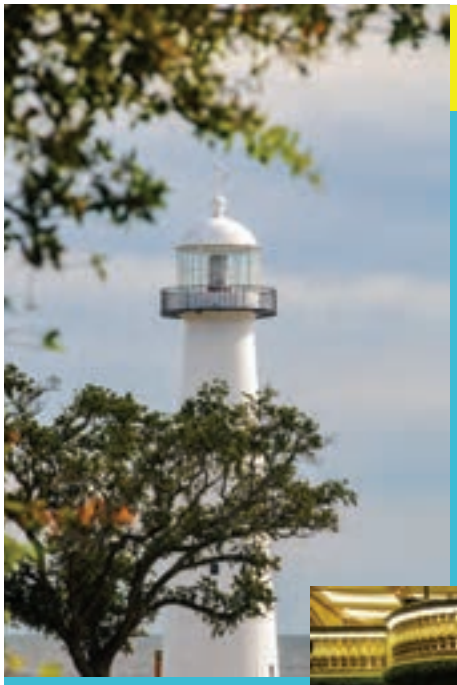
# OES BEACON

## Newsletter of the Oceanic Engineering Society

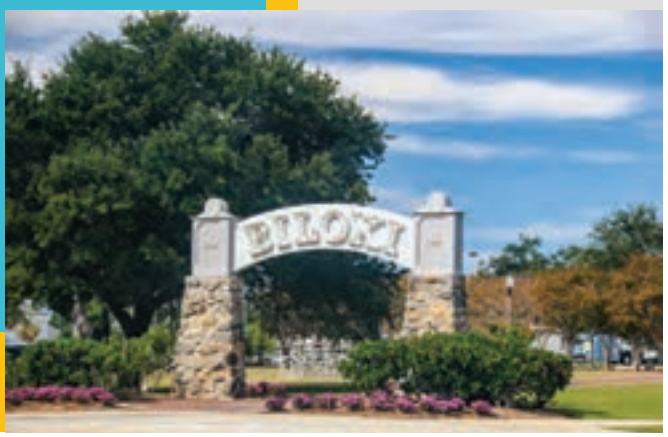
SEPTEMBER 2023, Volume 12, Number 3 www.ieeeoes.org (USPS 025-095) ISSN 2164-8042



## OCEANS 2023 Gulf Coast

*September 25-28, 2023*


*Welcome back to Biloxi in 2023*


IEEE

IEEE Oceanic Engineering Society

The OES BEACON is published four times a year as a benefit to the membership of the IEEE Ocean Engineering Society. The OES Beacon is printed and distributed from IEEE headquarters in New York City, New York, USA.



**Publication Copy-Due schedule:**
4th Qtr: December 2023: November 14 1st Qtr: March 2024: February14

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.



Front cover photos during OCEANS'09 Gulf Coast were taken by Stan Chamberlain, our previous OES photographer

*IEEE OES Beacon Newsletter* (ISSN 2164-8042) is published quarterly by the Oceanic Engineering Society of the Institute of Electrical and Electronics Engineers, Inc. Headquarters: 3 Park Avenue, 17th Floor, NY 10017-2394. $1.00 per member per year (included in Society fee) for each member of the Oceanic Engineering Society. Printed in U.S.A. Periodicals postage paid at New York, NY and at additional mailing offices. Postmaster: Send address changes to IEEE OES Beacon Newsletter, IEEE, 445 Hoes Lane, Piscataway, NJ 08854

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# Member Benefits—Did You Know?

Think you can't achieve your highest career potential alone? We have a solution. Networking! Build your technical and professional network by interacting with your fellow OES members. How? Join our technical committees (TCs). There are 10 technical committees in OES. Join those that are in your technical area and interact with the other members to build your professional network. And, use those connections to participate in the OCEANS conferences and other OES symposia and workshops to reach your ultimate potential. For more info on the TCs, visit the URL: https://ieeeoes.org/technical-activities/technology-committees/.

# From the OES BEACON Editors

***Harumi Sugimatsu and Robert Wernli***

Well, things have certainly been busy in OES. We've been having OCEANS of fun: OCEANS 23 Limerick, Ireland, was successfully held in June and the LOC for OCEANS 23 Gulf Coast, U.S., is very busy optimizing what is looking like an excellent conference during late September. And, we start off the new year with the AUV competition in Singapore just before OCEANS 2024 Singapore. Our report by the VP for OCEANS provides how OES will plan our future conferences.

With the completion of OCEANS Limerick, reported in this issue, we're also able to include the results of the Student Poster Competition to include the winning paper and articles written by the top two winners. And, don't miss the comprehensive report from the University of Zagreb, Croatia, Student Branch Chapter.

Don't forget the following workshops and symposia as listed in the Conference Calendar and reported by our VP for Workshops and Symposia: BTS 2023, MetroSea 2023, ENAEM 2023 and SYMPOL 2023. Included in this issue is an article by the Executive VP on our technical co-sponsorship of the Ocean Sciences Meeting 2024 (OSM24). Also reported is our involvement in this year's SusTech conference.

A short article included provides a link to the OCEANS 2019 Seattle plenary video that addresses the history of the development of the *Titan* submersible, which was lost earlier this year.

OTC is running again following the success of OTC Houston last May. Now, OTC Brazil is scheduled later this year and OTC Asia early next year, which should help future OES budgets.

Our technology committees (TCs) continue to be more active as reported by our VP for Technical Activities. This issue has an excellent report by the Autonomous Maritime Systems (AMS) TC that addresses all the competitions, workshops and symposia that are on their active schedule. The chairs for the OES Standards Committee on Standards also present their latest.

Our chapters have been busy as the reports show. This issue contains the latest on the activities of the Hong Kong and Malasia chapters. Also reported in this issue is how OES is involved in supporting the Ocean Decade Initiative.

The Journal EIC again provides a list of recently released papers that are available to our members. You will also see in the report from the OES president the latest on his view of the direction of the society. With the arrival of 2024 on the horizon, we welcome our new AdCom members, for 2024–2026.

Have you done something exciting lately? Received an award or professional recognition? Be sure to contact your editors about submitting an article. And don't miss the Who's Who in OES article on one of our outstanding members in each issue. This issue also sports a Blast from the Past that highlights our long-standing OES photographer, who wraps things up with an outstanding report on The Ocean Race, a high performance, hydrofoil-based, sailboat race around the world.

*Harumi at her office with colleagues.*

*Taking time off from the Beacon to cruise Glacier Bay, Alaska.*

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***

It seems like only yesterday some of us were together in Ireland for OCEANS 2023 Limerick, and as you read this, we are just about to gather again in the United States for OCEANS 2023 Gulf Coast. In between, there have been several great workshops and chapter events in Europe, Asia, and around the world.

In 2022 OES updated our Mission and Vision, which is "a collaborative community working towards a safe, healthy, and productive ocean" and our Mission is "to be the professional home of people passionate about ocean science, engineering and technology." This strategic planning work has been ongoing since my first term as President and represents the shared understanding of OES that guides the decisions of our Administrative Committee. There will be updates on the website soon, and a full strategic plan update in the coming months.

As the OES voting member of the IEEE Technical Activities Board (TAB), I attended the June TAB meeting in Chicago. There, I spoke to Presidents of many other Societies about how OES could collaborate to reach the many IEEE members who have interest in ocean technology but aren't yet OES members. There was an overwhelmingly positive response, and several follow-up conversations. In June, I spoke on a small panel at the Power and Energy Society General Meeting (PESGM) on the importance of the ocean for achieving sustainability. Additionally, OES had a presence at IGRSS, the flagship conference for the Geoscience and Remote Sensing Society (GRSS). We would love to hear from members (like you!) who would be willing to help coordinate activities between OES and additional Societies or Councils.

At our 2023 August virtual AdCom meeting, we elected our incoming officers for 2024–25. Please join me in welcoming:

- Gerardo Acosta as VP Workshops & Symposia
- Elizabeth Creed as VP Professional Activities
- Hari Vishnu as Secretary

Since both the VPPA and Secretary offices were vacant, the incoming officers are taking office immediately. Therefore, Bill Kirkwood has moved from Treasurer-Elect to Treasurer slightly ahead of schedule.

Elsewhere in this issue you will see a brief update on Standards. I am pleased to support the effort to have OES ratified as an official originator of IEEE Standards. There are already several potential standards in discussion, and the topic of sustainability has been generating much interest in this area, specifically.

Also, in this issue you will see a report from The Ocean Decade Initiative at Sections Congress. Sections Congress is IEEE's largest internal volunteer training conference, which brought together over 1000 of the most active and passionate IEEE volunteers from around the world. The OES Decade Initiative Booth was packed, and the response was excellent–there are many activities to follow up on. It was a unique opportunity to share with the larger IEEE how ocean engineering and science is crucial to better understand the ocean, so that we can better manage ocean resources while sustainably meeting the needs of society. This aligns very well with IEEE's tagline of Advancing Technology for Humanity.

We look forward to seeing some of you at OCEANS on the Gulf Coast very soon! Please see us at the Society booth and attend our member reception Tuesday evening.

As always, there are more exciting projects and opportunities than there are people to develop them. If you wish to get more involved in Society activities in any way, please email me! president@ieeeoes.org

# IEEE Oceanic Engineering Society Sponsored Sessions at Ocean Sciences Meeting, 2024

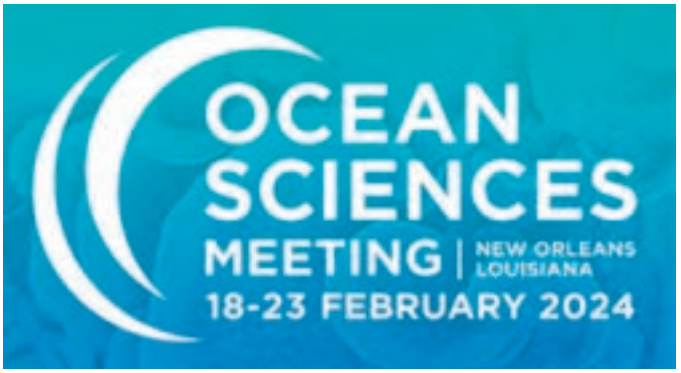
***Brandy Armstrong, Executive VP, executive-vp@ieeeoes.org***

The Executive Vice President (Executive VP) of IEEE OES is responsible for Governance, Strategic Planning and coordinating with other Societies and Organizations. IEEE OES has been meeting with the organizations that sponsor the Ocean Sciences Meeting to determine ways in which our organizations can work together to leverage resources and further our shared goals.

## Ocean Sciences Meeting

The IEEE OES has signed an MOU to technically co-sponsor the Ocean Sciences Meeting 2024 (OSM24). Activities between IEEE, Incorporated on behalf of OES and American Geophysical Union (AGU), American Society on Limnology and Oceanography (ASLO), and The Oceanographic Society (TOS) are envisioned to foster dissemination and exchange of scientific

research and promote scientific opportunities for all organizations. This technical co-sponsorship entails IEEE OES sponsoring technical sessions at the conference and participation by one of our volunteers in the technical program committee. There will also be an opportunity for IEEE OES to share an electronic ad or short presentation on its presence at OSM24.




*IEEE OES is technically co-sponsoring the 2024 Ocean Sciences Meeting.*

## Ocean Sciences Meeting and OCEANS Conferences

Ocean Sciences Meeting (OSM) is a bi-annual, academically heavy conference, which creates an excellent opportunity for technical and engineering content to reach an academic audience. OSM is also a conference where only abstracts are published and oral and poster presentations are made. Since there are not published papers at OSM, we encourage our session chairs to invite their presenters to present and publish at a future OCEANS Conference.

## IEEE OES Sponsored Sessions

Abstract submissions are now open for Ocean Sciences Meeting 2024, which will be held in New Orleans, Louisiana, USA, on 18-23 February of 2024. To ensure that our sessions are successful we need ample abstract submissions for each of our sponsored sessions. Abstract submissions for OSM24 close September 13, 2023, at 23:59 EDT/03:59+1 UTC. Please consider submitting an abstract to the IEEE OES sponsored technical sessions listed below:

**Session Title:** HE003: Autonomous Sensing and Monitoring in Polar Environments
**Topic Area:** High Latitude Environments

**Session Title:** OT006: Breaking Barriers: Bridging the Gap in Methodologies and Data Reporting for Ocean Biogeochemistry
**Topic Area:** Ocean Technologies and Observatories

**Session Title:** OT020: Sustained Ocean Observation Systems for Small Island Developing States (SIDS)
**Topic Area:** Ocean Technologies and Observatories:

**Session Title:** OT007: Combining Underwater Imaging with Deep Learning for Better Ocean Observations
**Topic Area:** Ocean Technologies and Observatories

**Session Title:** DO015: Pairing Autonomous Monitoring and Ocean Modelling: Advancing Our Understanding of Coastal Ocean Systems Through Capacity Expansion
**Topic Area:** Digital Ocean

**Session Title:** DO013: Online Session—What Should the Machine Learn if The Data is Not "Big"? Interpreting "Size-Limited" Oceanic Data Collected Autonomously or Manually Using Data Science and Explainable Artificial Intelligence
**Topic Area:** Digital Ocean

**Session Title:** DO012: Online Session—Cognitive Sonar and Other AI-driven Sonar Sensing of the Marine Environment
**Topic Area:** Digital Ocean

**Session Title:** CP013: Strategies for Combining Innovative Monitoring and Modeling Systems in Coastal Environments
**Topic Area:** Coastal and Estuarine Hydrodynamics and Sediment Processes

## IEEE OES Sponsored Town Halls

OSM is also seeking abstract submissions for Town Halls, which will be proposed by the community and open to all meeting participants. The Ocean Decade Initiative plans to submit an abstract for a Town Hall at OSM. This one-hour session will be used to:

- Collect feedback & raise awareness.
- Deliver updates and gather input from the broader OSM community.
- Could be in presentation, roundtable, or panel discussion format.

Approved town halls will be open to all meeting attendees, scheduled during lunchtime on Monday through Friday, and focused on topics that do not compete with, substitute, or duplicate scientific or learning sessions.

If you would like to contribute to the Ocean Decade Initiative and participate in helping organize future town halls and events focused on the Ocean Decade, please email Laura Meyer at laura.meyer@ieee.org . If you have ideas for collaboration with other IEEE organizational units or outside organizations, please contact the Executive Vice President at executive-vp@ieeeoes.org.

# VPTA Column

***Shyam Madhusudhana, VP for Technical Activities***

Well, it's been a pleasant part of the year with some 'smooth sailing' in the realm of technical activities. Technology Committees (TC) and the various Chapters have remained active and mostly in auto-pilot mode, requiring little to no assistance from me.

The Technology Committees (TCs) form the backbone of our Society, influencing various facets within OES. These committees were created with the primary aim of catering to our members in important and emerging thematic domains. As hinted in the previous edition of this newsletter, we continue to work towards an "overhaul" of the current slate of 10 TCs, with the aim to broaden their scopes and to improve their relevance among changing and emerging areas of oceanic engineering.

Contrasting to pre-pandemic years, the turnout of TC executives at OCEANS conferences continues to remain low. Seems that way for the upcoming Gulf Coast OCEANS too. Hence, the TC Coordinator Atmanand and I are looking at having our second TC executives' meeting of the year also be a virtual one; to be held in early October.

Congratulations to Maurizio Migliaccio for being appointed as the next Chapters Coordinator. He will be taking the baton from Gerardo Accosta whose second term ends this year. Many thanks to Gerardo for his contributions over the years. Maurizio will serve as the Chapters Coordinator for the term 2024–26. I anticipate the transition to be smooth, given that we have a good few months for effective knowledge-transfer. I am grateful to Amy Deeb for her continued contributions on the Chapters front, and I look forward to working with Amy and Maurizio in the coming years.


*Moments from our early years in a volunteering capacity in OES (2018, Kobe; left; can you see the "YP"?) and a shared cab ride in Limerick (2023; right) during the Limerick OCEANS.*

The call for nominations to the 2024–26 class of Distinguished Lecturers (DLs) ended on 31 July. I am quite pleased by the responses to the call – we have received ten excellent nominations. The committee will oversee the selection of the next DLs and I hope to make the announcements soon.

Finally, I wish to take this opportunity to appreciate the many lighter moments I have shared over the years with my classmate from the 2018 class of the YP-BOOST program. Fausto Ferreira (see photo), who currently serves as the VP for Workshops & Symposia, recently announced that he will be stepping away from OES leadership roles at the end of the year. Congratulations on the baby, Fausto. It's been a fun ride alongside you for the past 6 years, and I sincerely hope that this ain't the last of you, my friend.

# From the Vice President for Workshops & Symposia

***Fausto Ferreira, Vice President for W&S***

OES Workshops & Symposia (W&S) are more alive than ever! With record attendances in some cases, newcomers and new student chapters in others, 2023 has been a good year until now and I'm sure the remaining events will be successful as well. To make sure all events run smoothly and give the large number of events planned for 2024, please always check the guidebook at https://ieeeoes.org/conferences/workshops-and-symposia/. Indeed, during the Administrative Committee meeting in Limerick in June during OCEANS, we have approved the support of OES for 10 Workshops & Symposia to take place in 2024 (and 1 in 2025). This may be a record and it's definitely a sign of a vibrant and diverse OES community. On the other hand, regarding the portfolio organization, we are now focusing on finishing the paper management systems study and have narrowed down a few options to be further explored. Please check out the latest on W&S in the next couple of pages.

## 10th Annual IEEE Conference on Technologies for Sustainability (SusTech 2023)

The 10th Annual IEEE Conference on Technologies for Sustainability (SusTech 2023) took place from the 19th to the 22th of April, 2023, in Portland, Oregon, U.S. OES was involved int he organization of a panel session. A separate report in this newsletter talks more about our participation.

## SeaAI—Artificial Intelligence and Sea

The SeaAI–Artificial Intelligence and Sea, 10th Haifa Conference on Marine Sciences, took place on the 20th of June and was hosted by the Leon Charney School of Marine Sciences, University of Haifa, Israel. SeaAI, a forum for research and applications in the areas of Artificial Intelligence and Sea, had a record number of 170 participants. As an outcome, a student chapter is being formed. A full report on this conference will be provided in the next edition.

## Robotics for Asset Maintenance and Inspection (RAMI) Marine Robots 2023 Competition

The second RAMI Marine Robots competition took place at the NATO STO Centre for Maritime Research and Experimentation (CMRE) in La Spezia, Italy, from 16 to 21 July, 2023. 5 teams participated among which 2 were new teams (one from Turkey, a country not previously represented in RAMI/ERL competitions). A novelty in this year's edition was a Student Poster Competition among the participating students. On behalf of VPWS, Bill Kirkwood, Co-chair of the Autonomous Marine Systems TC delivered a plaque to the local organizing committee. A full report will be included in the next edition.

## Breaking the Surface (BTS) 2023

The 15th edition of International Interdisciplinary Field Workshop of Maritime Robotics and Applications–Breaking the Surface (BTS) 2023, co-organized by the OES University of Zagreb Student Branch Chapter (SBC), will be held in Kumbor, Montenegro, (first time outside Croatia) from the 24th of September to the 1st of October. By the time this newsletter is out, it will be too late to join BTS this year, but check out the next Beacon editions to know more. This year's program includes several newcomers from all over the world (Africa, Europe, U.S.), innovative technologies and the second edition of a localization challenge. A novelty of this year's edition is a pitching contest. Students will learn how to do elevator pitches and the best pitch will win an award. Providing practical and useful skills for students has been a long-standing mission of BTS and this goes along with that mission. For more info, check https://bts.fer.hr.

## 2023 IEEE International Workshop on Metrology for the Sea (MetroSea 2023)

Just two weeks after BTS, and a bit to the east of the Mediterranean Sea, the 2023 IEEE International Workshop on Metrology for the Sea (MetroSea 2023) will take place from the 4$^{th}$ to the 6$^{th}$ of October in La Valetta, Malta. Co-organized by the OES Italy Chapter, MetroSea will include a keynote on active sonar metrology by Dr. Kenneth Foote, from Woods Hole Oceanographic Institution. The call for papers is now closed but registration is open for anyone interested in the topic. See more on https://www.metrosea.org/.

## Argentine Meeting on Marine Energies (ENAEM) 2023

The Argentine Meeting on Marine Energies (ENAEM) 2023 will be held from the 6th to 8th of November, bringing together actors related to marine energies, in particular wave energy. Co-located with ENAEM 2023, the 8th Wave Energy Workshop will be hosted by the Argentine Network of Marine Energies (REMA), in collaboration with the Center for Ocean Energy Research (COER), Maynooth University, Ireland, and the Marine Offshore Renewable Energy Lab (MOREnergy Lab), Politecnico di Torino, Italy. The abstract submission deadline has been extended until 10 September, so hopefully the readers will be able to still submit. More details can be found on the website https://www.enaemcoer2023.ar/.

## Symposium on Ocean Technology, 2023 (SYMPOL 2023)

The 17th biennial Symposium on Ocean Technology (SYMPOL 2023) organized by the Department of Electronics of the Cochin University of Science and Technology, will take place

in Kochi, India from 13 to 15 December, 2023. This Symposium is intended to provide a forum for the researchers in the area of Ocean Electronics to interact with each other and present their innovative ideas and findings. The call for papers closes on 31 August ,but registration will still be open if you missed the chance to submit a paper https://sympol.cusat.ac.in/callforpapers.php.

## Workshops & Symposia Meeting at OCEANS 2023 Limerick

As in Hampton Roads, we had a Workshops & Symposia organizers meeting during OCEANS 2023 Limerick. During the meeting, I recapped the intense 2022 year and discussed some of the most important issues (including funding deadlines and procedures) and continued the discussion on conference registration systems. This meeting was followed by a W&S Committee meeting where we analyzed some critical situations and narrowed down some of the registration systems that could be an option for future OES W&S.

## Future Plans for 2024

For 2024, we have a very intense year with almost 1 Workshop/Symposia every month (and some months with more than one). In particular, in January we will have the 2024 Winter School on Underwater Network Design and Evaluation (UNWiS) in Padova, Italy. In March (18th–20th), the IEEE/OES Thirteenth Current, Waves and Turbulence Measurement Workshop (CWTM) 2024 will take place in Wanchese, North Carolina, U.S. Just before OCEANS 2024 Singapore, the Singapore AUV Challenge will take place from 5 to 8 April. SusTech 2024 will take place in Portland, Oregon, U.S. from 14 to 17 April. Then, from the 29th to the 31st of May we will have the China Ocean Acoustics conference in Wuhan, China. In July, we will have another RAMI competition in La Spezia, Italy, while in late August, the 7th edition of the UComms conference is expected to be held.

The Fall will be very intense with Breaking the Surface 2024 (late September/beginning October), a new workshop on Marine Imaging taking place from 7–10 October in Monterey, California, U.S., followed by the IEEE 10th International Conference on Underwater System Technology: Theory and Applications USYS 2024 in Xi'an, China (and online) from 11 to 13 October. MetroSea 2024 is expected to take place in Slovenia in mid-October and AUV 2024 will take place in Boston, Massachusetts, U.S., with dates to be confirmed. More news on each specific conference including call for papers will be announced shortly.

As always, I would like to remind any OES members that wish to get involved in current workshops, or propose new ones, to feel free 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!

## New VPWS

It's too early for me to say goodbye as my term finishes at the end of the year but we recently had elections for the Executive Committee, and we have elected Gerardo Acosta as the new VPWS. Gerardo has experience with this portfolio as a member of the W&S Committee and is also co-organizing the ENEAM conference. I am looking forward to starting the transition process immediately and getting him up to speed and I wish him the best of luck in this new endeavor. From my side, I will remain available for any doubts and transmitting any past experience that may be helpful for the next workshops and symposia.

# 'Changing' OCEANS

***Venugopalan Pallayil, Vice President for OCEANS (VPO)***

Hello OES Colleagues,

Here are some updates on the OCEANS front. I am happy to announce that we have appointed Jacqueline Cummings (Jackie) as our Conference Portfolio Manager. She is employed under IEEE Meetings, Conferences & Events (IEEE MCE) and supported financially by OES and MTS on a 50% share. Guided by VP OCEANS and MTS President and under the directions of OCEANS Steering Committee (OSC), she will be working with the Joint Conference Committee (JCC) to run OCEANS more effectively, technically, and financially. For all future OCEANS Jackie will be the main contact point for the corresponding LOCs. Please welcome Jackie to our community and support her as needed.

The following members will represent IEEE OES in the JCC.

Michael Pinto (Co-Chair)
Brian Horsburgh (Member)
Andreas Marouchos (Member)
Nikola Miskovic (member)

The above selection was based on the experience and expertise as well as the interest expressed by them to serve on JCC.

