OES BEACON

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

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

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IEEE Member Group Insurance Program—Professional Liability Insurance
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From the OES BEACON Editors

Harumi Sugimatsu and Robert Wernli

Based on all the articles in this issue, it's obvious that OES continues to be very busy, not only with our OCEANS conferences, but with the many workshops and symposia held in 2023, and planned for 2024. With the negative effects of Covid now behind us, it's great to see the attendance and finances of our events getting back to normal. This is supported by this issue's excellent reports on OCEANS 2023 Gulf Coast, in addition to a report with comments from students who attended the event, and also an article on the recipients of the annual OES awards. With the successes of the OCEANS conferences in Limerick and the Gulf Coast, we look forward to next year's OCEANS conferences in Singapore and Halifax. The latest on the OCEANS conference planning is provided in the report by our VP for OCEANS.

Our students have certainly been busy. This is highlighted in the the results of the OCEANS 2023 Gulf Coast Student Poster Competition (SPC) to include the winning paper and an article by the SPC winner. And, don't miss the reports of related events in Colombia and Sri Lanka.

OTC Brazil was just completed and we are planning for next year's OTC Asia in February and OTC Houston in May.

Upcoming workshops and symposia are listed in the Conference Calendar and reported by our VP for Workshops and Symposia. Reports on MetroSea 2023 and RAMI 2023 are included in this issue.

Our technology committees (TCs) continue to be more active as reported by our VP for Technical Activities and also from the Chair of the OSES committee.

Our chapters have been busy as the reports show. This issue contains the latest on the activities of the Malasia, Singapore, India and Japan chapters, in addition to the results of the JAMSTEC 2023 ROV competition and Norway's NJORD Challenge.

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 the hard work by our AdCom members. Want to participate? See the Call for AdCom nominations in this issue.

Harumi with AUV "BOSS-A".

And Bob wishing you a "Happy Holiday. Ho…Ho…Ho".

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's hard to believe that 2023 is already ending! What have we accomplished this year? A full return to in-person conferences and workshops, numerous chapter and student branch chapter events, lots of new activities in OES initiatives and projects, just to name a few.

This year's agenda of in-person meetings has been very successful. Both OCEANS Limerick and OCEANS Gulf Coast had higher than expected participation. Each was full of excellent new connections and productive interaction. OES thanks both the Limerick and Gulf Coast Local Organizing Committees for their hard work!

Similarly, the Offshore Technology Conference (OTC) in Houston in May, and OTC Brazil in Rio de Janeiro in October also exceeded expectations, for both attendance and technical quality. We look forward to OTC Asia in Kuala Lumpur in February, 2024, followed quickly by OCEANS Singapore in April, and the OTC in Houston, USA, as usual in May. I look forward to seeing some of you there!

In September I mentioned that we are working to have OES ratified as an official originator of IEEE Standards. That has now been formalized, so congratulations to the Standing Committee on Standards for this accomplishment!

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.

In November we closed our administrative year with both an in-person OES Executive Committee (ExCom) meeting, and the final meeting of the IEEE Technical Activities Board (TAB). At OES ExCom we looked ahead to our 2024 activity plan, with particular emphasis on improving our support for students, and collaborations with other IEEE Societies. At the TAB meeting, I continued the collaboration discussions with Presidents of many other Societies about how OES could reach the many IEEE members who have interest in ocean technology but aren't yet OES members.

One of the things I enjoy most when discussing OES with other IEEE leaders is sharing with them how ocean technology connects with so many areas of society at large and relates to so many other IEEE specific fields of interest. It is energizing to share what we, within OES, already know: that ocean technology will be a large part of meeting the world's needs for food, energy, security, transportation, and economic development. Sustainably and responsibly managing the ocean resources that we all depend on will take all the ingenuity, experience, and expertise of our community, and many more people in addition. This means ample opportunity for our members, student members, and potential members as we all build "a collaborative community working towards a safe, healthy, and productive ocean." This is a very positive and powerful message!

Finally, thank you to all the hard-working volunteers that make OES events happen! Volunteering with OES is one of the most rewarding ways to add value to your membership and build your professional network. If you have an idea for the Society to take on, or would just like to be involved but don't know where to start, please email me anytime at president@ieeeoes.org.

OCEANS Gulf Coast 2023

Brandy Armstrong, Deputy Co-Chair OCEANS Gulf Coast, Executive VP, executive-vp@ieeeoes.org

The long-awaited, in-person OCEANS Gulf Coast finally took place in Biloxi, Mississippi, this September of 2023 and was a great success. The well attended opening plenary was a foreshadowing of the week to come with excellent speakers and an engaged audience.

Thank You OES Volunteers

I want to thank the volunteers working with our Women in Engineering PROPEL Initiative, Ocean Decade Initiative, Young Professionals program and Career Networking Exhibit Tours Initiative. They were ever-present and fast to engage with

Co-chair Laurie Jugan (center) moderates the opening plenary, Blue Economy: Global Perspectives, with speakers Nicoe Leboeuf (left) and HON Meredith Berger (right).

Career networking exhibition tour organizers and guides for OCEANS Gulf Coast. Tracy Yanez (top, right), Jackie Veatch (top left), Arvind Bahrdwaj (middle right), Dr. Farheen Fauziya (bottom left) and Dr. Francesco Maurelli (bottom right).

all volunteer opportunities. We couldn't do these events without our volunteers who we hope will stay engaged and involved at the Society leadership level. Our volunteers included:

Jackie Veatch joined us at OCEANS on a student poster competition winner travel grant.

Arvind Bahrdwaj attended as a guide for the Career Networking Exhibit Tour (CNET) initiative.

Dr. Farheen Fauziya our Women in Engineering Liaison attended as the organizer and moderator of the Women in Engineering Breakfast Panel and as a guide for the CNET initiative.

Sara Falleni attended as one of the 2023-2024 Women in Engineering (WIE) PROPEL laureates.

Dr. Mehdi Rahmati attended as one of the 2022-2023 Young Professional (YP) BOOST laureates.

Dr. Francesco Maurelli attended as one of this year's Young Professional (YP) BOOST laureates.

Jhon Bermudez attended as a social media reporter for the Ocean Decade (OD) Initiative and as an official photographer for the Society.

Career Networking Exhibit Tours

I recruited Student Poster Competition winner Jackie Veatch to be the point contact for the Career Networking Initiative at OCEANS Gulf Coast. Working with our local Career Networking event organizer from Accelerate Mississippi, Traci Yanez, Jackie organized with tour guides Farheen, Arvind, Sara and Francesco to prepare students ahead of the big event. A special thanks to Farheen and Arvind who volunteered at Offshore Technology Conference in Houston for the career networking exhibit tours and brought their experience and enthusiasm to the event.

There were two student tour groups scheduled to move through the hall and network with exhibitors. Exhibitors had a full schedule Wednesday afternoon meeting with both our student tour groups and individual job seekers. The event also attracted additional foot traffic from students and young professionals who did not have the luck of signing up for a scheduled slot.

Women in Engineering Breakfast Panel

Dr. Farheen Fauziya organized and moderated the Women in Engineering Breakfast panel with a focus on work-life balance.

The panel resulted in a thoughtful and enlightening discussion that encouraged individuals to harmonize the diverse aspects of their lives, fostering well-being, growth, and fulfillment. Panelists included:

Ms. Becky Oh
President & CEO | PNI Sensor

Dr. Ananya Sen Gupta
Associate Professor, Electrical & Computer Engineering, | University of Iowa

Ms. Deborah Smith
Data Governance Manager | Ocean Exploration Cooperative Institute, University of Rhode Island

Ms. Sarah Groves
Data Analyst | NOAA Ocean Exploration

We are always especially appreciative of the supporters of women who come to our breakfast panels. Ian, from Jaia Robotics, attended his first Women in Engineering Panel at Gulf Coast.

"I was excited to go the Women in Engineering Breakfast Panel at Oceans 2023, focusing on achieving work-life balance in the realm of engineering, even though it was at 0700. Understanding the unique challenges faced by women in engineering

Women in Engineering panelists (from left to right) Ms. Becky Oh, Dr. Ananya Sen Gupta, Ms. Deborah Smith, and Ms. Sarah Groves speak on work life balance.

is crucial as we gear up to expand our tech startup. Witnessing the raw and personal reflections from the panelists about their journeys was both empowering and eye-opening. Their stories shed light on the resilience and determination needed to conquer the obstacles they face.

"For me, it was a profound source of inspiration, reaffirming the positive influence and diverse perspectives that women bring to the tech industry. At Jaia, we're committed to embodying our core value of innovation, which centers on embracing a wide range of experiences, backgrounds, and genders. We strive to create a team that mirrors this ethos, acknowledging that women engineers contribute a unique and invaluable outlook that helps counterbalance the often-prevalent male dominance in the tech world." ~ Ian Estaphan Owen, CEO, Jaia Robotics LLC"

Ocean Decade Initiative

John Bermudez took photographs throughout the conference, with a special focus on Ocean Decade Initiative activities. Ocean Decade focused events included:

1) Young Professionals and Early Career Ocean Professionals Listening Session
2) A panel organized by the IEEE OES and Technology Innovation Working Group on cost efficient, scalable, practical and innovative ocean observing technologies for 'the science we need for the oceans we want'

Young Professionals Listening Session

IEEE Young Professionals Mehdi Rahmati, Francesco Maurelli, Sara Falleni and Jackie Veatch worked with Marine Technology Society Early Career Ocean Professionals Katharine Weathers and Joshua Baghdady to organize a listening session Wednesday morning.

The session gave voice to the views, opinions, and perspectives of current and future MTS Early Career Ocean Professionals, or ECOPs (i.e., those within 10 years of completing their last professional degree) and IEEE OES Young Professionals (YPs) about their unique experiences through large and small group discussions. Society leadership came to facilitate and understand the perspectives of the emerging workforce that is critical to both MTS and IEEE OES in order to provide relevant content and support to ECOPs and YPs. The event provided a safe and inclusive space for ECOPs and YPs to network with one another and brainstorm future professional opportunities in MTS and IEEE OES. Given space constraints, please RSVP via this survey. Each table's discussion was facilitated by Society leadership with a designated YP note taker to ensure that all ideas made it into the shared documentation of the event. These ideas will be used by Society leadership to better meet the support needs of our YP and ECOPS.

Dr. Francesco Maurelli (left) and Joshua Baghdady (right) lead a listening session aimed at understanding how the Societies can better support Young Professionals.

Student Poster Competition

Many of our volunteers also helped to judge the student poster competition. We congratulate all the students who participated in the Student Poster Competition this year at OCEANS Gulf Coast. First place went to Shihab Hossain Saran, a local graduate student from the University of Southern Mississippi. Second place went to Andrew Bergey and Third place went to Chenyang Zhang. All 3 winners receive a cash prize. Shihab, the first prize winner, will be funded to attend a future OCEANS conference or other OES event of their choice. Each winning student is pictured below with Student Poster chair Stephan Howden, IEEE OES President Christopher Whitt and MTS President Justin Manley.

You can read more details in the SPC article in this issue.

First Place: Shihab Hossain Saran.

Second Place: Andrew Bergey.

Third Place: Chenyang Zhang.

VPTA Column

Shyam Madhusudhana, VP for Technical Activities

Well, it looks like we are well-poised to end 2023 on a high—

i) Invigoration of OES Chapters, thanks to the initiation of periodic digest emails and continued support from Amy Deeb.
ii) Technology Committees (TCs) exhibited increased activity, with all the newly appointed Chairs filling in their new shoes early on and leading their roles with vigor. You have seen regular reports from the Chairs in this year's newsletters. We aim to keep that going. Also, look out for a report by our TC Coordinator, Atmanand, in this edition of the newsletter, where he outlines the TCs' activities during 2023 and the Chairs' plans for the year ahead.
iii) Nine Distinguished Lecturer (DL) talks delivered, so far.
iv) New initiatives/programs well into the pipeline for materializing in 2024.

As I complete my first year as the VPTA, so does Atmanand as the TC Coordinator, while the end of the year marks the end for the current Chapters Coordinator Gerardo Acosta. Thank you, Gerry, for your service and good luck in your new role. Looking forward to working with the incoming Chapters Coordinator, Maurizio Migliaccio, in 2024.

The call for DL nominations, for the term 2024–26, had ended on 31 July. The nominations (10 received) were carefully evaluated by the Distinguished Lecturer Committee comprising myself, Venugopalan Pallayil, and Malcolm Heron. While I thank Venu and Mal for their service, I am pleased to announce the addition of the following esteemed scientists to our DL roster:

- Rizal Arshad
  University Sains Malaysia, Malaysia
- Itzik Klein
  University of Haifa, Israel
- Suleman Mazhar
  Harbin Engineering University, China
- John Potter
  Norwegian University of Science and Technology, Norway
- Peng Ren
  China University of Petroleum, China

Congratulations to the new appointees, and I look forward to facilitating their contributions to the Society's membership in the years ahead.

As we carry over, into 2024, our efforts on the overhauling of TCs, we are also looking into bringing in some structural changes in how we manage Chapters' activities to make them more tractable. I am also excited to drop a hint (that's all I can reveal now) regarding an additional funding scheme to support our DL program. So, we have a lot to look forward to in 2024. And, what tops them all, in my opinion, is the IEEE-OES Summer School.

The IEEE-OES Summer School, a new initiative approved by the Administrative Committee earlier this year, aims to offer added value to students and early career professionals attending an OCEANS conference. Set to pilot at the upcoming Singapore 2024 OCEANS, the School will be a 2-day event held just prior to the conference and offers attendees an immersive sortie into the breaths of oceanic engineering, related technologies, and applications, along with networking opportunities and interactions with industry. For more details, please visit: https://ieeeoessg.org/summerschool.html

I encourage students and early career professionals to make best use of the opportunity offered by the new program, and I request academic professionals to encourage their students to apply.

Cheerio, 2023! Looking forward to another successful year.

From the VP For Professional Activities

Elizabeth Creed, VP for Professional Activities

At the August 2023 OES AdCom Elections, I was elected the VP for Professional Activities, taking over for Steve Holt who resigned for personal reasons. This office is not new to me as I previously served as the VPPA from 2010–2013. This change of office also meant that I resigned as Treasurer four months early (my term was to end in December 2023) and Bill Kirkwood, the OES Treasurer-Elect, stepped into the Treasurer's position.

The last three months have been busy, especially with Student Branch activities. We had the opportunity to be a sponsor for both the Region 9 Student Branch Regional Meeting (SBRM) in Cartegena, Colombia, at the end of October and the Sri Lanka SYW Congress in Chilaw the beginning of November. While I attended the meeting in Colombia, Dr. Suleman Mazhar, the OES SBC Coordinator, attended the Sri Lanka event. I would also like to thank OES member

Dr. R. Venkatesan who delivered a key note talk on "Sustaining the Blue Planet: Climate Change and Oceans" at the Sri Lanka meeting. The OES presentations at both events generated a lot of student interest in the society that will hopefully translate into both membership in the OES and the formation of OES Student Branch Chapters (SBC). Both SBRM and Sri Lanka SYW Congress reports are in this issue.

The planning for 2024 activities is underway. Among other things, we will be sending out a quarterly newsletter to our student members, and another to our Young Professionals, highlighting opportunities and activities specific to each group. We also will be emphasizing senior member promotion, increasing our activities in Latin America, and involving more OES members in short term, low time commitment, volunteer activities within the Society. A list of ways that you can become involved in the OES will be distributed in January.

From the Vice President for Workshops & Symposia

Fausto Ferreira, Vice President for W&S

This article is hard to write as it is my last one as OES VP Workshops & Symposia (W&S). As mentioned in the last Beacon, in the recent elections I did not run for re-election and Gerardo Acosta was elected as the new VPWS. I wish him the best of luck and the promise that I will always be available to help out and provide advice from my 3 years' experience. The past 3 years have been a great experience and while challenging and in a couple of situations potentially frustrating, I have enjoyed a lot my role and I am grateful to everyone that trusted me with this role, that empowered me and helped out and to every single person involved in the organization of the wide network of OES W&S. Without you, my role would not exist! I also would like to mention that this is not a goodbye to OES, I will still be involved and volunteer just in different ways (Standards). Finally, I am also very grateful for the 2023 OES Distinguish Service Award bestowed upon me, it has been a pleasure to serve the Society along the past few years and I am sure I will keep enjoying doing it.

Alas, enough with the sentimentalisms! 2023 has been an excellent year for the W&S with a lot of events both recurring ones and new in the OES portfolio. I am glad that OES is expanding horizons both technically and geographical and I am certain that this trend will not stop. Indeed, for 2024 we have 10 Workshops & Symposia taking place. On the other hand, regarding the portfolio organization, the paper management system study has been enlarged and is not concluded yet as we are now checking if there could be a system that could work and encompass also OCEANS and JOE. Please check out the latest on W&S in the next couple of pages.

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. A novelty in this year's edition was a Student Poster Competition among the participating students. A full report is included in this newsletter.

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), took place in Kumbor, Montenegro, (first time outside Croatia) from the 24th of September to the 1st of October. This year's program includes several newcomers from all over the world (Africa, Europe, U.S.) and included two student competitions: one acoustic challenge and one pitching contest. This year's edition has been a success as it had the typical BTS attendance pre-COVID19 (close to 200 attendees) even though it took place at the same time as OCEANS 2023 Gulf Coast. In recognition of 15 years of BTS, as VPWS, I delivered a recognition plaque to the organizers. A full report will be provided in the next edition.

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

The 2023 IEEE International Workshop on Metrology for the Sea (MetroSea 2023) took place from the 4th to the 6th of October in La Valetta, Malta, for the first time, as well, out of its typical home country (Italy). Co-organized by the OES Italy Chapter, MetroSea had a keynote on active sonar metrology by Dr. Kenneth Foote, from Woods Hole Oceanographic Institution, that represented as well OES W&S Committee. MetroSea 2023 had over 100 attendees and over 100 paper presentations and 3 keynote speakers. In addition, for the first time, a special issue in our JOE journal is being prepared gathering the best papers from MetroSea.

Argentine Meeting on Marine Energies (ENAEM) 2023

The Argentine Meeting on Marine Energies (ENAEM) 2023 took place from the 6th to 8th of November in Buenos Aires, Argentina, bringing together actors related to marine energies, in particular wave energy. Our next VPWS, Gerardo Acosta, attended and will provide a full report in the next Beacon.

Marine Robotics School 2023

From the 20th to 25th of November, the Marine Robotics School 2023 is taking place in Goa, India. OES is supporting local students to attend through the initiative of one of our YP BOOST laureates: Francesco Maurelli. It's good to see that our YP BOOST laureates are active and bringing new events to the OES family.

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 the 13th to 15th of December 2023. After review, 17 papers have been accepted. For more on this symposium please visit https://sympol.cusat.ac.in/.

Winter School on Underwater Network Simulations and experimentation (UNWiS)

The second Winter School on Underwater Network Simulations and experimentation (UNWiS) will take place in Padova, Italy, from the 29th of January to the 2nd of February. This is being organized by another of our YP BOOST laureates, Filippo Campagnaro. More info is available here https://www.wirelessandmore.it/unwis.html

IEEE/OES Thirteenth Current, Waves and Turbulence Measurement Workshop (CWTM) 2024

From March 18th to 20th, the IEEE/OES Thirteenth Current, Waves and Turbulence Measurement Workshop (CWTM) 2024 will take place in Wanchese, North Carolina, U.S. The call for abstracts is now closed and 32 abstracts have been received. The registration is about to open here https://cwtm2024.org/register/

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). Besides CWTM, just before OCEANS 2024 Singapore, the Singapore AUV Challenge will take place from the 5th to 8th of 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 AUV 2024 taking place in Boston, Massachusetts, U.S., from the 19th of September to the 21st of September, just before OCEANS 2024 Halifax. Immediately after OCEANS, Breaking the Surface 2024 is expected to take place from the 29th of September to the 6th of October. This is followed by 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 the 11th to the 13th of October. MetroSea 2024 takes place immediately after on the 14th to the 16th of October in Portorož, Slovenia. There is definitely a lot happening in different technical areas, so please choose your preferred W&S, submit your papers and participate! 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 VPWS 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!

VP OCEANS Report

Venugopalan Pallayil, Vice President for OCEANS (VPO)

A year has passed since I took over as IEEE OES VP for OCEANS. In my first article I talked about 'changing OCEANS' and I shall touch upon some of the changes either being planned or have been implemented. I will share a short summary on the past two OCEANS, mainly on the technical aspects of the conference, and some concerns that we as ocean research community have to address when participating and presenting in our conferences. I shall close this report with an update on the forthcoming conference.

As some of you are aware, the Ocean Steering Committee (OSC) has setup an Adhoc Budget Committee to discuss and consider how the participation levels in OCEANS can be improved and promoted for a wider acceptance among our researchers in the field of marine science, engineering and technology. The Adhoc budget committee has just made its recommendations to the OSC. Once accepted by OSC, the recommendations will be shared with the AdCom for their feedback. Some key questions that the budget committee is considering are the following:

1) Can we reach out to a larger section of ocean researchers and increase the participation level to 5000 delegates?

2) Does it help if we focus on limited locations for hosting OCEANS and rotate them among those locations? If so, what criteria is to be used in picking those locations?

3) Periodicity of OCEANS; continue with two OCEANS per year?
4) Timing of the conference; are the current conference timings for North America (NA) and the Rest of the World (RoW) the best?
5) Clarity on the roles and responsibilities of OCEANS administration to improve our workings.
6) Hiring a single PCO for OCEANS RoW to ease operational and contract related delays?

OSC had taken a big step to disband RECON and JOAB and replace them with the Joint Conference Committee (JCC) and a Conference Manager (CM). Though the JCC was established some time back, unexpected resignation of one of the Co-Chairs and also delays in finding a suitable volunteer for replacement took time. This has now been fixed. We have Dr. Atmanand, a long standing AdCom member, who has agreed to serve on JCC. I am confident that his past experiences as General Co-Chairs of UT 2015 and OCEANS 2022 Chennai would help our mission to make OCEANS operations smooth and successful. He also has amassed a wealth of experience as a top administrator during his tenure as Director of National Institute of Ocean Technology (NIOT), Chennai.

We also had hired a CM for OCEANS under IEEE a few months back and due to operational constraints, we had to move the position to MTS and subsequently terminated the current position. A new CM will soon be hired and work with JCC for OCEANS conference operations. Until such time, the OSC and the Adhoc budget committee will continue to support the LOCs.

Another aspect I, as VP OCEANS, have been looking at has been the paper acceptance rate for OCEANS. Conferences have been often rated based on their paper acceptance rate, though it is not necessarily the only good indicator. More than the acceptance rate itself, OCEANS often see a large variation of it across conferences, which needs addressing. The acceptance rate for some of the past, and recently concluded, OCEANS conferences is listed in the following table.

OCEANS	**No of Received papers**	**Accepted Number**	**Rate of Acceptance (%)**
Kobe 2018	990	689	~70
Charleston 2018	705	660	~94
Marseille 2019	838	672	~80
Seattle 2019	636	487	~76
Singapore 2020	797	586	~74
Gulf Coast 2020	336	318	~95
Porto/San Diego (hybrid)	733	639	~87
Chennai 2022	664	603	~91
Hampton Roads 2022	590	568	~94
Limerick 2023	576	434	~75
Gulf Coast 2023	325	199	~62
Singapore 2024	525	390	~75

Notes:
1) The numbers in the table are assumed to be total regular papers and SPC submissions. Posters are not included (need to ascertain).
2) For Singapore 2024, the numbers are estimated as the process of acceptance is in progress.
3) The table also needs to be updated with accepted, but not registered/presented, to get a better picture. Some accepted may not have registered.
4) Singapore 2020 numbers are when the conference was planned for in-person. Only 50% of the accepted papers opted for virtual.
5) Porto/San Diego was a hybrid conference.

We have developed strong criteria for accepting papers, however, it appears that the same is not being followed fully. A committee is being set up to look into various factors that were being followed by the different TPC chairs and the acceptance criteria and advise VPO on improving quality of the papers and bringing uniformity to the acceptance rate.

Two OCEANS have been completed since I took over as VP for OCEANS. Much of the groundwork for the two OCEANS had been done by my predecessor. Nevertheless, one of the most time-consuming tasks was the contract review and approval. The two conferences have been largely successful, both technically and financially. Below table shows a summary of some of the technical aspects of the conference.

	Limerick	**Gulf Coast**
Total number of registrations	681	1536
Papers presented/ published	428	199
Student Poster Competition Participation	14	22
General Poster	28	23
Virtual Presentation	30	—
Exhibitors	43	121
Patrons	3	28

I would like to bring to our OCEANS participants the need for sticking to the code of conduct at our conferences. Recently there has been an instance of misbehavior reported. OCEANS provide a relaxed and friendly atmosphere for interacting and networking with our fellow scientists and engineers. But we have to set limits to the level of interaction as required by the societies code of conduct. Be prewarned that misbehavior of any kind at OCEANS will not be tolerated and, as needed, will be reported to relevant authorities for further actions. It could also shut the door to OCEANS for those who have been implicated. It has also come to our notice that some authors resorting to ‘wicked ways’ to get their papers presented at the conference when the presenting author is not able to attend. The Societies have decided that such papers will not be submitted to IEEE Xplore database, as it violates the preconditions set for acceptance.

Preparations for OCEANS 2024 Singapore are in full swing. The abstract review process is in progress. Plenary and Keynote speakers are being invited. We have two related events prior to OCEANS. One of the events is the Singapore AUV Challenge (student competition) and the other is a Summer School (first of its kind) being organized under the OES leadership. The details of these events have been covered elsewhere in this Newsletter. We also have a parallel event happening during the OCEANS 2024 Singapore Conference. Just a few blocks away from our conference, there will be another event, Singapore Maritime Week, an annual conference organized by the Maritime & Port Authority of Singapore. All in all, it is a travel worth planning for and spend a couple of weeks exploring Singapore and participating in these exciting events. A unique opportunity not to be missed. The LOC of OCEANS 2024 look forward to your in-person participation at the conference.

If you have comments and suggestions on OCEANS related matters, please feel to write to me at vp-oceans@ieeeoes.org.

Happy 2024 to all the OES colleagues and readers of this Newsletter.

