimensional Forward-Scan Sonar Imagery for Efficient Coding and Synthesis





In this paper, we present methods for segmenting noisy twodimensional forward-scan sonar images and classify and model their background. The segmentation approach differentiates the highlight blobs, cast shadows, and the background of sonar images. There is usually little information within relatively large background regions corresponding to the flat sea bottom and (or) water column, as they are often corrupted with speckle noise. Our experiments show that the background texture is dominated by the speckle noise which has the appearance of a pseudo-random texture. We show that the background texture of the underwater sonar images can be categorized by a small number of classes. The statistical features work better than the texture-based features in categorizing the pseudo-random background, which further strengthen our hypothesis of the dominance of noise over the background texture.

As a result, we can model the noisy background with a few parameters. This has an application in coding the sonar images in which highlight blob regions and cast shadows are coded at the encoder side while the speckle noise-corrupted background can be synthesized at the decoder side. Since the background regions occupy a large fraction of the FS sonar image, we expect higher compression rates than most current image or video coding standards and other custom-designed sonar image compression techniques.

Huai Huang, Missouri University of Science and Technology AoA Assisted Localization for Underwater Ad-Hoc Sensor Networks



In this paper, We propose angle of arrival (AoA) assisted localization scheme for underwater Ad-Hoc sensor networks in 2-D and 3-D. This scheme estimates distances from sensor nodes to anchor nodes via multi-hops with the help of AoA measurements. By forwarding distance at each node hop-byhop, the distance estimations can be flooded to the whole network. Once a sensor node got distance estimations from at least three (in 2-D) or four (3-D) anchor nodes, the location of the sensor node is calculated. Comparing to the existing localization schemes in Ad-Hoc networks: DV-distance, DV-hop, and Euclidean propagation, the simulation results show that our proposed method improves localization accuracy significantly while keeping high localization coverage.

Zheng Jiang, Huazhong University of Science and Technology An Open-Source Control software to the Virtual submerged floating operational system (VSFOS)

Virtual submerged floating operational system (VSFOS), built in the laboratory environment, consisted of an ABB



robot, the IRC5 controller, a six-degrees-of-freedom (6DOF) parallel robotic motion platform, an inertial navigation sensor and a real-time industrial computer, can make it possible to do all kinds of underwater operational simulation experiments very easily and expediently. In this paper, an open-source control software to the VSFOS is introduced, this software, which is compatible with all the ABB robots that use IRC5 controller, works as a remote-control end to the VSFOS, it can not only receive and analyze the data collected by the inertial navigation sensor, but also "talks to" the IRC5 controller and "tells" the robot how to work, no need of any other input devices that matches the robot or to obtain the communication protocol of the robot, that is, this software can break the communication blockade of traditional industrial manipulator, and expand the realtime control methods of the manipulator. Finally, simulation experiments of the VSFOS have been done to test the feasibility and stability of the software.

Conghui Zhang, Shanghai Jiao Tong University Chaotic Modulation Detection for Underwater Acoustic Communications via Instantaneous Features



Modulation detection is important for underwater military communications and warfare applications. Chaotic modulations based on chaotic sequences are proposed to protect confidential underwater communications. In this paper, we develop a detection algorithm employing instantaneous phase and frequency for underwater acoustic communications. The key features derived from instantaneous phase and frequency are used to detect two chaotic modulations. They are chaotic M-ary phase shift keying (CMPSK) and chaotic M-ary frequency shift keying (CMFSK), which are designed to provide confidential underwater communications. Simulation and experimental results confirm the effectiveness of our proposed algorithm for chaotic modulation detection.

Jose Valente, Faculty of Engineering, University of Porto Real-time TDOA measurements of an underwater acoustic source



The direction of arrival of sound waves has been extensively used for passive acoustic tracking of underwater sound sources, such as marine mammals or ultrasonic electronic tags attached to animals or submerged equipment. This process can be automated by measuring the time difference of arrival (TDOA) of the sound wave arriving to two or more hydrophones and then calculating the relative direction of the acoustic source using those time differences. Although the generalized crosscorrelation between the received signals is a common technique for determining the TDOA, the underwater environment introduces several distortions in amplitude and phase of the received sound waves due to reflections and reverberation, particularly in confined spaces. This is aggravated by the variation of the sound propagation speed with temperature, pressure and salinity. Because of this, the use of the cross-correlation method not effective to determine the TDOA especially when using single frequency pulses as the transmitted signal. In this work we propose an alternative method to calculate the TDOA, consisting in the analysis of the initial part of the received signals to discover a series of similar zero-crossing periods to identify their beginning, and then calculating the time difference between them. We have implemented this technique in a reconfigurable systemon-chip, attaching to an embedded ARM processor a custom designed digital signal processing system. This has been tested in a test tank and in outside environment. This system is capable of computing in real-time the 2D direction of an underwater acoustic transmitter, and combining the different directions resulting from the relative movement between transmitter and receiver it is possible to estimate the relative position of the acoustic source.

Manuel Silva, FEUP

Remote supervision system for aquaculture platforms



Aquaculture processes usually take place in remote and harsh environments, and are highly dependent on uncontrollable and unpredictable variables, therefore its monitoring and supervision can be a key factor in this activity. Taking that into account, this paper proposes a solution for a Remote Supervision System for Aquaculture Platforms, that contemplates a modular, reconfigurable and expandable sensor network based on the I2C protocol, which is composed by two different types of sensor nodes.

The main sensor node, which serves as the sensor network coordinator and as a gateway, and the tiny sensor nodes, that are responsible for simple data collection tasks.

Niaz Ahmed, Missouri University of Science and Technology Multi-Coil MI Based MAC Protocol for Wireless Sensor Networks



Medium Access Control (MAC) protocol is an important metric of wireless sensor networks because of its high impact on network performance. This paper proposes an energy efficient MAC protocol that can be used for both terrestrial and underwater wireless sensor networks. The state transition diagram has been presented in the paper and current consumption for each state has been recorded to evaluate the energy efficiency of the proposed MAC protocol.

John McKay, Pennsylvania State University

Robust Sonar ATR with Pose Corrected Sparse Reconstruction-Based Classification



Sonar imaging has seen vast improvements over the last few decades due in part to advances in synthetic aperture Sonar (SAS). Because of this, sophisticated classification techniques originally developed for other tasks can be used in Sonar automatic target recognition (ATR) to locate mines and other threatening objects. Among the most promising of these methods is sparse reconstruction-based classification (SRC) which has shown an impressive resiliency to noise, blur, and occlusion even in settings with little training. We present a coherent strategy for using SRC for Sonar ATR that retains SRC's robustness while also being able to handle targets with diverse geometric arrangements. Our method, pose corrected sparsity (PCS), incorporates state-of-the-art dictionary learning schemes on localized block extractions which we show produces compelling classification results on the RAWSAS dataset.

Joshua Mangelson, Perceptual Robotics Laboratory, University of Michigan

Robust Visual Fiducials for Skin-to-Skin Relative Ship Pose Estimation



This paper reports on an optical visual fiducial system developed for relative-pose estimation of two ships at sea. Visual fiducials are ubiquitous in the robotics literature, however none are specifically designed for use in outdoor lighting conditions.

Blooming of the CCD causes a significant bias in the estimated pose of square tags that use the outer corners as point correspondences. In this paper, we augment existing state-of-the-art visual fiducials with a border of circles that enables high accuracy, robust pose estimation. We also present a methodology for characterizing tag measurement uncertainty on a per measurement basis. We integrate these methods into a relative ship motion estimation system and support our results using outdoor imagery and field data collected aboard the USNS John Glenn and USNS Bob Hope during skin-to-skin operations.

