OES BEACON

Newsletter of the Oceanic Engineering Society

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Welcome to OCEANS 2022 Chennai
February 21-24

IEEE

IEEE Oceanic Engineering Society

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

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From the e-news IEEE Spectrum, The Institute Alert

The IEEE Car Rental Discount Program is available worldwide to members and employees of the IEEE. You may book directly with the provider, through the online booking tool (https://www.ieee.org/membership/services/travel/car-rental.html), or by contacting IEEE's preferred travel agency:

https://www.ieee.org/membership/services/travel/index.html

From the OES BEACON Editors

Harumi Sugimatsu and Robert Wernli

Welcome to the March 2022 issue of the Beacon. In the last issue we highlighted the OCEANS 2021 San Diego—Porto conference that once again brought us together in person … and virtually. With the success of OCEANS 2021, we continue to bring our members together again at OCEANS 2022 Chennai, which will also be hybrid. We'll have a report on that event in the June Beacon. And this year we also have OCEANS 2022 Hampton Roads, which will be in-person and also continue to have a virtual portion of the technical program. Haven't been to Hampton Roads, or Virginia Beach? Enjoy the Blast to the Past that highlights their OCEANS 2012 conference. We hope to see everyone there again.

As usual, our issue begins with a report from our President, which is followed by reports from our VPs for Professional Activities (VPPA), Technical Activities (VPTA), OCEANS (VPO) and Workshops and Symposia (VPWS). Overall, they show us that the future continues to get brighter regarding our events, chapter activities and our goals to encourage and increase the involvement of our young professionals and women in engineering; the VPPA report highlights our YP BOOST and WIE PROPEL Laureates. The Chapter Chairs (Cha-Cha) report highlights their recent meeting to address issues and encourage the Cha-Cha's to seek funding for future events; the VPWS report highlights those events that are coming in the near future.

The Journal EIC again provides recently released papers that are available to our members. And we'll be adding more papers to that list in the future as we hold our OCEANS 2022 Chennai and OCEANS 2022 Hampton Roads conferences. Also included is the latest report from our Webmaster that address the society web outreach to include the latest updates on Wikipedia.

Our Chapters continue to be active. This activity is highlighted in the reports from our Providence and Victoria chapters, which also includes an article on the Victoria Chapter's support of the University of Victoria submarine racing club (UVSRC). Three other events showcased include a report on the OES participation in SYMPOL 2021, held at the Cochin University of Science and Technology, Kochi, India. OES members are also active at the University of Zagreb SBC (Student Branch Chapter), Croatia, which organized a significant number of field trials during Breaking the Surface 2021. And finally, a report on the Underwater Robot Competition held at Kobe Port Island Sports Center last December as a concurrent event of Techno-Ocean2021.

Our members are certainly active and being recognized. Enjoy our Who's Who in the OES. Two additional reports are also provided on the latest society involvement in the UN Decade of Ocean Science for Sustainable Development 2021–2030; one from our VPTA and the other from the University of Southern Mississippi (Student Branch Chapter).

Harumi at UT15 Chennai. Wishing the great success of OCEANS 2022 Chennai!

Bob at OCEANS 2012 Hampton Roads with happy exhibitors who couldn't wait to come back. They get their wish this year.

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.

From the President

Christopher Whitt, OES President

Welcome to a new year!

I hope you and your loved ones are staying well. I see a lot of opportunity ahead, and I'm very much looking forward to increased Society energy and activity across the board—with your help!

A huge thank you to the Chennai OCEANS team for all the effort to put on another successful hybrid OCEANS conference. You can look forward to photos and reports in the next Beacon edition.

Of course, plans are still contingent on pandemic conditions, but we hope to see many of you in person in Hampton Roads in October for the next edition of OCEANS, and perhaps also in Houston for the Offshore Technology Conference in May.

The work of governing of the Society is always on-going. Our annual election of AdCom members happens in May and June. It is crucial that we elect hard-working and energetic representatives on AdCom. Please look for the emails sent to your IEEE member email address with voting information in the coming months. While nominations just closed for the 2022 election, please also consider nominating yourself, or a volunteer you know next year!

There are many opportunities to volunteer. Volunteering with your Society allows you to develop professional skills, connect with peers and mentors, and gain more exposure to the newest developments in our fields of engineering, science, and technology. This year we plan several volunteer information sessions, so if you would like to get involved, but don't know where to start, please join us at the next info session!

Congratulations to our new YP-BOOST and WIE-PROPEL Laureates, announced elsewhere in this issue. We look forward to your contribution to Society leadership over the coming years. There will be additional opportunities for designated volunteers related to the UN Ocean Decade. Look for information to be emailed out soon.

Once again, I'm truly excited to see the possibilities for bringing our communities together, in many ways in 2022!

VPTA Column

Venugopalan Pallayil, Vice President for Technical Activities, IEEE OES

OES colleagues,

We have stepped into another year and wish that it would be a better year than the one before. Indeed, it appears that the world is getting better in handling the pandemic and many countries have started to open for businesses, slowly but cautiously. This will surely add momentum to our technical and administrative activities in the coming months. The late Omicron virus scare has seen a much lower participation level than expected in our flagship conference OCEANS held in Chennai during 21–24 Feb 2022. The Ocean Science Meeting (OSM22), where OES is scheduled to organize many technical sessions and a Town Hall, has also been converted to a fully virtual event. The IEEE OES AUV Symposium in Singapore during Sept 2022 is planned to be a fully in-person event along with the Singapore AUV Challenge, an international student competition. This may be an opportunity for our AUV community to meet in person after a long time. All these are encouraging, but most of our activities under Technology Committees, Chapters and the Distinguished Lecture are likely to continue through virtual engagement.

Technology Committees (TC)

Many of our fellow colleagues have continued to sign up for various TCs and the numbers have gone up from last year. This indeed shows the willingness and interest of OES members to get engaged and participate in our technical activities. This is a great resource for our technical and volunteering activities. So, please take this opportunity to engage with them by organizing virtual meetings, technical talks, workshops, and symposia. The new list of sign-ups will be shared shortly with all TC Chairs. The OES members are also encouraged to identify, where there are technology gaps, and propose new TCs to build interest among our members.

Chapter Activities

I would like to welcome Ms. Amy Debb, a new volunteer who is helping our chapter coordinator Dr Gerardo Acosta (Gerry) to

organize chapter chairs (Cha-Cha) meetings and briefings. They together organized two virtual meetings on 16th and 17th Feb 2022. These meetings were well attended, and Gerry will carry a separate report on these meetings and outcomes. Thanks to them for a great job and well done! We would like to remind the Chapter Chairs and Student Branch Chapter coordinators to take advantage of our DL programme and get to hear the experts in different technical fields related to oceanic engineering.

Distinguished Lecturers (DL)

Starting this year, we have 14 DLs with expertise in varying topics. Our website will soon be updated with the details of four new DLs and their fields of interest. I wish to propose that we start a DL calendar where the availability of DLs for the current year is listed along with the topics. This would make it easier for those who would like to organize lectures to plan early and engage with relevant DLs. A separate website for DLs is also in my agenda for this year. Due to financial constraints at the society level, there will be no travel support this year as well for those who wish to give the lectures in person.

The call for new DLs for the period 2023–25 has been announced and is available in this edition of Beacon. The involvement of TC Chairs in identifying, endorsing, and proposing new candidates is key to the success of this programme. I request their active participation in this process. The candidates for DLs should be able to deliver talks to a broader audience of our community and hence should be prepared to be not too technical. Areas of emerging technologies and techniques should be given preference when selecting the topics.

Ocean Science Meeting 2022 (OSM 22)

As reported in the earlier editions of this Newsletter, IEEE OES is organizing virtual sessions covering five different technical areas during the OSM 22 event. A Town Hall on "Connecting Early Career Ocean Professionals with Academia" will be hosted on 25 Feb followed by other technical sessions. The full schedule of presentations is available on the OSM22 website and has also been circulated among the OES community through an e-Notice. At the time of writing this article, OSM22 is at its final preparation stages and by the time this edition of Beacon goes out, the program would have finished. Hence a detailed report on the OSM22 and OES participation will be covered in the next issue of Beacon Newsletter.

Feedback

What are your thoughts about IEEE OES Technical Activities? I welcome constructive suggestions and criticisms on VPTA activities. It would help to look at things from different perspectives and bring new ideas and thus make our technical activities more appealing and useful. Email me at vp-technical-activities@ieeeoes.org.

First Call for OES Distinguished Lecturers 2023–25 Nominations Close on July 31, 2022

Venugopalan Pallayil, Vice President for Technical Activities, IEEE OES

The IEEE Oceanic Engineering Society (OES) invites nominations for OES Distinguished Lecturers. The IEEE OES Distinguished Lecturers Program provides high quality speakers to the Oceanic Engineering Community, especially, OES Chapters, Student Branch Chapters, and Student Clubs. Appointment as an OES Distinguished Lecturer is a major Society recognition. The selected Distinguished Lecturers will be approved by the OES AdCom in one of their follow-up meetings.

Requirements

Distinguished Lectures are meant to appeal to a broader audience and not just technical experts. So, the talks should be prepared accordingly to attract as many members as possible from OES community.

Distinguished Lecturers will have

- high technical proficiency in their area
- demonstrated ability to make technical presentations that are inspiring to audiences of both experts and general audiences
- OES membership throughout the term of their appointment

Ability to deliver lectures using virtual tools is an added advantage.

Technology Committee Chairs and AdCom members are strongly encouraged to make nominations as long as there is no conflict of interest in the selection process. Nominations from Chapters as well as self-nominations are encouraged. All nominations are to be endorsed by the relevant TC. So, if you are looking for a nominator, we encourage you to contact the

chair of the most relevant OES Technology Committee. A nomination email to the Vice-President for Technical Activities (VPTA) should include a brief CV (1 page) of the nominee, contact details for the nominee, the nominator and endorsement by the relevant Technology Committee Chair.

The Distinguished Lecturer Committee will consider nominations, taking into account the diversity of topics and geographic spread of the pool of Distinguished Lecturers, in addition to the criteria given above.

Duties

The Distinguished Lecturers will start their three-year term in January 2023. Each Lecturer should submit topics in his/her field of expertise that will be posted on the Society Website. The Distinguished Lectures should be readily available to travel within their geographical area upon contact by the Chapters or appropriate organizations and are expected to add small diversions to their international travels to present lectures as opportunities arise. Reasonable travel expenses will be paid by the Distinguished Lecturer Program based on the availability of funds. Note that for the year 2022, there are no funds allocated for DL travels and DLs are encouraged to offer their talks using virtual platforms.

Closing Date

Nominations for a four-year term 2022–2025 close on **31 July 2022.**

Welcome to our YP BOOST and WIE PROPEL Laureates

Brandy Armstrong, VP Professional Activities
Roberto Petroccia, YP Liaison
Hari Vishnu, Earthzine Editor

As I begin my second term as your VP of Professional activities, I am proud of all of our accomplishments during these trying times and extremely thankful for our resilient volunteers. Despite COVID and restrictions, the OES teams working in the Professional Activities area have been very active in order to provide members with the ability to enhance their professional, social, economic and ethical status.

YP BOOST

Different and novel activities have been organized, bringing OES Young Professionals (YPs) into all spheres of Society's activities. OES has been giving particular importance to including the YPs in its leadership, via an award program called YP-BOOST aimed at promoting YPs involvement in Society leadership and events (https://ieeeoes.org/young-professionals/). Two new YP-BOOST Laureates, Dr Amy Deeb and Dr Mehdi Rahmati, were just enrolled in the program and will be fully included in the leadership of the OES for the following two years (2022–2023). Amy and Mehdi will take active roles in supporting the Society activities with special focus to the IEEE OCEANS Conferences where they will have the opportunity of networking/mentoring/tutoring (just to cite a few opportunities). They will participate in Society meetings, and the UN Ocean Decade among other activities. The IEEE

Dr. Amy Deeb, YP-BOOST Laureate 2022–2023. Dalhousie University, Nova Scotia, Canada."There are so many ways in which OES could support the Ocean Decade—building awareness, increasing collaborations with science-focused teams, strengthening regulatory and governmental relationships, to name a few—and I would be very pleased to work with the Ocean Decade Committee to further those projects."

Dr. Mehdi Rahmati, YP-BOOST Laureate 2022–2023. Cleveland State University, Ohio, USA. "Given the lessons learned from online meetings, and without disputing the clear benefits of in-person meet-ups, in the post-COVID years, I would do my best to suggest and, if approved, hold hybrid in-person and online presentations and seminars, because the hybridstyle can be more accessible to a larger group of audience, particularly those from low-income areas and those with disabilities."

OES YP Committee was also awarded in 2021 with the "IEEE Young Professionals Hall of Fame Award 2021" for the outstanding achievements that Inspire, Energize, Empower, and Engage Young Professionals.

The "IEEE Young Professionals Hall of Fame Award 2021" recognizes OES YPs active engagement in the Society, which encompasses many activities. YPs are writing and editing for our science outreach magazine, Earthzine (earthzine.org), which publishes articles on ocean and Earth science awareness, education and careers. YPs contribute articles to the Society's publication, OES Beacon, and support the ongoing UN Decade of Ocean sciences, targeting the next generation of early career professionals. YPs engaged with the community to contribute to the Virtual ECOPs (Early Career Ocean Professionals) day celebrations and performed a video testimonial campaign to encourage membership and participation in Society activities. Campaigns and panels are organized to encourage participation of women in engineering, to engage and support future YPs and ECOPs, to contribute to awareness on the importance of ocean science. Finally, OES YPs maintain the Society's social media handles and regularly contributed publicity material and graphics for the Society's events, helping spread awareness on the Society's thrust areas and upcoming conferences.

WIE PROPEL

Emulating our successful YP-BOOST program, the Society has developed a program for Women in Engineering (WIE) called PROPEL. The Society has received initiative funding to start our WIE-PROPEL program in 2022. The first two Laureates, Dr Giulia De Masi and Dr. Lu Ma, have been selected for the program and will be fully included in the leadership of the OES for the following two years (2022–2023). The program will provide an opportunity to the WIE-PROPEL awardees to represent and

Dr. Giulia De Masi, WIE-PROPEL Laureate 2022–2023. Technology Innovation Institute and Khalifa University, Abu Dhabi, UAE. "I would like to inspire the new generation of women, sharing my experience, transmitting the message that for a woman it is possible to have a family and at the same time develop her career and satisfy the intellectual curiosity, following her path in science and technology."

Dr. Lu Ma, WIE-PROPEL Laureate 2022–2023. Harbin Engineering University, China. "Now I am directing 12 graduate students, 5 of them are female. I believe most of them will devote themselves to working for Ocean Engineering after they graduate from school. These women students and I will proactively promote women's participation in Ocean Engineering."

advocate for WIE at OES events, giving them exposure and experience, and opportunity for career advancement.

The selected candidates will develop their relationship with the WIE Liaison, Executive and Administrative committee members, and other professional and student members, expanding their network and providing an opportunity for mentorship and career growth while increasing support of all Women in Engineering within the Oceanic Engineering Society.

Candidates chosen for 2022 will attend and participate in OCEANS 2022 Chennai, India (virtually), and OCEANS 2022 Hampton Roads, USA. In their first year the 2 chosen candidates will also attend the Women in Engineering International Leadership Conference (virtually) to develop leadership skills, which will aid them during the remainder of their term.

OES leadership is excited to get this new program started with such motivated and experienced candidates. Candidates will work with Society leadership to:

- actively implement the WIE pledge to work toward "gender-diversified panels at all IEEE OES meetings, conferences and events."
- actively participate in OCEANS including working with the WIE Liaison to plan a WIE panel and networking event
- compile a list of existing resources for planning inclusive scientific meetings for use by IEEE OES volunteers when organizing conferences, workshops and symposia
- proactively promote women's participation in Ocean Engineering
- give or organize two talks a year in a geographic region of the candidate's choice promoting WIE
- submit at least one article per year to either the Beacon, Earthzine or an IEEE publication where they highlight their experience as a WIE-PROPEL candidate.