**Michael Pinto**—CPA, JOAB member, multiple years of experience with OCEANS Conference finances as the MTS VP Finance and as the Treasurer for several conferences

**Brian Horsurgh**—Conference Planner, RECON Co-Chair, JOAB member, instrumental in the success of the two Aberdeen conferences

**Nikola Miskovic**—mid-career academic, MS and PhD student adviser, leader of Breaking the Surface (BtS) Workshop, very active in the academic world and aware of other conferences and how they are run, forward thinking. Active in Autonomous Marine Systems Technology Committee (AMS-TC) and contributed to OCEANS 2020 Global and the Singapore AUV Challenge (SAUVC)

**Andreas Marouchos**—TC Chair on Polar Oceans, early mid-career, works for Commonwealth Scientific and Industrial Research Organisation (CSIRO), leads an engineering team that designs science systems and platforms for use in marine and atmospheric research. He has organised workshops, presented papers at OCEANS Conferences and the AUV Workshop as well as at other non-OES Conferences, is a fairly new member to AdCom.

JCC members of MTS are as follows.

Susan Hunt (MTS Co-Chair)
Dick Crout
Katherine Weathers
Natalie Zielinski

JCC, in collaboration with the Conference Portfolio Manager, will be in charge of reviewing bids received from future potential conference organisers and make recommendations to OSC, which are then submitted for the approval of OES AdCom and the Board of Directors of MTS. More details will be available under the Agreement for Joint Operation of OCEANS Conferences between the IEEE Oceanic Engineering Society and the Marine Technology Society to be published shortly. The AdCom held in Limerick approved the new Joint Agreement on OCEANS between OES and MTS.

A virtual 'hotwash' was held as part of the OCEANS 2023 Limerick debrief to summarize the conference highlights and to solicit feedback from both the LOC and Professional Conference Organiser (PCO) on improving the conference organization based on their experience. The conference was successful both technically and financially. OCEANS 2023 Limerick saw 681 total registrations and 46 exhibitors including 3 patrons. 423 papers were published and there were 14 Student Poster Competition participants. JCC will consider feedback from the LOC and PCO and share them with future LOCs as needed to improve the future conference organisation.

The processing of OCEANS PCO contracts has picked up momentum. The Contract for Singapore PCO has now been completed and for other three future conferences, Halifax 2024, Brest 2025 and Great Lakes 2025 will be completed in the next couple of months. This is a big achievement considering the delays we had experienced with the processing of some of the past Contracts.

The call for abstracts for OCEANS 2024 Singapore has been opened on 01 Aug 2023 and will be closed on 30 Oct 2023. More details of the conference and some important dates are available at the conference website: https://singapore24.oceansconference.org/.

A joint bid (from China, Taiwan, Hong Kong and Japan) for hosting OCEANS 2026 in Sanya, Hainan Province, China, has been received and will be submitted to JCC for their action and recommendation once the JCC has been setup.

That is the summary of news from my end. I look forward to meeting some of you at OCEANS 2023 Gulf Coast in September and many of you in Singapore in April 2024. I will be back with more OCEANS news in the next edition of Beacon. Feedbacks are welcome at vp-oceans@ieeeoes.org.

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

***Mandar Chitre, Journal Editor-in Chief***

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

- Henning Oeveraas, Haakon Skogland Halvorsen, Olav Landstad, Vidar Smines, Tor Arne Johansen, "Dynamic Positioning Using Model Predictive Control With Short-Term Wave Prediction."
- Dianpeng Su, Fanlin Yang, Chao Qi, Yue Ma, Yan He, Xiao Hua Wang, Jiaoyang Liu, "Modeling and Analyzing Water Column Forward Scattering Effect on Airborne LiDAR Bathymetry."
- Cheng Chi, Shiping Chen, Pengfei Zhang, Peng Wang, Ruizhi Hu, Jiyuan Liu, Haining Huang, "Estimating AUV Motion Using a Dual-Sided Synthetic Aperture Sonar."
- Rahul Deogharia, Sourav Sil, "Reconstructing High-Frequency Radar Derived Ocean Surface-Current Fields Using Spatio-Temporal Kriging."
- Xiaoyang Yu, Tian Zhou, Yuqian Wang, Lihong Zhang, Baowei Chen, "Underwater Multitarget Tracking Method Based on Threshold Segmentation."
- Ildar Urazghildiiev, "Estimating the Motion Parameters of Sound Sources Using a Network of Compact Arrays."

- Alex Slonimer, Stan Dosso, Alexandra Branzan Albu, Melissa Cote, Tunai Porto Marques, Alireza Rezvanifar, Kaan Ersahin, Todd Mudge, Stéphane Gauthier, "Classification of Herring, Salmon, and Bubbles in Multifrequency Echograms Using U-Net Neural Networks."
- Panagiotis Agrafiotis, Konstantinos Karantzalos, Andreas Georgopoulos, "Seafloor-Invariant Caustics Removal From Underwater Imagery."
- Bruno Ferreira, Paula Graça, Jose Alves, Nuno Cruz, "Single Receiver Underwater Localization of an Unsynchronized Periodic Acoustic Beacon Using Synthetic Baseline."
- Peter Hoeher, Oliver Zenk, Boris Cisewski, Karin Boos, Joachim Groeger, "UVC-Based Biofouling Suppression for Long-Term Deployment of Underwater Cameras."
- Enrique Padilla, Rui Cao, Adrian H. Callaghan, "Spatial Interpolation of Wave Fields Based on Limited Spatial Measurements."
- Fengzhong Qu, Jingyu Qian, Jiayi Su, Yan Wei, Mingyuan Cheng, Honghui Guo, Jiang Zhu, Jie Wang, "Theoretical Model and Experiments of Focused Phased Array for Cross-Medium Communication in Misaligned Transmitter/Receiver Scenarios."
- Ryan McCarthy, Sophia Merrifield, Bikramjit Sarkar, Eric Terrill, "Reduced-Order Machine-Learning Model for Transmission Loss Prediction in Underwater Acoustics."
- Anatoly Virovlyansky, Anna Kazarova, Boris Katsnelson, "Phase Space Representation of Sound Fields in Lake Kinneret."
- William Stevens, Martin Siderius, Matt Carrier, Ying-Tsong Lin, Drew Wendeborn, "Ocean Ensemble-Enabled Stochastic Acoustic Prediction With Operational Metrics: New England Shelf Break Acoustics Signals and Noise Experiment."
- Jingchun Zhou, Jingchun Zhou, Yanyun Wang, Chongyi Li, "Multicolor Light Attenuation Modeling for Underwater Image Restoration."
- Rubén Boluda-Ruiz, Pedro Salcedo-Serrano, Beatriz Castillo-Vázquez, Antonio García-Zambrana, José María Garrido-Balsells, "Impact of Scattering on Secrecy Outage Probability of Underwater Optical Wireless Links."
- Ali Abdi, Erjian Zhang, Rami Rashid, "Particle Velocity Underwater Data Communication: Physics, Channels, System and Experiments."

# One Small Step *for* IEEE—One Giant Leap *for* OES

***Christoph Waldmann, Chair of the Standing Committee on Standards (waldmann@uni-bremen.de)***
***Stephen M. Holt, Standing Committee on Standards(sholt@ieee.org)***

Standards are challenging engineers in different disciplines. They feel caught up in a net of regulations that limit their creativeness. It is not so much though in the discipline of ocean engineering, which probably makes it an attractive field for young engineers, who have many innovative aspirations.

Alternatively, is it possible that standards are paving the way towards advancing successful technical developments that are accepted by potential users? Therefore, after a detailed discussion within the OES Standards Committee itself, and by conducting several inquiries with additional experts, both the OES President and the OES Standards Committee Chair, have decided to seek accreditation from the IEEE Standards Association in order to initiate development of new standards.

The topics that shall be addressed represent a broad scope of interest starting from underwater connectors for powering ocean going equipment, monitoring the distribution of marine debris, removal of $CO_2$ from ocean waters, as well as developing a Digital Twins process applicable to the world oceans. Note that a Digital Twin is a virtual representation synchronized with physical things, people, or processes. These are rather huge challenges, and the OES Standards Committee on Standards can only be successful if our members are offering their support.


*The IEEE scheme for the lifecycle of a standard (https://innovationatwork.ieee.org/understanding-how-technical-standards-are-made-maintained/).*

Therefore, we would like to take this opportunity to ask all members of OES to consider participating in the truly exciting activities that are ahead of us.

# Chapter News

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

## Hong Kong Chapter

### The home of the "Future Explore"

***Reported by Paul Hodgson, Chapter Chair and Dany Cho, ExCom member***

What a great time we live in! We live in a world surrounded by incredible technology that has magnified our range of potential experiences, enabling individuals to travel beyond the atmosphere as tourists with spacecrafts and rovers, provided they have the (financial) means to do so, of course. Yet, in light of these possibilities, we are facing rising cases of social isolation, misinformation, addiction, depression, and even war. The list goes on and could continue about how we lack the capability to explore unchartered territories due to modern dependencies, nevertheless, it is no intention to be a cynical here. There is no immediate solution – a cure for all, but we believe doing things in ways that involve discussion and action offer a way forward to begin addressing such issues. This article, we hope, is a catalyst to start this.

With the successful introduction of NASA's Rotation Pulse Detonation Engine and Elon Musk's Space X Starship proceeding at a steady pace, it seems as if we are on the brink of space travel and exploration. What we describe as "The Great Filter" has kept other species like the dinosaurs planet-bound, and we all know what happened to them. Some parallels can be drawn here, with mankind historically sticking to age-old traditions of brutality and violence, an image that appears to be straight from the Mesozoic Era. It's also quite funny to think that coincidence or not, the solar system has rotated around our galaxy into almost the same place it was when the dinosaurs got annihilated, but we are not expecting any large incoming asteroids within this century so no clobbering for us in the near future. Thankfully though, we have recently successfully tested a deflection system for high-speed collisions already, and this is a comforting thought. Our only expectation is that the asteroid Bennu will slam into the earth in about 300 years' time, and as a result, we do actually have more time to get things further developed.

Such technological development however, has been significant in terms of stress to our life support system. We have accelerated climate change, faced difficulty handling the social aspects of pandemics–as evidenced by the recent COVID pandemic, and these are only a few of many challenges. It took a while to ramp up action against the virus and the next pandemic that occurs will let us know how much we learnt from this experience. The information revolution has created an internet with heaps of conflicting data. This doesn't help. Not only that, we lack the people who would be willing to get into a rocket ship and risk sailing off the edge of the universe in search of new places.

At this point, you must be asking, what is the catalyst then, and how does the IEEE factor into all of this? In 2006, a program of ROV workshops and competitions was started by Prof. Robin Bradbeer at the City University in Hong Kong. She headed a small team of university students and myself, to promote underwater engineering to primary, secondary, and university aged students. The program was very successful and continued to expand, even after Robin left Hong Kong to retire. The primary objective was to hold workshops teaching students how to build a pipe-frame locally designed ROV. This machine could be modified to compete in ROV competitions. The main target, in the early times, being the MATE International ROV competition held yearly in the USA.

It soon became apparent that this simple ROV building program had a hidden feature. It quickly identified those students

*Early ROV Workshops – 2006.*

*Early ROV Regionals – 2010.*

who found their intelligence and abilities early. These students opened our "ROV in a Box" workshop packages and realized they could build anything with the array of bits and pieces the box contained. Our dilemma, at the time, was what to do with these students that would allow them to advance further. Initially, we pushed them to other competitions and similar demonstrations showing ability. We also advised them to try and do projects. Apart from this, the only other way was to try and get them into mentoring programs in the areas they were interested in. This was a far cry from a professional way the IEEE could recognize this potential.

In 2018, we realized that the number of "special" students the ROV workshop programme was uncovering had reached the point where a small IEEE conference could be organized for them to show off their work. Thus, the decision to run an IEEE Student conference was made. Paul's position, at that time, was Vice-Chairman of the CT/OES Joint Chapter so he could arrange it. After what seemed an eternity, eighteen secondary school students worked on projects that would normally be seen at university level. The conference was scheduled for the 17th of November 2019 at Polytechnic University. As usual the Gods of Chaos ruled. The year 2019 was a time of civil unrest in Hong Kong. Riots, teargas, and sieges were occurring on a daily basis. On the 15th of November, two days before we were to start, trouble started around the Polytechnic University that led to a full siege with constant clashes between the students and police as day turned to night. We had to cancel the event. This program was not starting very well.

Finally, we held the Young Engineer's Conference 2019 (YE-19) on the 13th of September, 2020, almost one year later. Eighteen projects, including the preparation of posters and written papers, were presented by each team for fifteen minutes, and it turned out better than we had expected. We had tapped into a hidden talent. Two more conferences followed; the YE-21 and YE-22. Each had more students and more projects. The program worked.

The students we find for the YE program are also the innovators the inner (undersea) and outer space program needs. Young minds who have found their intelligence early and strive to achieve and improve mankind in line with the IEEE theme–"Engineering for Humanity."

The physical and virtual world shows engineers have been involved in all aspects of recent human development. There is still a lot to do though, and we are not out of the woods yet. Traditionally, IEEE has been focused on the accolades of great inventions and innovation. This is correct, but contemporary education establishes the basis of our capabilities during our school years, and this system of educating our young is based on a method that was developed during the industrial revolution some 300 years ago. Sure, it has come a long way, but the principle has remained the same. Given the massive amount of technology and information available today on the internet, many youngsters are self-learning to the point that they sometimes know way more about a topic than the person teaching them about it. Our children are learning about a lot more stuff than ever before, and this allows those who discover their intelligence to advance forward in leaps and bounds. Unfortunately, the current school system usually cannot cater for them, particularly in schools with limited resources.

*YE-19.*

*YE-21.*

*ROV local Competition.*


*YE-22 at the TENCON 22 in Hong Kong.*

*10-year-old Lucas presenting.*

I have heard both teachers and students say that we are 50 years ahead of the times with this program. But one must ask themselves honestly, are humans truly at the forefront of everything when we have not even learnt that conflict and war campaigns are steps in the wrong direction? There must be a solution to our differences, using them to propel ourselves forward, not backward. Education must be the key to this.

Man has not returned to the surface of the moon for 50 years. Is the same type of procrastination happening with the way we educate our young? Perhaps the time has come for some adjustment of our education system, an adjustment catering for the rapid development of young human minds surrounded by the technology we have already developed.

While this change is being considered and (perhaps) implemented, the HK IEEE CTOES intends to concentrate on thickening the veneer we have put on top of the existing education system, allowing us to capture some of the fast growing wild grass that is punching through the roof of education. Working with them to allow these youngsters a chance of showing off the level they have reached through projects, fun activities and conferences, and giving them IEEE recognition of achievement as they succeed. This definitely helps their chances of getting into further education and gives them a better chance to realize their dreams. We encourage other IEEE chapters to jump on board and start something similar in their areas. After all, IEEE sets standards for the way technology should be taught in schools. How about we lead a little to show what we want.


*Battle Bots Poster – 2023 (Serious ROV fun).*

The HK IEEE CTOES YE program is open to all secondary school students anywhere on the planet. Programme information can be retrieved from the www.ieeeye.com website. Our ROV activity can be seen at www.rov.hk.

## Malaysia Chapter

### Technical Talk on Remote and Autonomous Technologies Development for Marine Survey and Exploration and IEEE OES Membership Drives

***Reported by Zulkifli Zainal Abidin, Vice Chair***

The webinar, entitled "REMOTE AND AUTONOMOUS TECHNOLOGIES DEVELOPMENT FOR MARINE SURVEY AND EXPLORATION" was presented by Assoc. Prof. Dr Zulkifli Zainal Abidin, from the IIUM at Gombak, Malaysia, on 19 May, 2023, at 10.00 MYT.

Zulkifli bin Zainal Abidin, a roboticist, obtained his B.Eng Computer and Information Engineering from IIUM in 2003, MSc. and Ph.D from USM, Penang, in 2007 and 2013, respectively. He then joined the Mechatronics Engineering Department at IIUM, and has been a member of the faculty there ever

*Figure 1. Students actively participate and draw inspiration from an IEEE OES Malaysia Chapter technical talk that fosters knowledge-sharing.*

since. He is actively engaged with industries and government agencies as a consultant and a subject expert. Among them are; PDRM, PROTON, MARA, Petronas, Petrosains, Temasek Engineering, Delloyd R&D, Jabil, Prostrain Technologies, MARii, HGIS, SIRIM, Altus Oil & Gas Malaysia, and many more. He is presently the director and co-founder of the Center for Unmanned Technologies (CUTe), a Competence Centre Programme under Industry@University by MITI and KPT. He has acquired a number of research projects and grants as a principal worth more than RM5 million, which is mainly from industry funding with more than 10-Research Agreements signed. He was awarded with the Chartered Engineer (C.Eng) status from the Engineering Council UK (IMarEST), a vice-chair for IEEE OES Malaysia Chapter and SAE International Malaysia as well. He has authored/reviewed as the editorial board member of publications in international and local refereed journals and conference proceedings. His research projects are mainly in the area of underwater, ground and space robotic platform development for fieldwork operations, new sensing devices and mechanisms, and intelligent control algorithms. Apart from academic activities, he is also actively involved in off-road motorsports as a trainer.

In the beginning of the presentation, he shared information about IEEE International and the developments of IEEE Malaysia, particularly the establishment of IEEE OES in Malaysia and its activities. Amongst the main topics covered was the vision, objectives, and focus of IEEE OES in Malaysia. Current activities and the benefits of being part of IEEE OES were also shared.

*Figure 2. Sharing the information about IEEE International and the developments of IEEE Malaysia.*

Then, he shared his experience in research and development related to remote and autonomous technologies for maritime survey and exploration.

Engineers and scientists must strive to meet the extremely tight design constraints imposed by the harsh conditions that both surface and underwater platforms have to face. Among these, the following are worth stressing:

1) High pressures and low temperatures related to extremely deep or harsh environments require suitable components and water-tight containers and equipment.
2) Underwater and surface communications mandate the use of acoustic devices that in challenging operational scenarios are plagued with intermittent communication losses and multi-path effects and exhibit reduced bandwidth and low reliability.
3) Long-range missions require that the vehicles be equipped with proper power supply systems (also relying on alternative technologies such as fuel cells, biological batteries, solar panels, etc.) and efficient energy management systems.

Towards the end of the presentation, he urged students to actively engage in any associations to gain knowledge related to professional societies and industries, particularly.

During the Q&A session, the students were particularly interested in gaining insights about TRL and how they can create cutting-edge technologies.

Technology Readiness Level (TRL) is a scale used to assess the maturity and readiness of a technology or innovation for practical application. It is commonly used in research and development (R&D) projects, particularly in engineering and scientific fields. TRL provides a framework to evaluate and communicate the progress of a technology from its early stages of development to its deployment in real-world applications.

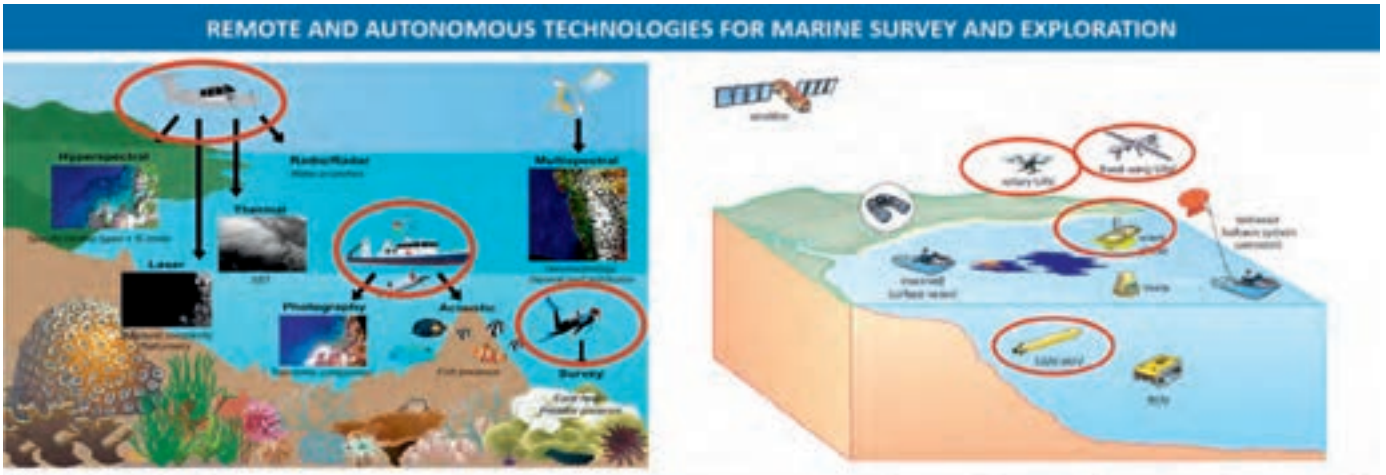
The TRL scale typically ranges from 1 to 9, with each level representing a specific stage of technology development:

1) Basic Principles Observed: This is the lowest level, where scientific research is conducted to understand the basic principles and concepts behind a technology.
2) Technology Concept Formulated: At this stage, the theoretical concept is developed, and initial experiments may be conducted to validate its feasibility.
3) Proof of Concept: The technology's basic functionality is demonstrated in a controlled laboratory environment.
4) Technology Validated in Lab: The technology is further tested and validated under laboratory conditions to ensure its reliability and performance.
5) Technology Validated in Relevant Environment: The technology is tested in a simulated or controlled environment that closely resembles real-world conditions.
6) Technology Demonstrated in a Relevant Environment: The technology is demonstrated in an operational environment to showcase its effectiveness and potential applications.

7) Technology Demonstrated in an Operational Environment: The technology is tested and validated in a real-world operational setting to assess its performance and functionality.

8) Technology Complete and Qualified: The technology is fully developed, and all necessary qualifications, certifications, and regulatory approvals are obtained.


*Figure 3. Overview of the establishment of IEEE OES in Malaysia.*




| Normal Platform | Satellite | Airborne | | | | Boat | | Diver | |
|---|---|---|---|---|---|---|---|---|---|
| Platform | | Unmanned System (Flying) | | | | (Floating) | | (Diving) | |
| Sensor | Multispectral | Hyperspectral | Laser | Thermal | Radio/Radar | Acoustic | Photography | Photography or visual survey | Multiparameter Sondes |
| | WorldView-1 to 3 | Sensor 1 | Sensor 2 | Sensor 3 | Sensor 4 | Sensor 5 | Sensor 6 | Sensor 7 | Sensor 8 |
| | IKONOS | | | | | | | | |
| | GeoEye-1 | | | | | | | | |
| Ground Station | Telemetry A | | | | Telemetry B | | Telemetry C | | |
| General outplanting parameter | Geomorphology; General reef distribution | Specific benthic types | Structural complexity; Bathymetry | Sea surface temperature | Water properties | MBES | Taxonomic composition | Coral health; Predator presence | Underwater properties |

*Figure 4. Advancements in marine survey and exploration: Remote and autonomous technologies*

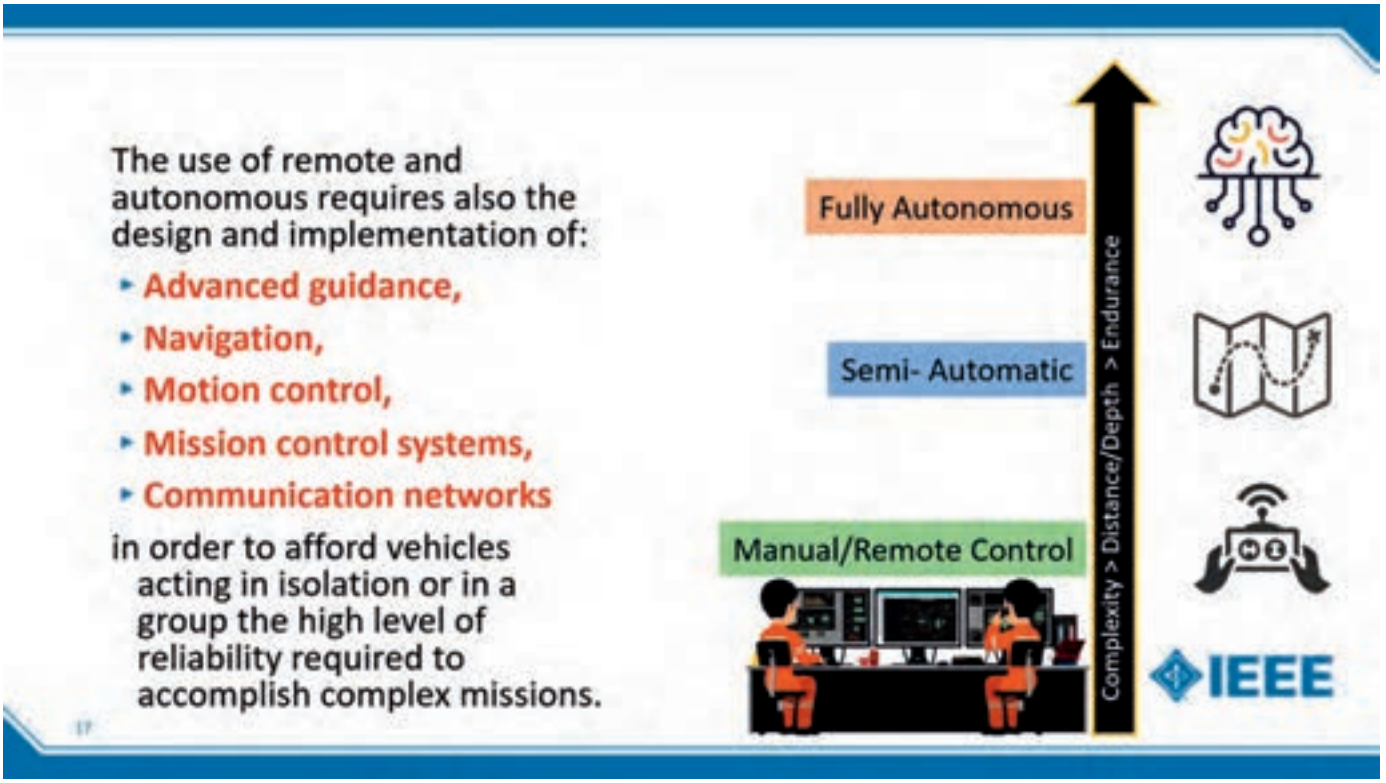



*Figure 5. Deploying remote and autonomous systems for effective implementation.*

9) Technology Ready for Deployment: The technology is deemed mature, reliable, and ready for widespread deployment and commercialization.