Yu Zhang, The University of Tokyo

New method of fish classification by using high-resolution acoustic video camera-ARIS and local invariant feature descriptor



A new observation method of fish classification by using acoustic video camera (ARIS) at 3.0 MHz center frequency was developed. Using the method, high-quality acoustic image was obtained. After getting the acoustic image of fish by ARIS, we utilized a method called Scale-Invariant Feature Transform (SIFT) into fish classification instead of the method that we used before, which is called Normalized Cross Correlation (NCC), and then we compared and contrasted position matching rate of the two methods of NCC and SIFT, and improved the SIFT algorithm to increase the accuracy.

Xinlong Lui, Memorial University of Newfoundland Wind Direction Determination From Rain-Contaminated X-Band Radar Images



A two-dimensional ensemble empirical mode decomposition (2D-EEMD)-based method is presented to improve wind direction retrieval from rain-contaminated X-band nautical radar sea surface images. 2D-EEMD is first implemented to decompose each rain-contaminated radar image into several intrinsic mode function (IMF) components. Then, a harmonic function that is least-squares fitted to the standard deviation of the first IMF component as a function of azimuth is used to retrieve the wind direction. Radar and anemometer data acquired in a sea trial off the east coast of Canada under rain conditions are employed to test the algorithm. The result shows that, compared to the traditional curve fitting method, the proposed method improves the wind direction results in rain events, showing a reduction of 35.9° in the root-mean-square (RMS) difference with respect to the reference.

Yue Ma, Memorial University of Newfoundland First-Order High Frequency Radar Ocean Surface Cross Section Incorporating a Dual-Frequency Platform Motion Model



The first-order high frequency radar cross section of the ocean surface is derived for an antenna on a floating platform. In this analysis, simulations are conducted for more complicated platform motion than appear in earlier work and comparisons are made to model outputs for a fixed antenna.

Results show that motion-induced peaks appear symmetrically in the Doppler frequency. The magnitude and width of the Bragg peaks are seen to decrease and broaden, respectively, as compared to the case for a fixed antenna.





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OES FASHION SETTERS

Our OES Fashion Aficionados continue to set the trend in footwear as shown in the photo of the trend setters at the OCEANS'16 Monterey conference.

But wait! Has Hollywood been to the OCEANS conferences and has picked up on the latest foot fetish fashions? Well, you be the judge when you examine the star's footwear in the photo taken of the new Designated Survivor TV series.



Winning Poster Paper

Underwater optical communication link using Orbital Angular Momentum Space Division Multiplexing

Joshua Baghdady*, Joseph Kelly, Keith Miller, Kaitlyn Morgan, Wenzhe Li, Eric Johnson Holcombe Department of Electrical and Computer Engineering Clemson University Clemson, South Carolina, USA *jbaghda@clemson.edu



Abstract—This work presents a novel and robust underwater optical communication link designed to address the growing need for high-bandwidth underwater communication systems. Space division multiplexing is demonstrated via Orbital Angular Momentum (OAM) using two laser sources over a link distance of 2.96 m and is shown to yield a collective data rate of 3 Gbit/s at an average bit error

ratio (BER) of 1.76×10^{-4} , well below the forward error correction (FEC) threshold. Techniques are discussed for further broadening of the communications bandwidth via scalable expansion of the model developed herein.

Keywords—Optical communications, Orbital Angular Momentum, GaN laser diodes, Space Division Multiplexing

I. Introduction

As the underwater realm has experienced a great increase in human activity over the past few years, so also has interest grown in developing high-speed wireless communication links that are viable underwater. Furthermore, the acoustic systems that have formed the backbone of underwater communications for over 70 years are becoming increasingly out-of-date as time goes on due to their limited bandwidths [1]. To confront the widening gap between the demands for high-speed communications and the limitations of acoustic architectures, this work proposes an optical alternative.

It is well known that traditional RF systems, with carrier frequencies in the range of 3 kHz–300 GHz, fail to function underwater due to the severe absorption of energy over this portion of the electromagnetic spectrum. This absorption drops off steeply, however, at optical frequencies over the blue-green window of the visible spectrum [2], making the 450–500 nm regime a viable carrier of information underwater. Aside from its viability, an optical approach lends the additional advantages of broader bandwidth and the potential for higher levels of security compared to its acoustic counterpart.

Another advantage of optical communications is their disposition toward multiplexing techniques that further increase the capacity of a communication link. One such technique is known as space division multiplexing (SDM), and involves spatially modifying different data-encoded light sources for co-aligned propagation and subsequent receiver discrimination and retrieval. One form of SDM that has received much attention over the past couple of years is known as Orbital Angular Momentum (OAM) [3–6]. In the sections that follow, an OAM-SDM underwater optical wireless communication link is described and experimentally demonstrated. Section II gives a brief introduction to Orbital Angular Momentum. Section III describes the experimental setup. Section IV provides the experimental results and discussion, and Section V presents the conclusions.

II. Orbital Angular Momentum

Orbital Angular Momentum describes a method of modifying a light beam's spatial profile and phase via the introduction of an azimuthal phase element [7]. Upon this introduction, the phase of the resulting light can be described by $e^{im\phi}$. Here ϕ is an angular variable that is uniformly distributed on the interval [0, 2π] and *m* is the azimuthal mode index, or charge number, of the OAM beam and can take on any integer value. Positive values of *m* indicate a beam with a counterclockwise rotating phase, while negative *m* values indicate a clockwise phase rotation. Given that the light propagates with a helical phase, the intensity profile of an OAM beam is a ring around the axis of propagation whose radius grows with |m|. To see how an OAM beam of charge number m = +1 is produced from a plane wave via a diffractive phase element, see Fig. 1. For images of the intensity and phase profiles of the resulting OAM beam, see Fig. 2.

Since the value of m completely characterizes the spatial mode of the light beam, all that is necessary to achieve discrimination among coaligned beams of varying charge numbers is to propagate the beams through a second phase element of mode index m opposite that of the desired beam. This will have the effect of phase-cancelling the desired beam to yield a beam profile that emulates a Bessel function of the first kind of order 0.

This beam will then have a maximum along the axis of propagation that can subsequently be spatially filtered to achieve separation from any other coaligned beams. This method of beam combination and separation via OAM multiplexing forms an orthogonal signal set over the index set of all values of the charge number *m* and enables the SDM capabilities of OAM.



Figure 1. Generation of an OAM beam from a diffractive phase element.

III. Experiment

Using an arbitrary waveform generator (AWG), two independent channels of binary non-return-to-zero (NRZ) line codes were generated, amplified, and encoded onto the optical output of two GaN laser diodes biased at emission wavelengths of 448.0 nm and 447.3 nm, respectively. An OAM phase element was placed in front of the collimated emission of each diode to induce beams of charge numbers m = +8 and m =-8 onto the incident light. Using a non-polarizing beam splitter, the two beams were then spatially combined before being allowed to propagate through 2.96 m of de-ionized (DI) water. At the receiving end of the link, a third phase element was used to discriminate between the two incoming signals. After this, a focusing lens and 40 µm pinhole were employed to serve the purpose of spatially separating the phase-cancelled beam from the beam doubling in phase after the receiving phase element. Finally, an avalanche photodetector (APD) was placed after the pinhole to perform an optical-electrical conversion of the input signals for analysis on a digital sampling oscilloscope. For a complete representation of the experimental layout, see Fig. 3. For ease of reference, the signal propagating through the water channel as a beam of charge m =+8 will be referred to as Channel 1, and the signal propagating through the channel as a beam of charge m = -8 will be referred to as Channel 2. In each case, the received information was analyzed at the sampling oscilloscope in the form of the eye patterns shown below.