It is exciting to see these programs take off and be successful. Previous YP-BOOST Laureates are actively engaged in several areas of OES leadership. We look forward to the 2022 class of YP-BOOST and WIE-PROPEL Laureates adding their energy and creativity to our volunteer leadership team. Again, please join me in welcoming Amy, Mehdi, Giulia and Lu as new leaders engaged in improving our Society's support for Young Professionals and Women in Engineering.

From the Vice President for Workshops & Symposia

Fausto Ferreira, Vice President for W&S

As mentioned in the last Beacon, the Guidelines for Workshops & Symposia Organization have been updated and approved. Thanks again to the volunteers that helped updating these. The guidelines have been distributed to prospective conference organizers and are available online at https://ieeeoes.org/conferences/workshops-and-symposia/ If you are interested in organizing an OES workshop, please check the website and contact me for any doubt or question. Bear in mind the different timelines for different types of sponsorships and make sure you submit your sponsorship request on time for approval. For 2023 conferences with a financial commitment, requests should come to me during Spring 2022.

The work on drafting Policies and Procedures (PnP) for VPWS has started and I hope to have them approved by AdCom in the first half of 2022. After this step, nominations to the Workshops & Symposia Committee will follow.

Looking at 2022, the year will be busy with a series of OES workshops, symposia and competitions. These will take place either in hybrid, virtual or in-presence mode and I am sure they will keep being high quality meetings.

Symposium on Ocean Technology (SYMPOL) 2021

The International Symposium on Ocean Technology (SYMPOL) 2021 took place in Kochi, India (and online), from the 9th to the 11th of December, 2021. There were 36 papers submitted of which 29 were accepted. Besides technical presentations, the symposium included a series of keynote talks and a workshop. Make sure you check the dedicated article in this newsletter for more information.

Ocean Sciences Meeting 2022

By the time this newsletter is published, the Ocean Sciences Meeting (OSM'22) will be finished. This will be reported in the next Beacon but I am sure that the OES sponsored sessions and the Town Hall connecting early career professionals with industry and academia will be not only interesting but well attended. More info can be found on https://www.aslo.org/osm2022/.

Underwater Communications and Networking (UCOMMS) 2022—Save the Date!

The 2022 Sixth Underwater Communications and Networking (UCOMMS) will take place in Lerici, Italy, from 30 August to 1 September. This will be the 10th anniversary of this high-quality single-track conference. The call for papers will be

launched soon, follow the official website https://ucomms.net/ for all updates.

Robotics for Asset Maintenance and Inspection (RAMI) Marine Robots 2022 Competition

The first RAMI Marine Robots competition will be held at the NATO STO Centre for Maritime Research and Experimentation (CMRE) in La Spezia, Italy, from 10 to 15 July 2022. The competition will challenge the Autonomous Underwater Vehicles (AUVs) of participant teams to accomplish Inspection & Maintenance tasks. This competition builds on the experience of the successful European Robotics League (ERL) Emergency. The call for participation is out and all details can be found in https://metricsproject.eu/inspection-maintenance/rami-physical-campaign-marine/ Apply by the 15th of April!

2022 IEEE OES Autonomous Underwater Vehicles (AUV) Symposium

The IEEE OES Autonomous Underwater Vehicles (AUV) 2022 is currently planned to take place in Singapore from the 19th to the 21st of September, 2022. The call for papers is out and the deadline for submission is 29 April! This is a high-level single track symposium that has been growing in attendees over the past few years and highly recommended for AUV practitioners. Check the website for more information and instructions on paper submission http://auv2022.org/

This symposium will be followed by the Singapore AUV Challenge from the 23rd to the 26th of September https://sauvc.org/

Breaking the Surface 2022—Save the Date!

The 14th International Interdisciplinary Field Workshop of Maritime Robotics and Applications—Breaking the Surface (BTS) 2022—will take place from the 25th to the 30th of September in Biograd na Moru, Croatia.

The OES University of Zagreb Student Branch Chapter will be involved in the organization of this workshop again and is planning some new features of the program. Follow the official website http://bts.fer.hr/ and Facebook page https://www.facebook.com/BtSCroatia for all updates.

Future Plans

While 2022 is a year rich with events, there are already confirmed workshops for 2023 as well! The International Symposium on Underwater Technology (UT23) will take place from the 6th to the 9th of March 2023 in Tokyo, Japan. Preliminary information is on the website http://www.ut23.org/

Finally, I would like to remind any OES members that wish to get involved in current workshops, or propose new ones, to contact me at vp-workshops-symposia@ieeeoes.org. We are here to serve the OES members and the larger community, and if you have ideas on improving current workshops, you are more than welcome to forward them to me!

OCEANS Conferences 2022

John Watson, OES Vice-President for OCEANS

By the time you read this OCEANS 2022 Chennai (https://chennai22.oceansconference.org) will, in all probability, be over. The impact of COVID-19 is still having an effect on our OCEANS program, and Chennai is no exception. Our local committee had to adopt and adapt to a hybrid conference, utilizing both in-person and virtual components. This they did with enthusiasm and diligence, and I can confidently predict that those who attended (in whatever form, virtual or in-person) will have had a worthwhile and successful, and enjoyable, conference. Given the extenuating circumstances I wish to extend, in advance, my thanks and congratulations to the LOC and all who have contributed to OCEANS in Chennai.

And so,,, onto OCEANS 2022 Hampton Roads (https://hamptonroads22.oceansconference.org). The Hampton Roads team are up and running towards October. They are also facing the same decision as Chennai: do they stick with in-person or adopt a virtual element? At the time of writing, and being aware of the ever-changing virus situation, it looks like a significant virtual component is likely. The Call for Papers will be issued following the Chennai conference. There will be an update on Hampton Roads in the next issue of BEACON.

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:

- F. Dong; Z. Li; Z. Hu; S. Wu, "The Effects of Vertical Correlation Characteristics on Vertical Array Gain Performance in Deep Water."
- M. Yang; H. Wang; K. Hu; G. Yi; Z. Wei, "IA-Net: An Inception-Attention-Module-Based Network for Classifying Underwater Images from Others."
- N. Sholl, K. Nelson, K. Mohseni , "Autonomous Underwater Vehicle Depth and Pitch Trajectory Tracking using Fiber-Reinforced Elastomer Bladders for Buoyancy Control."
- D. Sebino Terracciano; R. Costanzi; V. Manzari; M. Stifani; A. Caiti, "Passive Bearing Estimation Using a 2-D Acoustic Vector Sensor Mounted on a Hybrid Autonomous Underwater Vehicle."
- D. Tollefsen; W. S. Hodgkiss; S. E. Dosso; J. Bonnel; D. P. Knobles, "Probabilistic Estimation of Merchant Ship Source Levels in an Uncertain Shallow-Water Environment."
- K. Howarth; T. B. Neilsen; D. F. Van Komen; D. P. Knobles, "Seabed Classification Using a Convolutional Neural Network on Explosive Sounds."
- N. Favretto-Cristini; F. Wang; P. Cristini; T. Garlan; O. Morio; E. Diego Mercerat; V. Monteiller; A. Deschamps; E. Beucler, "Assessment of Risks Induced by Countermining Unexploded Large-Charge Historical Ordnance in a Shallow Water Environment: Part 2: Modeling of Seismo-Acoustic Wave Propagation."
- Z.-H. Michalopoulou; P. Gerstoft; D. Rios; W. S. Hodgkiss, "Tracking and Inversion Using Midfrequency Signals in the Seabed Characterization Experiment."
- S. D. Rajan; L. Wan; M. Badiey; P. S. Wilson, "Seabed Characterization Experiment: Analysis of Broadband Data."

From the OES Webmaster—New IEEE OES Wikipedia Site

Steve Holt, OES Webmaster

The IEEE OES has now had its presence on Wikipedia updated with the latest information. It begins with a description of our four part mission, which consists of our Vision, Objectives, Purpose and our Field of Interest. It then breaks further down into several activities, which are: Publications, Conferences, Workshops, and Symposia, Awards, Chapters, Technology Committees, Standing Committees on Standards, Distinguished Lecturers Program, Social Media and Outreach, Woman in Engineering and Young Professionals. An extensive References section was also added. Finally, an additional section of our RECON activities will be added soon.

This work consisted of input gathered from several of our OES Members who contribute to these various activities. As the OES Webmaster, I coordinated this effort and would like to thank everyone who forwarded info to me so that I could work with Wikipedia. I would also like to personally thank Hari Vishnu for his efforts in formatting all of the text to meet Wikipedia's rigid standards. To observe our Wikipedia presence, please go to: https://en.wikipedia.org/wiki/IEEE_Oceanic_Engineering_Society"

Hanumant Singh—Elevation to IEEE Fellow in 2021

Milica Stojanovic, OES Distinguished Lecturer

We are delighted to announce that a long-time OES member, Hanumant Singh, known to colleagues and friends alike as Hanu, was elevated to the rank of an IEEE Fellow in 2021. The fellow elevation recognizes Hanu "for the development of imaging techniques and autonomous systems for marine and polar applications."

Hanu's major contributions to the field of marine robotics are in the area of high-resolution optical and acoustic imaging. Computer vision techniques that draw on mosaicking, as well as simultaneous localization and mapping (SLAM), are among the principles he applied to bring to life ancient shipwrecks, hydrothermal vents, coral reefs and melting icebergs. His applications of modern imaging techniques to underwater exploration also led to the development of a new class of autonomous underwater vehicles known as Seabed. Specifically designed for imaging, these vehicles have been distributed to academic and government laboratories around the world. They have provided cost-effective deployments in shallow, deep and ice-covered waters around the world's oceans. Of particular note is the role they had in research expeditions that provided unprecedented access to the Arctic and Antarctic. Last but not the least, Hanu takes particular pleasure in working with his students and making them part of the team.

Taking the liberty to venture outside of a conventional "fellow" paragraph, I am reminded that behind every successful man there is a woman. I am thus very much compelled to give extra credit to Hanu's wife, Sandipa Singh, who has spent much of her engineering career at the Woods Hole Oceanographic Institution (WHOI) as part of the group that developed what is known as the WHOI acoustic modem—a tiny device that enables vehicles such as Seabed to communicate wirelessly to the mother ship. Congratulations to both of them, and to OES, on a well-deserved recognition.

When not on the ocean for work, Hanu enjoys the ocean for kitesurfing.

Request for Nominations for OES Awards 2022

Jerry Carroll, Chair of IEEE/OES Nominations and Appointments Committees

Each year at the beginning of January, the Oceanic Engineering Society is proposing a call for four Awards, with **a closing date of June 30th**. A reminder call for nominations is issued mid-March. The Awards Committee requests the nominator to provide the listing of qualifications of the nominee relevant to the award criteria, and up to 5 references, by filling the Awards Nomination on-line form(https://ieeeoes.org/menu/award-forms/oes-awards-nomination-form/).

The Awards descriptions are given below.

Request for Nominations for DTAA: The Distinguished Technical Achievement Award 2022

The Distinguished Technical Achievement Award is given to honor an outstanding technical contribution to oceanic engineering in either the fundamental or applied areas. The award recognizes either a single major invention or scientific contribution or a distinguished series of contributions over a long period of time.

Request for Nominations for DSA: The Distinguished Service Award 2022

The Distinguished Service Award is given to honor an individual IEEE OES member for outstanding contributions towards furthering the objectives of the Oceanic Engineering Society.

Company/Institution Award

The award will be presented to a corporation or institution that has significantly supported the activity and goals of OES through such areas as conference participation, patronage, technical innovation and technical or administrative participation.

Emeritus Award

The award will be presented to an OES member having been particularly important for the Society and who is no longer in any position of Society governance.

For more info, please visit the OES website as below: https://ieeeoes.org/menu/award-forms/

From your Chapter Coordinator

Gerardo "Gerry" Acosta, OES Chapter Coordinator

Gerardo Acosta, Chapter Coordinator

Good to get in touch with you to tell you about the recent Chapters Chairs meetings we have recently celebrated on the 16th and 17th of February. We split into two meetings to adapt to reasonable hours in different time zones all around the world. So, on February 16th most attendees were from Asia, and on the 17th, from Europe and Americas. In total, we were 25 enthusiastic people (and we are currently 33 Chapters + 12 SB Chapters, with 3 VACANT chairs, so it is a good percentage). Dr. Amy Deeb, OES YP-BOOST laureate, 22–23, and I prepared some slides with useful tips and advice for attendees, to move within our OES and manage chapters. Even when the Society is short of money to provide financial support for chapters during this year, due to the pandemic crisis that decreased our revenues, Chapter Chairs were instructed about funding opportunities and how to identify the appropriate funding stream. We asked them to make their requests as far in advance as possible (2 months or more ideally) for Chapter's funding on the order of $500–2000; larger amounts, such as for one-off initiatives, may also be considered but you must present the project to the AdCom. Specially to be considered is the Ocean Decade Initiative as another source for funding related activities. We also presented how to take advantage of the many facilities that we share by being part of the IEEE OES. For instance, the 15 Distinguished Lecturers that can give two or more talks per year and who are brilliant and experienced speakers on fascinating topics. We talked about the great number of awards that our Society is willing to spread among different regions, so we encourage Chapter Chairs to nominate their own chapter's members for them. Other important OES facilities that we can leverage are the information dissemination of meetings and activities through social media and this Beacon in particular.

The final half of the meetings were devoted to the Chapters' feedback. They shared their plans for this year, like the event that Hong-Kong chapter (Ch) is preparing for November, or the webinars that Indonesia Ch is programming for September. The SBCh of Shanghai is running two exciting field trips with prototype testing and academic lectures for this year. The Italian Ch is wishing to interact with other (geographically close) chapters to organize activities and get technical sponsorship of workshops and conferences. The United Kingdom and Republic of Ireland Chapter, the Chennai SBCh and the Singapore Ch and SBCh also shares their attractive plans for this year (international talks, ocean protection related activities, the AUV challenge, symposia and more). As you may see, OES is alive and active with tons of energy spread all over the world! Congratulations and success for all of them!

Stay upbeat and healthy and always tell me how I can help!

Chapter News

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

Providence Chapter

Technical Talk "General Overview of Offshore Wind"

Reported by David Leslie, Chapter Secretary

On November 18, 2021, Jeff Fodiak and Tim Reiher, engineers from Mayflower Wind, delivered a technical talk to the Providence Section, Ocean Engineering Chapter, titled "General Overview of Offshore Wind."

Jeff is the Electrical Systems Lead for Mayflower and a senior member of IEEE and the IEEE Power & Energy Society. His areas of expertise cover design of AC and DC electrical systems, design of offshore array and export cable systems, submarine and onshore cables, reliability analysis, due diligence, project strategy, planning requirements for electrical infrastructure, and power systems simulations.

Tim is the Offshore Export Array Cables Package Manager at Mayflower Wind. He worked previously for Shell Renewables and Energy Solutions. He has worked on planning, engineering, and execution of deep-water projects in the Gulf of Mexico and has strong experience in delivering large scale, complex projects in the offshore environment.

Mayflower Wind is a joint venture between Shell New Energies and Ocean Winds (which is itself a joint venture of EDP Renewables and ENGIE). The US Clean Energy plan proposes to develop 30,000 MW of offshore wind by 2030. There are 16 active federal lease areas off the Atlantic Coast with a total offshore wind pipeline of more than 35,000 MW to date. 1 MW is enough to power 1,000 homes. Mayflower Wind will be the largest contributor towards the Commonwealth of Massachusetts net-zero emissions goal. The

Mayflower project itself will eliminate over 4 million metric tons of greenhouse gas (GHGs) annually.

