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Member Benefits—Did You Know?

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From the OES BEACON Editors

Harumi Sugimatsu and Robert Wernli

Welcome to the March 2019 issue of the Beacon as we prepare for the next OCEANS conference in Marseille. The latest changes to all our committees and volunteers can be found on the inside of the front and back covers. Again, we'd like to thank all of the contributors to our quarterly newsletter. As you can see by the content, this is your newsletter, and we try to cover all aspects of the society activities from our workshops, symposia and conferences to what our individual members, chapters and committees are up to. And, don't forget, all issues of the Beacon are available on the OES website.

Of particular interest in this issue are the reports on our latest events—the SAUVC2019 in Singapore, the UT '19 symposium in Kaohsiung, Taiwan, the CWTMA workshop in San Diego, California and the Offshore Technology Conference (OTC) in Houston, Texas and upcoming ANOF 2019 in Helsinki, Finland and the upcoming OceanObs'19 in Honolulu, Hawaii. In addition, the international outreach by OES via the many robotic events is highlighted in the articles from Singapore, Japan and Europe.

Our student outreach is highlighted in the reports of activities by our student chapters at the University of Southern Mississippi and the University of Zagreb, Croatia. Also, don't miss the article on Women in Engineering (WIE) activities in the IEEE Delhi, India, section.

There is plenty going on in our chapters as reported in the articles from Singapore, Argentina and Providence.

We also take pride in our members. Be sure to see the latest articles on Member Highlights, Members in Print, "Who's Who in the OES" and a behind-the-scenes look at what our Junior Past President is up to.

Of particular interest in this issue is the information on our latest AdCom candidates. We think you'll agree that the international slate of candidates is very impressive. Please look them over and vote when you receive your electronic ballot.

There is a wealth of other information and articles in this issue that we hope you enjoy. And, as always, we'll close by inviting you to participate in your society. Submit articles and material for the Beacon. Or . . . volunteer for other society activities as a participant or an elected officer. It's your society and it is here to help you reach your professional goals. Enjoy.



Your Beacon editors at the Underwater Technology '19 symposium at Kaohsiung, Taiwan in April.



Your editors at UT '19, hosted by National Sun Yat-sen University, with the picturesque Sijihwan Bay in the background.

Life as Past President

René Garello, OES Junior Past President

I am often asked the question of “what is it to be ‘past president?’” To the opposite of politicians, the past president has a role to play in the structure of the IEEE Society (Oceanic Engineering, in this case) as indicated in the Constitution. The OES is a bit peculiar as we not only have an immediate past president (junior), but as well the former one (senior). Both are ExCom members, implying that their experience and opinion are still valuable (I hope) and important in all discussions.



The role of JPP (Junior Past President) and SPP (Senior Past President) is different. JPP is in charge of some shaping aspects of the Society, such as the elections (Administrative Committee, Executive Committee) or the Awards (Distinguished Service, Distinguished Technical Achievement, Institution/Company, Presidential, Emeritus).

This is, of course, much less time consuming than being President, meaning that I can devote more to research activities related (or not) to the Society, provided that I’m still active (that is, not retired). And as an active member I can propose to organize and possibly run OES seminars and workshops. Being Past President still offers some level of recognition, allowing me to be present as the OES (or IEEE) representative in diverse entities (provided that these activities are recognized and within the scope of the society). For instance, I’m a member of the Executive Committee of the Group on Earth Observation (GEO, <http://www.earthobservations.org>). And having been President is also an asset when applying for some IEEE Committees. There are plenty of them dealing with all aspects of the IEEE, and to name a few—publications, conferences, finances, standards, society reviews, member elevation (senior, fellow), etc., not mentioning several ad hoc committees.

For the last two years I have been participating on the TAB Strategic Planning Committee, which is quite instructive. This

leads to questions such as “*Are the TA (Technical Activities) mission and vision aligned with the IEEE mission and vision?*” This has a direct impact on the Societies as it encompasses the complete publication process, for instance. And just to name a few subjects of discussions concerning the Technical Activities, let me list some of the recent ones:

- IEEE is chartered for the public good as an organization, aka “for the good of humanity,” but not as a humanitarian group?
 - Who are we supporting? Members, engineers, the public—all the above?
 - The TA mission statement needs to be broader—we are more than building communities
 - What does IEEE mean to our members? What is the impact of including “for the benefit of humanity”
- Could TAB partner with other non-IEEE organizations to achieve what we want to stay competitive and should that be part of our vision?
- There is not an individual member connection to TAB or TA—there is a connection to their personal community(ies)—S/C/TC. And the way TAB governs itself is designed to protect ourselves from short-term disruption and for long-term management:
 - We may need to look at the entire way in which the Societies and TAB organize to move away from slow change,
 - New technologies will not be new foundational Societies—they will be horizontal, not vertical, or application focus,
 - We need to be more than just a federation of vertical Societies—we are a matrix of vertical and horizontal.

Clearly, a lot of work is in front of us (“on the table”, as we say in French)!

Several ad hoc subcommittees are working on all these topics and more (and beyond as well). We will deliver statements during the year and I’ll present some of the resulting documents in a future issue of the BEACON.

VPTA Report—Funding for Technical Activities

Malcolm Heron, OES Vice President for Technical Activities



OES ExCom officers are keen to see available funds going directly to support the Chapters and Technology Committees of the Society. At their February meeting they requested the VPTA and the Coordinators of Chapters and Technology Committees to come up with funding models. The documentation for these will go to the AdCom meeting in Marseille in June. The plan is to allocate funds in the budget so that Chairs of

Chapters and Technology Committees can submit proposals for support for planning or promotion activities like conference special sessions or streams, technical meetings and events. The plan is to have a rolling schedule with no closing date and quick response for approval on activities up to two years ahead. There is a complication that needs a work-around for Workshops and

Symposia where there has to be a formal budget approved by AdCom at least one year out. For those activities the proposed Activity Funding Schemes will be available for early planning and gap-filling where some augmentation is needed.

I think the real motivation behind this development is to acknowledge that the Chapters and Technology Committees provide the foundation for the technical activities of the Society. Also, it is hoped that schemes like this will enhance the communication between Chairs and the Coordinators of Chapters and Technology Committees.

As IEEE moves into open-access publications there is a perceived shift in emphasis to workshops, symposia and conferences as the activity focus for the Institution. OES is well-placed with active Technology Committees and Chapters that are already sponsoring a wide range of medium-sized events. Be sure that you affiliate with one or more Technology Committees, and keep involved in your local Chapter to get maximum benefit from these groups.

Call for Nominations for Distinguished Lecturers

Malcolm Heron, VPTA

Nominations are sought for three Distinguished Lecturers to commence their term on 1 January 2020. Nominations with brief CV and endorsement from one of the OES Technology Committees

close on 31 July 2019 with the VP for Technical Activities. DLs who are seeking a new term should include their record of DL activity.

Contact e-mail address: mal.heron@ieee.org

From the Journal Editor's Desk: IEEE Journal of Engineering Early Access Papers

Mandar Chitre, Journal Editor-in Chief

Congratulations to the authors of our most recently approved papers for the IEEE JOE. The following papers were published as Early Access papers online on IEEE Xplore and will appear in regular issues soon. You'll find these papers now:



- “Differential Pressure Sensor Speedometer for Autonomous Underwater Vehicle Velocity Estimation,” by C. Meurer; J. F. Fuentes-Pérez; N. Palomeras; M. Carreras, M. Kruusmaa
- “Long-Distance Path Planning for Unmanned Surface Vehicles in Complex Marine Environment,” by B. C. Shah; S. K. Gupta
- “Obstacle Tracking for Unmanned Surface Vessels Using 3-D Point Cloud,” by J. Muhovič; R. Mandeljc; B. Bovcon; M. Kristan; J. Perš
- “Ship-of-Opportunity Noise Inversions for Geoacoustic Profiles of a Layered Mud-Sand Seabed,” by D. Tollefsen; S. E. Dosso, D. P. Knobles
- “Long-Term Estimation of Wave Climate Variability in the Western Bay of Bengal,” by B. Sadhukhan; A. Chakraborty; K. Jossia Joseph; R. Venkatesan
- “Measurements, Metrics and Modeling of Normal-Incidence Acoustic Interaction with Ocean Sediment,” by M. J. Isakson, J. N. Piper; A. R. McNeese
- “Correlation Detection of Boundaries in Sonar Applications with Repeated Codes,” by J. Y. Taudien; S. G. Bilén
- “Adaptive Dynamic Surface Control for a Hybrid Aerial Underwater Vehicle with Parametric Dynamics and Uncertainties,” by D. Lu; C. Xiong; Z. Zeng; L. Lian
- “An Adaptive EKF-FMPC for the Trajectory Tracking of UVMS,” by Y. Dai; S. Yu; Y. Yan
- “Vector Acoustic Analysis of Time-Separated Modal Arrivals From Explosive Sound Sources During the 2017 Seabed Characterization Experiment,” by P. H. Dahl; D. R. Dall’Osto
- “Linearized Bayesian Inversion for Experiment Geometry at the New England Mud Patch,” by J. Belcourt; S. E. Dosso; C. W. Holland; J. Dettmer
- “Direct-Path Backscatter Measurements Along the Main Reverberation Track of TREX13,” by D. Tang; B. T. Hefner; D. R. Jackson

- “Breaking Wave Imaging Using Lidar and Sonar,” by O. Bryan; P. M. Bayle; C. E. Blenkinsopp; A. J. Hunter
- “Redefined Output Model-Free Adaptive Control Method and Unmanned Surface Vehicle Heading Control,” by Y. Liao; Q. Jiang; T. Du; W. Jiang
- “Multipath Broadband Localization, Bathymetry, and Sediment Inversion,” by Z.-H. Michalopoulou; P. Gerstoft
- “Dynamic Modeling of Passively Draining Structures for Aerial-Aquatic Unmanned Vehicles,” by W. Stewart; W. Weisler; M. Anderson; M. Bryant; K. Peters
- “Sizing Drop Weights for Deep Diving Submersibles Taking Into Account Non-Uniform Seawater Density Profiles,” by B. Thornton
- “Depth-Dependent Geoacoustic Inferences with Dispersion at the New England Mud Patch via Reflection Coefficient Inversion,” by J. Belcourt; C. W. Holland; S. E. Dosso; J. Dettmer; J. A. Goff
- “Diurnal Fluctuation of Shallow-Water Acoustic Propagation in the Cold Dome Off Northeastern Taiwan in Spring,” by C. Chen; Bo Lei; Y. Ma; Y. Liu; Y. Wang
- “Assessing Feasibility of Secure Quantum Communications Involving Underwater Assets,” by M. Lanzagorta; J. Uhlmann
- “Ice Condition Assessment Using Onboard Accelerometers and Statistical Change Detection,” by H.-M. Heyn; M. Blanke; R. Skjetne
- “Realizing Efficient Front Crawl Stroke with a Wheel-Paddle Integrated Mechanism: Inspired by Human Competitive Swimming,” by Y. Shen; H. Pu; S. Ma
- “Underwater Acoustic Source Seeking Using Time-Difference-of-Arrival Measurements,” by F. Mandić; N. Mišković; I. Lončar
- “Underwater Laser Triangulation Sensor Model with Flat Refractive Interfaces,” by G. Matos; P. Buschinelli; T. Pinto
- “Trans-Dimensional Inversion of Modal Dispersion Data on the New England Mud Patch,” by J. Bonnel; S. E. Dosso; D. Eleftherakis; N. R. Chapman

Obituary on Robert Thomas Bannon September 27, 1984–March 22, 2019

It is with a sad heart that we once again have to announce the passing of another pillar of our society this year. On March 22nd, Bob Bannon passed away at the age of 70.

Bob's support to IEEE and OES was nothing short of stellar. He seemed to be everywhere within IEEE and the OES. A member since 1985, he became a Senior member in 2001 and was elevated to IEEE FELLOW in 2003 for Oceanic Engineering Applications and Advanced Sensors Suites Integration. Bob received the OES Technical Achievement Award in 2009 and the OES Distinguished Service Award in 2013.

He served as the IEEE Publicity Visibility Initiative Fellow for Homeland and Maritime Security 2009–2011; served as a Member of the IEEE Technical Activities Board, 2006–2007; and the TAB Publications Committee, 2005–2007. He served as a Member of the IEEE-USA Technical Policy Committee on R&D, 2005–2008 and the Technical Committee on Critical Infrastructure Protection, Member 2006–2010. In the past Bob was a Member of the Communications, Power and Engineering, and Robotics and Automation Societies. He was the President of the Sensors Council (SC), 2006–2007, held various SC ExCom positions from 2001–2014, and received the SC 2008 Meritorious Service Award.

Bob has served the OES in a broad range of activities including 5 terms as a Member of the OES Administrative Committee during 2000–2017. He was the developer, coordinator and Co-chair of the Homeland Security Conferences 2003–2005, member of the RECON committee for the OCEANS Conference venue review and selection, and served as a Distinguished Lecturer. He has been a prolific reviewer of conference papers both for OES conferences as well as the Offshore Technology Conferences. Bob was an active participant in the development of the new Society Constitution and



Peggy and Jim Barbera with Bob and Janet at the OCEANS 2013 San Diego Leadership Dinner.

Bylaws and a major contributor to upgrading the Society website. He was the OES Rep to the Sensors Council AdCom and promoted OES waterborne interests in the Sensors and MEMS community.

Commercial Autonomous Underwater Vehicles (AUVs) for communications, oil and gas industries, and military operations. Bob also provided Submarine Telecommunications and Power Industries technical and litigation support to multiple law firms involved in domestic and international Alternative Dispute Resolution (ADR) and Appellate Practice (AP) suits.

Formerly, Bob was a Director with AT&T and Bell Labs. He was instrumental in the development of special underwater protection, maintenance and repair techniques for AT&T and other Trans-Oceanic Communications Companies. He was



Bob Bannon receives the OES Distinguished Achievement Award from Junior Past President Jerry Carroll at OCEANS 2013 San Diego.



Bob makes his point at the AdCom meeting at OCEANS 2017 Aberdeen.

responsible for designing special application ROVs, AUVs, and towed arrays and devices for government and commercial applications. He was the Chief Scientist and Sr. Systems Engineer for sensor data real time detection and identification for the U.S. Navy and other government applications. Bob was the Technical Lead for the US-Russian Homeland Security Congress 2005 in Moscow, and addressed the Russian Duma on behalf of the U.S. He was considered a leading expert on Maritime Security and Critical Infrastructure Protection. Bob's education included a BSEE, MS, and multiple MBA's from Pennsylvania State University, Wharton School—University of Pennsylvania and George Washington University.

Bob's goal for OES was to encourage the professional development of ocean related engineering and applied science careers, and to represent the OES at international venues promoting oceans awareness and fostering responsible use of our precious resource and to interest students in oceans related scientific and engineering careers. And he was quite successful in achieving his goals.

"Bob was a tremendous asset to our RECON team as we evaluated international sites for future OCEANS conferences," according to Bob Wernli. "Not only was he knowledgeable regarding international locations and concerns, he knew how to pick out a great wine during our dinners together."

Although, according to Jim Barbera, he wasn't perfect. "We were in Limerick checking it out for a place to have a conference. Bob got us rooms in a remodeled Marriott, as I recall, for our stay. He was on one of the higher floors. When he went to take a shower, it didn't work. He called down and they sent up someone who also failed to get it to work. So, the solution was to take Bob across the hall wrapped in his towels to another room to get his shower. Definitely not on the top of our list for the host hotel."

"We were also in Nashville for an IEEE event," Jim said. "Bob was in a room on the ground floor with the lawn outside his window. When he arrived at his room after dinner, he heard some noise inside and the door appeared to be open so he called security. When they arrived and went into the room it turned out that a mouse in the wall apparently chewed on an electric wire and was now dead. So, it took some time to repair the wall fix the lock before he finally got to bed. Someone knocked on the door at about 2 am. It was someone from the front office



Dinner at SSC'06 Dublin, Ireland (Right back Kenichi Asakawa, Right front Bob Bannon).

bringing him a gift from the night manager to make up for the event. To be fair, he got phone number for the manager and called him right then to thank him, whether the manager was awake or not. The hotel did not get five stars."

Kenichi Asakawa recalls his interaction with Bob. "Hearing the passing of Bob, I was deeply saddened, and remembered the days I worked with him and the friendship I received from him.

"It was at the 3rd International workshop on Scientific Use of Submarine Cables and Related Technologies (SSC03) in 2003 when I worked with him first. At that time, my colleagues and I were working to realize cabled scientific observation systems, and submitted a proposal to hold a workshop in Tokyo. Not only did he graciously support us, he also participated in this workshop and gave us valuable advice as a member of Advisory Committee of the workshop. Thanks to his cooperation, the workshop was a great success. Since then, we had another three SSC workshops, two of which were held with the symposium on Underwater Technology. He had contributed to all of these workshops. Furthermore, he had organized the technical committee "Submarine Cable Technology, Commercial and Scientific" in 2005, and lead it. His contribution in this field was worth of praise. Not just in this field,



Group photo at SSC03 Tokyo in 2003.

he has contributed to the development of many marine technologies, including Homeland Security, in addition to honoring his great achievements, I would like to express my sincere appreciation for his leadership and friendship. With my deepest condolences.”

According to the Candy’s, “Bob should be remembered for his generous time, energy and intellectual contributions. More importantly, Bob can be remembered as a man of deep Christian faith. Although the last years of his life were full of trials because of his failing health, he was blessed by his faith. He persevered like few others could have. He was heroic in his battle, thus making one mindful of Job. Bob fought his suffer-

ing valiantly, believing in God’s grace and mercy to carry him through. Bob’s faith and hope in Jesus Christ, as well as his love of family never wavered. May he rest in peace, remembered as a “big man” in many ways!”

Bob is survived by his loving wife of 51 years, Janet L. (Lummis) Bannon. He was born in Philadelphia on September 27, 1948 to the late Robert James and Anna Marie (Rowe) Bannon. Survivors include his children: Kara Lynn of East Stroudsburg, Bonnie Ann wife of William T. Adamski of Saylorburg, Eileen M. of Marshalls Creek; sister: Patricia Ann Slough of Panama City, FL; grandchildren: Jacob William, Joshua Michael and Rylan Taylor Adamski.

The Rise of Women in Engineering: The Story of IEEE Delhi Section

Farheen Fauziya, IEEE OES Liaison to WIE

I became the IEEE OES liaison to WIE in October 2018 and have since been looking for an occasion to share the story of WIE in India. The opportunity presented itself in the form of the Annual General Body Meeting (AGM) 2019 of IEEE Delhi section. I had shared the news of my appointment with Prof. Ranjan Mallik, Fellow IEEE and a senior faculty member at IIT Delhi, a couple of days before the event. He made a strong case for my attending the AGM. I had been skeptical before this interaction, but my conversation with him converted me.

I arrived at the event at 6 pm and was pleasantly surprised to find that the Vice-chairman and treasurer of our section were both women. It got even better as the evening progressed. The section elected a woman as the chairman, a very well deserved appointment I may add. Prof. Prerana Gaur, is the new *chairperson*, and has in her team no less than 5 women members. The vice chairperson, joint secretary and treasurer are women. I was fortunate to spend some time with the incumbent joint secretary Prof. Shabana, recipient of the “R10 2018 education activities outstanding volunteer” award. She is a role model for the vast majority of Indian women engineers, a growing community whose potential is not fully recognized at this time. Another woman researcher, Prof. Bhuvneshwari, Fellow IEEE, won the prestigious “Wanda Reder pioneer in power” award.

The event was attended by six IEEE Fellows, one of whom is a Life Fellow and another is a women. The ratio is skewed but it is encouraging that we do have a woman IEEE Fellow in our section. I took this opportunity to have a brief tete-a-tete with the IEEE Life Fellow and another Fellow. I wanted their views on the position of WIE; in particular about the status in India. Historically, women have enjoyed an exalted status in India. Women Goddesses have been represented as the strongest forces in the universe and ordinary women have enjoyed equal privileges traditionally. Unfortunately, somewhere along the line, women lost this status and were margin-

alized. This perception of women from India is common around the globe, but does not represent the current picture since there has been a recent resurgence. The conversations were an enlightening experience. I include some excerpts of the interviews.

Mr. H. L. Bajaj, Life Fellow, was extremely eulogizing of the role of women in the advance of human civilization. I



IEEE Delhi Section AGM meeting in 31st March 2019.



Prof. Rachna Garg, Vice chairperson (left), Prof. K. Subramanian, past chairperson (middle), Dr. Jasdeep Kaur Dhanoa, Treasures (right) of IEEE Delhi section in AGM meeting 2019.



Dr. Jasdeep Kaur Dhanoa, Treasures IEEE Delhi section presenting the financial updates.



Farheen Fauziya, WIE Leadership committee member 2019 with Dr. Shabana Urooj, Joint secretary of IEEE Delhi section 2019.



Prof. Bhuvneshwari, Fellow IEEE receiving the prestigious "Wanda Reder pioneer in power" award.



Mr. H. L. Bajaj, Life Fellow IEEE in conversation with Farheen Fauziya, IEEE WIE Liaison of OES society.



Dr. Shabana Urooj receiving outstanding volunteer award for R10 Education activities.



WIE members from Left: Farheen Fauziya, WIE Liaison of OES society; Prof. Rachna Garg, IEEE Delhi section vice President; Prof. Prerana Gaur, IEEE Delhi section Chairperson; and Rumaysa Manzoor, IEEE student member.



Prof. Ranjan k. Mallik, Fellow IEEE (left) with WIE members.

quote him; “behind every successful man is a woman.” Needless to say, this is not the only role that women play in the progress. He went on to say that the role and status of women in society is on the way up and he welcomes this development. He encouraged women to follow their dreams, work hard and reach the pinnacle of their chosen careers. Prof. Ranjan Mallik opened the conversation with the story of Hedy Lamarr. She was not only a brilliant researcher but also a celebrated actress. In a world where people struggle to be average in one field, she excelled in two. The status of WIE has only gotten better since: Prof. Mallik spoke of many women who have made fundamental contributions in the area of engineering—Prof. Adrea Goldsmith, Prof. Urbashi Mitra, Prof. G. Bhuvneshwari

and, Prof. Sneha Anand to name a few. He too shared the opinion of Mr. Bajaj that the status of women in India is headed in the right direction, which is heartening to note. Two of the top brains in the country share the opinion that the role of women in Engineering is set to rise further and both were extremely happy with this situation. He shared one concern though, the number of women in top engineering institutes in India is still low and should be addressed on an urgent basis.

The evening was invigorating, and I was driven to share my experience with fellow members of the WIE community. I am a firm believer of the important role women can play in engineering, and this affair redoubled my faith and enthusiasm to contribute to this cause.