IV. Results & Discussion

Before analyzing the quality of the digital data encoded onto the optical communication link, the 40 μ m pinhole was removed and the APD was replaced with a CCD camera to image the far-field intensity distributions of the OAM beams after propagation through the conjugate OAM phase plate located at the receiver. Fig. 4 [6] shows images of beams of charge numbers $m = \pm 8$ after propagation through a receiving phase plate of charge m = -8. In Fig. 4(a) only the m = -8 beam is allowed to propagate through the water channel before reaching the receiving m = -8phase plate and phase-doubling to assume a charge m =-16. In Fig. 4(b), only the m = +8 beam is allowed to propagate through the water channel before reaching the receiving m = -8 phase plate and phase-cancelling to



Figure 2. Left: Intensity profile of m = +1 beam. Right: Phase profile of m = +1 beam.

assume a charge m = 0. In Fig. 4(c), both of the coaligned beams are allowed to travel across the channel simultaneously before being imaged beyond the receiving m = -8phase plate. As Fig. 4 shows, discrimination of the two beams can be achieved by propagating both through a pinhole with a radius larger than the radius of the phase-cancelled beam but smaller than the radius of the phase-doubled beam. This forms the motivation for the receiver structure described in the previous section.

After imaging the two beams, the cameras were removed and the setup was restored to that shown in Fig. 3. To analyze the data carried by each Channel, all that is necessary is to ensure that the receiving phase element (item K. of Fig. 3) induces the conjugate, phase-cancelling charge number onto the Channel under investigation. The NRZ line codes produced by the AWG were sourced at frequencies of 1 GHz/ Channel and 1.5 GHz/Channel, corresponding to data rates of 1 Gbit/s/Channel and 1.5 Gbit/s/Channel, respectively. The sampling oscilloscope was set to capture 1000 received waveforms from each Channel and display them as eye patterns. These patterns are shown in Fig. 5.

From a given eye pattern, the bit error ratio (BER) of a received signal can be computed by producing a histogram over the 40%–60% window of the bit period of the "1" and "0" rails of the pattern, obtaining the corresponding mean and standard deviation values, and substituting them into the following equation:

$$BER = \frac{1}{4} erfc\left(\frac{\mu_1 - V_{\text{th}}}{\sigma_1 \sqrt{2}}\right) + \frac{1}{4} erfc\left(\frac{V_{\text{th}} - \mu_0}{\sigma_0 \sqrt{2}}\right)$$
(1)

Here μ_i and σ_i are the mean and standard deviation, respectively, of signal *i*, *i* = 0 or 1, erfc(.) is the complementary error function defined by

$$\operatorname{erfc}(x) = \frac{2}{\sqrt{\pi}} \int_{x}^{\infty} e^{-t^{2}} dt$$
(2)

and $V_{\rm th}$ is the threshold voltage, given by

$$V_{\rm th} = \frac{\mu_0 \sigma_1 + \mu_1 \sigma_0}{\sigma_0 \sigma_1}.$$
 (3)

Applying these equations to the data at hand, the BERs of Channel 1 and Channel 2 were calculated from the eye patterns of Fig. 5. The results may be seen in Table 1.



Figure 3. Experimental Layout: A. AWG, B. 10 dB Amplifiers, C. Bias-tees/LDs, D. DC Supply, E. & G. Fiber Collimators, F. & H. OAM Phase Plates, I. 50/50 Non-polarizing Beam Splitter, J. 5X Beam Expander, K. Conjugate OAM Phase Plate, L. Focusing Lens, M. 40 μm Pinhole, N. Focusing Lens, O. APD.



Figure 4. Received images of (a) m = -8 beam; (b) m = +8 beam; (c) $m=\pm 8$ beams, all after propagation through an m=-8 phase plate.

Since the two Channels were space division multiplexed via OAM, the collective data rates achieved were 2 Gbit/s and 3 Gbit/s. Averaged over the two Channels at these speeds, the link BERs were 2.24×10^{-8} and 1.76×10^{-4} , respectively. Note that both of these values are orders of magnitude below the forward error correction (FEC) threshold of 3.8×10^{-3} .

A couple of observations can be made from the preceding results. First, it should be noted that the per-channel modulation rates cannot be increased arbitrarily, but rather are limited by the various components that form the communication link. In this experiment, the NRZ line codes were sourced at frequencies of 1 GHz and 1.5 GHz each, corresponding to raw bit rates of 1 Gbit/s and 1.5 Gbit/s for each of the two Channels. It turns out that this latter modulation rate is pushing the limit of the per-channel capabilities of both the laser sources and the APDs used in the link. Although not shown in this work, further investigative results found that increasing the per-channel modulation rate beyond 1.5 GHz led to severe degradation of the signal-tonoise ratio at the receivers and resulted in a collapse of the communication link.

Second, it has been shown in this work that orbital angular momentum beams of varying charge states can be encoded and coaligned to widen the operable bandwidth of the underwater channel. This form of space division multiplexing achieves channel orthogonality via phase-discriminating optics located at a receiver paired with spatial filtering that allows only the desired mode index to pass uninhibited to a



Figure 5. Received eye patterns: (a) Channel 1, 1 Gbit/s; (b) Channel 1, 1.5 Gbit/s; (c) Channel 2, 1 Gbit/s; (d) Channel 2, 1.5 Gbit/s.

Table I. Bit Error Ratios of Received Data					
	Bit Error Ratio				
Channel	1 Gbit/s	1.5 Gbit/s			
1	3.96×10^{-9}	5.18×10^{-5}			
2	4.09×10^{-8}	3.01×10^{-4}			

detector. It should be noted that this approach is amenable to a high degree of scalability using a large number of charge states to multiplicatively increase the collective data rate of the water channel.

Third, although not demonstrated in this work, previous experiments performed by this and other groups have shown that, contrary to some early speculation, beams exhibiting orbital angular momentum do not disintegrate when traveling through turbid waters [8,9,10]. On the contrary, [6] shows that the performance of an OAM-SDM communication link very similar to the one used in this work was nearly constant across the range of water channel turbidities tested, ranging from that of pure seawater to that of a coastal ocean. It should be mentioned that neutral density filters were utilized in this experiment to maintain a constant signal-to-noise ratio at the detectors in order to directly compare results across attenuation levels. This constant behavior is encouraging, as it suggests that the OAM-SDM communication link can be utilized across a wide range of water channel environments.

Fourth, it should be noted that the receiver architecture used in this work could easily be expanded upon to allow for *simultaneous* reception of the two Channels. This method would preclude the need for changing out a single phase plate to observe one Channel at a time, as done in this work, and could be accomplished with the introduction of a nonpolarizing beam splitter at the front end of the receiver. For an example of this architecture, see Fig. 6 [6].



Figure 6. Simultaneous Receiver: A. – J. As in Fig. 3, K. 50/50 Non-polarizing beam splitter, L. & Q. Conjugate OAM Phase Plates, M. & R. Focusing Lenses, N. & S. 40 μm Pinholes, O. & T. Focusing Lenses, P. & U.APDs.