During the talk, Jeff and Tim spoke about their experiences in the Offshore Wind Industry and the opportunities which are ahead, as they see it. They gave an overview of offshore wind project components from wind farm design, cable routing and installation methods, landfall considerations, and survey and site assessment.

The Mayflower Wind project comprises 127,388 acres of outer continental shelf lease area south of Martha's Vineyard, Massachusetts. Up to 149 wind turbine generators (WTG) will be installed there along with offshore substation platforms (OSP). Turbines will be placed on a grid at 1 nm × 1 nm spacing. In order to maximize the potential of the lease area capacity, Mayflower is using dual export cable routes to deliver the power to electricity customers via interconnection points (POI) at Falmouth and Somerset, Massachusetts, providing 1,200 MW at each location. There is the potential for ~2,400 MW depending on technologies.

Several different offshore transmission technologies and topologies are available, depending on the power export requirements and length of the offshore cable section.

In the first "Medium Voltage AC Option," each WTG has a turbine that generates at a low level, usually less than 1 kV, and a transformer that can boost the voltage to ~34.5 kV or 69 kV for the recent, larger turbines. Cables from all WTG are combined and then transmitted to shore at 69 kV. The combined power can be about 80-100 MW max for each 69 kV cable. There are no offshore substation platforms, and the WTG string connects directly to the grid POI onshore. This option is suitable for nearshore projects less than 400 MW, and also for some deep-water floating projects.

A second "High Voltage AC Option" (HVAC) requires one or more offshore substations. These can be "traditional" OSPs with 2 or 3 transformers, plus 2 or 3 reactors, and 3–5 decks with enclosed rooms. The WTG transmit to the OSP at 69 kV, but voltage is stepped up at the OSP. Power may be exported at 138, 230, 345 kV. The option is suitable for export cable lengths up to ~120 km.

A third "High voltage DC Option" (HVDC) requires an offshore converter platform. The OSP has medium voltage to high voltage transformers, as well as an AC-to-DC converter. This is a significantly larger and more expensive OSP than an offshore AC platform. It is typically used for offshore distances >120 km, and for power of 900-1,200+ MW. At distances of 120 km or so this solution is cheaper. It is suitable for the larger power range, not the small (400 MW) projects.

The choice of offshore transmission technology depends also on AC and DC cable performance characteristics. HVAC is more efficient for short distance power delivery and HVDC more efficient for longer distances, HVAC has more redundancy than HVDC in terms of cable failures. HVAC requires more separately installed cables for power capacity beyond 300–400 MW. The capital cost of HVAC is less than HVDC for shorter distances, as HVDC has higher substation costs but lower cable costs.

Examples were shown of cable cross-sections. The HVDC cable bundle (~1200 MW) contained two armored wire bundles

An offshore windfarm.

(Cu, Al) for power, and an optical fiber, all contained in a 12-inch max. diameter oval encasement. The HVAC cable (~400 MW) contained three conductor bundles (Cu, Al) and an optical fiber bundle, all contained within a 12-inch diameter circular encasement.

Once the transmission technology is chosen, the hard work begins of determining how best to get the cables to shore. This stage is the "Siting and Routing Assessment." Desktop planning must consider the seabed with varying water depths, constraints and hazards, ecological sensitivities and existing infrastructure (telecommunication cables, gas pipelines, water pipelines). Options may be narrowed down if there are areas reserved for naval operations or anchorage, or prime areas for fishing activities. Cable installation operations are more complicated in shallow waters.

After initial desktop planning, survey data is acquired to "ground truth" the seabed route characteristics, which were assumed in the desktop studies. For further cable design and installation engineering, consideration is given to water depths, seabed slopes, and soil types/characteristics. Potential areas of archaeological sensitivity need to be avoided. Potential hazards such as boulders and sand waves need to be identified and characterized along the route. A "cable corridor" (500 m–1000 m wide) is surveyed to allow for "micro-routing" for avoidance of hazards and ecological sensitivity.

Surveys are conducted to acquire geophysical data, geotechnical core data, and benthic data within both the array lease area and along the offshore cable routes. Examples of survey types include Vessel-based geophysical surveys (multibeam bathymetry echo-sounder, side scan sonar, sub-bottom profiler, and gradiometer), Aircraft based LIDAR (light detection and ranging) bathymetry surveys, Vessel-based geotechnical surveys (Vibracores (shallow), CPTs (cone penetration testing, shallow or deep), Bore-holes (deep)), and Vessel based benthic and eelgrass surveys for understanding habitat for ecological considerations.

Cable installation may involve both seabed preparation and cable burial.: Grapnel runs, UXO (unexploded ordnance) clearance, dredging, and boulder clearance may all be performed to prepare the seabed. Cable burial methods depend on the seabed

type and can include the use of vertical injector, mechanical plow, Jetting plow / sled / ROV, Pre-Cut Plow, and Horizontal Directional Drilling (HDD).

HDD is employed as a landfall method to avoid impacts to sensitive nearshore environmental resources, including beaches. Permanent surface impacts will be minimal. Onshore cable vaults will be buried. Once onshore, cables will be conducted to onshore substations, typically while buried in trenches. The construction profile for a duct bank in a roadway will have conduits containing the two cables separated horizontally by about 15 inches at a depth of about 4–5 ft. Those conduits are encased in concrete, above which is a 30-inch-thick layer of FTB (fluidized thermal backfill), an 8-inch layer of concrete and about 6 inches of asphalt and binder. Alternatively, the cables may be directly buried without the use of conduits. An example showed two HVDC land cables buried about 15 inches apart at a depth of about 4 ft in a layer of thermal sand zone backfill, topped by a larger layer of native backfill.

Mayflower Wind conducted surveys in the lease and cable export areas in 2019, 2020 and 2021. The Mayflower Project itself is currently in a stage of development for which the construction and operations plan (COP) has been submitted and the program is undergoing environmental review. The proposed design includes a combination of the technologies described above. Two export cable routes are proposed.

An HVDC cable will run from Offshore to Onshore at Brayton Point: Turbines, inter array cables and OSP (HVDC Converter station) will be on the Outer Continental Shelf. The offshore underground export cable will make terminal landfall at Brayton Point at an onshore HVDC Converter station where DC-to-AC conversion is accomplished. From there they travel underground to a Point of Interconnection with the ISO New England grid system.

An HVAC cable will run from Offshore to Onshore Falmouth: Turbines, inter array cables and OSP (HVAC station) will be on the Outer Continental Shelf. The offshore underground export cable will make landfall and continue underground to an Onshore substation. The power will be transmitted from there to the POI interconnection switching station via overhead lines. At the POI it will be connected to the grid.

The route from the offshore lease area to Brayton Point is about 170 km and to Falmouth it is about 90 km. This dictated the choice of transmission technology. Dividing the power was driven by grid access. Connecting more than 1200 MW at a single connection point with a single circuit is difficult and, in fact, is not allowed because it is a system security issue.

This talk was an excellent technical talk for our chapter and resulted in an extensive period of post-talk questions.

- What is the nature of “thermal sand”?
- Will the fiber optic cables be used for distributed temperature or acoustic sensing (DTS, DAS)?
- Will there be any significant EM radiation from the cables that might affect fish or people in any way?
- Will there be continued acoustic or vibrational monitoring during installation and operation?
- Could the offshore installation be a host for further oceanographic monitoring equipment—AUVs?
- Has the choice of turbine technology been finalized?
- How is a field joint/splice performed offshore on these massive cables?
- What factors went into determining the planned grid spacing?
- …

With regard to the grid spacing issue, Chris Hardy from Mayflower Wind commented that all the New England lease holders worked with the US Coast Guard to come up with the 1 nautical mile spacing solution, which offers some of the widest transit lanes available anywhere in the world compared to other wind farms. This solution may be specific to this lease area given the history of concern and the history of fishing in and around New Bedford, Rhode Island and Long Island. Mayflower is proud of it because it does offer greater navigational safety for mariners.

Victoria Chapter

Student Support Activities

Reported by Nick Hall-Patch, Chapter Secretary

Over the last two years, the IEEE OES Victoria Chapter has been assisting with the funding for students’ ocean engineering capstone projects at the University of Victoria, in British Columbia, Canada. This support has already resulted in three short articles by students in the June, September and December 2020 issues of the Beacon, describing the results from their work. We are pleased to submit yet another student report in this issue of the Beacon (see the article in the page 41).

Underwater Robot Competition @ Techno-Ocean2021

Co-chairs: Masakazu Arima (Osaka Prefecture University) and Kazuo Ishii (Kyushu Institute of Technology)

Introduction

The Underwater Robot Competition was held at Kobe Port Island Sports Center on Saturday, December 11, 2021 as a concurrent event of Techno-Ocean2021, an international exhibition and conference on marine-related science and technology. The Competition categories were the 'AUV Division,' 'Free-style Division,' 'Junior Division,' 'Dream Underwater Robot Illustration Contest Division' and 'Marine Avatar Division.' Due to COVID-19 restrictions, only the AUV Division was held on site while the other Divisions were held online. In particular, the Marine Avatar Division was held at the Fukushima Robot Test Field and relayed to the Underwater Robot Competition in Kobe, the Ukedo fishing port in Fukushima, and Shimabara fishing port in Nagasaki. It was a successful event with 116 participants on site and 168 registered online viewers. This report provides an overview of the Competition including the rules, evaluation criteria, and results.

AUV Division

Scoring for the autonomous underwater vehicles (AUVs) with a weight of 50 kg or less is based on the following 3 criteria:

1) Introductory video
2) Competition on site
3) Operational & technical capabilities

The total score is 1000 points for the introductory video (300 points), competition on site (500 points), and operational & technical capabilities (200 points).

As shown in Fig. 1, the inside of the swimming pool is divided into Area0, Area1 and Area2. Starting from Area0, four round trips should be made between Area2. Area1 has a yellow buoy and Area2 has a red buoy so that a round trip between these buoys is a straight course. The following are the regular missions for each Area.

Regular missions are a "course round trip", "touch to buoys", "underwater gate passage", and "dive/surface", as shown in Fig. 2.

Bonus points are awarded for technically advanced missions (bonus challenges) such as "positioning and approaching the underwater acoustic lighthouse" and "raising a medal marking completion of all the missions". Teams should try to undertake these challenges. After 4 round trips, the AUV should surface

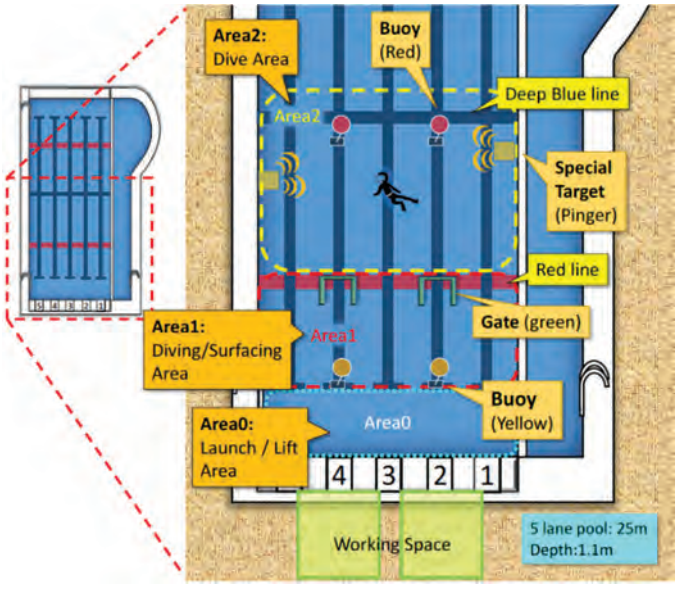


Fig. 1. Competition course in the swimming pool.

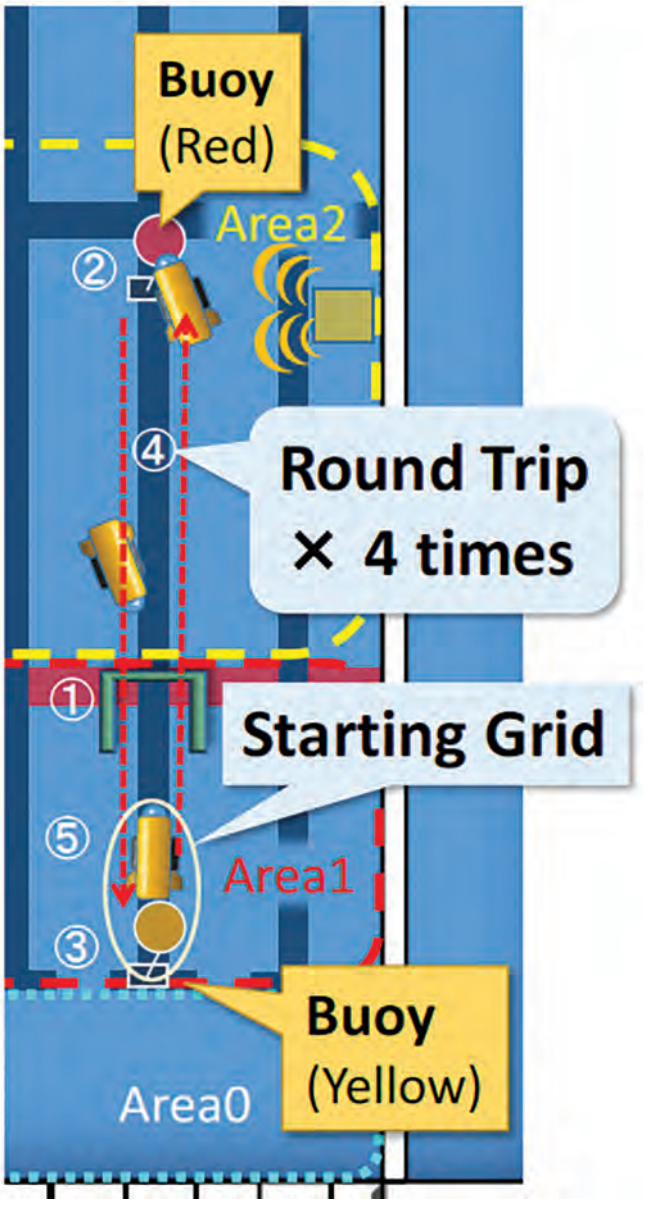


Fig. 2. Normal missions.

in Area0 or Area1 to indicate completion of the missions. Each team representative should then declare to the referee that they have reached the goal.

A maximum of 50 operational/technical points are given for the following 4 criteria:

A) Portability: Operational equipment judged to have excellent portability.
B) Failure resistance: Operational equipment judged to have excellent failure resistance.
C) Stability: Operational equipment judged to be excellent in stability.
D) Extensibility: Operational equipment judged to be highly expandable.

If an AUV loses control during the competition, it can be retrieved by a diver/swimmer and restarted.

The following contents are necessary in the Introductory video. Items (a) to (c) are required and item (d) is optional.

a) Team affiliation and team composition (self-introductions are optional)
b) Strategies, ingenuity, and technical challenges in the Aquarium competition
c) Appeal of the team's AUV concept and technology
d) Appeal of the vehicle's operational technology (optional)

Six teams competed in the AUV Division. One team's vehicle could not be submerged and the other five AUVs competed in the qualifying tournament, semi-finals and finals. Hamtaro of Osaka Prefecture University won the championship by steadily accumulating points from the qualifying round to the finals. The final results are shown on this report's last page.