From the Journal Editor's Desk

Mandar Chitre, Journal Editor-in Chief

It wasn't that long ago that I remember waiting outside a meeting room at the conference hotel during OCEANS 2016 Monterey, to be called in to say a few words and answer questions before the AdCom voted me in as the next Editor-in-Chief. I was excited to be taking on a new role, and at the same time scared that it would be a role that I knew very little about and had no experience with. While I had served as an Associate Editor for several years, it was clear that the experience there was necessary, but not sufficient, to prepare me for what was to come. And indeed, that was the case!

I spent 2017 as the Editor-in-Chief elect, mostly being copied on selected emails by the previous Editor-in-Chief, Ross Chapman, to get me up to speed on the workings of the Journal. I attended the IEEE Panel of Editors meeting that year, and that gave me a good perspective on some of the important issues. I also had a chance to meet with the administrative staff supporting the Journal and acquaint myself with the processes that kept the Journal running smoothly.

I took office in January 2018 as the Editor-in-Chief, and inherited a Journal that ran like a well-oiled machine—all because of the efforts of the previous few Editors-in-Chief and the administrative staff. Some of the major tasks for me then were the upcoming IEEE 5-year review of the Journal in 2019 and the decisions to make to manage the potential disruption in publications industry due to the Open Access push and cOAlition S (https://www.coalition-s.org). We surveyed our authors and readers to get opinions on the appetite for full Open Access, and based on the feedback, decided to hang-on to our hybrid publication model with an intent to review the position again in a few years. In hindsight, this turned out to be a good decision for the past years, but Karl von Ellenrieder, our incoming Editor-in-Chief, may need to revisit the decision in years to come.

In terms of bibliometrics, the Journal has done quite well over the years—thanks to the culture and values inherited from our previous Editors-in-Chief, the efforts of our Associate Editors to maintain quality, and most importantly the hard work of our authors and reviewers to generate, critique, and improve excellent research. I recall that when I published my first paper in our Journal about two decades ago, our impact factor was 0.8. Today the IEEE Xplore page for the IEEE Journal of Oceanic Engineering sports an impact factor of 4.1.

As Editor-in-Chief, every paper that came in for review went through my desk. And every paper that we published came to me for final review. This gave me a great birds-eye view of how the vast multi-disciplinary field of Oceanic Engineering was evolving. As the "hot" areas of research evolved over the years, we had to evolve our Editorial Board as well—to ensure that we had the right expertise to handle the volume of papers coming in on new emerging topics. Occasionally I had to smooth administrative kinks, and sometimes resolve conflicts between authors, editors, and reviewers. At times, I had to call upon Ross' experience to validate decisions I needed to make but was unsure of. And then there was a difficult time at the end of last year, when our administrative staff, who had been with us for decades, was unable to continue to serve. We had to scramble to find and train a new staff to keep the Journal running—but we managed to get it done without disruption to our operations. All-in-all, it has been six exciting years!

While this role took a lot of my time over the past seven years, it has been an enriching and fulfilling experience for me. In the process, I've made new friends and gained new perspectives. I'm glad to have had the opportunity to serve. It is now time for me to step down at the end of December, and hand over the reins of the Journal to Karl. I am sure he will take excellent care of the Journal.

This will be my last note in the Beacon as the Editor-in-Chief of the Journal, and so: Goodbye!

As usual, I'd like to convey my congratulations to the authors of our most recently approved papers. 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:

- Heron, Domps, Guérin, Wang and Petersen, "HF Radar Real-Time Alert to a Tsunami-Like Disturbance at Tofino on January 5, 2020: Surge or Tsunami?"
- Cuji and Stojanovic, "Transmit Beamforming for Underwater Acoustic OFDM Systems"
- Niu, Liu, Li and Zhai, "Unsupervised Domain Adaptation for Source Localization Using Ships of Opportunity With a Deep Vertical Line Array"
- Stevens, Siderius, Carrier and Wendeborn, "Optimally Distributed Receiver Placements Versus an Environmentally Aware Source: New England Shelf Break Acoustics Signals and Noise Experiment"
- Li, Shihua and Liem, "An Improved Experimental Framework of Amphibious Marine Vehicle Hull Hydrodynamics"
- Li, Hu, Xu, Zhao, Chen, Yang, Liu and Zhai, "Enhancing Underwater Image via Color-Cast Correction and Luminance Fusion"
- Escobar-Amado, Badiey and Wan, "Computer Vision for Bioacoustics: Detection of Bearded Seal Vocalizations in the Chukchi Shelf Using YOLOV5"
- Fischell, Fitzgerald, Manganini, Chen and Schmidt, "Seismo-Acoustic Sensing on the Beaufort Sea in the 2021 Sea Ice Dynamics Experiment (SIDEx)"
- Luo, Wu, He, Song, Xu and Li, "CEWformer: A Transformer-Based Collaborative Network for Simultaneous Underwater Image Enhancement and Watermarking"
- Liu, Bai, Deng, Liu, Wang, Lan, Li, Li and Wang, "Seal-Inspired Underwater Glider With a Rigid-Flexible Composite Hull"
- Ren, Li and Lyu, "Oil Spill Timely Backtracking Oriented by Wind Field Correction With Self-Attention Temporal Convolutional Networks"
- Liu, Zhu, Liu, Xu, Fu and Wang, "Unsupervised Multiple Representation Disentanglement Framework for Improved Underwater Visual Perception"
- Lidström, "Super Permutation Frequency-Shift-Keyed Underwater Acoustic Communication"
- Ma, Macdonald, Rouse and Ren, "Automatic Geolocation and Measuring of Offshore Energy Infrastructure With Multimodal Satellite Data"

Request for Nominations for OES Awards 2024

Jerry Carroll, Chair of IEEE/OES Awards Committees

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

The Awards descriptions are given below.

Request for Nominations for DTAA: The Distinguished Technical Achievement Award 2024

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

Request for Nominations for DSA: The Distinguished Service Award 2024

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

Company/Institution Award

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

Emeritus Award

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

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

*Jerry Carroll
*Chair of IEEE/OES Awards Committees
past-president@ieeeoes.org

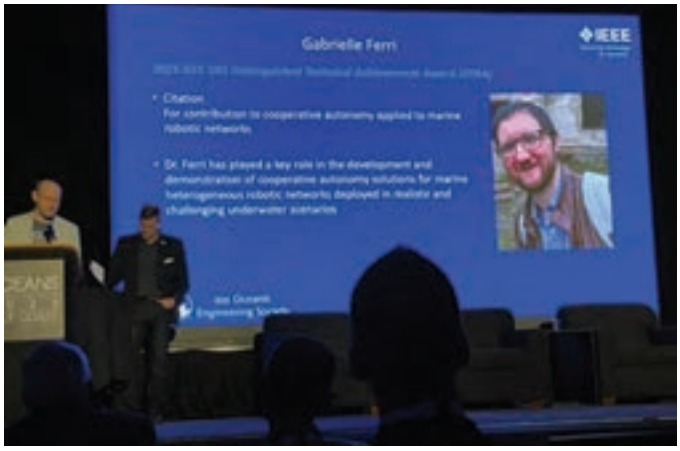
OES Society Awards

IEEE OES Awards Committees

The OES Awards Ceremony was held during the Tuesday Plenary at OCEANS 2023 Gulf Coast. We are honored to introduce the following 2023 OES award recipients. Congratulations!

2023 Distinguished Technical Achievement Award: Gabriele Ferri

Gabriele Ferri is presented the Distinguished Technical Achievement Award (DTAA) for contribution to cooperative autonomy applied to marine robotic networks. Since he was unable to attend the conference, he will receive the plaque at OCEANS 2024 Singapore.



OES President Christopher Whitt introducing Gabriele Ferri, the Distinguished Technical Achievement Award recipient.

The DTAA is bestowed upon an individual who has made exceptional fundamental or applied technical contributions to oceanic engineering. The award recognizes a single major invention or scientific contribution, or a distinguished series of contributions over a long period of time. Dr. Ferri's work exemplifies this criterion through a distinguished series of contributions over a productive and impactful career. He has played a key role in the development and demonstration of cooperative autonomy solutions for marine heterogeneous robotic networks deployed in realistic and challenging underwater scenarios.

Throughout his career, he has deeply explored the synergies between autonomy, data fusion and cooperative robotics. He validated these concepts in many at-sea experimentations, demonstrating the benefits of robot decision-making with respect to pre-planned missions, traditionally adopted in the marine community due to their predictability. He designed iCADME, a task-oriented autonomy architecture to execute complex multi-robot, multi-task missions in underwater environments with communications limitations. He was also the project leader of HydroNet project, which developed a network of marine surface robots for environmental monitoring.

Dr. Ferri has significantly advanced cooperative robotics, with lasting contributions in data-driven strategies, environment-aware autonomy, data fusion, cooperative decision-making, and autonomy architectures for controlling complex heterogeneous marine robotic networks. Indeed, his most distinctive quality is his determination in tackling the challenges to their effective use posed by marine scenarios, such as underwater surveillance.

The research community has recognized his achievements, as also shown by his collaboration with MIT and several invited seminars, for example at NASA JPL.

His activity has also had a strong impact on the operational maritime community. His autonomy solutions and the iCADME architecture have been considered as an inspiration by different NATO Navies. His contributions have been seminal to the development of a common autonomy language for interoperability in NATO SCI 343 panel. This culminated with the demonstration at a multinational submarine search and rescue experiment during REPMUS21.

2023 Distinguished Service Award: Fausto Ferreira

Fausto Ferreira is presented the Distinguished Service Award (DSA) for valuable contributions and effective management across the entire spectrum of OES activities. Since he was unable to attend the conference, he will receive the plaque at OCEANS 2024 Singapore.

OES President Christopher Whitt introducing Fausto Ferreira, the Distinguished Service Award recipient.

Fausto's journey with our society is inspiring. After volunteering in other robotics workshops in 2015, he became the Deputy Technical Director for an OES-sponsored marine robotics competitions in Europe, later serving as a judge in these events.

His commitment extended to organizing conferences, such as UCOMMS in 2018 and 2020, and the Breaking the Surface

workshop's Program Committee over several editions of BTS. In addition, Fausto contributed as Technical Co-chair for OCEANS 2021 San Diego-Porto, where he oversaw tutorials. He also played a vital role in finding European venues for OCEANS events and served as OES Liaison for the OCEANS 2023 Limerick conference.

In 2018, he was selected as one of the two inaugural Laureates for the OES Young Professional BOOST Program, which brings active volunteers into Society Leadership. He also became part of the Autonomous Marine Systems Technical Committee. Recently, he joined the Journal of Oceanic Engineering Editorial Board as an Associate Editor.

Fausto's leadership grew as he joined the Administrative Committee in 2020. He served on the Society Governance Committee, and the OES Standards Committee. In 2021, Fausto took on the role of VP of Workshops and Symposia. As VP, Fausto has energized our Workshop and Symposia portfolio, and established a strong committee to guide events into the future.

Fausto Ferreira's journey from workshop collaborator to VP of Workshops and Symposia is a testament to dedication and leadership within IEEE OES. His passion for oceanic engineering has inspired us all.

2023 Presidential Award: Bharath Kalyan

Bharath Kalyan is presented the Presidential Award for being a long-time leader in the OES Singapore Chapter. He served as Chair for the OES Singapore Chapter during 2020–21, and Vice-Chair in 2018–19, and 2022–23.

Bharath has been involved in the Singapore AUV Competition (SAUVC) since its inception in 2013 until today. He was Chair of SAUVC in 2019. He has always helped with SAUVC Chair transitions; continuing to move the event forward. He has played a significant role from the very first event back in 2013 to the point where his colleagues see him as one of the de facto owners of the event.

Bharath Kalyan receives the Presidential Award from OES President Christopher Whitt. The photo was taken by Chelsea Bladow.

In addition to SAUVC, he has constantly been involved in Singapore Chapter events, OES Technology Committees, and involved in several OES conferences and symposia.

Currently, Bharath is the Chair for the Autonomous Marine Systems Technology Committee. He has been the General Co-Chair of AUV 2022 Symposium, Exhibit Chair for OCEANS 2020 Singapore (virtual) and for the upcoming OCEANS 2024 Singapore.

He served as a member of the OES Technical Program Subcommittee for Offshore Technology Conference Houston 2023 and is serving again for 2024. He has organized many technical talks and panels during various OES Singapore Chapter-related activities.

Bharath has always been at the forefront of organizing all OES Singapore chapter events (especially SAUVC) irrespective of his position—he is happy to just make sure everything runs smoothly. Bharath always helps bring people together and encourages people from various organizations to join IEEE OES.

Awards for OES Members

Contact the Editors With Your Submissions

Congratulations to Dr. Karen Panetta

Dr. Karen Panetta, IEEE Fellow and IEEE OES Member-Large was recognized by Business Insider as one of the top people in Artificial Intelligence. Karen is the Dean for Graduate Education at Tufts University and CEO of Tessera Intelligence and Co-Founder of Sea Deep. Karen's work utilizes AI for real time underwater image enhancement and recognition systems. Karen was also recently inducted to the National Academy of Engineering in Washington, DC. She was recognized for her global leadership empowering females in STEM and for her contributions to computer vision and simulation algorithms.

The AI 100 2023: The Top People in Artificial Intelligence

Dr. Karen Panetta being inducted in the National Academy of Engineering.

Chapter News

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

Japan Chapter

The 10th Underwater Technology Forum•ZERO HYBRID—congratulating Prof. Yutaka Michida elected to Chair UNESCO's Intergovernmental Oceanographic Commission (IOC) for the 2023–2025 Biennium

Reported by Harumi Sugimatsu

The 10th Underwater Technology Forum•ZERO was held from 13:00-17:00 on 13 October 2023, on the Atmosphere and Ocean Research Institute, The University of Tokyo in Kashiwa Campus (https://seasat.iis.u-tokyo.ac.jp/UTforum/UTforumzero10/). This time, we had 85 in person attendees and 133 online attendees who tend to live far from Tokyo. Among the speakers, two Japanese youths who are living in Norway and Estonia were online.

The Forum congratulated of Prof. Yutaka Michida of the University of Tokyo (Forum's Co-Chair) on his election as Chair of IOC (https://www.ioc.unesco.org/en/ioc-officers), and opened the forum with a speech on the significance of the IOC's existence and its future prospects. We then celebrated this at the reception after the forum.

Other topics of the forum are as below;

- The current abnormal Kuroshio meander and its future prospective
- The strange creatures of Kagoshima Bay, Satsuma Haorimushi, A close look at the adaptation mechanisms to the chemosynthetic ecosystem
- Port Development considering biological symbiosis at Suzaki Port in Kochi Prefecture
- Operation of AUV "MONACA" in the 64th Antarctic Research Exploration
- Development of the VTOL-UAV "Asuka" and its operation in whale observation
- Challenge to reproduce the marine ecosphere by the environmental transfer venture "INOCA"
- Report on Overseas part 1, working at a Norwegian Maritime Company
- Report on Overseas part 2, life in a doctoral course in Estonia

The next Forum (hybrid) will be held on 26 April 2024, at the Institute of Industrial Science, The University of Tokyo, in Komaba Research Campus. If you are interested to attend or give a talk, please contact us (harumis@iis.u-tokyo.ac.jp).

The speaker Chuya Sinzato (above left), moderator Toshihiro Maki (above right) and participants (Tamaki Ura and others) (bottom) all get excited about Satsuma Haorimushi.

Talk by Prof. Yutaka Michida.

From the talk Satsuma Haorimushi.

From the talk "AUV MONAKA in the 64th Antarctic Research Exploration".

From the talk "working at a Norwegian Maritime Company" and audience.

From the talk "life in a doctoral course in Estonia", and discussions with the floor.

Singapore Chapter

Activities Report, 2023

Reported by Yuen Min Too, Hari Vishnu, Venugopalan Pallayil, Bharath Kalyan

In 2023, IEEE OES Singapore experienced a bustling year with a diverse range of activities, both technical and social. These encompassed technical talks and social gatherings.

At the beginning of the year, we organized a talk featuring Dr. V. P. Harigovindan, an Associate Professor at the National Institute of Technology Puducherry, India. The presentation, titled "Non Orthogonal Multiple Access IOT networks for 5G and beyond" took place on January 26, 2023.

Dr. V. P. Harigovindan delviering talk on "NOMA IOT networks for 5G and beyond".

During the month of June, we hosted a technical presentation titled "Horizontal Coherence Function for Ambient Noise and Helicopter Sound in Water" by Mr. Kok Hong Jie, a representative from the Defence Science Organisation (DSO) National Laboratories. This talk explored both the theoretical underpinnings and practical applications of horizontal coherence functions, particularly their utility in estimating the speed of sound in sediment.

Talk by Mr. Hong Jie on Coherence Function for Ambient Noise and Helicopter Sound in Water.

Later this year, we proudly hosted an IEEE Oceanic Engineering Society Distinguished Lecture (DL) featuring Professor John Potter from NTNU. On September 21, 2023, Professor Potter delivered an enlightening talk titled "Listening at the

speed of light: what could distributed acoustic sensing do for you?". During his presentation, he introduced the concept of Distributed Acoustic Sensing (DAS), a groundbreaking technology utilizing an array of sensors for passive acoustic sensing across a distributed area. Professor Potter provided a comprehensive overview of the manifold applications of DAS, encompassing diverse fields such as environmental monitoring, seismic activity analysis, passive acoustic monitoring of marine mammals, and traffic and transportation surveillance. His talk shed light on the far-reaching capabilities of DAS technology.

DL talk by Dr. John Potter on Distributed Acoustic Sensing.

Immediately following the Distinguished Lecture, we had a technical talk by Dr. Dora Hu Juanjuan from Institute for Infocomm Research (I2R), A*STAR. The presentation was titled "Underground Asset Integrity Monitoring using Distributed Acoustic Sensing (DAS)." Dr. Hu Juanjuan provided an overview of the ongoing efforts in the realm of underground asset integrity monitoring, utilizing the cutting-edge DAS technology and machine learning.

Dr. Dora Hu Juanjuan delivering a talk on "Underground Asset Integrity Monitoring using Distributed Acoustic Sensing".

On the social side, the chapter also hosted the IEEE OES leadership Executive Committee meeting on 4–5 November, 2023. We also organized a social networking and membership drive barbecue on 4 November, 2023 at Republic Singapore Yacht Club, alongside the ExCom meeting, allowing members a chance to interact with ExCom members. Our chapter members have also been active in organizing or delivering technical talks and activities in other parts of the world. Our member Dr. Mandar Chitre delivered a DL talk in Israel at Haifa university on "Glacier monitoring in the Arctic." Dr. Venu Pallayil helped organize a panel on low-cost ocean observing technologies at OCEANS Gulf Coast. Dr. Vishnu facilitated two well-attended webinars delivered in collaboration with the Early Career Ocean Professionals (ECOP) programme, delivered by TC chairs Dr. Suleiman Mazhar and Dr. Andreas Marouchos, on basics of acoustics and polar technologies respectively for ECOPs. Dr. Kalyan organized two technical sessions at Offshore Technology Conference, Houston, on Marine robotics.

We are in the midst of organizing two large upcoming events, namely the OES/MTS OCEANS 2024 conference in Marina Bay Sands, and the Singapore AUV Challenge 2024, our flagship chapter annual event to engage and promote student interest in underwater technology. It has been running very successfully for the past 11 years (every year except 2020–21 due to Covid) with excellent visibility. We are planning for an OES short school alongside these events led by the VP-TA.

We are also planning for an industrial workshop in December where several industrial representatives are expected to give talks on their latest developments with chapter members. Our member Dr. Chitre will be delivering a lecture in association with the robotics winter school being organized in the National Institute of Oceanography, Goa, India, in December. Our chapter members have also been active in the leadership of the society by being involved in various roles in ExCom such as VP-OCEANS, Secretary, and the Editor-in-Chief of JOE. One of our chapter members, Dr. Kalyan, received the 2023 IEEE OES Presidential Award for his service rendered to the Singapore Chapter, SAUVC, and the OES Technology Committees, and has been nominated to AdCom as well. Also, another matter of pride for our chapter is that we were awarded the Best Chapter award in the Singapore Section in 2022, for our activities.

Malaysia Chapter

Sharing Session by Visiting Professor António Pascoal on Marine Robotics Technologies for Science and Ocean Literacy at Universiti Teknologi Malaysia

Reported by Assoc. Prof. Ir Dr Zool Hilmi Ismail, Chapter Chair

On October 5th, 2023, Dr. António Pascoal, a visiting professor from the Dynamical Systems and Ocean Robotics Lab in Lisbon, Portugal, delivered a sharing session on Marine Robotics Technologies for Science and Ocean Literacy at the Center for Artificial Intelligence and Robotics, Universiti Teknologi Malaysia, Kuala Lumpur. Dr. Pascoal, a Life Member of IEEE, is a renowned figure in the field of Marine Robotic Technologies, with significant contributions to both science and ocean literacy, starting from his academic achievement of earning a Ph.D. in control science from the University of Minnesota, Minneapolis, MN, USA, in 1987. Pascoal's expertise and interest in the oceanic realm led him to take on a role as an Adjunct Scientist with the National Institute of Oceanography in Goa, India, in 2012. This position allowed him to extend his research and influence in marine technology on an international scale.

Pascoal's work in marine robotic technologies is characterized by his efforts to develop systems that can navigate and understand

the complex and often unpredictable marine environment. His research has implications for various applications, from environmental monitoring and oceanographic data collection to underwater infrastructure inspection and maintenance. Through his roles, António M. Pascoal has significantly contributed to the field of marine robotics, positioning himself as a leading figure in the advancement of technologies that are pivotal for ocean exploration and the dissemination of ocean literacy. His career reflects a deep commitment to harnessing technology for understanding and preserving the marine environment, making substantial contributions to the field of marine science and robotics.

During the sharing session, Dr. Pascoal presented the historical development and usage of robotic systems designed by Instituto Superior Técnico for marine environments. These technologies include autonomous underwater vehicles (AUVs), remotely operated vehicles (ROVs), and unmanned surface vehicles (USVs). These systems are equipped with sensors, cameras, and sometimes manipulative tools to perform tasks such as data collection, mapping, sampling, and inspecting underwater infrastructure.

Furthermore, he also discussed how these technologies enhance our understanding of the ocean's influence on us and our impact on the ocean. Marine robotics technologies significantly contribute to ocean literacy by providing data and visuals that assist in educating people about the marine environment. Through the data collected by marine robots, scientists, educators, and the public can gain insights into the ocean's health, biodiversity, and the challenges it faces.

Lastly, he explained that operating in the harsh and unpredictable ocean environment poses unique challenges. This leads to continuous innovation in areas such as robotics durability, energy efficiency, navigation, and data transmission.

Figure 1. Promotional poster for an engaging sharing session by Prof. Dr. Antonio Pascoal from Instituto Superior Técnico, focusing on the cutting-edge field of marine robotics.

Figure 2. Postgraduate students attentively listening to Prof. Dr. Antonio Pascoal's talk on marine robotics.

Figure 3. Mr. Syahmi Harith Hakim, a research student from CAIRO, actively participating in the session by inquiring about the control of swarm robotics.

The 13th National Technical Seminar On Unmanned System Technology 2023 (NUSYS'23)

THEME: "Advancing GLOBAL Sustainability Through Technological Breakthroughs"

Reported by Prof. Dr Mohd Rizal Arshad and Assoc. Prof. Ir Dr Zool Hilmi Ismail

The 13th National Technical Seminar on Unmanned System Technology, NUSYS'23, hosted on October 2nd and 3rd, 2023, at Universiti Sains Malaysia, Nibong Tebal in Penang, Malaysia, and organized by IEEE OES Malaysia, was a pivotal event that brought together a diverse group of professionals to discuss advancements in unmanned system technologies. The seminar was a confluence of researchers, scientists, engineers, academicians, and industry experts from around the world, sharing insights on a wide array of topics such as Unmanned Systems, Underwater Technology, Marine Power Systems, Sustainable Energy, Applied Electronics, Computer Engineering, Control Systems, Instrumentation, and Artificial Intelligence.

Figure 4. Group photo at the Science and Engineering Research Centre, Universiti Sains Malaysia, during NUSY'23, highlighting a gathering of innovative minds in the realm of ocean engineering.

Figure 5. Keynote speaker 1, Prof. Dr. Antonio Pascoal, imparting his extensive experience and addressing the challenges faced in ocean surface exploration during his insightful presentation.

Figure 6. Welcoming Remark and Opening Ceremony delivered by Prof. Dr. Mohd Azmier Ahmad, marking the commencement of an enlightening NUSYS'23 event.

The event commenced with a Welcoming Remark and Opening Ceremony by Prof. Dr. Mohd Azmier Ahmad, the Director of the Science and Engineering Research Centre at USM. His opening address set the tone for the seminar, emphasizing the importance of innovation and collaboration in the field of unmanned system technologies. This was followed by a Welcoming Remark by Assoc. Prof. Ir. Dr. Zool Hilmi Ismail, Chair of the IEEE OES Malaysia Chapter, who highlighted the chapter's commitment to advancing the field and fostering an environment conducive to knowledge exchange and networking. Keynote presentations were delivered by esteemed speakers: Prof. Dr. Antonio Pascoal from the Dynamical Systems and Ocean Robotics Lab in Lisbon, Portugal, and Professor Huiping Li from the School of Marine Science and Technology at Northwestern Polytechnical University in Xi'an, China. These sessions provided attendees with valuable insights into cutting-edge research and developments in the field.

Figure 7. Presenting a certificate to Dr. Mohd Shahrieel from Universiti Teknikal Malaysia Melaka, in recognition of his adept guidance and skilled chairmanship during his technical session.

Additionally, NUSYS'23 featured special talks from industry leaders. Dr. Hairi Zamzuri of eMooVit Technology Sdn Bhd and Mr. Kamarul Hisham Kamarulzaman from SS ROVER Sdn Bhd shared their industry experiences and perspectives, offering a practical viewpoint on the application of unmanned system and ROV technologies. A notable feature of the seminar was the announcement that all accepted and presented papers would be submitted for inclusion in the SCOPUS-indexed Springer LNEE (Lecture Notes in Electrical Engineering) Proceedings, providing a significant publication platform for participants' research. The seminar also focused on exploring innovative technologies for resource utilization, formulating strategies for ecological conservation, and envisioning the future of emerging technologies. With over 30 technical papers presented, the event provided a rich environment for learning, discussion, and collaboration.

In closing, heartfelt thanks were extended to all partners, volunteers, and the University of Science Malaysia for their invaluable support and hospitality, which were pivotal in the success of NUSYS'23. The technical seminar was not only a platform for sharing and discussing research but also an inspiring event, leaving participants with a renewed sense of purpose and a broader perspective on the possibilities in the field of unmanned systems.