From Your Chapter Coordinator

Gerardo Acosta, OES Chapter Coordinator

Once again I have the pleasure to communicate with all of you. I would like to invite chapter chairs or their associates who will be attending the OCEANS Conference at Marseille, France, on the Thursday's mornings at 12 o'clock, for a working lunch. There we are going to talk about the activities within our chapters, some tips to organize activities and events, the reporting procedure of these activities, the coordina-



Gerardo Acosta, Chapter Coordinator

tion with the Distinguished Lecture speakers program and many other concerns that you may have. These kind of meetings, which take place in every OCEANS Conference, are very fruitful to interchange our ideas and to have a feedback about how we are working and doing our best. Hope to see you soon!!! Just in case, remember that you can contact me at: gerardo.acosta@ieee.org



Let's sea our future together

Chapter News

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

Providence Chapter

Reported by Sandy Williams and David Leslie, photos by Stan Chamberlain

On May 2, 2019, members of the IEEE Providence Section and the OE22 Chapter gathered at White's Restaurant in Westport, MA for a joint social half-hour and dinner before attentively enjoying the technical presentation "Free Wind or Bought Wind?: Shifting Power Generation at Sea over Two Centuries." The lecturer, author John Laurence Busch, is an independent historian who focuses upon the interaction between humanity and technology, specializing in 1st and early 2nd generation steam-powered vessels. His book on the first steamship in history, entitled "STEAM COFFIN: Captain Moses Rogers and The Steamship Savannah Break the Barrier," has received positive reviews from over two dozen periodicals and academic journals in the United States, Canada, the United Kingdom and Australia. For more information, visit www.steamcoffin.com.

In his presentation, Mr. Busch chronicled the long evolution from natural power to artificial power at sea, breaking down the development from both a "steamboat" and "steamship" perspective.

At the beginning of the 19th century, the human race remained—practically speaking—in the same place it had been for millennia. Humans were beholden to the omnipotence of Nature, meaning the only way to move themselves from one place to another was by natural means. On land, this meant foot, hoof, or wheel, all of which were powered by animals; on water, it was either human-driven paddles or wind-driven sails. There was little reason to believe human locomotion would ever be any different.

Then, in 1807, an American named Robert Fulton built and ran the first commercially successful "steamboat" in history. In so doing, Fulton achieved something epically important: he proved that humans could create an artificial power to alter where they were and when they were there to practical effect. No other invention had achieved such a thing, and accordingly, steamboats may be considered the first "high technology" in history.

But the transition from sail energy to steam energy was not immediate, or easy. Nor was the transition from steamboats running on rivers, lakes and bays to steamships capable of making trans-ocean voyages.

The author then analyzed modern-day efforts to re-introduce various forms of natural power to modern, artificially-powered commercial vessels, and the rationale for doing so. This included an analysis of the types of fuel used to power the "new mode of transport," as well as efforts by the "old mode of transport" (i.e., sail) to compete, which led to a very long battle for supremacy at sea.

Technologies touched on included recent design proposals such as high profile sail-like hull shapes, and arrays of deck-



Members of the Providence Section and OE22 Chapter gathered for the technical talk in "The Presidents Room."



Author John Laurence Busch describing the evolution of power at sea from sail to steam over the last two centuries.

mounted sail-like solar panel arrays. One particularly promising technology, which has seen a recent revival, is the Flettner rotor. A Flettner rotor is a smooth cylinder with disc end plates which is spun along its long axis and, as air passes at right angles across it, the Magnus effect causes an aerodynamic force to be generated in the direction perpendicular to both the long axis and the direction of airflow. First introduced on an experimental rotor ship in 1922, this technology is again being considered as a means to reduce both fuel costs and carbon emissions.

Finally, the possibility that other high technologies will revert to some or a greater share of natural power generation was explored, and how studying the initial development of these inventions might help show the way forward.

Singapore Chapter—A Workshop on Autonomous Marine Systems

Reported by Bharath Kalyan, Hari Vishnu, Venugopalan Pallayil & Ahmed Mahmood

The IEEE OES Singapore chapter organized its third annual workshop on Autonomous Marine Systems on 11 March, 2019,



Guest speakers in action.



Lighter moments and intense discussions during networking lunch.



Panellists intently listening to questions put forward by the moderator.

at the Singapore Polytechnic, following the 7th edition of the Singapore AUV Challenge (SAUVC) event. The workshop idea was started in 2017 with an objective of complementing the hands-on experience that the students had gathered through the competition, with further insights from experts in the field. The workshop was aimed at motivating the students to continue to pursue the field of autonomous marine technology and enhance their knowledge through a sharing and learning session. This year's guest speakers included a good mix of experts from land and marine robotics and also representation from academia, industry, research institutions as well as student competition organisers and participants. This event also facilitated excellent networking amongst the AUV experts and the attendees, which



Tutorial on introduction to underwater robotics.

how it was a problem that required future technology solutions. Bill discussed about microplastics and their impact on our oceans and in-turn, on humans. His talk also focused on advanced instrumentation and robotics that are able to identify these plastics and trace them to their source. Finally, we had one talk from a student, Liu Ren Jie, a 4th year Electrical Engineering student from the National University of Singapore and also is the technical lead of the Bumblebee team. He spoke passionately about team Bumblebee and how they managed the challenges of sustaining and growing a student-run

included both student team members and external attendees. The talks were followed by a panel discussion. The focus of the panel discussion revolved around questions posed by the student attendees, which was collated via an online poll taken prior to the workshop.

The guest speakers included Dr. Gabriele Ferri, Assoc Prof Marcelo H. Ang, Jr, Ms. Kelly Cooper, Mr. Richard Mills, Mr. William J. Kirkwood and student Liu Ren Jie. Gabriele Ferri is a Research Scientist at the NATO's Centre for Maritime Research & Experimentation (CMRE). He spoke on autonomous robotics networks for underwater surveillance. In this talk, he compared the performance of autonomous vehicles for surveillance applications when operated in a networked configuration as compared to a single AUV configuration. He also discussed the potential and challenges of such a configuration. Marcelo H. Ang, Jr is an Associate Professor in the Department of Mechanical Engineering of National University of Singapore, delivered the second talk. He spoke on the impact of robotics in our daily lives and delved on the emerging applications in human robot interactions in unstructured environments. He also touched up on the state-of-the-art developments in sensing and intelligence to accelerate robotics revolution. Kelly Cooper is a Program Officer at the Office of Naval Research (ONR). She has been responsible for initiating a variety of student robotics competitions for the U.S. Navy, including the Maritime RobotX Challenge, RoboBoat and SeaPerch. In the post-lunch session, Kelly spoke about using a simulation environment (virtual competition) to enhance the performance of autonomous vehicles. Her talk was also an introduction to the Virtual RobotX competition, a new initiative by ONR. Richard Mills, who is the Director of Marine Robotics Sales with Kongsberg Maritime, spoke about improving productivity in deep water AUV surveys. He also discussed various sensing technologies that have gone into the HUGIN AUV including synthetic aperture sonar, multibeam echo-sounder, sub-bottom profiler, camera, laser, magnetometer and methane sensors. William J. Kirkwood is a senior R&D Engineer at Monterey Bay Aquarium Research Institute (MBARI). He spoke about plastics in the food web, and

team and covered topics ranging from knowledge management to competition preparations. The video recordings of these talks can be viewed at the following link: <https://www.youtube.com/user/ARLTMSINUSChannel/videos>. All the talks were well-received by the attendees.

In the afternoon session of the workshop, a panel discussion by the experts on autonomous marine systems and competitions and careers in underwater technologies was organized. The questions taken up for discussion by the panelists, were collected via a student participant's poll, the Pigeonhole App. The top 10 questions polled by the audience via an online poll were taken up at the discussion. The questions that were posed to the panel were:

- 1) What career opportunities are available in underwater robotics?
- 2) Tips to "debug" underwater robots during development?
- 3) What role does ROS play in the development of underwater robotics?
- 4) Any tips on how to build low-cost underwater robots?
- 5) How to tackle challenges like Localization, navigation & communications?
- 6) How does AUV research in Asia compare to Europe and North America?
- 7) How can we better promote AUV activities in secondary schools?
- 8) How can we harvest energy from the ocean for use by underwater robots?
- 9) How to use underwater tech to solve ocean pollution problems?
- 10) What is the role of swarm technology in underwater robotics?

The panel was moderated by Mandar Chitre, Associate Professor at National University of Singapore. Fausto Ferreira, a Research Scientist from at the NATO's Centre for Maritime Research & Experimentation (CMRE) joined as a panelist along with William Kirkwood, Richard Mills and Kelly Cooper. All the questions posed via the poll were pertinent to

student involvement in AUV technologies and competitions. They included queries on the future of AUVs, the benefit and career opportunities for students in this field, how to tackle some commonly faced issues in constructing AUVs and questions on real-world applications of AUVs. The questions saw some very animated involvement from the panel members, who all chipped in to give a well-rounded take on the students' queries. Overall, the workshop turned out to be a useful learning experience for all the participants.

Apart from this workshop on the side-lines of SAUVC (the report is in this issue), we had two public engagement sessions which were conducted at Singapore Polytechnic on March 9th, 2019:

- **Singapore Robot Operating System (ROS) Meetup** organized a session on practitioner's guide to autonomous vehicle development. Dr. Benjamin Ma discussed about an on-going self-driving car project and provided an overview of future of autonomous vehicles.
- The SAUVC LOC organized a tutorial session on **"Introduction to underwater robotics."** The tutorial was led by Rajat Mishra, a graduate research student with National University of Singapore. At this session, we had a large representation from ANZA scouts with students in the age group of 8–17 years. This event was very well-received and we are planning on expanding the public engagement exercise for the next edition of SAUVC.

These workshops were very beneficial for the students, specifically for the teams who participated in the SAUVC event. This was evident from the excellent feedback we obtained through a survey. We propose to continue the organization of similar workshops alongside future SAUVC events. We would like to acknowledge our speakers for their inspirational talks and supporting this event.

Argentina Chapter—Post-degree Course: "Introduction to Underwater Acoustics"

Reported by Gerardo Acosta

During the days 26 to 30 of November 2018, the post-degree course "Introduction to Underwater Acoustics" was carried



Professors and some of the participants of the course at the BIP Víctor Angelescu.

out at the city of Puerto Madryn, Chubut, Argentina. This course was given at the CENPAT (Centro Nacional Patagónico). Daniel Rodriguez, PhD (UDE, Spain) and Noela Sánchez Carnero, PhD (CESIMAR-CENPAT, Argentina) were the professors in charge. The course covered the theoretical principles of sound propagation in underwater environments, SONAR fundamentals and the working principles of the most common acoustic equipment for hydrographic, bottom and sub-bottom structures and fishery studies. A practical session on gathering and post-processing of Single Beam and Side Scan SONAR data was also carried out. The course concluded with a guided visit to the BIP Víctor Angelescu (INIDEP) and the oceanographic vessel ARA Austral (Q-21) moored at the local Luis Piedrabuena dock. Several professionals of diverse disciplines: physics, biologists, a geologist and engineer members of different institutions, participated in the course. Among these institutions were: INIDEP, Argentinean Antarctic Institute, CENPAT, INTELYMEC (FIO-UNCPBA) and other Nationals Universities. The IEEE OES sponsored some of the attendees.

Workshop: "Broadband Acoustics Advances and SIMRAD EK-80 Scientific Sound Applications"

Reported by Gerardo Acosta

During the past March 6 to 9 of 2019, the Workshop "Broadband Acoustics Advances and SIMRAD EK-80 scientific sound applications" was carried out at INIDEP facilities in the city of Mar del Plata, Buenos Aires, Argentina, with the Hydro acoustic



Workshop classroom sessions. Eng. Adrián Madirolas from INIDEP is giving one of his talks.



Workshop classroom sessions.



Partial view of Mar del Plata Navy Base during the development of the workshop.

Cabinet Chief Eng. Adrián Madirolas as instructor. The workshop covered the theoretical and practical aspects of the broadband acoustics principles. Practical sessions of EK-80 data processing in classroom and EK-80 Split Beam transducer calibration at the oceanographic vessel ARA Austral (Q-21) were carried out.

People with different backgrounds, like physics, biologists, Argentinian Navy personnel, officers and sub-officers and engineer members of different institutions (INIDEP, Argentinean Antarctic Institute, Argentinian Navy Hydrographic Service, CENPAT, CADIC, UNIDEP, INTELYMEC (FIO-UNCPBA) and other Nationals Universities) attended the workshop that was sponsored by the local IEEE OES Chapter.

Malaysia Chapter

Reported by Khalid Isa

The first OTC Asia 2020 technical programme committee organisational meeting was held on 19 Feb 2019 at the Kuala Lumpur Convention Centre. IEEE OES was invited as the Programme Subcommittee. Khalid Isa, as the Chair of IEEE OES Malaysia Chapter, attended this meeting as the representative of IEEE OES. The agenda of the meeting is to discuss the programme structure and workflow. OTC Asia 2020 to be held 24–27 March 2020 at the Kuala Lumpur Convention Centre in Malaysia.



Briefing from the Conference Programme Vice Chair.

Singapore Autonomous Underwater Vehicle Challenge (SAUVC 2019)

Reported by Mohd Shahrriel Mohd Aras

IEEE OES Malaysia Chapter has sent 4 teams. Universiti Teknikal Malaysia Melaka (UTeM) Team are Panther, Tuah and Noah's Arc are represented by students from the Faculty of Electrical Engineering, Faculty of Mechanical Engineering and Faculty of Technology Engineering. Dr. Mohd Shahrriel



Team Panthers.



Team Roboteam.



Team TUAH.

Mohd Aras and Dr. Ahmad Anas Yusof is an Advisor for this team and also Vice Chair and an executive committee of the IEEE OES Malaysia Chapter. From International Islamic University Malaysia (UIAM), the Roboteam is lead by Dr. Zulkifli bin Zainal Abidin. Having completed the first task in the final round, the Panthers team has been ranked 4th place and IIUM Roboteam 5th place from more than 60 register team from Russia, Japan, Singapore, Hong Kong, Thailand, Sri Lanka, China, India, Pakistan, Bangladesh, Indonesia, and Malaysia.



Photo session with participants.

Industrial Lecture on RADAR Level Measurement Technology

Reported by Herdawatie Abdul Kadir and Khalid Isa

This event was held at the Innovation Lab. Universiti Tun Hussein Onn Malaysia (UTHM). The invited speaker, Ir. Shah Rizal Dahlan from Petronas, gave a presentation on RADAR level measurement Technology. He provided both fundamen-

tal studies on the development and application of Radar as used for measuring level. We benefited in his availability in Petronas, Malaysia, due to his position as Custodian Engineer and Group Technical Authority for instrument and controls in PETRONAS. This talk was conducted on February 24, 2019, and attended by 15 IEEE members and 180 guests.



Shah Rizal deliver his lecture to the participants.

Robotics Operating System (ROS) Workshop

Reported by Herdawatie Abdul Kadir

On 3rd March 2019, The IEEE OES Malaysia Chapter organized a technical workshop ROS. The event took place at Innovation Lab, Universiti Tun Hussein Onn Malaysia (UTHM), Johor, Malaysia. The workshop was conducted by Dr. Abu Ubaidah Shamsuddin from UTHM. The purpose of the workshop was to share the fundamental behind the open source robotics framework using ROS Kinetic Kame is primarily targeted at Ubuntu. The workshop was attended by participants from various agencies, including representatives from the other university undergraduate and postgraduate students. The participants were divided into several groups that follow hands-on learning and in-depth explanation.



Appreciation ceremony (L-R) Khalid Isa (Chair of OES Malaysia Chapter) and Shah Rizal.



Abu Ubaidah displaying the examples of application using ROS.

Presenting the European Robotics League (ERL) Emergency 2019

Gabriele Ferri¹, Fausto Ferreira²

¹ERL Emergency 2019 Director ²OES AdCom 2018–2020

Background

NATO-STO Centre for Maritime Research and Experimentation (CMRE) has been organizing robotics competitions since 2010. The Student AUV Challenge—Europe (SAUC-E), the premier European student competition for underwater vehicles, started in 2006 and has been organized by CMRE since 2010. This is a realistic competition as it is set in CMRE's sea basin in open water with real-life conditions: turbidity, tides and waves. Initially, this competition was dedicated to AUVs only, but since 2013, Autonomous Surface Vehicles (ASVs) could participate for collaborative tasks. One interesting aspect, and a way of promoting collaboration among teams, is that this task could be performed with an AUV and an ASV belonging to different teams. This could bring points for both teams and it was a way to push cooperation between heterogeneous robots and between teams. Along the years we have been increasing the complexity of the tasks, pushing for more autonomy and cooperative behaviors. Initially among marine vehicles, then since 2015 including other domains.

The experience gathered with the organization of SAUC-E led CMRE to be part of the euRathlon European Union (EU) project in which CMRE was the local organizer of the first world's multi-domain (air, sea, land) robotics competition in 2015, the euRathlon 2015 Grand Challenge in Piombino, Italy. For the first time in the robotics world, a competition required aerial, marine and land robots to cooperate in tasks such as valve closing, finding missing workers or surveying an area. The euRathlon 2015 Grand Challenge was inspired by the Fukushima nuclear plant 2011 accident and simulated a disaster area after a tsunami. While SAUC-E required a team made

of at least 75% students, euRathlon allowed the participation of teams coming from industry as, being a Grand Challenge, the goal was to push the state of the art in search and rescue robotics with a real-world Challenge never attempted before.

Following the success of the euRathlon project, CMRE was also part of the RockEU2 project (2016-2018) and locally organized the second multi-domain (air, sea, land) competition named European Robotics League (ERL) Emergency 2017 competition, again in Piombino (Italy). This was followed by the ERL Emergency 2018, a land and marine robotics competition in La Spezia at CMRE's premises and by this year's ERL Emergency 2019, again land + marine robotics competition. In addition to this, a land + aerial robotics competition took place in Seville, Spain in February 2019.

The Concept

The European Robotics League (ERL) Emergency Robots is an outdoor robotics competition funded by the European Union in the framework of the SciRoc H2020 Project. After the success of RockEU2 project (2016-2018) and the initial launch of ERL in three vibrant fields of robotics—industrial, service and emergency robots—the ongoing SciRoc EU project is extending the ERL concept to the Smart Cities environment.

In each domain, there is a set of Local and Major Tournaments and teams are ranked in different Functionality Benchmarks and Task Benchmarks. The ERL concept is novel with respect to euRathlon and SAUC-E as it divides the competition in Functionalities and Tasks and allows for benchmarking through scoring. Besides the ERL tournaments in the three domains, the SciRoc project will organize also two Major Tournaments related to robots working in Smart Cities. The first one will take place in Milton Keynes, UK, in September 2019.

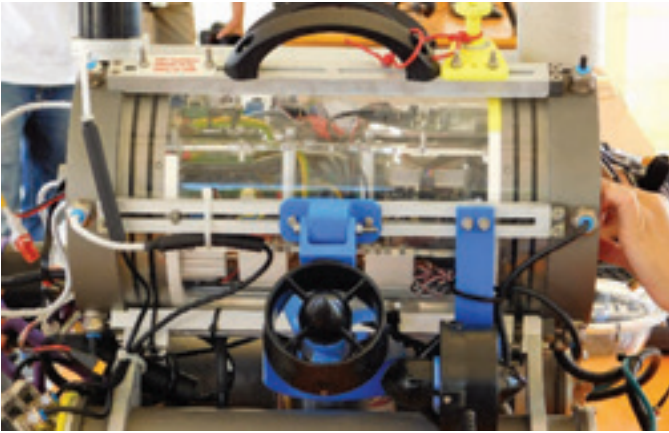
The Competition

CMRE will host the annual European Robotics League (ERL)-Emergency 2019 robotics competition from 13 to 19 July, involving land and underwater cooperating robots. The teams' selection is being finalized. Teams have to apply and produce a journal paper with a description of how they plan to tackle the different tasks. They can participate with both types of robots or come with only one domain and will be matched with another team. This process of match making, done by the organizers, fosters cross-fertilization and networking.

This year competition will be based on a Yacht accident in a harbour. This is to connect it to the Smart Cities theme. As in past years, the sea basin of CMRE's premises will be used for the marine robots and its surroundings for land robots. This



The scenario from euRathlon 2015 and ERL Emergency 2017 competitions with one the land robots in action.



The FeelHippo AUV from UNIFI team, a veteran participant in SAUC-E/ERL competitions.



The ERL 2017 local committee receives a plaque from Dr. Bill Kirkwood in representation of IEEE OES.

means that the limited visibility underwater makes object recognition by AUVs a very challenging task.

The Tasks

The Yacht accident scenario materialized in tasks similar to those presented in ERL Emergency 2017 and 2018. However, to push the advancement of the state of the art we have introduced new tasks or increased the difficulty level of others as in previous years. For instance, if in earlier SAUC-E, AUVs had to cross only one gate (formed by two buoys), last year we added two other gates that could change location from team's run to the next team's run. For the 2019 edition, in order to push real-time processing and autonomy, robots will have to move in a different pattern depending on the colour of which individual buoy. The aim of this task is to challenge the team adaptive mission planning and the robot reactive behaviors. As a competition taking place at sea with limited visibility, it is often hard to judge real-time processing/autonomy. While the organization installs a sonar that can show in real-time the position of the vehicle, making the vehicle's perform different movements depending on the buoy can help the difficult task of judging.

After passing through the buoys, the AUVs need to reach the disaster area and inspect the underwater pipelines. They also have to find the damaged pipe and communicate it to the land robot. An acoustic pinger also signals a leak in the damaged pipe. AUVs need to find the leak by finding acoustically the pinger. Another task that AUVs need to do is to search for a missing person underwater, represented by a realistic mannequin, as the accident and explosion threw some workers in the water.

For the land domain, typical search and rescue tasks are presented such as searching for a missing worker, area surveying and obstacle avoidance. Manipulation tasks are also included such as rubble removal, closing a valve to stop a leaking pipe on land and transporting a water bucket to put off a (simulated) fire.

Community Building and Impact

One of the important outcomes of the competitions that CMRE has been organizing for the past 10 years is the community

building around the competition. This means to connect students and young engineers with companies and research institutions. While it is hard to measure this outcome, we have had many examples of students that later were hired by the competition's organizers and sponsoring institutions/companies. Other students later became team leaders or judges, closing the loop and bringing a different perspective to the teams and judging. This community building has been done successfully for many years, mostly for the marine robotics domain and later extended to the land and aerial robotics domains. In the multi-domain competitions (land, aerial, sea), which are still unique in the robotics world, the effort is extended to disseminate robotics among the general public. Over 3000 people in total attended euRathlon 2015 Grand Challenge and ERL Emergency 2017 including the parallel programs with talks and demos dedicated to the general public including workshops for young children.