Freestyle Division

The competition rules for the Freestyle Division are as follows:

Competition participants should create a video of about 5 minutes in a safe and accessible place. The judges will review each video, and individually evaluate and score the content quality, uniqueness of the underwater robot, its performance, perfection in executing freestyle maneuvers, and the quality of the handouts distributed, as described below:

1) Video quality and ease of understanding (presentation points): 20 points
2) Uniqueness of design concept (artistic points): 20 points
3) Operational performance (technical points): 10 points
4) Perfection in executing disclosed freestyle maneuvers (execution points): 30 points
5) Quality of the handouts (document points): 20 points

Taking each criterion into consideration, the total points are tallied to determine the ranking. For the execution of the

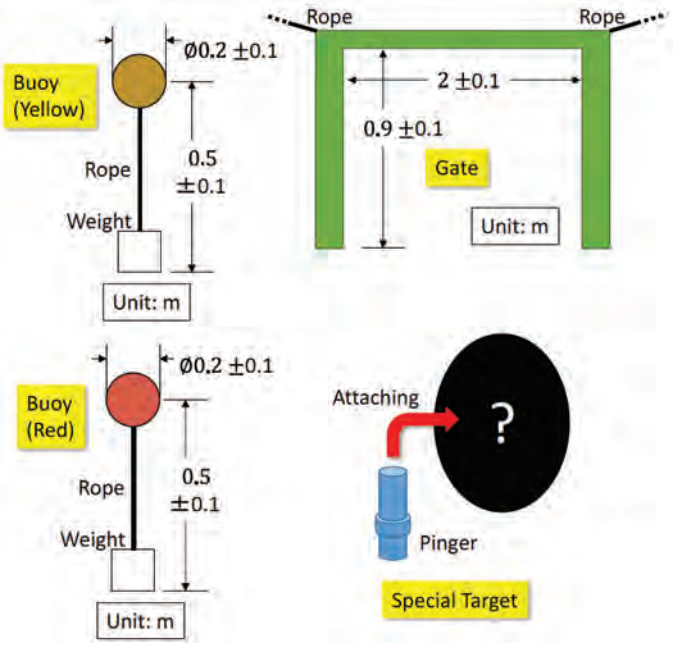


Fig. 3. Items used for underwater missions.

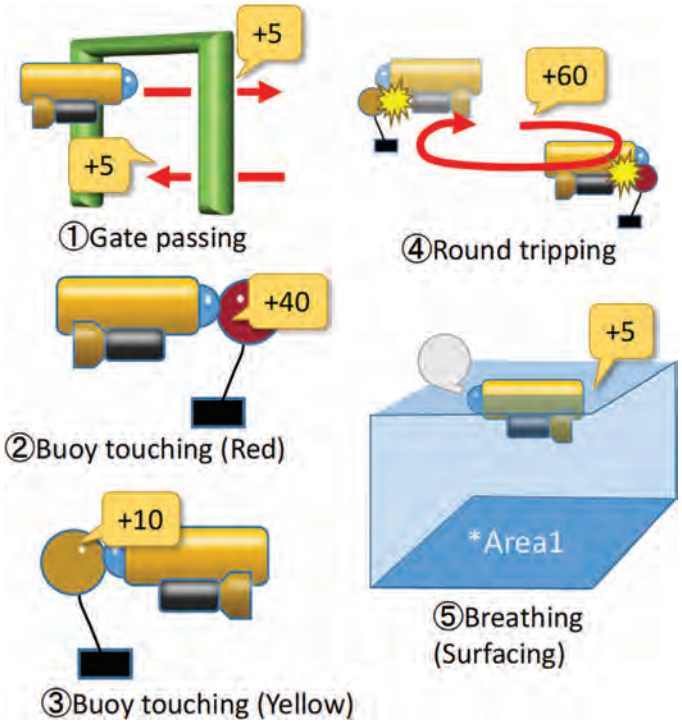


Fig. 4 Points for each mission.

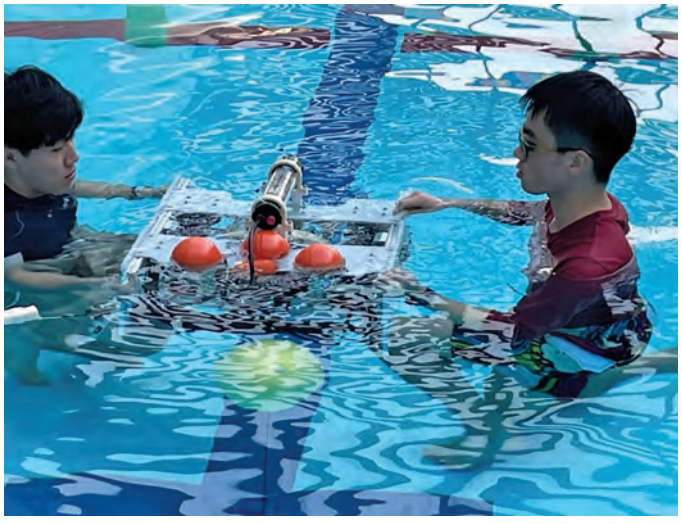


Fig. 5. Rescue and support scene by swimmers.

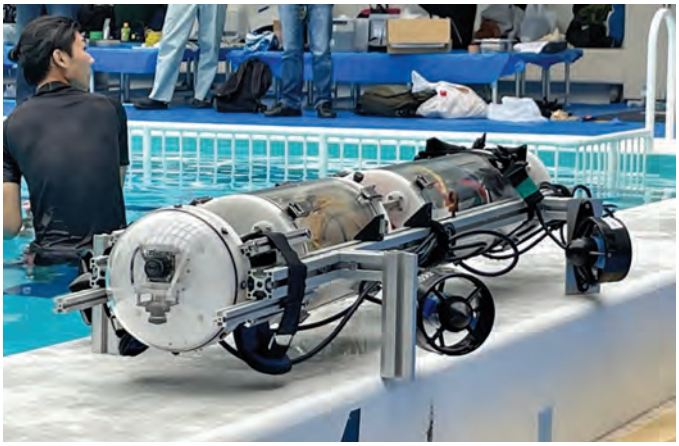


Fig. 6. Champion vehicle 'Hamtaro' of the AUV Division.

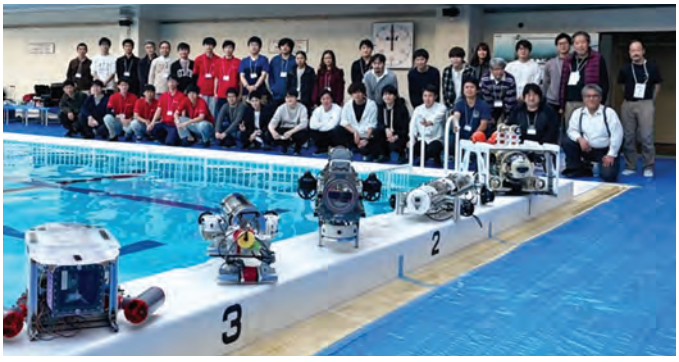


Fig. 7. Group photo of AUV Division participants and their AUVs at the Kobe Port Island Sports Center.

freestyle maneuvers, high reproducibility is desired. These maneuvers (for example, diving, surfacing, turns, jumps, etc.) should be clearly described in the handouts. Based on the judges' evaluations, the team showing the best robot performance was awarded the Freestyle Division Prize. Rankings of the five participating teams are shown at the end of this article.

Junior Division

The first screening is based on the posters submitted by the applicants, which addressed the following issues:

1) Why is marine debris a problem and what kind of problems does it cause? Are these investigated and explained in an easy-to-understand manner? [10 points]
2) Are the difficulties in the collection and disposal of marine debris investigated and clearly described? [10 points]
3) Are the efforts to address marine debris investigated and clearly described? [10 points]
4) Is the way in which the team would tackle the problem of marine debris using robots clearly explained? [10 points]
5) Are the sources for each team's information clearly specified? [10 points]

These 5 criteria were evaluated for a total of 50 points.

A robot creation kit and vinyl pool were distributed to the teams that passed the first screening. The robot should be developed based on the information provided in the distributed robot kit. In addition, an online pre-training session was held in late October. In this workshop, how to program a microcomputer and use the robot kit were explained.

When the robot is completed, a vinyl pool distributed by the Organizing Committee should be set up in a free space at school and the robot operated to collect the floating objects that simulate marine debris, also provided by the Committee. A picture of the landscape and a PR video of about 3 minutes with the following information should also be submitted:

- Video showing the idea behind the robot (about 2 min)
- Uncut video showing how the robot collects debris. (1 min)
- Finally, the number of pieces of debris collected in one minute should be displayed using captions.

Fourteen teams participated in the Junior Division, and after rigorous evaluation, a certificate of commendation was given to the teams showing excellent presentation and robot performance.

Fig. 8. Grand Prix of Dream Underwater Robot Illustration Contest (Lower grade group:"Robots that find and dig undersea resources").

Dream Underwater Robot Illustration Division

Elementary and junior high school students were invited to submit illustrations to the Organizing Committee, as an e-mail attachment, on the following theme:

Theme: As a maritime nation, what kind of robots would be active in places related to water in Japan such as the sea, rivers, lakes, and dams?

Ideas for robots that would work underwater in the future as well as drawings of imaginary underwater robots were also solicited. Not only drawings, but manga, illustrations, prints or concept designs were also accepted.

There were 13 applications from all over the country, and after vigorous review, a certificate of commendation and a supplementary prize were given to the most excellent and imaginative works.

Conclusions

Since 2006, underwater robot competitions have been held once or twice a year in Japan. The OCEANS'18 MTS/IEEE Underwater

Robot Competition was held at Kobe/Techno-Ocean 2018 (OTO'18), and it was memorable that many original underwater robots were gathered from both Japan and abroad. However, due to COVID-19 restrictions, Techno-Ocean was postponed for a year, and for the Techno-Ocean2021, we had no choice but to forgo participation from overseas. The competition and judging were held online except for the AUV Division, which was carried out smoothly on site without any major trouble. Previously, there were some underwater robots that could not demonstrate their abilities on site, however, by viewing the videos sent in advance that maximized the characteristics of the robots, we could make a fair evaluation. For future meetings, we would like to continue to improve the content while retaining the benefits of holding hybrid conferences.

We strongly hope that our usual international research collaborations and exchanges can be resumed as soon as possible so that we can once again welcome participants from overseas. Next time, we look forward to your participation.

Competition Results:

- **AUV Division** (Vehicle Name / Team Name / Affiliation)

Champion	Hamtaro / OPU / Osaka Prefecture University
2nd Prize	orca-olympia / KPC-AUV / Kyushu Polytechnic College
3rd Prize	Kurione / Aqua Lab. / Tokyo Institute of Technology
3rd Prize	KURO / Sato Lab / Nagasaki Institute of Applied Science

- **Free-style Division** (Vehicle Name / Team Name / Affiliation)

Champion	J.E.N.O.S. / Team-J.E.R.O.S. / Hiroshima Institute of Technology & Nishinippon Institute of Technology
2nd Prize	M.I.R.O.C.A./ Team-M.I.R.O.C.A. / Hiroshima Institute of Technology & Nishinippon Institute of Technology
Special Award	Seto Inland Sea / Industrial Technology Club / Okayama Shoka University High School

- **Junior Division** (Team Name / Affiliation)

Champion	Clean the sea with an underwater robot Team / Fukuoka Jyoto High School
2nd Prize	Underwater Suikou-san / Minamata High School
3rd Prize	YSYO / Fukuoka Jyoto High School
Best Poster Award	MTT / Fukuoka Jyoto High School
Best Presentation Award	Ryugei (Dragon Whale) / Fukuoka Jyoto High School
Best Score Award	Clean the sea with an underwater robot Team / Fukuoka Jyoto High School
Best Score Award	NiAScience / High School attached to Nagasaki Institute of Applied Science
Best Idea Award	Swimmy / Fukuoka Jyoto High School
Judges' Special Award	Keiai marine / Keiai Junior Highschool

- **Dream Underwater Robot Illustration Contest Division** (Title / Name (Age) / School Name)

<Lower grades: 1st and 2nd grades of elementary school>

Grand Prix	Robots that find and dig undersea resources / Takeda Aoi (6) / Koito Elementary School
Prize for Excellence	A fish robot that eats marine debris and lays eggs / Tamaki Maya (6) / Hisamoto Elementary School
Prize for Excellence	Sea cleaning robot / Takasaki Mai (6) / Kikugaoka Elementary School
Recognition Award	Fish shelter robot / Okuhira Risa (7) / Higashi Elementary School
Recognition Award	Robot that collects garbage / Yamaguchi Hukuhito (6) / Hibikino Elementary School
Best Idea Award	Underwater Robot / Iwasaki Rui (7) / Yobaru Elementary School

<Middle grades: 3rd and 4th grades of elementary school>

Grand Prix	Gold, Silver, Cobalt Jewel Picking Robot / Terauchi Masanari (9) / Moritsune Elementary School
Prize for Excellence	Fish amusement park / Wakabayashi Sakurako (8) / Nishi-Kasai Elementary School
Prize for Excellence	Octopus robot / Matsuo Rio (8) / Isegaoka Elementary School
Recognition Award	Undersea garbage disposal robot / Okuhira Sana (9) / Higashi Elementary School
Recognition Award	Pakomo: A robot that carries luggage underwater / Akahori Tsukasa (8) / Kitayama Elementary School
Recognition Award	Whale diving robot / Kamei Souma (9) / Kanda Elementary School

<Upper grades: 5th and 6th grades of elementary school>

Prize for Excellence	Shark robot / Oba Moe (10) / Kanda Elementary School

The Ocean Decade Technology & Innovation Informal Working Group—UN Decade of Oceans

Venugopalan Pallayil (Member, Technology & Innovation Informal Working Group)

Oceans, the globe's largest ecosystem, regulate our climate, provide food security and employment to people. It affects our weather conditions with 90% of the additional heat generated from global warming being stored in it. The First World Ocean Assessment released in 2016, however, found that much of the ocean is now seriously degraded and largely due to unscientific and uncontrolled human activities. In addition, the impact of multiple stressors on the ocean is projected to increase as the human population grows towards the expected 9 billion by 2050. The need for wide ranging plans of actions and partnerships to strengthen scientific knowledge and innovation about oceans have been identified during the First Global Planning Meeting for the UN Decade of Ocean Science for Sustainable Development 2021–2030. The main objective of these actions and partnerships are to increase our resilience against marine and coastal hazards and reverse the decline in the health of ocean. As mandated by the UN General Assembly, the Intergovernmental Oceanographic Commission (IOC) of UNESCO will coordinate the Decade's preparatory process, inviting the global ocean community to plan for the next ten years in ocean science and technology to deliver, together, **'the ocean we need for the future we want!.'** This decade is for nations to work together to generate the ocean science needed to support the sustainable development so that future generations are provided with a chance to live in a sustainable world.

Scientific understanding of the ocean's responses to pressures and management action is key to the sustainable development. Science-informed policy responses to global change and adaptation strategies are important as brought out in the tagline **'the science we need for the oceans we want.'** Technology and engineering solutions are instrumental for carrying out scientific studies. They have a crucial role to play in both informing research directions and in moving from science to solutions. Technological innovation is, therefore, necessary for achieving the vision of the Ocean Decade and, if leveraged in a timely manner, will lead to greater impacts at scale. For the success of UN Decade of Oceans objectives, it is therefore important to ensure technology is available, accessible and affordable to all stakeholders in a credible and timely manner. Wherever relevant technologies are not available, innovating new technological solutions and their implementation are also crucial.

The Technology & Innovation Informal Working Group (TIIWG) has been setup to serve the objective of a strong science-technology-innovation interface and provide strategic insight and inputs to the Ocean Decade Coordination Unit. As stated in the 'Terms of Reference', the task for this group is 'to ensure technology and innovation is leveraged, mainstreamed, and accessible and leads to implementation of impact-driven solutions for sustainable development for ocean.' The Working Group will address a large scope of cutting-edge and disruptive technologies and emerging trends, particularly the following, which are relevant to the Ocean Decade and its challenges.

- Autonomous platforms
- Advanced data processing including machine learning, and artificial intelligence
- Underwater acoustics and imaging
- Robotics and automation
- Augmented and virtual reality
- Mobility and miniaturization of sensors, and their applications in ocean sciences and related domains such as sustainable fisheries and seafood
- Deep sea exploration
- Renewable ocean energy and
- Transportation.