IEEE OES Malaysia Chapter and Northwestern Polytechnical University Joint Technical Seminar and Cultural Exploration

Reported by Prof. Dr Mohd Rizal Arshad, Assoc. Prof. Ir Dr Zool Hilmi Ismail, Ts Dr Zainah Binti Md. Zain and Dr Maziyah Binti Mat Noh

A group of distinguished academics and researchers from the OES Malaysia Chapter and Northwestern Polytechnical

University (NPU) recently came together for an enriching four-day event at Northwestern Polytechnical University in Xi'an, China. The delegation included prominent figures such as Professor Dr. Mohd Rizal Arshad from OES Malaysia Chapter team, Professor Dr. Guang Pan and Professor Dr. Huiping Li from NPU, among other esteemed guests. The program commenced with a comprehensive Joint Tech Seminar, followed by an exploration of the historical treasures of Xi'an.

Day 1: Joint Tech Seminar

The event began on 31 October 2023 with the Joint Tech Seminar. Starting at 9:00 AM, the seminar featured a series of insightful presentations from both OES Malaysia Chapter and NPU teams. These presentations covered diverse topics, from breakthroughs in technology to collaborative research achievements and insights into future tech trends. The morning session was rich in intellectual discourse, fostering a spirit of learning and collaboration.

After the lunch break, the afternoon was dedicated to discussion sessions, providing practical insights into various technological fields. This provided a unique opportunity for hands-on learning and potential research collaborations. The day concluded with an interactive Q&A session, enabling a lively discussion and concluding remarks from the organizer.

The evening was reserved for a networking dinner, where participants engaged in informal discussions, shared ideas, and built professional connections.

Figure 8. Chair of IEEE OES Malaysia presenting a special souvenir to Prof. Dr. Guang Pan, esteemed Dean of the School of Marine Science and Technology.

Figure 9. A visit to the legendary Terracotta Army, guided by Prof. Huiping Li's student.

Day 2: Tour of Xi'an

The final day of the event was a cultural tour of Xi'an. The morning began with a visit to the legendary Terracotta Army, offering attendees a peek into China's rich historical heritage. The visit was both enlightening and inspiring, showcasing the artistic and cultural achievements of ancient China.

In the afternoon, after a delightful lunch at a local restaurant, the group toured the Ancient City Wall and the Big Wild Goose Pagoda. These sites are not only significant for their historical

Figure 10. Dr. Zhang, presenting online from HUST, engagingly explains his innovative project on the intelligent detection and inspection of subsea cables using AUV.

Figure 11. A networking dinner hosted by Professor Dr. Huiping Li from NPU.

Figure 12. Marine Lab and Campus tour led by Dr. Le Li, an Assistant Professor in Control Science and Engineering at Northwestern Polytechnical University in Xi'an, China.

Figure 13. Dr. Maziyah presenting her recent innovative work on sliding mode control scheme, highlighting advancements and applications in marine engineering.

and cultural value but also stand as testaments to the seamless blend of ancient traditions and modern developments characteristic of Xi'an.

The day concluded with participants having the option to extend their stay, allowing further exploration of this vibrant city.

This event was more than just an academic conference; it was an immersion into culture, blending the exploration of technological advancements with the appreciation of historical and cultural heritage. The participants left with enhanced knowledge, potential collaborative prospects, and a deeper understanding of Xi'an's rich cultural backdrop.

Committee Meeting and Collaborative Efforts Between NPU & IEEE OES Malaysia Chapter for USYS'24

Reported by rof. Dr. Mohd Rizal Arshad, Assoc. Prof. Ir. Dr. Zool Hilmi Ismail, Ts. Dr. Zainah Binti Md. Zain and Dr. Maziyah Binti Mat Noh

The recent collaboration between the IEEE Oceanic Engineering Society (OES) Malaysia Chapter, Northwestern Polytechnical University (NWPU), and Huazhong University of Science and Technology (HUST) marks a significant stride towards the upcoming USYS'24. This gathering aimed not only to strengthen ties but also to lay down a concrete plan for the conference scheduled for next year in Xi'an, China. The visit included a comprehensive tour of NWPU's research facilities and marine labs, followed by in-depth discussions led by Professor Huiping Li from NWPU and Professor Xiang Bo, along with his team from HUST Wuhan.

Tour and Visit to NWPU Research Facilities and Marine Labs

The day commenced with an insightful tour of NWPU's cutting-edge research facilities. The visit showcased a variety of technological innovations and projects, each aligning with the broader objectives of USYS'24. Particularly impressive were the advanced marine research labs, where a plethora of ongoing projects displayed NWPU's commitment to marine science and technology. These labs, equipped with state-of-the-art apparatus, are pivotal in advancing research in underwater acoustics,

Figure 14. On-site visit for possible venue of USYS'24 conference.

Figure 15. USYS'24 technical meeting was held on October 31, 2023, at Northwestern Polytechnic University in Xi'an.

Figure 16. Online session was attended by representatives from Huazhong University of Science and Technology and Dalian University.

marine robotics, and other related fields, directly contributing to the themes of USYS'24.

Lunch and Discussions on USYS24

Post the tour, the delegation gathered at the NWPU cafeteria for lunch. This provided an informal setting for preliminary discussions, setting the stage for the afternoon session. The main discussion, focused on the upcoming USYS'24 conference, was both comprehensive and detailed. Key topics included conference themes, paper submission guidelines, panel discussions, keynote speeches, and logistical arrangements for the event in Xi'an. Professors Huiping Li and Xiang Bo spearheaded the conversation, emphasizing the need for a multidisciplinary approach and international collaboration in addressing the challenges and opportunities in ocean engineering and technology.

Planning and Technical Discussion for USYS'24 Conference Organization

The core of the meeting revolved around the meticulous planning of USYS'24. Discussions delved into the technical aspects of the conference, including session formats, publication protocols, and the integration of innovative research findings. The team also outlined a roadmap for engaging global experts, securing local sponsorships, and facilitating smooth execution. A significant portion of the dialogue was dedicated to ensuring a diverse and inclusive paper submission platform, allowing researchers from various backgrounds to contribute and benefit. The visit to NWPU and the subsequent discussions with IEEE OES Malaysia Chapter, NWPU, and HUST representatives have laid a solid foundation for the successful organization of USYS'24. The emphasis on collaboration, innovation, and inclusivity resonated throughout the day's events, setting a promising tone for next year's conference. The upcoming months will see these plans refined and implemented, gearing up for what promises to be a landmark event in the field of ocean engineering. Key details for USYS 2024 include a proposed date of October 18–20, 2024 in Xi'an, China, with an aim for more than 100 presented papers, and important deadlines for paper submissions set throughout 2024.

EVOLUTION

Life Member Conference

April 14-16, 2024

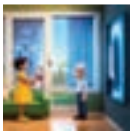
Hyatt Regency, Austin, TX

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.

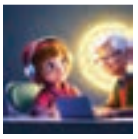
The conference has three tracks:

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.

IEEE OES Technical Committees Update—2023 Achievements and Future Plans

M A Atmanand, Technical Activities Coordinator, Shyam Madhusudhana, VP Technical Activities

As we reflect on the dynamic year that was 2023, we take pride in the accomplishments and endeavors of our revamped Technical Committees (TCs) and their dedicated Chairs and Vice Chairs. Here's a snapshot of the activities and plans from a few of our TCs:

Autonomous Maritime Systems—Bharath Kalyan & William Kirkwood:
The Autonomous Maritime Systems TC spearheaded the Robotics for Asset Maintenance and Inspection (RAMI) Marine Robots challenge, a highlight in the European Robotics League. Breaking the Surface 2023 in Kumbor, Montenegro, showcased cutting-edge advancements in maritime robotics, drawing over 200 participants from 32 countries.

Looking ahead, mark your calendars for SAUVC 2024 (April 5–8) in Singapore, an event that promises to captivate underwater vehicle enthusiasts. OCEANS 2024 (April 15–18) in Singapore is set to host a special session on novel AUV, USV, and multi-domain platforms, delving into trusted AI-driven autonomy and ocean robotics.

Subsea Optics and Vision—Haiyong Zheng & John Watson:
The SOV TC Chair, based in Qingdao/Shandong, welcomed 15+ new IEEE OES members. A remarkable DL Talk by Prof. Ferdinando Nunziata at the Italian National Research Council and active participation in various conferences showcased their commitment.

Looking forward, the SOV TC plans to continue its efforts in promoting underwater imaging with deep learning. They aim to submit a petition for the Chinese IEEE OES Chapter in Qingdao/Shandong Section and organize SOV-related workshops and special issues in reputable journals.

Ocean Remote Sensing—Ferdinando Nunziata & Paolo de Matthaeis:
The Ocean Remote Sensing TC organized a full-day tutorial on Synthetic Aperture Radar (SAR) remote sensing at OCEANS, Limerick. Future plans include another tutorial on SAR remote sensing of coastal areas at the IEEE MetroSea Conference in Malta. The TC is fostering connections with IEEE Geoscience and Remote Sensing Society *(***GRSS***)* and Power and Energy Society (PES) societies, planning thematic sessions, and proposing community-contributed sessions for IGARSS'24.

Underwater Communications, Navigation and Positioning—Milicia Stojanovic & Mandar Chitre:
The TC is actively engaged in organizing events and lectures worldwide. The website is up and running, reinforcing their commitment to fostering collaboration and knowledge exchange in underwater communications, navigation, and positioning.

Polar Oceans—Andreas Marouchos & Bill Yu:
Contributing to the Southern Ocean Observation System (SOOS) Symposium 2023 and planning for future collaborations, the Polar Oceans TC is making strides. Their special session at Ocean Sciences Meeting 2024 is a must-attend for those interested in autonomous sensing and monitoring in polar environments.

Ocean Sustainable Energy Systems—Bill Wilson:
The TC orchestrated a successful Sustainable Technology Conference, sparking discussions on ocean energy technology and policy. SusTech 2024 is on the horizon, with potential collaborations covering grid connectivity, offshore energy standards, and emerging technologies.

Underwater Acoustics—Suleman Mazhar, Xuebo Zhang & Mehdi Rahmati:
With an online presence of around 20 members, the TC is actively participating in various conferences and coordinating with student branch chapters. Special issues in reputable journals showcase their commitment to advancing underwater acoustics.

Current, Wave, Turbulence Measurement and Applications—Weimin Huang:
The TC is gearing up for the 13th IEEE OES CWTM Workshop in 2024, and they actively participated in OCEANS 2023.

Data Analytics, Integration, and Modeling—Gopu Potty & Ananya Sen Gupta:
The TC hosted a successful OES Meeting in Feb 2024, organizing online sessions and town halls. Their future plans include DL nominations and active participation in Oceans Decade activities.

Ocean Observation Systems and Environmental Sustainability—René Garello & R. Venkatesan:
This TC is driving initiatives for an Ocean Best Practices workshop, forging connections with International Oceanographic Data and Information Exchange" (IODE)/ Global Ocean Observations System (GOOS), and planning a special session at Singapore OCEANS. The TC took an active part in the IEEE R8 Committee on Climate Change, as lead on the Ocean topic. TC also gave an invited talk on Climate Change at the IEEE R8 Humanitarian Activities Committee. Development of "Marine

Debris monitoring activities," in collaboration with GEO Blue Planet, was also taken up. A Keynote address at IEEE Sri Lanka Young Professionals & Women (SYW) Congress 2023 Sustaining the Blue Planet: Climate Change and Oceans at Sri Lanka was made by the TC.

The TC is planning a Webinar on Marine Debris pollution. It is also proposed to participate in the UN Decade meeting, Barcelona, April, 2024, and also organize potential sessions at the OCEANS conferences. Another activity is to organize Ocean Best Practices (OBPS) workshop with a focus session on "Integration of low-cost sensor technologies into observing systems - a need for best practices and standards"

As we look forward to the exciting prospects of 2024, we extend our gratitude to all our TCs for their dedication, innovation, and collaborative spirit. Together, we continue to shape the future of oceanic exploration and research.

Technology Committee on Ocean Sustainable Energy Systems (OSES) Report

Bill Wilson, Chair of Ocean Sustainable Energy Systems (OSES)

The Ocean Sustainable Energy Systems (OSES) Technology Committee supports the development and deployment of fully sustainable and affordable systems for harvesting energy offshore, and delivering that energy in appropriate forms for human use. Thus, offshore wind power plant, tidal-range and tidal-stream generation plant, wave energy converters, systems generating electricity from thermal gradients and/or salinity gradients, offshore solar thermal and photovoltaic systems and systems for the offshore farming of algae and other biomass are all within the scope. Coupled with these energy harvesting technologies, the scope necessarily embraces systems for energy storage such as the various forms of offshore pumped-hydro, underwater compressed air storage and storage of synthesized energy vectors as well as systems for power transmission across stretches of the ocean/sea. Integrated systems comprising systems for energy harvesting, storage and transmission are central.

- In 2023 as the new Chair of OSES my first task was to organize a panel on "Sustainable Ocean Energy Technology and Policy" at the OES sponsored 2023 IEEE Conference on Technologies for Sustainability (SusTech). This panel was well received and included subject matter experts from academia, industry and government.
- At OCEANS 2023 Gulf Coast there were two panels relating to Ocean Energy, a Technical Session on Ocean Renewable Energy as well as a number of ocean energy related papers presented in other sessions. It is an objective of OSES to participate in future OCEANS conferences.
- OES OSES and The Power Engineering Society (PES) Marine Systems Coordinating Committee (MSCC) initiated discussions in September to organize collaborative activities.

In 2024 OSES is planning to:

- Develop program content for Sustech 2024 including a potential SusTech Talks webinar on an Ocean Energy related topic in one of the months leading up to the conference.
- Provide program assistance related to Sustainable Ocean Energy for other OES sponsored conferences in 2024.
- Further explore opportunities for collaboration with PES and other organizations such as MTS who recently created a committee on Offshore Renewable Energy.
- Develop one or more programs specifically for OSES members such as a quarterly newsletter and/or webinars.

The OSES Technology Committee invites you to support and attend the above events or volunteer to participate in the mission of OSES. You may contact the committee at wpwilson@ieee.org

Cost Efficient, Scalable, Practical and Innovative Ocean Observing Technologies for 'The Science We Need for the Oceans We Want—Panel Discussion

Venugopalan Pallayil, Vice President for OCEANS (VPO)

The IEEE Oceanic Engineering Society (OES), in collaboration with the Ocean Decade Technology Innovation Working Group (TIWG), organized a panel discussion on the above topic during OCEANS 2023 Gulf Coast. Venugopalan Pallayil (Venu), IEEE OES VP for OCEANS, and Justin Manley (Justin), Co-Chair TIWG and President of the Marine Technology Society, were

Six Panelists.

the lead organisers. The panel started with an introductory note by Justin on TIWG and its objectives. Venu then introduced the speakers and moderated the 90min session. The panel was well attended (about 55 attendees) and the engagement of the attendees was evident from the fact that the Q&A session overshot allocated time. The following theme set the basis for the panel discussion:

Implementation of the Ocean Decade agenda 2030 of sustainable oceans requires knowing our ocean better and following it up with development and implementation of right solutions. This is well captured in the Decade vision of 'The science we need for the oceans we want', organized within the framework of the 10 Ocean Decade challenges. Technologies and engineering them play an important role in the study of science of our ocean and implementing relevant solutions. Our understanding of oceans and our ability to manage and conserve critical marine ecosystems are limited by our ability to acquire quality, interoperable data from marine observations. But do we have enough tools and technologies to address the Ocean Decade vision? Are there gaps that need to be addressed? How accessible and affordable are these tools and technologies for the researchers? Are they cost efficient and suitable for scalable deployments and long-term measurements? Do they provide optimal coverage with reasonable resolution and scalability required for conservation and restoration of marine environment? The panel addressed these questions and made recommendations.

Six panelists, representing different industries and academic institutions, shared their thoughts on low-cost alternatives to commercial technologies yet provide better scale of performance. Following are the list of speakers and their affiliations:

Justin, who is also the founder of Just Innovation, talked about innovation for fisheries technology and explained how start-ups and philanthropic organisations can work hand-in-hand to address cost and scalability, which are critical issues. He cited a few examples, such as 'Katchi' and SafetyNet technologies for precision fish harvesting, and SharkGuard, a technology that reduces unintentional bycatch of sharks. Yi Chao, CEO of Seatrec, showcased a float that can recharge using ocean temperature difference and thus able to do persistent monitoring compared to the Argo floats, which have a limited lifetime and also leave electronic waste on the seabed. Seatrec floats are thus environmental-friendly and cost effective as well.

Julie Angus, CEO and Co-founder of Open Ocean Robotics presented a sustainable Un-manned Surface Vehicle (USV) platform for ocean monitoring. This solar-powered platform let the user to collect multiple ocean parameters (environmental, oceanographic and situational awareness data) and upload pre-processed data onto a cloud storage for later retrieval, post processing and viewing. Allan Adams, CEO & Founder of Aquatic Labs – an early hard-tech start-up, presented his vision on tracking ocean carbon, nutrients, biodiversity to changing ecosystem using cutting edge semiconductor tools and sensors.

Another speaker, Carlos Barerra, who is the head of VIMAS (Vehicles, Instruments and Underwater Machines) at PLOCAN (Platforma Oceanica de Canarias), stressed the need for a network of autonomous assets powered by 'environmental propulsion' using tides, wind, waves, and solar power sources. Such a fleet of autonomous vehicles at sea can provide solutions for large scale persistent monitoring of oceans sustainably. The final speaker of the panel was Melissa Omand, oceanography professor at the University of Rhode Island. Her search for a robust and low-cost commercial solution for persistent quantification of ocean carbon pump ended up with Melissa developing the technology by herself. The result was the MINION (Miniature Isopycnal), a low-cost smaller and cheaper drifter, but without any moving parts such as propulsion or buoyancy pump. Melissa says: "These floats are open source, with a bill of materials of about $2000 and they could be deployed in large enough fleets so that we can begin to resolve fluxes, efficiencies and mechanisms sufficiently to inform high resolution data assimilating models"

Panel members with Moderator, Venu Pallayil.

I would like to acknowledge the support provided by Jyotika Virmani, Executive Director, Smith Ocean Institute for her initial guidance and discussions. Jyotika is also one of the co-chairs of TIWG, UN Ocean Decade.

OES Conference Calendar

Contact BEACON Editors, OES VPWS and VPTA

OCEANS

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

OCEANS 2024 Halifax
September 23–26, 2024
Halifax, Canada
https://halifax24.oceansconference.org

OTC

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

Marine Robotics School 2023
November 20–25, 2023
Goa, India
https://mrs2023.nio.res.in

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

2024 Winter School on UNWiS
January, 2024
Padova, Italy
https://www.wirelessandmore.it/unwis.html

CWTM 2024
March 18–20, 2024
Greenville, USA
http://www.cwtm2024.org

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

OSM 24
February 18–23, 2024
New Orleans, USA
https://www.agu.org/ocean-sciences-meeting

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

Robotics for Asset Maintenance and Inspection (RAMI) 2023 Competition

Gabriele Ferri[1], Alessandro Faggiani[2], Tommaso Fabbri[2], Fausto Ferreira[3]
[1]RAMI 2023 Technical Director, [2]RAMI2023 Deputy Technical Director,
[3]VP Workshops & Symposia

NATO-STO Centre for Maritime Research and Experimentation (CMRE) has been organising Student AUV Challenge—Europe (SAUC-E), the premier European student competition for underwater vehicles, since 2010. Over the years, we have been fostering autonomy and robotics in different events such as euRathlon 2015 Grand Challenge and the European Robotics League Emergency 2017, involving the use of multi-domain cooperative teams of robots in search and rescue scenarios. euRathlon 2015 Grand Challenge, organised in the framework of the euRathlon EU project, was the first world's multi-domain robotics competition. Disaster response tasks were proposed to teams composed of land, sea and air robots and

were held at a real power plant site, specifically Tor del Sale in Piombino, Italy. The inspiration came from the Fukushima 2011 accident.

This formula of multi-domain competitions has continued with the European Robotics League (ERL) Emergency. ERL is a common framework for robotics competition funded by the European Union. ERL was launched in 2016 in three vibrant fields of robotics: industrial, service and emergency robots. The first season culminated with the ERL Emergency 2017, a multi-domain competition again locally organised by CMRE at the Tor del Sale power plant site in Piombino. ERL Emergency 2018 and 2019 took place again in La Spezia and were planned to take place in 2020 and 2021 but the COVID-19 pandemic made it impossible to have physical competitions.

Following this tradition, we have started in 2022 a new competition named Robotics for Asset Inspection and Maintenance (RAMI). RAMI is part of the ERL Emergency League and is organised in the framework of the EU-funded METRICS project (https://metricsproject.eu/) aiming at addressing Inspection & Maintenance (I&M) tasks achieved in risky and/or hostile environments where human intervention is challenging or impossible, where direct link with an operator could not be guaranteed and where autonomous decisions are necessary to reduce operational time of the inspection tasks and ensure repeatability while maintaining an appropriate safety level for the mission. RAMI proposes events for aerial robots, organised by CATEC (Spain), and for underwater vehicles organised by CMRE.

RAMI consists of both virtual and field competitions. At CMRE, we have organised two virtual competitions (https://metricsproject.eu/inspection-maintenance/rami-cascade-campaign-marine-2023/). In such competitions a dataset of images of underwater objects of potential interest (OPIs) are provided to teams, which are requested to develop the adequate software in order to classify, identify and localise images of OPIs of a test dataset. These virtual or cascade competitions are important to prepare teams for the field events and to attract researchers from other domains to tackle with underwater image processing challenges.

The first field event for marine robots was organised at CMRE seawater basin in July 2022. In this report, we present the second RAMI event, recently held at CMRE in July 2023.

The Competition

CMRE hosted this year the RAMI23 robotics competition from 16 to 21 July. The competition took place in CMRE seawater basin. The areas were prepared to simulate an Oil & Gas plant in a harbour connecting it to the general theme of the RAMI competition: Inspection & Maintenance (I&M). To support teams' growth, we proposed tasks similar to those present in ERL Emergency 2019 and in RAMI22.

The RAMI marine competition tasks are inspired by the following user story:

An Oil&Gas offshore site has to be investigated after that a malfunction has been reported by the plant safety systems. From what is known, a pipeline has started leaking and an explosion may occur soon.

A robotic team composed of underwater robots (AUVs) is ready to intervene. It is time for the emergency team to act. The priorities are to reach the area of the accident, and to assess and quantify the entity of the leak. Then the robots have to reach the pipe assembly area for quantifying the damage to the plant and for identifying which pipe has been damaged and is responsible for the leak. Finally, the robots must intervene on the plant itself by closing a valve to stop the leak to prevent the explosion and further damages to the environment.

Underwater robots were challenged to inspect a pipe structure, reach several waypoints and pass through a validation gate. In addition, several buoys of four possible colors had to be detected, localised and their colour recognised. A different action was requested to the teams depending on the buoy color: for instance, turning around the buoy in a clock-wise circle or stopping for 30 seconds increasing the depth. The objective was to force teams to integrate perception with adaptive mission planning in a realistic environment such as CMRE water basin. Finally, three manipulation tasks were proposed, specifically staying into contact with the pipe, valve closing and picking a stick, bringing that to the surface in a controlled way. These tasks were the only ones allowed to be performed through teleoperation (ROV mode), while all other tasks had to be performed autonomously. As in the previous editions, the challenges were held at the CMRE waterfront sea basin, which is a sheltered harbor, providing participants with the opportunity to grapple with real-life sea conditions, including limited visibility and salty water, but within a safe, controlled environment. The limited visibility added severe difficulties to object recognition by AUVs, even if the targets were bright orange or red in color.

We have noticed that, despite the COVID-19 interruption and related issues for the students, teams' performance generally has been improving over the past years, especially for entries with experience in our competitions. UNIFI Robotics Team (Italy), in particular, accomplished several tasks, showing a good maturity in navigation, survey, buoy localization and manipulation. For the first time in our competitions, a buoy was classified correctly in real-time and the appropriate autonomous behaviour was triggered (the AUV changed depth in a controlled way). The other buoys were also localised, classified and identified in post-processing with good accuracy. All the teams were able to deploy their AUV in the water and to score some achievements. ITU AUV Team from the Istanbul Technical University (Turkey), for instance, was a rookie team in RAMI events. The team was the winner of the Singapore

Figure 1. (Left) The OUBOT's team during the deployment. (Right) Judges controlling a mission from the Judge Tent.

SAUVC 2022. SAUVC, sponsored by OES as well, is held in a swimming pool and targets at more junior teams. Despite some problems and difficulties in adapting to the sea scenario, they were able to accomplish manipulation tasks in the last day, showing good capabilities of adaptation and improvement in performance over the event week. This is extremely encouraging showing how competitions all around the world can be a common training ground for teams to grow and improve.

Further work has to be done to improve the performance of teams in real-time perception and related adaptive mission planning. Cascade competitions can help in this aspect.

Finally, for the first time in our event, we organised a student poster competition. This was an opportunity to further increase contacts and involvement between teams and the international experts present at the event.

The Participant Teams

This year 5 teams attended the event. Four teams attempted the competition tasks, while a fifth team only practiced in the arenas. It is to be noticed that after the COVID19 pandemic, some teams lost continuity as students graduate and there was no overlap between older generations and younger ones. This is why it is important to organise annual competitions and to support team participation, facilitating the succession with the required handover of experience. To start again after the COVID-19 period, we think it is pivotal to involve people with the aim to strengthen the community, and to contact and involve as much as possible participants and potential sponsors. This year, we had the participation of three teams at their first participation in our competitions, and the other two had attended many of our past events. This good mixture of new and veteran teams shows how RAMI/ERL is today a fixed appointment for several European research groups, and continues to attract new venues.

The Participant Teams Were

1) ITU AUV Team from the Istanbul Technical University in Turkey was the winner of the Singapore SAUVC 22, a competition held in a swimming pool. They participated in RAMI23 for the first time with their Taluy AUV.
2) NAUTILUS Team consisted of three people, from ESTACA School of Engineering in France. They were at their first participation in one of our competitions.
3) UNIFI Robotics Team, from the University of Florence, Italy. A veteran of our competitions (first participation in 2012). They participated in RAMI23 with their FeelHippo AUV.
4) OUBOT, from the Obuda University, Budapest, Hungary. This team had participated in euRathlon 2015 and ERL Emergency 2017. In these competitions, they participated thanks to an AUV loaned by the organisation. Then, they built their own robot to participate in our events.
5) Team ERGO from the University of Pisa, Italy. Their robot, a Zeno vehicle manufactured by MDM Team company, was used mostly for practicing in the area and collecting optical and acoustic imaging. This is important in view of a future participation of the team in our events.