Most of all, competitions act, as well as an excellent opportunity for teams with limited access to sea, to test and develop their vehicles. Over the years, we have seen the evolution of several teams that have used the competition to test new algorithms and hardware. Not only, experimental results from the competitions have been published in conferences such as OCEANS, AUV as well as in journals. This is an excellent way of disseminating the knowledge and experience acquired by the teams' participation and at the same time can show the competition's benefit and the state of the art advancement over the years.

None of this would have been possible without the fundamental support of the Office of Naval Research Global (ONRG) and, since 2015, IEEE OES, which has been our Main Sponsor. The synergy has been explored with papers coming from the competitions being published in OES conferences and new student members signing in.

Many other institutions/companies participated in the past by offering internships, products as awards or discounts. In some cases, companies borrow products in beta release to get feedback from teams and improve their products, which is a win-win situation. For this year's edition, we again welcome the sponsorship of 'Breaking the Surface' (BTS) 2019, the 11th

Interdisciplinary Field Workshop of Marine Robotics and Applications and Blue Robotics. BTS 2019 will give out vouchers for free registrations while Blue Robotics will provide vouchers for their online store and an Echosounder as special award.

Finally, and as part of the community building, judges are an essential piece of the puzzle. We have had truly international events with judges coming not only from Europe but also from Asia and the U.S. This allows us to showcase the best of European robotics research to a wider audience and increases the exposure of teams to the international research community.

The IEEE OES committee Marine Autonomous Systems Competitions Coordination (MASC2) has been working globally to standardize student marine robotics competitions. One of the aims of MASC2 is to identify common tasks of interest for the marine community to be proposed in the different challenges. In this framework, there have been visit exchanges between ERL Emergency with other events, such as RobotX maritime challenge and the Singapore AUV Challenge (SAUVC). These relationships are crucial to create synergies between competitions around the world to improve their impact and their sustainability.

The Singapore Autonomous Underwater Vehicle Challenge (SAUVC) 2019: The 7th Edition

*Bharath Kalyan, Hari Vishnu, Venugopalan Pallayil & Ahmed Mahmood
(With Inputs From the SAUVC Committee)*



The seventh edition of the SAUVC was organized from March 8 to 11, 2019. It was held in Singapore Polytechnic. This edition was the largest ever in terms of team registration and participation, continuing the trend set by the past editions. It witnessed a record-breaking 61 teams registered. Similar to the previous editions, we also had a student engagement technical workshop on AUV related topics. Public engagement is an important element to any event and is the best way to disseminate the objective of scientific events to the general public. To meet this objective, SAUVC, this year and for the first time, organized two special events; a technical workshop featuring a tutorial on the basics of underwater robotics and another one on Robot Operating System (ROS) meet up. The details of these technical workshops have been covered in a separate report.

Participating Teams

The teams that registered for the event had to pass a qualification criteria for participation in the event. The teams were required to submit a video of their AUV swimming underwater

for at least 10 seconds and demonstrate the usage of their AUV's kill switch to showcase AUV operation and safety. Based on these criteria, 39 of the 61 registered teams were selected to compete in the event. In total there were around 350 student participants at the event. The SAUVC 2019 witnessed 11 teams from India, 6 teams from Singapore, 4 teams each from Indonesia & Malaysia, 3 teams each from Hong Kong, 2 teams each from Bangladesh, China, & Russia and a team each from Japan, Sri Lanka, Macau, Thailand & Taiwan respectively. The representation of teams from all across Asia, particularly from South Asia & South East Asia, was phenomenal and shows the value that SAUVC brings to this region. There were many first-timers and some regulars in the participating teams.

Opening Ceremony

Dr Mohamad Maliki bin Osman, Senior Minister of State at the Ministry of Defence and the Ministry of Foreign Affairs, Singapore was the guest of honor and inaugurated the 7th edition of SAUVC.



Figure 1. Dr Mohamad Maliki bin Osman, Senior Minister of State at the Ministry of Defence and the Ministry of Foreign Affairs, Singapore, with the organizing committee and invited guests.



Figure 2. Senior Minister of State, Dr Mohamad Maliki bin Osman, interacting with students during walk-about session.

Following the inauguration, a walk-about session was organized where the senior minister had a chance to interact with some of the participating students. This was followed by a walk-about with a panel of judges scoring the teams for the newly introduced “most innovative engineering” award by IEEE OES.

The Challenge

The SAUVC 2019 consisted of two tiers—qualification round and final round for the participating teams. To qualify for the final round of the competition, the AUV had to swim from a starting line and pass through the qualification gate without surfacing, touching the bottom/wall or the qualification gate. Only the top 15 from the qualified teams, with the fastest time for the qualifying round, were allowed to advance to the final round. In the final round, the teams would accumulate points by completing a series

of tasks aimed at testing the AUV’s acoustic and visual navigation capabilities, positioning, actuation and robotic manipulation. The table below provides the different functional capabilities of the AUV being tested and the related tasks.

Each task carried a certain number of points, depending on the challenge and the difficulty involved in performing it. Teams were awarded bonus points if the AUV met certain weight and dimension conditions and also based on the time taken for the tasks to be performed. The tasks were similar to the past year’s competition, but made more challenging through randomization of the position



Figure 3. Teams preparing for the challenge and having fun at the same time!

of the buckets, flare and gate and its orientation. A complete description of the tasks, static judging criteria and award of points are covered in the competition rule book available at <https://sauvc.github.io/rulebook/>. 19 teams, out of the 39 that competed, completed the qualification task, which is a record within the SAUVC event. This demonstrated the improving quality of participating teams, and their increased level of preparedness. This could partly be attributed to prior participation by the teams in similar competitions held locally or regionally. Out of these 19, however, only the top 16 were allowed to compete in the finals due to constraints on the logistics and time available for the finals day.

No.	Task	Aspect of Operation
1.	Passing through a gate	Navigation
2.	Locating a particular bucket amongst 4 options, and dropping a ball into it	Target acquisition and manipulation
3.	Moving out of the bucket arena, returning and reacquiring the ball dropped	Target reacquisition and manipulation
4.	Bumping against a flare holding a ball to drop it	Localisation
5.	Resurfacing at the end of the run	Controls



Figure 4. AUVs having a go at the challenge.

SAUVC 2019: Award Winners

The team from Far Eastern Federal University, Russia, who has also been consistently in the top 3 over the last 5 years, emerged as the champions for completing the largest number of the tasks with additional bonus points on time and system weight. They have been doing consistently well because the team has passed on the expertise gained over the years effectively to junior teams. The team from Bogor Agricultural University, again one of the SAUVC veterans, secured the first runner-up position and the Northwestern Polytechnical University who were the SAUVC 2018 champions, secured the 2nd runner up position this year. The top 3 teams in the finals are as follows:



Figure 5. SAUVC 2019 Champions: Far Eastern Federal University, Russia.



Figure 6. First Runner-up (Bogor Agricultural University, Indonesia).



Figure 7. Second Runner-up (Northwestern Polytechnical University).



Figure 8. Most Innovation Engineering Award (City University, Hong Kong).

- 1) Far Eastern Federal University/Institute of Marine Technology Problems, Russia
- 2) Bogor Agricultural University, Indonesia
- 3) Northwestern Polytechnical University, China

In addition to the top 3 finalists, we had introduced in this edition an OES “most innovative engineering” award. This was judged by a technical panel consisting of 5 members. The following rubrics were used to judge the teams:

- Innovative Hardware Design and Engineering
- Innovative Software Engineering
- Innovative Operational Techniques
- Innovative Competition Strategy

Innovation was defined as anything that is new/different and intentionally implemented for a specific stated purpose in SAUVC. Based on the above criteria, the team from City University Hong Kong (Team Pioneer) was awarded the OES “most innovative engineering” award, in this edition of SAUVC.

As in previous editions, we continued with the social media photo competition, which was started in 2016, to engage more students, including non-participants on the competition. This has also helped to get more visibility for the event. This year, the numbers on social media outreach and impressions achieved

via the competition, went through the roof. SVKM’s NMIMS Mukesh Patel Institute from India received a staggering 46,077 likes on their photo, while Bogor Agricultural university, Indonesia received 17,300 likes. One of the noteworthy changes this time was the shift by teams to Instagram as the social media portal of choice for the competition, as compared to Facebook last year. Instagram was included in the list of allowed social media outlets only starting from this year, so that word of SAUVC would reach a larger crowd of youngsters worldwide.

Gala Dinner & Award Ceremony

The winners were announced at an award presentation ceremony on March 11th, which was held at University Town Auditorium, National University of Singapore. This saw over three hundred students come together with the guest speakers, SAUVC committee members and volunteers, for an eventful evening to close the competition. The award presentation saw some fun-filled and high-adrenaline moments when each of the prizes were announced. Loud cheers erupted when video summaries of the competition days were played, while participants rejoiced over the memories of the past 4 days. The gala dinner was hosted to show our appreciation to the participating student teams and our sponsors and volunteers, as well as facilitate good interaction to bring the curtains down on the event. A plaque was presented to the SAUVC 2019 committee by IEEE OES, in appreciation of their efforts in organizing the event successfully with such a large outreach.

Participant Feedback

We sought anonymous feedback from the participants through an online survey following the event. The feedback was excellent. Some statistics from the feedback are shown in an infographic here.

Some of the testimonials received are as follows:

- “I enjoy listening to the talks and sharing sessions very much. The thing I like the most throughout the whole event is the atmosphere and interaction with other teams and professionals. It’s really a good learning platform. So, please organize again next year:)”
- “Keep spare parts for EVERYTHING, make a lot of friends (including/specially the organizes)!! Try to arrive at least one



Figure 9. The 7th edition local organizing committee received a token of appreciation from IEEE OES. Dr. Ahmed Mahmood, the General Chair of SAUVC 2019 holding the plaque.



Figure 10. Participants enjoying the gala dinner at University Town Auditorium, National University of Singapore.

day before day0, leave as late as possible;) In your main system/program/bot, add a status feedback(display/dashboard/led indicator) for all the sensors so that u know all your sensors are working properly.”

- “The best part of this event was—It was more like a meet up of Engineering teams from different countries.”
- “I have grown my knowledge and exercised my abilities. My favourite is post-match communication and party carnival.”

Event Publicity & Social Outreach

The event publicity statistics for this edition of SAUVC were impressive. The competition was extensively covered on social media platforms (Facebook, Instagram, Weibo, Twitter, LinkedIn and YouTube) by our social media team. Instagram and Weibo were explored newly this year as publicity media, to tap into a larger base of youngsters, and also interested people from China. The SAUVC Facebook page saw very high activity based on the numbers we obtained from Facebook page statistics. The organic impressions on Facebook over a 2 week period from March 3-16 was 89,458. We also undertook extensive video coverage, which included video interviews with all the teams, invited guest speakers, getting their views on the competition and their experience at the event. Interviews of the teams and guests, and daily highlights from the event, are available at the following link (<https://www.youtube.com/user/ARLTMSINUS> Channel). The interest and international reach of the SAUVC was also evident from the fact that we had members from organizing committees of Robosub, RobotX and Virtual AUV Competition visiting us as observers and sharing their feedback.

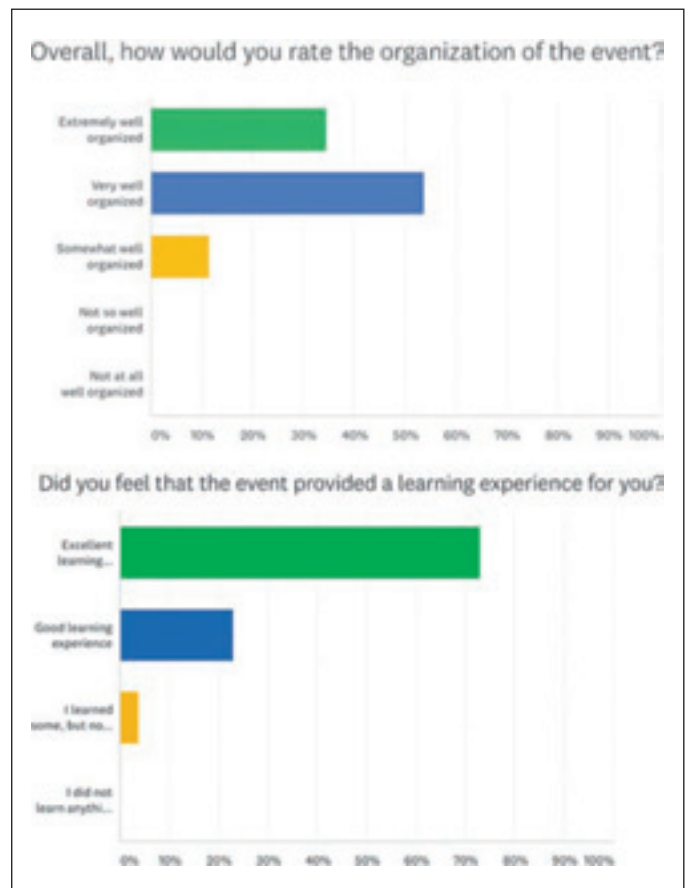


Figure 11. Participants feedback.

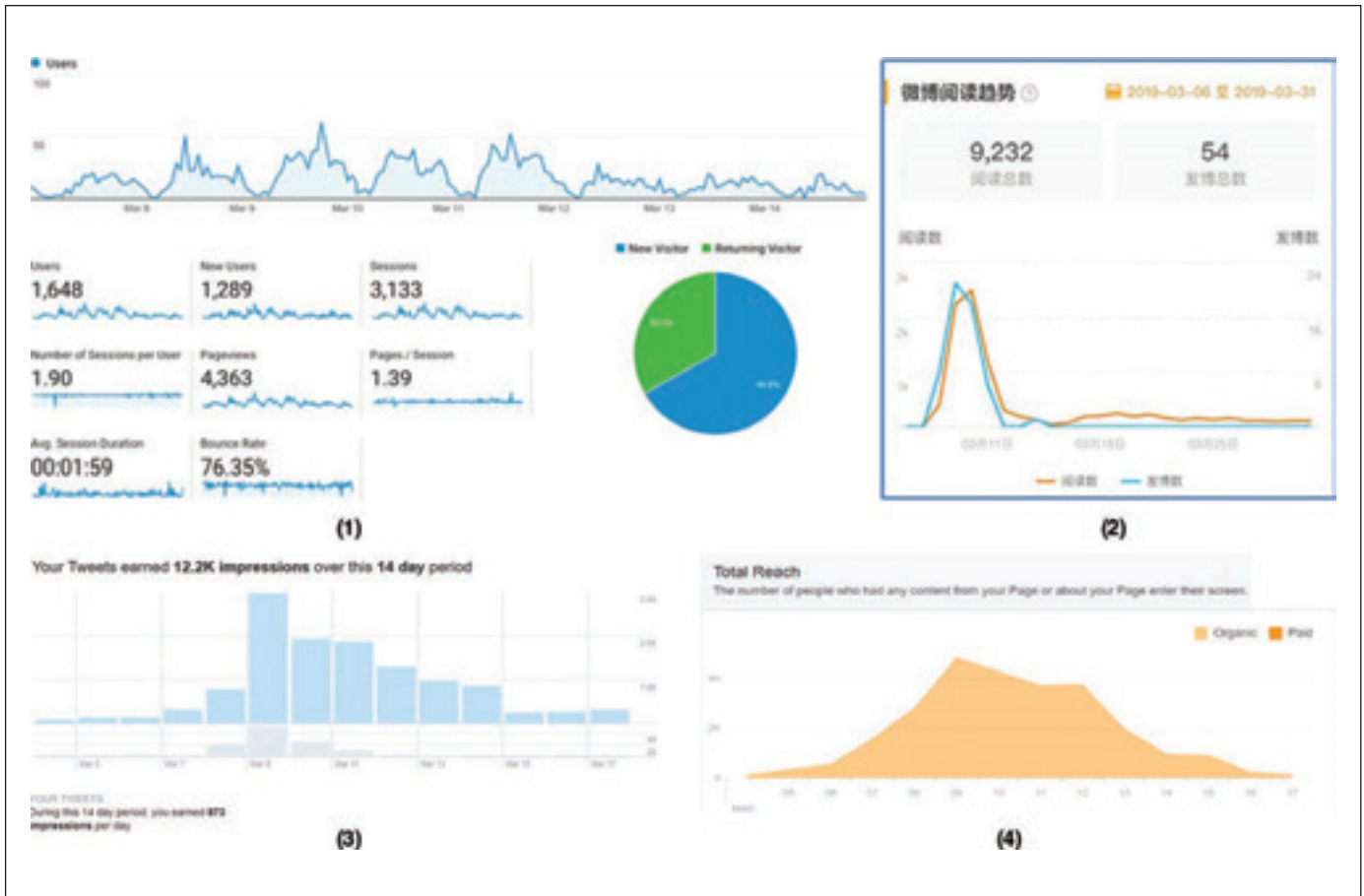


Figure 12. Internet traffic on— 1. sauvc.org 2. Weibo account 3. Twitter handle 4. Facebook page (Top to Bottom).

Sponsorship

The SAUVC is run solely on sponsorship. Like every edition, IEEE OES has been the biggest supporter and its local chapter is the co-organizer of the event. NUS & SP have been extremely supportive in co-organizing the event. ONR & ONRG have been supportive over the years and we had a big delegation visiting us, this year. Society of Underwater Technology had set up standees promoting their society during the event. We are very grateful and would like to say a big “thank you” to all our sponsors of SAUVC.



Figure 13. SAUVC 2019 sponsors & co-organizers.

Organizing Committee & Volunteers

SAUVC is a complete volunteering effort. It is solely organized by a passionate group of ocean engineers. The local organizing committee (LOC) comprises of the chair, secretary, treasurer and five sub-committees namely technical, sponsorship, academic outreach, publicity & logistics.

Acknowledgements

SAUVC 2019 was attended by several invited eminent underwater robotics experts from around the world. This includes Mr. William Kirkwood from Monterey Bay Aquarium Research Institute, a familiar face at SAUVC, who has been extremely supportive of the event over the years. His presence at the event has always been a morale booster for the organizing committee and the participants. Dr. Gabriele Ferri & Dr. Fausto Ferreira, from NATO Centre for Maritime Research and Experimentation were extremely supportive in judging the event and providing technical insights to the teams from their years of experience in organizing ERL. Ms. Kelly Cooper from Office of Naval Research & Mr. Richard Mills from Kongsberg Maritime were also a constant presence amongst the participants, and could be seen discussing with teams. We also thank Dr. Jeffrey Simmen from Office of Naval Research Global, Singapore office, another familiar face at SAUVC, for his extensive supportive of the event, over the years.



Figure 14. SAUVC 2019 LOC.

Concluding Remarks

SAUVC has been successfully organized for seven consecutive years now, growing each year and becoming possibly the largest and most well represented autonomous underwater vehicle competition for students in Asia. One aspect of SAUVC is that it does not charge a blanket registration fee for teams to participate. This is a policy aimed at promoting fledgling teams to compete, and generating interest in underwater robotics.

SAUVC is also popular for its academic outreach, and we also try our best to provide mentoring for the teams. It was encouraging to see that there was very good information sharing amongst the teams. Most teams took home the message that SAUVC is all about learning and sharing rather than just competing. As far as we, the SAUVC committee are concerned, this is the biggest win of all and one that provides us with the utmost satisfaction.

“FROM LITTLE THINGS, BIG THINGS GROW” (Paul Kelly, 1992) IEEE/OES 12th CWTMA Workshop, San Diego 10–13 March 2019

From Mal Heron, Sandy Williams and Hugh Roarty



The group photo.

A brilliant success! Under the auspices of the CWTMA Technology Committee, the twelfth Currents, Waves, Turbulence Measurements and Applications Workshop started with a flourish by Prof. Jen MacKinnon from Scripps who delivered the keynote address entitled “Tools for a Multi-Scale World”. The theme of her talk was that we must not underestimate the impact of small-scale processes in oceanography: hence the title for this article. She called for multiple tools for overlapping scales in time and space; and she emphasized the need for measuring different parameters at the same time and in the same space. Sometimes better insights can be gained from coherent structures than from conventional statistics of an ensemble. This served as an excellent entry into the theme “CWTMA in the 2020s” and many papers aimed at higher resolution and improved accuracy for those key measurements.

The single-stream workshop had 46 presentations and 87 delegates. The venue had two adjacent, connected rooms; one

for the presentations and one for breakout and a trade exhibition with 10 vendor booths. On a straw poll, some 30% of delegates claimed that this was their first CWTMA in the 36-year history. The presentations included new directions in microwave radars, applications with sensors on drones and fine-scale measurements.

Student papers were presented on the first morning and five awards of \$1,000 were made as follows (alphabetically):

Mairi Dorward “Currents, Waves and Turbulence Measurement: A View from Multiple Industrial-Academic Projects in Tidal Stream Energy”.

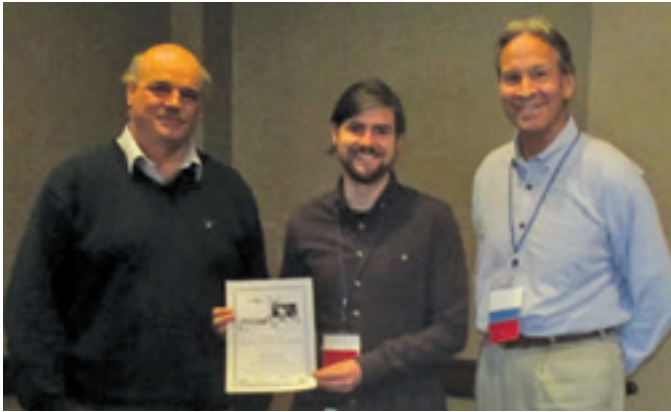
Colin Evans “Towards Implementing the Operational Use of High Frequency Radar Wave Parameter Estimations in Puerto Rico”.

Lisa Nyman “A New Empirical Approach to Detect Surface Currents Using Doppler Marine Radar”.

David Ortiz-Suslow “Quantifying the Impact of Nonlinear Internal Waves on the Atmospheric Surface Layer”.



Student paper sessions (left to right): Rick Cole (General Chair), Trevor Harrison, Lisa Nyman, Michael Stresser, David Ortiz-Suslow, Grant Mickelsen, Mairi Dorward, Kelsey Brunner, Colin Evans and Hugh Roarty (CWTMA Technology Committee Chair).



Best paper award went to Jochen Horstmann (left) and Michael Stresser, presented by Rick Cole (right).