The present Working Group is comprised of 15 members from a range of stakeholder groups including government, intergovernmental organisations, private sector, NGOs, academia, and philanthropic Foundations. The members were recruited via invitation from the Executive Secretary of the I0C-UNESCO and taking into account geographic, gender and generational diversity. Members have expertise in the field of domain relevant to Ocean Decade Challenges and include ocean and marine technology, robotics and automation, data and artificial intelligence, mixed reality, underwater acoustics and imaging, prediction models, behavioural change, etc. The membership in the committee is for a period of two years, but renewable for another term. The group held its first annual meet on 21 Oct, 2021, and elected two Co-Chairs: Dr. Jyotika Virmani, CEO, Schmidt Ocean Institute, and Dr. Justin Manley, President, Just Innovation Inc., USA.

"This inaugural Technology & Innovation Informal Working Group seeks to bridge the gap between innovation and the use of technology in the field in order to improve our collective knowledge of the ocean. These experts have an incredible global awareness of disruptive technologies and trends, which is needed to ensure that science keeps pace with technological change, unlocks new discoveries, and provides the information to sustainably care for our ocean"–**Dr Virmani**.

"Driven by significant new investments, ocean technology is evolving rapidly, enabling new scientific understanding and new business models for sustainable use of the ocean,"–**Dr Manley**.

Ocean Remote Sensing Technology Committee

Ferdinando Nunziata, Paolo de Matthaeis, René Garello

The Ocean Remote Sensing TC is now led by Ferdinando Nunziata, Università di Napoli Parthenope, Napoli, Italy, and Co-chaired by Paolo de Matthaeis, NASA Goddard Space Flight Center, Greenbelt, MD, USA, and René Garello, IMT Atlantique, Brést, France.

To better disseminate TC activities, a new webpage has been prepared and will soon be online at https://ieeeoes.org/technical-activities/technology-committees/. The pandemic has limited our social contacts and travels, but we used this opportunity to offer virtual scientific events. In particular, the OES Remote Sensing TC and the OE Italy Chapter jointly organized two webinars (via Google Meet platform) to stimulate the discussion on two hot topics related to microwave remote sensing of ocean surface. Both the speakers agreed to have their speeches recorded and publicly available to a broader audience through the OES YouTube channel[1].

The first webinar, entitled "Image Ocean Microplastic Dynamics with Spaceborne Radar" was presented by Prof. Christopher Ruf, from the University of Michigan at Ann Arbor, USA, on January 19, 2022, at 3.30 CET.

Prof. Ruf (Fellow, IEEE) has been a recipient of several international awards and is Principal Investigator of the Cyclone Global Navigation Satellite System (GNSS) NASA Earth Venture Mission. His research interests include GNSS-Reflectometry remote sensing, microwave radiometry, atmosphere and ocean geophysical retrieval algorithm development, and sensor technology development.

The webinar focused on a new approach to the imaging of microplastics from space. Spaceborne radar measurements of ocean surface roughness are used to infer the reduction in responsiveness to wind-driven roughening caused by the presence of surfactant tracers of the microplastics. On a global scale over monthly time scales, time-lapse images derived from the satellite radar observations reveal seasonal changes in the microplastic mass density within the major ocean basin gyres,

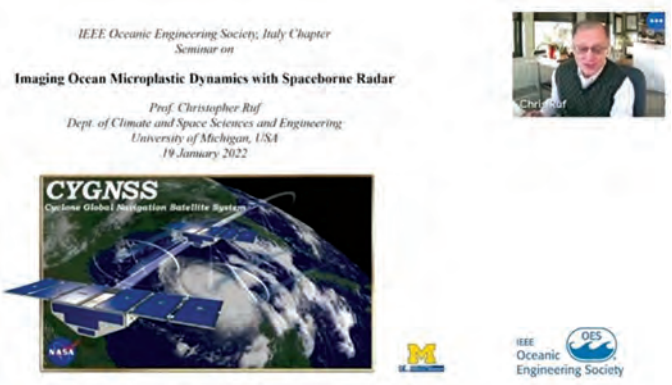


Figure 1. Screenshot of Prof. Ruf webinar.

which appear to be related to seasonal changes in ocean circulation patterns. On smaller spatial and temporal scales, weekly time-lapse images near the mouth of major rivers reveal episodic bursts of microplastic outflow from the river into the sea. The physical relationship between the presence of surfactants and the suppression of ocean surface roughening caused by winds has been investigated via a series of controlled wave tank experiments. Varying concentrations of surfactants are introduced onto the water surface, near-surface winds are generated in a controlled manner with variable speeds, and the surface roughness is measured directly. The results are found to be consistent with the empirical relationship found from the satellite measurements.

The second webinar, entitled "The effect of oil spills on the marine environment and coastal population—a quantitative interdisciplinary approach" was presented by Dr. Igal Berenshtein, Rosenstiel from the School of Marine and Atmospheric Science (RSMAS) of the University of Miami, USA, on February 3, 2022, at 16:00 CET.

Dr Berenshtein is a quantitative marine ecologist, studying complex interactions in the ocean combining advanced modelling techniques, data science, and empirical field and laboratory studies to tackle fundamental scientific and environmental

[1]https://www.youtube.com/channel/UC6wjVnDY2-BmzdS8LzxrdHQ/featured

Figure 2. Screenshot of Prof. Berenshtein webinar.

questions concerning the marine environment. Dr. Berenshtein is expected to start an Assistant professorship position at the Department of Marine Biology, at the University of Haifa, Israel, in summer 2022.

The webinar focused on quantitative spatio-temporally explicit frameworks linking visible oil slicks and in-situ toxic oil concentrations related to the Deepwater Horizon (DWH) oil spill, as well as quantitative frameworks linking possible oil spills, fisheries closures, fishing revenue loss, and social vulnerability. In the current era of rapid deterioration of our marine ecosystems, such research can increase the understanding of marine ecosystems, and may support effective management of marine resources.

Both webinars were advertised via eNotice and through the OE YP delegate and the Italy Section YP delegate. They were attended by approximately 25 scholars with a good level of interaction and several questions asked by the audience.

"There is Nothing—Absolutely Nothing—Half So Much Worth Doing as Simply Messing About in Boats" (Kenneth Grahame, The Wind in the Willows)

John Potter—IEEE Fellow, OES AdCom, Dist. Lecturer and Chair, Norway Chapter, Assoc. Ed. JOE.

So the famous children's story goes, enticing generations of young minds to stretch their imagination to the horizon, to take on the challenges of travel, change, and excitement that comes with an uncertain leap into the wide blue ocean, where the horizon changes hour by hour, day by day. An old-fashioned romantic dream, perhaps? Overtaken by the cumbersome realities and financial burdens of big research vessels, operated by professional crews? But what if I told you that this kind of dream has now come full circle, in this age of miniaturised and low-cost oceanographic sensing systems, with all that the romantic vision offers and more?

I am talking about a game-changer in ocean scientific research. No, not about how robotics and autonomous vehicles will change the face of ocean data collection (although they have, and will continue to do so in even greater measure). I'm talking about the next wave, smaller perhaps, but with an important niche that fits between the 'traditional' research vessel and the un-crewed autonomous or remotely-operated platform. Sailing boats.

Why sail, you ask? Well, because in order to reach thousands of miles offshore, to remote and inhospitable places without the infrastructure to refuel a motor vessel, an engine-driven research ship has to carry enough of its own fuel for the entire trip. That needs a bigger boat. Which burns more fuel, which needs larger tanks, which needs an even bigger boat.

Searching in paradise for the right spot to sample marine eDNA.

Fortunately, this version of Zeno's paradox converges, essentially because the mechanical power required to push a vessel's hull through the water increases as the square of its length, whereas its capacity to carry fuel increases as the cube of its length. But it means that for offshore work, a motor vessel must

Expedition crew, messing about in boats, on the foredeck of Jocara. Bathed in the light of the setting sun, yet the sky has turned storm titanium grey by an incoming squall system, which will bring heavy winds.

be at least ~50 m to be capable of operating anywhere in the world. And this is fine, if you can afford it and need to carry large equipment, with heavy winches to lift it, or need a sizeable scientific team. But you must find the $10,000–$20,000 a day that such a vessel demands in operating expenses. A sea trial of 20 days (and remember, it can take a week to get wherever you are going and a week to get back) might then require more than a quarter of a million dollars, before you even set foot on the gangway.

But a sailboat, with solar power, a watermaker and modern navigational electronics, is quite a different proposition. A sailboat, being wind-powered, does not need to carry vast amounts of fuel. With modern wind and solar energy conversion systems, a small auxiliary generator, and a watermaker, an ~18 m sailboat can be both completely seaworthy and support a scientific crew of perhaps 6 for up to 3 months without resupply.

Contrary to common thinking, a vessel does not have to be large to be seaworthy, even in the most savage storms. An empty wine bottle, well-corked, may survive the most powerful hurricane, while a super-tanker may not. OK, so it would not be a

Preparing eDNA sampling kits (left) and sorting rat DNA samples for storage and distribution to various analysis laboratories (right) on board Jocara.

The research expedition was multi-national (Netherlands, New Zealand, UK and USA) honoured in the traditional manner by flying courtesy flags from the port shrouds.

comfortable experience (even if, like Alice after eating her cake, you could fit inside) but you would survive. Even the uncertainty of heavy weather is now much reduced with affordable Iridium satellite connectivity, providing telephone, email and custom weather forecasts derived from the most sophisticated ocean-atmosphere models now available, lending considerable confidence to route planning and safety. Smaller boats also bring some advantages, being able to enter more restricted passages and navigate in shallower waters than their larger sisters.

Caution! Engineer at work! Installing a compact magnetometer onto a plastic unsinkable kayak.

Setting up the magnetometer for towing by the dinghy, with a ruggedized laptop and portable 12 VDC battery box—this is how we found some wrecks!

And here is the punchline. An 18 m sailboat, well founded and equipped with modern navigational aids and facilities comparable with many 'small' research vessels, probably costs only 10% of a 'traditional' research vessel. Suddenly, a sea trial that might have cost half a million dollars could perhaps be organized for $50 k. So why are we not seeing many more sailboats out doing research?

Firstly, this is a niche market. It only works if the number on the research team can be kept small, if there is no need for large and heavy equipment, and if the researchers are comfortable on a small vessel. Secondly, the size, weight, cost and power requirements of sophisticated ocean research equipment, everything from side-scan sonars to rugged laptops, has only recently come down to the point where it becomes possible to economically host genuinely top-notch research efforts from a small platform. Take the watermaker, for example. The last couple of decades have seen great improvements with the advent of energy recovery systems and membrane technologies, so that reverse osmosis desalination of substantial quantities of water are now within reach of a sailboat electrical power budget. A litre of pure drinking water can now be squeezed out of seawater for <18 kJ. Thirdly, you need a compact crew that has a very broad range of skills. Once out of sight of land, the crew must be able to fix anything that goes wrong, or do without it. In addition to redundant critical systems and spares, you need good sailors first and foremost, but also a sailmaker, carpenter, electrician, plumber, mechanical engineer, diesel mechanic, electronic engineer and of course a cook, plus someone who knows how to make a mean gin and tonic for sundowners.

No more working from home, when this is 'The Office'! Towing the magnetometer kayak with the dinghy, Jocara in the background.

And so to my example. In the last issue of the Beacon, I covered the 'rescue' of 'Jocara' from the rat-infested dungeons of a dilapidated and rapidly deteriorating marina in the south of Malaysia, where her innards had been eaten out by a team of special forces rats, intent on sinking her before she could host an expedition to the Indian Ocean. In that article I said that we were interested in discovering if ancient mariners had wrecked upon the treacherous shores of this vast archipelago of reefs and islands, but that we were not going searching for wrecks, but for rats. We found both.

Allow me to explain. It all starts with a brilliant marine archeologist by the name of Bridget Buxton, who is a Professor at University of Rhode Island. Bridget has had a dream for the past decade; to search the Chagos Archipelago for evidence of ancient wrecks. For if ancient mariners had discovered the conveyor-belt-like oscillating winds and currents of the two opposing monsoon seasons in the Indian Ocean, they could have been circumnavigating that great expanse before the invention of rigs that can sail upwind. And if, as she suspected, they did not hug the coast, but boldly struck out across the core of the Indian Ocean, then some, perhaps many, would inevitably have 'discovered' the Chagos Archipelago by unexpectedly wrecking on it. But these ships would have been of wood, of course, which splinters and decays and may be quickly buried in shifting sand or carried away to the waiting deep. So where to look, among the thousands of square kilometers of this massive archipelago? The place to look is not for big pieces of wood or hefty iron anchors, but for little pieces of DNA.

With the cost of DNA sequencing now so affordable, it has become possible, and very smart, to look for evidence in the descendants of the survivors of these wrecks. Not human survivors, for they often did not, but rats. As in deserting the sinking ship. Given that rats are not indigenous and cannot swim large distances, the current rat populations on the various islands will bear the indelible thumbprint of their ancestors, and hence from where they came. So what we were after was rat DNA, from as many distinct islands as we could manage to sample.

And then suddenly, with Jocara available 'only' 1,500 n.m. away in Malaysia (and Jocara has already visited the Chagos Archipelago, in 2005) at a fraction of the cost of a 'regular' research vessel, perhaps this dream could finally be realised.

End of the day. Jocara, at anchor on a windless evening.

But this was not all. We were also after DNA from the entire marine ecosystem, to test the diversity and health of the reefs and shallows. This was inspired by a recent Nature paper (Graham et. al., 2018) which established that where there are rats, not only are there fewer birds (impoverishing the diversity of the terrestrial biome) but that this also impacts the marine environment, which benefits from the nutrients washed into the sea from bird guano. The whole island ecosystem, on land and in the sea, is inextricably linked and interdependent. Well, there's a surprise. Who could have known?

But how does one go about sampling the marine species diversity? Traditionally, this might be done by extensive visual sampling, identification and counting over weeks and months. Hundreds of hours on scuba and snorkel, supplemented by traps and physical sediment sampling. But now, with the advent of environmental DNA (eDNA), there is an easier way to understand some aspects of the biodiversity. 'All' one has to do is pump a few litres of seawater through a filter, inject a stabilizer, pop it in the fridge and, once home, sequence the DNA to reveal some of the things that swam, crawled, hopped or squirmed in and around that piece of water in the preceding days.

But there's more. DNA takes very little space, even on a 'small' sailboat. So we also took an underwater metal detector. And we took a top-of-the-line Overhauser magnetometer, an order of magnitude more sensitive that traditional proton magnetometers and requiring a fraction of the energy (allowing lighter-weight batteries for portable units) with faster sampling. Just for good measure, we had a high-frequency forward-looking acoustic imaging sonar, a compact sidescan and a dipping hydrophone with portable recorder. All of these instruments were so small and required so little power, they could be mounted on a cheap plastic unsinkable kayak, complete with cables, batteries, laptop and all, and towed by our dinghy or another kayak.

So it was that our little band of five crew were able to voyage over 1,500 n.m. round-trip on a 30-day expedition from the Maldives to the farthest reaches of the Chagos Archipelago, without the need to interact with a single external soul on the entire trip, provisioned and fueled to conduct several leading-edge research programmes across a dozen island groups scattered across the archipelago. We were able to collect rat DNA from every targeted island group, and took repeat eDNA samples at eleven of the twelve sites analysed in the original Nature paper, providing an invaluable opportunity to confirm their findings and explore how the islands have evolved since the first samples were taken. We were also able to discover several actual wrecks (albeit rather recent) and re-discover an ancient anchor, which was first sighted almost 50 years ago, before GPS, and which as far as we know, has not been located and documented until now.

Of course, there was also a good deal of messing about in boats.