Understanding TRL is important for undergraduates as it helps them assess the stage of development of a technology they might be working on or researching. It provides a common language for discussing technology readiness, evaluating risks and challenges, and setting realistic expectations for the implementation of innovations in practical applications. TRL can also guide decision-making processes, funding allocation, and the transition of technologies from research to industry.

## Excursion to Redang and Bidong Island

***Reported by Ahmad Faisal Mohammad Ayob, Zool Hilmi Ismail, Mohd Ikhwan Hadi Yaacob and Zainah Md Zain***

A team of five members from the IEEE OES Malaysia Chapter recently embarked on a short visit to explore the natural wonders and research facilities of Redang Island and Bidong Island. The team consisted of Assoc. Prof. Dr. Ahmad Faisal Mohammad Ayob, our host from UMT, Assoc. Prof. Ir. Dr. Zool Hilmi Ismail from Universiti Teknologi Malaysia, Assoc. Prof. Dr. Mohd Ikhwan Hadi Yaacob from Universiti Pendidikan Sultan Idris (UPSI), and Dr. Zainah Md Zain from Universiti Malaysia Pahang (UMP) and Mrs Syahirah Hanizam from International Islamic University Malaysia (IIUM).

Their journey began on 28 May, 2023, with a boat ride from the mainland to Redang Island. Redang Island is known for its breathtaking beaches, crystal-clear waters, and vibrant marine life. The team arrived at Merang Jetty, where they departed for their exciting two-day, one-night trip. At 10:00 AM, the team boarded the boat and set off for Redang Island. The boat journey provided them with stunning views of the turquoise waters and lush landscapes. Their first day was filled with various outdoor activities and exploration of the island's beauty.

The main agenda for the first day included an island hopping and snorkeling adventure. They visited several captivating locations, starting with Turtle Point in Teluk Dalam. This spot is famous for its abundance of sea turtles, allowing the team to witness these magnificent creatures in their natural habitat.

Next, they ventured to Little Maldives Redang, a picturesque spot with crystal-clear waters and stunning white sandy

*Figure 1. Capturing a moment of friendship at SEATRU, as our IEEE OES Malaysia team members strike a pose before an informative briefing about the remarkable Redang Island.*

*Figure 2. At the Vietnamese Memorial in Bidong Island.*

*Figure 4. Stepping ashore with excitement and anticipation, our team disembarks from Jetti Marang, ready to embark on a memorable adventure at Redang and Bidong Island.*

*Figure 3. Cradles precious baby turtles at SEATRU, fostering a deep commitment to marine conservation.*

beaches reminiscent of the renowned Maldives. The team enjoyed snorkeling and were amazed by the vibrant marine life and colorful coral reefs.

Continuing their journey, they visited Pulau Paku, where they immersed themselves in the beauty of the island's pristine beaches and lush greenery. They took leisurely walks, appreciating the serene surroundings and the soothing sounds of nature.

The final stop of the day was Nemo Point Redang, named after the famous clownfish character from Finding Nemo. The team had the opportunity to explore an underwater paradise and observe the captivating marine life that Redang Island is known for.

On 29 May, the team's agenda focused on Seatru Chagar Hutang on Redang Island. They participated in a Seatru-related briefing, which provided valuable insights into sea turtle research, conservation, and rehabilitation efforts. They learned about the challenges faced by sea turtles and the importance of preserving their habitats.

After the briefing, the team departed from Redang Island to Pulau Bidong. They arrived at Pulau Bidong at 11:30 AM and received a briefing at the UMT Research Station. The briefing provided an overview of the research conducted on Bidong Island, emphasizing marine biodiversity, ecosystem dynamics, and sustainable management practices.

With a day filled with enriching experiences and knowledge, the team departed from Merang Jetty at 3:00 PM, carrying newfound knowledge and cherished memories of their journey. At 3:30 PM, they arrived back at Merang Jetty, concluding their remarkable trip to Redang Island and Bidong Island.

The trip offered a perfect blend of outdoor adventures, educational briefings, and opportunities to witness the beauty of marine life and conservation efforts. The team returned with a deeper understanding of the importance of preserving these precious ecosystems and a renewed commitment to contribute to their protection.

# EVOLUTION

## Life Member Conference

## April 14-16, 2024

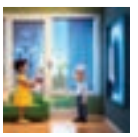
## Hyatt Regency, Austin, TX

We are excited to announce the inaugural Life Member Conference, designed to strengthen the engagement of IEEE's 38,000 Life Members in shaping our collective future. Life Members represent all disciplines across the IEEE's fields of interest. We are also dedicated to giving back and sharing our expertise with the next generation.

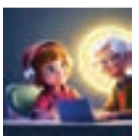
The conference has three tracks:

1. Emerging Technologies – that impact seniors
   - ❖ Technologies of the Future and the Next Chapter
   - ❖ Aging Society and Technology Progress
   - ❖ Renewable Energy and Sustainability

2. Applications – technologies used by aging populations
   - ❖ Financial and Investment Strategies
   - ❖ Smart Systems, Infrastructure, Equipment and Living



3. Contributions – members sharing resources with future leaders
   - ❖ Mentors and Influencers in the Modern Society
   - ❖ Professional Development, Sharing and STEM Education



Our growing list of speakers include Rodney Brooks (iRobot), John McDonald (GE), Whurley (Strangeworks), Manuela Veloso (JP Morgan), Bernie Sander (AMD), Julie Shah (MIT) (and more!). Speaker commitments are ongoing and over the summer and fall, we'll have a large list of exciting and engaging speakers, keynotes and topics to share.

Join other Life Members, Senior Members, influencers, innovators, technical professionals, and members of the STEM community in Austin for this inaugural event. Registration will be limited, so be sure to secure your spot early.

Stay tuned for further details about the conference at https://life.ieee.org/news-events/ieee-life-member-conference and our social media channels.

# Autonomous Maritime Systems (AMS) Technology Committee Report

***Bharath Kalyan & Bill Kirkwood, Chairs of AMS Technology Committee***

The realm of Autonomous Maritime Systems (AMS) encompasses a diverse array of vehicles, spanning flight, surface, and subsurface assemblies, each comprised of various sophisticated sub-systems and instruments. Among these are flight systems, navigation components, acoustics, propulsion systems, actuators, batteries, vision systems, and computational assets for controls and data analysis, resulting in valuable data products. These technologies are not limited to single-purpose systems; rather, they are ingeniously deployed in both vertical and horizontal multi-asset configurations, seamlessly integrated to achieve remarkable feats.

AMS implementation finds significant utilisation in the military domain, safeguarding harbours and similar areas. Beyond the military, AMS technology has widespread applications in various marine sciences, such as mid-water biology, mapping, chemical sensing, sampling, and persistent monitoring. Moreover, the industry is rapidly embracing AMS vehicles, particularly for oil field inspections and intervention tasks, signifying its growing importance.

The AMS Technology Committee is an active force in advancing this domain. Our focal point is a distinguished single-track symposium, convened biennially, and hosted at different global locations, dedicated to serving our esteemed international membership. Additionally, we proudly contribute to the publication of special issues in the esteemed IEEE OES Journal of Ocean Engineering. Education in AMS is another area where we actively contribute, fostering talent through sponsoring student poster competitions for both Masters and PhD students. Moreover, we passionately support and judge AMS competitions worldwide, where the OES often stands tall as a key sponsor.

## RAMI (16–21 July 2023, La Spezia, Italy)

The Robotics for Asset Maintenance and Inspection (RAMI) Marine Robots is the latest challenge in the European Robotics League (ERL) series of marine competitions. The competition recently concluded its second edition of RAMI at the esteemed NATO STO Centre for Maritime Research and Experimentation (CMRE) in La Spezia, Italy. The competition consisted of 3 sections, Poster, Team Presentations and the in-water component which had a new challenge each day over three days. Coming out of COVID this competition tested the capabilities of Autonomous Underwater Vehicles (AUVs) from participating teams, challenging them with intricate inspection and maintenance tasks within the secure CMRE protected seawater basin. The AUVs demonstrated their prowess in perception, manipulation, adaptive mission planning, and autonomous navigation to achieve success in this demanding event. A series of awards were given for the various competition components with an additional award given by IEEE OES for Innovation. A full article will be coming from the event organisers with the list of participants and winners. Next year's competition was also announced and will again be held in La Spezia during July of 2024. The CMRE organisers are looking forward to it and have already received input from several universities that they plan to attend which will expand the pool of competitors. Although the competition is listed as ERL, it is open to all who want to compete and teams from Asia, the Americas and elsewhere are encouraged to look for the new challenge announcement, which will also be published in the Beacon. Further details can be found at this link: https://metricsproject.eu/inspection-maintenance/rami-2nd-field-campaign-marine.

## BTS 2023 (25–29 September 2023, Kumbor, Montenegro)

Breaking the Surface (BTS) is a prestigious international interdisciplinary field workshop dedicated to maritime robotics and applications. Since its inception in 2009, it has been a convergence point for global experts, university professors, scientists, industry leaders, and students across various disciplines. The meticulously designed program includes illuminating lectures that unveil the latest scientific research and discoveries. Field demonstrations showcase cutting-edge technological advancements by research groups and companies, while hands-on tutorials offer experiential learning with complex modern underwater systems. Company presentations, featuring insights from industry professionals about their organisations and products, further enrich this exceptional event. Comprehensive information regarding the 2023 edition can be found here https://bts.fer.hr/program-2023/.

## SAUVC 2024 (5–8 April 2024, Singapore)

The Singapore Autonomous Underwater Vehicle Challenge (SAUVC) stands tall as Asia's grandest underwater vehicle competition, inviting teams to develop an exceptional AUV capable of accomplishing assigned tasks. These tasks simulate real-world operational challenges, putting the AUVs through

their paces. Held in an aquatic arena, each team's AUV must complete a series of five demanding tasks (AUV navigation, underwater communication, visual identification, acoustic localisation and robotic manipulation), with speed and precision determining the ultimate victor. The 9th edition, scheduled for 2024, will precede OCEANS 2024 Singapore, providing a unique opportunity for participating student teams to be part of this prestigious international conference. Further details about the challenge can be found here: https://sauvc.org/.

### AUV 2024 (TBD, Boston, USA)

The IEEE OES AUV Symposium stands as a collaborative endeavour, proudly sponsored by IEEE OES, and held once every two years. This symposium aims to unite pioneers in the field of marine robotics, with a special focus on autonomous underwater vehicles (AUVs), facilitating knowledge exchange and charting the course for future innovations. The much-awaited 2024 edition of the IEEE OES AUV Symposium will grace the campus of Northeastern University, Boston.

### Conference Technical Sessions

OCEANS 2024 Singapore has proposed two special topics highly relevant to the AMS TC:

1) Novel AUV, USV, and multi-domain platform designs.
2) Field Marine Robotics.

The AMS TC extends a cordial invitation and enthusiastic encouragement for your support and participation in these compelling sessions. Should you wish to reach out to the committee, kindly do so via e-mail at bharath.kalyan@ieee.org and kiwi@mbari.org.

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# Ocean Decade Initiative at Sections Congress 2023 in Ottawa, Canada, 11–13 August, 2023

***Laura Meyer, Giulia De Masi, Brandy Armstrong, Christopher Whitt***

We just finished our intense and exciting weekend as an exhibitor at the Section Congress 2023. Organized by Member and Geographic Activities (MGA), this event is an opportunity to meet volunteers coming from different Regions worldwide, across Societies and Technical Activities (TA). After the cancellation in 2020 due to the pandemic, all attendees were more than excited to meet again after 6 years. One could feel the excitement amongst the participants, enabling large proactivity and desire of collaboration. Enabling Leaders to Build a Sustainable Future was the theme, with a central booth from the TA Climate Change Program at the exhibition hall. We had the opportunity to present IEEE Oceanic Engineering Society (OES) and especially our focus on ocean sustainability with the global IEEE community at IEEE Sections Congress. Strictly related to it, the Ocean Decade initiative supported by the OES played a significant role and attracted large interest from many participants.

The United Nations Decade of Ocean Science for Sustainable Development (2021-2030) is a global initiative aimed at enhancing our understanding of the ocean and its role in sustaining life on Earth. As humanity faces growing challenges posed by climate change, pollution, overfishing, and habitat degradation, the oceanic engineering community has a pivotal role to play in supporting the goals of this decade. The Ocean Decade Initiative connects the engineering and technical community with the global UN Ocean Decade community.

Many opportunities of collaboration in dedicated initiatives also related to the Ocean Decade are foreseen. New connections this weekend included the Computer Society, the IEEE Foundation, the Technology and Engineering Management Society (TEMS), the Power and Energy Society, as well as the Humanitarian Activity Board (formerly the Humanitarian Activities Committee).

Also, student chapters and young professionals have shown interest to be directly involved—like the Tunisia student chapter. Many Regions representatives came to our booth to start a collaboration with OES. For instance, R9 Costa Rica invited OES to give a talk about the Ocean Decade at the 5th IEEE International Conference on BioInspired Processing, BIP 2023 Conference Costa Rica. Moreover, Hong Kong Section Chair wants OES to influence and suggest projects for a new R10 initiative for coastal resilience. Similarly, Italy (R8) is hosting the next International Humanitarian Conference (IHTC) in Nov 2024 and the organizers also invited OES for Technical Co-Sponsorship.

Specific synergies are identified with Planet Positive 2030 (PP2030) program, where already a common Focus group has been set up. The OES Ocean Decade Initiative Committee members led the Ocean and Coasts chapter for PP2030, which has been widely-recognized as a great example of how cross-cutting technologies are needed to address sustainability.

In terms of public visibility, OES will provide its expertise for a highlight article on the IEEE Climate Change website.

Moreover, we are much looking forward to our next panel focusing on the topic of marine Carbon Dioxide Removal taking place at the Science Summit side event during the UN General Assembly on September 19th in New York City. The panel will be supported financially by IEEE, hosted at IEEE Corporate Headquarters, and IEEE may provide video recording and highlights for later OES use. Stay tuned for more information on how to follow this event.

From 25–28 September, the Ocean Decade Initiative will be present at OCEANS 2023 Gulf Coast.

The positive feedback we got from all our conversations from Sections Chairs across the world and even with the IEEE President himself gives the Ocean Decade Initiative a lot of motivation to continue its efforts.

CALL FOR ACTION on how to get involved in the Ocean Decade Initiative: https://docs.google.com/forms/d/1biFFc4vggUOYZa6WD4_BIz1fd6P8fDVpx7e3TA6N4-Q/edit

# Using Sports to Advocate for Environmental Sustainability

***Stan Chamberlain, IEEE Life Member, First OES President***

Is it possible to use sports to advocate for environmental sustainability? The Ocean Race says you not only can but they are doing it big time.

The Ocean Race is a high performance, hydrofoil-based, sailboat race around the world (Figure 1), with teams representing France, Germany, Switzerland, European Union and the United States. Since 1973, The Ocean Race has provided the ultimate test of a team and a human adventure like no other.

The 14th edition of The Ocean Race started from Alicante, Spain on January 12, 2023, and finished in Genova, Italy on June 29, 2023. The race visited nine cities around the globe during the six-month period: Alicante, Spain; Cabo Verde; Cape Town, South Africa; Itajai, Brazil; Newport, Rhode Island, (RI), USA; Aarhus, Denmark; Kiel Fly-by, Germany; The Hague, the Netherlands; and Genova, Italy. The longest leg was from Cape Town to Itajai, a distance of 12,750 nautical miles with no stopping between (Figure 2).

The leg of most interest to me was leg 4, from Itajai, Brazil to Newport, RI, USA, and leg 5, from Newport to Aarhus, Denmark, since my home is in RI. I had the opportunity to see (and photograph as an IEEE OES official photographer) the first boat to reach Newport, to observe the boats racing while in Newport, and to watch their start of leg 5 heading for Aarhus, Denmark. It was exciting to see that the boat which won leg 4 ending in Newport was the boat from the United States (11th Hour Racing) and that its captain, Charlie Enright, is from the town next to mine.

*Figure 1. High Performance, Hydrofoil Race Boat (https://www.theoceanrace.com).*


*Figure 2. The Around-The-World Race Course (https://www.theoceanrace.com).*

## So how is The Ocean Race Advocating for Environmental Sustainability?

In support of the United Nations Decade of Ocean Science for Sustainable Development 2021-2030, The Ocean Race believes they have a platform from which they can educate, inspire and accelerate action for the ocean at this critical time in history. They believe the ocean environment is in serious decline, that this is "the ocean hour," that it is, in fact, in "the 11th hour" as it moves most rapidly toward its potential midnight of destruction. They are using their global platform to inspire all those that they can reach to take action to help the ocean, explaining that this is the most important race they are in, and emphasizing that it is a Race We Must Win. Note the messages emblazoned on the racing boats themselves (Figure 3).

As they seek to reach the sailing community, wider sports industry, businesses, host cities, governments, children, fans and many more, they have embraced a program of Racing with Purpose. In conjunction with the 11th Hour Racing organization, Premier Partner of The Ocean Race and Founding Partner of Racing with Purpose, this includes a number of initiatives, including a Race Team Commitment, One Blue Voice, Ocean Summits, and Science – Capturing Ocean Data.

## Race Team Commitment

Before the start of the round-the-world race, teams signed up to a series of individual and team-wide actions that support a healthy ocean. The skippers and managers, on behalf of each of the racing teams, signed a Race Team Sustainability Charter. This charter pledges team actions across four key themes: (1)

*Figure 3. The Ocean Messages Emblazoned on Sail and Boat.*

Advocacy for the ocean, (2) Science support with onboard scientific equipment, (3) Support for the Race's Learning Programs that teach young people about the threats to the seas and empower them to take action, and (4) Onboard renewable energy operations.

## One Blue Voice

The Ocean Race sponsors believe a healthy ocean starts with recognizing ocean rights—valuing our marine world not just for the services that it provides us, but because the ocean has a right to thrive. From climate change and pollution to industrial overfishing, these rights are being ignored. To make them heard, The Ocean Race has established a global petition for a Universal Declaration of Ocean Rights. This petition, with a mechanism for individuals and organizations to sign, and which was open for signatures before, during and after The Ocean Race (https://www.onebluevoice.net/), will be presented to the UN General Assembly members in September 2023. This is in support of the United Nations **Decade of Ocean Science for Sustainable Development (2021-2030),** which is also actively supported by OES, as exemplified, among others, by the OES presentation on July 12, 2023, at the United Nations High-Level Political Forum (UNHLPF) on "Ocean Sustainability and the Impact of Pollution."

## Ocean Summits

The Ocean Race Summits are a series of summits seeking to drive new and improved policies around the major issues affecting the ocean: lack of governance, lack of protection, and climate change. The series examines whether giving the ocean rights could be a key to ensuring its future. The Summits use the Race's global platform to help accelerate action for our marine world. One of the ways they are doing this is by reaching the decision-makers who can make this happen. The Summits support the United Nations Sustainable Development Goal 14 (SDG14) to conserve and sustainably use the oceans, seas and marine resources.

Starting as a stand-alone event during the 2014–15 edition of the Race, at the stopover in Newport, Rhode Island, USA, the Summits have become one of the most important elements of the Racing with Purpose sustainability program. During this year's edition, the Summits were held in each of the stopover cities, except Cape Town and The Hague. They included a physical presence from local government, industry and civic participants and virtual participation from attendees from around the globe. The Carbo Verde Summit was opened with a powerful message from United Nations Secretary-General António Guterres. In his remarks, he noted that in the face of climate change and plastic pollution, humanity has its own race to win — the race to protect our ocean for the future.

The Summits feature innovative Action Labs, in which the participants break into groups to look at different issues relating to ocean health, building on best practice from across the world to create clear pathways and actions. The Summit at the final city focused on the outcomes of the "Genova Process," a pathway bringing together international experts in international law, diplomacy, ocean science and sport to drive the ambitious goal of giving the ocean a voice. The Genova Process included a series of Innovation Workshops towards the drafting of principles on Ocean Rights. Along with the One Blue Voice petition, the principles will be delivered to the UN Assembly in New York in September 2023.

## Science—Capturing Ocean Data

An important element of The Ocean Race Science Program is using their unique race—which goes through some of the most remote parts of the planet that are rarely accessible for scientific research—to gather valuable information about the health of the ocean. With guidance from leading oceanic science organizations, they collected key ocean measurements to help provide a more accurate view of what is happening to the ocean and the important role it plays in maintaining a healthy planet. They believe this is the most comprehensive science program of any sporting event in the world. Their goal is to take 4.3 million measurements during the 32,000 nautical mile long race and more than 400 samples of marine litter. Data was transmitted to science organizations via satellite in real time, contributing to the Ocean Decade Odyssey project, an endorsed project of the UN Decade of Ocean Science (2021-2030). Figure 4 provides an overview of the comprehensive data collection program and Figure 5 identifies the ocean parameters that were collected during the race.

## The Ocean Race—Over The Water

These are the some of the activities associated with "the Race We Must Win." What of the 32,000 nautical mile, nearly 6-month race around the world? The Race started in Alicante, Spain on January 12, 2023 and ended in Genova, Italy on June 29, 2023 when the last of the boats to arrive in Genova was declared the winner (last, not first to arrive, as explained in Leg 7 below).

The Ocean Race, sometimes considered "the ultimate test of a team in sport," had situations that give some credence to the characterization:

- Leg 3: Shortly after the start of leg 3, from Cape Town, South Africa, one of the boats (GUYOT environment – Team Europe) experienced delamination in a portion of its hull and had to withdraw from leg 3.


*Figure 4. Comprehensive Data Collection Process (https://www.theoceanrace.com).*


*Figure 5. Ocean Measurements During The Race (https://www.theoceanrace.com).*


*Figure 6. Official Photographer Badge.*

- Leg 4: One boat (Team Holcim – PRB) was 200 miles off the coast of Brazil when it lost the top half of its only mast. They jury-rigged a jib and were able to slowly return to Itajai, Brazil, ship the boat to Newport, get a new mast from Europe, and be ready for the start of the next leg. Another boat (GUYOT environment – Team Europe) on that same leg broke its port shroud supporting the mast. Under reduced sails they slowly sailed the boat to Canada. From there they shipped it to Denmark where they obtained a new mast in time for the start of leg 6.
- Leg 5: One boat (Team Holcim – PRB) broke a world distance record by sailing 640.9 nm in 24 hours. But less than 24 hours later one of the other boats (Team Malizia) set a new world record by sailing 641.13 nm in 24 hours. These averaged speeds of 27 knots while sailing in an average wind speed less than 27 knots. Also on that leg, a third boat (11th Hour Racing) was abruptly stopped dead in the water when they rammed into a large marine mammal, presumably a whale. One crew member sustained a concussion from the abrupt stop, but to a degree deemed by a shore doctor insufficient to abandon the leg.
- Leg 7: Shortly after the start of this the last leg, the boat then in the overall Race lead and expected to win the Race, 11th Hour Racing, was unintentionally rammed by one of the other boats (GUYOT environment – Team Europe), causing 11th Hour Racing to abandon that leg. This resulted in the loss of its lead with no more legs remaining to regain the lead. Fortunately for them, 11th Hour Racing, not being at fault in the collision, was granted points by the international race jurors, sufficient to recapture the lead and be crowned the overall winner of The Ocean Race.