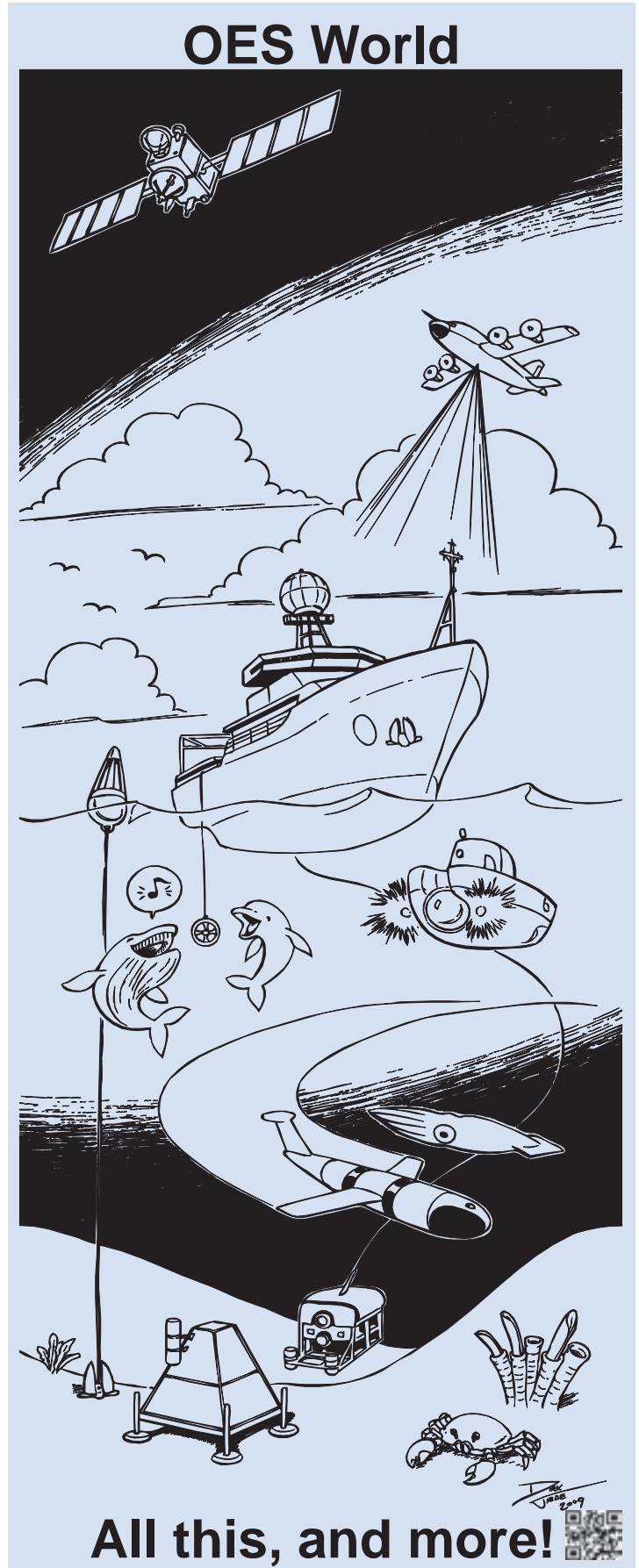
Michael Stresser “Remote Quantification of Nearshore Wave Energy Dissipation Rates from Coherent X-Band Radar Backscatter”.

The best paper award for the conference went to **Michael Stresser and Jochen Horstmann** from Helmholtz-Zentrum Geesthacht for their paper titled “Remote Quantification of Nearshore Wave Energy Dissipation Rates from Coherent X-Band Radar Backscatter”.

The exhibitors were well integrated and added a good practical dimension to the conference.

(alphabetically):

- Deep Water Buoyancy
- Del Mar
- GTS Consulting, Inc.
- Metocean Telemetrics
- Ocean Innovations
- Pacific Gyre
- Rockland Scientific
- Sonardyne
- Teledyne
- Xylem—Anderaa/YSI-ISS



All this, and more!



Underwater Technology 2019 (UT'19) Kaohsiung, Taiwan, 16–19 April, 2019

Chau-Chang Wang, Technical Program Committee Co-Chair of UT'19



Figure 1. Group photo taken after the plenary session on April 17.

The IEEE OES international symposium on Underwater Technology 2019 (UT'19) organized by IEEE Oceanic Engineering Society (IEEE/OES), IEEE/OES Japan Chapter, IEEE/OES Taipei, Taiwan Chapter, Taiwan Ocean Research Institute, and National Sun Yat-sen University, was held during 16-19 April 2019 at the International Building of National Sun Yat-sen University (NSYSU) in Kaohsiung. The venue is on the fifth and

sixth floors of the building where the beautiful Sizihwan beach can be overseen.

There were 146 researchers, students and professionals from 18 countries coming for this important gathering for the underwater technology community. In the symposium, two and one plenary talks were given on 17th and 18th mornings respectively. Two parallel sessions were arranged for the 70 talks such



Figure 2. Ice Breaker and Reception at NSYSU Alumni Hall.



Figure 3. At the opening ceremony, Prof. Tamaki Ura (left) and Dr. Yeong-Her Wang (center) gave welcome messages; Mr. Robert Wernli (right) briefed on the 20-year history of UT symposium.

that the attendees could have the best coverage of participation at their own interest. In the exhibition hall, nine student posters drew the attendees' attention about the young talents for the ocean, while seven booths demonstrated their up to date products and information for new solutions. This exhibition hall and several social corners were the places for refreshing old friendships and establishing new connections. The overture of UT'19 started with an Ice Breaker and Reception at the balcony of NSYSU Alumni

Hall where delicious food and an astonishing sunset entertained every guest. At the opening, Prof. Tamaki Ura, General Co-Chair of UT'19, and Dr. Yeong-Her Wang, Technical Program Committee General Chair of UT'19 and President of NARLabs, gave welcome messages to greet the guests, followed by Mr. Robert Wernli, former OES Vice President for Professional Activities, briefing on the 20-year history of the Underwater Technology Symposium.

Plenary Session

Dr. Katsuyoshi Kawaguchi, the Director of Engineering Department, Institute for Marine-Earth Exploration and Engineering, gave the first plenary talk on 17th morning. Dr. Kawaguchi's speech is on the development history of Japan seafloor observa-

tory, and how this infrastructure helps Japan to endeavor for early warning time for mitigating disaster, such as tsunami. The second talk was given by Dr. Chi-Ming Peng, the CEO of WeatherRisk Explore Inc., Taiwan. He elaborated on the importance of "Open Data", and how an open data structure can enhance the values of data collected by government agencies



Figure 5. Dr. Chi-Ming Peng gave a plenary speech entitled "Making the weather and ocean data ecosystem through the public-private engagement".



Figure 4. Dr. Katsuyoshi Kawaguchi gave a plenary speech entitled "Submarine cabled real time observation and digital twin of tectonic plate boundary—The future of earthquake and tsunami prediction".



Figure 6. Dr. Ban-Yuan Kuo gave a plenary speech entitled "Underwater technology and the solid-earth science: bypassing the ocean".

and private sectors. He also pointed out how new business can be created by opening and sharing data. The last plenary talk was on 18th, given by Dr. Ban-Yuan Kuo, Research Fellow of Institute of Earth Sciences, Academia Sinica, Taiwan. He has been studying the tectonic plate structure and dynamics for

more than two decades. In his talk, he mentioned that scientists strive to extract the secrets beneath the Earth surface with different tools overcoming all kinds of difficulties. On land, geologists climb up and down the mountains to collect rock samples. For the vast ocean covered seafloor, the evidence can only be



Figure 7. Technical sessions on April 17.



Figure 8. Technical sessions on April 18.

retrieved with the help of underwater technology. All three talks gave the attendees insight into what the underwater technology can contribute to the society.

Technical Sessions

Professor Chau-Chang Wang chaired the technical program committee. The submitted abstracts were peer-reviewed, and 70 papers and 9 posters were selected by the technical committee for presentation categorized into the following topics:

- UUVs & ROVs
- Observatories and Applications
- Vehicle AI Control
- Instrumentation and Sensors
- AUV Design & Development
- AUV Navigation
- Sonar Signal Processing
- AUV Control

- Acoustic Signal Processing
- AUV Application & Investigation
- Vehicle Tracking & Path Planning

We can see that the topics related to the AUV are the focal point of this symposium. This also serves as an indicator that autonomous agent technology is getting mature in solving many difficult marine and underwater challenges.

Student Poster Competition

The student posters were put on stands for the attendees to visit on 16th in the exhibition hall where many attendees walked around and chatted for new ideas. On 18th noon time, the judge group visited every poster, and listened to the authors and inspired them with the potential applications or insights of their work. After careful evaluation and discussion of their work, the first place was won by Miss Jenny Walker on “The effect of physics based corrections and data



Figure 9. Technical sessions on April 19.



Figure 10. Exhibition booths and student posters.

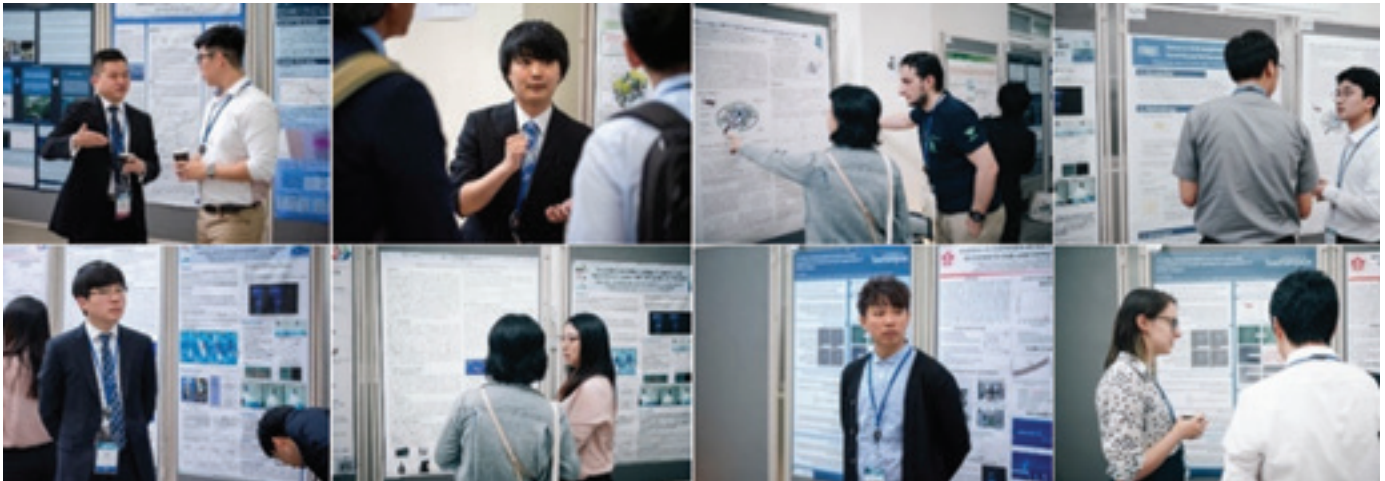


Figure 11. Student poster presenters.



Figure 12. Student poster competition winners (from left to right):
 Ms. Jenny Walker, Mr. Anton Tolstonogov, Mr. Adrian Chan,
 Mr. Jing-Heng Huang, and Mr. Junwoo Jang.

augmentation on transfer learning for segmentation of benthic imagery”. The second place goes to Mr. Anton Tolstonogov on “The compact ROV with variable center of gravity and its control”. The third place goes to Mr. Adrian Chan on “A belt transect fish abundance survey methodology using an underwater vehicle”. Two excellences go to Mr. Jing-Heng Huang on “Adaptation of a commercially available laser Raman spectrometer for underwater chemical sensing” and Mr. Junwoo Jang on “Dynamic grid adaptation for panel-based bathymetric SLAM”, respectively.

Exhibition and Social Event

There were six local and international companies setting booths for promotion. They



Figure 13. Local and international exhibitors.



Figure 14. Gala dinner on Sizihwan Beach.

are: Awareocean Technology Co., Ltd., Kongsberg Maritime Pte Ltd., Nijin Environmental Technology Co., Ltd., Sonardyne Asia Pte Ltd., AiTRIX GUAN HUNG TECHNOLOGY CO., LTD., and NORBIT SUBSEA. The organizing committee of OCEANS 2020 Singapore also joined us for promoting the event.

The Gala dinner to greet all the participants and their accompanied family and friends was held on Sizihwan Beach on 18th evening. An NSYSU student band “Dreamers Quartet” played traditional Taiwanese melody and Jazz for the

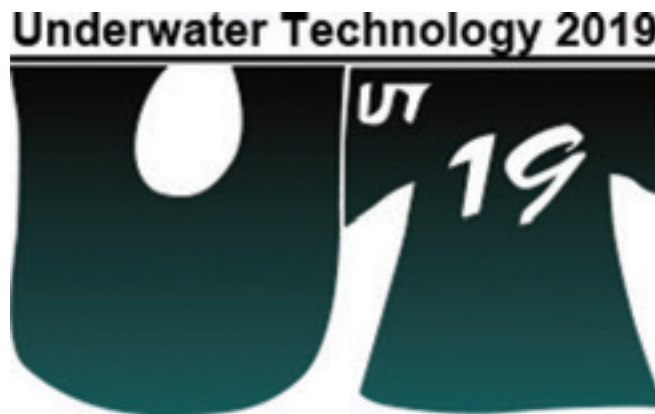


Figure 15. UT'19 Logo.

friends”, as Mr. Wernli said. Looking forward to seeing you at UT'21 Tokyo.

guests to enjoy the food and the unforgettable beautiful sunset. Professor Ura and Mr. Wernli each gave a farewell address prior to the announcement of the student poster awards winners. The party ended with a traditional Taiwanese Glove Puppet show by the Master Rong-Chang Wu to demonstrate the richness of Taiwanese culture.

Thank you all for helping UT'19 symposium such that everyone enjoyed a wonderful gathering of “academic



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OceanObs'19 Conference, An Ocean of Opportunity

Jay Pearlman, Christopher Whitt and Mal Heron



OceanObs is a conference held every 10 years to celebrate the successes of the past decade and to make plans for the next. IEEE OES is an Intellectual Sponsor of the upcoming OceanObs'19 and our participation is led by the Ocean Observation Systems and Environmental Sustainability Technology Committee.

This conference meets every ten years and has had significant impacts on the way that ocean observing is done. The Argo float system is an outcome of OceanObs'99 and the Governance structure "Framework for Ocean Observing" is a product of OceanObs'09. What will be the next step forward? OceanObs'19 seeks to improve response to both scientific and societal needs by a global scale integrated ocean observing system. It is reinforcing the importance of serving society to meet the grand challenges of food, climate, security and sustainability.

Overall, OceanObs'19 will strive to improve the governance of a global ocean observing system, including advocacy, funding, and alignment with best practices and to designate responsibility for product definition, including production and timely delivery at the appropriate scales (global, basin, regional, national) to serve user needs. The Conference flyer gives the vision, the mission and the impacts expected for the meeting.

THE VISION In recognition of the central role the ocean plays in supporting all life on earth, we see a resilient world whose societies prosper through sustainable interactions with our ocean, guided by timely, reliable, and accessible information.

THE MISSION OceanObs'19 is a community-driven conference that brings people from all over the planet to communicate the decadal progress of ocean observing networks and to chart innovative solutions to society's growing needs for ocean information.

THE IMPACT OceanObs'19 will determine how we meet future user needs (information), improve the delivery of products across the globe (interoperability), advance technology and services (innovation), and balance needs, capabilities, and knowledge worldwide (integration). Achieving these outcomes will result in a fit-for-purpose Global Ocean Observing System over the next decade.

Societal benefit themes have been chosen to support the vision and mission. These reflect major issues and opportunities of our times, including:

Discovery

The deep sea is one of the last frontiers of ocean discovery. Rapid technology development is expected to lead to more exciting discoveries of the ocean.

Ecosystem health & biodiversity

Human society benefits from marine biodiversity and healthy ecosystems that are under increasing pressure from multiple

stressors. Observing complex ecosystem, biodiversity, and biogeochemical dynamics in a globally integrated manner is a challenging task for next decade.

Climate variability & change

Monitoring, understanding, and predicting oceanic variations associated with natural climate variability and human-induced changes informs societies on how to plan and adapt to climate impacts. Ocean observers play a key role in shaping climate strategies.

Water, food, & energy security

To sustain provisional and regulating services from the ocean, communication between oceanographers and multiple stakeholders is indispensable in planning and implementing ocean observation and monitoring.

Pollution & human health

Ocean observations are discovering that human activities on-land and at-sea are polluting the oceans at increasing concentrations and depths. Plastic pollution has also captivated the public's attention and observers are finding that their impacts extend to the deepest points of our ocean. Monitoring and assessing these pollutants from source-to-sinks is needed for better management to sustain ocean and human health.

Hazards & maritime safety

Improving ocean forecasts, seasonal and weather predictions, and hazard monitoring translates to more advanced maritime safety, search and rescue, natural disaster prediction, and weather impact resiliency.

Blue economy

Ocean observing data, products, and services underpin the blue economy. Determining how societies leverage ocean businesses is a priority for the next decade.

These societal benefit themes will be examined by their relationship to ocean observing and how information products can be best supported through three observing system themes:

- observing system governance; data & information systems, and
- observing technologies & networks.

The ocean community has contributed significantly to the Conference through Community White Papers (CWP) already submitted to *Frontiers in Marine Science* for peer reviewed publication. Authoring these CWP has brought together experts in our community to discuss current capabilities and to define the vision looking forward. IEEE OES has lead authorship for two papers. One is the "Future Vision for Autonomous and Remote Observing Technologies" led by Christopher Whitt and the second is "Evolving And Sustaining Ocean Best Practices And Standards For The Next Decade" led by Jay Pearlman.

IEEE OES is an Intellectual Sponsor of OceanObs'19. We are pleased to have this role in a decadal ocean event.

If you have the opportunity, we encourage you to attend. The conference will be held at the Hawaii Conference Center, Honolulu HI during September 16-20 2019. Registration is available through <http://www.oceanobs19.net>

The authors note that the contents of this article include selected information on the Conference provided by the organizers.



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- To create opportunities to institute and strengthen intersociety collaboration and cooperation with member societies based in Asia.

For more info., please visit the URL: <http://2020.otcasia.org/welcome>

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OCEANS 2019 Seattle

Seattle's connection to maritime exploration, commerce, and innovation goes back to the first humans who settled by its shores. The Duwamish people, European settlers, and more recent American tech migrants have all come to Seattle drawn by two things: enormous natural and intellectual resources marshaled in a compact-sized city centrally located in an easily navigable region.

Returning for its decadal visit, Seattle again hosts the Marine Technology Society's and IEEE's Oceanic Engineering Society's OCEANS Conference from Sunday, October 27, to Thursday, October 31, 2019.



Convention Center and Hotel

OCEANS 2019 Seattle's home will be in the Washington State Convention Center, nestled at the edge of downtown's main business district. The 60,000-square foot Exhibit Hall will house marine technology instrument makers and service vendors while comfortable seminar rooms will allow presenters and participants to exchange ideas about the latest scientific findings and current marine technology innovations in dozens of presentations and tutorials.

Conference Highlights

Themed "Blue Sky. Blue Sea. Blue Tech," OCEANS 2019 Seattle's focus is to attract professionals and students in industry, academia, and the public sector seeking a common forum to exchange information and ideas, particularly about developing next-generation technologies and materials to explore the oceans for science, resource extraction, and remediation.

The local organizing committee, in partnership with the societies and the conference event planner, has a few new things in store for OCEANS 2019 Seattle attendees:

- A Start-Up Pavilion in the Exhibit Hall offering new and emerging companies opportunities to have their new technologies and services exposed to a broader audience;
- A moderated town hall discussion featuring an expert panel on ocean plastics;
- A poster session for professionals; and,
- Tutorials integrated into OCEANS more seamlessly and occurring on Thursday, October 31st.

Visit the OCEANS 2019 Seattle's website for more specific and updated information. <https://seattle19.oceansconference.org/>



Golden Planet of Seattle by Sigma Sreedharan.



Seattle skyline

One block away, the newly-built and recently-opened Grand Hyatt Seattle will be the place you lay your head at the end of a busy day. While the Grand Hyatt Seattle features an in-house restaurant, you will be within easy walking distance of myriad restaurants including Ruth's Chris Steak House, the Cheesecake Factory, Palomino, Dragonfish Asian Café, and Tap House Seattle . . . to name a very few dining choices outside the conference venue and your hotel.

Come Early or Stay Late

Despite its latitude, Seattle is temperate year-round. The North Pacific provides enough rain to give the city one of its nicknames ("The Emerald City") but not so much to interfere in year-round outdoor activities.

The city itself offers museums (The Seattle Art Museum, Wing Luke Museum, The Museum of History and Industry),

attractions (the Space Needle, the Seattle Aquarium, the Underground Tour, Pike Place Market, Pioneer Square), and enough shopping opportunities to make year-end festivities and gift giving unique. Yet, within two-hours travel time you are able to visit wilderness in any one of three national parks (Mount Rainier National Park, North Cascades National Park, and Olympic National Park). Closer still, the western slope of the Cascades offers hiking and mountain biking opportunities on state park and national forest lands while Lake Washington, Lake Union and Puget Sound provide fresh and saltwater boating opportunities for all tastes and experience levels.

OCEANS 2019 Seattle provides a once-in-a-lifetime opportunity to explore new science, new technology, to catch-up with old friends and colleagues, and to meet new ones. Mark your calendar, submit your abstract, and make your travel plans to attend.

Welcome Message from General Chair of OCEANS 2020 Singapore

Dear Research and Industry Colleagues,
Greetings from Singapore!



After a gap of 14 years, **Singapore** is set to host again **OCEANS Conference** during **6–9 April 2020**. This instance stands out in particular as OCEANS celebrates its successful legacy on its 50th anniversary. The conference venue, **Marina Bay Sands Expo and Convention Centre** is an iconic venue with an infinity swimming pool on its top. **OCEANS 2020 Singapore** is expected to attract about 600 delegates

and 50 to 60 exhibitors from related industries. Apart from presentations by researchers from many different fields of oceans science and technologies, there will also be special sessions on emerging research and technologies organised by experts in those areas. Another feature of the conference will be sessions and topics focused on local needs and scenarios. I would like to encourage experts to propose and organise such special sessions that would help in furthering research and innovations in their respective fields.

Active student participation is another integral part of OCEANS. There will be a student poster competition where papers from select student submissions are displayed, reviewed and evaluated by experts. Top three winning posters are awarded prize money at the conference. To encourage student participation, limited travel and lodging grants are also offered by OCEANS. So, grab this opportunity to showcase your best research output during the OCEANS conference.

Singapore is one of the busiest ports in the world. It connects over 600 ports in 120 countries with 130,000 vessel calls annually. This heavy-shipping scenario brings up a unique set of complicated operational constraints. On the other hand, we now live in a world that has realized the importance to uphold the sanctity of its oceans. Maintaining a balance between crucial market flow and ocean conservation is a complex problem which demands attention. It may arguably be the most pressing issue at hand. In view of this, our theme for OCEANS 2020 Singapore is "**Green Ports: In Harmony with Oceans**", which reflects the need to address the ocean environment through the use of smart marine engineering and technological solutions.