Reference

Graham, N.A.J., Wilson, S.K., Carr, P. et al. "Seabirds enhance coral reef productivity and functioning in the absence of invasive rats". Nature ***559,*** *250–253, 2018.*

OES Conference Calendar

Qianyi Yang and Muhammad Mohsin, New OES Calendar Coordinators

OCEANS

OCEANS 2022 Chennai
February 21–24, 2022
Chennai, India
https://chennai22.oceansconference.org

OCEANS 2022 Hampton Roads
October 17–21, 2022
Hampton Roads, Virginia
https://hamptonroads22.oceansconference.org/

OCEANS 2023 Limerick
June 5–8, 2023
Limerick, Ireland

OTC

OTC Asia 2022
March 22–25, 2022
Kuala Lumpur, Malaysia
https://2022.otcasia.org

OTC 2022
May 2–5, 2022
Houston, TX, USA
http://www.otcnet.org

OTC Brasil
October 24–26, 2022
Rio de Janeiro, Brasil
http://www.otcbrasil.org/

OES Sponsored

Ocean Sciences Meeting (OSM) 2022
February 27–March 4, 2022
Honolulu, HI, USA
https://www.aslo.org/osm2022/

RAMI 2022
July 10–15, 2022
La Spezia, Italy
https://metricsproject.eu/inspection-maintenance/rami-physical-campaign-marine/

UCOMMS 2022
August 30–September 1, 2022
Lerici, Italy
https://ucomms.net
*Please follow for all updates.

AUV 2022
September 19–21, 2022
Singapore
http://auv2022.org/

SAUVC 2022
In-Person, September 23–26, 2022
Singapore
https://sauvc.org

BTS 2022
September 25–30, 2022
Biograd na Moru, Croatia
http://bts.fer.hr
*Please follow for all updates.

UT23
March 6–9, 2023
Tokyo, Japan
http://www.ut23.org

Non-OES

OSEA 2022
March 15–17, 2022
Marina Bay, Singapore
https://www.osea-asia.com

Please contact us if you have any information about non-OES events that OES members are involved in.

2021 International Symposium on Ocean Technology (SYMPOL 2021)

Supriya M.H., Chairperson, SYMPOL 2021
Arun A. Balakrishnan, Coordinator, SYMPOL 2021

Introduction

The 2021 International Symposium on Ocean Technology (SYMPOL 2021), addressing the Global Oceans, Systems and Technologies, organized by the Department of Electronics of the Cochin University of Science and Technology, Kochi, with the technical co-sponsorship of IEEE-OES was held during 9–11 December 2021. SYMPOL is being organized as a biennial program and the first symposium of the series was held in the Cochin University of Science and Technology, during 18–20 December 1991 to highlight the formal opening of the Center for Ocean Electronics established in the Department of Electronics as a joint venture of the University Grants Commission and Ministry of Human Resource Development, Government of India. SYMPOL, which is organized as a biennial event, was held in a hybrid mode this time in light of the COVID-19 pandemic.

Inaugural Function

The three-day symposium was inaugurated on 9 December 2021 by Dr. K. N. Madhusoodanan, Vice-Chancellor, Cochin University of Science and Technology. Dr. Tessy Thomas, Distinguished Scientist & Director General, Aeronautical Systems, released the Proceedings of SYMPOL 2021. Rear Admiral Antony George, Chief of Staff, Southern Naval Command, gave a felicitation on the occasion of the sixteenth symposium. Dr. Supriya M. H., Chairperson, SYMPOL 2021, welcomed the gathering. Mr. Arun A. Balakrishnan, Coordinator, SYMPOL 2021, provided an overview of the previous SYMPOL conferences and Dr. Nalesh S., Workshop Coordinator, proposed the vote of thanks.

Dr. K. N. Madhusoodanan, Vice-Chancellor, CUSAT, inaugurates SYMPOL 2021 by lighting the lamp. Rear Admiral Antony George, Dr. Supriya M. H., Mr. Arun A. Balakrishnan and Dr. Nalesh S. are also seen.

Release of Proceedings of SYMPOL 2021 via online mode by Dr. Tessy Thomas, Distinguished Scientist & Director General, Aeronautical Systems (top) and the display of hard copy of the proceedings (bottom).

Technical Program

The technical program of SYMPOL 2021 commenced with a keynote address on "Trends in Underwater Surveillance Systems" by Shri. S. Vijayan Pillai, Director, Naval Physical & Oceanographic Laboratory (NPOL), Kochi. The keynote address was followed by an invited talk on "Mitigating the Impacts of Climate Change: Role of Ocean Engineers" by Dr. Gopu R. Potty, Professor, Department of Ocean Engineering, University of Rhode Island, USA. Dr. Christopher D. P. Baxter, Department of Ocean/Civil & Environmental Engineering, University of Rhode Island, USA, delivered a talk on "Impacts of Storm Surge and Sea Level Rise on a Coastal Community in Rhode Island, USA: Mitigation and Adaptation Strategies." Another invited talk was delivered by Dr. Meghan Quinn,

Keynote address by Shri. S. Vijayan Pillai, Director, Naval Physical & Oceanographic Laboratory (NPOL).

Invited talks by Dr. Gopu R. Potty (top), Dr. Christopher D. P. Baxter (middle) and Dr. Meghan Quinn (bottom), University of Rhode Island.

Research Geotechnical Engineer at USACE-CRREL, US Army Corps of Engineers, University of Rhode Island, USA, on "Fiber optic Distributed Acoustic Sensing (DAS) to Monitor Infrastructure Vibrations."

Out of the 36 manuscripts submitted for evaluation, 29 papers were accepted for oral presentation and 26 of them were eventually presented. These presentations were organized in the following technical sessions covering a broad-spectrum of topics of interest to the SYMPOL community:

- Signal Processing
- Ocean Acoustics
- Artificial Intelligence for Ocean Exploration
- Sonar Technology
- Navigation, Communication, Instrumentation & Localization

While the research sessions of SYMPOL spanned two days, the third day was dedicated for a workshop entitled "Tech Summit on Smart Sensing & Edge Computing," conducted by Sony India Software Centre Pvt. Ltd.

Delegate receiving presentation certificate from the session chairs.

Exhibition of Spatial Reality Display (SRD), the 3D display device from Sony.

Announcement

The seventeenth biennial Symposium on Ocean Technology (SYMPOL 2023) is scheduled to be held in the Department of Electronics of the Cochin University of Science and Technology, Kochi, during 13–15 December 2023.

Diverse Perspectives on the Future of Offshore Energy Will Be Discussed at OTC

OTC 2022 will safely and responsibly unite energy game-changers in person from 2–5 May in Houston, Texas, USA. For four days, there will be many opportunities to collaborate with your peers on ground-breaking technologies behind a net-zero strategy and the critical roles oil and gas play as a necessary part of a vision of the future.

Visit the website to learn more about these discussions and even add them to your calendar. Don't delay. Register today to be at the forefront of the discussions centered around the technological disruptions and innovations that could help shift and drive the world's energy mix.


Offshore
Technology
Conference
2022
Access leading-edge technical information
and valuable new professional contacts
Register Today
2–5 May 2022
NRG Park » Houston, Texas, USA
2022.otcnet.org
OFFSHORE TECHNOLOGY CONFERENCE


AUV
SYMPOSIUM 2022
19-21 SEPTEMBER, 2022, SINGAPORE
National University of Singapore
Submission open for full-papers or
Extended abstracts
See more details at auv2022.org
IEEE
Oceanic
Engineering Society
OES
Email:
auv.oes@gmail.com
Follow us on Twitter
@AUV2022SG
Important dates:
Full Paper submission: 29 Apr 2022
Final Paper Submission: 1 July 2022
Watch budding AUV engineers in action at
Singapore AUV Challenge following the
conference, 23-26 Sep 2022

OCEANS 2021 San Diego—Porto Proceedings on IEEE Xplore

The proceedings for the OCEANS 2021 San Diego—Porto conference are now available on line on IEEE Xplore. To access the technical papers and related videos, use the following link: https://ieeexplore.ieee.org/xpl/conhome/9705657/proceeding

The University of Tokyo is delighted to welcome international experts for the International Symposium on Underwater Technology (UT23). UT23 will provide you with a thematic umbrella under which attendees will discuss the problems and potential long-term solutions that concern not only the Pacific Rim countries, but the world in general.

Conference Scope

Environmental Monitoring, Marine Robotics, Marine Mineral Resources
Renewable Energy, Marine Construction, Observatory and Disaster Mitigation
Fishery Engineering, Acoustics and Communications, Sensors
Special Topic: Remote Observation and Cloud Computing

Important Dates

Abstracts submission page open: April, 2022
Deadline for Abstract Submission: September 16, 2022
Notification of Acceptance: October 14, 2022
Deadline for Paper Submission: December 9, 2022
Deadline for Early Registration: January 20, 2023
Symposium Dates: March 6 - 9, 2023

Organizers

IEEE Oceanic Engineering Society (IEEE/OES)
IEEE/OES Japan Chapter
Institute of Industrial Science (IIS), the University of Tokyo
Earthquake Research Institute (ERI), the University of Tokyo

Exhibition Opportunities

In conjunction with UT23, there will be a limited number of booths for technical exhibition. We hope you would take this opportunity to display your products at the symposium. There are also opportunities for supporting the symposium. For more information, please contact the secretariat at info@ut23.org

For more information about UT23, please contact:
UT23 Secretariat: info@ut23.org

A Blast from the Past! … A Look to the Future!

Bob Wernli—Beacon Co-Editor-in-Chief and Photographer Stan Chamberlain

OCEANS 2012 Hampton Roads provided a "springboard" from the east coast to OCEANS 2013 San Diego on the west coast. This time we are able to return the favor with OCEANS 2021 San Diego—Porto providing a springboard back to OCEANS 2022 Hampton Roads, which will happen this October. In preparation, here's a look back at the very successful OCEANS 2012 Hampton Roads.

Virginia Beach Convention Center

Virginia Beach.

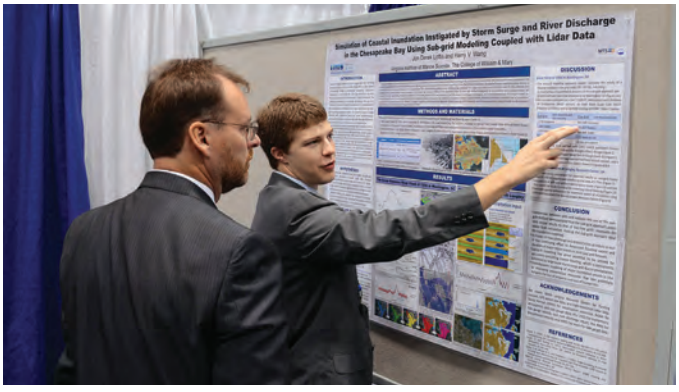
Plenary.

Ray Toll and Jerry Carroll at the OES Awards Ceremony.

Hampton Roads Exhibitors.

Author's Breakfast.

Technical Session.



Student Posters, Jon Loftis.

Massachusetts Maritime Academy Cadets.

Stan Chamberlain with the Wave Glider .

Exhibitor's Reception.

Nauticus Gala.

Battleship Wisconsin.


OCEANS
CONFERENCE & EXPOSITION
2022
HAMPTON ROADS
October 17-21
Hampton Roads, VA
In-Person & Virtual
marine technology
SOCIETY
IEEE
Oceanic
Engineering Society
OES


Limerick
2023


Gulf Coast
2023

Who's Who in the IEEE OES

Manu Ignatius, IEEE OES Member, OES Singapore Chapter Chair; CEO, Subnero

Having spent my entire childhood in the coastal state of Kerala, southern India, I loved spending time outdoors in the rivers and sea near my hometown with my friends. One of our usual hangout places was a neighborhood river bank. Even though I had spent all of that time near waterbodies, I never knew the role played by Earth's oceans in our day-to-day lives. All of that changed in 2009, when I met Dr. Mandar Chitre at the National University of Singapore while doing my postgraduate program. Fast forward 13 years, I am now the CEO of Subnero, a startup whose vision is *to be the de facto standard for underwater communication and in-water sensing networks.* So, where do I start?

Covering the robots of SAUVC, 2019, Singapore.

During my school days, I wasn't entirely sure what I wanted to do with my life. In fact, I never really thought about it. As long as something was fun and challenging, I was always game. I pursued engineering for my undergraduate studies, thanks to my parents who thought it would be a good fit for me due to my interest in building (and equally in demolishing) things. I graduated in 2004 from Mahatma Gandhi University College of Engineering, Muttom, Kerala in Electronics and Communication engineering. Shortly after, I joined a technology company where I was involved in developing network stacks for WiFi routers and embedded devices. While the theory of digital communication was part of my undergraduate studies, seeing some of the techniques applied in the real world piqued my interest. Within the next year or so, I knew wireless communications and networking is a field I would like to focus on for my career. In 2009, I enrolled in the master's program at the National University of Singapore Electrical and Computer Engineering Department with a focus on computer communications networks.

That is where I got introduced to ARL (Acoustic Research Laboratory) and all the cool things that they do there with underwater wireless communications, acoustic sensing, underwater robotics, etc., thanks to Dr. Mandar who is the head of the lab. There I learned that there are so many challenges in the various aspects of oceanography and ocean sciences, that these fields required background in a variety of other fields. Especially, the fact that underwater wireless communication is exponentially challenging when compared to its terrestrial counterpart. And I always loved a good challenge. That allowed me to combine my love of water bodies with my chosen career path—wireless communications and networking.

On our way to the Everest Base Camp, Nepal.

Although it was my interest in wireless technology that started my journey, it was some of the people I met at various stages of my life, who opened my eyes to this profession as more than just a career in underwater communications. They are highly motivated and passionate about their domains and some of the best minds in their fields. More importantly, they actively contribute back to the community. While I was lucky to have met them, learn from them, many others are not. That led me to join the IEEE OES Singapore Chapter.

Currently, I am an active member of the IEEE OES. Over the years, I have been heavily involved in many of the activities organized by the IEEE OES Singapore chapter such as The Singapore AUV Challenge (SAUVC), OCEANS 2020, Singapore conference, etc. I currently hold the social media coordinator position and work closely with the VPPA of IEEE OES to promote OES's activities through our social media channels.

Apart from my involvement in the academic community, I am also an active participant in the marine industry scene in Singapore. My role as the CEO of a marine technology company gives me plenty of opportunities to work with some of the well-established names in the industry and consider myself lucky to be able to witness the evolution of the industry.

Like many others in our community, I am also an avid scuba diver who specializes in underwater photography. My other

Bromo Semeru Tengger national park, Indonesia with my better half.

hobbies include photography (which I pursue professionally at times), trekking, and travel. These interests have taken me to various places around the world from bottom of the seas to top of the mountains, that otherwise I would never even have heard of, sometimes in search of unique shots to click.

Looking back, I think very few people can grasp the significance of something that covers more than 70% of our planet. I was one of them and I keep learning new things every day. I hope I can pass along some of my learning to inspire the next set of pioneers in the field of oceanography and ocean sciences through my work at OES and Subnero, by also showing them how much fun this can be.

If you are still reading this and are not bored (yet), check out my website at https://thedragonflypage.com/ or my portfolio (photography) at https://portfolio.thedragonflypage.com/ or https://www.youtube.com/c/ManuIgnatius and follow me at @dfly_manu (Instagram)

Schooling Baracuda, Koh Tao, Thailand.

Request for OES AdCom Nominations

Nominees for the Term 1 January 2023–31 December 2025

Jerry Carroll, Chair of IEEE/OES Nominations and Appointments Committees

The IEEE OCEANIC ENGINEERING SOCIETY is governed by an Administrative Committee of 18 members. Six are elected each year to serve three-year terms. Members are limited to two consecutive terms, although they may be reelected after a lapse of one year. This will be the thirty-eighth election to be held to determine the membership of our Administrative Committee (AdCom).