V. Conclusion

In this work we have demonstrated the successful encoding and decoding of high-speed binary digital data onto and off of two space division multiplexed orbital angular momentum beams of equal charge number and opposite phase polarity relative to one another. As mentioned in the previous section, this approach lends itself to a high degree of scalability resulting in a multiplicative effect on the collective data rate of the communication link.

In this work we have demonstrated such a link with two orthogonal OAM beams of charge numbers $m = \pm 8$ carrying information at collective data rates of 2 Gbit/s and 3 Gbit/s. Averaged over the two Channels, the link BERs at these speeds were found to be 2.24×10^{-8} and 1.76×10^{-4} , respectively, both well below the FEC threshold of 3.8×10^{-3} . As potential for future work, we plan to investigate modulation techniques that yield a higher degree of bandwidth efficiency than the simple NRZ line code. This will serve to increase the per- Channel data rate by overcoming the 1-bit/s/Hz ratio restriction imposed by NRZ without further straining the limited direct-modulation bandwidths of the various system components. We are also investigating an optical approach to multiplexing and demultiplexing different OAM beams that vields a higher degree of power efficiency than do the 50/50 non-polarizing beam splitters. Third, we wish to take advantage of other degrees of beam separation such as polarization and wavelength division multiplexing, both viable methods of further beam discrimination, to further broaden the operable underwater bandwidth in multiple dimensions [11,12,13]. Finally, we hope to move beyond the laboratory setting and begin testing in the waters surrounding our nation's coastlines in an attempt to further optimize our communication link for performance in the environments in which it is ultimately slated to perform.

Acknowledgment

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A Low Cost, Hovering, Novel, 2-DOF Micro AUV

Harold Tay, Acoustic Research Lab, Tropical Marine Science Institute, National University of Singapore

Baby AUV is a low cost, hovering, novel 2-DOF micro AUV which will be capable of multi-day environmental monitoring missions, in particular for taking CTD casts at high spatial resolution. The estimated single-unit BOM cost is \$500. Apart from CTD, Baby AUV carries GPS and a 3D compass/accelerometer.

The moving mass actuator controls pitch, and there is a single 1.5 W surge thruster. There are no fins and no sail. Removing these vulnerable parts keeps the cost and drag down. A flexible GPS antenna is carried in the nose.

With the AUV pitched nose high, hovering is achieved by balancing reverse thrust against reserve buoyancy. The thruster torque reaction causes the AUV to rotate about the vertical and describe a tight orbit, so the AUV will not tend to drift away but remain in the same water parcel. It's like a helicopter that has lost its tail rotor.

Without fins or multiple thrusters to provide yaw, Baby AUV controls heading in 2 different and novel ways.

Coarse heading control (see figure) begins as for hovering, but with greater reverse thrust to corkscrew downwards at a



Figure 1. Baby AUV: \$500, 3.5kg, 50m, 48 hours, 1m/s, CTD.

high rotational rate. At the appropriate point, the vehicle pitches level and drives forward on a new heading. The corkscrew can complete in a few seconds and results in a turning circle



Figure 2. Coarse heading sequence shown (L-R,T-B) covers 15 seconds. The off-centre thruster is due only to space constraints.

radius of almost zero. Typically it will take the AUV to within 30 degrees of the desired heading.

After it gets under way, Baby AUV can trim its heading by appropriately modulating the torque to the single-bladed propeller, to develop a net side force. Put another way, the asymmetry induces in the AUV a left/right wiggle, like a fish but less pronounced. By raising the torque when the blade moves from 9 to 3 o'clock and reducing it from 3 to 9 o'clock, the stern of the AUV wiggles left more than right, resulting in a slow left turn, for example.

This is like prop walk in power boats, except here it is the propeller and not the flow condition that is asymmetric, but the effect is the same.

While it may appear odd, single bladed propellers are occasionally used in aviation. It is also found in nature as the bacterial flagellum (whip-like tail), and in fact tumbling motility in bacteria is strikingly similar to coarse heading control described above.

Apart from taking a minimalist approach to actuation, cost is reduced by restricting machining to mostly the end bulkheads. The hull itself is a standard aluminium extrusion. O-rings are eschewed because they require tight tolerances and a controlled surface finish. Instead, the bulkheads carry a neoprene expansion seal which permits assembly and disassembly without special tools. Endurance is helped by the lack of hull protrusions into the flow (no fins, no sail), from a high slenderness ratio of 6, and from the efficiency gains of the large and slow propeller, which gains are predicted from momentum theory. Not coincidentally, a large and slow propeller is also needed to generate enough torque for effective coarse heading control. This contrasts strongly against the usual AUV practice of running small propellers at high speed and regarding thruster torque reaction as an embarrassment.

There are other volume–or area-covering missions suitable for Baby AUV that do not require high path or position accuracy. Apart from electrical conductivity, the sensors for pH, dissolved oxygen, ORP, and PAR, are low in power and fairly economical. Probably 1 or 2 such sensors can be integrated per AUV in addition to depth.

Algal bloom monitoring would appear to be a perfect use case, but the fact that a chlorophyll sensor costs several times the rest of the AUV gives one pause.

Acoustic monitoring is attractive for reef monitoring, harbour protection, for anti-poaching, etc. and can be quite economical, but work will be needed to reduce the power requirement.

More information on Baby AUV may be found at http://arl. nus.edu.sg/twiki6/bin/view/ARL/HaroldTay.

The author graduated from the University of Texas at Austin in mechanical engineering. He has worked as mechanical, software,



and systems engineer at various times. Now he also works in electronics in his capacity as senior engineer at Acoustic Research Lab of the Tropical Marine Science Institute, National University of Singapore. He is a member of IEEE & OES and has been involved with the Singapore AUV Challenge for the past 3 years and as its chair for the 2016 competition. He has also contributed to a beacon article earlier. See details at http://www.oceanicengineering.org/userfiles/files/

Harold Tay

June-2016-OES-Beacon.pdf). Harold also served on the executive committee of the IEEE OES Singapore Chapter in 2016.

CoolTech: Energizer Ultimate Lithium Batteries

Kevin Hardy, Associate EIC

About Lithium/Iron Disulfide cells

Standard alkaline cells are hard to beat in ocean applications for a lot of reasons, but new chemistries provide interesting alternatives for instruments and releases in the cold waters of the deep sea.

One of the more interesting chemistries is Lithium/Iron Disulfide (Li/FeS2) that operates well in the broad temperature range of -40 °C to 60 °C (-40 °F to 140 °F).

The cells are built as a spiral construction featuring two long, thin electrodes rolled together to form a jellyroll shape. This shape provides almost 20 times more reactive surface area



A direct replacement for 1.5 v "AA" and "AAA" alkaline primary cells, and 9v batteries, the Energizer Ultimate Lithium cell (L91) retains its higher capacity at low temperatures, while providing higher capacity in high-drain situations.



than a standard alkaline, resulting in high-energy potential. Lithium is the lightest metal, making the cells a full 33% lighter than alkaline. When lithium metal (anode) is paired with iron disulfide (cathode), a voltage of 1.5 volts is generated. A lithium salt in an organic solvent blend is the electrolyte. This non-aqueous electrolyte provides the excellent low temperature performance.