I had the opportunity of covering the race on behalf of our OES Beacon newsletter, and was granted Photographer credentials allowing me onto one of the Official Photo Boats (Figure 6).

In addition to the ocean sustainability aspects, of most interest to me was the performance of the sole United States boat, 11th Hour Racing, with its captain from the town next to mine. By winning leg 4, coming in to Newport, he arrived as a local hero and I was able to meet him (Figure 7).

11th Hour Racing was able to go on to also win Legs 5 and 6. And after being rammed by a competitor boat and thereby knocked out of Leg 7, but being granted points by the

international jurors, 11th Hour Racing was declared The Ocean Race overall winner (Figure 8).

*Figure 7. Stan With Winning Skipper, Charlie Enright.*


*Figure 8. The Overall Winner of The Ocean Race, 11th Hour Racing.*

*Figure 9. The Start of Leg 5 in Newport, RI, USA.*

*Figure 10. Under the Bridge during the Start of Leg 5 in Newport.*

*Figure 11. Heading out to Sea from Newport on Leg 5.*

# OCEANS 2019 Seattle Plenary Speaker—Stockton Rush

***Robert Wernli, BEACON Co-Editor-in-Chief***

The unfortunate loss of the *Titan* submersible earlier this year is a very sad subject that has been, and continues to be, addressed in multiple articles. There have been many questions regarding the development of the *Titan* by Stockton Rush and his company OceanGate. Prior to this accident, Stockton Rush was the Plenary speaker at OCEANS 2019 Seattle where he addresses his history and development philosophy. You can view this nearly one hour presentation by visiting the OCEANS Video Gallery and choosing the OCEANS 2019 Seattle video link at https://ieeeoes.org/conferences/video-gallery/.

*Stockton Rush's plenary speech and audience at OCEANS 2019 Seattle.*

# OES Conference Calendar

***Contact BEACON Editors, OES VPWS and VPTA***

## OCEANS

**OCEANS 2023 Gulf Coast**
September 25–28, 2023
Gulf Coast, USA
https://gulfcoast23.oceansconference.org

**OCEANS 2024 Singapore**
April 14–18, 2024
Singapore
https://singapore24.oceansconference.org

## OTC

**OTC Brazil**
October 24–26, 2023
Rio de Janeiro, Brazil
http://www.otcbrasil.org

**OTC Asia 2024**
February 27–March 1, 2024
Kuala Lumpur, Malaysia
https://2024.otcasia.org

**OTC 2024**
May 6–9, 2024
Houston, USA
https://2024.otcnet.org

## OES Sponsored

**BTS2023**
September 24–October 1, 2023
Kumbor, Montenegro
https://bts.fer.hr

**MetroSea 2023**
October 4–6, 2023
La Valetta, Malta
https://www.metrosea.org

**ENAEM 2023**
November 6-8, 2023
Buenos Aires, Argentina
https://www.enaemcoer2023.ar/

**SYMPOL2023**
December 13–15, 2023
Kochi, India
https://sympol.cusat.ac.in/callforpapers.php

**2024 Winter School on UNWiS**
January, 2024
Padova, Italy
https://desert-underwater.dei.unipd.it/index.php/winter-school/
*The website will soon be updated with more news.

**CWTM 2024**
March 18–20, 2024
Greenville, USA
http://www.cwtm2024.org
*The website will soon be updated with more news.

**SAUVC 2024**
April 5-8, 2024
Singapore
https://sauvc.org

**SusTech 2024**
April 14-17, 2024
Portland, USA
https://ieee-sustech.org

**COA 2024**
May 29-31, 2024
Wuhan, China
*More info will soon be updated.

## Non-OES

**5th International Conference on Synthetic Aperture in Sonar and Radar**
6–8 September, 2023
Villa Marigola, Lerici, Italy
https://www.ioa.org.uk/civicrm/event/info?reset=1&id=718

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

# 10th IEEE Conference on Technologies for Sustainability 2023 (SusTech 2023)

***Venugopalan Pallayil, Vice President for OCEANS (VPO)***


The IEEE Conference SusTech is an annual event usually hosted in Portland, Oregon, USA, and sponsored and technically supported by different IEEE organisations. You can read the details of the conference at this website: https://ieee-sustech.org. Some of the IEEE OES members have been contributing to this conference (through paper submission and review) either in their personal capacities or as part of a different organization that supported the conference. In 2023, IEEE OES became a technical co-sponsor to the above conference with a view to propagate the importance of a sustainable ocean among the IEEE community and how OES is contributing to its cause. OES also got actively engaged with the UN Decade of Oceans' theme 'the science we need for the oceans we want.' The plans were to organize relevant technical sessions and a plenary talk that would cover aspects of sustainable oceans. As a member of the technical committee, I attended some of the SusTech 2023 meetings and proposed a couple of technical sessions and a plenary.

Due to limited resources, OES could not handle organization of the technical sessions. However, Mr. Bill Wilson, the Technology Committee Chair for Ocean Sustainable Energy Systems (OSES), helped to organize a panel on "Sustainable Ocean Energy Technologies and Policies" successfully. The panel was well attended and moderated by Mr. Jason Busch, Director, Pacific Ocean Energy and Trust (POET). An abstract of the panel topic and speaker details can be found here: https://ieee-sustech.org/archives/home-2023/program-2023/panels-2023/#oespanel

A summary of the 3.5 day program is provided below:
• Interactive Workshop • 11 Keynotes • 4 Panels • Over 50 papers in 15 sessions • Sustainability Forum • Student Poster Competition (virtual) • Welcome Reception • YP Networking Event with online Talk by IEEE President Rahman • Conference Dinner
• Total registrations 109 • In person author 25 • Virtual author 22 • In person attendee 39 • Virtual attendee 11 • Student poster only 11 • Guest 1 • Conference plus Student Poster 4 Speakers and Panelists: • Speakers 11 • Panelists 14

The 2024 schedule of SusTech (April 14-17, 2024) overlaps with OCEANS 2024 Singapore but is not expected to have a big impact on the attendance at OCEANS. In addition, since Mr. Bill Wilson will be able to support it technically again, OES has decided to continue its technical co-sponsorship of SusTech 2024.


2023
24.09. - 1.10.
Kumbor, Montenegro
BREAKING THE SURFACE
15th INTERNATIONAL INTERDISCIPLINARY FIELD WORKSHOP OF MARITIME ROBOTICS AND APPLICATIONS
Registration for Breaking the Surface 2023 are now open at bts.fer.hr/registration
Early bird deadline: 1st July
200 ATTENDEES
15 LECTURES
8 TUTORIALS
4 PROGRAMME TRACKS
bts@fer.hr
bts.fer.hr
facebook.com /BTSCroatia

IEEE Oceanic Engineering Society

Currents, Waves and Turbulence Measurement and Applications Technology Committee

# CALL FOR PAPERS

# CWTM

**Coastal Studies Institute, University of East Carolina, Greenville, NC, USA**

**March 18-20, 2024**

## 2024 IEEE/OES THIRTEENTH CURRENT, WAVES AND TURBULENCE MEASUREMENT WORKSHOP (CWTM2024)

### *"CWTM in the UN Decade of Ocean Science"*

Workshop objectives are to provide the ocean community with a forum for technical information exchange and to promote coordination among those interested in measuring current, waves and turbulence, and their applications.

### Topic Areas

Papers are invited in all aspects of Current, Wave and Turbulence Measurement and Applications. For the 2024 workshop, in addition to the general topic list, we are soliciting the submission of papers which address innovations and developments of these technologies in the UN Decade of Ocean Science for Sustainable Development.

* Sensor Networking
* Artificial Intelligence and Deep Learning
* Measurements from Autonomous Vehicles
* Archiving, Quality Assurance/Quality Control and Data Visualization
* Manufacturer/User Collaborations
* CWTM in the Decade of Ocean Science for Sustainable Development

### Important Dates

| | | | | | |
|---|---|---|---|---|---|
| Nov. 4, 2023 | Dec. 18, 2023 | Feb. 4, 2024 | Feb. 4, 2024 | Mar. 18–20, 2024 | April. 18, 2024 |
| Abstract submission deadline | Notification of acceptance | Final extended abstract deadline | Author, exhibitor, early bird registration deadline | Workshop dates | Final paper submission deadline |

## Abstracts

Please submit one-page extended abstracts by **4 November 2023** on the CWTA2024 workshop website (**http://www.cwtm2024.org**). Abstracts will be reviewed by **18 December 2023** and final abstracts are due by **4 February 2024**. Abstracts will be published on the CWTA24 website prior to the meeting. Authors wishing to publish full papers (4+ pages) in IEEE Xplore must submit their final papers by **18 April 2024**. Abstracts and full papers for the technical program should be technical and not proprietary by nature.

## Exhibitor Information

CWTM2024 promotes the merging of Academic, Engineering and Manufacturing aspects of Current, Waves and Turbulence Measurement. Providers of commercial products are welcome to participate in the Exhibition with promotional displays, promotional presentations and technical papers that show test data or field operations. A special session will enable 'Gold' package exhibitors to make brief promotional presentations in the single-stream workshop. Exhibitor Registration closes on **4 February 2024**.

## Student Grants

**IEEE OES is pleased to provide up to two Ocean Decade Scholarships to students and postdocs to support their participation in the IEEE/OES THIRTEENTH CURRENT, WAVES AND TURBULENCE MEASUREMENT WORKSHOP (CWTM2024). The scholarships are linked to the UN Decade of Ocean Science for Sustainable Development and will be designated ODS Scholarship.**

The grant will include registration and up to $575 towards travel expenses. To qualify for the grant, the applicant must be a bona fide student and submit an abstract by **4 November 2023**, with the student being first author, and present the paper at the conference. Preference will be given to abstracts that show a connection to the Decade of Ocean Science.

Upon abstract submission, please send an email to (weimin@mun.ca) requesting consideration for the Decade of Ocean Science grant. The conference Technical Committee will review abstracts and award the grants to top ranked abstracts by **18 December 2023**.

## The CWTM2024 Workshop Team

**General Co-Chairs:**
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Weimin Huang weimin@mun.ca

**Technical Chairs:**
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**Emeritus Support:**
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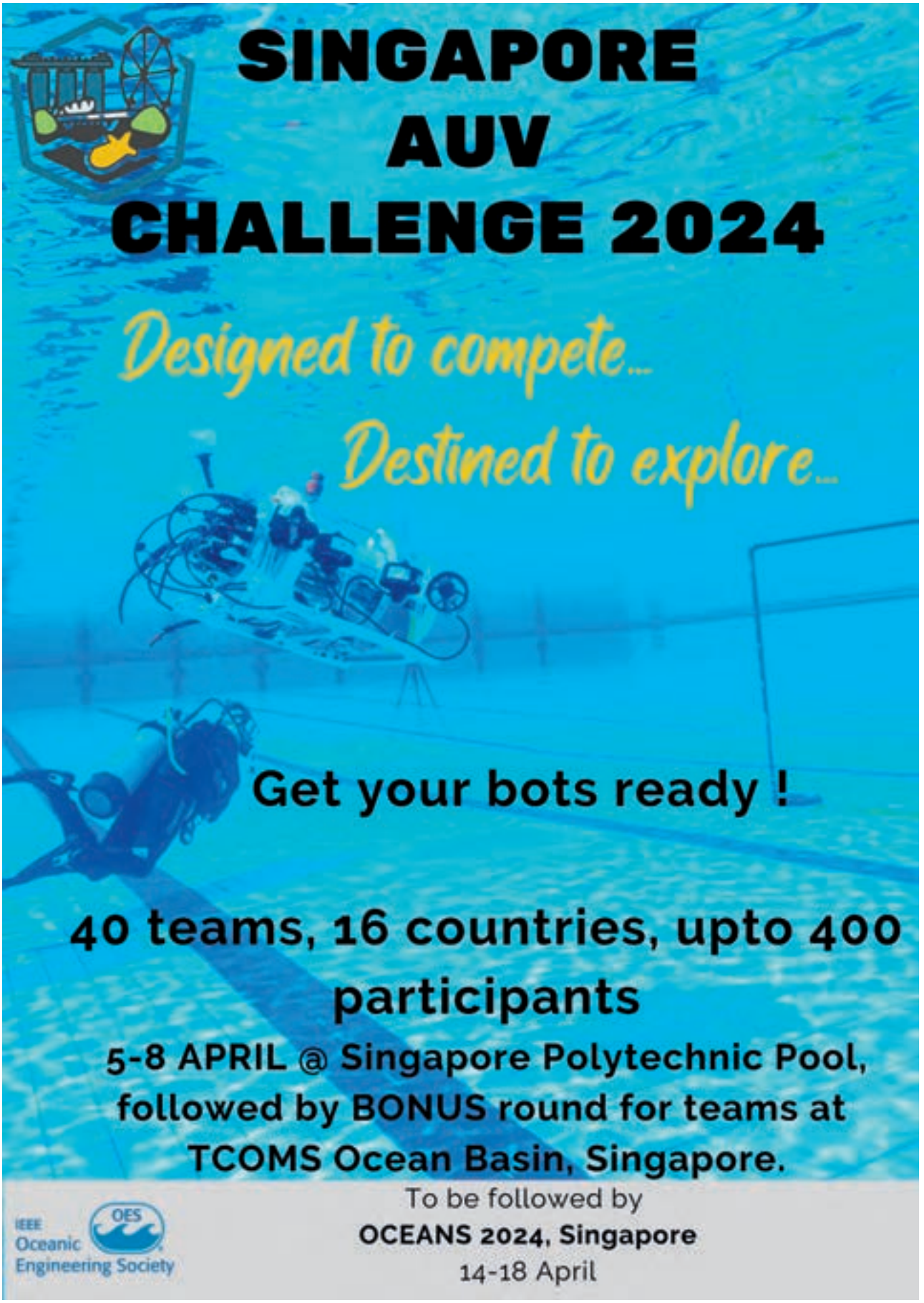
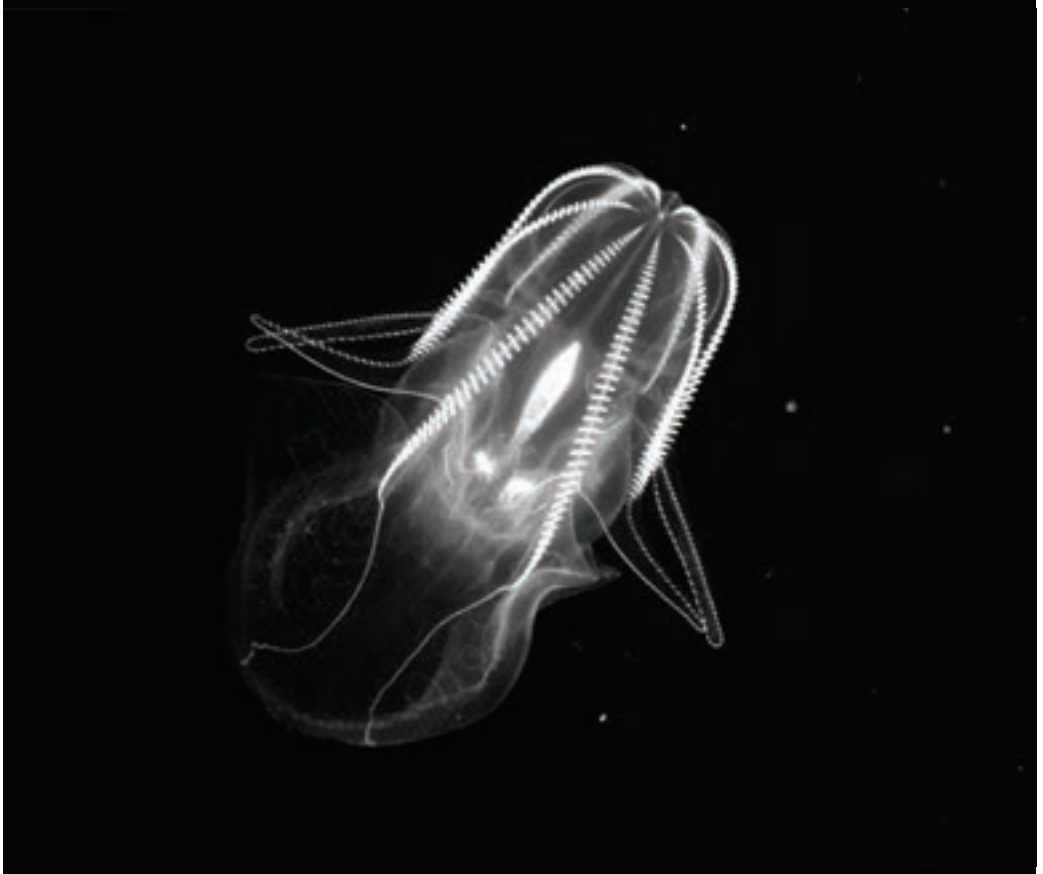

SINGAPORE
AUV
CHALLENGE 2024
Designed to compete...
Destined to explore...
Get your bots ready !
40 teams, 16 countries, upto 400 participants
5-8 APRIL @ Singapore Polytechnic Pool, followed by BONUS round for teams at TCOMS Ocean Basin, Singapore.
IEEE Oceanic Engineering Society
OES
To be followed by
OCEANS 2024, Singapore
14-18 April

IEEE Oceanic Engineering Society

MBARI

marine imaging

# 5th Marine Imaging Workshop (#MIW24)



Coming to Monterey, CA
Fall 2024

Image credit:
MBARI's Bioinspiration Lab

# A Blast from the Past! . . . Thanks Stan!

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

*Stan Chamberlain, who has documented our OCEANS conference activities for decades, is now passing his camera on to others to do the same. As shown in the below photo, Stan was one of the first OES Presidents ('83-'85), VP for Technical Activities and the recipient of the Distinguished Service Award. The following photos are a tribute to our photographer who was usually behind the camera, not in front of it. Thanks, Stan, for all the great photos.*

*OCEANS '05 Brest*

*OCEANS 'O7 Vancouver – OES Presidents Chamberlain, Eller, Czika, Wiener, Barbera*

*OCEANS '08 Kobe – Stan (left) Enjoying sushi*

*OCEANS '08 Kobe – Stan and Harumi*

*OCEANS '08 Quebec—Stan Chamberlain Receiving a Special Recognition Award from Jim Barbera*


*OCEANS '12 Hampton Roads*

*OCEANS '13 Bergen, Stan and wife Sally*

*OCEANS '13 San Diego – Star of India Captain*

*OCEANS '14 Taipei*

*OCEANS '14 St. Johns – Stan and Jim Barbera*

*OCEANS '17 Anchorage – Mr. Totem*

*OCEANS '18 Kobe – Stan and Jim Collins*

# OCEANS2023 Limerick—The First OCEANS Conference in Ireland

***Author: Isela Ibrahimovic, Coordination Chair, OCEANS Limerick 2023***



## Introduction

This was the first time the OCEANS conference came to the "Emerald Isle" and the first entirely in-person conference after COVID-19.

The event was held at the University of Limerick Green Campus, a beautiful parkland with the River Shannon as its unifying focal point. The local hosting was led by the Centre for Robotics and Intelligent Systems (CRIS), the only research Centre in Ireland in underwater robotics, with the support of the key partner for the event, Marine Institute, a leading Irish marine research institution.

*Icebreaking and registration Day 1.*

OCEANS'23 Limerick attracted close to 700 delegates across all the registration categories.

Delegates gathered from around the world for four days (5 to 8 June) to highlight relevant topics and current trends while creating a community of learners and influencers who consistently advance research, practices, and policies under the "Blue Ocean Planet Earth" theme. The conference theme was broader, enabling the committee to offer a diverse technical programme, but with a focus on the relevant local and geographical interest topics.

Behind the "scene," there is always a great team of people making OCEANS events possible. We give special thanks to our local committee members who worked very hard to ensure a successful conference.

*CRIS team with honorary chair Karen Wiltshire (AWI) and OES liaison OCEANS Limerick Fausto Ferreira (FER).*

**General Chair:** Prof. Daniel Toal, CRIS, UL
**Honorary Chair:** Prof. Karen Wiltshire, Alfred Wegener Institute for Polar and Marine Research (AWI)
Peter Heffernan, Special Advisor of Board of Directors, Oceano Azul Foundation, Portugal.

**Coordination Chair:** Isela Ibrahimovic, CRIS, UL
**Executive/UN Decade of Ocean Science Chair:** Fiona Grant, Marine Institute.

**Finance Chair:** Gerard Dooly, CRIS, UL
**Technical Chair:** Edin Omerdic, CRIS, UL
**Technical-Co Chairs:** Phillipe Cardoso Santos, CRIS, UL
John Ringwood, Dept. of Electronic Engineering, Maynooth University.
**Tutorial Chair:** Cathal O'Donnell, CRIS, UL
**Student poster Chair**: Petar Trslic, CRIS, UL
**Women in Engineering Chair:** Aoife Hegarty, Atlantic Technological University.
**Young Professionals Chair:** Lubna Luxmi, CRIS, UL
**Young Professionals Co-Chair:** A'Qilah Ahmad Dahalan, University of Limerick,
**Exhibits Chair**: Ray O'Brien, University of Limerick, Bernal Institute, MaREI
**Exhibits Co-Chairs**: Anthony Weir, CRIS, UL
Jerry Hallissey, Shannon Foynes Port Company.

## OCEANS 2023 Programme

To reflect and underpin the conference theme, a set of local Limerick topics was chosen to be the conference's centerpiece. A series of plenary and keynote talks were presented to highlight them. These local topics include Offshore wind energy, Ship decarbonisation, Drones in marine applications, Cultural heritage and underwater archaeology, Artificial Intelligence in Ocean Science & Technology, Analytics and Sensing: A new age of dynamic observations, Renewable Energy from the Sea (Wave, Tidal, OTEC, Salinity gradient…), Sustainable Blue Economy, Maritime Vehicle Navigation, Deep Sea Mining, deep sea exploration and parallels to outer space.

In addition, all the traditional OCEANS conference technical tracks ensured that the conference in Limerick retained and maintained its standard structure.

### Plenaries and Panels

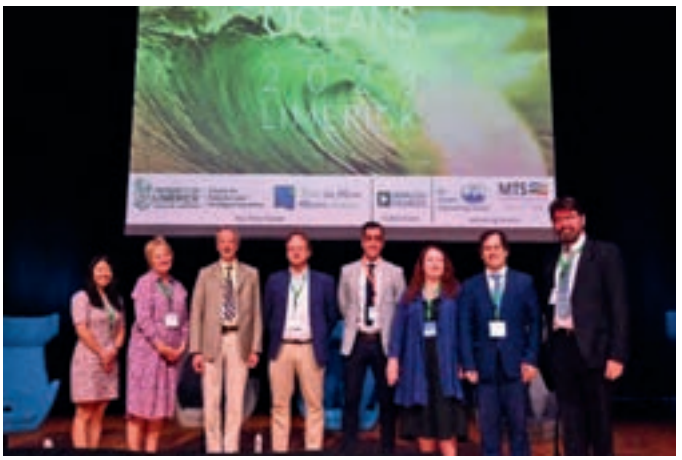
The plenaries took place on the morning of each conference day. The plenary sessions included one keynote speaker and a panel discussion with several experts in the subject area. In total, we had 20 speakers, including the moderators.

**PLENARY I:** Offshore Wind, Carbon Neutral Energy by 2050, Keynote *Una Brosnan*, Head of Offshore Strategy & New Markets, Mainstream Renewable Power
Expert Panel: Philip Cole (WindEurope), Peter Lefroy (RWE), Noel Cunniffe (Wind Energy Ireland), Jeannine Dunne (GDG), Jerry Hallissey (SFPC).


*Conference opening Prof. Daniel Toal, General Chair, Philip Nolan Director Science Foundation Ireland.*

*Plenary I (from left to right): Noel Cunniffe (Wind Energy Ireland), Liam Lacey (moderator, Marine Institute), Philip Cole (WindEurope), Jeannine Dunne (GDG), Una Brosnan (Mainstream Renewable Power), Peter Lefroy (RWE), Jerry Hallissey (SFPC and Prof. Daniel Toal).*

**PLENARY II**: Sustainable Commercial Use of Seas and Oceans, Keynote *Mary Crowley*, President Ocean Voyages Institute. Expert Panel: Prof. Karen Wiltshire (AWI), Prof. Richard Neilson (National Decommissioning Centre UK), Kimberly Blakemore (Analog Devices), Gerard Dooly (CRIS/UL), George Kallimasiotis (Resolve Marine).