The Winners

RAMI 2023 proposed one Task Benchmark (TBM) in a different competition day: Pipeline area inspection on Wednesday, Intervention on the pipeline structure on Thursday and finally the Complete mission at the plant on Friday. TBMs are oriented to task fulfillment and are judged by judges in real-time, or scrutinizing the data produced by teams within one hour from the end of their time-slot. On the other hand, Functionality Benchmarks (FBMs) aim to evaluate robot functionalities, such as mapping capabilities. They are evaluated after the competition by analyzing the output data from the teams.

UNIFI Robotics Team stood out in the three TBMs, winning all of the TBMs and having a draw in the Intervention on the pipeline with OUBOT team. UNIFI Robotics Team was finally awarded with the SAUC-E 2023 award, the best team over all the proposed TBMs.

Furthermore, UNIFI Robotics Team also was first in rank in the FBMs involving mapping the area (detecting and localizing the coloured buoys) and object recognition (classifying and identifying the coloured buoys).

Other prizes awarded were:

- "Best team SAUC-E award" (best team of the rankings over the three TBMs): UNIFI Robotics Team—voucher from Breaking the Surface sponsor.
- "Best presentation" (teams were asked to give a presentation on their robot and team): ITU AUV Team—voucher from Breaking the Surface sponsor.
- IEEE OES Innovation Award Plaque—UNIFI Robotics Team—300 $ from IEEE OES sponsor.
- "Best rookie team": NAUTILUS Team.
- "Most improved vehicle award": OUBOT - ping sonar from Blue Robotics sponsor.
- "Best student poster"—Simone Tani "Comparison of Monocular and Stereo Vision Approaches for Structure Inspection using Autonomous Underwater Vehicles," ERGO Team—voucher from Breaking the Surface sponsor.

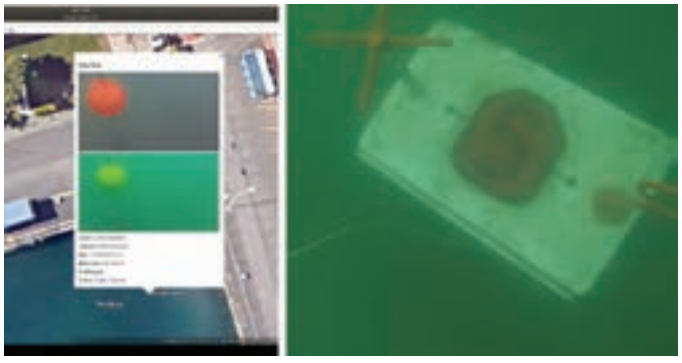


Figure 2. (Left) Identification of a yellow buoy by UNIFI Team's robot. (Right) The manipulation console as imaged by UNIFI. The valve and the pole are visible, together with the number. Photo credit: NATO STO CMRE and UNIFI Team.

Feedback

The feedback from both the participants and the judges was very positive. We have noticed a general improvement in

Figure 3. Teams and the Organising Committee during the award ceremony at CMRE.

Figure 4. The RAMI23 Organising Committee awarded by Bill Kirkwood with a plaque in recognition by IEEE OES of the excellence in the organisation of robotics competitions over the last 10 years.

teams's performance. In particular, we had good results in tasks involving the combination of real-time perception with autonomous behaviours. For instance, UNIFI Team was capable, for the first time in our competitions, to detect a buoy in real-time, to determine its colour and to react with the required behaviour. This witnesses how proposing the same tasks over different editions can support the gradual growth of participant teams. At the same time, it is felt the need to keep or create some simple tasks for the newcomers (we had two rookie teams this year). We will try to achieve this trade-off between more complex and more basic tasks in the future, to be attractive for both new entries, and for more experienced teams, which require to be pushed by more challenging missions. The realistic scenario, which attracts participants, is also central to involve end-users and companies. This year, for instance, we had one judge from ROSEN group and many judges from the U.S., interested in our realistic set-up. Results of RAMI23 showed, for most of the teams, good performance in autonomous navigation, mapping and imaging. However, in general, more work and support are needed for real-time perception and autonomy. This will be addressed in the future campaigns. In the ongoing cascade campaign, we provided teams with an underwater image dataset for developing image processing software. This is important to prepare teams to challenge with real-world conditions; especially when there is a lack of available datasets in the underwater domain to support the development and the validation of image processing algorithms.

The Judges

We had more than 30 judges and observers from Europe and U.S., both from companies, academia and research institutions. In particular, this year's edition saw a large presence of judges and experts from the U.S. We had people from key-players in the Oil&Gas field, such as ROSEN group (Germany), DLR (Germany), FINCANTIERI and Leonardo (Italy). From the U.S. we had the strong presence and support of the Office of Naval Research (ONR). Other judges were present from NRL, Spawar and RoboNation. As in previous competitions, CMRE provided the full engineering and logistical support during the event execution. Teams were supported by CMRE logistics, having access to a good support, since engineers and technicians helped the teams with suggestions and supply parts. This was appreciated by teams and is crucial in helping teams to solve the unavoidable technical issues. Teams' general feedback was very positive regarding the marine trial area and the way the scenario was setup.

The local community was also engaged. Local schools from the La Spezia area were also involved in the framework of Giona's Project. This allowed around 20 students close to high school graduation to come and interact with the teams.

Sponsors

As in previous years, IEEE OES played a fundamental role as the Main Sponsor. IEEE OES supported team travel and participation. This is essential to attract teams and allow them to take part in such complex events. One of the RAMI goals is to educate future multi-disciplinary engineers. Therefore, the sponsorship of 'Breaking the Surface' 2023, the 15th Interdisciplinary Field Workshop of Marine Robotics and Applications, is well aligned with our mission. The organisers of 'Breaking the Surface' provided complimentary registrations for three students. These students had the opportunity to participate in the 15th edition of this multi-disciplinary and educational workshop that since 2019 counts with the IEEE OES sponsorship.

As in the past, we again had the marine robotics commercial sector involved. Blue Robotics gave a Ping sonar to the team that won the 'Most improved vehicle' award. Other sponsors were Fincantieri and ROV-Expert.

Our aim is to continue to develop RAMI as a unique event that challenges teams with realistic conditions, with an emphasis on precise metrological evaluation. These achievements were made possible thanks to the fundamental support of IEEE OES and all our other sponsors. We thank all the teams, judges, presenters, visitors, staff and everyone involved, who made RAMI 2023 such as a successful event.

IEEE MetroSea 2023

Sebastiano d'Amico, Pasquale Daponte and Maurizio Migliaccio

IEEE MetroSea 2023 was the first true international edition of the IEEE MetroSea conferences series, and it was sponsored by the IEEE Oceanic Engineering Society (OES). It was held at University of Malta, Valletta Campus, Valletta, Malta, on October 4–6, 2023. Although it was the first IEEE MetroSea conference out of Italy there was a great involvement of Italian Institutions including the IEEE OES Italy Chapter. Further, patronages came from Italian Navy, Italian National Council of Research, OGS, ISPRA, University of Napoli Parthenope, University of Genoa, University of Trieste, University of Padua and University of Sannio.

The organizing committee was made by Pasquale Daponte (University of Sannio), Sebastiano d'Amico (University of Malta) and Adam Gauci (University of Malta).

Malta is a nation made by three major islands: Malta, Gozo and Comino. Its name is meant to come from the Arabic name (*Malita*) of honey because of the presence of many honeybees. It is the smallest country within the UE, and among the smallest countries in the world with its 315,6 km².

Malta, is at the center of the Mediterranean Sea and it has always been an historical and cultural corner point for the cultures facing this Sea. As you can see in Fig. 1, it is not far away from Sicily and also northern Africa. It is only 80 km away from Sicily, 284 km from Tunisia and 333 km from Libya. Two historical periods are particularly relevant: when in 1530 the islands were given to the Order of St. John to establish the base for his Knights, and of course during the World War II when Malta's islands were a fundamental and strategical outpost of the allied forces. With reference to the crusades period and the Knights, very important artists worked in Malta, as Caravaggio, to make marvelous masterpieces, especially in the St. John's Co-Cathedral, see Fig. 2.

The conference venue was the Valletta Campus in the historical and fascinating city capital of Malta, see Fig. 3.

Valletta's 16th-century buildings were constructed by the Knights Hospitaller. The city was named after Jean Parisot de Valette, who succeeded in defending the island from an Ottoman invasion during the Great Siege of Malta. The city is Baroque in character, with elements of Mannerist, Neo-Classical and Modern architecture, though the Second World War left major scars on the city. The city was officially recognized as a World Heritage Site by UNESCO in 1980. The city has 320 monuments, all within an area of 0.55 square kilometers (0.21 sq mi), making it one of the most concentrated historic areas in the world.

Figure 1. A geographical sketch of Malta in the Mediterranean Sea.

Figure 2. The "San Girolamo scrivente" by Caravaggio at the Co-Cathedral of St. John in Valletta, Malta.

Figure 3. The marble stone located in the University of Malta, Valletta Campus.

Coming to recent years, Malta is a very open economy (listed 41st according to the 2023 index of Economic Freedom) within the European Union, that it joined in 2004, and uses the euro currency since 2008. It accounts for a population of about 520,000 inhabitants. The official languages are Maltese, a mixture of Sicilian and Arabic, and English.

Malta is characterized by its natural port and by the emphatical relationship of its citizens with the sea, see Fig. 4. In short, a sunny and pleasant place to organize the IEEE MetroSea!

The conference accepted papers were 104, with a number of international registered attendees summing to 112. All articles submitted to IEEE MetroSea 2023, that have been accepted in a peer-reviewed process, have been published on IEEE Xplore Digital Library.

The Conference included 26 oral sessions, 1 poster session. Further, the conference schedule incorporates 3 keynote talks and 1 tutorial. The keynotes were held by the speakers: Emma Woolliams, Kenneth G. Foote and Andrea Buono. During the conference a theoretical-practical tutorial was also held by Ferdinando Nunziata, Università di Napoli Parthenope, Italy, on "*SAR remote sensing of coastal areas*", see Fig. 5.

The three keynotes were particularly appreciated and truly outstanding. Emma Woolliams (National Physical Laboratory - NPL, UK), lectured on "*Metrology to support satellite measurements of the ocean*", Kenneth G. Foote (Woods Hole Oceanographic Institution, WOODS HOLE, MA, USA), lectured on "*Active-sonar metrology*" and Andrea Buono (Parthenope University of Naples, Italy) lectured on "*New trends for Synthetic Aperture Radar marine applications*".

Figure 4. From Valletta the harbor of Malta.

Figure 5. Participants of the Theoretical-practical tutorial held by Ferdinando Nunziata on "SAR remote sensing of coastal areas".

The conference was lively, scientifically vivid and with participation of academic, operational and governmental people. Many young people attended the conference and participants from Italy, Malta, USA, UK, Norway, The Netherland, Poland, Croatia, France, Romania, Poland, Belgium, etc. Parallel oral sessions and poster sessions were organized out of the Plenary Sessions. The usual core of the presentations was about measurements of oceanographic parameters by several remote methods, e.g., satellite-borne sensors, drones, coastal radars, but also new methods based on marine bottom deployed optical fibers, and in situ sensors. Indeed, several challenging and emerging applications have been illustrated including sea plastic monitoring, earthquake signals, fishery stocks, etc. On the methodological side, several papers explored the benefit of artificial intelligence in marine signal processing. As usual, great attention was paid to marine pollutions and navigation risks.

The conference participants had the chance to visit the Italian Navy destroyer-missile launcher "Francesco Mimbelli" (Fig 6), and the Italian Coast Guard "Bruno Gregoretti" vessel (Fig. 7). A technical visit was organized during the conference to the two vessels, see Fig 8.

As usual, the Special Session, "Military Metrology for the Sea", was organized by the Italian Navy and the Armed Forces

Figure 6. The Italian Navy destroyer-missile launcher "Francesco Mimbelli".

Figure 7. The Italian Coast Guard "Bruno Gregoretti" vessel.

Figure 8. A picture of some participants visiting the Bruno Gregoretti Italian Cost guard vessel.

Communications and Electronics Association (AFCEA) Naples Chapter.

In Fig. 8 you can recognize (from left to right) the civilian Salvatore Gaglione, John Potter, Emma Woolliams, Maurizio Migliaccio, Pasquale Daponte, Kenneth Foote and Salvatore d'Amico.

In Fig. 9, you can see (from left to right) Ferdinando Nunziata, Salvatore Gaglione and Giuseppe Grieco in an off-session moment.

In Fig. 10 you can see (from left to right) Maurizio Migliaccio, John Potter and Sebastiano d'Amico.

All social events were excellent and organized with great care and professionality.

Figure 9. Participants at IEEE MetroSea 2023 in Malta.

Figure 10. More participants at IEEE MetroSea 2023 in Malta.

The gala dinner was held on October 5th at the very peculiar M'dina Restaurant in the city of M'dina. M'dina is a fortified city in the northern region of the island of Malta, which served as the island's capital from antiquity to the medieval period. The city is still confined within its walls, and has a population of 250, but it is contiguous with the town of Rabat, which takes its name from the Arabic word for suburb.

During the closing ceremony the awards were announced. The best paper award was achieved by Menno Buisman (Delft University of Technology, Port of Rotterdam, The Netherlands), for his paper entitled "Monitoring Water Column and Sediments Using DAS", see Fig. 11.

Figure 11. Award ceremony: The winner of the best paper, Menno Buisman (left) and Pasquale Daponte (right)

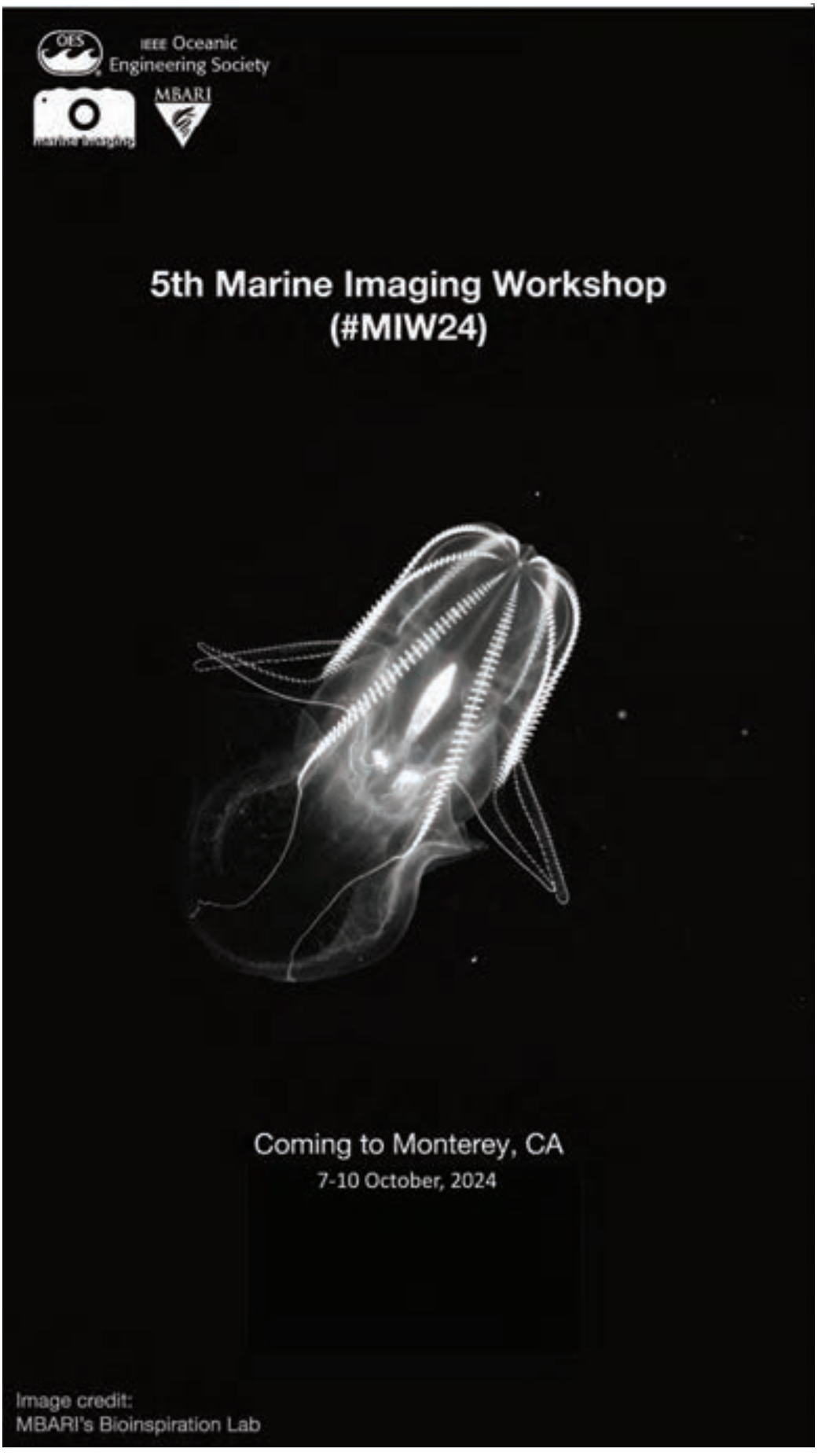
Figure 12. Portorose, Slovenia, will be the next venue of IEEE MetroSea.

Further, it was announced the approval of especially dedicated IEEE Journal of Oceanic Engineering Special Issue about the extended version of the best IEEE MetroSea 2023 (deadline 4 March 2024).

All details can be found on the Conference website (https://metrosea.org/special-issue-joe) and on the IEEE Journal of Oceanic Engineering webpages (see issues of IEEE JOE from Oct.23 under Announcements).

IEEE MetroSea 2024 will be held in Portorose, Slovenia, (Fig.11), October 14–16, 2024 The IEEE Oceanic Engineerring community is warmly invited to enjoy the Conference. Then, Čakamo vas v Portorožu!


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
OES
MBARI
marine imaging
5th Marine Imaging Workshop
(#MIW24)
Coming to Monterey, CA
7-10 October, 2024
Image credit:
MBARI's Bioinspiration Lab

A Blast from the Past! . . . Your AdCom at Work

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

When most of us attend an OCEANS conference, we don't see what goes on behind the scenes to keep the OES running smoothly. One of our primary meetings at OCEANS is the Advisory Committee (AdCom) meeting that also includes our Executive Committee members. Lots of issues and points to be made by your elected AdCom members. For example, see the following photos from the OCEANS 2017 Anchorage meeting. Thanks to all our volunteers.

OCEANS 2017 AdCom meeting.

Rene, Diane and Sandy.

Jim, Marinna and John.

Jim, Bill and Bob.

Ross, Mal and Ken.

John, Philippe and Christian.

M. A. Atmanand, Brandy and Mandar.

OCEANS 2017 Anchorage AdCom meeting participants.

OCEANS 2023 Gulf Coast Report

Craig Peterson, Co-Chair OCEANS 2023 Gulf Coast, Kenneth Sharp, TPC Co-Chair of OCEANS 2023 Gulf Coast

Hotel Beau Rivage and the Mississippi Coast Convention Center.

OCEANS 2023-Gulf Coast, "**Blue Economy: Locally Sourced, Globally Driven,"** was the 4th highly successful OCEANS's Conference assigned to our Gulf Coast that was sponsored by the Institute of Electrical and Electronics Engineers (IEEE) Oceanic Engineering Society (OES) and the Marine Technology Society (MTS). It was planned, organized, and executed by the joint Gulf Coast MTS/ IEEE (OES) Local Organizing Committee (LOC), and we are excited to share highlights from the recent OCEANS 2023 Gulf Coast conference and expo. With over 120 exhibitors, the event featured cutting-edge technology, innovative solutions, and remarkable marine marvels. Attendees had the opportunity to explore the latest advancements in the field, sparking inspiration and collaboration. We welcomed over 1500 passionate attendees from around the world who shared their enthusiasm for the deep blue. The event's success was a testament to the collective dedication and commitment to the world's oceans.

OCEANS 02 and 09 "Ocean Technology for Our Future: Global and Local Challenges," were in-person, technically excellent and exceptionally well attended conferences. They set a standard for Gulf Coast OCEANS Conferences and provided fantastic lessons learned for the Gulf Coast LOC. The OES Beacon Newsletter PDF Archive https://ieeeoes.org/publications/oes-beacon/ has valuable highlights on all past OCEANS Conferences. At OCEANS 2019 in Seattle, the General Chairs of OCEANS's 2020 Singapore (scheduled in April 2020) and OCEANS 2020 Gulf Coast "VISIONS for the Blue Economy" (scheduled in October 2020), had met and shared the incredible efforts and excitement of their LOC's and Local communities for their in-person OCEANS's conferences. In 2020, the COVID-19 pandemic made it impossible for delegates to meet and greet through an in-person conference. The LOC's of Singapore and the Gulf Coast showed incredible flexibility and joined forces and with IEEE (OES) and MTS leadership, co hosting the first ever virtual IEEE OES/MTS OCEANS conference, Global OCEANS 2020: Singapore-U.S. Gulf Coast. This virtual conference was also unique as it combined two regional OCEANS into a single Global OCEANS. Even though the virtual Global OCEANS 2020: Singapore-U.S. Gulf Coast was deemed an incredible success, both LOC's recognized that virtual events are not a replacement for the in-person dynamics and collaboration. The In-person event continues to be valuable to industries across many sectors, but especially the ability to highlight the local community's capabilities. With the support of IEEE(OES) and MTS leadership, in-person OCEANS 2023 Gulf Coast and OCEANS 2024 Singapore (OCEANS—Singapore Conference (oceansconference.org)) were assigned.

With our theme **Blue Economy: Locally Sourced, Globally Driven** emphasizing the fact that all our local efforts are integrally linked to the larger world ocean, we recognize that we must all work toward sustainability together. The Mississippi coast is home to a number of U.S. Navy and National Oceanic and Atmospheric Administration (NOAA) offices, many of which are located at Stennis Space Center, and it only makes sense that the LOC invited both to serve as Federal Honorary Co-Chairs for OCEANS 2023. Their acceptance and support had incredible impact on OCEANS 2023 Gulf Coast and started with their welcomes on the OCEANS 2023 Gulf Coast website:

"*Naval Oceanography is excited to welcome the breadth of government and civilian sector oceanographic expertise to the Mississippi Gulf Coast for OCEANS 2023. This event will showcase the strong partnership between the U.S. Navy, U.S. Government agencies, Academia, and Industry along the Gulf Coast. Naval Oceanography and this consortium of talented organizations tackle some of the Nation's toughest challenges, and I look forward to a productive conference.*"—**Admiral Ron Piret, Commander Naval Meteorology and Oceanography Command.**

"*This is an amazing time to be located on the Mississippi Gulf Coast! OCEANS 2023 in Biloxi, MS will showcase many New Blue Economy opportunities, including the Gulf Blue initiative, the Roger F. Wicker Ocean Enterprise Facility, the U.S. Navy's Gulf Coast Tech Bridge, the Commercial Engagement of Ocean Technologies (CENOTE) Act capabilities between NOAA and the U.S. Navy, Ocean Aero's new office building in Gulfport and the Uncrewed Maritime Systems Test and Training Range located in the Gulf of Mexico. As the Director of NOAA's National Data Buoy Center, I welcome you to the area and share your excitement that the new Blue Economy presents.*"—**Dr. William (Bill) Burnett, Director of the National Data Buoy Center**

The enthusiasm, expertise, and makeup of the LOC echoed the amazing cooperation National, State, and Local government agencies, Academia, and Industry, and validated the faith that our superb IEEE OES and MTS Liaisons (Jerry Carrol and Zdenka Willis) had in the LOC. They worked tirelessly after the virtual Global OCEANS 2020 Singapore—Gulf Coast, first to modify the OCEANS Conferences schedule to fit the Gulf Coast into the schedule without having to wait 5 to 10 years, and then to support our decisions regarding the execution of our theme, to be an IN-PERSON CONFERENCE, only, and to have Two Federal Honorary Co-Chairs. The LOC General Co-Chairs and IEEE OES and MTS Liaisons recognized the importance of identifying and developing potential leaders for future Gulf Coast Conferences. OES: Brandy Armstrong, University of Southern Mississippi and MTS: Katharine Weathers, NOAA National Centers for Environmental Information, accepted positions as Deputy Co-Chairs and MTS: Clint Edrington, Northern Gulf Institute/Mississippi State University/NOAA National Centers for Environmental Information and OES: Jane Moorhead, Mississippi State University, accepted leadership positions on the Technical Program Committee with OES: Ken Sharp KMS Oceanic Consultants. Brandy Armstrong and Katherine Weather were involved in every LOC policy decision and represented OCEANS 2023 Gulf Coast at OCEANS 2022 Hampton Roads. Additionally, they organized the OCEANS 2023 Young Professional Program and Students events. Brandy Armstrong authored the OCEANS 2023 GULF Coast OES

Lively OCEANS 2023 Gulf Coast Ice Breaker Reception at the Beau Rivage sponsored by Mississippi Department of Marine Resources and Mississippi Development Authority.

OCEANS 2023-Gulf Coast Conference Local Organizing Committee (LOC)

Organizing Co-Chairs
MTS: Laurie Jugan, Mississippi Enterprise for Technology (MSET)
OES: Craig Peterson, USN (retired), Mississippi Research Consortium/Mississippi State University
Deputy Co-Chairs
MTS: Katharine Weathers, NOAA National Centers for Environmental Information
OES: Brandy Armstrong, University of Southern Mississippi
Finance/Treasurer
Dick Croul, Naval Research Laboratory – Stennis Detachment
Technical Program Committee
Clint Edrington, Northern Gulf Institute/Mississippi State University
Jane Moorhead, Mississippi State University
Ken Sharp, KMS Oceanic Consultants
Student Poster Competition
Stephan Howden, University of Southern Mississippi
Training Program
Keith Long, Center of Higher Learning
Special Speakers/Plenaries
John Cousins, General Dynamics Information Technology
Kathleen O'Neil, NOAA National Data Buoy Center
Workshops and Panels
Peter Furze, Teledyne Marine
Angela Sallis, NOAA's National Centers for Environmental Information
Young Professionals Program
Brandy Armstrong, University of Southern Mississippi
Katharine Weathers, NOAA National Centers for Environmental Information
Women's Program
Brandy Armstrong, University of Southern Mississippi
Exhibits and Patrons
Anna Cathey Linhoss, Mississippi State University
Mark Smits, Woolpert
Outreach Program
Jonathan Harris, Northern Gulf Institute, Mississippi State University
Shannon Turner, Naval Research Laboratory – Stennis Detachment
Social Events/Things to do
Ari Covacevich, Coastal Mississippi
Beach Trash Art Contest
Craig Cumbee, Naval Oceanographic Office
Liaison with Other Organizations
Mike Jugan, Retired Naval Oceanographic Office

Beacon article regarding Young Professionals, Women's Program, Student Poster Competition and Ocean Decade Initiative.