Other advantages of the lithium/iron disulfide (Li/FeS2) system over the alkaline chemistry include:

- Direct drop-in compatibility in applications using primary 1.5 volt "AA" and "AAA" battery sizes;
- Greater power density;
- A flatter discharge curve allows for consistent performance throughout the life of the battery;
- Longer service life in moderate to heavy drain applications;
- Higher operating voltage and flatter discharge curve;
- Superior leakage resistance;
- Outstanding shelf life; and
- No added mercury, cadmium, or lead.

Energizer has no current plans to make the larger "C" or "D" cells.

Engineers must consider the following conditions that can affect internal heating of LiFeS2 batteries during discharge.

- Surrounding air temperature
- Thermal insulating properties of the battery container
- · Heat generated by equipment components

- Cumulative heating effects of multiple batteries
- Discharge rate(s) and duration(s)
- Frequency and length of rest periods

Safety

"Intrinsic safety" is the globally recognized protection technique designed to ensure safe operation of electronic devices in potentially explosive environments by eliminating the potential for ignition. "There is no risk of hydrogen generation with lithium iron disulfide batteries and they can be used safely in water tight applications," states the application note. Additional safety references may be found at the Energizer battery website: http://data.energizer.com/PDFs/design_and_safety_overview2.pdf>.

Pack assembly

Use of pressure contact for battery pack assemblies is recommended. If spot welded connections are needed, they can be made to the nickel-plated positive cap and the nickelplated bottom using a capacitor discharge spot welder. Solder connections should be avoided because of the intense heat that needs to be applied to the battery. The use of a battery tube will allow rapid assembly of a battery pack from loose cells. For example, see the Open ROV Store: <http://store.openrov.com/products/battery-tube-replacement-kit-for-2-8>. It is important to not mix battery types, or old and new batteries.

Shipping

Shipping and transportation, including US DOT traveling with lithium battery guidelines, can be reviewed at <http://data.ener-gizer.com/PDFs/lishipmentpolicy.PDF>

Disposal

Primary batteries may be disposed of in landfills, provided no contrary local statutes exist.

For further information, please go on-line to retrieve a copy of the "Cylindrical Primary Lithium Handbook and Application Manual" at the Energizer website: http://data.energizer.com/PDFs/lithium191192_appman.pdf>.

Member Highlights

Contact the editors if you have items of interest for the society

Tamaki Ura—Three AUV Boys Chronicle from AUV2016 Workshop Keynote Talk

The AUV Workshop and UUST (International Symposium on Unmanned Untethered Submersible Technology) have been held in odd years for the last several decades. UUST, which was organized by Dick Blidberg from the University of New Hampshire, was held at the New England Center in New Hampshire. I joined the symposium for the first time in 1989, and met two



Introduction by Tamaki (above), then Dick introduced the three boys chronicle and performed the Initiation by cutting a tether (tie) from a young AUV boy saying "drop your tether!" (bottom).



From left, Carl L. Kaiser and Dick Blidberg with a photo taken at the New England Center in New Hampshire in 1995.



From left, Carl L. Kaiser, Dick Blidberg and Tamaki Ura with a photo taken in Jenova in 2005.



A third three boys photo taken at the AUV2016 Workshop in Tokyo in 2016 with Carl, Dick and Tamaki.



YES, a third three boys photo taken at the AUV2016 Workshop in Tokyo in 2016 with Dana, Dick and Tamaki.

boys who were the leaders of AUV research and development. The elder one was Dick Blidberg, the symposium organizer, and the younger one was Dana Yoerger from the Woods Hole Oceanographic Institution. From 1989, we often met each other at the many symposia and conferences all over the world.

The first three AUV boys photo was taken at the New England Center in New Hampshire on 1995 when we visited there. After ten years, the second one was taken at Jenova in 2005 when we met again there. Then, after ten years again, the AUV2016 Workshop was held in Tokyo from Nov.6–9, 2016, where we had a chance to meet again and take a third photo. Unfortunately, Dana could not attend the meeting due to a research cruise, however, on behalf of Dana, Carl L. Kaiser attended the workshop and took a chronicle photo with us.

We hope that we can take another three boys photo in some symposia or workshops within ten years again! We are also very eager to welcome a new AUV boys and girls generation.



A special gift"mug" of UUST was presented to the youngest attendee of the AUV2016 Workshop.

Who's Who in OES

Bob Seitz, Chair, OCEANS'17 Anchorage



As the editors of the Beacon, we strive to introduce you to the many experts in our society. It is our pleasure to introduce Bob Seitz, chair of OCEANS'17 Anchorage. His background and commitment to the oceans underscores the reasons why he was chosen to lead the Anchorage team.

Bob Seitz volunteered to lead the effort to promote Anchorage, Alaska as the location for OCEANS 2017 in 2011

in response to an email from Bob Wernli asking if any one of the IEEE OES or MTS members in Alaska was interested in taking on the responsibility. He knew something about what he was getting into as he had attended OCEANS conferences in the 1970's.

Robert Seitz has lived in Alaska for over 7 decades, with some breaks for service in the US Navy (1960–64) and attendance at graduate school at the University of Arizona (1968) and Oregon State University (1969–71). He grew up with both Arctic experience and ocean experience so understands well the implications of OCEANS 17 in the only Arctic state in the US. Bob worked on the first crab processing boat in Alaska in 1957 and fished commercially for salmon in the 1958 and 1965 timeframe. He has two sons who have been fishing commercially for more than 25 years. Mr. Seitz graduated from the University of Alaska in Fairbanks in 1968 with a degree in Electrical Engineering. He joined IEEE in



Bob Seitz promoting OCEANS' 17 Anchorage at the OCEANS' 16 Monterey Plenary Session.

1964 as a student member and was Student Branch Chair in 1965/66.

At Oregon State University, while in an MS program for electrical engineering and working as a Research Assistant on a joint program between engineering and oceanography (Totem Buoy Program), he became fascinated with the study of oceanography and added oceanography courses to the set of electrical engineering courses in his degree program. In 1971 he returned to Alaska and worked at the Institute of Marine Science, University of Alaska, Fairbanks, Alaska where he oversaw the development and use of instrumentation for oceanographic



research. It was during this time Bob joined IEEE OES and MTS, and he is now a Life Senior Member of IEEE. In 2011 he was elected Chair of the IEEE Alaska Section and retained that

position until the end of 2015. He continues to be involved with the Alaska Section.

In 1970 Mr. Seitz left the ocean arena and went to work in the design and installation of Oil and Gas production facilities on the North Slope of Alaska. Some of the projects included offshore production facilities with interconnecting pipe and cable between the offshore and on shore facilities. He participated in the design of the Oil Spill Containment barge developed for use during exploratory drilling by SHELL on their Burger Prospect.

He contends that the best future for the Arctic Oceans and for the polar bears is to have economic activity in the region, including oil and gas development, as the best way to approach the effects of climate change. With a blend of modern technology and traditional knowledge the challenges can be better met. Without an economy in the region there is no positive thing that can be done for the marine mammals as the governments do not have the financial strength to do all that must be done, and thus the importance of OCEANS 17 Anchorage at this time.

Member Benefits—Are You a Senior Member of IEEE?

Robert Wernli, VP for Professional Activities

Are you a senior member of IEEE, essentially a professional member with at least 10 years of experience? Gray hair is not a requirement. If you're eligible and not yet a Senior member, contact us so that we can work with you to become one. Or, as detailed below, you can self-nominate.

Senior member is the highest grade for which IEEE members can apply. IEEE members can self-nominate, or be nominated, for Senior Member grade.