*Plenary II. Kimberly Blakemore (ADI), Prof Karen Wiltshire (AWI), Prof Richard Neilson (National Decommissioning Centre UK), Gerard Dooly (CRIS/UL), George Kallimasiotis (Resolve Marine). Mary Crowley (Ocean Voyages Institute). Fausto Ferreira (moderator, OES/FER), Prof. Daniel Toal, (from left to right).*

**PLENARY III** Ocean Health and Resilience,
Keynote: *Peter Heffernan*, Ocean Ambassador & Member of the Board of the Oceano Azul Foundation. Board Member EU Mission Board 'Restore Our Ocean and Waters by 2030.'
Expert Panel: Craig N. McLean (Former Chief Scientist NOAA), Sigi Gruber (Senior Advisor EU), Carol Anne Clayson (WHOI), Paul Connolly (Marine Institute).



*Above image Peter Heffernan, OCEANS Honorary Chair.*

*Middle image: Plenary III panelists Sigi Gruber (Senior Advisor EU), Craig N. McLean (Former Chief Scientist NOAA), Carol Anne Clayson (WHOI), Paul Connolly (Marine Institute).*

*Left. Moderator, Karen Coleman, Award Winning Irish Journalist.*

In addition to the regular technical programmes and plenaries, we had three special sessions/town hall covering relevant topics such as green shipping, fair and affordable access/use of ocean technology and industry accelerators (new partnerships and findings).

Special session titles:
- Green Shipping, moderated by: Peter Lefroy, RWE Ireland
- Accelerating Technology Development to Address Climate Change: New Types of Partnerships and Funding, moderated by Kathryn Hautanen, Analog Devices/Ocean & Climate Innovation Accelerator
- Fair solutions in engineering for sustainable oceans, moderated by Niall McDonough, Marine Institute

*Green shipping Special session on 6 June, with Elias Ar. Yfantis (Cyprus Marine and Maritime Institute), Nicholas Townsend (University of Southampton), Prof. J J Leahy (UL), Jerry Hallissey, (SFPC). (L to R).*


*Steffen Knodt (Center for Sustainable Ocean Business at Fraunhofer IG), Pol Mac Aonghusa (IBM), Simon Jordan, (Cambridge Consultants), Donna Kocak (L3Harris & MTS), James Ives (XOCEAN), Liam Curran (Enterprise Ireland).*


*Fair solutions in engineering with Eva-Maria Brodte, Prof Karen Wiltshire (AWI), Fiona Beckman (POGO), Toste Tanhua, (GEOMAR).*

## Technical Sessions

Ten parallel trucks were run during each conference day, covering a total of 428 presentations, including the general poster session and student poster competition. There were ten special sessions. Traditionally the highest number of papers were presented under the "Autonomous underwater vehicle" topic. The programme was exciting, comprehensive and well-balanced.

*Technical session on drones in marine environment.*

*General poster session.*

## Tutorials

As an add-on to the general programme, the first day of the conference was dedicated to the tutorials. Ten tutorials and one workshop were held on 5 June, with an attendance of over 220 delegates across all sessions. The tutorial fee was included in all full registrations, which we believe significantly increased the number of tutorial attendees.

The covered topics were the following:

- Detection of Underwater Acoustic Signals—theory and techniques
- SAR Remote Sensing of the Ocean Surface
- Building Marine Cyber Resilience using Cybersecurity Standards,
- Governance, Risk and Control
- Transceiver Design for Underwater Acoustic communications
- Introduction to LSTS Toolchain: Bridging interoperability challenges
- Data Management: A Short Hands-On How-To
- MARUS—Unity Based Simulator for Marine Robotic
- Underwater Optical Sensing and Real-time Data Transmission: in-situ measurement of marine particles and other organisms
- Navigating Estuary and Port Applications of Small Autonomous Surface Vessels: Tips, Pitfalls, and Rules of the Road

*Prof. Roee Diamant, University of Haifa and Lubna Luxmi UL giving their tutorials on Day 1.*

## Women in Engineering

The WIE activities during the conference were run by the OES and MTS societies' WIE chairs with the support of our local team. The sessions were scheduled as a working breakfast and lunch on the last conference day, 8 June.

IEEE OES Women in Engineering (WIE) hosted a special session breakfast with a panel that featured three women (Lubna Luxmi, Donna Kocak, Sarah Jane Pell) communicating how their experiences have helped shape their careers and how challenges & support have influenced where they are today.

The WIE lunch was a collaboration between the Empowering Women for the UN Decade of Ocean Science for Sustainable Development Programme and the Women Leadership in Marine Technology and Science initiative. It was hosted by Liesl Hotaling, Marine Technology Society and moderated by Ronan Long, WMU-Sasakawa Global Institute.'


*Panelists WIE OES breakfast (from left to right): Donna Kocak, Lubna Luxmi, Sarah Jane Pell and Giulia de Masi (host).*

*Panelists MTS WIE lunch (from left to right): Flavia Destro, Ronan Long, Fiona Grant, Ellen Johanessen, Mariamalia Rodriguez Chaves, Cathy Hogan, Liesl Hotaling.*

The panelists were:

- Fiona Grant, Women in Blue Economy Intelligence Gathering and Capacity Boosting
- Mariamalia Rodriguez Chaves, Gender Mainstreaming in Ocean Governance Bodies
- Ellen Johansen, Understanding the Role of Gender in the Practice of International Marine Science
- Renis Auma Ojwala, Gender Equality in Ocean Science for Sustainable Development: Analysis of Ocean Science Institutions in Kenya
- Cathy Hogan, Scaling Up Actions to Empower Women for the Ocean Decade

## Young Professionals

The young professional breakfast was held on Wednesday, 6 June, and offered an opportunity to hear from veterans in the ocean engineering sector about professional development and career exits. The panelists were:

- Mandar Chitre, Head of the Acoustic Research Laboratory (ARL) at the Tropical Marine Science Institute (TMSI)
- Christoph Waldmann, Senior Scientist. MARUM
- Asma Khatoon Department of Electronic and Computer Engineering, UL
- Nuno Cruz, Centre for Robotics and Autonomous Systems at INESC TEC

*Young Professionals breakfast.*

## Student Poster Competition

One hundred and fifty-six abstracts were submitted for the student poster competition, and based on the threshold score, around 121 were selected for 2nd stage of review (SPC). Following this 2nd review stage, 14 posters were selected for the SPC final. The SPC jury selected the following winners:

- First Prize: Amelia Ritger, University of California,
- Second Prize: Jared McFadden, Florida Atlantic University
- Third Prize: Patrick McGuire, Woods Hole Oceanographic Institution

The prize winners' details were announced during lunchtime at the Innovation Hub theatre on the closing day. You can read the SPC report, winning article and articles from top two winners in this Beacon issue, too.

*The SPC finalists with judges.*

## Exhibition

The exhibition was held in two connected marquees near the conference hall. This made it still possible to bring the technical sessions and the exhibits close together and to have an increased footfall in the exhibition space. The existing crisis inevitably led to reduced exhibitors registering for OCEANS Limerick, and we eventually had 46 booths available. Hard work by the LOC resulted in 42 Institutions (Companies, Research Institutes, Professional Bodies, Societies, and Media Organizations) represented across 46 booths (triple, single, shared or small booths). The exhibitor track was run in the Innovation Theater, and the slots were given to all exhibitors to address the audience and present their products, research or institutions.

*Exhibition opening (from left to right): Ray O'Brien (LOC), Christopher Whitt (OES President), Paul Connolly (CEO Marine Institute), Norelee Kennedy (VPR University of Limerick), Mike Morrissey (ADI Catalyst Director), Justin Manley(MTS President), Philip Nolan (Director Science Foundation Ireland).*

*Reception at Canadian Pavilion.*


*Future OCEANS 2024 Singapore.*


*Future OCEANS 2025 Brest.*


*Analog Devices booth (Golden sponsor).*

*Commissioners of Irish light booth.*


*From the exhibition.*

*Innovation Theater: Exhibitor track.*

## Social Programme

As in all OCEANS conferences, the social program is essential in enabling delegates to relax and interact in an informal atmosphere. The OCEANS '23 Limerick team organised a schedule of events designed to give delegates the full flavour of Irish culture.

1) Student mixer

The Student Mixer was organised for registered students and student poster competitors in a casual setting for networking. Young Professionals and leaders from the Oceanic Engineering Society and Marine Technology Society attended to orient the

students to the OCEANS conference and guide how to get the most out of the event. Stables Club, University of Limerick, has a great atmosphere with DJ and BBQ.

2) Icebreaking event

Another successful networking event was held on Monday afternoon (5 June), the Icebreaking Reception in the University Concert Hall Atrium—a great way to end the first day with relaxing music, good food and drinks.

3) Exhibition reception

Tuesday afternoon was reserved for networking with exhibitors, starting with the Canadian National Pavilion event, followed by the exhibitors' reception. Drinks and nibbles were offered to enable exhibitors and attendees to relax in an informal environment.

4) Gala dinner

The conference banquet was held at the Strand Hotel and was followed by a visit to King John's Castle for an exciting medieval experience. The gala program included traditional Irish music and dance, and 480 delegates could also enjoy the performances of Prof. Daniel Toal, whose fiddle melodies give the atmosphere an extra spark of Irish hospitality.

*Student Mixer at Stables Club UL.*

*Justin Manley giving the welcome speech at Student mixer.*

*John Watson ex OES VP OCEANS, Edin Omerdic Technical chair, Milica Stojanovic, (Northeastern University, SPC judge), Zoran Zvonar (Director University Programme Analog Devices, golden sponsor of OCEANS Limerick.*

*OES management team.*

*Delegates: Jessica Wolfe (Mississippi State University, Una Brosnan (Mainstream Renewable Power), Kathryn Hautanen (Analog Devices).*

*Icebreaking reception, Atrium UCH, OCEANS Limerick beer.*

*Welcome speech by Michael Gillooly, on behalf of Marine Institute, a key supporting partner of the event.*

*Medieval experience at King John's Castle.*

*Irish dancers, making the atmosphere.*

*A great performance by Prof. Daniel Toal, OCEANS Limerick General Chair.*

*Cathal W. O'Donnell, Tutorials chair, Isela Ibrahimovic, Coordination Chair, Peter Trslic, SPC chair and Sagar Dalai, CRIS support team.*

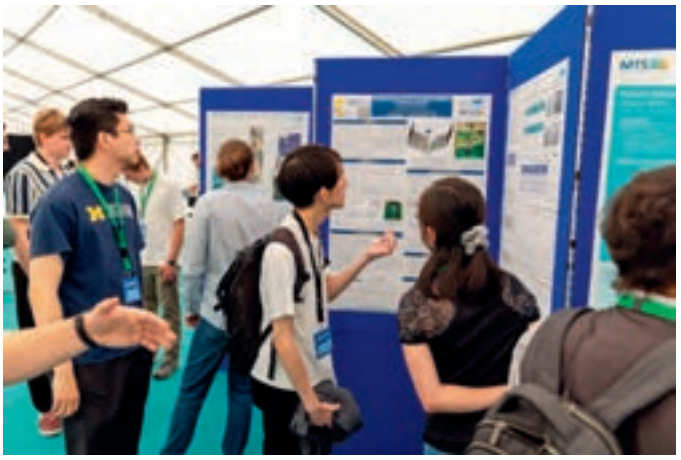
*OCEANS crowd enjoying the entertainment programme.*

# The Student Poster Competition at OCEANS 2023 Limerick

***Dr. Shyam Madhusudhana, OES Student Poster Competition Chair***
***Photo credits: Nicholas Chotiros, Caoimhe Corrigan, and Manu Ignatius***

Col. Normal Miller conceived and brought to life the esteemed Student Poster Competition (SPC) during the 1989 Seattle OCEANS conference. Since its inception, the SPC has remained a prominent highlight of OCEANS conferences worldwide. Welcoming undergraduate and graduate students from esteemed institutions across the globe, the SPC stands tall as a flagship event of the esteemed MTS/OES OCEANS conferences. Each year, we witness a plethora of aspiring talents vying for a spot in the Competition. Through a stringent two-stage review process of their submitted abstracts, we handpick a select group of 15–20 students who demonstrate exceptional promise. These chosen candidates' conference registration fees are waived, and they also receive financial support to aid their travel and accommodation expenses.

The success of the SPC would not be possible without the generous support of our sponsoring societies —OES and MTS. We extend our heartfelt gratitude to the Office of Naval Research—Global (ONR-G) for their unwavering financial backing, which has allowed us to continue nurturing the next generation of brilliant minds. The Schmidt Ocean Institute has generously continued their contribution of prize money for this edition of the SPC.

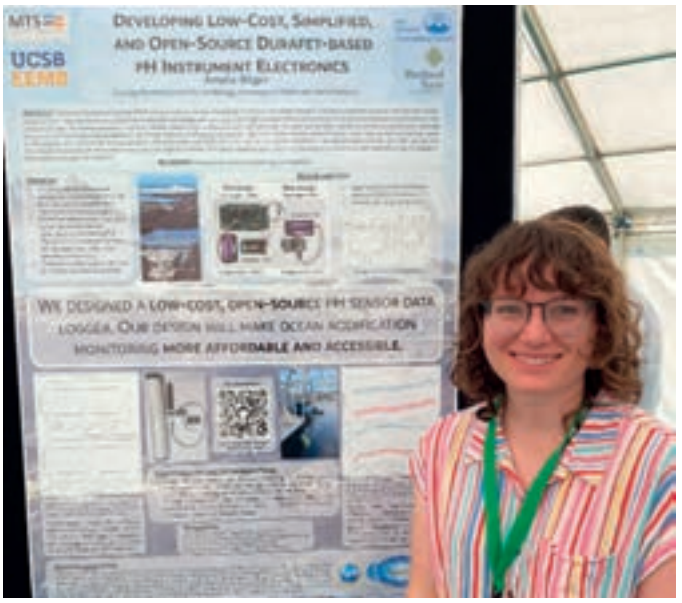


*Poster sessions were well-attended on all days (top) and so was the awards ceremony (bottom).*

The Limerick OCEANS SPC received a whopping 83 abstracts. The Local Organizing Committee's (LOC) SPC Chair, Petar Trslic, and Coordination Chair, Isela Ibrahimovic, bravely took on the gargantuan task of running the SPC successfully. Out of the submissions received, 14 abstracts were shortlisted for the final program. Of these, one participant could not attend due to visa issues. The poster sessions were very well attended, and the students seemed to have enjoyed their time at the conference. We had a panel of 7 judges who generously offered their time, speaking to each participant and scoring their posters. We are grateful for their support. The awards ceremony was held prior to the exhibitors' luncheon on the final day of the conference. Participation certificates and winning prizes were handed out by the sponsoring societies' Presidents — Christopher Whitt (OES) and Justin Manley (MTS).

The list of participants (including the prize winners), together with their affiliation, poster title and an abstract of their poster, are given below.

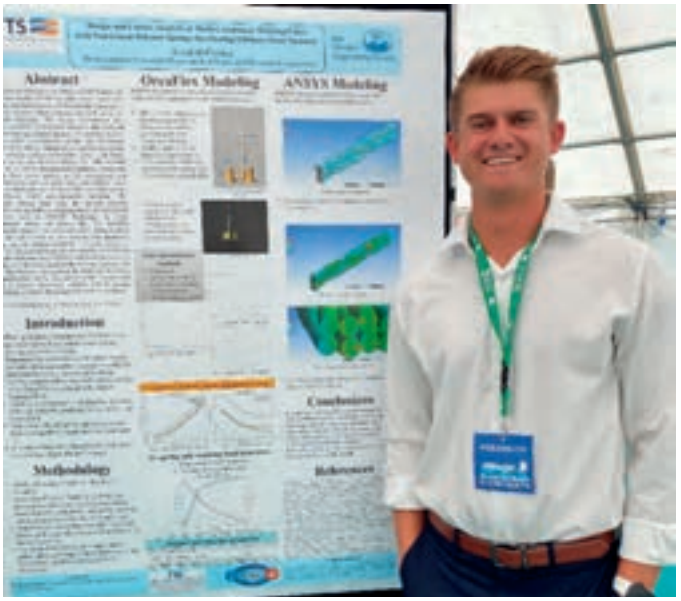
**First prize (Norman Miller Award)** (Certificate and $ 3000)
**Amelia Ritger**, University of California, Santa Barbara, USA
*Developing Low-Cost, Simplified, and Open-Source Durafet-based pH Instrument Electronics*




*Abstract*—Ocean acidification monitoring efforts are a crucial component of tracking the impacts of climate change in

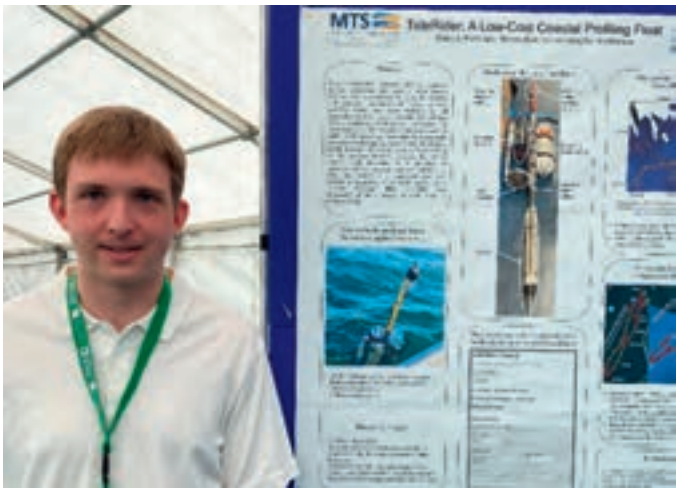
marine ecosystems. However, the high instrument cost presents a major barrier to the production of scientific knowledge and has resulted in a highly fragmented understanding of the global progression of acidification. Our project built upon an existing nearshore marine pH sensor design which utilizes a Durafet pH electrode. Our goal was to lower barriers to access by significantly lowering the cost of, and improving approachability to, the design and use of pH sensor electronics. We have created a more compact design using open-source components based on the popular and easy-to-use Arduino platform that eliminates over $900 from the cost of the sensor electronics. We demonstrate with lab and field testing that switching to Arduino-based sensor electronics maintains high data fidelity. Our design supports open science by allowing more individuals and research groups to engage in high-quality oceanographic research.

**Second prize** (Certificate and $ 2000)
**Jared McFadden**, Florida Atlantic University, USA
*Design and Failure Analysis of Multi-Component Mooring Lines with Non-Linear Polymer Springs for Floating Offshore Wind Turbines*




*Abstract*—Floating offshore wind turbines (FOWT) stationed in transition depths (50-80 m) offer easier access for installation and maintenance and broaden the spectrum of operational locations when compared to fixed bottom or deepwater structures. The fatigue performance and abrasion resistance of polyester makes it the preferred choice for taut leg systems because this mooring method uses the elastic characteristics of the rope to provide station keeping effects. Adding non-linear polymer springs to this mooring configuration helps reduce peak loads, platform surge, and increase fatigue life. This research studied the effects of changing line pretension, spring safe working load (force exerted at 50% elongation), and spring response curve on peak loads and platform surge first by modeling the system in OrcaFlex at yearly average and 50-year storm environmental conditions. The maximum tension load from the optimized mooring assembly was applied to a modeled section of the 8-strand multiplait rope in ANSYS Workbench to study deformation, stress, and fatigue life. The OrcaFlex simulations showed that a mooring line pretensioned at 1250 kN with a 4500 kN safe working load degressive spring was the optimal assembly. The peak tension of 3717 kN was applied to the section model in ANSYS and yielded a deformation of 0.268 m and maximum stress of 3.20e8 Pa at the inner radius of the weaving section of the rope. This research will continue by analyzing the fatigue life performance of the rope section at the 50-year storm data to predict operational lifetime and at average conditions to validate the design with industry standards.

**Third prize** (Certificate and $ 1000)
**Patrick McGuire**, Woods Hole Oceanographic Institution, USA
*TideRider: A Low-Cost Coastal Profiling Float*

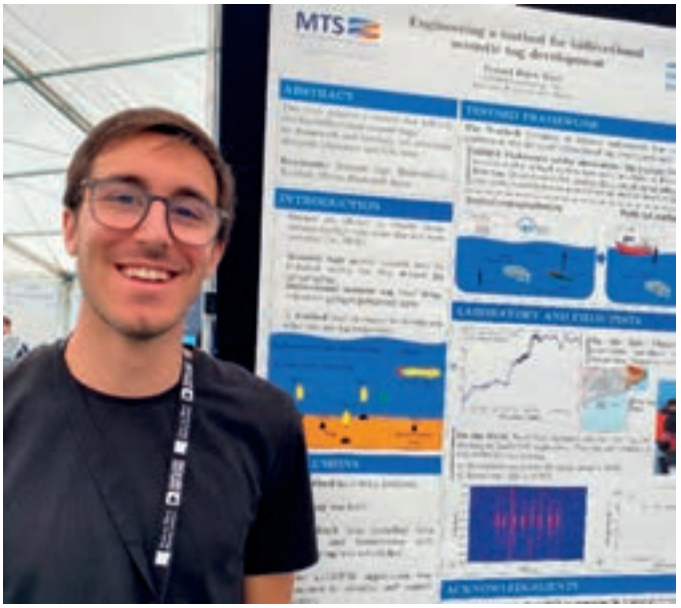



*Abstract*—Coastal ecosystem stressors such as hypoxia, marine heatwaves and harmful algal blooms require new technologies to properly monitor and predict. Instrumented buoys, gliders, profiling floats, and shore stations are all applicable to the coastal domain, but all face certain limitations that prevent deployment in large numbers. We designed TideRider, easy to build, $1600 profiling floats intended primarily for coastal water quality monitoring.

TideRiders profile between the surface and seafloor, resting on the seafloor between profiles. By timing ascents and descents, it is possible to opportunistically harness ambient currents to move the devices in a controlled way, e.g., toward a waypoint, or to hold station as a "virtual mooring." This capability was demonstrated in a series of field tests in summer 2022.

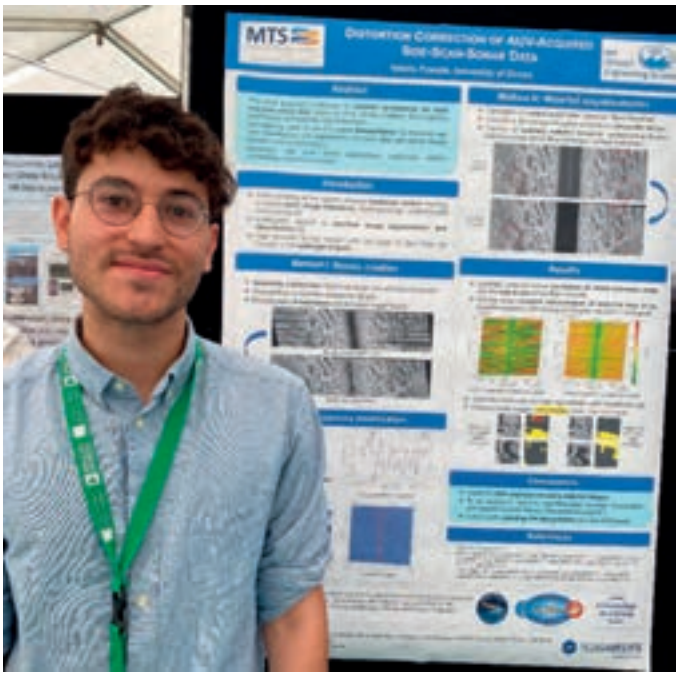
**Gerard Batet**, Universitat Politecnica de Catalunya, Spain
*Engineering a testbed for bidirectional acoustic tag development*

*Abstract*—Marine protected areas (MPAs) have been implemented to mitigate the effects of climate change and overfishing on various marine ecosystems. Nonetheless, these areas need monitoring to ensure their actual utility. Tools like



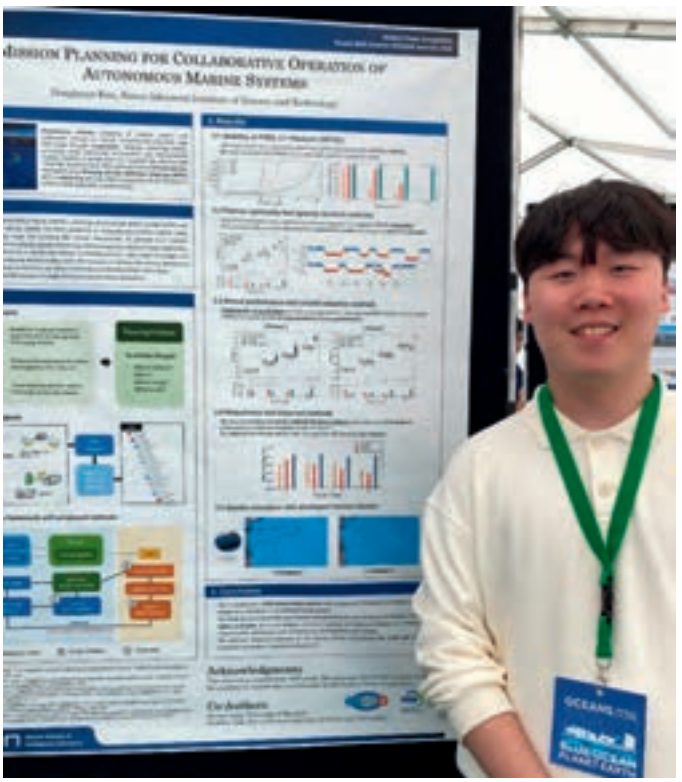

acoustic tags are used to study the animals' behavioural patterns and obtain valuable information to improve MPAs. Recently, new architectures have been proposed to overcome the inherent limitations of off-the-shelf tags, for example, by implementing bidirectional communication capabilities with the newly developed open protocol from European Tracking Network. In this paper, the testbed topology and methodology used to develop these bidirectional acoustic tags are discussed alongside the laboratory results achieved.