Attending a conference is not just about participation in the technical programme and exhibition. It also provides the delegates over the world an opportunity to explore, understand and experience the unique cultures of the country where the conference is being held. One of the safest countries in the world, Singapore is also the best example of how people of different religious faiths can co-exist in peace and harmony. A Garden City state with lush green vegetation in an urban setting, good transportation system, world class airport, mouthwatering international cuisine and ease of communication in English language all make it very special for visitors. This is also a great opportunity for visiting many neighbouring countries such as

Malaysia, Thailand, Vietnam, Cambodia and Indonesia, to name a few, which are all 2 to 3 hours by flight from Singapore.

We look forward to welcoming you all to Singapore for an exciting conference.

Yours Sincerely,
Venugopalan Pallayil
General Chair, OCEANS 2020 Singapore.



A Blast from the Past! . . . Our Fearless OES Leaders!

Bob Wernli—Beacon Co-Editor-in-Chief, Photos by Stan Chamberlain



*Christian De Moustier—2017–2020
OCEANS 2017 Anchorage Plenary.*



*Rene Garello—2013–2016
OCEANS 2015 Washington AdCom.*



*Jerry Carroll—2009–2012
OCEANS 2010 Seattle,
OES Awards Luncheon.*



*Jim Barbera—2005–2008
OCEANS 2008 Kobe,
OES Awards Luncheon.*



*Tom Wiener—2001–2004
OCEANS 2004 Kobe, OES Awards Luncheon.*



*Glen Williams—1990–1992, 1999–2000
OCEANS 2008 Quebec Banquet.*



*Claude Brancart—1997–1998
OCEANS 2005 Washington
Receiving Distinguished Service Award.*



*Daniel L. Alspach
1988–1989*



*Anthony I. Eller
1986–1987*



*Stanley G. Chamberlain
1983–1985*



*Joseph Czika—1993–1996
OCEANS 2017 Anchorage
Receiving Recognition Award.*

And, let's not forget those past Presidents who started and cared for our society:

- Donald M. Bolle, 1981–1982
- Lloyd Z. Maudlin, 1978–1980
- Edward W. Early, 1976–1977
- Arthur S. Westneat, 1974–1975
- Algernon S. Badger, 1972–1973
- O. Lyle Tiffany, 1971
- Gilbert Jaffe, 1968–1970





CEANS 2020

Singapore

April 6 - 9, 2020

Marina Bay Sands Convention Centre

Green Ports: In harmony with the Oceans



<https://singapore20.oceansconference.org/>

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Plastics: A Threat to our Oceans

René Garello, IEEE Fellow, Hans-Peter Plag, IEEE senior member, Jay Pearlman, IEEE Fellow

Have you ever thought about how much plastic we use in our daily lives? Walk around your local market and start to count. Plastics are ubiquitous and integrated in almost everything we produce, trade and use from the cloths we wear to the way our food is protected to the many tools we utilize. This massive use of plastics, along with an estimated average use time of 5 year [1] compared to a plastic materials life-time of between 500 and 5000 years has led to a steadily increasing and potentially catastrophic burden of plastics in all aspects of the Earth's ecosystems. About five years ago, Marcus Eriksen, et al [1] reported an estimate of the total number of plastic particles and their weight floating in the world's oceans from 24 expeditions (2007–2013) across all five sub-tropical gyres, costal Australia, Bay of Bengal and the Mediterranean Sea. Using an oceanographic model of floating debris dispersal, he estimated a minimum of 5.25 trillion particles weighing 268,940 tons.

In a paper on the New Plastics Economy [2] the Ellen McArthur Foundation, working with the McKinsey Center for Business and Environment, noted that the best research currently available estimates that there are over 150 million tons of plastics in the ocean today. In a business-as-usual scenario, the ocean is expected to contain 1 ton of plastic for every 3 tons of fish by 2025, and by 2050, more plastics than fish (by weight). This is dramatic, but estimates vary and the need for quantitative measurements cannot be understated. For example, the distribution of microplastics on the surface was less than expected by Eriksen, and there are still questions on the dynamics of plastic transformations and depth profiles that need further study.

Why are we concerned about plastics if they are small pieces of inert matter? Plastics have been found in the guts of marine mega fauna and humans and in the tissues of fish. The smallest components that are still plastic (nanoplastics) have become integrated at the cellular level in some organisms. Plastics are not inert and can be a breeding platform for bacteria. Plastics can transport harmful organisms that will have deleterious effects when they are ingested by fish and marine mammals. The extents of this and other issues is not well quantified.

What can be done to quantify the amount of plastics in the ocean? There are many challenges here also. There are several scales to the size of plastics pieces in the ocean from whole fishing nets and contents of lost cargo container content to nanoparticles. The impact of plastics varies according to their size and chemical characteristics. Larger pieces (macroplastics) are 5 mm or more in dimension. Microplastics are plastic fragments or particles that are less than 5.0 mm in size. In [3], nanoplastics have been defined as particles unintentionally produced (i.e. from degradation and the manufacturing of the plastic objects) and presenting a colloidal behavior, within the size range from 1 to 1000 nm. In the monitoring of plastics, very



PHOTOGRAPH: FACHRUL REZA/BARGROFT IMAGES

Birds search for plastic delicacies at a landfill site in Aceh, Indonesia. Only 9% of all plastic waste ever produced has been recycled. About 12% has been incinerated, while the rest—79%—has accumulated in landfills, dumps or the natural environment.



PHOTOGRAPH: GRAHAM MOORE/ALAMYGARNET

A gannet carries some tasty plastic food back to its nest.

different techniques are required to understand the dynamics of different sizes of plastics in the rivers and oceans. However, it has been noted that most of the plastic pollution in the ocean can be originating from river flows, with the ten top-ranked rivers accounting for roughly 90% of the global load being located in Asia and Africa [14]. For further debris, the river assessments are essential, but there are analyses such as those referenced above, which implore us to address both the current ocean inputs and the existing pool of plastic debris across the oceans. This may require different techniques depending on the size and type of the plastic fragments.

How can we routinely monitor ocean plastics? There are alternative approaches that include remote sensing (from space, airborne and ground based systems) and in situ observations. There are generally many challenges for the space-based remote sensing of plastic pollution in the coastal and marine environment.



This grey mullet in Hong Kong is thrilled to find microplastics in its habitat.

First, the size of plastic, generally sub-meter size is difficult to image from existing space platforms, which typically have resolutions from 5 meters up to 1 km depending on the system. In addition, fragmentation and decomposition reduces the plastic size over time, and thus reduces the possibility of detection. Airborne systems offer higher spatial resolution, but have limited temporal and spatial coverage. Ground-based systems such as HF radar can monitor coastal surface currents that transport plastics, but will not see small plastic debris. Thus, we need to be able to synthesize results from many data acquisitions from multi sources to improve the spatial and temporal resolutions and then use larger scale, coupled models of surface current circulation (with a 10m depth extent). A critical part of modeling is to have validated data whose collection methods and uncertainties are well understood. This includes adequate description of the data through metadata. It also needs methods documentation that is readily accessible through a global repository such as the Ocean Best Practices System [4].

There may also be “indicators” linked to the plastic presence which may be useful similar to the way oil pollution in the ocean is observed by radar due to its calming effect on ocean surface waves. Indeed, large-scale remote sensing instruments are not able to directly detect the plastic(s) per se and so the indicators need to be defined and tested. This comes not only from the scale size of the plastics vs. the resolution of satellite systems, but the limited ability of high spectral resolution systems (optical, radar or hyperspectral sensors) to differentiate water covered plastic from the surrounding water. Thus, additional inputs are necessary. For example, in situ observation sensors could be developed with an emphasis on having them on-board ships, and then comparing this real-time monitoring of measurements with a global satellite system. When using ships and considering surface macroplastic debris, optical monitoring may be a complementary step to space and airborne observations. This is still limited in that the ships travel defined routes between major commercial ports and thus global coverage is not complete.

In order to fully explore the existing observation means for the detection, monitoring and quantifying of ocean plastics, a comprehensive strategy is need. This strategy should be aligned to the Sustainable Development Goal (SDG) 14 “Life Below Water,” which has the Target 14.1 “By 2025, prevent and sig-

nificantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution” and the associated Indicator 14.1.1 “Index of coastal eutrophication (ICEP) and floating plastic debris density.”

IEEE OES has initiated a program in which we propose to develop a set of objectives for assessing the means of observation and the methods of detection, according to indicators to define. This will need the organization of seminars and workshops for a working group led by OES in collaboration with the UN Environment and the GEO (Group on Earth Observation) initiative “Blue Planet”. At the OES level, this activity will be developed by the associated Technology Committees, mainly “Ocean Observation Systems and Environmental Sustainability” and “Ocean Remote Sensing”. It is already proposed as a topic for our OCEANS flagship conference and it will be the basis for a potential growth in our members.

The major outcome of this initiative will consist of aggregating all the potential partners and stakeholders in order to propose projects at the international level. Considering the amount of plastic already present, the immediate need is to explore downstream solutions for assessing the sources and presence of plastics, as well as to detect plastics in the ocean through a range of observation means (underwater, satellite-borne, in situ, ... sensors). Another objective is to perform quantitative as well as qualitative measurements, and to track the circulation of plastics in the ocean and at the coastal level. But for achieving these objectives, we need to understand how the decisions are taken that refer to scientific findings and take on the concerns of civil society.

In order to achieve these objectives, we have started to develop, as a preliminary step, a roadmap with milestones at 6 months (paper at OCEANS 2019 Marseille) and 2 years for a set of goals after 5 years. We will also be part of a town hall session on this topic at the fall conference OCEANS 2019 Seattle.

We invite all interested members to contact us:

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hpplag@mari-odu.org

jay.pearlman@ieee.org

References

- [1] Eriksen M, Lebreton LCM, Carson HS, Thiel M, Moore CJ, Borroero JC, et al. (2014) Plastic Pollution in the World’s Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea. PLoS ONE 9(12): e111913. <https://doi.org/10.1371/journal.pone.0111913>
- [2] https://www.ellenmacarthurfoundation.org/assets/downloads/EllenMacArthurFoundation_TheNewPlasticsEconomy_Pages.pdf
- [3] Gigault, J., et al. (2018). “Current opinion: What is a nanoplastic?” Environmental Pollution (published January 19, 2018).
- [4] Jay Pearlman^{1*}, Mark Bushnell², Laurent Coppola³, Johannes Karstensen⁴, Pier Luigi Buttigieg⁵, Françoise Pearlman¹, et al, (2019), Evolving and Sustaining Ocean Best Practices and Standards for the Next Decade, Frontiers in Marine Science, accepted for publication.

Photos from the Guardians

(<https://www.theguardian.com/environment/gallery/2018/jun/08/the-week-in-plastic-in-pictures>).

Who's who in the OES

Brandy Armstrong, Administrative Committee, Student Activities Chair, and Social Media Initiative

I think the most interesting part of my story is how a small-town girl from Ohio become an oceanographer and active OES member. It's a story full of colorful experiences and mentorship.

I always loved earth science. I chose oceanography for good reason. The ocean was the furthest thing from Ohio, aside from becoming an astronaut, and I was not ready to leave the planet. I joined the Mighty Sound of the Southeast, the University of South Carolina marching band, and captained the color guard team. Maybe you are thinking what does that have to do with anything? This is where mentorship first played a starring role in my life. While I did spend many enjoyable hours practicing and performing with the band, I still made time for practical hands on activities: collecting data with the undergraduate research group, learning instrumentation as a lab technician, running ocean models and working with large data sets.

As an undergraduate I seized upon every opportunity to gain valuable experience and mentorship. I volunteered to collect vibra-cores in swamps and on islands, to collect grab samples off the coast, and collect water samples and ADCP transects in estuaries. I was chosen for a 2-month research expedition to Siberia collecting hydrographic data along the Lena River. I represented an undergraduate research group at multiple conferences and helped pilot and edit an undergraduate research journal. In graduate school I mentored the undergraduates in the research group and also spent a week collecting drifter data along the Mesoamerican Barrier Reef.

After graduating in 2005 with high honors and a master's in marine science, I did a short stint as island and sea turtle program manager on Pritchards Island, SC. In 2008 I headed to Woods Hole, MA, to join the US Geological Survey (USGS) Coastal Marine Geology Program, where I focused on coupled ocean-atmosphere-wave sediment-transport modeling and field work. During this time, Marinna Martini introduced me to the IEEE Oceanic Engineering Society.

After several years enjoying the small town atmosphere and social life on the Cape, including living in downtown Falmouth, riding my bike to work along the seashore, coaching the local high school color guard, and being an active member of the Cape Cod Curling Club, I transferred to the USGS Hydrologic Instrumentation Facility in 2014 where I manage the Water Mission Area Hydraulics Laboratory and quality assurance programs for field instrumentation.

My daughter was born in August of 2017. I prefer to spend most of my free time with my husband and daughter, which is why you may have seen them at OCEANS Aberdeen, Anchorage, Kobe and Charleston.

While I am almost always enjoying family time, I use any time I have leftover (and some I pull out of thin air) to focus on sustainability, growing a food forest, advocacy for safer, more sustainable food and personal products, and volunteer work



Steve, Aileen and I at OCEANS 2017 anchorage leadership dinner.



Our family enjoys food and music at the OCEANS Aberdeen gala.

that improves the local community and the world. One of the non-profits I volunteer with, Open Food Network, combines my passion for gardening and local community building.

As an elected OES Administrative Committee member I focus on mentorship and support for women, students and Young Professionals (YP) using social media as a communication tool and an opportunity for involvement. Every day I am inspired by our members' skill, ingenuity, and passion! As I mentor YP and students from around the world, it is exciting to watch them discover their paths by seizing opportunities, many discovered through IEEE OES. It encourages me to remain alert, so I do not miss the next opportunity on my own path.

Member Highlights

Contact the Editors if You Have Items of Interest for the Society Control & Robotics in OCEANS Meet in Beijing, China By Dr. Ferial El-Hawary, IEEE-Life Fellow

It was my pleasure to accept an invitation to be among the Keynote Speakers and Conference International Advisory Committee for the fifth International IEEE Conference on Control, Automation and Robotics (ICCAR'2019) www.iccar.org held in Beijing, China, April 19–22, 2019. A mega City, as everyone knows, Beijing is the second largest Chinese city by urban population after Shanghai and is the nation's political, cultural, and educational center. Beijing is an important world capital and global power city, and one of the world's leading centers for politics, economy and business, finance, education, culture, innovation and technology, architecture, language, and diplomacy.

The past four IEEE-ICCAR conferences were held in Singapore, Hong Kong, Nagoya, Japan and Auckland, New Zealand. ICCAR is one of the most successful IEEE technically sponsored series. The conference organizers received 300 submissions from 17 countries. From these, the Technical Program Committee selected close to 150 papers based on their originality, innovative relevance, and clarity of presentation, to be included in the IEEE Conference Proceedings and Xplore.

The goal of the conference organization was to include only the best talented researchers in the various facets of cutting-edge and extremely challenging areas. On the theoretical side, this conference featured papers focusing on intelligent systems engineering, distributed intelligence systems, multi-level systems, intelligent control, multi-robot systems, cooperation and coordination of unmanned vehicle systems, etc. On the application side, it emphasized autonomous systems, industrial robotic systems, multi-robot systems, aerial vehicles, underwater robots and sensor-based control.

In addition to the accepted papers, the technical program included, a plenary address by Professor Yutaka Ishibashi, Nagoya Institute of Technology, Japan, whose talk was on “Enhanced cooperation among humans and robots with force feedback over networks,” and three keynote speakers: IEEE President-Elect. 2019, Professor Toshio Fukuda, Nagoya University, Japan, whose talk was on “Multi-Scale Robotic System—Maintenance and Enhancement of Artifact and Life” focusing on Medical Nano-Robotics; Professor Wei-Hsin Liao, the Chinese University of Hong Kong, whose talk was on “Robotic Exoskeletons for Motion Assistance and Rehabilitation;” and myself, Former Faculty of Engineering, Dalhousie University, Canada.

The aim of my talk was to introduce underwater vehicles with the title “Advanced Underwater Robotics: Most Uses for Obtaining Processed Useful Big Data.” The numbers and diversity of assets available and the developed expertise in this area continues to grow. This presentation summarized advances and needs in this field.



Prof. Huafeng Ding, Conf. Co-Chair; Prof. Yutaka Ishibashi, Plenary and 3 Keynote Speakers: Dr. Ferial El-Hawary, Prof. Toshio Fukuda (IEEE-President Elect 2019) and Prof. Wei-Hsin Liao, L. to R.



Professor Toshio Fukuda (IEEE President-Elect. 2019).



Some Participants at IEEE-ICCAR'2019.

I focused my discussion on the fact that underwater vehicle's communications have been acknowledged to be much more challenging than similar terrestrial, air, and planetary exploration applications. Achieving reliable high-speed performance for underwater vehicles, such as remotely operated vehicles (ROV) and autonomous underwater vehicles (AUV) operating in the water environment, must deal with issues arising from the water's inherent physical properties. The current rising trends in popularity of the Internet of Things (IoT) is creating a demand for the underwater counterpart of the Internet of Underwater Things (IoUT) with its applications for Environmental Monitoring, Underwater Explorations, Disaster Prevention, Military, etc., and future data sharing. The grand goal of the IoUT is to create a worldwide network of smart interconnected underwater sensors to accomplish Smart Environment Monitoring and Analytics in Real-time Systems (SEMAR).

The most significant requirement is determining the accurate location for a deployed autonomous underwater robot. The location methods of mobile robots use multi-sensor data fusion to combine multi-sensor's information, which is redundant or complementary in the space or time to obtain an appropriate uniform description or the understanding of the target object according to a certain criterion. There are some issues for researchers to consider, for example: The transmission media is the main challenge for IoUT. The 2nd top challenge is the difficulty to recharge sensors deployed underwater. Moreover, the highlight of this Conference was the excellent Young Professionals and Students Program (Noticeable number of Poster Sessions and Best Paper Awards).

Following the conference, we had the opportunity to visit the laboratories of the University of Science and Technology of Beijing (USTB) and shared the Celebration of its 67 years anniversary. The USTB, formerly known as Beijing Steel and Iron Institute before 1988, is a national key university in Beijing,



Some Participants at USTB Olympic 2008 Gymnasium.

China, <http://en.ustb.edu.cn/> USTB is an institution involving the Chinese Government Scholarship Program and has been accepting the international students since 1954. Also, we toured the 2008 Olympic facilities, which is located on the USTB Campus, and it was a good reminder with the up-coming 2020 Olympics, Tokyo, Japan.

There are at least 70 establishments of higher education in the Chinese capital. Most of the colleges and universities are public or affiliated; only a few are privately established. <https://web.archive.org/web/20100928001512/http://www.moe.edu.cn/english/list.htm>

I note that the ICCAR conference has attracted several research papers that are within the scope and fields of interest of the IEEE Oceanic Engineering Society. I hope to see this trend continue and grow. Please accept this as a personal invitation to consider contributing to the ICCAR '2020 being organized to be held in Canada.

Dr. Ferial El-Hawary, F. IEEE, F.EIC, F.MTS
 IEEE- Board of Directors 2008–2009
 IEEE/OES Board Member 2019–2021
 Email: F.El-Hawary@ieee.org
 Website: www.ferialdal.ca



Some Participants at USTB Campus.

OES Members in Print

Contact the Editors if You Have New Items

Model-Based Processing: An Applied Subspace Identification Approach

James V. Candy
Lawrence Livermore National Laboratory
University of California Santa Barbara

A JOHN WILEY & SONS, INC., PUBLICATION

This text encompasses the basic idea of the model-based approach to signal processing by incorporating the often overlooked, but necessary, requirement of obtaining a model initially in order to perform the processing in the first place. Here we are focused on presenting the development of models for the design of model-based signal processors using subspace identification techniques to achieve a model based identification as well as incorporating validation and statistical analysis methods to evaluate their overall performance. It presents a different approach that incorporates the solution to the system identification problem as the integral part of the model-based signal processor (Kalman filter) that can be applied to a large number of applications, but with little success unless a reliable model is available or can be adapted to a changing environment. Here, using subspace approaches, it is possible to identify the model very rapidly and incorporate it into a variety of processing problems such as state estimation, tracking, detection, classification, controls and communications to mention a few. Models for the processor evolve in a variety of ways, either from first principles accompanied by estimating its inherent uncertain parameters as in parametrically adaptive schemes, or by extracting constrained model sets employing direct optimization methodologies, or by simply fitting a black box structure to noisy data. Once the model is extracted from controlled experimental data, or a vast amount of measured data,

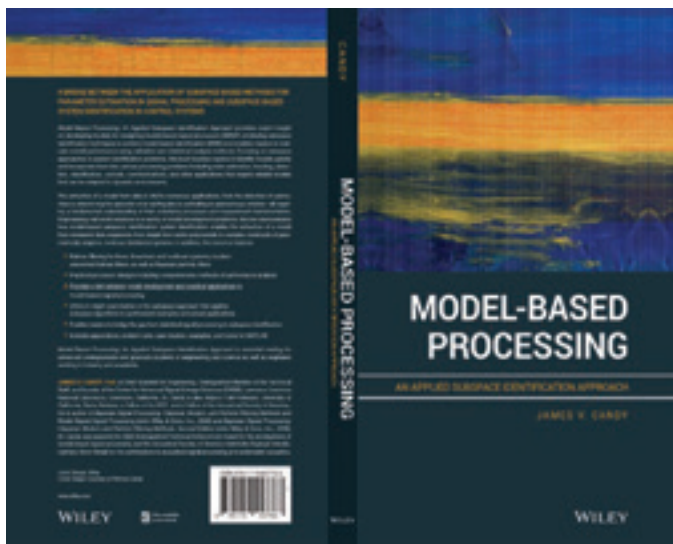
or even synthesized from a highly complex truth model, the long-term processor can be developed for direct application. Since many real-world applications seek a real-time solution, we concentrate primarily on the development of fast, reliable identification methods that enable such an implementation. Model extraction/development must be followed by validation and testing to ensure that the model reliably represents the underlying phenomenology—a bad model can only lead to failure!

Although this proposed text is designed primarily as a graduate text, it will prove useful to practicing signal processing professionals and scientists, since a wide variety of case studies are included to demonstrate the applicability of the model-based subspace identification approach to real-world problems. It is unique in the sense that many texts cover some of its topics in piecemeal fashion. The underlying model-based approach of this text is the thread that is embedded throughout in the algorithms, examples, applications, and case studies. It is the model-based theme, together with the developed hierarchy of physics-based models, that contributes to its uniqueness coupled with the now robust, subspace model identification methods that even enable potential real-time methods to become a reality.