This year, the Nominations and Appointments Committee is chaired by the Senior Past President. The committee is charged with proposing a slate of nominees each year. For this election, twelve members of the OES will be nominated to fill six positions on the AdCom for the three-year term 1 January 2023–31 December 2025.

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

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

The election will be conducted in accordance with our Bylaws. Follow this link to read the Bylaws: https://ieeeoes.org/about-us/bylaws-of-the-ieee-oceanic-engineering-society/).

The Bylaws specify that general nominations close on *March 1*, and nominations by petition close by *April 15*.

Please submit nominations to the undersigned starting 1 January 2022. Please do not delay your efforts in finding and nominating qualified candidates. Send your nominations to:

Jerry Carroll
Chair of IEEE/OES Nominations
and Appointments Committees
SrPastPresident@ieeeoes.org

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University of Victoria Submarine Racing Club

Josh Fernandes (OES Student Member), and Team Members

The members of the University of Victoria submarine racing club (UVSRC) are a diverse bunch, ranging from history majors to engineering students. The common thread between them is their passion for marine engineering and the goal to compete at the international submarine race (ISR). Founded in 2018, the UVSRC has since designed and built three human powered submarines, and with the help of the IEEE Oceanic Engineering Society Victoria Chapter, is on track to build and race a fourth at the upcoming European International Submarine Race.

The most recent race was the 15th International Submarine Race back in 2019, being held in Washington D.C. This was a massive success for the club, coming out in 5th place and being acknowledged with the Best Use of Technology award. This was in recognition of the submarine's innovative design elements including tubercles on the dive planes, mimicking that of a whale to increase the stall angle and to decrease drag. The submarine also boasted an electrical system to automate depth control, as well as a four-piece modular hull.

Jaryd Middleton piloting the Chinook II, 2019.

Since 2019, there have been no in-person races, but the UVSRC has still been working. Now with fully worked designs from the past years, the UVSRC is aiming for the upcoming 2022 European International Submarine Race. This fourth iteration from the UVSRC builds upon all the knowledge that has been gained from previous years.

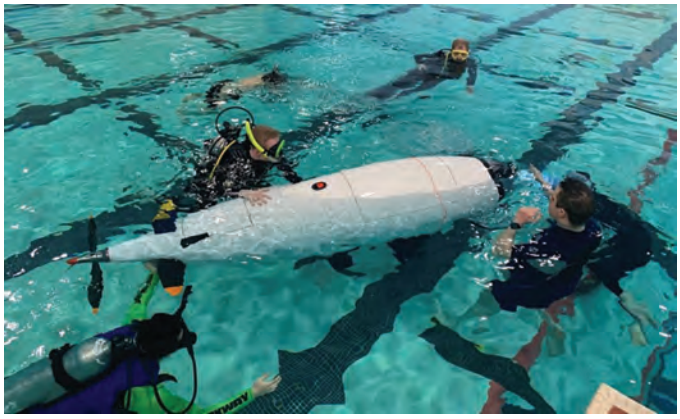
Mechanical

The mechanical team made significant changes to the structure of the propulsion system while keeping the same contra rotating propeller concept. A thrust block with a custom bottom bracket was implemented to save weight and take up less space inside the hull. A weight rail was introduced to efficiently achieve neutral buoyancy and level pitch prior to race runs. It consists of a length of T-Slot extrusion, to which custom made weights can be attached until neutral buoyancy and level pitch are achieved. The largest change is the new hull design. A taller hull has been adopted to reduce sideslip while turning and to increase ergonomics for the pilot. The subsequent changes follow the goal of increasing ergonomics.

Electrical

A new electrical system is being introduced to improve both the depth control, but also instrumentation. The addition of an Inertial Measurement Unit, hull speed sensor, and RPM sensor, combined with the previous depth sensors, will allow for a robust logging of the submarine dynamics. This information will be key in evaluating design changes in the future. This influx of data will also be used to assist a more robust depth control system.

For more detail on both the mechanical and electrical system, please visit https://www.uvicsubmarine.com/project to read a comprehensive review of the submarine.



First wet test of the Chinook III.

The continued projects of the UVic Submarine Racing Club would not be possible without the generous contribution of the IEEE OES Victoria Chapter, and the team would like to extend their sincerest thanks. For more information about the UVic Submarine Racing Club, please visit: https://www.uvic-submarine.com/

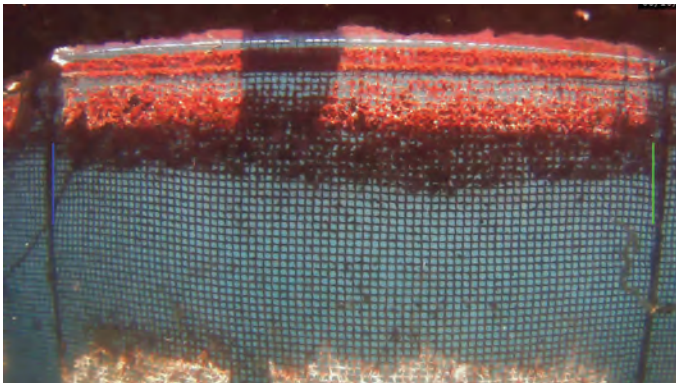
Breaking the Surface 2021—Overview of Field Trial Experiments

Nadir Kapetanović, Anja Babić, Ivan Lončar, Igor Kvasić, Vladimir Slošić, and Barbara Arbanas

Members of the IEEE OES University of Zagreb SBC organized a significant number of field trials during Breaking the Surface international interdisciplinary field workshop of maritime robotics and applications that was held in Biograd na Moru, Croatia, during the week of 26 September to 3 October. as well as during the following week. This article brings a short overview of those activities.

HEKTOR Project Trials

Our SBC members working on the HEKTOR project are in charge of developing the heterogeneous autonomous robotic system in mariculture applications. Mariculture scenarios include an ASV Korkyra (developed by our team), Blueye Pro ROV integrated with the ASV by our team, and a UAV (developed by our colleagues from LARICS team at the University of Zagreb Faculty of Electrical Engineering and Computing). The main objective is to enable autonomous inspection of the fish cages from air, at and below the surface of the sea.



An example of vertical rope detection used for visual servoing of the ROV w.r.t. the fish cage during inspection missions.

During the BtS 2021 workshop, the performance of vertical rope detection and mission control was tested at the seawater pool in Biograd na Moru, Croatia. A real fish cage net was strung across the pool to emulate a real-world environment, and the ROV was controlled by ROS2 running on a laptop, as shown in the following figure. The performance tests were successful, but the visual detection algorithm should be made even more robust to different lighting conditions, especially early in the morning and at dusk.

Extensive tests of ASV Korkyra's power consumption were also performed. Minimum and maximum consumption of each subsystem or device were measured and corrected for the baseline consumption. It shows that the autonomy of the ASV

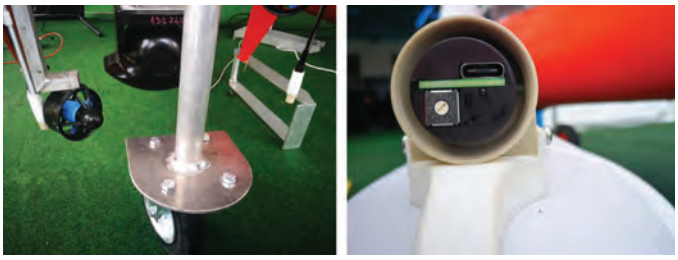
ROV fish net inspection performance tests at the seawater pool in Biograd na Moru, Croatia.

Korkyra ranges from the theoretical worst-case of 3.22h (when all the motors, computers and subsystems are working at full power) to 20.58h in the best case. It is however realistic to conclude that the average expected autonomy would range from 10h to 11h.

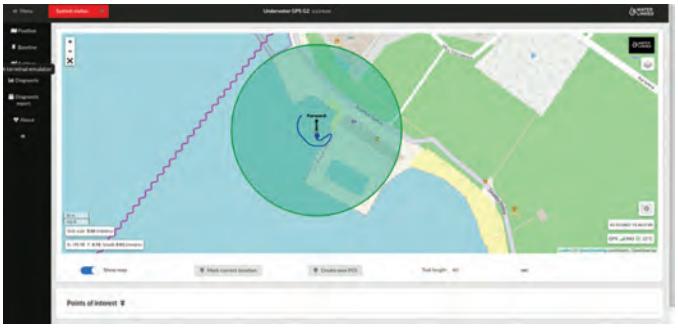
Tying the ASV Korkyra to a pillar at the beach in Biograd na Moru to ensure safety during the thruster power consumption tests.

Control of the ROV by the ASV needs position feedback. Thus, WaterLinked Underwater GPS (UWGPS) G2 SBL topside system with a bottomside Locator U1 system met all these requirements and was integrated into the ASV Korkyra during the week after the BtS 2021.

Since the integration of the UWGPS G2 with ROS2 was done before BtS 2021, this meant that frame transforms needed to be performed in the post-processing phase taking into account ASV's known GPS position and orientation in 3D space.

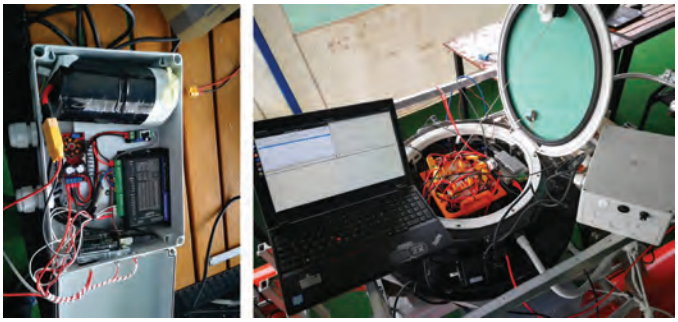


Integration of the topside transponders on the ASV Korkyra (left). Mounting the Locator 1 bottomside unit on the Blueye Pro ROV (right).



Screenshot of UWGPS G2 web browser GUI used for setup and visual feedback of ROV's position.

Integration of the ROV onto the ASV and their cooperative path planning in autonomous inspection missions requires a tether management system (TMS) to be developed together with a docking mechanism (DM). During the BtS 2021 workshop, a prototype control box of the TMS was developed. It enables the manual control mode of the TMS motor but also an automatic control mode from the ASV's main computer over serial communication.



Control box of the TMS prototype (left) and TMS-ROS tests (right).

As mentioned earlier, the UAV will perform fish cage inspections from the air. This will be done in coordination with the ASV Korkyra, so a landing platform (LP) is needed for the UAV to be docked onto the ASV. A great number of test runs were performed to detect possible issues with the LP. Extensive testing was first performed in the lab environment. Similar to the TMS, the LP has a control box allowing manual control, but also automatic control over serial communication integrated with ROS. During Breaking the Surface 2021, additional LP robustness tests were performed and were successful. These tests showed that the auto control mode is fully functional together with serial communication integration with ROS1.

LP performance tests in Biograd na Moru. Manual landing of the UAV and automatic LP open/close actions were a success.

Multifunctional Smart Buoys Trials

The trials taking place after BTS 2021 were the first field trials for the Multifunctional Smart Buoy project, which started in April 2021. The team working on the project prepared two initial prototypes of the underwater sensor units that communicate with a floating buoy unit, forming a marine system for long-term environmental monitoring.

The aim of these initial field trials was to perform full integration of the developed subsystems - Cyclops fluorometer sensors for various water quality measurements, a small acoustic nanomodem for long-range underwater communication, the units' main electronic boards including an SD-card based logger and a Real Time Clock, as well as a battery assembly composed of lithium-ion cells, all housed within a plexiglass enclosure and equipped with specially-made attachment points for a surface unit's mooring line.

After integration, two units were vacuum-tested and left to perform an overnight experiment on land, logging their respective sensor data and battery voltage. Once this "test run" was successfully concluded, the units' batteries were recharged and they were deployed in the seaside pool.

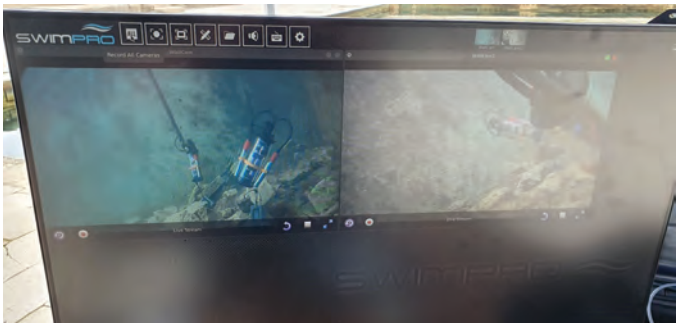
Two underwater sensor units prepared for long-term deployment in the pool at Biograd na Moru.

Martin Oreč testing out mooring line attachments for sensor units before deployment.

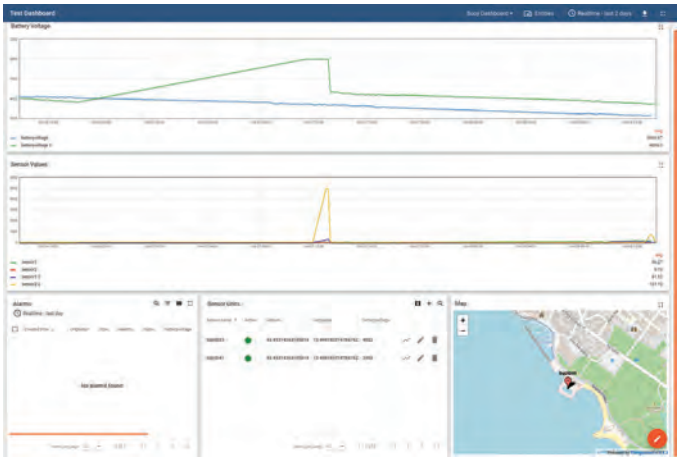
To serve as a surface node and an endpoint for the sensor units' acoustic packets, a topside laptop was set up with an acoustic modem running into the pool. This laptop collected data sent by the units, parsed it, and sent it to a ThingsBoard IoT dashboard where it was presented in a user-friendly way. All the while, the deployed sensor units were monitored using underwater cameras affixed to the sides of the pool.

Differences in sensor unit behaviour were analysed each day, especially with regards to energy consumption. For the remaining three days of the field trials, the units were recharged and redeployed underwater with the goal of testing different sleep modes and sleep durations, in order to gather valuable data for ensuring long-term autonomy of the final buoy system, while achieving regular and persistent acoustic communication of all gathered sensor measurements.

A topside laptop (right) served as a placeholder "buoy unit" in the initial experiments, providing an endpoint for acoustic communication (left).



Monitoring the deployed sensor units via underwater cameras in the pool.



IoT dashboard showing several days of sensor unit data.

The trials after BtS 2021 proved incredibly useful as both data and experience gathered during the first-ever deployment of the developed prototypes lead to excellent insights regarding the current state of the system, as well as extensive and specific plans for future work.

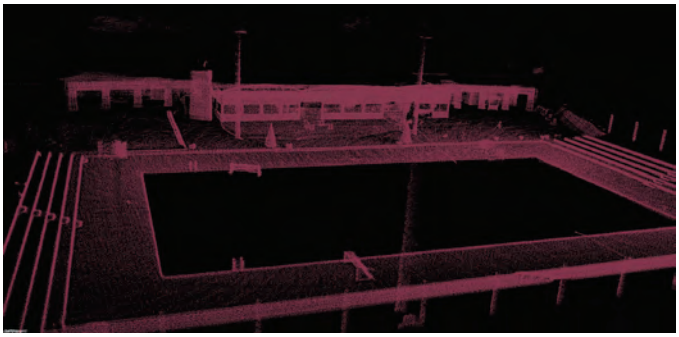
Autonomous Multipurpose Ship Project Trials

During and after the Breaking the Surface 2021 workshop, the initial trials for the Autonomous ship project took place. In the project, the plan is to build a Multipurpose autonomous ship in collaboration with Brodosplit shipyard. The ship will be a fast response vessel for firefighting and oil recovery. The goal is to mitigate negative impact of maritime accidents on the environment. Since the project was still in the design phase as it started in July 2021, we could only rely on equipment available in LABUST.