**Valerio Franchi**, University of Girona, Spain
*Distortion Correction of AUV-acquired Side-Scan Sonar Data*




*Abstract*—Side scan sonars (SSS) are types of sonars that produce representations of the sea-bed by emitting and receiving acoustic fan-shaped pulses perpendicularly to the motion of the sensor in the water. Generally, SSS are deployed from a towed vehicle pulled from a boat at high speed to avoid oscillatory motions and thus achieve a clean and consistent sea-bed scan. Our approach targets the use of SSSs on small AUVs with limited computing power, and travelling at slow speeds, where the waterfall is directly used for real-time classfication. Due to the increased oscillatory motion, the SSS waterfall tends to have significant distortion, that will preclude the classifier from obtaining correct results. The algorithm described in this paper performs a geometric correction of the sonar scanlines by taking into account the AUV's change in height, yaw and pitch to calculate correctly their positions on the seabed. The data is mapped into a 2D grid using the scanline intensities to form a mosaic, and the missing mosaic pixels are interpolated using a Gaussian-based kernel. The waterfall is recreated by considering a modified AUV trajectory with smooth changes in heading and a null pitch. The results show a significant improvement in the waterfall output, removing unwanted distortions and displaying the seabed structures with higher geometric consistency. In addition, the concentration of the ping data on the waterfall is constant all around, compared to the varying contribution density in the original one.

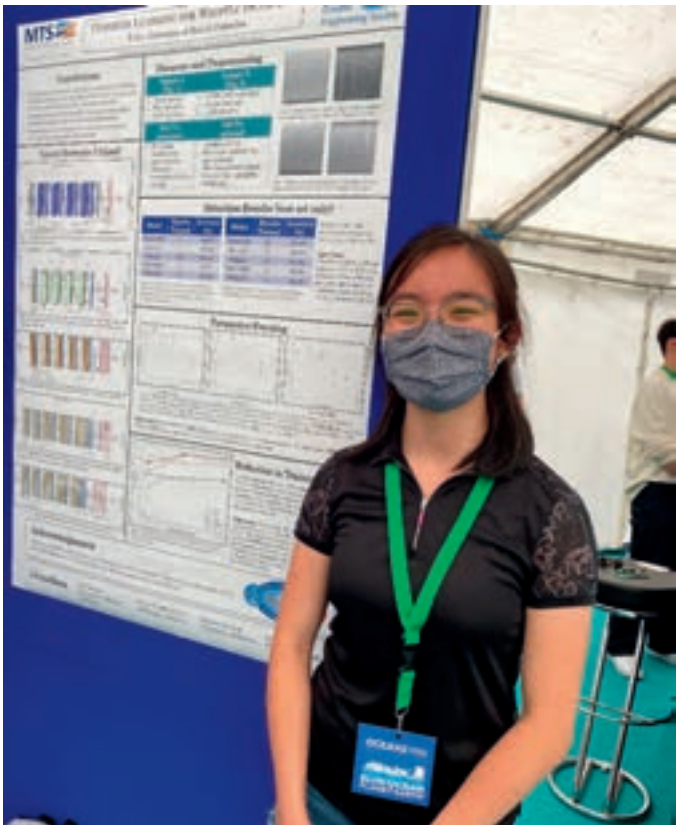
**Donghyun Kim**, Korea Advanced Institute of Science and Technology, Republic of Korea
*Mission planning for collaborative operation of autonomous marine systems*



*Abstract*—Autonomous systems consisting of multiple surface and underwater vehicles are capable of performing long-term, high level tasks through cooperation. However, achieving

reliable autonomy under substantial uncertaies and environmental changes requires a system that can recognize the situation and make high-level decisions. This study presents a mission planner developed using Planning Domain Definition Language (PDDL) with a replanning structure that incorporates three methods to enhance both optimality and robustness. The planner employs three methods to achieve this: the greedy iterative method improves the planner's optimality, the model adaptive reduces the gap between the environment and the model to increase operational performance, and the reserved enhances mission success rates by allowing the planner to adapt to changes in the environment. We demonstrate that the proposed mission planner can provide an efficient and stable plan to complete a mission.

**Xi Lu**, University of British Columbia, Canada
*Transfer Learning of Image Classification Networks in Application to Dolphin Whistle Detection*



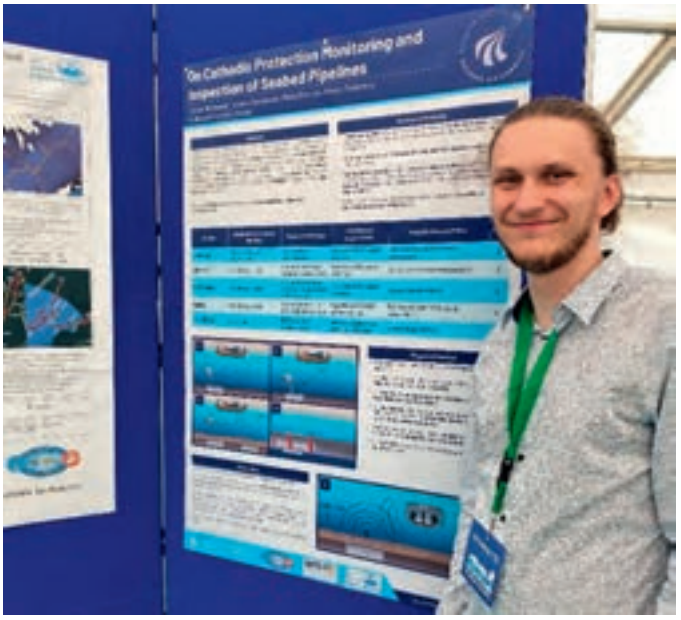
*Abstract*—Dolphin whistle detection is an important and multi-purpose but time-consuming task. The ability to automate and streamline this process can be invaluable for future research in marine studies and other fields that aim to utilise these signals. When dealing with underwater acoustics, a large obstacle to overcome is the abundance of noise and interfering sounds, natural and anthropogenic alike. In this paper, we apply successful image classification networks to two separate datasets containing dolphin whistles with the goal of determining an effective method to conduct automated detection with minimal interference from a manual operator regardless of environment. We further investigate the impacts of shrinking the dataset size and performing parameter freezing on the networks at hand. Networks are assessed by their detection accuracy and achieve performances comparable to those in existing works, the best being 96.7%, thus proving the effectiveness of these pre-trained image classification models.

**António Oliveira**, Faculdade de Engenharia da Universidade do Porto, Portugal
*Feature Extraction Towards Underwater SLAM using Imaging Sonar*

*Abstract*—Blob features are particularly common in acoustic imagery, as isolated objects (e.g., moorings, mines, rocks) appear as blobs in the acquired images. This work focuses the application of the SIFT, SURF, KAZE and U-SURF feature extraction algorithms for blob feature tracking towards Simultaneous Localization and Mapping applications. We introduce a modified feature extraction and matching pipeline intended to improve feature detection and matching precision, tackling performance deterioration caused by the differences between optical and acoustic imagery. Experimental evaluation was undertaken resorting to datasets collected from a water tank structure.

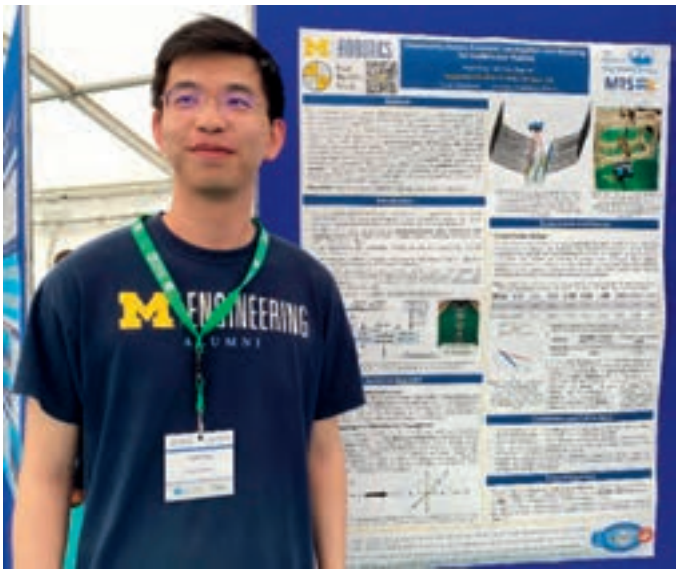
**Patryk Olszewski**, Aalborg University Esbjerg, Denmark
*On Cathodic Protection Monitoring and Inspection of Seabed Pipelines*

*Abstract*—Cathodic Protection (CP), alongside coating, is the primary prevention technique against corrosion of seabed pipelines. This system requires a regular monitoring that ensures its proper functioning. This study presents a review of existing, widely used methods for CP surveillance. Additionally, an optimal and robust surveillance method, based on testing stations using Wireless Sensor Network (WSN) mediated by an Autonomous Underwater Vehicle (AUV), is described. The description involves powering of the test station, its



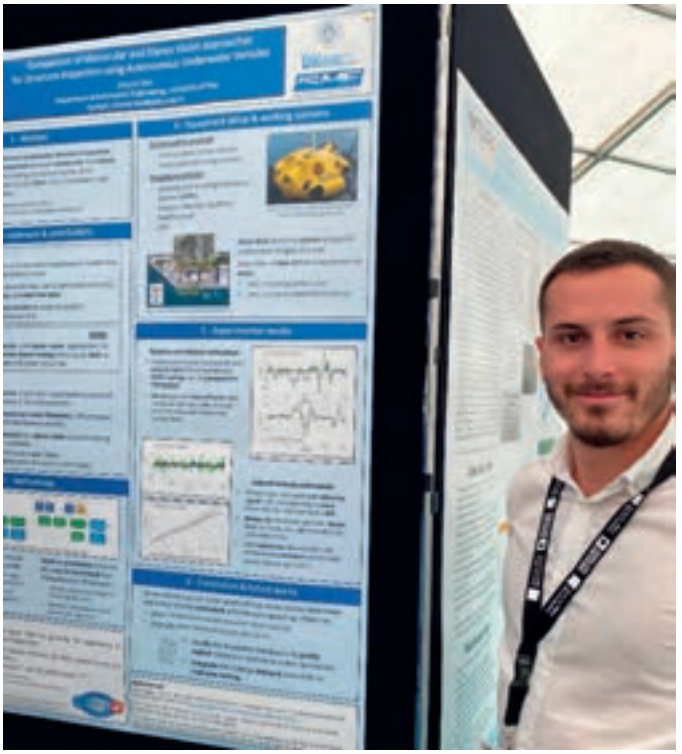

communication with the AUV as well as the navigation requirements for pipe following of the vehicle.

**Jingyu Song**, University of Michigan, USA
*Uncertainty-Aware Acoustic Localization and Mapping for Underwater Robots*



*Abstract*—For underwater vehicles, robotic applications have the added difficulty of operating in highly unstructured and dynamic environments. Environmental effects impact not only the dynamics and controls of the robot but also the perception and sensing modalities. Acoustic sensors, which inherently use mechanically vibrated signals for measuring range or velocity, are particularly prone to the effects that such dynamic environments induce. This paper presents an uncertainty-aware localization and mapping framework that accounts for induced disturbances in acoustic sensing modalities for underwater robots operating near the surface in dynamic wave conditions. For the state estimation task, the uncertainty is accounted for as the added noise caused by the environmental disturbance. The mapping method uses an adaptive kernel-based method to propagate measurement and pose uncertainty into an occupancy map. Experiments are carried out in a wave tank environment to perform qualitative and quantitative evaluations of the proposed method. More details about this project can be found at https://umfieldrobotics.github.io/PUMA.github.io.

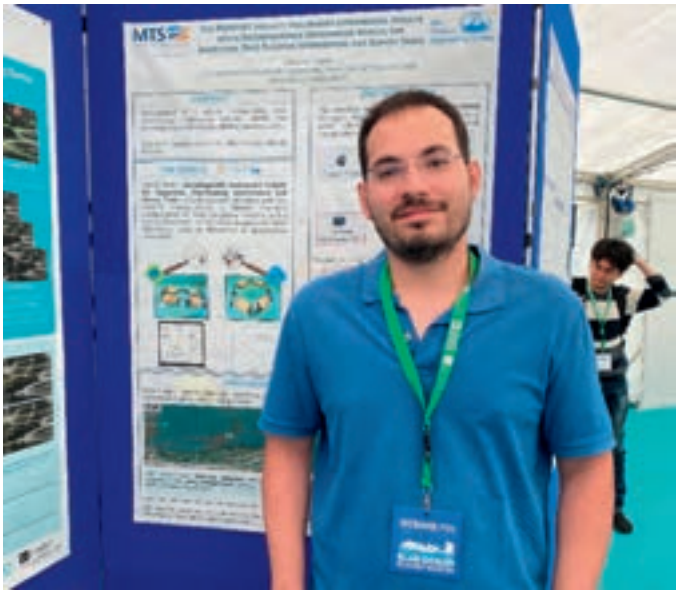
**Simone Tani**, Università di Pisa, Italy
*Comparison of Monocular and Stereo Vision approaches for Structure Inspection using Autonomous Underwater Vehicles*



*Abstract*—Periodical inspections are a fundamental operation to monitor the status of underwater structures and to assess their need for proper maintenance or repair interventions. Autonomous Underwater Vehicles (AUVs) could represent a viable option to carry out underwater inspection tasks, potentially bringing benefits in terms of safety for human operators and quality of the collected data. Aiming at developing a fully autonomous vision-based inspection strategy, this paper proposes a comparative analysis between monocular and stereo vision approaches for estimating the lateral velocity of an AUV and its orientation with respect to a target surface. The proposed analysis is performed by exploiting a dataset of real underwater images, collected during at-sea experiments in which the Zeno AUV was remotely driven to carry out a pier inspection. Specifically, the performance of the two solutions in terms of estimation of the robot lateral velocity is assessed by considering doppler velocity log measurements as benchmark. Instead, the accuracy of the estimation of the vehicle orientation with respect to the target is evaluated by taking into

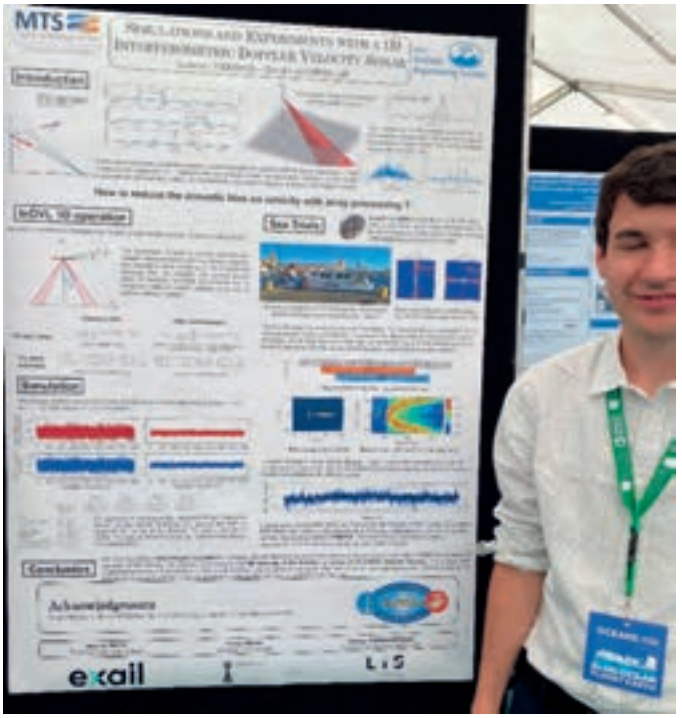
account both geographical information of the pier and AUV attitude observations. The comparison suggests that stereo vision provides better performance for estimating the relative orientation between the AUV and the target; on the contrary, the monocular approach produces more reliable lateral velocity estimates. The results obtained prove the suitability of the two vision-based strategies for inspection applications in a real underwater scenario, thus suggesting a possible implementation onboard the reference vehicle.

**Edoardo Topini**, University of Florence, Italy
*The RUVIFIST project: preliminary experimental results with a Reconfigurable Underwater Vehicle for Inspection, Free Floating Intervention, and Survey Tasks*




*Abstract*—The development of vehicles incorporating both the Autonomous Underwater Vehicle (AUV) and the Remotely Operated Vehicles (ROV) intervention functionalities can be considered one of the most investigated tasks of the underwater industry and the scientific community. A feasible solution can be the development of Autonomous Underwater Reconfigurable Vehicles (AURVs), i.e. vehicles that can change their current configuration depending on the demanded task. Driven by these considerations, an innovative AURV has been developed by the Department of Industrial Engineering of the University of Florence (DIEF), Italy, capable of efficiently reconfiguring its shape according to the task at hand. In particular, the RUVIFIST (Reconfigurable Underwater Vehicle for Inspection, Free-floating Intervention and Survey Tasks) vehicle has been provided with two extreme configurations: a slender ("survey") configuration for long navigation tasks and a stocky ("hovering") configuration designed for challenging goals as intervention operations. Consequently, this work presents the results obtained during several experimental campaigns conducted to accurately test the vehicle reconfigurable system and how the standard Guidance, Navigation and Control (GNC) strategies must be adapted for AURVs.

**Laurent Verrier**, Exail, France
*Simulations and Experiments with a 1D Interferometric Doppler Velocity Sonar*




*Abstract*—The Interferometric DVL (InDVL) is a new instrument designed to be free from acoustic bias. The InDVL combines pulse-to-pulse phase comparison, used by all wideband Doppler sonars, with element-to-element phase comparison generally used for direction finding. The most general InDVL receiver array design consists of a 3D ultrashort baseline, with four hydrophones in a tetrahedral configuration allowing the synthesis of three orthogonal baselines. In this paper we study the performance of a much simpler system consisting of a single baseline and present both Monte Carlo simulations and preliminary experimental results using a COTS sonar of opportunity, which is a dual Mills cross scientific echo sounder used for fishery research and obstacle avoidance.

# Participating in OCEANS 2023 Limerick

***Amelia Ritger, OCEANS 2023 Limerick SPC First Prize Winner***

My name is Amelia Ritger, and I'm an ecologist. If you met me at OCEANS 2023 Limerick, this is likely how I introduced myself to you. Although it was not my first conference, OCEANS 2023 Limerick was my first engineering conference, and I arrived in Limerick feeling like an imposter. What was an ecologist doing at a meeting for engineers? Yet, by the end of the week, many of those feelings dissipated. I met you and your colleagues, learned about your research, taught you about my own, and shared stories with you during the plentiful mixers, receptions, and gala dinner. I now firmly believe that more ecologists and other scientists must attend engineering conferences, and vice versa, because OCEANS 2023 Limerick was the tip of the iceberg for cross-disciplinary collaborations.

You are doing extraordinary and brilliant work, finding creative solutions to the issues afflicting our oceans. You have developed technologies I did not know were possible, and much of your work can be applied to ecological questions. As a marine ecologist and climate scientist, I study how marine species are responding to climate change events like ocean acidification and marine heatwaves. I rely upon technologies such as oceanographic sensors, developed by engineers, to accomplish my research. I am certain many of my colleagues would benefit from a conversation with you to discuss how to infuse engineering more into our research. How much more progress could we make towards our collective goals if more engineers, biologists, chemists, physicists, and others sat down and talked with each other? We share similar concerns about the health and future of our oceans. It will take all of us to tackle these huge, global issues.

OCEANS 2023 Limerick was not just a crash course for me on the benefits of cross-pollination across research disciplines. It was an opportunity to connect with an international group of like-minded researchers and explore Ireland with new friends. As a participant in the Student Poster Competition (SPC), I was fortunate to be initiated into a cohort of students with a shared experience. It was not difficult to bond while enduring the heat in the exhibition tent where our posters were set up! The SPC students were a friendly, supportive community I could always turn to if I was feeling particularly introverted or overwhelmed with the abundance of networking opportunities throughout the conference.

When I stepped outside of my comfort zone and sat down with strangers during breakfast or lunch, we often ended the meal as acquaintances. It was comforting to be able to walk around the University of Limerick campus and recognize faces and share a smile or a wave. I knew my conference networking had peaked when I traveled to the Cliffs of Moher with two new conference friends and, by coincidence, ran into other conference friends! Although these gestures may appear small, your recognition and kindness went a long way toward alleviating my imposter syndrome at a conference overflowing with talented researchers.

*Intertidal show and tell during one of my field trips.*

Thank you for welcoming me to the OCEANS community with open arms. It was easy to be excited to share my research with you during the SPC because you expressed genuine interest in my work. I look forward to more conversations that foster new collaborations. Together, we can discover unique solutions that benefit our society and our oceans. If we didn't get the chance to meet in Limerick, I look forward to meeting you at OCEANS 2024 Singapore!

# Where My Research Has Taken Me

***Jared McFadden, OCEANS 2023 Limerick SPC Second Prize Winner***

I originally had no plans of attending the OCEANS 2023 Limerick Conference – in fact I had never even heard of it until my research advisor suggested I apply to a conference. After doing some research on upcoming conferences, I applied to compete in the Student Poster Competition at OCEANS 2023 Limerick and was lucky enough to be accepted. It turned out to be the most beneficial experience throughout my college career for academic and professional development and satisfying the desire for international travel.

As this was the first conference I had ever attended, I had no idea what to expect. I had always thought conferences were a very formal, business only type of setting but I was pleasantly surprised to see that it was just the opposite. Between the events hosted by OCEANS and the overall layout and schedule of the conference, it allowed casual conversation to flow freely with brainstorming about research and great connections to be made (especially with getting those LinkedIn connection numbers up). I was able to not only present my research, but also receive feedback from industry professionals coming from all over the world. One interaction gave me the opportunity to share my research with an industry leading company working on a mooring line project for an ocean current turbine. Brainstorming with another fellow conference attendee pushed me to dive deeper into the impacts of mooring line strumming on marine life echolocation.

Getting accepted to compete in the Student Poster Competition was an added bonus and an opportunity I never thought I would have. After being stuck in my own bubble of research for the past year, I really enjoyed seeing the research paths that other students had taken, especially those with topics I was unfamiliar with. The competition made us all have a friendly yet competitive nature throughout the week. Manning our posters every day felt like we were all just hanging out, having some good laughs, but there to compete. By the end of the week, we were exploring Limerick together and felt as though a new group of friends was formed. I know these are connections that will last a lifetime.

Aside from the business part of my trip to Ireland, the conference gave me a good reason to make a vacation out of the experience. With the conference only being 4 days, I extended the trip to 8 days with a range of adventures before the conference. The fun started in Dublin, where I spent a day there before travelling to Galway for a day and finishing in Limerick. Along the way, I saw the rolling hills and beautiful green landscape of Ireland, stood on the edge of the Cliffs of Moher (they should be the 8$^{th}$ wonder of the world in my opinion), and stopped by the Caherconnell Stone Fort and Sheepdog Farm. Heading across the pond to Europe was not on my to-do list this year, but thanks to the OCEANS Conference I was able to experience the beauty of Ireland.

*Figure 1. Enjoying the views at the Cliffs of Moher.*

None of this would have been possible without the support from the Office of Naval Research (ONR) and the IEEE Oceanic Engineering Society (OES), so I would like to formally thank them for allowing me this opportunity.

## Winning Poster Paper

# Developing Low-Cost, Simplified, and Open-Source Durafet-based pH Instrument Electronics

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***Abstract*— Ocean acidification monitoring efforts are a crucial component of tracking the impacts of climate change in marine ecosystems. However, the high instrument cost presents a major barrier to the production of scientific knowledge and has resulted in a highly fragmented understanding of the global progression of acidification. Our project built upon an existing nearshore marine pH sensor design which utilizes a Durafet pH electrode. Our goal was to lower barriers to access by significantly lowering the cost of, and improving approachability to, the design and use of pH sensor electronics. We have created a more compact design using open-source components based on the popular and easy-to-use Arduino platform that eliminates over $900 from the cost of the sensor electronics. We demonstrate with lab and field testing that switching to Arduino-based sensor electronics maintains high data fidelity. Our design supports open science by allowing more individuals and research groups to engage in high-quality oceanographic research.**

***Keywords*— *Instruments, marine, monitoring, oceanography***

## I. Introduction

Ocean acidification occurs when seawater pH declines as a result of the ocean absorbing anthropogenically produced carbon dioxide from the atmosphere. Acidification is an increasingly prevalent environmental stressor with measurable effects on marine ecosystems, including disrupting trophic interactions [1] and reducing calcification rates of ecologically and economically important marine species [2].