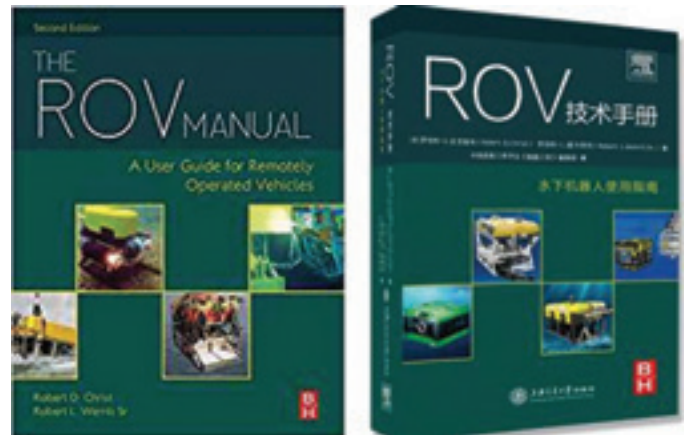
The ROV Manual, 2nd Edition, Reaches a New Milestone

Robert L. Wernli Sr., First Centurion Enterprises
Robert D. Christ, SeaTrepid

The 2nd edition of The ROV Manual, co-authored by Robert Wernli, Co-EIC of the Beacon, has reached a new milestone. The popular manual, published by Elsevier in 2014, has requested that we consider a third edition because the manual has not only sold over 1200 print copies, in addition to the digital copies, but has been translated into Chinese under the guidance of the Shanghai Jiao Tong University. Needless to say, the authors are quite honored.



James V. Candy: *Model-Based Processing: An Applied Subspace Identification Approach*: John Wiley, 2019.



Robert L. Wernli Sr.: *The ROV Manual, 2nd Edition, Reaches a New Milestone.*

IEEE Oceanic Engineering Society Election for Members to the Administrative Committee Nominees for the Term 1 January 2020–31 December 2022

René Garello, OES Junior Past President

The OES Administrative Committee election closes on 25 June. When you review the below candidates, I think you will agree that OES is truly becoming a major international society of IEEE, that includes participating members from students, Young Professionals to our Senior members. Be sure to cast your vote.

VOTE NOW at <https://eballot4.votenet.com/IEEE>

You will need your IEEE Account username/password to access the ballot. For quick reference, your username is <your email address>. If you do not remember your password, you may retrieve it on the voter login page. Please make sure you are signed out of all other applications in your browser. You can copy the link and paste into a private browsing window if using Firefox or an incognito window if using Chrome.

Voting must be completed no later than 25 June 2019. Any returns received after this date will not be counted. The online voting site will close at 4:00 pm Eastern Time.

The photos, bios and statements of our excellent slate of candidates follows. You can see their information on the voting site.



JOÃO ALVES (M'09-SM'17) BSc., MSc. in Electrotechnical Engineering, Control and Robotics by the Technical University of Lisbon. He has been working in underwater robotics and associated technologies since 1995.

He had a key role in the development of the hardware and software architectures for the MARIUS AUV and DELFIM ASV developed at the Technical University of Lisbon. These were fully distributed and networked architectures including more than 30 processors in charge of the different components of the vehicles. This work was the base for his MSc. dissertation.

In 2003 he co-founded a private start-up company—Blue Edge Systems Engineering, offering services and conducting R&D activity in the maritime domain. In 2007 he took scientific leadership for the underwater communications activities of the EC project GREX where pioneering maritime cooperative robotics was demonstrated. In late 2009 he joined the NATO Undersea Research Centre (NURC), now Centre For Maritime Research and Experimentation (CMRE) as a scientist to work on underwater communications. He led studies in support of establishing the first underwater communications standard and developed innovative protocols for underwater ad hoc networking. In 2014 he took a leadership role as Principal Scientist responsible for the underwater communications activities at CMRE. He conducted several trials as scientist in charge, leading teams of several tens of people during long sea-going campaigns. During this period he also served as PI for different

European commission projects (like MORPH and SUNRISE) and was co-general chair for the IEEE OES UComms14, UComms16 and UComms18 conferences. He is an invited lecturer for the Masters in Ocean Engineering offered by the University of Pisa (ITA), a guest editor of the *IEEE Journal of Oceanic Engineering* and a member of the editorial body of the *Elsevier Journal of Ad Hoc Networks*. João currently serves as a member of the IEEE OES Administrative Committee and is also the OES Liaison for OCEANS 2021 Porto. He is also involved in the AUVSI subcommittee for the international regulations for preventing collisions at sea, dealing with the challenging issues of adding robots to our Oceans.

João received the NATO Scientific Achievement Award 2018 for his work as team leader in the development and promulgation of JANUS—the first digital underwater communications standard.

Statement: We are very lucky to have an extremely strong group of people that is vested in the success of this society. I'm proud to be part of such group and would like to continue giving my contribution.

I joined the AdCom in 2018 and my first year of seeing the society “from the inside” has been extremely valuable and formative. Later in 2018, I took the role of liaison for OCEANS 2021 Porto and I'm now contemplating additional ways to contribute.

I believe my experience as co-chair of the UComms conference series can be put to service with two major objectives: On one hand improving the interaction of conference organisers with IEEE (something that I'm sure can be considerably improved) and on the other hand to increase the quality of the output of OES conferences. I'm very interested in working directly with the Vice-President for Conferences and Symposia towards continuing shaping and maturing the guidelines for society conferences with the aim of producing high quality meetings and contributions to IEEE Xplore. In these days of conference proliferation and overflow of paper production, we should aim at holding our OES conferences output to the highest possible standards.



BRANDY ARMSTRONG (M'15) was born and raised in Dayton, Ohio. She left home to become an oceanographer in 1999. After receiving her Masters degree in Marine Science at the University of South Carolina and a short stint working on a remote island, she spent nearly 7 years in

Woods Hole working with the USGS Coastal Marine Geology program. She transferred to the USGS Hydrologic Instrumentation Facility in 2014 where she runs the Hydraulics Laboratory.

Brandy spends most of her free time with her husband Steve and daughter Aileen, but still finds time to keep an eye on the latest technology and opportunities in both oceanography and surface water, and share that information with others through the IEEE OES social media channels. She also enjoys volunteering with the Open Food Network and practicing permaculture on her 11.5 acre homestead in south Mississippi.

As a member of the IEEE OES Administrative Committee (2017–2019) and chair of the student activities committee (2018–2019), Brandy has built up OES' social media presence and provided mentorship and career building opportunities for students and Young Professionals. She is active on the Earthzine board of directors and a strong member and supporter of the Women in Engineering affiliate group.

Brandy is an accomplished scientist with 10 years of experience in data collection and management and expertise in managing field teams and equipment. She is skilled in data analysis, data visualization, and scientific publication and preparing publicly accessible datasets. She has a strong leadership and communication acumen and promotes collaboration with key stakeholders across organizations. <https://www.linkedin.com/in/brandystarmstrong/>

Statement: As an elected Administrative Committee member (2017–2019) I have championed the social media initiative which has received 82.5K of requested funds towards creating and maintaining a social media presence through IEEE OES member involvement and content creation. I have also recruited a team of IEEE OES student and Young Professional members to help maintain that social media presence and create content to share from Earthzine and Beacon.

As student activities committee chair (2018–2019) I have held regular meetings with student and Young Professional members that have led to increased opportunities for mentorship at OCEANS and the organization of Career and WIE panels to benefit our student, YP, women and minority members. These meetings have enabled me to share current opportunities with students and YP and involve them in planning for the creation of future opportunities that meet their needs. The effectiveness of these efforts can be seen through an increase in new and active student branch chapters and a recent increase in Young Professional membership.

If re-elected I propose to continue working with the students and YP members through social media and Earthzine and to promote other career building and mentorship opportunities. I will continue to mentor students and YP and encourage them to apply for technical and leadership positions in the IEEE OES, both locally and internationally.



JEAN-FRANÇOIS BOUSQUET (S'07-GSM'08-M'10) I was raised in Kuujuaq, an Inuit community North of Quebec, in the Ungava Bay. There, I experienced the rigours of the tundra, and I also learned about the Inuit culture and their love for nature. As a teenager, I later spent my summers canoeing and kayaking, enjoying my passion for water sports on the St-Lawrence River in Montreal.

I completed my Bachelor of Electrical Engineering at École Polytechnique de Montréal in 2001. I then spent two years working as a software analyst in the defence industry at Oerlikon Contraves (now Rheinmetall Canada). Eager to advance my knowledge in my preferred field of communication electronics, I returned to pursue my graduate at the Schulich School of Engineering, in Calgary Alberta. During my Masters, I developed a space-time coding technique to advance the performance of Wifi in fading indoor environments. I also implemented an active scatterer to control the signature of the communication channel. This work earned me an Outstanding Analog Designer Award by Analog Devices. After, two years in industry as an Analog Integrated Circuits Designer, I returned to academia, and I currently serve as Interim Department Head of Electrical and Computer Engineering at Dalhousie University.

Dalhousie University is in the Atlantic Maritimes in Canada. Atlantic Canada has a strong ocean technologies industry with approximately 140 companies generating an estimated \$330 million in sales annually and responsible for approximately 5300 person-years of employment. When I joined the University, I started the UW-STREAM (The Underwater Sensing and Transmission using Electro-Acoustic Modems Laboratory), an applied research facility focused mainly on the development of underwater communication systems. The UW-STREAM lab actively collaborates with local and international industry partners, including Ultra Electronics Maritime Systems, Ocean Sonics, General Dynamics Mission Systems and more recently Jasco Applied Science. The laboratory holds 3 PhD Candidates, 5 M.A.Sc. Students and one Post-Doctoral Researcher that are working towards next generation underwater communication networks.

In the Summer 2016, our research group participated in an ambitious 3-day sea trial 10 km off the coast of Nova Scotia. While a 5-element receiver was deployed in the middle of the water column, in 80 meters of water, we transmitted different waveforms to demonstrate the communication reliability of several modulation schemes, and to validate the channel propagation conditions against real physical conditions. The sea trial provided us a rich dataset, and we were able to confirm the high sensitivity of the different modulation techniques to extreme channel conditions.

My research team has also developed an autonomous sailboat that has participated in the MicroTransat Challenge to cross the Atlantic. In the Summer 2016, the SeaLeon, a 1.8-meter vessel left Scatarie Island, in Cape Breton, and travelled over 3000 km in 76 days, before we lost communication to her. Just recently, she was found on the shores of Ireland, and we are in the process of recovering her to North America to diagnose its status.

Ocean technology has become my passion in the past four years, and I continuously share my interest with my graduate and undergraduate students. I am looking forward to working as an active member of the IEEE Ocean Engineering Society.

Oceanic Engineering Society—Opportunities and Challenges: The IEEE Oceanic Engineering Society is a unique community applied to oceans technology. As a body of the IEEE, its community consists primarily of electrical engineering scientists and professionals. However, because of the breadth of the challenges, it also attracts other engineering disciplines, as

well as oceanographers, physicists and mathematicians. This unique characteristic provides both opportunities and challenges to promote the objectives of the society through networking, conferences and publications, and towards the education of students and support of young professional members.

The mandate of the society includes: 1) the sponsorship of different international events, 2) the planning of the conference, 3) the definition of standards, 4) the management of professional activities through 30 international Chapters, 5) the recognition of excellence in the student body through scholarships, and 6) the publication of a peer-reviewed journal as well as magazines, and newsletters. In order to achieve this, the Society governance is managed through an administrative body, an executive body as well as 18 technical committees. The individuals belonging to the society are primarily enrolled on a voluntary basis.

As the interest in the ocean resources grows, there is an increasing need for ocean technology, and particularly to deploy infrastructure along the littoral, in the Arctic or even in the deep sea. The applications are vast and include oil & gas, military, environmental, and scientific sectors of activity. As such, there is an opportunity to train future engineers and scientists in this field. The role of the OES is to attract students in this exciting field of expertise. There is a potential to increase the size of this community and ensure that knowledge gets transferred to the next generations. Fostering a large community that can support the economy is an essential need for the long-term growth of the industry. For this purpose, the society must keep at the forefront of its activities, the promotion of its field to attract strong researchers in the area.

The ocean is considered by many as one of the last frontiers, since its realms remain vastly unexplored and difficult to monitor. Advancing the ocean technology poses many challenges, and this must be done in collaboration between universities and industry. Enhancing partnerships should be an important mandate of the OES, such that the University research is relevant, and that it can meet current industry demands. For example, the cost of subsea sensors and autonomous underwater vehicles that can sustain harsh subsea conditions remains extremely high, and a thorough review of the systems needs to be considered to enable large scale monitoring of our oceans.

In the 21st century's reality, climate has become a global concern and all nations are putting in resources to reduce pollution and sustain the Earth's health. The OES can play a major role in supporting this international effort, since the oceans are directly impacted by the climate. At Dalhousie University, monitoring climate changes has become the mandate of the Ocean Frontier Institute, a government funded program that received over \$94M to advance the technology and science in this field. Through this initiative, the advancement of underwater sensor networks encourages standardization, and interoperability between the sensors. Also, scientists are developing standards and processes to protect marine life. Such standards should also be promoted at the OES. Finally, since the challenges related to oceans are international, the OES must ensure that it reaches out to a diverse community from all parts of the world, by fostering international networking events that encourage collaboration between different entities.



JAMES V. CANDY (S'73-M'76-SM'94-F'99-LF'17) is the Chief Scientist for Engineering, a Distinguished Member of the Technical Staff and founder/former Director of the Center for Advanced Signal & Image Sciences (CASIS) at the Lawrence Livermore National Laboratory. Dr. Candy

received a commission in the USAF in 1967 and was a Systems Engineer/Test Director from 1967 to 1971 (Captain/Vietnam Era Veteran). He has been a Researcher at the Lawrence Livermore National Laboratory since 1976 holding various positions including that of Project Engineer for Signal Processing and Thrust/Focus Area Leader for Signal and Control Engineering. Educationally, he received his B.S.E.E. degree from the University of Cincinnati and his M.S.E. and Ph.D. degrees in Electrical Engineering from the University of Florida. He is a registered professional Control System Engineer in the state of California. He has been an Adjunct Professor at San Francisco State University, University of Santa Clara, and UC Berkeley, Extension teaching graduate courses in signal and image processing. He is an Adjunct Full-Professor at the University of California, Santa Barbara. Dr. Candy is a Fellow of the IEEE "for contributions to model-based ocean acoustic signal processing" and a Fellow of the Acoustical Society of America (ASA) "for contributions to model-based acoustic signal processing." He was elected as a Life Member (Fellow) at the University of Cambridge (Clare Hall College). He is a member of Eta Kappa Nu and Phi Kappa Phi honorary societies. He was elected as a Distinguished Alumnus by the University of Cincinnati "for meritorious achievement, recognized stature and conspicuous success in the imaginative blending of engineering education with highly productive endeavors in industry, professional activities, and public service." Dr. Candy received the IEEE Distinguished Technical Achievement Award for the "development of model-based signal processing in ocean acoustics." Dr. Candy is an IEEE Distinguished Lecturer for oceanic signal processing. He was nominated for the prestigious Edward Teller Fellowship at Lawrence Livermore National Laboratory. Dr. Candy has been awarded the Interdisciplinary Helmholtz-Rayleigh Silver Medal in Signal Processing/Underwater Acoustics by the Acoustical Society of America "for contributions to the advancement of science, engineering, or human welfare through research accomplishments." He has received the R&D100 award for his innovative invention in radiation threat detection. He has published over 225 journal articles, book chapters, and technical reports as well as written six texts in signal processing, "Signal Processing: the Model-Based Approach," (McGraw-Hill, 1986) and "Signal Processing: the Modern Approach," (McGraw-Hill, 1988), "Model-Based Signal Processing," (Wiley/IEEE Press, 2006), "Bayesian Signal Processing: Classical, Modern and Particle Filtering" (Wiley/IEEE Press, 2009/2016) and currently "Model-Based Processing: An Applied Subspace Identification Approach," (Wiley/IEEE Press, 2019). He was the General Chairman of the inaugural 2006 IEEE Nonlinear Statistical Signal Processing Workshop held at the Corpus Christi College, University of Cambridge. He has presented a variety of short courses and tutorials sponsored by the IEEE and ASA in Applied Signal Processing,

Spectral Estimation, Advanced Digital Signal Processing, Applied Model-Based Signal Processing, Applied Acoustical Signal Processing, Model-Based Ocean Acoustic Signal Processing and most recently Bayesian Signal Processing for IEEE Oceanic Engineering Society/ASA. He has also presented short courses in Applied Model-Based Signal Processing for the SPIE Optical Society. He was the IEEE Co-Chair of the Technical Committee on “Signal/Image Processing and Statistical Learning” and was the Chair of the ASA Technical Committee on “Signal Processing in Acoustics” as well as being an Associate Editor for *Signal Processing of ASA* (on-line JASAE). He was elected to the Administrative Committee of IEEE OES. His research interests include Bayesian learning, estimation, identification, spatial estimation, signal and image processing, array signal processing, nonlinear signal processing, tomography, sonar/radar processing and biomedical applications.

Statement: If elected to the Administrative Committee of the IEEE Oceanic Engineering Society for the Class of 2020, I would continue to focus my attention on the technical aspects of the society and motivate more technical participation especially from those colleagues in signal processing related areas (ocean acoustics, imaging, tracking, communications, etc.). The heart of any technical society is its members and their technical efforts that lead to high interest both inside and outside OES (e.g. papers, conferences, workshops, books, etc.). I would continue my efforts consulting on tutorials, participation and education, since this is typically an area that our members seek to gain technical knowledge and direction especially when entering a new technical area. I am currently an IEEE OES Distinguished Lecturer and recently was the OES Tutorials Chair/Liaison participating in the organization of the OCEANS tutorials and awarding of CEU certificates. Also as a participant in the Signal/Image Processing and Statistical Learning Technical Committee I encourage our members participation in recommending potential tutorial/short course instructors that actively engage in “educating” our OES members in areas of high interest.



TIMOTHY DUDA (M’05-SM’09) Senior Scientist at the Woods Hole Oceanographic Institution, is an ocean acoustician and physical oceanographer. He is a Senior Member of IEEE and IEEE Oceanic Engineering Society, Fellow of the Acoustical Society of America, and Member of the

American Geophysical Union and the American Meteorological Society. Dr. Duda received his BA degree in physics from Pomona College and his PhD degree in oceanography from UC San Diego (Scripps Institution of Oceanography). He has led the design, fabrication, or assembly of physical oceanographic measurement systems beginning in graduate school in 1979 (Cartesian Diver, Micro Sampling Sled, Webb Shearmeters, Locomoor, DIMES Shearmeters). He has collected and analyzed acoustic data from multiple experiments in deep and shallow water over the last few decades, and has devised theories to explain complex underwater acoustic behavior. He is also a developer of three-dimensional (3D) underwater acoustic propa-

gation models and an experienced user of 2D and 3D acoustic propagation models. Recently he has led a diverse multiple-PI DoD MURI program in coupled ocean dynamical and ocean acoustic modeling, and works actively on ocean acoustic effects and situations that are strongly influenced by rapidly evolving water-column events and complex bathymetry.

As OES member since 2005 and IEEE Senior Member since 2009, as Environmental Acoustics TC Chair and Underwater Acoustics TC member, and as technical program participant at numerous Oceans Conferences, and through activity in other societies, I know first-hand the value of structured and informal communications with professional peers, open dissemination of vetted or partially vetted research results, archived research and development papers, and organized meetings of scientists and engineers with common interests. My motivation for AdCom membership is to preserve the strength of OES sponsored meetings that are faced with a number of threats. Smaller and more targeted grants discourage researchers from attending and writing papers, while proprietary corporate development can be incompletely presented and documented. The ability of the Oceans Conferences to attract quality work with full technical description should be enhanced, raising their profile, their ability to attract the highest caliber of keynote speakers and exhibitors seeking a knowledgeable market, and their educational and professional value to attendees. Preserving the strength of the Journal is an additional priority.



KEN FOOTE (M’96-SM’11-F’15) is completing a term as an AdCom member. He is serving as Technology Committee chair for Underwater Acoustics and for Standards. He has earlier served two terms as OES Vice President for Technical Activities. He is a Life Member of OES and an IEEE Fellow. He received a BS in electrical engineering from The George Washington University and PhD in physics from Brown University. He worked at Raytheon Company Submarine Signal Division 1968–1974, spent a year at Loughborough University of Technology, then six years at the University of Bergen. In 1981 he became a Senior Scientist at the Institute of Marine Research, Bergen, and in 1999, a Senior Scientist at the Woods Hole Oceanographic Institution. His research interests include acoustic scattering by marine organisms and the physical environment, marine resource estimation, and sonar performance evaluation and calibration.

Statement: The core of any IEEE society is its technical activities. We in OES are focused on ocean engineering. Some of us make tools; others use them; but always in the most challenging environment of the ocean—to exploit its power or resources, to conserve resources, or for understanding. As a society, we sponsor major meetings, such as the semi-annual OCEANS Conference, and publish the premier journal in ocean engineering. We also promote and serve the professional interests of the membership. All this requires diverse talents. It is my conviction, based on observation, that technical activities need strong representation on AdCom, especially during this period of IEEE-compelled financial austerity, when technical

activities are being viewed as “revenue sinks” and priority is being given to “revenue sources.” This is my motivation for continued service.



BHARATH KALYAN (S'04-M'07-GSM'10-M'10) graduated as Engineer in Electronics & Communication from Bangalore University, India (2001), and has a Ph.D in Control & Instrumentation Engineering from Nanyang Technological University, Singapore (2010). He has been working in unmanned underwater systems and associated technologies since 2002. In 2004, he was a visiting research fellow with Ura Laboratory, IIS, University of Tokyo. He was a research engineer for 3 years at Intelligent Robotics Laboratory, Nanyang Technological University where he worked on various underwater projects, primarily focusing on underwater sensing, navigation for surface & underwater vehicles. In 2010, he joined Acoustic Research Laboratory (ARL), National University of Singapore where he is now a Senior Research Fellow. In ARL, he managed the autonomous underwater vehicle program, STARFISH and networked autonomous underwater assets program, NETGEAR. As a Co-PI, he is also leading the deepsea nodule harvesting program under the auspices of Keppel-NUS corporate laboratory, along with Ocean Minerals Singapore to explore polymetallic nodules using autonomous systems in the Eastern Pacific Ocean. He also holds a joint position as a senior research scientist at Marine & Offshore Program Office (MOPO), A*Star, tasked with co-developing a national level offshore marine robotics program.

Bharath has been a member of IEEE OES for over a decade. He is also a member of International Marine Minerals Society. He has served IEEE OES Singapore Chapter as an executive member and is now the Vice-Chair. He served as the Academic Chair and Technical Chair for the Asia's first international student AUV competition, Singapore AUV Challenge (SAUVC 2013). Since then, he has contributed in various capacities in the LOC, including being the General Chair for SAUVC 2018. He is a member of the LOC for OCEANS 2020 in Singapore, as Exhibition Chair. He is also a member of the technical committee, Autonomous Marine Systems, an IEEE OES initiative. He serves as reviewer for IEEE OCEANS, JOE, TRO, IJRR, IROS & ICARCV.