The OCEANS 2023 Training Program, held on Day One, really delivered a first-class learning experience and delivered a comprehensive day of sessions led by industry experts in project management, cybersecurity awareness, leadership essentials, advanced technology, and interpersonal skills. Each topic was presented with expertise in its respective field. To have or not have an OCEANS 2023 Training Program was not taken lightly by the LOC. After several discussions with the young professionals' groups of both MTS and IEEE, the LOC decided to provide training for this group (as well as any other attendees wishing the training). Several discussions took place to determine the need for both soft skills and technical training. The OCEANS LOC approached the Center for Higher Learning (CHL) at Stennis Space Center, Director Keith Long who compiled a list of training options and a survey sent to our young professionals. This OCEANS 2023 Training Program developed replaced the normal tutorials at previous OCEANS Conferences and received great interest and was well attended.

The Three **OCEANS 2023 Gulf Coast Plenaries** were linked to the conference theme, **"Blue Economy: Locally Sourced, Globally Driven,"** in progressive manner (global, national, local), and by design allowed the LOC to structure each conference day's events and activities. The attendance for each of the three plenaries was incredible and it is clear that the Plenary speakers set the tone for the overall conference and helped drive its success!

OCEANS 2023 Training Program Check In.

Plenary—Blue Economy: Global Perspectives

The opening OCEANS 2023 plenary was exceptional and set the tone for the rest of OCEANS 2023. It featured HON Meredith Berger Assistant Secretary of the Navy (Energy, Installations, and Environment) | U.S. Navy and Nicole LeBoeuf Assistant Administrator | National Ocean Service, NOAA. These speakers detailed the importance of data collection efforts within their organizations, as well as how the data are used in their various missions. Familiar missions will include climate change, the increasing need for better understanding of the environment supporting global conflicts, solutions to degraded/depleting ocean resources, sustainable coastal development, and understanding our planet's oceans as well as lesser-known missions such as humanitarian support, search and rescue.

Opening OCEANS 2023 plenary speakers.

Plenary—Blue Economy: National Perspectives

The Wednesday Plenary featured Dr. Ruth Perry, United Nations Decade of the Ocean U.S. Committee, and Dr. Steven Thur, NOAA Oceanic and Atmospheric Research . The Speakers brought the global issues to the national level to include initiatives spearheaded by United States agencies and United Nations allies. They also detailed how their organization's

efforts align with the Blue Economy for sustainability and economic development.

Plenary—Blue Economy: Embrace the Gulf

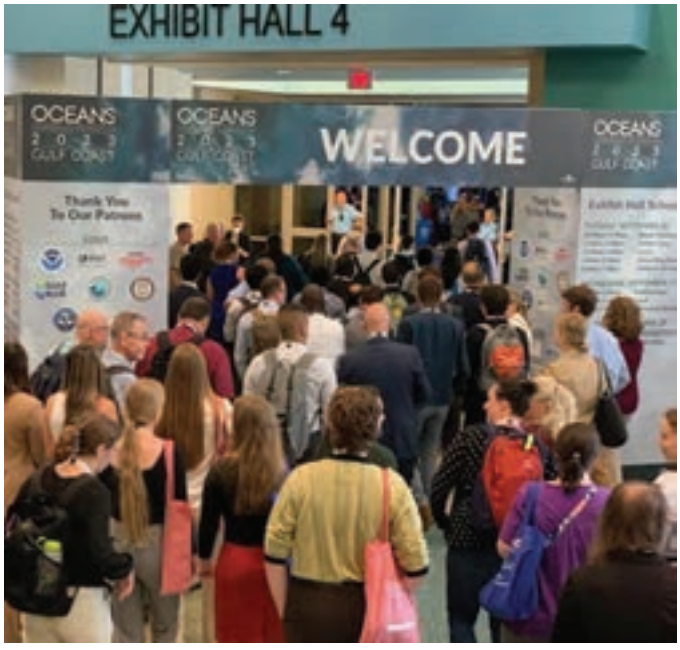
This final plenary on Thursday featured Laura Bowie, Gulf of Mexico Alliance; Hailey Bathurst, Gulf Blue Navigator; Valerie Alley, RESTORE Act (MDEQ); Dr. Jorge Brenner, Gulf of Mexico Coastal Ocean Observing System; Dr. James Kendall, Bureau of Ocean Energy Management (BOEM). These Speakers brought the scope of the Blue Economy to the Gulf of Mexico. Topics included elements of the Blue Economy that take place or are planned for the Gulf Coast region. These programs serve as assets along the U. S. Gulf Coast that support the continued development of the Blue Economy in the region.

The OCEANS 2023 Exhibit Hall Buzzed—All the Time!

The Mississippi Coast Convention Center Exhibit Hall was perfect for our 120 Exhibitors. Not too big and not too small. The Exhibit Hall was in a state-of-the art facility where all daytime meetings and activities for OCEANS 2023 Gulf Coast took place including Conference lunches and The Exhibitors Reception. It is ideally located on the beachfront in Biloxi! The fact that it was a short bus trip from the conference hotel made it the perfect venue to keep the 1500 registrants meeting with the Exhibitors during their free time. OCEANS 2023 Innovation Theater was centrally located in the Exhibit Hall and tremendously active with presentations by Saildrone, Teledyne Marine, NOAA, Xylem, Sonardyne and ESRI.

"From the Depths of the Oceans to the Reaches of the Stars" is the Theme for the OCEANS 2023 Gulf Coast Gala

The gala took place on Wednesday evening, 27 September, in the ballrooms of the Beau Rivage Resort and Casino.



Entrance to Exhibit Hall.

Exhibitors Reception.

OCEANS 2023 Gulf Coast Patrons

What made this gala so different and spectacular? The gala theme was taken from tag lines used by both our Honorary Federal Co-Chairs—the Naval Meteorology and Oceanography Command and the NOAA National Data Buoy Center. Both know, understand, and center their missions around all sorts of data—from the ocean bottom to atmospheric and space weather, and recognize all are important to our planet.

We celebrated this theme with a Fireside Chat featuring two incredible explorers who have visited the extremes of our planet and beyond. We welcomed Apollo 13 Astronaut Fred Haise, a native of Biloxi, MS, whose mission had the world on edge for its return to Earth following numerous challenges during the space flight. Joining him was Retired Navy Captain Barbara Scholley, a diving professional whose career includes expeditions to the USS Monitor and recovery efforts following the attack on the USS Cole. Fred and Barbara answered

Applauded by OES and MTS Presidents and LOC General Chairs.

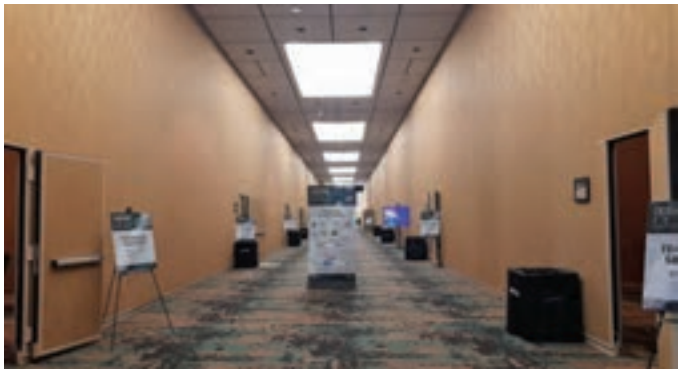
Packed Gala Attendees.

Ms. Mary Coakley Munk, Navy Captain (Ret) Scholley, Fred Haise, Rear Adm. Piret (From L to R).

questions directed at the differences and similarities of their careers, training, and missions. The conversation included their activities in giving back and supporting industry, nonprofit, and educational institutions to inspire the next generation of scientists and engineers in similar career paths.

Technical Sessions, Town Halls/Panels/ Workshops

OCEANS 2023 Gulf Coast represented the first resumption of the live/in person only attendance format. Up to eight parallel technical tracks were run during the seven session time tracks: two on Tuesday afternoon, four Wednesday morning and afternoon, and one on Thursday morning. The total number of presentations including the student poster competition and general poster sessions was 244 with authors from 24 nations.

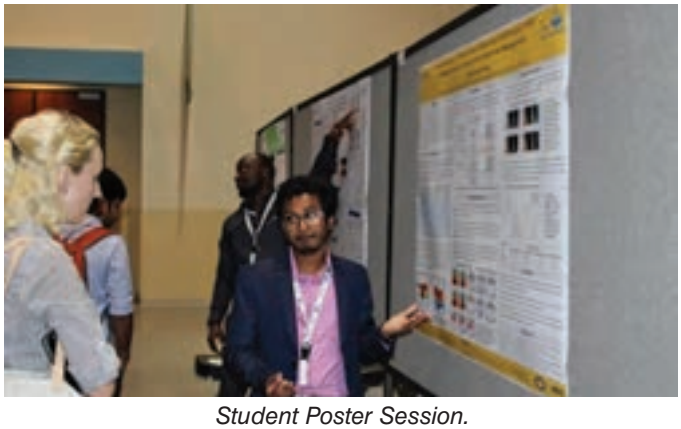


Technical session rooms.

Technical Session: Data Information Management.

Student Poster Competition

In addition to the standard technical tracks, OCEANS 2023 Gulf Coast hosted eight local interest tracks that focused on the rapidly growing blue economy across the maritime technology sector.



Student Poster Session.

The conference also hosted 14 panels and town halls on a variety of maritime technology and workforce development topics that were closely aligned with the technical program. These topics included:

- Operational Oceanography
- Offshore Wind Development
- Uncrewed Maritime Systems
- Tech Innovations for EEZ mapping
- Technological Innovation to Map, Explore, and Characterize the United States EEZ –

- Ocean Observing Technology
- Workforce Development
- Community-Based Ocean Observations
- NOAA's Ocean Enterprise
- Commercializing developing technologies
- IOOS and Regional/National Collaboration Federal and Port Business Opportunities
- Maritime Sensing Technologies for U.S. Navy
- Gliders
- American Leadership in Marine Technology

Charting the Future: Navigating Uncrewed Maritime Systems Through Regulatory Waters—Panel.

Committed Support to the OCEANS Program from Related Professional Societies

- The Hydrographic Society in America (THSOA)
- Association for Unmanned Vehicle Systems International (AUVSI)
- Society for Underwater Technology (SUT)

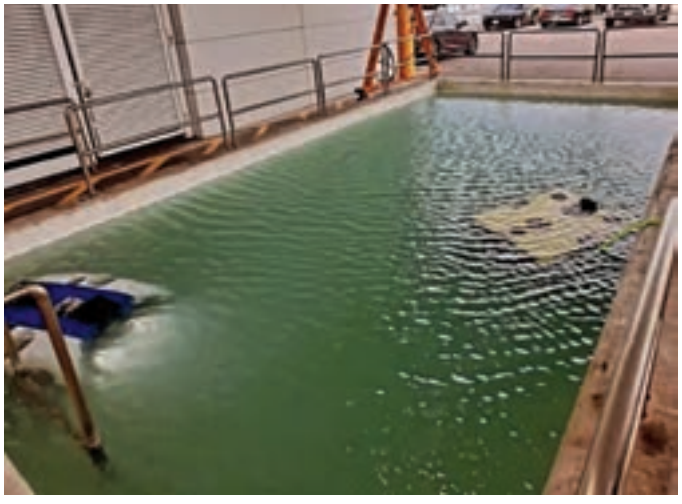
Operational Oceanography

The final day of OCEANS 2023 Gulf Coast appropriately closed with a focus and Panel on Operational Oceanography with Rear Admiral Ronald J. Piret, Commander, Naval Meteorology and Oceanography Command | U..S Navy, and Dr. William Burnett, Director | National Data Buoy Center, as speakers. The Naval Meteorology and Oceanography Command (NMOC) and the National Oceanic and Atmospheric Administration (NOAA) are leaders in operational oceanography with a workforce footprint, a combination of civilian, military, and contractor personnel, spread across the country and around the world. While science and technology are always at the foundation of operational oceanography programs, the mission of each organization provides the purpose, focus, and application. With significant overlap in the collection and application of meteorological and oceanographic data, NMOC and NOAA partner together to support the Advanced Naval Technology Exercise (ANTX) culminating event to the OCEANS 2023 conference and see it as an opportunity to maintain competitive technical advantage, while also supporting outreach to the broader scientific and academic communities.

ANTX Demo Day

What's ANTX? It's the Advanced Naval Technology Exercise. It's the process by which the Navy and their partners test new technologies in real-world mission scenarios (called vignettes) to see the advantages of integrating that technology permanently into that mission. Conference attendees were shuttled to the Port of Gulfport's new Roger Wicker Ocean Enterprise Facility. The University of Southern Mississippi served as host for ANTX results displays.

ANTX Demo Day Remus Display.



Roger Wicker Ocean Enterprise Facility Undersea Equipment/Vehicle Test Pool.

OCEANS 2023 Gulf Coast Co-Chair Special Award

Highly Successful OCEANS Conferences don't happen without incredible people. Laurie Jugan the OCEANS 2023 Gulf Coast Co-Chair was honored by Admiral Ron Piret and Dr. Bill Burnett with an award for her outstanding and sustained contributions to 4 highly successful OCEANS Gulf Coast Conferences and the marine technology community.

OCEANS 2023 Gulf Coast Co-Chair, Admiral Piret and Dr Burnett.

The Student Poster Competition at OCEANS 2023 Gulf Coast

Dr. Shyam Madhusudhana, OES Student Poster Competition Chair

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.

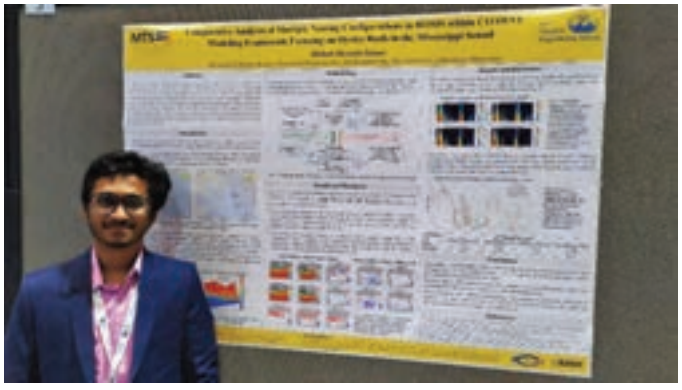
The success of the SPC would not be possible without the generous support of our sponsoring societies — OES and MTS. We extend our heartfelt gratitude to the Office of Naval Research (ONR) for their unwavering financial backing, which has allowed us to continue recognizing the next generation of brilliant minds. The Gulf Coast Section of MTS generously contributed prize money for this edition of the SPC.

The Local Organizing Committee's (LOC) SPC Chair, Stephen Howden, oversaw running of the SPC at the Gulf Coast OCEANS. This edition of the SPC received 81 abstracts, out of which 22 abstracts were shortlisted for the final program. The poster sessions were very well attended, and the students seemed to have enjoyed their time at the conference. We had a healthy panel of enthusiastic 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).

Poster sessions were well-attended on all days.

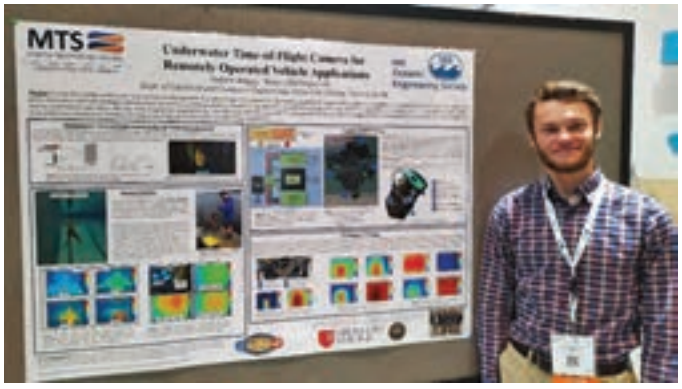
The list of participants (including the prize winners), together with their affiliation, poster title and an abstract of their poster, are given below.

First prize (Norman Miller Award) (Certificate and $ 3000)
Shihab Hossain Saran, The University of Southern Mississippi, USA
Comparative Analysis of Multiple Nesting Configurations in ROMS within COAWST Modeling Framework Focusing on Oyster Reefs in the Mississippi Sound



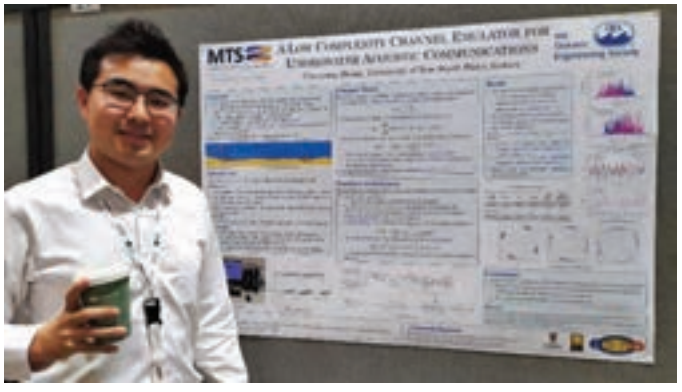
Abstract—The oyster reef restoration process in the state of Mississippi has recently culminated because of its decline trends over the past one and a half decades. Two successive years of low salinity in 2018 and 2019 due to the excessive freshwater inflow via the Bonnet Carré spillway opening counteracted the restoration efforts. To make the oyster restoration efforts successful in the Mississippi Sound, more accurate salinity and temperature estimates should be provided within and around the proposed reef locations (Bay St. Louis & Pascagoula Bay) to understand the variability in a broader way. As the Mississippi Sound is a complex estuary, a high spatial resolution of numerical simulation is necessary to capture the physical variability of this region at smaller scales. To provide more accurate results, different configurations of nested simulation (both one-way and two-way) are run using two separate high-resolution (133m) nested grids focusing on the locations of experimental oyster leases; near Bay St. Louis, and near Pascagoula Bay. Significant spatial salinity differences occur among the different nested solutions where the salinity gradients are stronger between the estuarine and shelf water masses in the Pascagoula Bay. One-way and two-way solutions show less spatial salinity differences in the water column of Bay St. Louis nested solution because of the less salinity gradients between the estuarine and shelf water masses due to the high freshwater influx and confined communication between two water masses at Bay St. Louis area. Due to the exchange of information between the parent and nested grids in two-way solution, both solutions show higher correlation coefficients than the one-way solutions when compared with the observed tidal and subtidal salinity data at MDMR Station 9.

Second prize (Certificate and $ 2000)
Andrew Bergey, Grove City College, USA
Underwater Time-of-Flight Camera for Remotely Operated Vehicle Applications



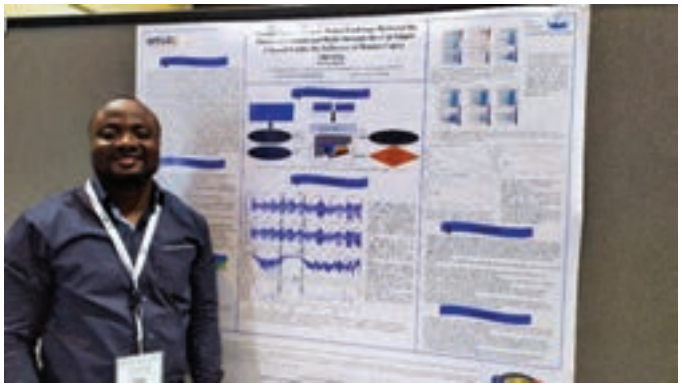
Abstract—This paper describes recent developments in the use of a time-of-flight (ToF) camera for 3D imaging aboard underwater vehicles. We have modified a commercial camera for use underwater with green illuminators and have packaged and deployed this camera as payload aboard a BlueROV2. In this paper, we describe the system hardware, including the 525 nm laser diode illuminator modules, the signal breakout board, and the wide field of view optics. We also show imaging and ranging results from laboratory and field tests with the 3D camera and discuss the challenges introduced by absorption and scattering in turbid water. We show preliminary results from a method for improving imaging in turbid water via backscatter subtraction.

Third prize (Certificate and $ 1000)
Chenyang Zhang, University of New South Wales, Australia
A Low Complexity Channel Emulator for Underwater Acoustic Communications



Abstract—This paper presents a low-complexity channel emulator for underwater acoustic communications. The proposed emulator utilizes Bellhop's underwater acoustic toolbox to calculate the channel response at the beginning and end of each stationary time interval. It also takes into account the motion of the transmitter and receiver to compute the Doppler factor. It applies a low-complexity resampling method for each path to generate the channel output signals during each stationary interval. This emulator assumes that the channel is doubly selective. To verify the emulator, a software-defined radio platform is used for implementation. The numerical results demonstrate that the proposed emulator achieves higher accuracy and much lower complexity than the existing underwater channel emulator based on Waymark.

Hameed Ajibade, The University of Southern Mississippi, USA
Quantifying the Flux of Water Exchange Between-the Mississippi Sound and Bight through the Cat Island Channel Under the Influence of Bonnet Carré Opening



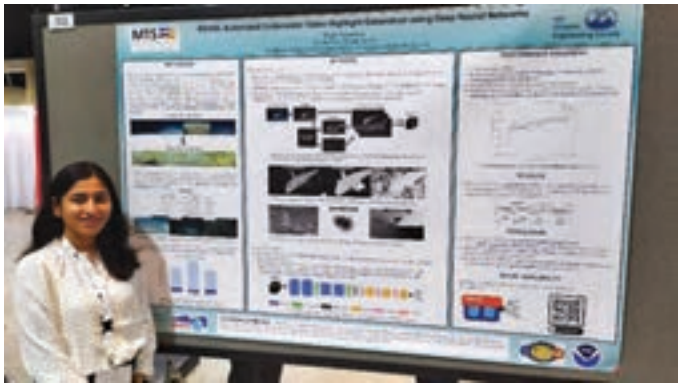
Abstract—The Great Mississippi Flood of 1927 was a major natural disaster in American history, resulting in extensive damage and the displacement of hundreds of thousands of people. As a response, engineers and policymakers sought to find a solution to effectively manage the river's flow during floods. They ultimately devised the Bonnet Carré Spillway system as a means of achieving this goal. The Bonnet Carré Spillway is a control structure designed to prevent flooding in New Orleans because of high Mississippi River flows during the spring freshet. Opening this structure modifies the dynamism of freshwater by diverting Mississippi River waters into Lake Pontchartrain and subsequently into the Mississippi Sound and Bight. The Bonnet Carré Spillway was opened twice in 2019 (February 27th and April 11th) with each opening lasting for more than 40 days. These two diversions significantly impacted the salinity environment of the MS Sound, resulting in catastrophic die-offs of the extant oyster population.

The Mississippi Sound and Bight is a point of interest to researchers and coastal managers due to the various fisheries and recreational economic engines housed in this region. Protecting these resources from potential hazards has been a top priority for the stakeholders involved. Understanding the northern Gulf of Mexico's complex circulation pattern and exploring the dynamism and the impact of water exchange between the Mississippi Sound and Bight is an important step in predicting and mitigating future harmful impacts. For this reason, among others, a 400 m resolution, 24-layer circulation model of the Mississippi Sound and Bight was developed. This model is based on a regional application established during the GoMRI-funded CONCORDE consortium (msbCOAWST) and has most recently been applied to assess proposed additional freshwater diversion infrastructure.

For the study presented here, our numerical modeling application is used in conducting a twin experiment with the aim of quantifying the changes in volume fluxes of riverine freshwater flowing into the western Mississippi Sound and how this

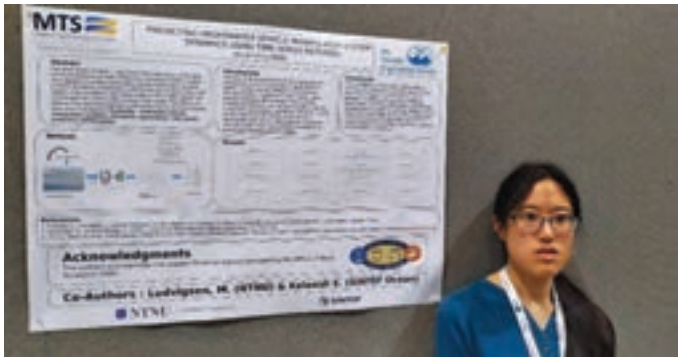
modified advective patterns and material exchanges with the Mississippi Bight through the Cat Island Channel. The first experiment establishes the state of the Cat Island Channel in terms of calculating the volume fluxes of freshwater from the various regional river sources, such as the Pearl River, entering the Mississippi Bight through the Cat Island Channel. The second experiment seeks to understand the changes in the freshwater volume flux when the Bonnet Carré Spillway is opened. Cat Island Channel is purposely chosen because of its role as an exchange pathway for estuarine (fresh) waters of Mississippi Sound and oceanic (saline) waters of Mississippi Bight; therefore, having a direct effect on the oyster reefs sites adjacent to the Cat Island Channel. Previous studies have involved studying the variability of salinity and temperature state of water mass in this same domain under the influence of Bonnet Carré and diurnal land-sea breeze circulation. These studies have shown that the 2019 diversions have to some great extent impacted the habitat suitability of most oyster beds in the domain of study. In support of the previous studies, this investigation aims at quantifying the freshwater fluxes which were not explicitly determined in earlier research. Having run a long-time simulation of the 2019 model, it was observed that during the first opening, the Bonnet Carré water pushes water eastward and subsequently southward through the Cat Island Channel. For this study, we focus more on the second opening of the Bonnet Carré spillway to examine the impact of the combined 2019 openings of the spillway on regional circulation patterns.