Unfortunately, near-shore oceanographic monitoring efforts largely rely upon commercially available sensors that are bulky and expensive. These monitoring programs often require large research budgets to cover the initial equipment purchase, as well as sustained funding to pay for annual maintenance and calibration fees. This presents a major barrier to comprehensive environmental monitoring, as financial support for long-term monitoring programs is limited [3] and well-funded research groups are more likely to receive additional funding [4], [5]. With limited research groups able to access the funding to start and maintain their own oceanographic monitoring programs, there are consequently few pH sensors deployed in the nearshore marine environment. This patchy network of sensors contributes to the current uncertainty on the progression of ocean acidification in many ecosystems – especially in regions that have been deemed particularly vulnerable to acidification [6].

Oceanographic research presents an opportunity for improved accessibility and thus better science with the development of lower cost instrumentation. Low-cost, open-source instrumentation is becoming an increasingly popular method for environmental sensing in a variety of systems [7]–[9]. In the marine environment, for example, the Cave Pearl Project and Oceanography for Everyone have both used open-source, Arduino-based systems to create inexpensive alternatives to commercially available environmental monitoring sensors [10], [11]. The adoption of these methods increases access to environmental monitoring technologies and subsequently expands the spatial and temporal coverage of environmental data [12]. Ocean acidification monitoring programs would benefit from lower cost instrumentation, as more deployed sensors would facilitate more comprehensive measurements characterizing pH variability across time and space. Increasing access to oceanographic monitoring will support scientific research to assess the state of our oceans and predict how future climate scenarios may threaten marine ecosystems.

Our project sought to improve upon a current pH sensor design which utilizes a commercially available Honeywell Durafet Ion Sensitive Field Effect Transistor (ISFET) pH electrode [13] and is widely used to collect autonomous intertidal pH measurements [14]–[20]. We used off the shelf components and an Arduino-based data logger to create an open-source design that may be built by anyone with access to basic electronics equipment. We demonstrate that our new data logger collects seawater pH and temperature measurements comparable to the old design, at a fraction of the cost.

## II. Methods

### A. Design

Our goal was to design an open source data logger that would read the electrical signals from the Durafet pH electrode and generate an output comparable to the old data logger design, at a significantly lower cost and complexity by using an Arduino-based microcontroller. Our design was motivated by the following requirements:

- Built using low-cost, readily available components
- Operating life span similar to the old data logger design (at least 6 months)
- Compact footprint to fit neatly in sensor housing

- Interfacing with non-proprietary software and standard USB connectors
- User-adjustable deployment parameters, such as start time and sampling interval
- Removable microSD storage

The old sensor design uses the commercially available VoltX data logger (including a 24-bit ADC) manufactured by MadgeTech [21], paired with a custom-manufactured voltage divider (original design by [22]; Fig. 1). MadgeTech offers free, proprietary software to communicate with the VoltX data logger in order to configure the logger and download data through a standard USB-A to Micro USB interface cable. The old design requires one 9 V LiON battery to power the data logger and two 3.6 V LiON batteries to power the Durafet pH electrode.

In our new design, we used an Adafruit Feather M0 Adalogger (including a 10-bit ADC, not used for sensor digitization) [23] paired with an Adafruit DS3231 Precision real-time clock (RTC) [24], an Adafruit ADS1015 12-bit ADC [25], an Adafruit ADS1115 16-bit ADC [26], and off the shelf passive components (Fig. 1). Communication with the Arduino occurs through the free Arduino IDE via a USB-A to Micro USB cable. The new design eliminates the 9 V LiON battery and only requires two 3.6 V LiON batteries to power all sensor electronics.

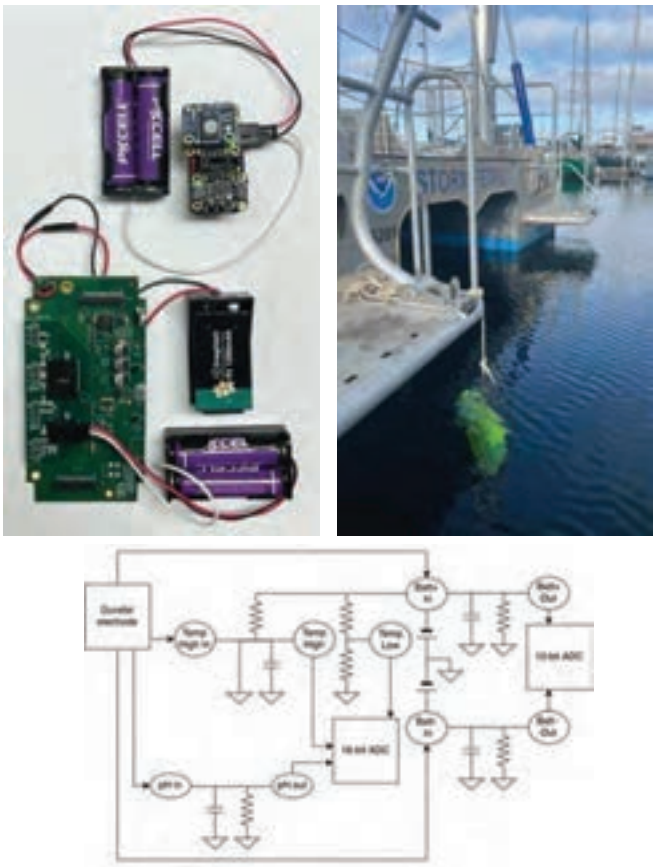

Fig. 1. *Top left*: Side-by-side comparison of old (MadgeTech, bottom) and new (open-source, top) sensor electronics. *Top right*: Packaged sensor systems concurrently deployed in a dive bag for field deployments in Port Angeles Harbor, Washington. *Bottom*: Circuit schematic of the voltage divider circuits joining the pH electrode to the ADC inputs [22].

The Adalogger's single-ended 10-bit ADC only provides 1024 sampling levels, and so we added Adafruit 12-bit and 16-bit ADCs to increase sampling resolution and allow for the differential signals needed to sample negative voltages. Both ADCs have programmable gain amplifiers, and so we further increased sampling resolution by increasing the gain to 8x on the 12-bit ADC (1 least significant bit = 250 µV) and to 4x on the 16-bit ADC (1 least significant bit = 31.25 µV).

Additionally, the Adalogger's on-board crystal oscillator exhibits temperature-dependent drift and requires external input to accurately log date and time, and so we used the Adafruit precision RTC in our design. The precision RTC has a temperature-compensated crystal with ±2 minutes drift per year [24], making it more suitable for environmental monitoring applications with long unattended deployment times.

The materials cost for both designs is presented in Table 1. Documentation and instructions for building the new design are available on GitHub under the Apache 2.0 license: `https://github.com/ameliaritger/arduino-ph-sensor`.

### *B. Testing*

We compared performance of the new design with the old design using two Honeywell Durafet II pH electrodes [27] connected to each data logger design via a Honeywell Cap Adapter [28].

In order to fairly compare performance of the new and old data logger designs, we needed to account for the known sensor-to-sensor offset in each Durafet electrode. We achieved this in the lab by using two Durafets, each connected to a data logger of either the new or old design, and repeating the measurements with the electrode originally connected to the other data logger. For these "sensor swaps", we placed sensors in equimolar tris in artificial seawater (hereafter, "tris"), a buffer with a pH that is well defined as a function of temperature [29], [30], to draw comparisons between designs in a solution with a known pH. Sensors were directly next to each other in the same tris solution in a 25 ºC water bath and collected readings every 15 seconds for a total of 2 hours. After 1 hour, we swapped the data loggers between pH electrodes to isolate sensor effects from data logger effects on pH and temperature measurements. We performed sensor swaps with the new design and old design data loggers, in addition to two data loggers of the old design, to isolate

TABLE I. COST COMPARISON BETWEEN THE SENSOR ELECTRONICS OF THE OLD DESIGN, WHICH USES COMMERCIALLY AVAILABLE AND CUSTOM MANUFACTURED COMPONENTS, AND THE NEW DESIGN, WHICH USES COMMERCIALLY AVAILABLE AND OFF THE SHELF COMPONENTS. COMPONENT MANUFACTURERS ARE LISTED IN PARENTHESES.

| Item | Old design | New design |
|---|---|---|
| Data logger[a] | $649 (MadgeTech) | $67 (Adafruit) |
| Voltage divider PCB | $400 (Go Tech Corp) | $22 (Adafruit) |
| Batteries | $14 | $9 |
| **Total cost[b]** | **$1063** | **$98** |

[a.] Electronics required to digitize Durafet analog voltages and store them in local nonvolatile memory
[b.] Excludes fixed costs (e.g., the Durafet and PVC housing) which are the same for both designs

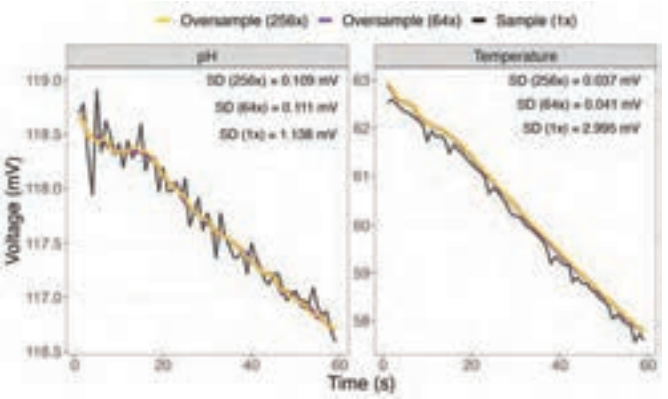


Fig. 2. Oversampling rate comparison between 256x (yellow) and 64x (purple) oversampled data, and 1x (black) sampled data for pH (left) and temperature (right) pins on the new design data logger. Standard deviations (SD) are displayed for each sampling rate. Each time point represents a 10 second sampling period for a total of 10 minutes.

differences between sensors and data loggers. To reduce noise and achieve a similar resolution to the old data logger, the new data logger oversampled the temperature and pH signal 256 times (Fig. 2).

We also evaluated performance of our new design in a real-world scenario using field deployments to monitor measurement differences between designs *in situ*. Sensors were configured with either a new design or old design data logger and deployed in the Port Angeles Harbor (Washington, U.S.) on December 15, 2022, for 24 hours (Fig. 1). We placed sensors immediately next to each other in a dive bag that was sunk to approx. 1 meter depth in the harbor. Sensors collected readings every 5 minutes. To reduce noise and achieve a similar resolution to the old data logger, the new data logger oversampled the temperature and pH signal 64 times. We reduced the oversampling rate for field deployments as a conservative measure to preserve battery life, because field deployments occurred prior to collecting measurements on current consumption between oversampling rates.

Finally, we measured current consumption for each data logger design using a voltage drop over a 1 Ω shunt resistor in series with each data logger's battery power supply [31], [32]. Voltage and current measurements were collected on a Keithley DMM6500 multimeter [33] and Rigol DS1054Z oscilloscope [34]. We measured the current draw from each design while sampling and idle, in addition to current draw from the new design at oversampling rates of 64x and 256x.

### C. Analysis

We temperature calibrated sensors using known temperature readings measured by an Onset HOBO Tidbit water temperature data logger [35] in an ice bath, at stable room temperature, and in a 25 ºC water bath. We calibrated temperature readings for each sensor by fitting a line to the mean temperature measured by the HOBO logger and the difference in temperature readings between each pH sensor and the HOBO logger. We then tris calibrated sensors using tris buffer at stable room temperature (20.3 ± 0.2 ºC) and applied calibration values to each unique Durafet-logger pairing.

To analyze sensor swap data, we calculated the theoretical difference between data loggers by subtracting the mean differences in temperature and pH voltage readings between data loggers before and after the sensor swap, which allowed us to account for differences attributed to individual pH electrodes. We then converted voltages to temperature and pH units and determined differences between data loggers by subtracting the mean temperature and pH readings before and after the sensor swap, and then averaging those values between time periods. We converted voltages to pH and temperature values using equations found in [13].

All data were analyzed and visualized using R version 4.1.1.

## III. Results

### A. Sensor swap

The average difference in temperature voltage readings between new and old design sensors before and after the swap was 1.7 and 1.4 mV, respectively. The average difference in pH voltage readings between sensors before and after the swap was 32.1 and 32.0 mV, respectively. We therefore estimate the average difference between the new and old design data loggers, after accounting for pH electrode variation, was between 0.2 and 0.3 mV (Fig. 3), which corresponds to an approx. difference of 0.5 ºC and 0.002 pH units. In comparison, the old design data loggers measured temperature voltage readings with average differences of 0.05 and 0.12 mV before and after the swap, respectively. The average difference in pH voltage measurements before and after the swap were 31.6 and 32.3 mV,

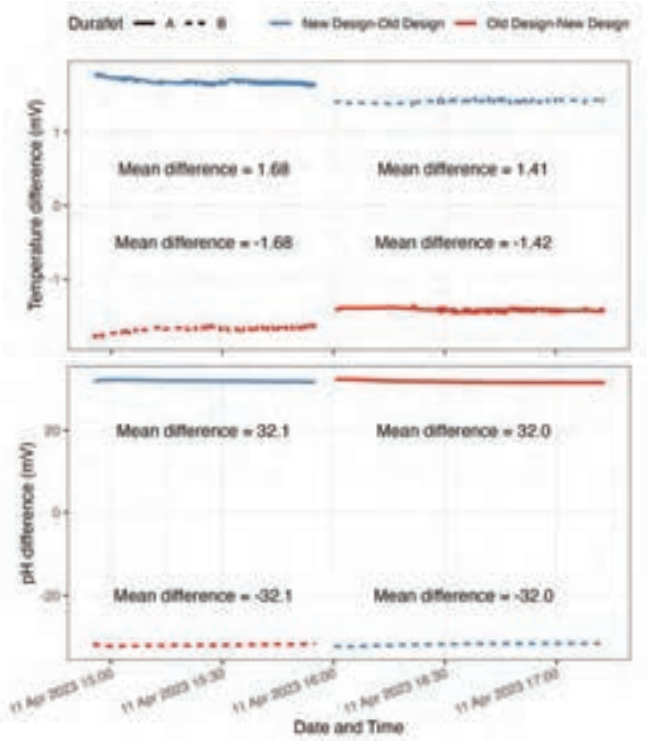


Fig. 3. Differences in temperature (top) and pH (bottom) voltage measurements collected by the new (blue) and old (red) data logger designs sensor swaps in a 25 ºC water bath. Voltage measurements do not exclude differences attributed to individual Durafet electrodes.

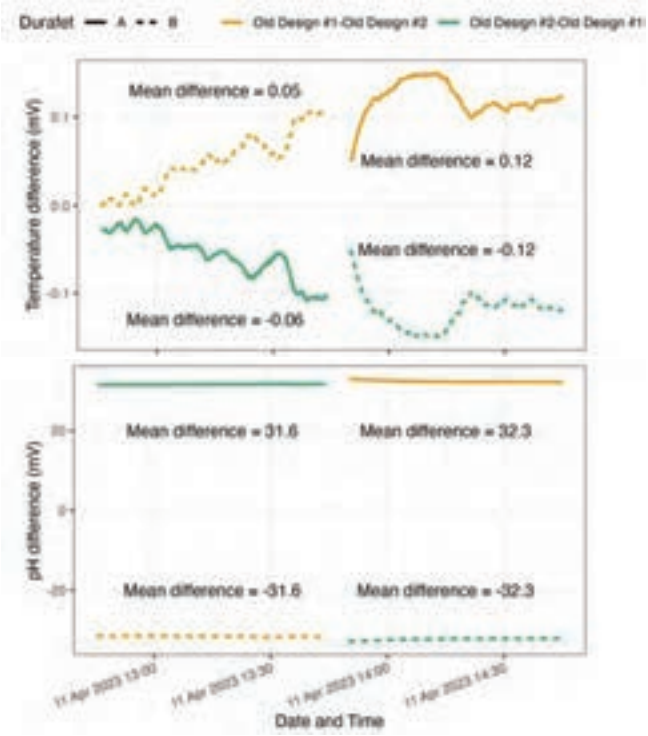


Fig. 4. Differences in temperature (top) and pH (bottom) voltage measurements collected by two old design (#1: orange; #2: green) data loggers during sensor swaps in a 25 ºC water bath. Voltage measurements do not exclude differences attributed to individual Durafet electrodes.

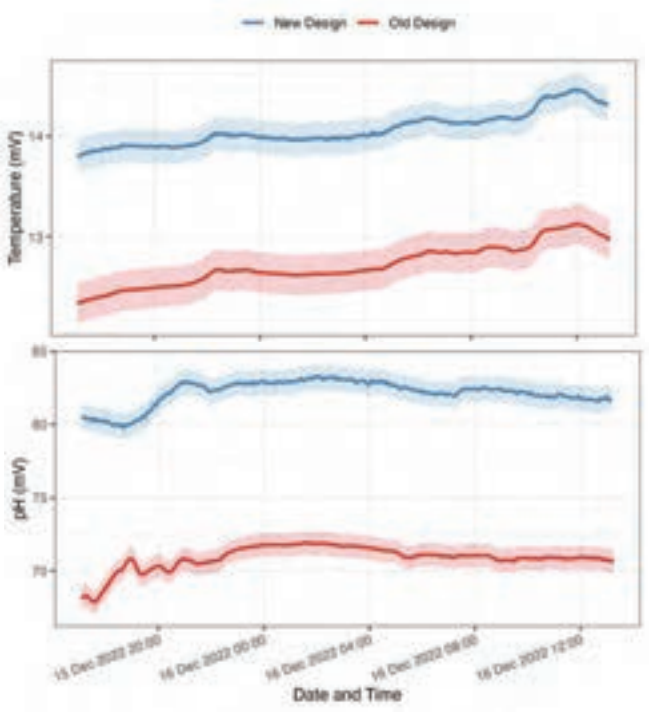


Fig. 5. Temperature (top) and pH (bottom) voltage measurements collected by the new (blue) and old (red) design data loggers during the field deployment in December 2022. Shaded areas represent the standard deviation for each design. Voltage measurements do not exclude differences attributed to individual Durafet electrodes.

respectively. We therefore estimate the old design data loggers measure average differences between 0.1 and 0.7 mV (Fig. 4), which corresponds to an approx. difference of 0.4 ºC and 0.01 pH units.

### *B. Field deployment*

During the field deployment, both data loggers measured similar trends in temperature and pH voltage readings after the first 6 hours, with voltage offsets of sizes expected from sensor-to-sensor variability (Fig. 5). The range of temperature voltage measurements was 0.7 mV for the new design and 0.8 mV for the old design, and the range of pH voltage measurements was 3.5 mV for the new design and 4.1 mV for the old design. The standard deviation of temperature measurements was ±0.2 mV for both the new and old design, and the standard deviation of pH measurements was ±0.9 mV for the new design and ±0.8 mV for the old design. These differences in standard deviation between designs correspond to an approximate difference of 0.02 ºC and $7x10^{-4}$ pH units.

### *C. Power consumption*

While sampling, the old design has an average current draw of approx. 2 mA and a maximum current draw of approx. 90 mA over 1 second. The new design has an average current draw of approx. 12 mA and a maximum current draw of approx. 30 mA while sampling, which takes 2 seconds when using a 64x oversampling rate. When not sampling, the old design draws approx. 1 mA current, whereas the new design has an approx. 2 mA current draw (Fig. 6). Oversampling at 256x increases the sampling time to 8 seconds; therefore, with the current configuration at a sampling rate of 1 sample every 10 minutes, oversampling at 256x consumes 5% more power than at 64x.

## IV. Discussion

This project's aim was to improve the design of a current pH sensor by lowering costs and making sensor electronics accessible to a wider audience while maintaining a high level of measurement accuracy. The measured differences between sensors were significantly higher than the estimated difference between data loggers, and the measurements collected by the new design were comparable to the old design during sensor swaps. Therefore, we conclude the proposed electronics have a negligible effect on data fidelity. Our findings demonstrate that our design, which uses equivalent sensor electronics that cost $965 less than the original design, is an effective and lower-cost alternative to measuring seawater pH and temperature.

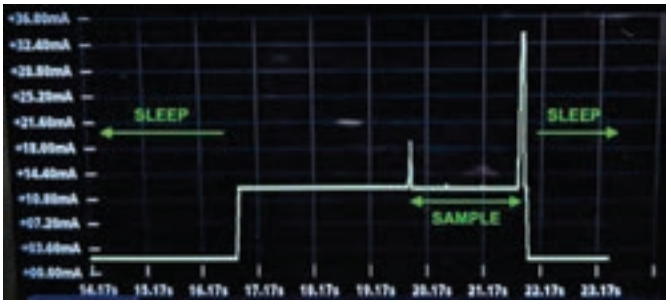


Fig. 6. Current readings from the new data logger design during sleep mode (approx. 2 mA) and while sampling (approx. 12mA).

Our design uses a more streamlined and customizable Arduino-based data logger to meet most of the identified project goals and requirements. Users with access to basic electronics equipment are able to use our design to build their own low-cost data logger with off the shelf components, program their own deployment parameters, and download data without proprietary software. Our design not only reduces the upfront cost of data logger electronics, but it also lowers the cost of regular equipment maintenance and response to catastrophic events such as flooding of the sensor housing by using a modular design with inexpensive, easily-replaceable components.

The measured differences in pH and temperature readings between data logger designs were significantly lower than the measured differences between pH electrodes, even after calibration. Differences between the old and new designs are likely not due to the Adafruit ADCs, as the offset voltages for both the 12-bit and 16-bit ADC at 3.3 V are approx. -100 µV [25], [26], which is significantly lower than the observed voltage differences. Internal sensor differences, however, are a well-acknowledged phenomenon with autonomous sensors [36], [37], and sensor differences can be corrected with independent validation and adjustment to achieve climate quality data [38].

However, in a temperature-controlled water bath during sensor swaps, we observed two old design data loggers collected temperature and pH readings that were different by 0.4 ºC and 0.012 pH units, whereas the differences between the new design and the old design were only 0.5 ºC and 0.002 pH units. Through our testing and analysis, we observed degradation of one Durafet, and we suspect the poor performance of the old design data loggers was due to sensor failure, rather than data logger differences. After excluding the degrading sensor data from analyses, the differences in temperature and pH readings between the new design and the old design were 0.3 ºC and 0.002 pH units, and the differences between the two old design data loggers were 0.3 ºC and 0.001 pH units. Both of these pH differences are well within the standard uncertainties proposed by the Global Ocean Acidification Observing Network [38].

### *A. Considerations*

The new design is a considerable improvement over the old design, given the significant reduction in cost without a significant effect on data fidelity. Nevertheless, the new design has room for even more improvements and further optimization with regards to power consumption. The old design does not allow users to optimize power consumption, and has periods of high current draw while not sampling (presumably, waking up to check for the sampling time). In contrast, our design can be programmed to sleep until the sampling time, which can maximize power savings.

However, our design currently has significantly higher power consumption than the old design, due to the elevated current draw while in idle mode. The current sleep configuration only lowers the current draw to 2 mA, although there is evidence that microcontroller sleep modes may achieve current consumptions as low as 1 µA [39]. As most of the power consumption occurs while the device is in sleep mode (e.g., during sampling intervals of 10 to 30 minutes during field deployments), reducing the current draw an order of magnitude would vastly improve and outperform the lifespan of the old design. With the current power consumption and sampling configuration, the new design's two 3.6V LiON batteries each have a capacity of 2400 mAh and therefore we expect an overall system lifetime of 49 days before the battery that powers the data logger needs to be changed or recharged.

Our decision to use a removable microSD card, in order to increase ease of use for data storage and retrieval, may be one main source of the elevated power consumption while in idle mode. The use of a microSD card increases power requirements during card initialization and operations [40], which likely corresponds to the high current draw events we observed during sampling (Fig. 6). Moreover, microSD cards may be a source of current leakage between sampling intervals, increasing current draw while the microcontroller is in idle mode by an order of magnitude [41]. However, there is evidence that slight hardware and software modifications may circumvent this and other sources of power loss [10].