The goal of the initial trials was to gather perception data from the maritime environment using a lidar. This data will be useful for testing of developed algorithms used for detection of objects commonly encountered in maritime environment and testing of readily available SLAM algorithms. Since the marina is an environment in which you can only rely on perception data for safe navigation, there is a great benefit on having real data for algorithm validation.

During the trials we integrated the lidar to the Korkyra catamaran vehicle. Lidar was mounted together with a camera to a landing platform used in project HEKTOR. For a test run, we first mounted the sensor rig to a box and pushed it around a seawater pool. Results of the lidar processing can be seen from the image below where a reconstructed map of the pool can be seen.

After the initial test, we set out to the sea to gather more relevant data from a marina in Biograd na Moru. The catamaran



Map reconstructed from lidar measurements after a dry run.

Catamaran with a sensor rig in a marina in Biograd na Moru.

was driven manually around a marina with close supervision from a dinghy. The data collected will be used as a testing dataset in future publications.

ADRIATIC Project Trials

As part of the Breaking the Surface 2021 program, our IEEE OES SBC members held an introduction lecture and a hands-on tutorial in Unity simulator related to the ongoing project ADRIATIC—Advancing Diver-Robot Interaction Capabilities. The project focuses on finding innovative and intuitive ways of interaction between human divers and autonomous underwater vehicles (AUVs). Within the project the collaboration scheme between the diver and the AUV envisions the robot vehicle to take the place of a robotic diving buddy, with the prime goal of observing the diver and determining his physiological parameters such as breathing, hearth and motion rate and to allow the detection of critical diver states and in turn increase safety. One of the project scenarios includes the autonomous underwater vehicle as a diver navigator, where the vehicle uses its advanced localization and navigation capabilities to navigate the diver to a target or point of interest. The participants have had the chance to experience that scenario in a simulated environment using Unity 3D. The tutorial had multiple objectives:

- Showcasing the Unity marine simulator developed within the Laboratory and demonstrating its capabilities
- Evaluating the feasibility of using this type of underwater simulation for developing algorithms and training
- Gathering valuable mission data and feedback from a larger audience of experts from various marine-related fields

Ivan Lončar demonstrating simulator controls to tutorial participants.

The simulator works as a first person-view game played from a diver's perspective. The diver is controlled using "WASD" keyboard controls and mouse for movement, plus "C" and "SPACE" keys for diving and ascending when underwater. The task is divided into two separate missions. The mission starts as the dive commences at the diving vessel. The first objective is to navigate the diver underwater using keyboard controls to two separate targets at previously known positions. The first target is a sunken plane and the second is a shipwreck. In the first mission the participants navigate to the position using a diving compass and depth sensor gauge, which is the usual equipment that divers would have at their disposal.

Example scene from the Unity simulator from the divers' perspective.

At the dive start, the player is given only the direction and distance towards each target and has to overcome waves, sea currents and low visibility underwater in order to reach the targets. In the second mission the goal is the same, but this time the navigation is aided by the diving robot. The robot uses its simulated proprioceptive navigational sensors to determine its location and positions itself on an imaginary safety circle between the diver and the target, pointing to the waypoint from the divers' perspective. While the visualization and simulation parts are running in Unity, all the navigation algorithms are running in ROS and are connected to Unity, which generates the simulated sensor readings. At the end of the two missions, participants can view their results in the form of displaying the trajectories in 2D and 3D along with the statistics such as distance traveled and time of each mission. At the end, the participants were given a short output survey to express their feedback and help further develop the simulator. Future plans of the project include analyzing the navigation data and statistics, along with the gathered feedback, and publish the results in a future paper.

Participants of the tutorial contributing to the study in a game-like environment.

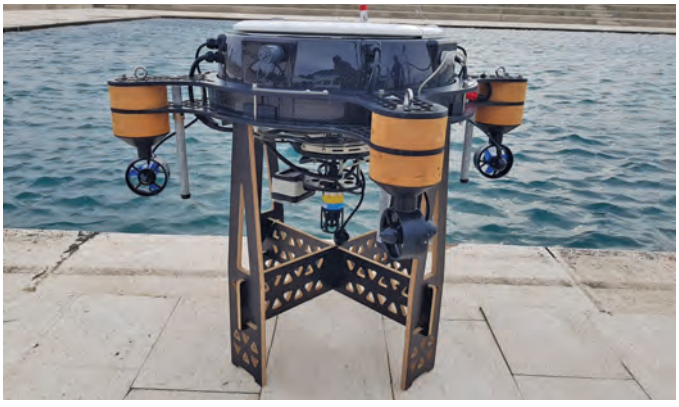
ROADMAP Project Trials

During the trials on BtS 2021, another experiment was performed in the field of underwater localization. Most of the projects that LABUST is involved in demand precise localization of the AUVs. Therefore, a new localization technique—breadcrumb localization—was introduced as an upgrade to the localization algorithms that we already use at LABUST.

The main goal of the experiment was to collect data that will confirm the theoretical background of breadcrumb localization. The experiment was performed in the Olympic seawater swimming pool (dimensions: 50 m by 25 m). Equipment used:

- autonomous surface vehicle aPad (further in the text—ASV aPad) with mounted underwater acoustic pingers and camera looking downwards
- five underwater acoustic pingers in waterproof casing with anchors
- GPS RTK system for precise navigation and localization
- PC with ROS installed.

When it comes to underwater localization of the AUVs, a common problem regarding proprioceptive sensors, such as IMU, is a drift error that accumulates during time as AUV executes its mission. The idea of the breadcrumb algorithm was to minimize the error of the localization with so-called "breadcrumbs" that are actually underwater acoustic pingers deployed one after another during the mission. ASV aPad (or AUV in a different scenario) can measure the distance between itself and each of the breadcrumbs individually. Those measurements can be used to correct the localization estimate from IMU and other sensors that are mounted on/inside the AUV/ASV.



Autonomous surface vehicle aPad in front of the swimming pool in Biograd.

Breadcrumbs in housings with anchors.

Before the experiment aPad was serviced, all of the needed sensors for experiments were mounted on it. Breadcrumbs housings were made at LABUST out of plexiglass tubes inside of which is the pingers' electronics and battery.

During the experiment, there has been poor weather conditions that postponed the experiment for some time and caused a lower amount of recorded data. There were also some technical problems with the aPad's IMU that wasn't able to calibrate itself. One breadcrumb was replaced because of the seawater penetration inside of the housing due to a defective seal.

The recorded data will be used for the confirmation of the breadcrumb localization theoretical background and some other algorithms that are being developed and tested at the moment at LABUST.

Conclusion

BtS 2021 workshop and the field trials in the following week were a successful demonstration for many of our research projects. It gave us a chance to involve our fellow IEEE OES UNIZG SBC members to participate actively. During the field trials of 5 research projects, various vehicles and subsystems were tested: 2 ASVs, 1 ROV, 1AUV, 1 1UAV, 1 landing platform, 1 TMS, and a 2-node underwater sensor network (UWSN). Several cameras, lidar, environmental sensors, acoustical localization and communication systems, and sonars were used for performance testing of mission planning, navigation guidance and control systems, as well as long-term Internet of underwater things (IoUWT) modules. Furthermore, a transition from real-life into virtual reality (VR) experiments took place to test human-robot interaction (HRI) and robot-aided underwater diver navigation.

We are looking forward to our Spring/Summer field trials and of course yet another edition of Breaking the Surface in Autumn 2022. During this year's BtS, HEKTOR project is planned to have final experiments of AS-ROV-UAV cooperative fish net pen inspection. BOVE project will have its final experiments as well, testing the long-term environmental monitoring by a UWSN in all configurations defined by the project. For the Autonomous ship project, the plan is to add either virtual or real obstacles in the sea to demonstrate collision avoidance algorithms while autonomously navigating a predefined route. Breadcrumb underwater localization algorithm will be tested in the scope of the ROADMAP project, this time with an AUV and a diver.

2021–2030: Decade of Ocean Science for Sustainability Development

Olaoluwa Oderinde, Graduate Research Assistant, Division of Marine Science, M.Sc. Hydrographic Science, University of Southern Mississippi, USA

Theme of Oceans Conference and Exposition 2021(Photo by: MTS, OES).

The world as we know it is composed mostly of water taking up to 70%, which poses a great need for monitoring and sustainability. The world oceans are vast with significant developments in underwater technology to explore and unravel resources in the deep ocean, mapping of biodiversity, and collection of data from the sea surface to the deep ocean basins necessary for sustaining the ocean and providing data crucial to various industries from shipping to navy and commercial use. The OCEANS Conference and Exposition 2021, a hybrid event (virtual and in-person), which was organized by the Marine Technology Society (MTS) & IEEE Oceanic Engineering Society (OES), was held at San Diego, California, and Porto, Portugal and it witnessed a crowd of great minds and experts in the industry gathered to shed light on recent developments and breakthroughs in the underwater technology for mapping and acquiring information about the world's ocean and its environments.

I was fortunate enough to attend the virtual aspect of the conference, thanks to the support of the University of Southern Mississippi Chapter of IEEE Oceanic Engineering Society, and I can say it was worth every time spent. The conference was packed with numerous activities including plenary sessions, the exhibition of products and services, and workshops spanning different topics and issues faced in the marine industry and on how best to tackle these problems. The conference theme was centered around the sustainability of the oceans as a way of sustaining our future. A total of 485 papers from 389 authors were accepted for the conference. These submissions were centered around three major topics: Innovative Technologies and Commercial Products for Ocean Development and Exploration, Innovative Academic Research and Scientific Studies, and Investment Opportunities for Ocean science technologies.

The US Navy, represented by Carly Jackson, NAVWAR Chief Technology Officer, gave a presentation on the involvement of the US Navy in Ocean Sustainability and the importance of climate change. It was evident that they currently focus on advancing marine technologies with a low carbon footprint, and endurance and survival capabilities in harsh marine environments, while providing ocean observations for climate risk analysis and conservation studies for marine protected areas. A quote that struck my attention was by Rear Admiral Selby, Chief of Naval Research, which stated that "Understanding the environment we work in helps us maintain our tactical advantage", which iterates all we are saying about the importance of ocean sustainability and exploration.

The session on the role of marine robotics for the sustainable blue economy was the session I found most interesting due to my interest in underwater technologies (AUVs and ASVs). In recent years, marine robotics has seen drastic technological advancement for ocean mapping, data collection, and analysis. It is pivotal in solving complex data collection issues in unfavorable sea states. The session focused on the increasing demand for marine robotics and how it plays a big role in ocean sustainability. The session was graced with panelists from the industry and academia. It had the likes of Steve Brodet of Kongsberg Maritime, David Jones of Saildrone, Josh Wells CEO of Planck AeroSystems, Clara Hulburt of Teledyne, etc. Saildrone, an American-owned company that manufactures uncrewed vehicles, has been successful in collecting in-situ oceanographic and climatic data above and below the sea surface, providing significant improvement in the methods of data collection in remote areas. The uncrewed systems help to provide accurate assessments for fish stocks with sensors mounted onboard and the accuracy is attributed to its low noise emission. These systems are also supporting the offshore wind farm industry with seabed mapping to support construction, thereby aiding the growth of the blue economy. Planck AeroSystems is a company specialized in the development and production of unmanned aircraft systems and utilizing machine learning techniques for Whale Strike mitigations. They specialize in mapping shifts in migratory patterns of whales due to climate changes through the analysis of images captured by the aircraft system rover sensor.

The advent of marine robotics removed the old method of manning aircraft with equipment for taking pictures and solely relies on robotics and machine learning algorithms for data collection, processing, and analysis. A significant improvement in their technology is the capability to sort thousands of ultra-high-resolution images and classify whales on the pre-processed images and only upload the required species to the server, thereby reducing the time of data upload. However, these processes are faced with some challenges that affect the accuracy of the classification algorithms, hence, the need for algorithm optimization, augmentation, and post-processing. An interesting mention would be a question asked by one of the conference participants regarding marine robotics increasing unemployment through the reduction in manpower and physical presence. The question was answered by one of the panelists with a statement saying, “there would always be a need for personnel to monitor the robots, configure the system and perform analysis and QC checks on the data acquired.” I believe marine technologists must be updated with current technologies and technical procedures to maximize the capabilities of these robots and rovers. With the world constantly evolving in the digital age, there would also be a need for skilled personnel to program and design these marine robots. Then the question to put out there is “would you be willing to acquire the necessary skills and training needed as the world evolves?”

IEEE Oceanic Engineering Society

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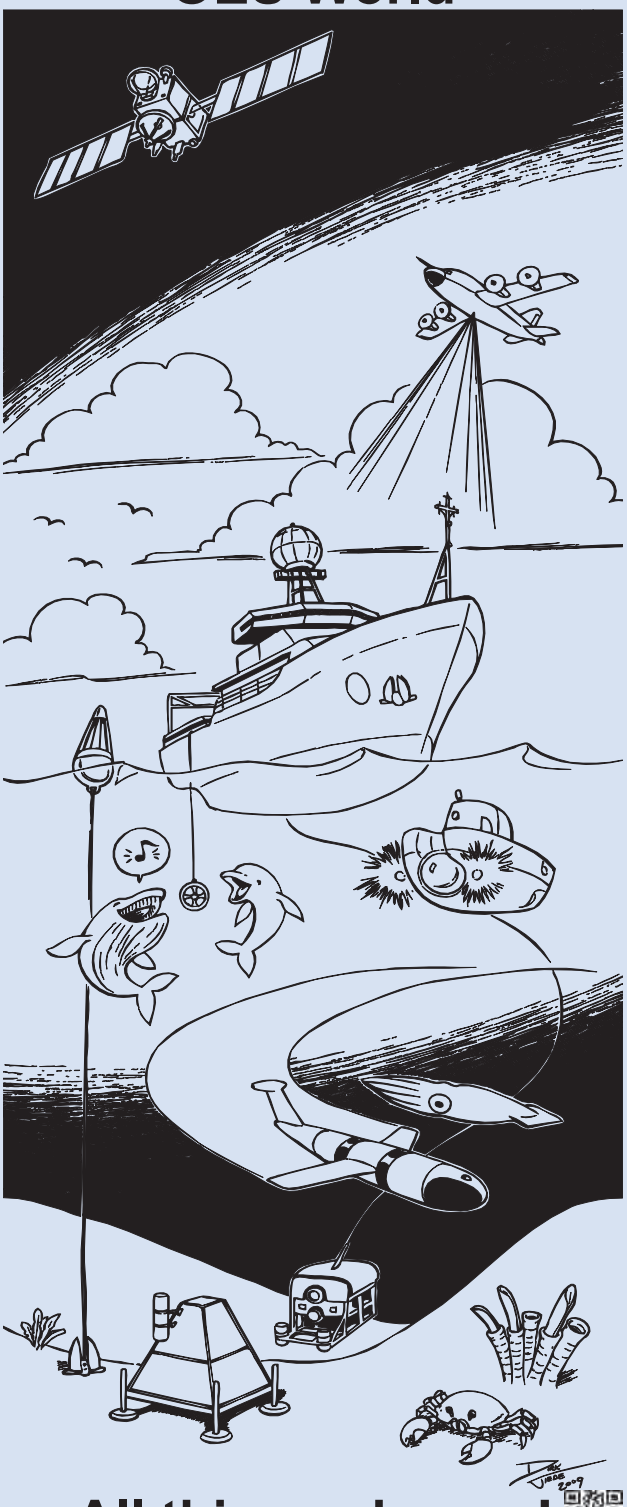

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