Puja Banerjee, University of Rhode Island, USA
ROVIA: Automated Underwater Video Highlight Generation using Deep Neural Network



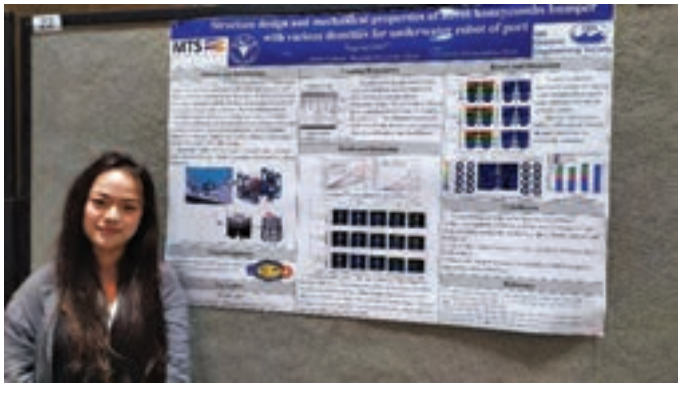
Abstract— Deep-sea video is one of the most important data sources in deep-sea science, but also an extreme challenge for data usage and archiving. With technological advances, underwater videos collected by HOVs (Human Occupied Vehicles), AUVs (Autonomous Underwater Vehicles and ROVs (Remotely Operated Vehicles) produce extreme volumes of data. For general use, underwater dive videos, however, can be sparse, with only a few high-value clips interspersed with hours of video relevant only to specific domains. The process of condensing such high-volume datasets can be time-consuming as human annotators must manually clip videos to identify highlights. Our study develops a portable and field-deployable CNN (Convolutional Neural Network) model to identify potential biological, geological, and operational highlights from long-dive videos. ROVIA is a smart deep-sea video highlight generator that effectively extracts spatiotemporal features linked to camera zooming, organism movement, and changes in optical flow to identify a highlight accurately. This automated highlight generator provides increased efficiency in condensing deep-sea video to aid in archiving and enhance the utilization of the clips for scientific and educational purposes.

Wai Yen Chan, NTNU, Norway
Predicting underwater vehicle manipulator system dynamics using time-series methods



Abstract—In this study, we apply two time-series models, Long Short-Term Memory (LSTM) and Vector AutoRgressive with eXogenous Variables (VARX) models to predict underwater vehicle manipulator system (UVMS) dynamics simulated in a ROS/Gazebo environment under two environmental conditions commonly encountered in the wave zone, namely splash zone conditions, and wave loads on the UVMS when it is fully submerged, but close to the surface of the water. We also investigate the effect of dataset size and heterogeneity on the performance of these models.

Jingjing Chen, Zhejiang University, China
Structure design and mechanical properties of novel honeycombs bumper with various densities for underwater robot of port

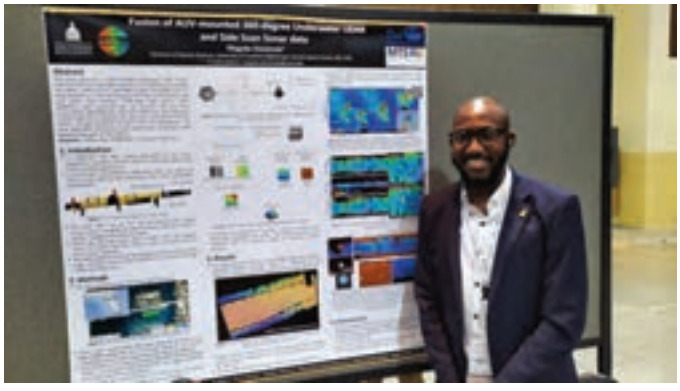


Abstract—In this paper, honeycomb bumpers with various densities were proposed, which absorb impact energy and provide support in engineering application of underwater robot of port. The Honeycomb bumper was based on Double Arrowhead Wings Honeycomb (DAWH) cell, which were mainly composed of double arrowhead honeycombs cell and fused with re-entrant honeycombs connection. In order to achieve longitudinal variable

density and gradient design, the number of cell layers, cell size, number of cells, and connection positions in the longitudinal direction of the honeycomb dumpers exhibited difference. The finite element model of honeycomb dumpers with three typical densities based on equivalent method were established and selected matrix of polyurethane with resistant to seawater corrosion. The mechanical properties, energy absorption characteristic, dynamic response, and structure efficiency of honeycomb dumpers were studied with rubber bumper. The mechanical properties, energy absorption, deformation mode, section plane, and strain energy were recorded and discussed. The stress and energy absorption of the structure increased with the increase of cell combination diffusion angle and cell density. Honeycomb dumpers possessed a cost similar to rubber bumper but significantly greater performance, which were of great significance for the application of underwater robot of port and coastal engineering.

Olagoke Daramola, The University of Southern Mississippi, USA

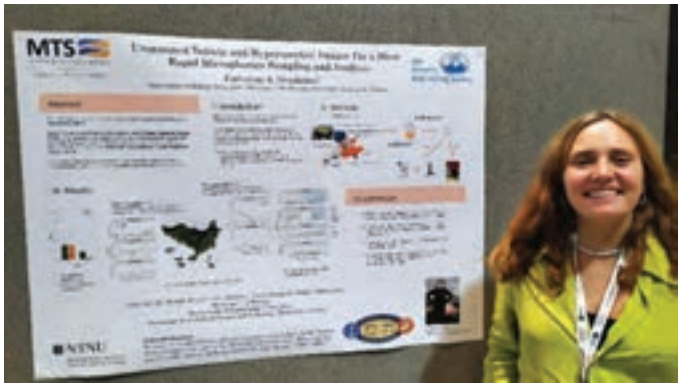
Fusion of AUV-mounted 360-degree Underwater LiDAR and Side Scan Sonar data



Abstract—Recent advancements in mapping coastal waters have birthed underwater bathymetric LiDAR systems, addressing the limitations of energy loss through the interaction of light with the air-water interface by Airborne bathymetric LiDAR systems. This study introduces an innovative and compact underwater 360° Pulsed Laser Line Scanner (PLLS-360°) system. This system boasts a 360° scanning angle and a 360° field-of-view (FOV) receiver, providing its ability to map the seafloor, water column, and water surface simultaneously thereby enhancing its utility in various scenarios. The PLLS-360° is suitable for diverse applications such as seafloor mapping, underwater asset inspection, and construction progress monitoring. The LiDAR system is integrated with an Iver3 AUV equipped with an interferometric side scan sonar (SSS) allowing LiDAR-sonar data fusion. A test involving mapping an artificial reef site at the Blue Heron Bridge in Florida, was carried out. The acquired LiDAR raw waveforms were corrected for spreading loss as the light returned from the target to the LiDAR receiver. The peak intensities of the corrected waveforms were detected, and the ranges were calculated from the peak position. The range was corrected for the AUV motion and georeferenced to obtain the final bathymetry. The sonar image and bathymetric data were fused, providing a more detailed description of the seafloor.

Catherine Deschênes, Norwegian University of Science and Technology, Norway

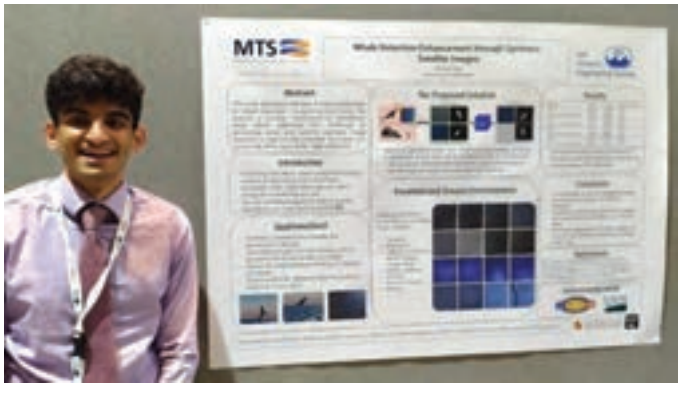
Unmanned vehicle and hyperspectral imager for a more rapid microplastics sampling and analysis



Abstract—In this paper, we present a proof-of-concept study aiming to improve the sampling and analysis of microplastics (MPs) by implementing a novel methodology combining an autonomous surface vehicle and a near-infrared hyperspectral imager (HSI). The field study was conducted from the 2nd to the 5th of August 2022 at Runde—a well-known bird preservation island on the Western coast of Norway. Over 35 samples from two different locations (*Exposed (A)* and *Sheltered (B)*), MPs concentration was at its highest (0.511 MPs/m^3) in location A. During the four days of sampling, at least 25 % of the data did not detect any MPs (0 MPs/m^3). Thus, we showcase an easy repeatable method towards the assessment of high variable MPs concentration using a Portable Catamaran Drones (PCD) and a near-infrared hyperspectral imager (HSI). The results from HSI were compared against Attenuated Total Reflection Fourier-Transform infrared (ATR-FTIR). No significant difference ($P > 0.05$) found at location A indicated that both instruments can provide accurate MPs concentration. A potential future correlation between MPs concentration and Key Environmental Variables (KEVs) could help to contribute to the modeling and policymaking world.

Akshaj Gaur, University of Maryland, USA

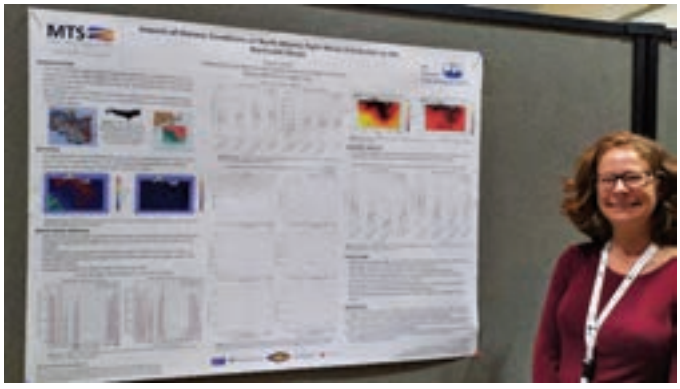
Whale Detection Enhancement through Synthetic Satellite Images



Abstract—With a number of marine populations in rapid decline, collecting and analyzing data about marine populations

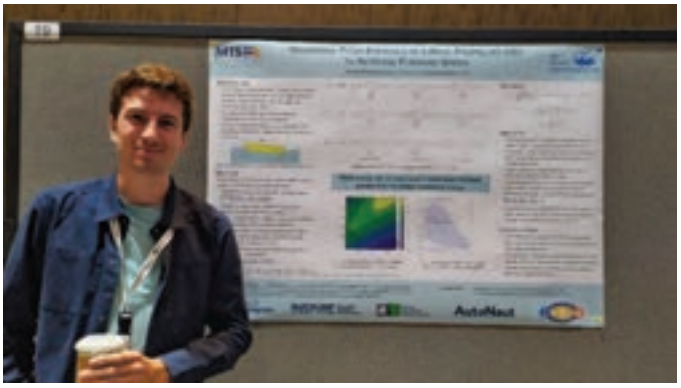
has become increasingly important to develop effective conservation policies for a wide range of marine animals, including whales. Modern computer vision algorithms allow us to detect whales in images in a wide range of domains, further speeding up and enhancing the monitoring process. However, these algorithms heavily rely on large training datasets, which are challenging and time-consuming to collect particularly in marine or aquatic environments. Recent advances in AI however have made it possible to synthetically create datasets for training machine learning algorithms, thus enabling new solutions that were not possible before. In this work, we present a solution—*SeaDroneSim2* benchmark suite, which addresses this challenge by generating aerial, and satellite synthetic image datasets to improve the detection of whales and reduce the effort required for training data collection. We show that we can achieve a 15% performance boost on whale detection compared to using the real data alone for training, by augmenting a 10% real data. We open source 1 both the code of the simulation platform *SeaDroneSim2* and the dataset generated through it.

Rhyan Grech, Rutgers University, USA
Impacts of Oceanic Conditions on North Atlantic Right Whale Distribution on the Nantucket Shoals



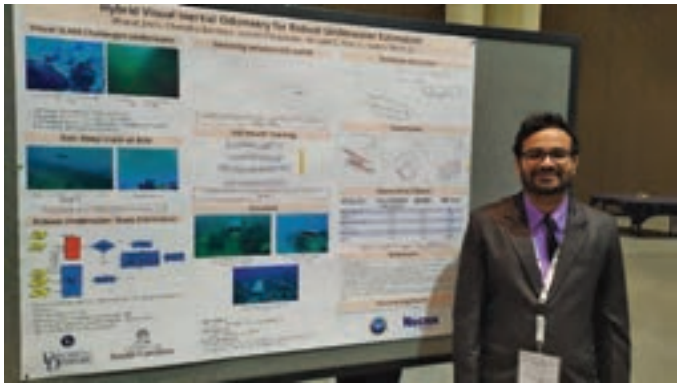
Abstract—The habitat of North Atlantic right whales, like that of countless other species, is changing as a result of a changing climate. As scientists, proactive policy makers and innovative industries look for climate change solutions, the ocean is seen as providing myriad opportunities in the new blue economy. Offshore wind offers a promising alternative to fossil fuels, but impacts of turbine surveying, construction and operation on right whales are still largely unknown. Over the past decade, researchers at the Anderson Cabot Center for Ocean Life at the New England Aquarium have documented changes in right whale distribution in a historic whaling area overlapping with planned offshore wind development on the southern New England shelf. During a decade of aerial surveys, right whales began using the area year-round, with increasing abundance trends found in winters and springs. This study examined changes in oceanic conditions on the southern New England shelf and Nantucket Shoals with a potential relationship to the right whale abundance shifts between 2013 and 2019. Maps of coastal water masses and the fronts between them provided by satellite data are the basis for this comparative study. We identified water masses and their gradients during each season prior to 2016, and each season after 2016. The number of unique water masses and associated statistics were calculated for each season, which suggested a trend of convergence of seasonal averages of unique daily water masses in the survey area. We also compared which specific water masses were present prior to 2016 with those afterward, and analyzed the characteristics of those that exhibited substantial changes. Results suggest an overall cooling of water in the study area during winters and falls, and an overall warming during springs. Gradient values increased during spring, summer and fall months from the first time frame to the second. The percentage of area in which strong gradients were found increased meaningfully in summer and fall on the Nantucket Shoals. The goal of this study was to further understand the dynamic habitat of an imperiled species to contribute to the creation of tools for responsible wind energy development. While a transition away from fossil fuels will mitigate climate change impacts, strong preservation policies must be simultaneously enacted to protect right whales as new energy infrastructure is added to their environment.

James Hawkins-Dady, University of Southampton, UK
Maximising Pitch Energies of a Wave-Propelled ASV to Increase Forward Speed



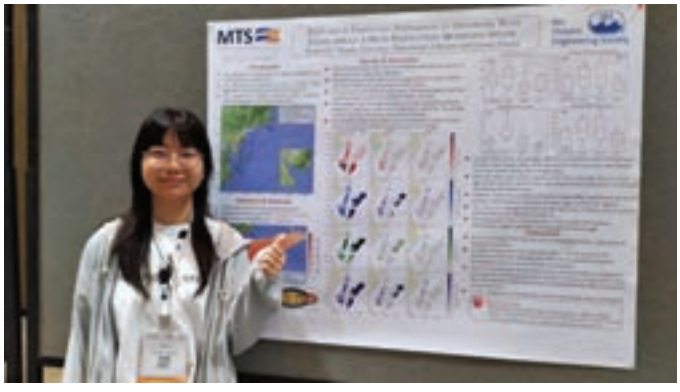
Abstract—Pitch-driven, wave-propelled vessels are able to use the energy contained solely within the waves to propel themselves across theoretically unlimited distances. For this type of platform, maximising the energy harnessed from the environment and transferred to the vessel's pitch motions is important for increasing forward speed. In this paper, a parametric range of hullforms based on a Wigley hull is analysed in terms of the average energy-per-second in the pitch motions and the average energy lost to added resistance. This reveals that there exists a range of hullforms where the energy in the pitch motions can be 1.6 times greater than the energy lost to added resistance. The analysis is repeated over a range of vessel drafts, which reveals that a beam to draft ratio of less than 3 allows a hullform to be designed to achieve this effect. This work indicates that the hullform is a crucial part of the functioning of a wave-propelled vessel, and it can be designed to maximise energy harnessed from the waves. Provided this energy is effectively transferred to the foils, it can lead to an increase in forward speed.

Bharat Joshi, University of South Carolina, USA
Hybrid Visual Inertial Odometry for Robust Underwater Estimation



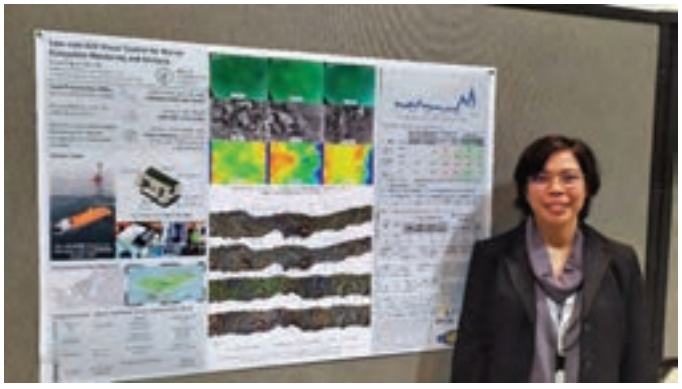
Abstract—Vision-based state estimation is challenging in underwater environments due to color attenuation, low visibility and floating particulates. All visual-inertial estimators are prone to failure due to degradation in image quality. However, underwater robots are required to keep track of their pose during field deployments. We propose robust estimator fusing the robot's dynamic and kinematic model with proprioceptive sensors to propagate the pose whenever visual-inertial odometry (VIO) fails. To detect the VIO failures, health tracking is used, which enables switching between pose estimates from VIO and a kinematic estimator. Loop closure implemented on weighted posegraph for global trajectory optimization. Experimental results from an Aqua2 Autonomous Underwater Vehicle field deployments demonstrates the robustness of our approach over different underwater environments such as over shipwrecks and coral reefs. The proposed hybrid approach is robust to VIO failures producing consistent trajectories even in harsh conditions.

Yachen Li, Rutgers University, USA
Estuarine Particles Simulations: the Connection Between Delaware Bay and Offshore Wind Lease Areas



Abstract—The issue of microplastics is becoming increasingly severe; meanwhile, there is a surge in the construction of offshore wind farms. The base of wind turbines can act as artificial reefs, playing a positive role in facilitating the proliferation of a variety of marine organisms and the establishment of ecosystems. However, the potential impact of microplastics from estuaries on the ecosystems within wind farms is concerning. In this study, we use the particle tracking model ROMSPath to perform a simulation tracking the trajectories of 3650 particles over a year to reveal the connectivity from Delaware Bay to offshore wind lease areas located in the Mid-Atlantic Bight. The results suggest that 92% of the particles released from Delaware Bay did not remain in any wind lease areas after 180 days. A total of 26 wind lease areas were reached by the particles, with the area hosting the highest percentage capturing up to 41% of the particles. The particles were released from the Delaware River near Wilmington, DE and it took a minimum of 54 days for them to reach the wind lease area nearest to the bay mouth. The average residence time of the particles ranges from 0.14 to 6.5 days, indicating it would be reasonable to assume a particular impact from estuarine outflow on the wind lease area ecosystems. This study provides a reference for understanding estuarine particles' dispersion and migration patterns entering offshore wind development zones.

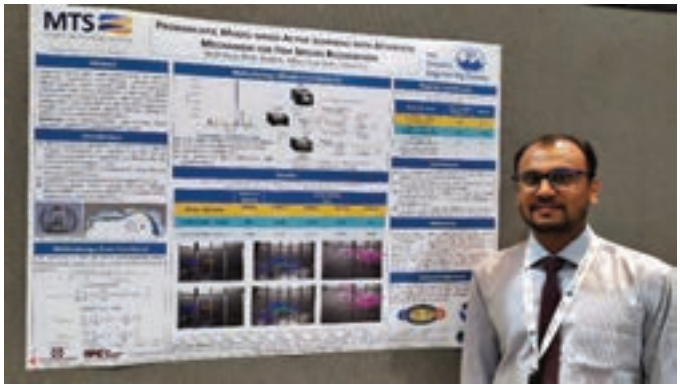
Marie Angelyn Mercado, The University of Tokyo, Japan
Low-cost AUV Visual System for Marine Ecosystem Monitoring and Analysis



Abstract—Marine protected areas (MPAs) play a vital role in safeguarding marine ecosystems and preserving their ecological and societal benefits. Japan, with its expansive marine territory, has designated a substantial area as MPAs. However, monitoring and analyzing these vast regions present challenges, necessitating significant resources and workforce. In recent years, the use of low-cost Autonomous Underwater Vehicles (AUVs) has emerged as a promising approach for data collection in MPAs, especially when coupled with visual data collection. This study aims to develop a cost-efficient visual system to attach to a low-cost AUV, enabling effective data gathering and analysis for ecological and economic purposes. Algorithms that use monocular and stereo image inputs were used to generate data such as 3D mosaic of the seafloor and dimension estimation of marine animals. By utilizing easy-to-obtain hardware visual systems, this research contributes to enhancing the efficiency and cost-effectiveness of data collection and analysis of MPAs.

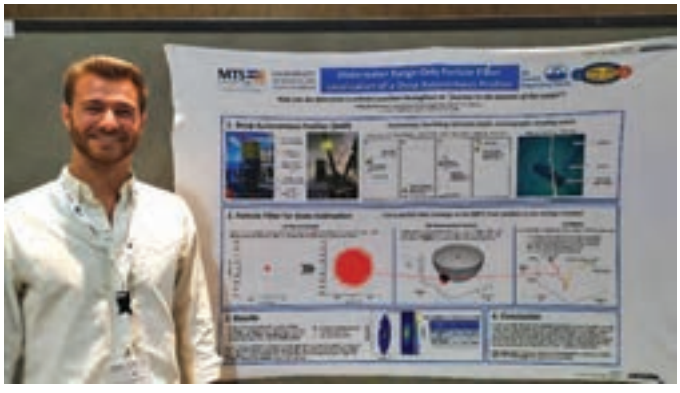
M M Nabi, Mississippi State University, USA
Probabilistic Model-based Active Learning with Attention Mechanism for Fish Species Recognition

Abstract—Accurate fish species identification is essential for stock assessments, production management, document ecosystem changes, and protection of endangered species. Image



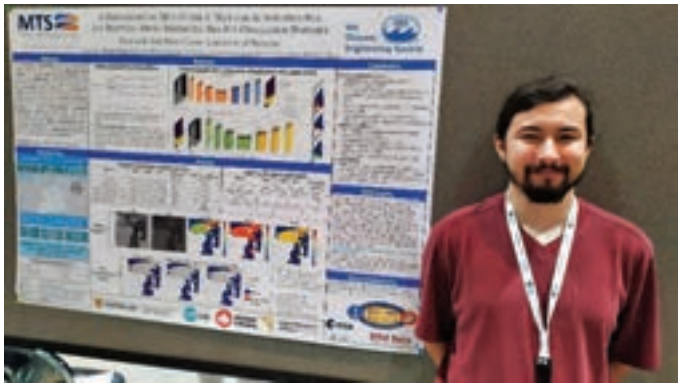
processing and computer vision techniques have been widely employed for fish species detection, classification, and tracking, reducing human efforts in these tasks. However, these methods often rely on extensive training data with correct annotations. Annotating many images captured from marine environments poses a significant challenge. This work proposes a deep-learning model designed for fish detection and classification. The model incorporates an attention mechanism named Convolutional Block Attention Module (CBAM) to improve detection performance. A popular Deep Active Learning approach with cost-efficient annotation is employed, which selects the most informative samples from the unlabeled set. The proposed method utilizes probabilistic modeling based on mixture density networks to estimate probability distributions for localization and classification heads. This study uses the Southeast Area Monitoring and Assessment Program Dataset 2021 (SEAMAPD21). Our model is compared with the conventional supervised algorithm. Experimental results demonstrate superior detection accuracy, achieving a mean average precision (mAP) of 41.6% with minimal labeled data, compared to traditional supervised approaches (mAP-36.7%) that rely on larger labeled datasets. The active learning method with the attention module effectively reduces annotation costs while maintaining excellent detection accuracy. Overall, our proposed deep active learning model with an attention mechanism proves to be highly effective for fish species recognition, providing significant advancements in accuracy and cost efficiency for fish detection tasks.

Phillip Parisi, University of Rhode Island, USA
Underwater Range-Only Particle Filter Localization of a Full Ocean Depth Autonomous Profiler



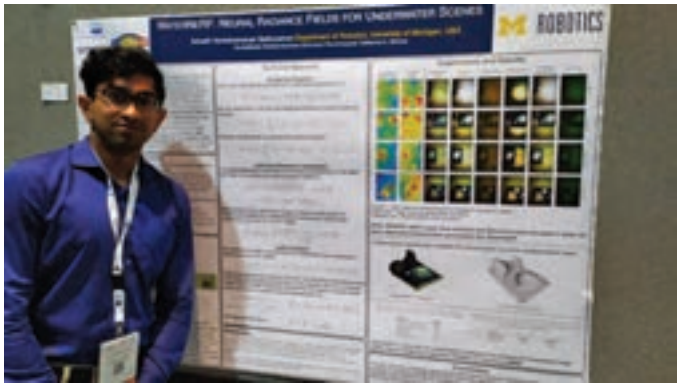
Abstract—Autonomous marine vehicles of various types have become essential tools for oceanographic research, enabling in-situ data collection in challenging marine environments. However, accurately determining the position of a vehicle during underwater missions remains a challenging problem which limits the effectiveness of data collection. This study utilizes a particle filter- based localization method for the hadal-rated Deep Autonomous Profiler (DAP). Our particle filter approach successfully estimates the DAP's position throughout its deployment using range only acoustic measurements. The computational efficiency allows for real-time implementation, making it suitable for a range of operations scenarios and other vehicles. The particle filter-based localization can provide precise placement of in-situ measurements and data collection, opening new opportunities for exploration and data-driven decision-making in marine sciences.