To be eligible for application or nomination, candidates must:

- Be engineers, scientists, educators, technical executives, or originators in IEEE-designated fields
- Have experience reflecting professional maturity
- Have been in professional practice for at least ten years (with some credit for certain degrees)
- Show significant performance over a period of at least five of their years in professional practice

There is no additional fee to apply for Senior Member grade.

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- **Recognition:** The professional recognition of your peers for technical and professional excellence.
- Senior Member plaque: All newly elevated Senior members receive an engraved Senior Member plaque to be proudly displayed for colleagues, clients, and employers to see. The plaque, made of fine wood with bronze engraving, is sent within six to eight weeks after elevation.
- US\$25 coupon: IEEE will recognize all newly elevated Senior members with a coupon worth up to US\$25. This coupon can



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be used to join one new IEEE Society. The coupon expires on 31 December of the year in which it is received.

- Letter of commendation: A letter of commendation can be sent to your employer on the achievement of Senior Member grade upon the request of the newly elected Senior member.
- **Announcements:** Announcement of elevation can be made upon request to your Section/Society in their local newsletters, newspapers, and notices.

- Leadership Eligibility: Senior members are eligible to hold executive IEEE volunteer positions.
- Ability to refer other candidates: Senior members can serve as a reference for other applicants for senior membership.
- **Review panel:** Senior members are invited to be on the panel to review Senior member applications.
- US\$25 referral coupon: Newly elevated Senior members are encouraged to find the next innovators of tomorrow and invite them to join IEEE. Invite them to join and the new

IEEE member will receive US\$25 off their first year of membership.

You can apply for Senior membership by going to the IEEE website and searching or directly to the following: https://www.ieee.org/ membership_services/membership/senior/application/index.html

Or, if you need application assistance, please contact our OES representative, Venu Pallayil, at venu@arl.nus.edu.sg.

We look forward in helping all our applicable OES members receive the recognition of Senior status.!

Welcome New and Reinstated Members

Canada

Murwan Elmahdi Bashir Lihong Zhang

Ireland Dermot M Tynan

Japan Jonghyun Ahn

Malaysia Mohd Fairuz Bin Nor Azmi

Nigeria David Adegbola Adeniran Singapore Akshat Dubey Rui Gao Bien Aik Tan

Taiwan Rene F Koch

Tunisia Ayoub Salha Ghazi Tabka Tabka

Turkey Lalehan Can United Kingdom Henry Bennett

USA Brian Abbott Mitchell C. Barham Danarose Brown Donald P Brutzman Rick Cole Allisa Dalpe Max Deffenbaugh William C Eason Brian Emery

Sean Michael Fitzpatrick

James Garrison Andrew Goodney Anna E Hagstrom Forrest T Hannahs Anthony Amaro Jr Dexter Malley Dana Manalang James W Partan Ashesh Srivastava Kieran Sweeney Hayden Caine Tekerman Isaac Vandor Erin Walters Libe Washburn

AUV "Minty Roll" in Underwater Robot Conventions The Road to Success

Takaaki Ito, Ryota Takizawa, Yukiyasu Noguchi, Yuto Mori, Soichi Yoshino (master course students of U-Tokyo) and Takumi Matsuda (OES Beacon Editorial Team)

Minty Roll is the AUV that has been developed by students of Maki laboratory, Institute of Industrial Science, The University of Tokyo, as we introduced in the last Beacon Newsletter (September issue). Characteristics of Minty Roll are as follows.

- 1) It has sophisticated hardware for easy operation.
- 2) A particle filter is implemented by ROS (Robot Operating System) to realize robust system.
- 3) It has been developed and aimed to be the champion of the underwater robot convention.

In the convention held in JAMSTEC (Japan Agency for Marine-Earth Science and Technology), we couldn't become the champion because of hardware trouble. Minty Roll's CPU was broken just before our performance. We think there were some reasons for this breakdown.

First of all, we think a water leak is one of the reasons of the breakdown. During the time of development of Minty Roll, it sometimes suffered a water leak by accident. Although Minty Roll worked well after drying, this might accumulate damages to the system.

Second, we think humidity might affect bad influence on the system. We opened the robot's CPU hull to make a final check. However, the pool is very stuffy, so this might give a bad influence on the CPU.

In addition, we think that we could not manage time schedule well. It took more time to develop Minty Roll than we expected. So we could not have enough time to prepare for spares of robot's components such as CPU memory for the convention.

After the convention in JAMSTEC, we decided to participate in the underwater robot convention in Techno-Ocean 2016 in Kobe. The convention was held in a 25m pool and tasks were more difficult than those of the convention in JAMSTEC. Missions are line tracking and gate passing. There were also new missions and tasks that included searching some pictures hidden in the pool and developing the system to deploy and recover the AUV without using hand directly.

We discussed the problems and improved the following items.



Appearance of Minty Roll.



The System for Development and Recovery of the AUV.



Performance Test of Minty Roll in JAMSTEC.



Underwater Robot Convention in Kobe.

- 1) Electric circuit was improved to realize the compact system.
- 2) Deployment and recovery system was developed.
- 3) Software was improved to cope with the new mission such as searching hidden pictures.
- 4) Camera was additionally mounted on Minty Roll for a search mission and line tracking.

As a result, we became the champion of the convention

in Techno-Ocean 2016. In the convention, as the robot's



Award Ceremony of Underwater Robot Convention in Kobe.

camera still had problems, it couldn't get clear pictures for line tracking. But Minty Roll had the other sensor such as a scanning sonar, and it worked very well. This shows the robustness of Minty Roll's software. And thanks to the system for deployment and recovery, we can deploy and recover Minty Roll easily. This was highly evaluated and received a high score.

Through the conventions in JAMSTEC and Kobe, we learned the AUV technology and the fun and difficulty of developing AUVs. And more than anything, this success in the convention gives us that it is important not to give up in any situation. We hope to make use of this experience in our research in the future.

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The Student Chapter—Shanghai Jiao Tong University

Zheng Zeng, Oceanic Engineering Society Shanghai Chapter Secretary

SJTU OES student members attending the 18th China international industry fair

The 18th China international industry fair (CIIF) was held in Shanghai on November 1-5, 2016, which is the top event of equipment and manufacture industry (see Fig.1). The CIIF attracted research institutes, companies, organizations and engineers to attend. In November 3rd, the SJTU OES student members went to this fair together.

There were eight shows in this fair: metal working and CNC machine tool show, industrial automation show, environmental protection technology show, information and communication technology show, energy show, new energy auto show, robotics show, scientific and technological innovation show.

Many excellent exhibitions are on this fair, such as quadrotor, manipulator, unmanned vehicles, numerically-controlled machine tool, etc. Most noteworthy is the "HaiXiang-1500" ROV exhibited in the scientific and technological innovation show (see Fig.2); this system was initiated by the research team led by Professor Lian Lian. "HaiXiang-1500" ROV was noted for its capacity at the working depth of no more than 1500 meters in installation, connection and maintenance of underwater devices and prefabrication of jumper tubes. It was expected that this system would help to establish and enhance China's independent capability in underwater delivery and working systems, which would better serve the exploitation of the oil and gas in South China Sea and provide guarantees for security in production in marine oil and gas fields.

The successful development of the heavy duty work class ROV with a working depth of 1500 meters has helped to add a new member to the family of China's self-developed ROVs, which represented another enormous stride in the field of research and development of submersibles after the ROV "HAIMA-4500" with a working depth of 4500 meters was put into application.