### *B. Recommendations*

Oversampling with the new design enhances the resolution of data to more closely match the 24-bit ADC of the current design. For our tests, we used both 64x and 256x oversampling rates. Although both oversampling rates allowed us to achieve pH errors well below climate quality thresholds [38] and oversampling at 256x had a negligible overall power consumption increase, the reduced measurement variation at 256x only has a minor effect on temperature and pH measurements (approx. $2x10^{-3}$ and $3x10^{-5}$, respectively; Fig. 6).

Additionally, our new design uses off the shelf passive components with higher tolerances than the surface mount components of the old design. To achieve temperature and pH uncertainties equivalent to the original design and reinforce comparability across designs, we recommend using components with equivalent (1%) tolerances. It is also possible to account for variability in component values during data processing by applying real resistor values to conversion equations [13]. Although passive component values are only directly applied to the temperature calculation, calculations of pH are affected by temperature and consequently pH is indirectly also affected by the resistor values. Therefore, we recommend measuring resistor values before soldering components to ensure accurate calculations of pH and temperature from measured voltages for each sensor.

## V. Conclusion

We have demonstrated a field-deployable temperature and pH sensor system that can collect data with high accuracy using off the shelf components that are open-source, reconfigurable, and less expensive than the current state-of-the-art. Using an Arduino-based data logger reduces the prohibitive cost barrier to oceanographic research and enables individuals and groups with modest research budgets to monitor ocean pH conditions. Increasing the number of researchers able to access oceanographic equipment supports more comprehensive tracking of ocean acidification and other climate stressors in the marine environment.

## Acknowledgments

This work would not have been possible without inspiration and support from A. Baish. We would like to graciously thank F. Chan for his expertise and guidance on the original design of the pH sensor and B. Roberts for his time and support collecting power measurements on the oscilloscope. We would also like to thank A. Thompson for her generosity with sharing laboratory glassware. This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. 2139319. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

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# Who's Who in the IEEE OES

## *Toshihiro MAKI, The University of Tokyo and a Newly Elected AdCom Member (from 2024–2026)*

Hello, OES members. I received my Ph.D from The University of Tokyo in 2008. I am currently an associate professor of the Center for Integrated Underwater Observation Technology, Institute of Industrial Science, The University of Tokyo. I served as secretary of OES Japan Chapter 2016-2021 and have been vice chair of OES Japan Chapter since 2022. I have also been serving as associate editor of the Journal of Oceanic Engineering since 2013. During this period, I served as Publications & Publicity Committee Co-Chair at OCEANS'18 MTS/IEEE Kobe / Techno-Ocean 2018. I also served as a TPC Co-Chairs at AUV 2016, UT21 online, and International Symposium on Underwater Technology 2023 (UT23). I was elected to the OES AdCom in 2023 for a term 2024 to 2027.

*Figure 1. Autonomous Marine Platforms we have developed (Top-left: AUV MONACA, Middle-center: AUV Tri-Dog 1). Tri-Dog 1 was originally developed in Prof. Ura's lab.*

My research field is underwater platform systems, especially autonomous underwater vehicles (AUVs) and related technologies. We have developed several ocean-going AUVs (see Fig. 1), and have extensive experience in sea trials in Kagoshima Bay, Okinawa Trough, Ishigaki Island, etc. In 2015, while staying at the Woods Hole Oceanographic Institution in the United States, I boarded the icebreaker Sikuliaq on an observation cruise in the Arctic Ocean, gaining experience in operating AUVs under sea ice. Since 2017, I have been leading the development of AUV MONACA for Antarctic sea ice and ice shelf exploration in collaboration with National Institute of Polar Research. In 2023, our team succeeded in the first deployment of the AUV to Antarctica from the icebreaker Shirase. Please visit website of my lab for more information (http://makilab.iis.u-tokyo.ac.jp/).

When I entered the university, I wanted to become a pilot or engineer on aircraft or spacecraft. I also belonged to the university soaring club. The turning point was when I failed to enter the department of aeronautics because my grade wasn't good enough. So, I went to naval engineering department, where I met Prof. Tamaki Ura, OES fellow. I was fascinated in underwater robotics, especially AUVs, as his lecture was very interesting. So I proceeded to the graduate school to study about it under his supervision in 2003.

I was very fortunate to have many opportunities for field experiments and presentations at academic conferences. Actually, it was very tough to publish papers at the field of 'experimental underwater robotics,' as there are many things to do, such as design, development, and maintenance of robots,

*Figure 2. Debugging AUV Tri-Dog 1 at Kamaishi port in 2004. Left: Hayato KONDO (Tokyo University of Marine Science and Technology), Center: myself, Right: Bharath KALYAN (National University of Singapore).*

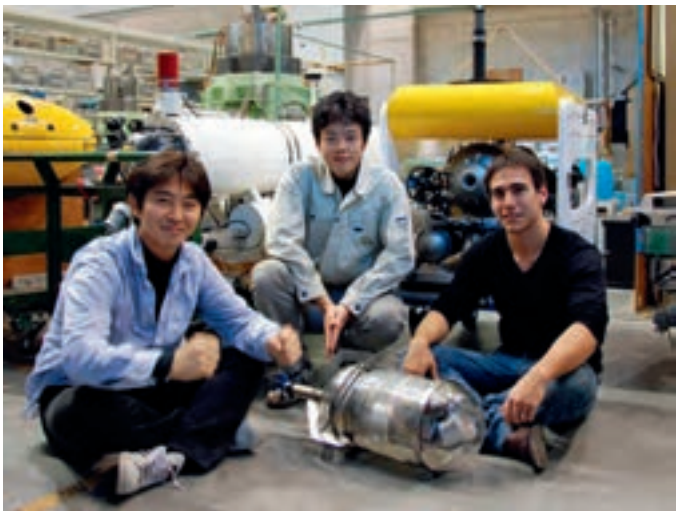

*Figure 3. The 'three brothers' of Prof. Ura's lab in 2007. Left: Takeshi NAKATANI (JAMSTEC), Center: myself, Right: Blair THORNTON (University of Southampton / The University of Tokyo).*

*Figure 4. Our group (Maki Lab. and Thornton Lab.), just after graduation ceremony in 2023.*

*Figure 5. Myself, at a field experiment in 2022.*

*Figure 6. The latest work of my youngest son, as of 14 Aug. 2023.*

software development, debugging, theoretical study, offline simulations, experiment, post-processing, analysis, and writing. However, I feel like all my hard work has paid off when our hard-earned robot moves exactly as I intended. I still remember the excitement and a feeling of satisfaction when the AUV Tri-Dog 1, which I used as a testbed for master thesis research, first succeeded in wall following at a tank experiment. At that time, I decided to do my best to become an AUV researcher.

I am also interested in outreach activities. I have been organizing student underwater robot competitions as a director of the NPO 'Japan Underwater Robot Network' since 2013. The last event was held in August 2022, and it was a great success with 20 teams and more than 160 participants, even though it was held online. This year, we are preparing for a face-to-face event for the first time since 2019, expecting more than 20 teams from universities, high schools, and junior-high schools.

I have three boys. The youngest one has just entered elementary school, so I have a busy life at home. Watching children grow (and getting along with my wife) is another important mission of mine. Here I write that the three boys are currently addicted to each, just for your reference. Oldest: Minecraft, Middle: The Battle Cats, Youngest: Handcraft (see Fig. 6).

# AdCom Election Results

The election results are in for the 2024-2026 Administrative Committee members. This year we had a great list of 13 candidates from around the world (see their bios in the last issue of the Beacon) and the results were very close. Congratulation to the following six candidates who were elected:

*Monika Agrawal*

*Giulia De Masi*

*Gabriele Ferri*

*Malcolm (Mal) L. Heron*

*Toshihiro Maki*

*Konstantinos Pelekanakis*

**Welcome aboard. Now…let's get to work!**

# Welcome New and Reinstated Members

**From 8 May through 13 August, 2023**
**Total: 100 (Incl 56 Student)**

**Australia**
Mohan V Mohan
David Myoren Martin

**Canada**
Philipp A Schmid

**China**
Junjun Cao
Huijun Chen
Pan Huang
Jun Li
Pinpin Li
Ronghuan Qiu
Xinghao Qu
Zhensheng Shi
Haixin Sun
Jiadong Sun
Xingbin Tu
Yan Wei
Yongjia Xia
Jiajie Yu
Rongxin Zhang
Hangfang Zhao
Ruiqin Zhao
Mingzhang Zhou

**Colombia**
Yesenia Alexandra Alfonso
German Diaz
Jorge Granada

**Ecuador**
Melissa Lizbeth Gomez Tapia
Andrea Sofia Monard Monteverde
Ivan Marcelo Sarmiento

**France**
Leo-Paul Pelletier

**Greece**
Alexandros Troupiotis-Kapeliari

**India**
Rajendra Prasad Arani
Phani Raju Dandemraju
Jemina I
Rajesh J
Pitchaimani Jayaraman
Rajeshwari K
Venkataraman Kalyanasundram
Sridhar Krishnamoorthy
Brejesh Lall
Sivaranjani M
Asha R M
Nisha N
Vasudevan N
Suganya Natarajan
Maheswari P
Mohammed Ashick R
Devakandhan R
Kiruthika R
Raja Rout
Neelakandan S
Vinoth Kumar S
Sivaramakrishnan S
Daisylin Anbu Sujitha S
Brindha Saminathan
Kandasamy Sengodan
Rathika Subburam
Shadhin Sudhershan
Sumathi Swaminathan
Myvizhi Selvi V

**Ireland**
Gary Patrick Breslin

**Israel**
Talmon Alexandri
Shlomi Amitai
Gershon Ben Arie
Piet Brodowski
Nadav Cohen
Aviad Etzion
Yaakov Kobi Libero
Shira Massas
Yair Stolero
Shunit Truzman
Zeev Yampolsky
Aleksei Zakharchenko

**Italy**
Nicola Secciani

**Japan**
Emi Kitano

**Korea, Republic of**
Gun Rae Cho

**Norway**
John Joseph Mulholland

**Singapore**
Bien Aik Tan

**Spain**
Julio Cesar Gonzales Alcalde

**Thailand**
Yodyium Tipsuwan

**Turkiye**
Kaan Alper
Ismail Bayezit

**USA**
Erfan Amini
Peter Baxter
Youngwan Choi
Max Deffenbaugh
John A. Doorley
Muthu Elen
Elin Hanson
Timothy L Howard
Angela Johnson
Rajini Kanth Reddy Karduri
Kris Kim
Alison Laferriere
Karen N Mulberry
Edward Patton
Nicholas Rahardiyan
Rypkema
Brian Schlining
Henok Yared
Lin Zhao
Thomas Savarino

**Vietnam**
Minh Quang Tran

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# IEEE OES University of Zagreb SBC Activities

***Igor Kvasić, Vladimir Slošić, Luka Mandić, Juraj Obradović, Kristijan Krčmar, Matko Batoš***

In the spirit of knowledge dissemination and fostering a vibrant maritime community, the IEEE OES UNIZG student branch chapter has once again concluded a dynamic quarter filled with an array of interesting activities and engaging lectures. As we reflect on the past few months, we find ourselves inspired by the dedication of our members and the diverse range of events that have enriched our maritime community.

Since March, our chapter has hosted lectures titled "Communicating and raising awareness about Underwater Natural and Cultural Heritage," held by Assoc. Prof. Dr. Fabio Bruno and "Underwater remote sensing systems simulation for synthetic dataset generation" by Dr. Sc. Antonio Lagudi, both from the University of Calabria in Italy. As part of the UWIN-LABUST project, together with the Laboratory for Underwater Systems and Technologies (LABUST), we organized a hands-on tutorial titled "Technologies for underwater surveying: Workflow for 3D reconstruction of UCH sites" held by Engr. Umberto Severino—a Ph.D. student currently in the exchange program within the Tectonic project.

Most of our members participated in the largest event we had in the last quarter—the Workshop on EU-funded Marine Robotics and Applications (EMRA) 2023, held on the 20th and 21st of June in Šibenik, Croatia. The workshop was hosted jointly by University of Zagreb, Faculty of Electrical Engineering and Computing (UNIZG-FER) together with IN2 and DIH AgriFood Croatia. This highly anticipated event brought together over 90 leading experts, researchers, and professionals in the field of marine robotics and applications. In a single-track conference programme over two days, 25 speakers presented their interesting research topics with ample time for discussions and networking.

## Nadir Kapetanović Successfully Defends his PhD Thesis

We are thrilled to announce that on 26 June, 2023, our former SBC secretary Nadir Kapetanović successfully defended his PhD thesis titled "Complete coverage of large seabed areas using sonar data-based path planning for an autonomous marine vehicle" with Summa Cum Laude honors! Congratulations to Nadir on reaching this important milestone. His student days may be over, but we are confident that he will continue to make significant contributions to his research field as he did contributing to our student chapter. We wish him all the best on his post-doctoral research journey and look forward to his future accomplishments!

## OES UNIZG SBC at OCEANS Limerick, June 2023

During 5-8 June, many of our chapter members participated in the OCEANS 2023 Limerick conference with several different activities. More than 10 members travelled to Limerick to present their recent work, connect with the community, and learn about new academic achievements in the field. We participated in multiple activities, which included a tutorial for general audience, presentation of three papers, and an exposition booth presenting the collaboration with the University of Montenegro in the scope of the MONUSEN project, a Horizon Europe Twinning Project.

*Nadir with his mentors after successful PhD thesis presentation and defense.*

Our members, Ivan Lončar, Natko Kraševac, Fausto Ferreira, and Juraj Obradović, conducted the tutorial titled MARUS—Unity Based Simulator for Marine Robotics. During this tutorial participants learned how to use MARUS simulator, which was fully developed in LABUST and is finding many implementations in the academy and industry. Additionally, we conducted a citizen science experiment in which we compared the performance of participants to the previously developed algorithm in following COLREG rules. The same

*IEEE OES UNIZG SBC team with colleagues and collaborators from other institutions at the MONUSEN project stand.*

*Autonomous catamaran at the dock with integrated hardware.*

citizen science experiment was conducted in the MONUSEN booth. During the conference the startup company, H2O Robotics, which originated from LABUST, had a booth where they presented their technologies to the community.

In the session "Maritime Vehicle Navigation 1" our vice president Vladimir Slošić had a presentation of his paper titled "Underwater breadcrumb localization." In the session titled "Pollution Monitoring" our former president and secretary Anja Babić and Nadir Kapetanović presented their paper titled "Cooperative marine litter detection and environmental monitoring using heterogeneous robotic agents." Additionally, Anja Babić chaired this session. In the session "Maritime Vehicle Navigation 2" our secretary, Juraj Obradović, presented his paper titled "Navigation, Guidance and Control of a catamaran robust to external disturbances."

## ICRA 2023, London, July 2023

Three of our SBC members participated in the IEEE International Conference on Robotics and Automation—ICRA 2023, that took place at London Excel. At one of the largest robotic conferences, our members Ivan Lončar, Natko Kraševac, and Juraj Obradović, conducted a tutorial titled "TEAM – Technology Enablers for Autonomous Maritime Robots: Digital Twins with Simulations and Cloud-enabled Massive Scale Datasets for Experimentation and Validation."

This tutorial was conducted in collaboration with the research group Reeds from Chalmers University of Technology in Gothenburg, Sweden. The collaboration between LABUST and Reeds began during the unmanned ship project with a common goal of creating large datasets for research and development in the field of autonomous boat driving. Although both groups shared the same goal, they chose different approaches. The Reeds group acquired large amounts of data from their custom-made ship, equipped with a variety of sensors, while LABUST decided to take a different approach by creating a realistic simulation of the marine environment and tools for automatic data labeling using the MARUS simulator. For this tutorial, we decided to test the fusion of these two approaches in a Digital Twin, combining the best of both worlds to provide the best possible results for anyone using the data. The tutorial was a half-day event that took place on the first day of the conference, May 29th, 2023.

On the final day of the conference, Natko Kraševac and Juraj Obradović participated in the **Scalable Autonomous Driving** tutorial, where they had the opportunity to listen to presentations from leading companies in the autonomous driving field, such as Nvidia and Cruise.

## First Test of Algorithms for the MBZIRC Competition, July 2023

From the 3rd to the 8th of July, our joint team UNIZG-FER, competing in the Mohamed Bin Zayed International Robotics Challenge (MBZIRC) 2023, had our first field trials in Rijeka, Croatia. All system components have been tested, and we are very happy with the results. A great thanks to our supporters from Centar za morske tehnologije (CMT) at the Faculty of Maritime Studies in Rijeka for providing us with logistical help and access to their excellent facilities.

During this period, we focused on testing our control algorithms for the Unmanned Surface Vehicle (USV). First, we managed to achieve accurate localization of the USV using IMU and GNSS data. Then, we successfully tuned all the PID parameters, enabling the go-to point functionality to work. This, in turn, allowed us to test the docking procedure, which will involve a series of points.

Additionally, we conducted tests of path planning algorithms in a marina environment and integrated them with the waypoint following algorithm. Meanwhile, our companion team at LARICS tested all algorithms related to the


*Entire team at the CMT facilities doing their best at testing all navigation components hardware.*

Unmanned Aerial Vehicles (UAVs) and the robotic arm mounted on the USV.

In conclusion, we are truly satisfied with the outcomes of these field trials and eagerly anticipate the next set of trials scheduled for September this year.

## The Lecture "Technologies for Underwater Surveying: Workflow for 3D Reconstruction of UCH Sites"

As part of the UWIN-LABUST project, the Laboratory for Underwater Systems and Technologies, in collaboration with the IEEE Croatia Section—Robotics and Automation Chapter, the IEEE OES University of Zagreb Student Branch Chapter, and IEEE Life Member Affinity Group—Croatia, successfully hosted the lecture titled: "Technologies for Underwater Surveying: Workflow for 3D Reconstruction of UCH Sites." The lecture was delivered by Umberto Severino, a PhD. student from the Department of Mechanical, Energetic and Management Engineering (DIMEG) at the University of Calabria, Arcavacata di Rende, Italy. The event took place on Friday, July 14th, 2023, at 10:00 AM in the LABUST pool laboratory, located in the Martinovka building at the Faculty of Electrical Engineering and Computing (FER).

This event provided valuable insights into underwater surveying technologies and the workflow for three-dimensional reconstruction of underwater cultural heritage (UCH) sites. Attendees had the opportunity to learn from Umberto Severino's expertise and contribute to the advancement of knowledge in this field. The collaboration between various IEEE entities and the UWIN-LABUST project facilitated an exchange of ideas and expertise, helping innovation and progress in underwater exploration and technology.

The workshop followed a brief yet practical introduction to underwater surveying technologies. It then delved into the step-by-step workflow for reconstructing three-dimensional scenes, focusing on their application in the context of Underwater Cultural Heritage (UCH) sites. The central emphasis of the workshop was directed at passive optical technologies and the crucial image filtering process essential for laying the groundwork for structure-from-motion (SfM) reconstruction. Attendees were given the unique opportunity to observe the entire procedure. Practical demonstrations were carried out using Adobe Camera Raw and Agisoft Metashape software, providing participants with valuable hands-on experience and insight. This seminar and workshop were a part of a larger Knowledge Transfer Activity (KTA), initiative. Conceived within the framework of the H2020 MSCA—Tectonic project, its primary objective was to facilitate seamless knowledge exchange and collaboration among project partners

*SeaTechHub partners after project has been confirmed.*

*LABUST team with partners in SOUND project from Haifa.*

## EU-Funded Horizon Europe SeaTecHub Project Kicks Off

The highly anticipated Horizon Europe SeaTecHub project, funded by the European Union under the Horizon Europe program, has officially commenced on June 1st, 2023. University


*Testing floater developed in LABUST in the Red Sea in Israel.*

of Zagreb, Faculty of Electrical Engineering and Computing (UNIZG-FER), in collaboration with esteemed institutions and organizations, is proud to announce its involvement in this leading-edge Coordination and Support Action.

The SeaTecHub project, coordinated by the Cyprus Marine and Maritime Institute (CMMI), aims to strengthen innovation ecosystems in eco-innovative technologies for healthy and productive seas. As a key participant, UNIZG-FER will contribute by leading the Crotian ecosystem and leading the Research and Innovation Work Package.

During the kick-off meeting on June 19th, participants engaged in fruitful discussions, exchanged knowledge, and established collaborative frameworks that will drive innovation and move the project forward. This gathering marks the beginning of a transformative journey, where stakeholders will work hand in hand to develop progressive solutions for the challenges our seas face today.

## SOUND Project, Visit to Partners in Israel

The SOUND team from LABUST visited Haifa, Israel and the ANL facilities from July 16th to 20th ,2023. As part of this visit, a meeting was held with the Croatian Ambassador to Israel, Vesela Mrđen Korać, in order to discuss both ongoing and future collaboration between the two countries. The Ambassador toured the laboratory facilities, met the various research teams, learned about current projects, and provided valuable insight into potential avenues for strengthening cooperative efforts.

From July 18th to 20th, field trials for the SOUND project took place in Eilat, Israel. This area of the Red Sea was chosen due to its steep bathymetry, enabling measurements at a great variety of depths. Five joint sea experiments were performed by the researchers from the University of Haifa and the University of Zagreb in order to check the integrated operation of the developed floater and the acoustic unit.

# OES Judges RoboSub 2023

***Robert L. Wernli, OES AdCom, RoboSub Judge***

The 26th RoboSub Competition, 31 July—6 August, 2023, returned to NIWC Pacific's TRANSDEC, in San Diego, California, with 34 teams representing Bangladesh, Canada, India, Singapore, and the United States. The fundamental goal of the RoboSub competition is for an Autonomous Underwater Vehicle (AUV) to demonstrate its autonomy by completing underwater tasks, with a new theme each year. And, once again, I was proud to represent IEEE OES as one of the judges. Some photographs of the competition follow. The top 5 teams and their awards follow. RoboSub details can be found at robonation.org.

*One of the teams provides their AUV design details to the judges.*

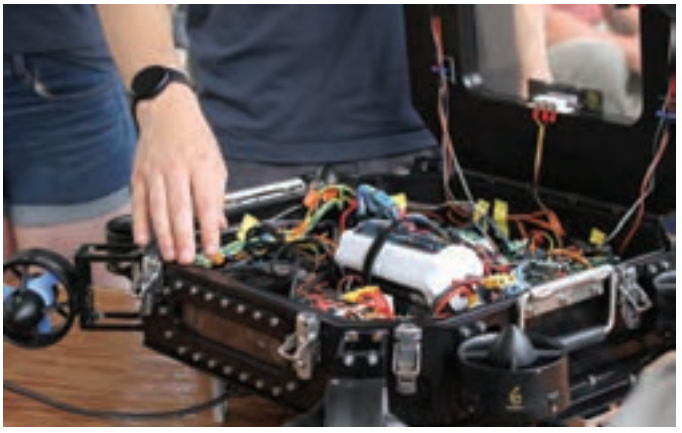
*Divers help launch an AUV.*

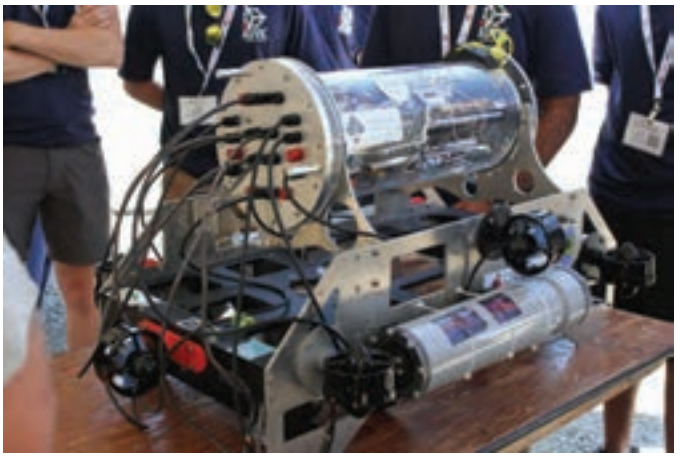
*Divers provide status of the AUV as it runs the course.*

**Autonomy Challenge Awards**
1st Place ($6,500): National University of Singapore
2nd Place ($3,750): BRAC University
3rd Place ($2,000): University of Alberta
4th Place ($1,500): Si Se Puede Foundation
5th Place ($1,000): Amador Valley High School

*Underwater targets*


*National University of Singapore takes first place*





*Various teams presenting their vehicle designs to the judges. (Thanks to RoboSub for the photos)*

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**HAVE YOU COMPLETED SOME EXCELLENT RESEARCH? BE SURE TO ENTER THE OES STUDENT POSTER COMPETITION. UP TO 25 INTERNTIONAL STUDENTS ARE CHOSEN TWICE A YEAR TO TRAVEL, ALL EXPENSES PAID, TO THE NEXT OCEANS CONFERENCE TO PRESENT THEIR RESEARCH IN THE POSTER SESSION. THE THREE TOP POSTERS RECEIVE $3,000, $2,000 AND $1,000 FOR 1ST, 2ND AND 3RD PLACE.**


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