Statement: Having seen IEEE OES as a student member, then a member and now as a Vice-Chair of the Singapore chapter, I'm convinced that IEEE OES is strategically positioned to bridge the gap between policy makers, academia and industry. However, as with all professional volunteering organizations, the biggest challenge is to encourage young professionals to get more involved in the society. For this IEEE OES must strive towards remaining relevant and provide opportunities that excite young professionals as they are vital to its recruitment.

I welcome the opportunity to bring my experience to the IEEE OES AdCom, and if elected my priorities would be as follows:

- To work towards building an integrated marine robotics database with increased focus on integrating observing systems, support of standards, calibration practices to improve interoperability.

This could then be used by researchers to benchmark their data, developed algorithms & software, similar to AI Tribune (formerly popular as CVOnline that has over 50,000 registered users).

- To raise the awareness of OES as a professional society and its activities through expanded outreach program (workshops, seminars, competitions) and through various social media platforms.
- Engage students, young professionals and support the development of marine technology communities around the world.



DEBBI KILL (AF'07-AM'15-M'17) is a Chartered Professional Accountant with 40+ years financial management experience. Her strengths in the areas of financial management, analysis, planning and reporting are combined with a solid background in computerized information systems and general accounting management. Her oceans engineering industry experience began in 2001 when she accepted the position of Controller at International Submarine Engineering Ltd. As Controller, Debbi provided financial leadership in the design and build of unmanned submersible technologies.

Debbi has now turned her sights to the MATE ROV competition as Treasurer on the inaugural board of MATE Inspiration for Innovation (MATE II); a newly formed non-profit spun off from Monterey Peninsula College's MATE Centre. She has also served for the last five years as the Official Scorekeeper at the Regional MATE ROV competition event in Seattle and the International competition held in various locations throughout North America.

She is a member in good standing of IEEE OES, the Marine Technology Society and the Chartered Professional Accountants of British Columbia and holds a business certificate in Computer Systems Technology from the British Columbia Institute of Technology.

She is a long time resident of the West Coast of British Columbia.

Service to the Oceanic Engineering Community to Date:

- Chief Financial Officer, MATE Inspiration for Innovation
- Official Scorekeeper, MATE International ROV Competition
- Official Scorekeeper, MATE Pacific Northwest Regional Competition
- Member, Local Organizing Committee, OCEANS 2019 Seattle, WA
- Treasurer and VP Budget and Finance, Marine Technology Society (MTS)
- Financial Liaison, Joint OCEANS Administrative Board
- MTS Liaison, OCEANS 2016 Monterey CA
- Finance Chair, OCEANS 2015 Washington DC
- Finance Chair, OCEANS 2007 Vancouver BC

Statement: OES has a long history of successful engagement in the oceanic engineering community. It has done so through the delivery of quality conferences, workshops and publications that provide society members with opportunities to network with like-minded professionals.

If elected, I would welcome the opportunity to bring my unique skill set in finance, business management and strategic

planning to assist OES AdCom in building on that success. My past experience serving on various boards and organizing committees for OCEANS conferences has been very rewarding. I am excited at the prospect of using that experience to contribute to the financial and technical success of future conferences, workshops and symposiums.

I would also work hard to connect the next generation of OES members and volunteers by promoting the society to the large number of professionals and students involved in the MATE ROV competition.

With your support, I will serve tirelessly in helping OES achieve its mission of fostering technical and professional growth of its members wherever possible.



SHYAM MADHUSUDHANA (GSM'08-M'09-GSM'12-M'16) I obtained my Bachelors degree in Computer Science & Engineering from Visvesvaraya Technological University, India, my Masters degree in Computer Science from San Diego State University—California State University,

and my PhD in Applied Physics from Curtin University, Australia. My Masters research was carried out in collaboration with researchers at the Scripps Institution of Oceanography. My doctoral research involved development of solutions for the automation of underwater soundscape assessments. Over the past years, I have worked at the Centre for Marine Science and Technology (CMST), Australia, and at the National Institute of Oceanography (NIO), India. At present, I am with the Bioacoustics Research Program at Cornell Lab of Ornithology (Cornell University). My research interests have been largely multidisciplinary, with applications in autonomous monitoring and conservation of marine fauna. My current research involves developing solutions for automatic source separation in continuous ambient audio streams and the development of deep-learning techniques for unsupervised multi-class classification of acoustic events in the big-data realm, with focus on efficient utilization of modern computing capabilities.

My tryst with IEEE OES began in 2008, when I had attended the then OCEANS conference in Kobe, Japan as a participant in the Student Poster Competition. I have since been involved at various levels in the society as an active and contributing member. In 2009/2010, along with Kevin Delaney and James Collins, I had worked towards and succeeded in resurrecting the San Diego Chapter of OES. I served as the Chapter's Secretary and Treasurer for two years. I was a member of the local organizing committee for OCEANS' 13 at San Diego. I am among the founding members of the Australian Chapter of OES which came into existence in 2013. I also served as the Secretary of the new Chapter for three years. During my residence in Perth, Australia, I had liaised with the Director of the Centre for Marine Science & Technology (Curtin University) for co-branding of some of their weekly seminars as IEEE-OES events, thereby providing OES some much needed exposure in Western Australia which was otherwise dominated by the Society of Underwater Technology. In 2018, I was appointed as the Coordinator of Technology Committees. With inputs from the

Chairs of the various Committees, Malcolm Heron (VPTA) and I have been revising the committees' scopes and statements to maintain their relevance in the evolving industry. Since my appointment, I have chaired two meetings of the Technology Committees. Also, in 2018, I was awarded membership to the inaugural OES YP-BOOST program. As part of the initiative, I have participated in two AdCom meetings so far and have a very good understanding of the processes and the purposes. Most recently, I was nominated to serve as the OES Chair of Student Poster Competitions at OCEANS conferences.

Statement: Over the past decade, having volunteered at various levels of IEEE OES and having contributed to its various facets, I have developed a well-rounded understanding of the scope, purpose and the evolving needs of the Society. I welcome the opportunity to put this knowledge to use for further development of the Society and to keep up its relevance in the rapidly evolving field of oceanic engineering research. Election to the AdCom would enable me to stay more engaged with the Society and would make my efforts most successful.

One of my primary goals is to expand the technology base of OES and plug prevalent gaps by bringing in more of the emerging technologies under the ambit of its various Technology Committees. For example, marine bioacoustics, underwater soundscape studies and marine pollution are well-matured interdisciplinary fields of research globally and yet they continue to have relatively small footprints within OES. The fact that the futures of the IEEE and its Societies depend on membership growth is well known. Keeping OES's technology base regularly updated ensures that the Society remains attractive to newer generations of professionals coming from emerging fields of research. Furthermore, the active engagement of students and young professionals is vital for strengthening their loyalty, both to the profession and to the Society. I will support initiatives for encouraging their increased participation and for expanding their roles in the Society. Student Poster Competition (SPC), which is a flagship event of the bi-annual OCEANS conferences, offers a rewarding experience to the participants. Given that my association with OES had started from participation in an SPC more than a decade ago, it still remains close to my heart. I will continue to support and further develop the program.



ANDREAS MAROUCHES (M'10) is a Principal Research Engineer and Research Group Leader in the Engineering and Technology Program in the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Oceans and Atmosphere (O&A) business unit. He provides engineering and technical support to scientists and industry working the marine and atmospheric domains. In addition to providing technical guidance in the deployment of projects, Andreas and his group specialise in the design of bespoke science systems and platforms. This includes the design and manufacture of ship-based systems and instrumentation, autonomous platforms, and oceanographic moorings. In addition, Andreas is involved the development of new leading edge engineering

technologies and methods to meet present and future engineering challenges. The Engineering and Technology program has a strong track record for delivering technical solutions to address challenging science problems in the field. Andreas also leads several ongoing international collaborative efforts on technology development with partner agencies including JAMSTEC and NOAA, as well as academic partners such as MIT. These projects are specifically targeted towards addressing fundamental technical and operational challenges in the advancement of ocean observing science platforms. The fields of study include ocean science and monitoring, mooring development, advanced materials, system autonomy, and environmental technology to support aquaculture science and industry.

Andreas' technical background includes a broad range of engineering fields including aerospace, aero-structures, technologies for the environment, audio-visual engineering, optics, ocean engineering, autonomous systems, and engineering systems modelling and simulation. Andreas has worked with a wide range of research and industry institutions including the University of Toronto, Boeing Aerospace, IMAX and CSIRO.

Andreas is active in both the IEEE Oceanic Engineering Society and the Marine Technology Society. Andreas is the Tasmanian sub-section chair in the Australian Chapter of the IEEE Oceanic Engineering Society, and actively engages the extensive marine technology community in Tasmania with talks and supporting visits from field experts. Andreas is also the Chair of the OES Polar Oceans Technical committee and most recently planned and executed the first Antarctic and Southern Ocean Forum for Science and Technology (ASOF-Fest) conference in August 2018 to bring together researchers across both science and technology domains to discuss emerging challenges in conducting southern-ocean research. Andreas is also contributing to the planning of the sister conference the Arctic and Northern Ocean Forum scheduled for September 2019. Over his ten years working in the marine industry Andreas has also regularly attended and presented papers at Oceans conferences (over 16 in 10 years).

Statement: In the next five years we are poised to see significant change in the method and technologies being deployed in our oceans. The operational challenges of localisation, persistence and scale faced by the marine sector will become more acute as operations of all sorts venture into more remote regions, deeper waters and further from on-shore support. Autonomy is the future of ocean operations. Advanced unmanned platforms working both at the surface of the oceans and below, combined with advances in AI and sensor technology will change the way ocean operations are conducted in support of both research and commercial activities. These technology drivers will demand new engineering skills, legal and regularity frameworks, business models and new standards to succeed. The next generation of marine and ocean engineers will need to embrace a new set of skills to succeed.

The Oceanic Engineering Society (OES) has the opportunity to play a central role in helping enable and lead this change but not without challenge. Engineering activities in the sector will become increasingly multi-disciplinary and requiring a more diverse set of skills. Interactions between disciplines are also

likely to become more nuanced and require the creation of new sub-disciplines in engineering curricula. As always the primary opportunity for OES is to help engage with students and emerging engineers in the field helping to provide a framework (and subsequently a home) for new members who may increasingly find their new skills at odds with traditional marine engineering curricula. Continued investment in student engagement through workshop and conferences is critical in this regard.

As part of the IEEE, OES in in the unique opportunity to provide guidance on setting of standards, and contribute to the development of best practice and subsequent discussions informing regulatory frameworks. This is particularly necessary in the context of autonomous or unmanned systems. Outside of the engineering discipline, OES has an opportunity to engage with the broader science community to create strong working groups around key science theme areas to help break free the constraints of siloed expertise in particular domain areas, and encourage interaction and idea sharing across specialised areas. An example of this is the Antarctic and Southern Ocean Forum which mixed in science presentations with engineering discussions around the challenges faced by conducting science operations in the Southern Ocean. Is it envisioned that along with it's sister conference (the Arctic and Northern Ocean Forum) that bridges could be formed by specialist groups working at opposite poles to address often similar technical challenges.



NIKOLA MIŠKOVIĆ (S'05-M'08-SM'17) obtained his PhD in 2010 from University of Zagreb, Faculty of Electrical Engineering and Computing where he is an Associate Professor and the Head of the Centre for Research Support. He has been elected Vice Dean for Research for academic years 2018/2019 and 2019/2020. Prof. Mišković teaches Control Theory, Nonlinear Control Systems, and an elective course Guidance and Control of Marine Vehicles. He is also the co-founder of two spinoff companies: MARS—Marine Robotics and Systems, and H2O robotics.

His research activities are conducted within the Laboratory for Underwater Systems and Technologies (LABUST, <https://labust.fer.hr/>). He participated in 14 European projects (H2020, FP7, DG-ECHO, INTERREG) out of which he coordinated FP7 CADDY, focussing on the development of the first underwater robot for interaction with divers; H2020 aPad, devoted to commercialization of an autonomous surface vehicles developed in LABUST, and H2020 EXCELLABUST devoted to increasing LABUST excellence in marine robotics. He also participated in 4 Office of Naval Research Global (ONR-G) projects (coordinated 3), 2 NATO projects, and 7 national projects (coordinated 3). He published more than 70 papers in journals and conference proceedings in the area of navigation, guidance and control, as well as cooperative control in marine robotics.

Assoc. Prof. Mišković is a Senior Member of IEEE – he has been a member of IEEE for 15 years, and a member of IEEE OES for 14 years. During this time, he significantly contributed

to IEEE by acting as a president of Chapter for Robotics and Automation of the Croatian Section from 2016 to 2019. He is the Branch Counselor of a newly founded IEEE OES Student Branch Chapter University of Zagreb. Prof. Mišković also participated in a number of IEEE OES OCEANS conferences where he also organized a special session devoted to dissemination of FP7 CADDY project research results. He published in IEEE journals such as *IEEE/ASME Transactions on Mechatronics*, *IEEE Robotics & Automation Magazine* and *IEEE Journal of Oceanic Engineering*.

He is involved as a judge in student autonomous marine vehicle competitions such as Student Autonomous Underwater Vehicles Challenge—Europe (SAUC-e), European Robotics League (ERL), Singapore AUV Challenge, and RobotX.

He is one of the founders and the Chairman of the Programme Committee of “Breaking the Surface”, an international interdisciplinary field workshop of maritime robotics and applications that has been organized for 11 years in a row.

In 2013 he received the young scientist award “Vera Johanides” of the Croatian Academy of Engineering (HATZ) for scientific achievements, and he received the annual State science award for 2015, awarded by the Croatian Parliament.

Statement: I have been a member of IEEE for 15 years now, and a member of OES for 14 years (Senior Member since 2017). My goal is to continue my engagement with OES activities as a Member of the Administrative Committee.

I am one of the founders and the Chairman of the Programme Committee of “Breaking the Surface” (BtS, <http://bts.fer.hr/>, <https://www.facebook.com/BtSCroatia>) that has been organized for 11 years in a row in Croatia. BtS is the only interdisciplinary field workshop of marine robotics and applications that fuses a standard, workshop-type knowledge transfer event with several days of fieldwork in end-user disciplines such as marine robotics and marine remote sensing; maritime and nautical archaeology and history, submerged cultural landscapes; marine biology, biological oceanography and marine natural conservation; maritime security; etc. In 2018, BtS hosted around 200 participants from 18 countries, 38 lectures were delivered, and 8 vehicles were demonstrated. *I will advocate strengthening links between ocean engineering and application domains, by enabling synergies between “Breaking the Surface” workshop and IEEE Oceanographic Engineering Society since I believe it would significantly increase outreach to next professional generations and would contribute towards strengthening student experience within OES.*

Over the last few years I was involved as a judge in student autonomous marine vehicle competitions such as Student Autonomous Underwater Vehicles Challenge—Europe (SAUC-e), European Robotics League (ERL), Singapore AUV Challenge, and RobotX. While these events significantly contribute to the engineering education and careers of students, what I consider is missing is the transfer of knowledge across generations of students. *I will support knowledge transfer events at various student competitions, publications in IEEE OES publications; and organization of tutorials in order to boost excellence in marine robotics competitions.*



JOHN R. POTTER (M'96-SM'98-F'18) is a Fellow of the IEEE and an Associate Editor of the OES *Journal of Oceanic Engineering*. He has a B.Sc. from Bristol and a PhD. in Glaciology and Oceanography from Cambridge for his research in the Antarctic, where he spent four consecutive summers. He was awarded the Polar Medal for this work by Queen Elizabeth II in 1988.

In 2004–2005 he took a year ‘seabatical’ with his family to circumnavigate the Indian Ocean by sailboat on a sponsored voyage of research, public outreach and secondary school education to increase awareness of the plight of the oceans from pollution and climate change. The project interacted with over 3000 school children, generated environmentally-focussed maritime articles in every edition of Asia Geographic for an entire year, and generated groundbreaking peer-reviewed publications on persistent organic pollutants in the Indian Ocean, which continue to draw citations.

Dr. Potter has three decades of experience in marine scientific research, engineering management & technology development with a holistic ‘big picture’ view and environmental focus, the last 20 years’ in senior management and leadership roles. He also has 10 years’ experience facilitating, coaching & training personal performance & leadership skills, change-management, team building, relationship management & corporate strategy and is adept at driving inclusive consensus through discussion and dialogue in management committee environments. Dr. Potter has served three terms on the IEEE OES Administrative Committee in the past 12 years, founded the Singapore OES section and was co-chair of one of the first OCEANS to be held in Asia, OCEANS Singapore 2005.

He has a proven track record of recognising and developing novel opportunities, leading award-winning projects such as the ‘JANUS’ underwater communications standard and scientific and engineering projects such as ‘ADONIS’ and ‘ROMANIS’.

Dr. Potter has broad experience in dealing with multi-national governmental, academic, military & industrial organisations from the Americas through Europe, to Asia, demonstrated by numerous multi-million grants and awards from US, European and Asian funding sources over the span of three decades. Co-founder of the Tropical Marine Science Institute and Founder of the Acoustic Research Laboratory in the National University of Singapore (ranked #15 in the world) he led these organisations from inception, through growth, to sustainable, internationally-recognised centres of excellence.

John is an International Fellow of the Explorers Club, Member MTS, Life Member of the Marine Mammal Society, PADI Master Scuba Diver Trainer, TDI Nitrox and ECC Rebreather Diver and a Private Pilot (Gliders and Gyrocopters).

It is no longer true that he neither owns nor operates a television.

Statement: I am proud to have been an active OES volunteer for more than 20 years, founding the OES Singapore Section in 2000, co-chairing the first IEEE OES OCEANS conference and exhibition in Asia (OCEANS Singapore 2005) and serving on the organizing committee of OCEANS Genova 2015. I have published extensively in JOE and the Beacon, co-chaired five

IEEE OES conferences, and have been a guest editor for six JOE Special Issues. I have also served three terms on the OES AdCom so far, dating back to 2007, and look forward to serving a fourth, should the membership see fit to re-elect me.

I believe we live, as Asians often say (with a sense of a double-edged sword) in interesting times. The traditional value of a society such as OES is in offering services such as access to technical publications and interaction with peers, mentorship and awareness of the latest developments in the field. To a large extent, these are now going digital. Publications, formerly printed, have become online resources, social networks such as LinkedIn now provide online community interaction and job forums. So to remain relevant and valuable to its members, traditional societies (and OES is no exception) need to reinvent themselves to continue delivering value to members. This does not mean abandoning core values, or competencies, but it does mean pivoting the business model to new delivery channels, taking advantage of new technologies to deliver increased value to members. That is why I believe initiatives such as including code and data in peer-reviewed publications (as our new Editor in Chief of *JOE* has done), reaching out through social media and young professional development activities, providing personal mentorship interactions for students and young professionals, to name a few, are so important. The one thing that the digital age has not been able to copy is the value of actual

physical gatherings of members, where face-to-face interaction and real networking happens, vital elements of OES activities. There is no substitute for personal presence and interaction, and the OCEANS conference and exhibition is a flagship event where all this comes together. At the same time, the digital age has globalized communication, connecting people from all over the world, and OES is following suit. Based in Europe, with an extensive network spanning Australasia and the US, I believe that I can be of unique value in supporting OES to recruit and engage a wider membership.

It should come as no surprise, then, that I am a passionate advocate of developing both digital and personal interactive services for our members, with particular focus on students and young professional development, through conferences, workshops and particularly OCEANS, facilitating exchange of knowledge between our members and communities in emerging and frontier research domains. I am excited by the opportunity to contribute to the development of some of these areas over the next few years, which I believe will be critical to establishing the future health and vibrancy of the OES, and its contribution to the health of the planet through awareness and advocacy.

If you have any questions about the IEEE Oceanic Engineering Society voting process, please contact ieee-oevote@ieee.org or +1 732 562 3904.

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University of Zagreb IEEE OES Student Branch Chapter Activities

Anja Babić, Nadir Kapetanović, and Igor Kvasić

In the months since its official founding, members of the University of Zagreb IEEE OES Student Branch Chapter have been hard at work on several fronts.

Throughout March and April our student branch members took several trips in order to participate in conducting extensive bathymetric measurements in Plitvice Lakes National Park in



Lake Galovac at Plitvice, one of the several surveyed lakes.



The PlaDyBath platform ready to begin bathymetric survey of the lakes.



Nadir Kapetanović preparing the survey mission.



Barbara Arbanas, Ivan Lončar, and Filip Mandić preparing the aMussel and aPad marine robots for deployment at lake Jarun.



Ivan Lončar and Goran Vasilević preparing the aMussel swarm for its long-term monitoring mission.

Croatia. This national park is the oldest and largest national park in the Republic of Croatia. The process of tufa formation, which results in the building of the tufa, or travertine, barriers and which resulted in the creation of the lakes, is the outstanding universal value for which the Plitvice Lakes were internationally recognized on 26 October 1979 with their inscription onto the UNESCO World Heritage List.

The lake system is comprised of 16 named and several smaller unnamed lakes, cascading one into the next. Due to the geological substrate and characteristic hydrogeological conditions, the lake system has been divided into the Upper and Lower lakes, ending in the impressive waterfalls Sastavci, with the Korana River springing under the base of the falls.

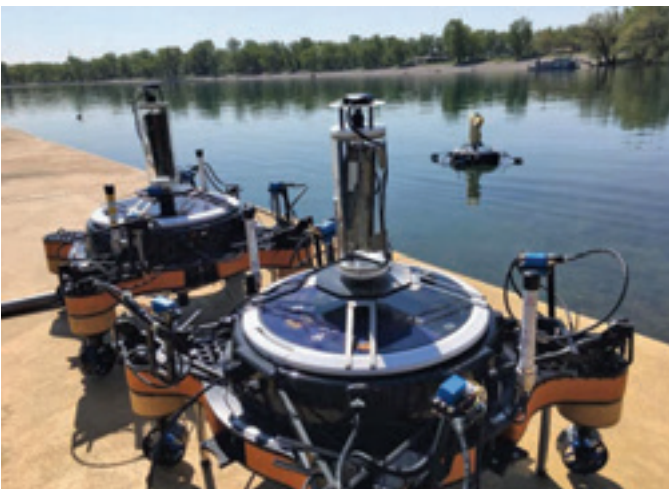
The goal of profiling and measuring the depth of the lakes was to enable detailed environmental monitoring of tufa formation and changes over time. Bathymetric surveys were performed by an autonomous surface vehicle named PlaDyBath,



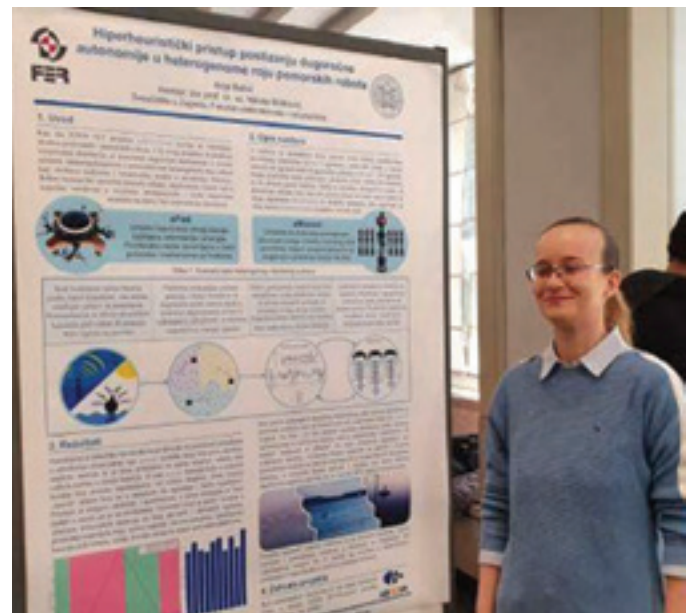
Anja Babić, Filip Mandić, Ivan Lončar, and Goran Vasiljević monitoring mission progress during cooperative behaviour experiments at lake Jarun.