After visiting this fair, SJTU OES student members are impressed that in China we keep improving our ability to transform scientific and technological strength to realistic produc-



Figure 1. A panorama of CIIF.



Figure 2. The "HaiXiang-1500" ROV and some of the IEEE OES student members.

tivity. However, how to transform from a big nation in manufacturing to a powerful one is still a great subject of China's economic development in the new era.



OES Awards Student Scholarships



OES awards eight scholarships a year to deserving students across the world. We introduced two students who received a scholarship award in May 2016. Profiled below are Andrew Dobbin, a master's student at Dalhousie University studying ocean and electrical engineering and Carmen Glasser, a master student at Florida Institute of Technology studying ocean engineering.

Personal statement by scholarship recipient, Andrew Dobbin

Andrew is currently a Master's student at Dalhousie University studying ocean and electrical engineering. He became interested in ocean engineering while working with a team as part of the MicroTransat Challenge. He was the lead designer of the electronic controller for an autonomous sailboat designed to sail



across the Atlantic Ocean. During this contribution to the team, he developed an interest in ocean engineering, specifically underwater acoustic (UWA) communication network systems. His primary research focus is on software defined radio design using fieldprogrammable gate arrays (FPGAs) with underwater applications.

Andrew has just started with his degree in January 2016. However,

he has made significant process since and is now working on implementing an orthogonal frequency-division multiplexing (OFDM) receiver on an FPGA. This receiver will be the backbone for testing underwater acoustic signals at the Dalhousie UW-STREAM Laboratory. He continues to design new tools, including a micro-electric mechanical system (MEMS) hydrophone, as part of his graduate work. His hope is that the hydrophone could be integrated with the OFDM receiver with supporting electronics for a complete acoustic receiver.

'To conquer the ocean is truly an amazing feat which, if done together, can be done right.' Andrew believes there is much to be discovered in underwater communications and oceanic engineering. His passion is evident through his research and innovation thus far by his undergraduate and early graduate career accomplishment. He is looking forward to continued development of new engineering tools during his time at Dalhousie and hopes to become an expert in ocean and electrical engineering.

Personal statement by scholarship recipient, Carmen Glasser

Carmen is currently a Master's student at the Florida Institute of Technology studying ocean engineering. She plans to graduate at the end of 2017. Before graduate school, Carmen graduated from the United States Naval Academy and been working for the U.S. Navy since.

Carmen's experience and graduate work is unique and a bit nontraditional to the IEEE OES community. Her research focus is primarily centered on bioremediation and habitat restoration platforms, in which she combines expertise in environmental systems with biological sciences to improve lagoon water quality, restore seagrasses and rebuild bivalve populations in the



Indian River Lagoon of Florida. She has organized and overseen refurbishment of four platforms, including planting of vegetation to the construction of the platforms. Her research project combines science and engineering to create a functional habitat to act as a nursery for plants and mollusks. The project is also unique in that she integrates renewable energy, specifically solar energy, to help power

the water pumps and other equipment supporting water quality of the system.

Carmen's background in oceanography has been valuable in ensuring the restoration and survival of these sensitive habitats. Her background with her time in the Navy has been complementary in ensuring the proper mooring design of the platforms to prevent structural damage. Her passion for protecting these habitats is shown in her outreach of the project. She has included local Indian River Lagoon community to be part of the project through social media and engagements with local schools. She is now continuing similar habitat restoration efforts with the Brevard County Zoo to design a living shoreline project.

General call for scholarship applications

The IEEE Oceanic Engineering Society recognizes that the future of ocean engineering depends on the recruitment of talented, engaged young people. To encourage advanced education in ocean engineering, OES offers up to eight awards annually for \$5,000 each. Graduate and undergraduate students are encouraged to apply for these grants at any time. Selections are made twice each year, with deadlines of 1 May and 1 September. Information on the application process is available on the OES website:

http://ieeeoes.org/page.cfm/cat/62/Student-Scholarship-Program/

Applications for OES scholarships are reviewed. This requires the time of volunteer members. Thanks to the following who are presently on the OES Scholarship Committee: Liesl Hotaling, Ruth Perry, Co-Chairs; Kenneth G. Foote, Philippe Courmontagne, Mal Heron, Venugopalan Pallayil, Ye Li, Arjuna Balasuriya, Hans-Peter Plag, John Watson, Hanumant Singh, Paul Hines, Hayato Kondo, Brandy Armstrong, Frederic Maussang.

OES Strategic Planning

1. Introduction

1.1 Rationale and Summary

The need for a Strategic Planning, along with its implementation plan has always been present in the Society, and nevertheless never quite implemented. Description of strategic planning steps were studied or worked on by the AdCom in 2001 and 2011 (see summary at the end of the document). At the last Society Review by IEEE, the committee even noticed that: "the society does not seem to have a strategic plan for the next several years to accomplish the aim of extending their international activities and impact".

The aim has always been to increase the impact of the IEEE Oceanic Engineering Society (OES) in its field of interest. The overarching aim is to establish a growth path that keeps OES active and relevant as long as foreseeable. The main goals will then be to grow the OES membership, to extend the OES international activities and impact and to Introduce new means of dissemination of knowledge in the field of interest of OES.

The path toward achieving these goals requires we promote our activities in a rational manner. The central and more important part of the strategic planning will consist of describing the ways to achieve these goals. Our Strategy will then be developed around three specific objectives:

- Developing thematic and coordinated workshops and symposia within the focus of our scientific and technological domains
- Extending them to members and non-members around the globe.
- Creating new means of dissemination for the scientific and technical products to benefit our members and the overall MS&T community.

The same objectives are of course true for OCEANS, our flagship conference. The expected impacts will be for the benefit of our members and will lead to increase membership numbers looking for an inclusive and worldwide audience. They will also raise the awareness of the Society at the international level, especially government lead organizations.

This document addresses the vision and the future of the Society for the next 10 years with a first 3-year milestone corresponding to the IEEE Society Review. The plan and its implementation will then be reviewed every 5 years or, as conditions changes, as soon as 3 years. The aim is to outline some of the future goals of the Society by examining the benefit that can be brought to the members and the overall Marine Science and Technology (MS&T) community. This strategic planning must follow the structural governance of the Society and be supervised by the elected Officers following the implementation plan and derived actions depicted in this document, and with approval by AdCom as outlined in the policy and procedures for OES.

2. Thematic Strategy

2.1 OCEANS Conference

The OCEANS conferences have been following a relatively stable model for the last 10 years. The model started as a strategic development at the beginning of the century and developed into two OCEANS conferences per year as an effort to bring the conference to the members and as well as the MS&T community.

New digital information and communications technologies pose the question if the traditional face-to-face way of operating a conference is the best method. The current model we use for presentations should be examined as we think about solicited session on currently hot topics in the MS&T community, emerging and challenging issues, panels, plenaries, diverse exhibitors, research and development tracks, video presentations and tutorials and small internal workshops. We'll have to use W&S as feeder vehicles for expanding OCEANS and possibly adapt to the expanding themes of maritime sustainability (Blue Economy).

The implementation plan will put forward specific actions related to the Oceans conference and how to keep the meeting relevant to OES membership.

2.2 Workshops and Symposia (W&S)

The Society is already sponsoring many W&S throughout the world. These W&S are generally topical (Autonomous Under-

water Vehicles, Underwater Technology, Underwater Communications, and others) or can be a special regional topic. In order to intensify the experience of OES with our members and bring more benefits through membership, we will extend our W&S efforts by presenting them where our members are or where a potential future membership community can be built.