Fernando Pena Cantu, University of Waterloo, Canada
A Hierarchical Multitask U-Net for Automated Sea Ice Mapping from AI4Arctic Sea Ice Challenge Dataset



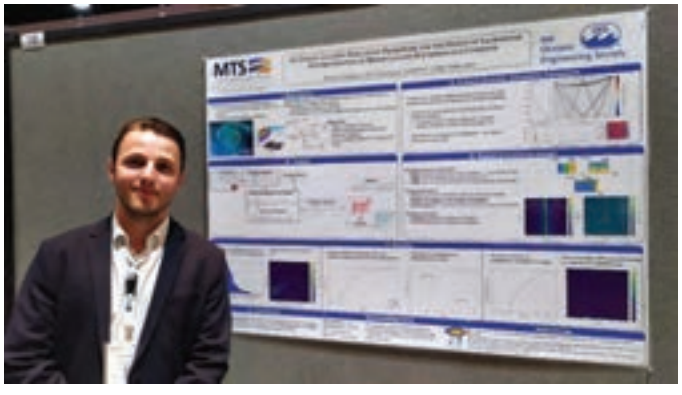
Abstract—Sea ice monitoring is a vital task for various applications, such as climate research, ship navigation, and Arctic sea route planning. However, manual generation of sea ice condition maps using synthetic aperture radar (SAR) imagery is time-consuming and labor intensive. To address this issue, the European Space Agency (ESA)-lab has created the AutoICE challenge with the AI4Arctic Sea Ice Challenge Dataset provided, which aims to develop deep learning (DL) models capable of producing segmentation maps for ice concentration (SIC), stage of development (SOD), and floe size (FLOE). Among different DL-based models, U-Net is a popular choice used for different sea ice segmentation tasks. However, the ice-water boundaries predicted by U-Net are not always the same between the three different tasks. In this paper, we investigate two methods to address this inconsistency and assess their impact on the model's performance. The first method is the introduction of a new loss function, the water consistency loss, which penalizes inconsistencies in the open-water class between the three outputs. The second method is to use a hierarchical U-Net, which first segments water and ice and then classifies the ice regions into finer categories. The results show that both approaches eliminate the inconsistencies between tasks effectively.

Advaith Sethuraman, University of Michigan, USA
WaterNeRF: Neural Radiance Fields for Underwater Scenes



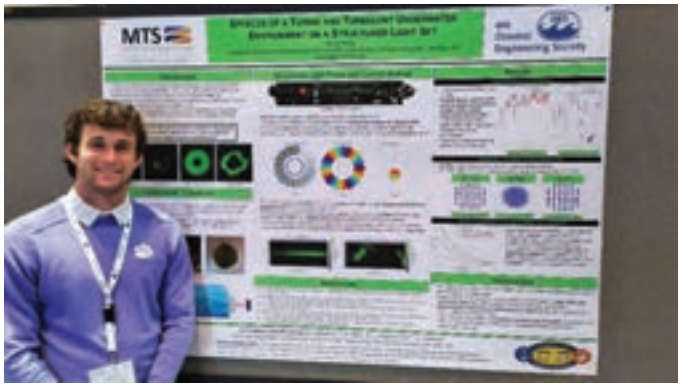
Abstract—Underwater imaging is a critical task performed by marine robots for a wide range of applications including aquaculture, marine infrastructure inspection, and environmental monitoring. However, water column effects, such as attenuation and backscattering, drastically change the color and quality of imagery captured underwater. Due to varying water conditions and range-dependency of these effects, restoring underwater imagery is a challenging problem. This impacts downstream perception tasks including depth estimation and 3D reconstruction. In this paper, we leverage state-of-the-art neural radiance fields (NeRFs) to enable physics-informed novel view synthesis with image restoration and dense depth estimation for underwater scenes. Our proposed method, WaterNeRF, estimates parameters of a physics-based model for underwater image formation and uses these parameters for novel view synthesis. After learning the scene structure and radiance field, we can produce novel views of degraded as well as corrected underwater images. We evaluate the proposed method qualitatively and quantitatively on a real underwater dataset.

Mathis Grangeon, IMT Atlantique, France
An Oceano-acoustic Simulation Framework for the Design of Lagrangian Systems Drifting in Mesoscale and Sub-mesoscale Currents



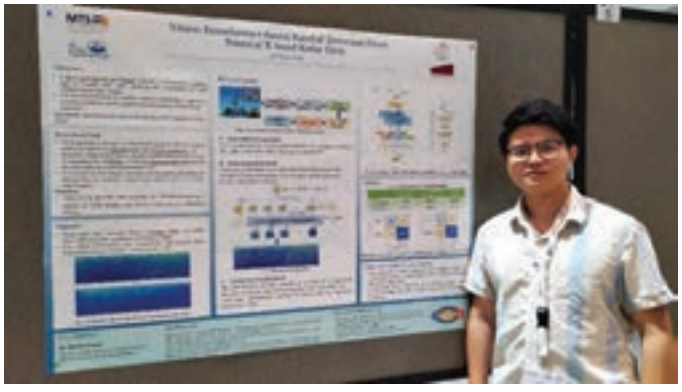
Abstract—Sub-mesoscale currents are of great interest for oceanographers but unfortunately their observation is a very difficult task. Lagrangian systems can be used to monitor them and require the implementation of an acoustic signal processing chain leading to the localization of each node of that system. In order to help the design of the Lagrangian system prior to sea trials, a simulation framework coupling the results of an oceanographic model with a ray trace software is presented. To illustrate the benefit of this framework, an experimental set-up composed of 5 sources and 20 floats which are drifting for 15 days is analyzed. A dataset of 358,000 frequency responses reflecting sub-mesoscale dynamics is built up. From this dataset, relevant statistics are calculated to define the best transmission parameters of the acoustic sources and to choose the right ranging method. It turns out that using pseudo-random sequences and allocating the spectral resources with Code Division Multiple Access method is a relevant design in our context. Also, it appears that a non-coherent ranging processor gives the best performance.

Jaxon Wiley, Clemson University, USA
Effects of a Turbid and Turbulent Underwater Environment on a Structured Light Set



Abstract—Real-world underwater environments present obstacles to optical systems including turbulence and turbidity. The effects of scattering and underwater turbulence on an optical system are observed simultaneously to optimize the propagation of structured beamlets through these conditions with minimized distortion.

Zhiding Yang, Memorial University of Newfoundland, Canada
Vision Transformer-based Rainfall Detection From Nautical X-band Radar Data



Abstract—Due to the sensitivity of the X-band signal to rain, rain may affect the precision of oceanic parameters retrieval from X-band marine radar images. In this paper, a vision transformer (ViT)-based approach is proposed to detect rain in X-band radar

data, allowing the recognition of rain-contaminated radar images. Given its ability to capture long-range dependencies in images and model global context effectively, ViT is considered as a promising alternative to convolutional neural networks (CNNs) for radar image classification tasks. Each radar image is first preprocessed and then separated into patches. They are subsequently flattened and embedded to form a sequence that is supplied to the transformer encoder block. Then, the outputs from the transformer encoder are aggregated to obtain the final classification result. The data in this study were acquired using a shipborne Decca marine radar system from south-southeast of Halifax, Canada. The real-time precipitation information was provided by a Non-Acoustic Data Acquisition System (NADAS) installed on the ship. The experiment results demonstrate that the ViT-based approach achieves a relatively superior rainfall recognition precision of 98.5% compared with the support vector machine (SVM)-based approach.

OCEANS 2023 Gulf Coast: Memory of A Lifetime

Shihab Hossain Saran, OCEANS 2023 Gulf Coast SPC First Prize Winner

Participating in the Student Poster Competition at the OCEANS 2023 Gulf Coast conference was like a dream come true to me as this is one of the most competitive and prestigious events for undergraduate and graduate students in the ocean sciences and marine technology fields. Though this is the second time I participated in the OCEANS conference, being selected as one of 22 finalists in the Student Poster Competition (SPC) for the first time has made this conference a significant life event of mine. Generally, when we think of participating in a science conference, we certainly think of sharing and presenting several research works, gathering recent scientific and technological knowledge and findings, and so on. However, participating in SPC at the OCEANS conference makes me realize that a conference can go beyond these opportunities. So, I highly encourage other students who are working with oceans should give a try to be a part of this great opportunity.

First, I would like to mention that if any student gets the opportunity to participate in SPC as a finalist at any OCEAN conference, all the expenses i.e., travel, accommodation, and registration are going to be covered by the conference authority. I express my cordial gratitude to IEEE Oceanic Engineering Society (OES), Marine Technology Society (MTS), and Office of Naval Research (ONR) for sponsoring this conference and SPC. As a part of student mixing, I participated in the dinner that was arranged for the SPC students where I got the chance to get familiar with the other students from different countries all over the world. That was an amazing experience for me as we all shared our research work and got the chance to discuss different cultures and foods in a welcoming environment. I never experienced such a great opportunity to build networks and make new friends at a conference I previously attended. One of the greatest surprises was waiting for us on the first day of the conference, 25 September, when we came to know that we were going to visit the Mississippi Aquarium riding on a large luxurious limousine. We spent about 4 hours there to enjoy different living fish of different species including the dance of dolphins. We captured these valuable moments as a memory of a lifetime.

Though I was initially nervous to attend the SPC, as this was my first time presenting a poster at a conference, the friendly environment with the other students made it enjoyable to present my research. At some point I felt that I was not competing; rather I was telling the story to the audience from different backgrounds. It was challenging, but at the same time, it was interesting when the audience interacted with me and gave their valuable feedback

A visit to the Mississippi Aquarium.

to me. Their feedback inspires me to continue my research work in full swing. Among the audiences, I got the chance to interact with different professionals i.e., faculty members, research scientists from famous research organizations, and professionals from different industries which eventually will help me to achieve my future career goals.

Becoming one of the finalists in SPC was a surprise for me and I was very excited to attend there. But the most surprising moment, which I never imagined, was yet waiting for me on the last day of the conference during the SPC award ceremony. I will never forget the moment when my name was announced as a winner of the poster competition. This award is special to me as for the first time I secured an award in recognition of my research work. This award will inspire me to go a long way in the research field. I want to dedicate this award to my newborn baby boy Saifan Hossain Suhrid, whose age was 25 days when I attended the conference.

Aside from presenting research and collaborating with different professionals at the conference, we all the students built our network, enjoyed every moment, and had lunch and dinner together. These valuable moments will remain fresh in my mind for the rest of my life. I became sad when I said goodbye to the other students at the end of the conference. I realized OCEANS 2023 Gulf Coast was more than a conference: a memory of a lifetime for me. I would like to encourage other students to give it a try to participate in the future OCEANS conference to make their own memories.

Winning Poster Paper

Comparative Analysis of Multiple Nesting Configurations in ROMS within COAWST Modeling Framework Focusing on Oyster Reefs in the Mississippi Sound

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***Abstract*—The oyster reef restoration process in the state of Mississippi has recently culminated because of its decline trends over the past one and a half decades. Two successive years of low salinity in 2018 and 2019 due to the excessive freshwater inflow via the Bonnet Carré spillway opening counteracted the restoration efforts. To make the oyster restoration efforts successful in the Mississippi Sound, more accurate salinity and temperature estimates should be provided within and around the proposed reef locations (Bay St. Louis & Pascagoula Bay) to understand the variability in a broader way. As the Mississippi Sound is a complex estuary, a high spatial resolution of numerical simulation is necessary to capture the physical variability of this region at smaller scales. To provide more accurate results, different configurations of nested simulation (both one-way and two-way) are run using two separate high-resolution (133m) nested grids focusing on the locations of experimental oyster leases; near Bay St. Louis, and near Pascagoula Bay. Significant spatial salinity differences occur among the different nested solutions where the salinity gradients are stronger between the estuarine and shelf water masses in the Pascagoula Bay. One-way and two-way solutions show less spatial salinity differences in the water column of Bay St. Louis nested solution because of the less salinity gradients between the estuarine and shelf water masses due to the high freshwater influx and confined communication between two water masses at Bay St. Louis area. Due to the exchange of information between the parent and nested grids in two-way solution, both solutions show higher correlation coefficients than the one-way solutions when compared with the observed tidal and subtidal salinity data at MDMR Station 9.**

***Keywords*—Oyster reefs, Mississippi Sound, ROMS, COAWST**

Funded by US Army Engineer Research and Development Center (ERDC)

I. Introduction

Over the last 130 years, about 85% of oyster reef habitats have been lost worldwide [1],[2]. A trending decline of the Eastern Oyster has culminated over the past one and a half decades in the northern Gulf of Mexico which is the largest remaining wild oyster fishery in the world [1]. The Eastern Oyster (*Crassostrea virginica*) is an ecologically, and economically important species which contributes to the coastal ecosystem by improving water quality, enhancing biodiversity and stabilizing shoreline [3],[4]. But rapid reductions in salinity caused by spring flooding and storms causes oyster mortality in areas prone to such freshet events [5]. Extreme freshwater events also increase nutrient loads into the coastal region which eventually lead to eutrophication that can be responsible for harmful algal blooms and hypoxia [6]. The decay of algal blooms can be responsible for oyster mortality [7] by creating hypoxia conditions (<2 mgL^{-1} O_2) and reducing pH levels [8].

Though the northern Gulf of Mexico contains more than half of the United States' oyster population, multiple stressors associated with the extreme freshwater input via the Bonnet Carré Spillway into the Mississippi Sound (MSS) have counteracted the oyster restoration efforts. The Bonnet Carré Spillway (BCS) is the final flood control structure on Mississippi River before it flows into the Gulf [9] and is located about 52 kilometers upstream from New Orleans [10]. The Bonnet Carré Spillway is operated by US Army Corps of Engineers to prevent flooding conditions at New Orleans above the levees' design flow rate of 35,400 m^{3}s^{-1} [9]. The Bonnet Carré Spillway has a design capacity to release up to 7000 m^3

per second of water into Lake Pontchartrain; the released waters enter the Mississippi Sound and Bight through the Lake Borgne estuary [9]. The higher frequency of flooding in the deltaic Mississippi River due to higher precipitation rate and land use changes has led to more frequent BCS opening in recent years [11]. BCS has been opened in 3 consecutive years (2018,2019 & 2020) for the first time ever and 2019 was the first time in which BCS was opened twice in a calendar year [9]. BCS Openings can create adverse ecological events, such as freshening the brackish waters of Lake Pontchartrain [11], toxic algal blooms due to very high nutrient loads of river water [11], and severe hypoxia events in the Mississippi Sound and Bight [12]. These adverse effects were evident during the 2019 spillway opening which caused 100% mortality of MSS shellfisheries at many locations in the Mississippi Sound [13]. Considering the adverse extreme events which severely limit oyster productivity and restoration effectiveness, a strategic assessment of oyster reef restoration is necessary to realize greater ecological return from future restoration efforts. In response to this need, establishment of experimental oyster leases was proposed in order to provide the guidance and assessment of restoration efforts of creating the oyster reefs on Gulf Sturgeon habitat utilization [14]. Following the artificial oyster reef establishment criteria, such as maintaining enough spatial coverage of the reefs to be representative of existing or future reefs created and being established within the same general area to reflect the within-site variability of factors of interest, four 50-acre oyster leases were recommended (two near Bay St. Louis and two near Pascagoula Bay) within the Mississippi Sound (BS, BN, PW and PE shown in Fig. 1).

Winds and freshwater inflow are the primary drivers of spatial and temporal hydrographic variability in the Mississippi Sound [15],[16]. The circulation in the Mississippi Sound is affected by the seasonal winds [10], [17], daily land-sea breeze, and weekly frontal passage of high energy storms [18]. The land-sea breeze is an important forcing that affects the coastal circulation and freshwater effluent mixing in the Mississippi Sound and Bight [18]. The combined effects of extreme freshwater inflow due to the BCS opening and strong land-sea breeze on the salinity variability in 2019 was assessed in a previous study [19] which was a continuation of CONCORDE (CONsortium for oil exposure pathways in COastal River-Dominated Ecosystems) synthesis 4D model of the northern Gulf of Mexico (nGOM). The CONCORDE synthesis circulation model was based on a 400-m resolution implementation of the Regional Ocean Modeling System (ROMS) within the Coupled Ocean-Atmosphere-Wave-Sediment Transport (COAWST) modeling system [20]. This spatial resolution is not sufficient to capture the needed detail in spatio-temporal variability of circulation, salinity and temperature within and around the 50-acre experimental reefs. As temperature and salinity are considered the most important factors which control the success and habitat suitability of oysters, it is important to accurately capture the variability of salinity and temperature. To do so, two high resolution nested grids of 133-m spatial resolution focusing on the experimental oyster lease locations are introduced to capture water quality (salinity and temperature) variability. This study aims to provide a comparative analysis of different nesting configurations (one-way vs two-way) in ROMS simulations within COAWST modeling framework. Ocean models which have structured grids, embedding high resolution grid (HR or child/nested/donor grid) within a certain area of the coarse resolution grid (CR or parent/receiver grid) in a nested grid modeling system is well-established method for capturing finer scale processes [21]. There are two basic techniques of nesting: one-way, and two-way. In one-way nesting, information is provided from the parent to the child grid as boundary conditions [22]. In two-way nesting simulation, information is also transferred back to the parent grid from the child grid (update) [21]. The one-way and two-way nesting algorithm along with its implementation has been shown in the previous studies [22],[21],[23],[24]. The study presented herein mainly focuses on (i) spatial salinity variability of both surface and bottom layer in the parent and child models using one-way and two-way nesting configurations (ii) water column variability focusing on the experimental oyster lease areas using one-way and two-way nesting systems and (iii) how well parent and nested grids of one-way and two-way nesting configurations capture the salinity variability in comparison of observed data.

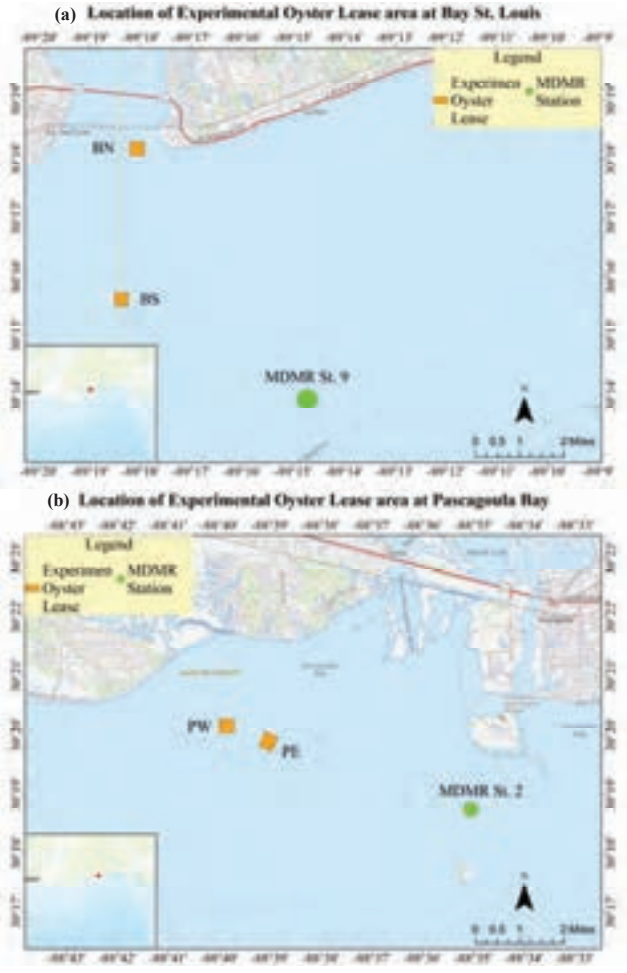


Fig. 1. 50-acre experimental oyster leases near (a) Bay St. Louis (BN & BS) and near (b) Pascagoula Bay (PW and PE). The leases are shown to the scale.

II. Methodology

A high spatial resolution (400-m structured grid, 24 vertical layers) application of COAWST (Coupled Ocean Atmosphere Wave Sediment Transport) modeling system [25] has been developed by the University of Southern Mississippi (USM) Ocean Modeling Group during the Gulf of Mexico Research Initiative (GoMRI)-funded CONCORDE (Consortium for Coastal River-Dominated Ecosystems) [20]. In this study, ROMS (Regional Ocean Modeling System) [26] has been run as an ocean circulation component within this COAWST modeling framework for the Mississippi Sound and Bight (msb-COAWST). The domain of parent model (PM) grid (400-m resolution) extends from Lake Pontchartrain system (western boundary) to the west Florida panhandle (eastern boundary) (Fig. 2).

To capture the finer scale variability in the proposed experimental oyster leases; two high resolution nested grids have been embedded in the coarser parent grid. This refinement occurs only in the horizontal direction and the ratio of the grid spacing between the parent grid and the nested grids is 1:3 as odd grid refinement factor simplifies the grid interactions which is explained in the previous study [27]. The refinement ratio is

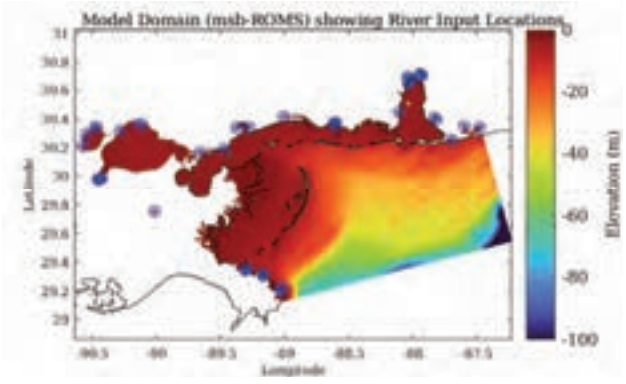


Fig. 2. Model domain of msb-COAWST with model bathymetry and river input locations (blue circles) [19]

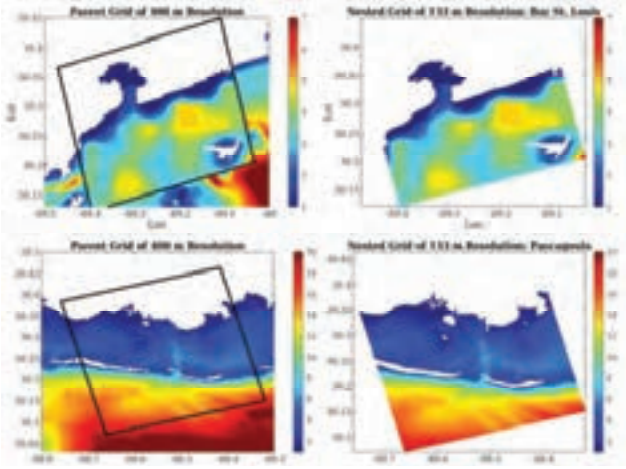


Fig. 3. 133 m high resolution nested grid covering Bay St Louis (upper) and Pascagoula (bottom) with their dimension shown in 400-m parent grid.

identical for both the nested model grids; Bay St. Louis and Pascagoula Bay nested grids which are shown in Fig. 3. Both nested grids have 133-m spatial resolution with 24 vertical layers. It is evident that the nested grids capture the coastline more accurately than the parent grid due to the refinement process (Fig. 3).

Though ROMS has the option to simulate the nested model using multiple nested grids in the same layer in the parent grid, this study simulates the nested model (both one-way and two-way) separately for the two separate nested grids to hindcast the shorter duration in winter season in 2019. Following the grid refinement, a time refinement factor of 3 has been applied to both HR one-way and two-way models to maintain the CFL (Courant Friedrichs Lewy) stability condition [27]. The basic algorithm for one-way and two-way nesting solution and the main steps mentioned in [27] to exchange the data between the coarse grid (CR) and high resolution (HR) grid at the baroclinic time step are shown in Fig. 4.

At first, the model is integrated on the coarse grid with a time step which is equal to the parent baroclinic time step (Δt_c). Then the coarse grid interpolates the necessary variables in time and space to provide the boundary conditions for the nested fine grid. Interpolation in the coarse grid occurs at the end of each fine grid time step and the fine grid completes its integration as many fine grid time steps as necessary to reach the coarse grid time step. At the end of the coarse grid time step, the coarse grid is updated by averaging the values of child grid. This update step is the only difference between the one-way and two-way nesting solution. In one-way nesting solution, the fine grid does not provide information back to the coarse grid [21],[22],[27]. This study only focuses on the application of different nesting system in the Mississippi Sound, while previous studies [21],[22],[27] focused on the one-way and two-way nesting algorithms with different applications of ROMS.

Fig. 5 shows the conceptual diagram indicating the input files and different boundary conditions applicable to both parent and child grids. In the parent grid, a Gulf of Mexico application of Navy Coastal Ocean Model (NCOM-GOM: 1-km spatial resolution) provides the lateral boundary conditions for water levels, velocities, temperature and salinity along the eastern and southern boundary of the parent grid domain [28]. NOAA High Resolution Rapid Refresh (HRRR) model provides surface boundary conditions of atmospheric forcing including winds, pressure, heat and buoyancy fluxes to both the parent grid and nested/child grids. Both the parent model and child models run

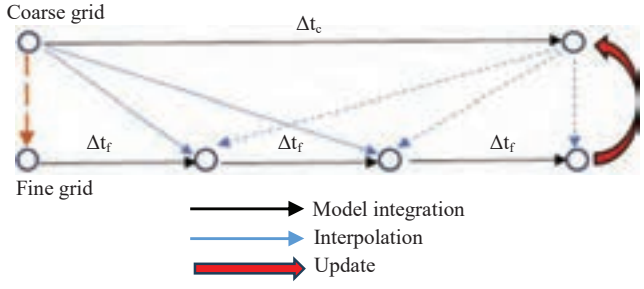


Fig. 4. Temporal coupling at the baroclinic time step between the coarse and fine grid for a time refinement factor of 3 [27].

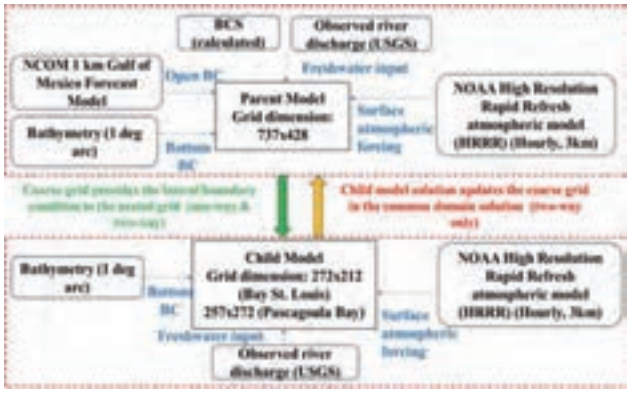


Fig. 5. Conceptual diagram showing different types of input data, boundary conditions and nesting information exchange.

with observed river forcing and the river forcing input cells are shown in Fig. 2 for the parent model. For child models, rivers which flow into the respective child grid domains are considered as river forcing for the respective child domain. The observed river discharges are obtained from the US Geological Survey (USGS) gauge stations while the Bonnet Carré Spillway discharge are calculated as reported by U.S. Army Corp of Engineers [28]. 1-arc second digital elevation model (DEM) provides the bathymetry in the parent and nested models [28].