Student branch chapter advisor Nikola Mišković during the PhD Day event opening.



aPad platforms being deployed at lake Jarun.



Anja Babić presenting a poster of her doctoral research in marine robotics during the PhD Day event.



The marine robotics exhibition at the University of Zagreb Faculty of Electrical Engineering and Computing.



aPad and aMussel robots being introduced to elementary and high school students.

mounted with a multibeam sonar. The team surveyed three out of four of the Lower Lakes, and eight out of twelve of the Upper Lakes. Save for the two largest lakes in the park several years ago, these lakes had never previously been surveyed with sonar technology. Working in the unique and untouched environment of the national park, with often unwelcoming terrain as well as strict demands on preservation and high ecological standards, was challenging as well as extremely rewarding and made for a very useful and informative—and striking—experience.

Next, good use was made of a handful of sunny days in mid-April and several exciting field experiments at Zagreb's popular lake Jarun were conducted, featuring new cooperative behaviours developed for marine robot interactions within the EU Horizon 2020 subCULTron project which the student chapter is heavily involved in. These tests in a realistic environment were conducted as part of preparations for upcoming field experiments and deployment in the Venice Lagoon in July 2019. There the robotic swarm will have to conduct autonomous long-term environmental monitoring of several critical points in the lagoon, in order to collect useful data on the *anoxia* phenomenon of changing oxygen concentration levels within the water.

Not neglecting the more academic side of things, members of the chapter took part in the Faculty of Electrical Engineering and Computing PhD Day. This is an event inspired by top universities from around the world, as an open gathering where doctoral students publicly present their research results, and everyone interested can get an insight into the diversity and quality of scientific work at the Faculty. Student chapter members presented their research and attended several interesting talks about experiences of young researchers in academia and industry, receiving useful advice,



Igor Kvasić presenting marine robots and vehicles before a captivated audience.

guidance, as well as a motivational boost for becoming successful doctoral students.

Furthermore, the IEEE OES student chapter members presented some of their work during the Croatian Science Festival which is a week-long outreach and dissemination event whose goal is to bring science closer to the general public. The manifestation is held simultaneously in the Technical Museum Nikola Tesla, most Croatian universities, and many museums in various cities. Its lectures, exhibitions, workshops, and presentations are designed for participants of all ages, so many elementary and high school students had a chance to see and learn something about marine robotics and the exploration of the underwater world.

Next to look forward to on the agenda is attending OCEANS 2019 in Marseille, where members of the student branch chapter will be presenting several papers, as well as getting to better know the wider IEEE OES community.

The University of Southern Mississippi Student Branch Chapter Activities Report

Courtney Bouchard, Laura Hode

Following the launch of the Ocean Engineering program at the University of Southern Mississippi (USM), students petitioned to form a new IEEE Oceanic Engineering Society (OES) student branch chapter in 2018. Ultimately, we want the chapter to fulfill three major goals: social outreach, career development through networking, and increased conference attendance. In regard to the last goal, three USM students were sponsored to attend the OCEANS 2018 conference in Charleston, South Carolina. The conference highlighted the opportunities that IEEE OES has to offer students. While we look forward to future conferences, networking, and research and development opportunities, we want to highlight the social outreach events that have comprised the bulk of our chapter's early activities.



USM-OES-SBC officers (left to right: Courtney Bouchard, Laura Hode, Sam Glasscock, Cameron Heckman) with a USM glider and AUV.

USM's Division of Marine Science is located at Stennis Space Center and Gulfport (Mississippi). We have a unique opportunity to volunteer with the many organizations located on Stennis and along the Gulf Coast. NASA's Infinity Science Center has provided an exciting opportunity for the students at USM to volunteer with the local community. Our student branch chapter has been volunteering regularly at Scout Saturdays at the Infinity Center where several hundred boy scouts and girl scouts come for a day of learning and to earn badges for their activities. Each Scout Saturday is themed, and our student branch volunteers there create small activities to engage the students.

USM students have also been working with the Infinity Science Center on Homeschool Mondays. The event invites the many homeschooled children in the area to the center for the day to learn about the monthly theme. The USM students have a blast participating in this event and look forward to having more community outreach activities with the Infinity Science Center.

Across the Gulf Coast, there are plenty of opportunities for outreach. SeaPerch is an annual high school and middle school remotely operated vehicle (ROV) competition. The high school and middle school students build and operate the ROVs themselves, and the University of Southern Mississippi hosts one of the regional competitions. The 2019 Regional SeaPerch Competition took place at the Biloxi Natatorium. It is an honor to assist with the competition and a pleasure to see the students' excitement.

We have also assisted with the First Lego League Junior competition. This involved working the competition floor and teaching elementary school teams a variety of science concepts.



Stephan O'Brien at Scout Saturday playing the game Gulp! with a scout to learn about the food web and how harmful algal blooms can affect an ecosystem.



Laura Hode (Chair of USM OES SBC) teaching scouts about crater formation during intergalactic-themed Scout Saturday.

One of our most rewarding experiences has been helping with the Hurricane Bowl. The Hurricane Bowl is a regional competition for the National Ocean Science Bowl where high school students showcase their oceanographic knowledge. Teams come from states across the Gulf Coast to compete. Their level of knowledge and dedication are exemplary. The 2019 Hurricane Bowl took place at the Gulf Coast Research Laboratory.

On a monthly basis, the student branch chapter has been participating in beach cleanup. Recently, this has meant cleaning up a section of Mississippi beach with other local volunteers and taking a survey of what materials make up the bulk of the litter we find. We have now been volunteering long enough and consistently enough that other groups reach out to us to assist with additional events.

As part of our outreach activities, we try to pair with organizations and agencies at Stennis Space Center, at the various USM campus, and with local organizations in the area. We also work closely with our Marine Technology Society student branch chapter and Student Oceanographic Society, a student organization providing academic and networking assistance to graduate students. In this way, we can be better and more involved with a range of opportunities.

Opportunities for the Future

As we near the halfway point of our first year, the student branch chapter has been developing plans for our future. We



A high school team preparing to start the obstacle course of the SeaPerch competition with the ROV they built.

intend to start the fall semester with a mixer for students, faculty, and staff, and we intend to invite researchers from the organizations at Stennis and across the Gulf Coast to attend.

We are also excited to announce that a member of the student branch chapter will be attending OCEANS 2019 in Marseille, and we hope to send a representative to OCEANS 2019 in Seattle as well. Additionally, we plan to invite speakers to give seminars on Stennis.

Of course, community outreach will remain a priority. We look forward to collaborating with other companies and expanding our volunteering network. We appreciate the support of IEEE and OES, and we are happy to be part of the IEEE OES family.

Reflection for Singapore Autonomous Underwater Vehicle Challenge—the Comparison Between SAUVC and a Competition Held in Japan

Kenichi Fujita, Yuya Hamamatsu and Hiroya Yatagai (The University of Tokyo)

University of Tokyo students challenged the SAUVC for the first time supported by OES Japan student program. Enjoy the story!

1. Introduction

Singapore Autonomous Underwater Vehicle Challenge 2019[4] was held at Singapore Polytechnic on 8-11th March 2019. The event has been held annually since 2013, and this is the first time for a Japanese team to join this challenge.

This report provides an overview of the event including what we felt during the competition, especially about the difference between SAUVC and an underwater robot competition held in Japan, which we had attended.

2. Introduction of SAUVC

SAUVC has three rounds: video audition, qualification round, and final round.

In the video audition, teams have to upload a short video to show their AUV actually works. This year, this audition was

conducted around December 2018. 61 teams registered, and 40 teams, including our team, passed this round.

The next round is the qualification round. In this round, every team tries to make their AUV pass the gate 10m apart. The teams are ranked by the time to pass the gate. Top 15 teams qualify for the final stage.

The final round has the following 5 tasks (Fig. 1):

- (1) Navigation (10pt)**
- (2) Target acquisition (50pt)**
- (3) Target reacquisition (60pt)**
- (4) Localisation (40pt)**
- (5) Other bonuses (Time, size, weight) (52pt)**

(1) Navigation

The AUV passes through the 1.5 m height gate (the color of the left pole is red and the other pole is green). The AUV has to complete this task before proceeding to other tasks.

(2) Target Acquisition

Four drums are installed at the bottom of the pool. One is blue and the others are red (one red drum has a pinger inside). Dropping a ball in the blue drum gives 30pt, in the red drum with pinger gives 50pt, and in any other red drum gives 10pt.

(3) Target Reacquisition

After the task of Target Acquisition is completed, the AUV can try to pick up the ball in the drum. If the AUV reacquires the ball, the team gets the score.

(4) Localization

The AUV localizes a pole called “flare,” marked with a pinger, located somewhere in the main arena and bumps it to drop the golf ball on top of the flare.

3. Our Team

We had joined the AUV competition held in Kobe, Japan, in May 2018 (OCEANS'18 / Techno-Ocean 2018 Kobe (OTO'18))[6]. The tasks are swimming through a gate, touching a buoy, coming close to a pinger, dropping a ball, and landing on a plate.

Our vehicle ‘Minty-Roll’[1] successfully completed 3 tasks, swimming through the gate, touching a buoy, and dropping a ball (Fig. 2).

Three teams from The University of Tokyo, Kyushu polytechnic college, and Kyushu Institute of Technology joined, and our team got the first prize.

In October 2018, we heard OES Japan Chapter plans to give a scholarship for student teams to join SAUVC. Therefore, we applied and were successfully accepted.

To join SAUVC, we had to modify both hardware and software of the vehicle. In hardware, we added a kill-switch and changed the batteries. The size of the battery was too big to carry in airplanes, therefore we modified the AUV to use smaller batteries. In software, as we decided to focus on passing the gate and detecting the flare (because completing all the tasks seemed to be difficult for us), codes for the tasks were rewritten based on the previous program used for detecting a buoy at the competition in OTO' 18 (Fig. 3).

4. Our Struggle in Singapore

(1) Preparation Day (Fig. 4)

The first day of SAUVC had short guidance and preparation for qualification and final round. After giving a short presentation on our AUV to the judges, we moved to the pool and checked our AUV. We were worried that some parts could be broken during transportation, although it looked like no problem. Through the number of trials, we found the problem that one of four thrusters did not work well and the AUV could not go straight, once in ten times. We tried to detect the cause, but we could not.

(2) Qualification Round (Figs. 5, 6)

Our time slot was in the early morning. In our first and second trial, one thruster did not work well and our AUV swam to a different direction. The third trial was the most regrettable. Thrusters had no problem and our AUV swam straight to the gate. However, our AUV was slower than we expected. The AUV was programmed to move forward for 100 seconds. The AUV could not reach the gate before the AUV's thrusters

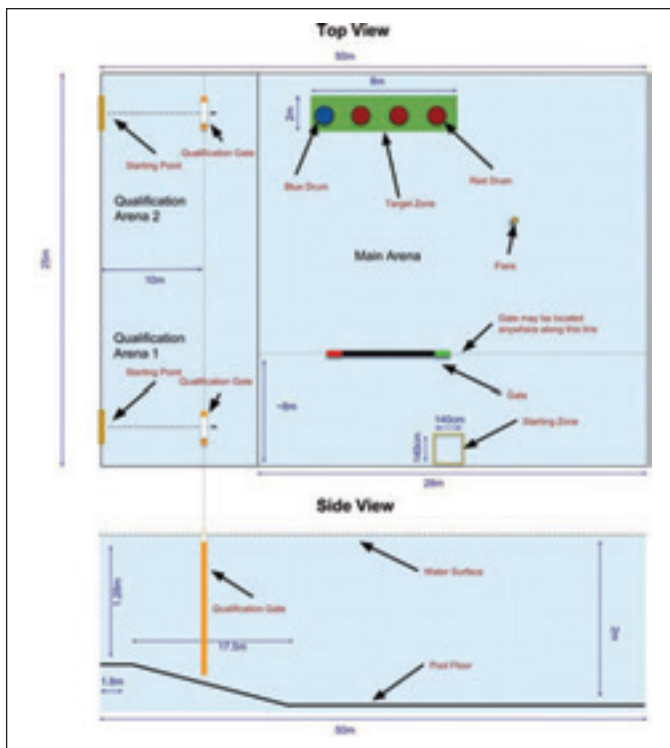


Figure 1. Top and side view of the main arena (SAUVC 2019) (<https://sauvc.org/rulebook/>).

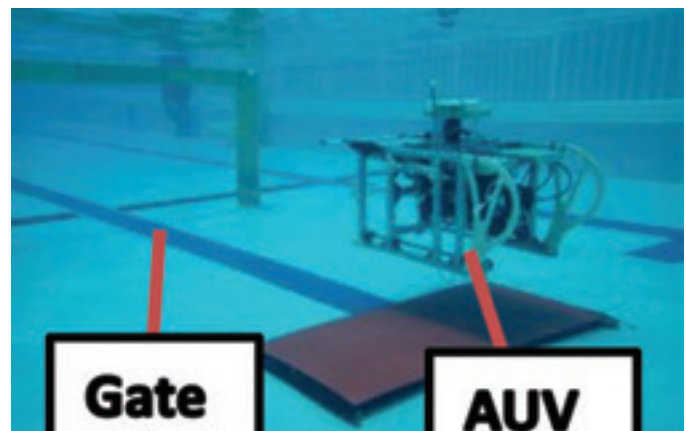


Figure 2. Our AUV passed through the gate (underwater robot competition at OCEANS'18 Kobe (OTO'18)) (<http://www.oceans18mtsieekobe.org/underwaterrobots-competition/>).



Figure 3. Our AUV approaching the buoy (underwater robot competition at OTO'18).



Figure 4. Preparation day.



Figure 5. Qualification round [5].

stopped. If we programmed to move for a longer time, the AUV would have passed the gate. The fourth trial was the same as the first and the second. Finally, the AUV could not pass through the gate, and we could not go to the final stage. Even if our AUV passed the gate, we would not be one of the top 15 teams, considering the time.

5. Differences Between the Two Events

We joined competitions both in Japan and in Singapore. We noticed there are some differences between the two competitions. In this section, the differences are discussed in the context of AUV, team, rule, and atmosphere.

(1) AUV

One of the biggest differences is the AUV's size and speed. The AUVs in SAUVC were smaller and faster compared with those found in OTO' 18. The size of our AUV is 0.67 m (height) \times 0.40 m (width) \times 0.46 m (length). This was the smallest in OTO' 18, but this is one of the biggest in SAUVC. The weight is also the same. Ours is 15 kg, but I heard the weight of many other AUVs in SAUVC is around 5 kg. One of the reasons seems to be that the AUVs have to move as fast as possible in SAUVC to pass the qualification round. More than half of the vehicles looked to use thrusters from Blue Robotics (T100 or T200) [2]. Because the thrusters are the same, smaller and lighter body is beneficial for gaining speed.

Another difference is the variety of the shape (Fig. 7 Left). The box-shaped AUV, from Far Eastern Federal University, is the champion of SAUVC 2019. The distinctive design attracted the attention of many participants. It is designed to be able to efficiently accomplish the tasks of the final round using sensors, such as a hydrophone and a camera, without sacrificing mobility. The center of gravity is placed to be lower for higher stability in water. This vehicle passed the qualification round at a relatively higher rank, and it also accomplished some tasks in the final round.

Another interesting vehicle is a UFO-like cylindrical AUV (Fig.7 Right) from National University of Singapore (NUS). The most distinctive structure is the heavy thruster placed at the

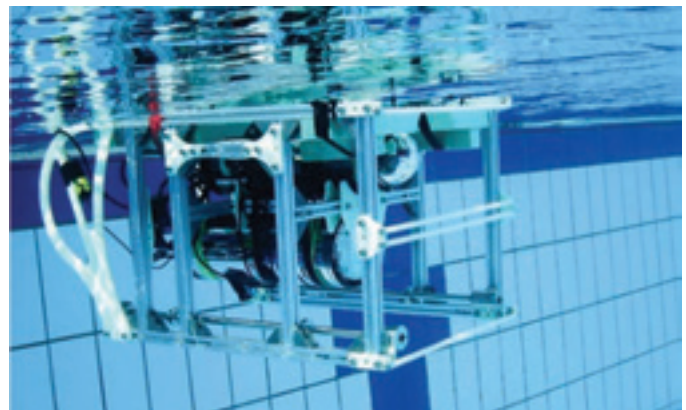


Figure 6. Our AUV in qualification round [5].

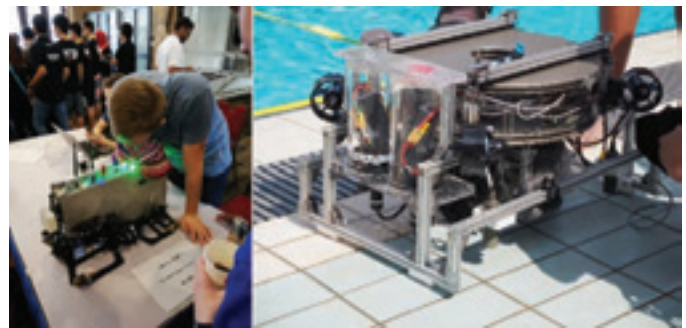


Figure 7. Various AUVs joined to SAUVC.

center of the cylinder. They also used a stereo camera for object detection and navigation. Though we heard the system did not work well, if it works it would bring great advantages for accomplishing tasks.

Our AUV was made aiming for robustness enough for the shallow sea. This is beneficial for winning Japanese competition and for research.

(2) Team

There was a big difference in the number of teams and team members. In OTO' 18, there were only 3 teams (10, including



Figure 8. Display of underwater scene.



Figure 9. Kenichi Fujita, Hiroya Yatagai and Yuya Hamamatsu (from L to R) [5].

freestyle category), but SAUVC had around 40 teams. Some participants in SAUVC were surprised to hear Japanese AUV competition only had 3 teams. Some teams in SAUVC had more than 10 members and averaged 5 members. Our team has only 3 members, which is almost average in OTO' 18. We were asked many times about how to build and operate the AUV with such a small team. Our answer was “we do everything.”

We found almost all the other teams in SAUVC are club teams. For example, Bumblebee, the team from NUS, is a robotics club participating in international competitions such as Robosub [3] and Robot X [4] besides SAUVC. In OTO18, two of the three teams consisted of graduate students. Many Japanese universities have club teams for robotics competitions, but their main focus is flying a robot like a drone or robots working on the ground.

(3) Rule

The recommended way of localization is different. In OTO'18, the recommended method for localization is line tracing. On the other hand, the main arena in SAUVC has no line to follow. Therefore, the main localization method was pinger and object detection.

Time to pass the task, the weight of the AUV are not important in Japanese competition. The weight is measured just to check that the vehicle is not heavier than a certain threshold. Therefore, we did not consider the speed to be important. We thought that we can go to the final round if the AUV passed the gate. This was not true. We were required to pass the gate much

faster in the qualification round. Although we planned to use a vision-based gate detection algorithm, some of the teams that passed the qualification round seemed not to use any visual feedback. Their AUVs seemed just to go straight using PID control based on gyro or compass.

(4) Atmosphere

Underwater scenes were displayed in real time by underwater cameras in SAUVC (Fig. 8). This was very effective, as it is often difficult to understand what is happening underwater because the underwater environment is not clearly seen from outside. In Japan, the chairperson tried to verbally explain the situation, but sometimes it is difficult.

We had a lot of chances to communicate with other teams in both events. We were able to move around the venue and ask questions about other AUVs. All the teams gathered at the end of the competition. That also helped our communication.

Almost all the teams in SAUVC had some SNS accounts. As the accounts have many followers, they are a good platform for advertisement. For some teams having sponsor companies, advertisement is especially important. SAUVC offered SNS award for the team which earned the highest number of “likes” during the event. Surprisingly, the winner earned 46,805 likes in 3 days. Japanese AUV community is not so big. SNS seems to be a good way to attract young people who are interested in underwater robots.

6. Conclusions

We learned a lot from SAUVC 2019, although we could not pass the qualification round. This is the first time for a Japanese team to join the event. There were some differences between Japanese competitions and SAUVC. We hope that more teams from Japan will join future SAUVC events. Also, we hope more people, especially more students, join the world of underwater robotics.

Acknowledgments

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References

- [1] H. Horimoto, T. Nishimura, T. Matsuda, AUV “Minty Roll” and results of “Underwater Robot Convention 2017 in JAM-STEAC”, IEEE OES Beacon Newsletter, 6(4), 77–79 (2017.12)
- [2] Blue Robotics—ROV and Marine Robotics Systems and Components, <https://www.bluerobotics.com/> (accessed 2019-05-07)
- [3] RoboSub | Robonation, <https://www.robonation.org/competition/robosub> (accessed 2019-05-07)
- [4] Maritime Robotx Challenge | AUVSI Foundation | Hawaii Robotics Competition 2016, <https://www.robotx.org/> (accessed 2019-05-07)
- [5] Singapore AUV Challenge, <https://sauvc.org/> (accessed 2019-05-07)
- [6] Underwater Robots Competition, <http://www.oceans18mtsieekobe.org/underwater-robots-competition/> (accessed 2019-05-07)

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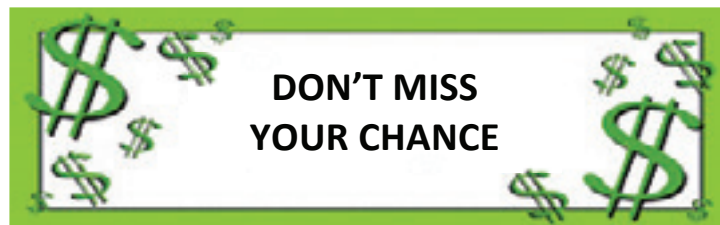


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