A Regional strategy consolidated with a thematic strategy must be developed (see IP) for proposing new W&S activities that will accomplish the stated goals. This requires a coordinated and concerted effort at the science & technology level of OES while planning implementation. For instance, an initiative (ASI—Advance Study Institute) has been started recently for addressing young professional in a summer school like approach.

2.3 Membership & Chapters

Many Countries/Regions around the world are involved in activities related to our Fields of Interest (FoI) but there a relatively few OES members in comparison. A proactive path is required in order to showcase the S&T community we are representing. We must identify places where MS&T communities exist that are underserved or who have not been served in recent years as we propose activities (seminars, lectures, workshops, ...) with specific actions that are able to raise membership numbers. The Distinguished Lecturers (DL) Program needs rejuvenation to support Chapters and also might be used in Topical Workshops & Symposia.

In principle all our existing chapters have enough student members, yet we don't have very many Student chapters. An effort must be undertaken for promoting our actions and supports—scholarships, poster competitions, ocean-related meetings—all oriented towards the students.

2.4 Promotion—Publicity—Outreach

Our promotional effort requires review and upgrading to reach the goals we are outlining. One path to improvement is implementing modern methods through an increase in effort using non-conventional media (Twitter, Instagram, push of information, as well as other forms of social media) for a more efficient outreach. In order to achieve this goal, we will seek interactive versus reactive announcements as a path to improvement. We will make better use of IEEE services like IEEE-tv which can host our on-line seminars, plenary videos, and other presentations.

Publicity of our conferences and publications must be rethought. Concepts include modernization of the web site technology to improve the look and feel for members and the MS&T community. Ease of use is a top priority and consistency so that from conference to conference the community will have a familiarity developed. A consistent and singular web address would make finding meeting information easier as well as increase search engine ranking for each established workshop, symposium or conference. Specific efforts might include:

- Utilizing existing IEEE capabilities, such as "IEEE Collabratec Community", https://ieee-collabratec.ieee.org/
- IEEE Community of Practices
- Incorporating recommendations of present OES Web Modernization Committee, which were presented at two recent OES AdCom meetings.
- These web based efforts also involve major outreach efforts via social media, especially towards students.

- Utilization of regular press releases to a variety of ocean oriented magazines to appear in their publications, as well as their web based versions.
- Continuation of use of "barter agreements' to insure consistent advertising of our main Oceans conferences, as possibly even expanding efforts to include some of our workshops, symposia, etc.

Hosting websites for regional chapters and events as well as provide links/pointers from our main website will increase member's participation.

We should increase awareness that although the society name is Oceanic Engineering Society we actually include all fresh water in any form of lake, river or storage condition as well as in any condition be it ice, liquid or vapor.

2.5 New Marine S&T themes/Publications

The present main stream of papers and articles (either for the journal or for conferences/workshops) is addressing mainly underwater acoustics and vehicles. Our FoI, represents a much wider scope within the science and technical communities and the journal must diversify beyond these two main topics. Oil & Gas, military and surface vehicles as well as some aerial systems and the data associated with each topic area all fall within our FoI. We need to increase our support in those additional topic areas, however we recognize the current low oil prices might hamper development. The excellence of these papers in these areas is not doubted. The advent of a digital and more highly integrated world can assist with bring other new fields to prospect and inject in as main topics of OES meetings and the OES journal: connected sensors, integrated and collaborative measurements, massive data acquisition, intelligent vehicles are examples of fields of interest we can expand into.

Other avenues for possible future topics are worth exploring through deeper integration of ocean engineering and science with marine renewable energy and/or ocean societal impact. The marine biology communities are poorly- or un-aware of the technical developments in ocean science and technology over the last 25–30 years.

Using the Journal of Oceanic Engineering (JOE) to publish special collections is one answer to this challenge. Another is the possible development of JOE letters for faster publication. In particular, expanded interest in the new "environmental engineering initiative" along with the SEI (Synthesizing Environmental Information) initiative is supported by IEEE and Division IX with a co-leadership from OES.

2.6 Partnerships

We have at present three main partnerships, at different level of participation and meaning: the Marine Technology Society (MTS), the Ocean Technology Conference (OTC) and the Group on Earth Observations (GEO)/Global Earth Observation System of Systems (GEOSS). Increasing the partnerships may be a path to increase recognition and outreach.

Our relationship with MTS has been much more integrated over the past years and we have several joint committees (for example RECON or JOAB). There is a need to formalize how the two societies are managing what they have in common (mainly the OCEANS conference).

We are one of the participating (founding) Societies of OTC and have recently increased our involvement (at the scientific level) by being a very active part of the steering and technical committees. We have an Ad Hoc committee and we need to redefine its role to promote it into a more permanent position within OES.

We have had a central role in the adhesion of IEEE to GEO and we were one of the main societies managing the ICEO (IEEE Committee on Earth Observation) which has seen the bulk of its activities integrated into OES. This interact in different ways through Technical Committees, the Earthzine electronic magazine, and representation of IEEE at GEO plenaries with a major connection to ocean related concerns, such as the newly created Blue Planet initiative. There is a need to better recognize this set of activities as they are integrated into OES.



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OCEANS'17 MTS/IEEE Aberdeen Call for Abstracts

Important Dates

Abstract submission opens: 1st October 2016 Abstract submission closes: 1st December 2016 Call for tutorials: December 2016 Authors notified: February 2017 Tutorial proposals submission: February 2017 Full papers required: March 2017 Tutorial presenters notified: March 2017 Early bird registration deadline: April 2017

OCEANS'17 will be a tremendous opportunity to focus on topics of interest to you in all fields of Marine Technology and Ocean Engineering. We are developing a Technical Program that we hope will appeal to the most significant areas of interest. The conference will feature:

- Over 400 professionally reviewed technical papers, including sessions focused on local themes.
- Plenary sessions with leaders from industry, academia, the military and government.
- · Exhibitors showcasing the latest innovations in products and services.
- · A student poster session featuring outstanding projects from around the world.
- Tutorials, workshops, demonstrations, government listening sessions, social/networking opportunities, professional field trips ...and much, much more

Abstract submissions are now open: http://abstracts.oceans17mtsieeeaberdeen.org/abstract-rules.cfm

Abstracts may be submitted in one or both of the following categories:

- Regular Technical Program: Abstract submitted for review, technical paper presentation intechnical or poster session at the conference, and publication in IEEE Xplore.
- Student Poster Competition: Abstract, paper, poster presentation, and publications in IEEE Xplore.
- Open to any full-time student in an accredited program. Selected applicants, based on abstract reviews, will have travel and registration expenses fully reimbursed.
- Abstract submissions will close in December and we will continue developing the full technical program over the coming months. We hope you are planning to attend the conference, and we hope you will submit a paper of interest to the MTS/IEEE OES community.

The Local Organizing Committee (LOC) for OCEANS' 17 MTS/IEEE Aberdeen has selected seven topics with both special local interest and broad international significance. Those topics were chosen in line with the conference theme, A Vision for Sustaining Our Marine Futures.

In addition, the OCEANS'17 has standard conference topics and all may be seen here: <u>http://www.oceans17mtsieeeaberdeen.org/index.php/authors/programme-topics</u>

For more information, visit our website at http://www.oceans17mtsieeeaberdeen.org/