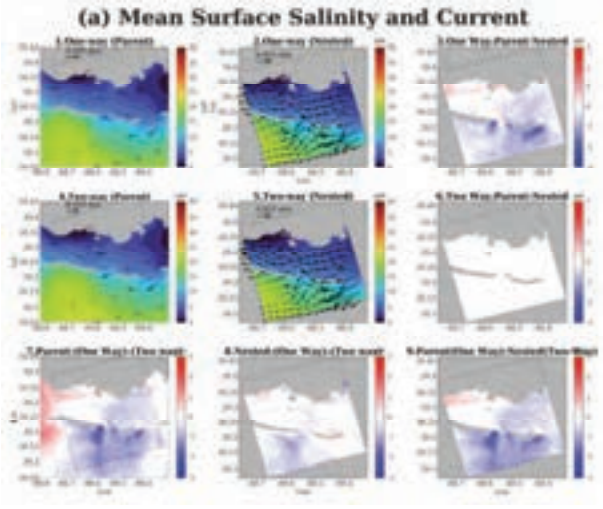
III. Results and Discussion

A. Spatial salinity variability in one-way and two-way nested configuration

Both one-way and two-way nested simulations using Pascagoula nested grid have been run for 25 days to hindcast from February 18 to March 14 in 2019. For Bay St. Louis nested grid, the simulation has been run for 18 days (18 February to 7 March 2019). As salinity is a good tracer to track the different water masses in the coastal zone, the hourly salinity snapshot from the output files in ROMS have been averaged in all cells' (both parent and child grids) surface and bottom layer for the respective duration of the simulations. The mean spatial variability of salinity and the associated differences among different configurations are shown in Fig. 6(a-d). In order to calculate the difference between the parent and nested grid, the parent grid structured data has been interpolated so that it can align with the nested grid structure data. It is evident that in the surface layer of Pascagoula nested simulations, there is no difference of salinity between the parent and nest solutions of two-way nested simulation in both surface and bottom layer (Fig. 6a & 6b) which is expected as parent and nested grid exchange salinity data at each baroclinic time step and child grid updates the parent grid in the common region of parent and nested grid.

The parent grid solution in one-way nested configuration shows significant differences with the parent grid solution in two-way nested configuration and child grid solutions in both one-way and two-way nested configuration as shown in Fig. 6a[3,7,8,9] and Fig. 6b[3,7,8,9]. The salinity differences generally occur in areas where shelf waters mix with estuarine waters and the differences are larger where the salinity gradients are stronger between the two water masses. This is because the refinement of grid resolution can lead to an increase of physical mixing and decrease of numerical mixing [29],[30],[31] which eventually affects the salinity of water column. For this reason, the surface layer is mostly saltier in parent (two-way) and child grid solutions (both in one and two-way) whereas the bottom layer is mostly fresher in parent (two-way) and child grids (both in one and two-way) than the one-way parent grid. As child grid updates the parent grid in the two-way nested simulation, both the difference plots between the one-way parent and two-way parent grid and between the one-way parent and two-way nested grid are identical 6a[7,9] and 6b[7,9] which is also expected. One important observation is that in the bottom layer of Pascagoula nested simulation (both in one-way and two-way) salinity differences occur only within the Mississippi Sound bound by the barrier islands while surface layer shows differences both inside and outside of the Sound. This is because, the estuarine return flow at depth varies in strength due to surface outflow, but it is always shoreward. So, salinity in the sound may be impacted by modification of total flux in, but source waters of the inner shelf are not.

Like the Pascagoula nested simulations, Bay St. Louis nested simulations (one-way and two-way) also show the salinity difference both in the surface and bottom layers in the parent and nested grids. But the extent and magnitude of the differences are much smaller than the Pascagoula nested simulations. This is because Bay St. Louis in the western Mississippi Sound, show less salinity variability in the water column because of the high freshwater influx and confined communications between this region and the Gulf of Mexico shelf specially in winter and summer season [19]. As the water column is mostly well mixed already, the nested simulation cannot cause significant salinity differences due to the increased physical mixing. But the differences might be significant at the end of the summer and fall season when water column is more stratified [19].



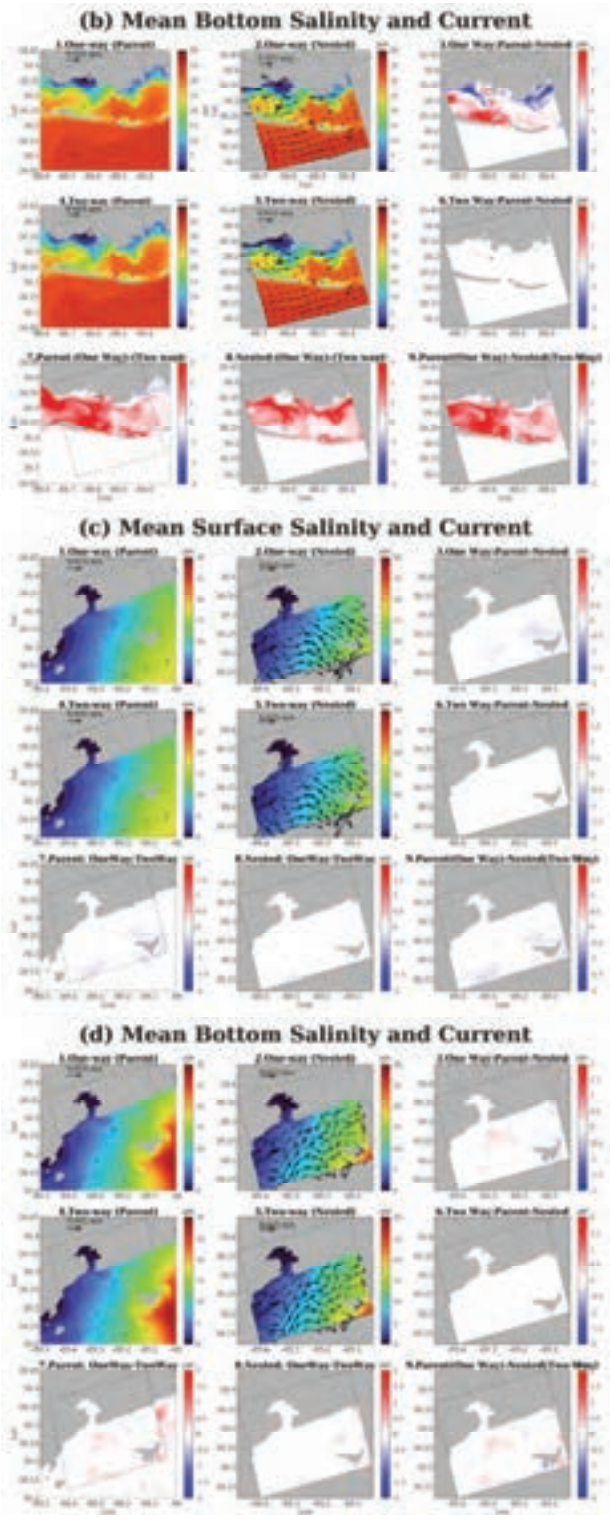


Fig. 6. Spatial variability of salinity and their differences among the different configurations both in surface and bottom layer of the Pascagoula (a-b) and Bay St. Louis (c-d) nested simulations.

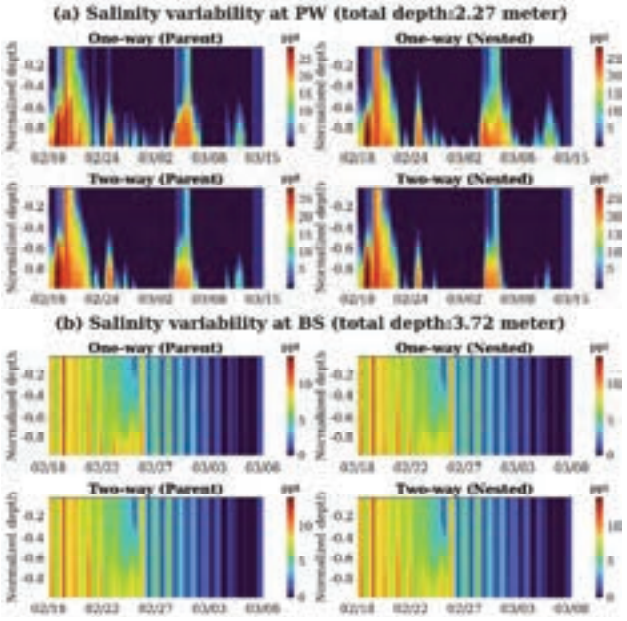


Fig. 7. Hovmöller diagram of hourly salinity inside the proposed experimental oyster leases; (a) PW and (b) BS

B. Water column variability at experimental oyster leases

Another focus of this study is to understand how parent and child grids in one-way and two-way nesting simulations capture the salinity variability in the water column as salinity is one of the major stressors for oysters and one of the most important factors for oyster habitat suitability. As the resolution of both child grids is three times higher than the parent grid, one cell in parent grid will be equivalent to 3x3 cell in the child grid. That's why 3x3 cell spatial average salinity in child grids have been used to compare the water column variability of oyster leases with the parent grids which is shown in Fig. 7 (a-b). One oyster lease location near the Bay St. Louis (BS) and another near the Pascagoula (PW) (Fig. 1) have been considered to plot the Hovmöller diagram of salinity showing the vertical variability of salinity (along the water column) over time in Fig. 7.

Like the spatial salinity variability, parent (two-way) and child grid solutions (both one-way and two-way) indicate higher physical mixing than the one-way parent grid in the water column at PW (Fig. 7a). Around 20th of February, one-way parent grid shows strong gradients of salinity throughout the water column than the rest with a more homogenous water column due to the increased mixing at PW. In that particular day, the water column is saltier in all the grids when compared to the one-way parent grid. But when there is less shelf water coming into the PW lease area, the water column becomes homogenous in the parent and child grid of two-way nested simulation whereas parent grid of one-way simulation shows stratification in the water column (Fig. 7a). The different configurations of nested simulations show mostly identical water column salinity variability in the BS oyster lease area near Bay St. Louis. As previously mentioned, this region is well mixed in winter, so there are no significant differences observed in one-way and two-way nested simulations. It is worth mentioning that BCS was opened on February 27 in 2019 [32] and the BCS opening

effects are evident in all the simulations (Fig. 7b) during March as salinity drops to nearly zero in the water column in BS which is close to Lake Pontchartrain estuary through which BCS water comes into Mississippi Sound.

C. Tidal and Subtidal Variability of Salinity

This study also aims to compare the salinity variability of different nested models with the observed data collected from the Mississippi Department of Marine Resources (MDMR) monitoring stations operated by the United States Geological Survey (USGS). In this study salinity extracted from the model hourly output has been compared with the hourly observed data at MDMR station 9 (Fig. 8). For subtidal salinity variability, 48 hours moving mean has been applied to both the observed data and simulated data to smooth out the tidal frequencies. The coefficient of correlation (R^2) values from the regression analysis is shown in Table 1 for one-way and two-way parent and child model. As, MDMR station 9 is within the Bay St. Louis nested grid, the Bay St. Louis nested simulations have been considered for short term trend analysis of different nested models with the observed data. It is evident that all the model configurations capture the observed salinity trend very well. The models capture the subtidal salinity variability comparatively better than the tidal variability at MDMR station 9. Both the parent and child solutions in two-way nested simulation show R^2 values higher than the one-way nested solutions due to the continuous exchange of information. It is also evident that for this particular time, the salinity difference can be much higher among the one-way and two-way nesting configurations (Fig. 9) which eventually can be crucial for the survival of oysters if salinity drops below 5 for larval or below 2 for adult oysters.

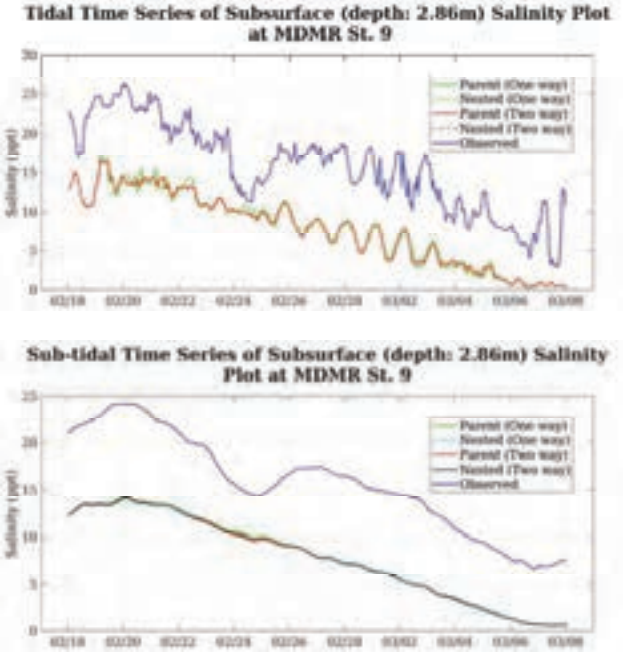


Fig. 8. Comparison of time series of salinity of different nested configurations with observed data at MDMR station 9 for (a) tidal and (b) subtidal circulation

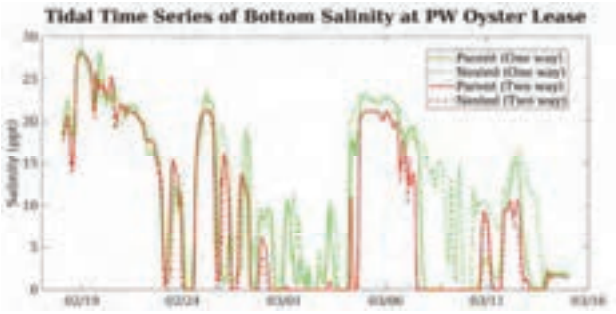


Fig. 9. Temporal variability of bottom salinity for one-way and two-way (Parent and Child model) simulations within the experimental oyster reef PW

TABLE I. COEFFICIENT OF CORRELATION (R^2) VALUES FOR DIFFERENT NESTED MODELS

Simulations type	R^2	
	Tidal	*Subtidal*
Parent (One-way)	0.835	0.976
Nested (One-way)	0.845	0.979
Parent (Two-way)	0.853	0.983
Nested (Two-way)	0.848	0.982

IV. CONCLUSION

Eastern Oysters are one of the important species in the coastal ecosystem for their ecological and economical contribution. But the continued lack of productivity of oyster reefs in the northern Gulf of Mexico creates critical ecological and economical issues for this coastal region. Extreme freshwater inflow due to frequent Bonnet Carré Spillway openings in recent years (2018,2019 & 2020) limits oyster reef restoration efforts in the Mississippi Sound. To make these restoration efforts successful, establishment of experimental oyster leases are necessary to provide a platform for research and demonstration purposes to provide science-based guidance and assessment actions on Gulf Sturgeon habitat utilization. Supporting these efforts with a high resolution nested numerical model will provide a broader understanding of the circulation and hydrodynamics within and around the experimental oyster leases.

This study applied one-way and two-way nested model configurations focusing on the experimental oyster reefs in the Mississippi Sound for a shorter timescale so that a suitable configuration can be selected to hindcast the extreme freshwater inflow for longer time-scale simulation. It is evident that the present 400-m msbCOAWST grid can overestimate or underestimate the salinity significantly at times. The two-way parent and nested solutions both capture the observed salinity trend more accurately than the one-way solutions for the shorter simulated period. But it is better to consider all the seasons to assess the variability of salinity by embedding the nested grids in the same layer of the parent grid which will be the next step of this study to enable well informed decisions considering the 4-D spatial and temporal distribution of physical and water quality conditions.

ACKNOWLEDGMENT

We thank U.S. Army Engineer Research and Development Center's (ERDC) Environmental Laboratory for funding provided for the cooperative agreement titled "Experimental Oyster Leases as a Platform for Demonstrating Effective Restoration Strategies and Assessing Influence on Gulf Sturgeon Habitat", managed through the Ecosystem Management and Restoration Research Program. The authors acknowledge HPC at The University of Southern Mississippi supported by the National Science Foundation under the Major Research Instrumentation (MRI) program via Grant # ACI 1626217.

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OCEANS 2024 Singapore—'Like No Other OCEANS'

Venugopalan Pallayil, General Chair of OCEANS 2024 Singapore

Singapore hosted the first in-person OCEANS conference in 2006. Like us, many of you were also disappointed when we had to cancel the OCEANS 2020 Singapore conference due to the Covid-19 pandemic. However it was also an opportunity for us to organise the first ever virtual OCEANS conference jointly with our colleagues in Gulf Coast and the conference was very successful.

Singapore is now all set to organize the next in-person **OCEANS Conference** during **15–18 April 2024**. The conference is expected to attract about 700 delegates and 50 exhibitors who will showcase their latest research and technologies in the area of ocean science and engineering. 524 abstracts have been received and once the reviews are completed, we expect 350 to 400 technical presentations at the conference. The conference theme "**Climate resilience, coastal protection and a sustainable Ocean,**" has great significance, not just for Singapore, a small Island nation, but for the region and the world. The conference will feature sessions and topics focused on this theme and beyond. Apart from the regular technical sessions, Keynote presentations, Panel sessions, Town Halls, and the Student Poster Competition are all part of the OCEANS 2024 Singapore.

The conference venue, **Sands Expo and Convention Centre, Marina Bay,** is an iconic venue, often dubbed as a 'mini city,' featuring an infinity swimming pool on its top. The SkyPark at Marina Bay Sands provides a stunning view of the city, a must-see photo opportunity for visitors and locals alike. The ArtScience Museum always has a top-quality exhibition, and Gardens by the Bay is a fascinating manifestation of the government's vision of Singapore as a "city in a garden." Enticing Marina Bay is well worth a visit.

Figure 1. OES site visit to Singapore – 2006 Conference.

Figure 2. Sands Expo Convention Centre (left) and Arts Science Museum.

Technical Tours

We propose to organise three technical tours during the conference to entice our delegates. These are listed below:

1) Technology Centre for Offshore and Marine, Singapore (TCOMS) is a world class next generation Deepwater Ocean Basin research facility, which is equipped with advanced wave and current generation systems to simulate challenging ocean environments that marine platforms and ships operate in. More details on this facility can be found here: https://www.tcoms.sg
2) St Johns Island National Marine Laboratory (SJINML) is Singapore's only offshore marine research facility managed by the National University of Singapore (NUS). Strategically located near the Sister's Island Marine Park, the first designated Marine Park in Singapore, the facility is built as a National Research Infrastructure. Thirty minutes by boat from the mainland, this facility hosts marine research labs, an aquaria and other supporting facilities including a small research vessel. Read more on this facility here: https://sjinml.nus.edu.sg
3) Singapore New Water Plants (SNWP) produces 12% of Singapore's current water needs. Integrated with Changi water Reclamation Plant, the Sembcorp NEWater Plant is one of the only large-scale water recycling plants in the world to be housed on top of a water reclamation plant. You can find details of this facility here: https://www.siww.com.sg/spotlight-2023/programme/technical-site-visits/changi-water-reclamation-plant-n-sembcorp-newater-plant

Nurturing Future Leaders: Inaugural IEEE OES Summer School 2024

Embarking on a new chapter of educational excellence, the IEEE Oceanic Engineering Society (OES) proudly announces the debut of the IEEE-OES Summer School. It opens doors to a realm of interdisciplinary exploration. Over two immersive days, participants will delve into a diverse range of topics, guided by presentations from distinguished experts in oceanic engineering. This platform serves as more than just an educational experience; it's a catalyst for building lasting connections, fostering mentorship opportunities, and initiating collaborative research dialogues. The Summer School is targeted towards Graduate Students, Young Professionals (YPs) and Early Career Ocean Professionals (ECOPs) and is being organised on the 13th and 14th of April, 2024. Checkout the OCEANS 2024 Singapore conference website for more details.

The Singapore AUV Challenge (SAUVC)

This event needs no introduction. Since 2013, IEEE OES Singapore Chapter has been organising SAUVC, a swimming pool-based AUV competition for tertiary students. In 2024 this event will be held during 5–8 April, a week before the OCEANS conference kicks off. We expect 250 to 300 students from over 15 countries to participate in the 2024 competition. The top three teams of the competition will compete in a grand challenge at the TCOMs deep sea test facility where their vehicle will fight against currents and waves to perform the designated task. Catch the fun and visit www.sauvc.org for more details of the competition.

Figure 3. Images from SAUVC 2022.

Explore Singapore

Attending a conference is not just about participation in the technical program and exhibition. It also provides delegates over the world an opportunity to explore, understand and experience the unique cultures of the country where the conference is being held. One of the safest countries in the world, Singapore is also the best example of how people of different religious faiths can co-exist in peace and harmony. A Garden City state with lush green vegetation in an urban setting, a good transportation system, a world-class airport, mouth-watering international cuisine, and ease of communication in the English language all make it very special for visitors. This is also a great opportunity for visiting many neighbouring countries such as Malaysia, Thailand, Vietnam, Cambodia, and Indonesia, to name a few, which are all 2 to 3 hrs by flight from Singapore.

Singapore Maritime Week is another event scheduled to be on the same dates of OCEANS and will be held at Suntec City, just blocks away from Sands Expo Convention Centre. This is yet another opportunity for our delegates to go and attend another maritime event when they are in Singapore. So, come, participate, and experience an exciting week of conference together with us.

Figure 4. Tree top hotel with the convention centre in the backdrop.

Who's Who in the IEEE OES

Gabriele Ferri, IEEE Senior Member, 2023 IEEE OES Distinguished Technical Achievement Award, OES AdCom Member 2024–2026

The apple does not fall far from the tree, they say. Sometimes, it does.

I was born in Piombino, a town located on a promontory along the west coast of Italy. A promontory protruding into the sea, with the eyes gazing at Elba Island and the other pearls of the Tuscan archipelago.

I spent the long days of my childhood on sunny beaches and bays, by swimming and diving, and by hunting for little crabs while exploring mysterious sea-side cliffs.

Developing a passion for the sea was unavoidable.

And then there was my father, who instilled in me many strong interests and passions, which would eventually steer all my personal and professional life.

History, art, and, in particular, a huge curiosity and love for computers and science fiction.

Fascination for the unknown and for science fiction stories are typically the best sources of inspiration for young roboticists. This was true for me.

This heterogeneous mix of passions led me naturally to earn a Master Degree in Computer Engineering with a specialization in Robotics at the University of Pisa in Italy.

After graduating, I started my professional journey by joining the passion for computer science with robotics, working as a Software Engineer at a Leonardo company, by developing the system of control and guidance of a new autonomous vehicle.

Successively, strange coincidences in life led me to come back to the academic life. I started a PhD in Biorobotic Science and Engineering, jointly at Scuola Superiore Sant'Anna of Pisa and IMT Advanced Studies Lucca. My PhD research focused on using biorobotics for the mapping and localization of potentially dangerous chemical sources. This provided me also the opportunity to spend one year at the Woods Hole Oceanographic Institution (WHOI) in Massachusetts, USA. There, I developed novel autonomy algorithms for hydrothermal vents prospecting for the amazing ABE AUV, at the same time getting fascinated more and more by the ocean's depths and mysteries.

In that period, my professional passions matured in the long-lasting objective of developing smart and autonomous robotic networks capable to accomplish useful tasks in the real world.

I pursued this ambition during my Post-Doc period at Scuola Sant'Anna, in which I worked in the DustBot EU project, developing a network of urban robots for automatic garbage collection. Then, I had the chance to be the project leader of the HydroNet EU project, which developed a hybrid robotic network composed of buoys and autonomous catamarans for environmental monitoring.

My path to marine robotics was definitely marked. I started a new position as a Research Scientist at the NATO STO Centre for Maritime Research and Experimentation in La Spezia, Italy, in 2013.

Since then, I have been working on robot cooperative autonomy in communication-limited environments and I have been investigating the whole spectrum of topics related to the development and control of heterogeneous robotic networks. Over the years, I had the chance to develop and extensively test autonomy strategies in real-world scenarios, by combining the development of innovative multi-robot solutions with their extensive validation in the field. The results achieved in many sea trials demonstrate that cooperative autonomy solutions not only can increase the effectiveness of robotic networks, but also proved that they can be used actually in real-world scenarios.

Figure 1. Sometimes field robotics can be tough. I was walking with DustBot, the fully autonomous trash-collecting robot, in Orebro, Sweden, in July 2009, the day before a project demo. The robot was not yet fully convinced about what to do the following day.

The field experience taught me that robot vehicle deployment can be challenging for the best of veterans. For small research groups from academia, this difficulty is increased by orders of magnitude. For this reason, I started getting involved with robotics competitions with enthusiasm, with the aim of both disseminating robotics and AI and of supporting the new generations of oceanic scientists and engineers.

CMRE has a long tradition in organizing robotics competitions, starting from 2010 with the Student AUV Challenge-Europe (SAUC-E), the leading student AUV competition in Europe. I inherited the charge of SAUC-E Technical Director and I started leading the CMRE Robotics Competition Program in 2013.

Over these last 10 years, I have been heavily involved with the robotics community by organizing increasingly complex

Figure 2. The organizing team of the European Robotics League Emergency 2017 in Piombino, Italy. Beyond a successful event there is always a great team.

Figure 3. Award ceremony of RAMI23, in July 2023. RAMI is the latest of our competitions focusing on Inspection & Maintenance missions in an Oil & Gas scenario.

competitions, which were also events for the specialized and the general public. I was the General Chair of euRathlon 2015 Grand Challenge and of the European Robotics League Emergency 2017, the first and so far unique world's competitions challenging international multi-domain robotics teams (sea, land and air) in realistic search and rescue objectives during mock-up emergency missions held at a real power plant.

It has been incredibly rewarding to support young generations of marine engineers and scientists, providing them training grounds and observing their initial steps into the robotics community!

It was only natural that this activity put me in contact with IEEE OES, which has always been fundamental in supporting our events. OES has strongly believed in my work and has sponsored our competitions since 2015.

Since 2017, I have been serving as the Chair for Europe of the IEEE OES Marine Autonomous Systems Competition Committee (MASC2). MASC2 Committee was born with the aim of homogenizing marine robot competitions around the world.

Along my career, I have pursued my passion for robotics and the ocean in my research activity, by organizing large competitions and events relevant to robotics and artificial intelligence, and with talks aimed at young students and the general public. It has been an incredible journey, made possible by the great friends and collaborators I met along the way.

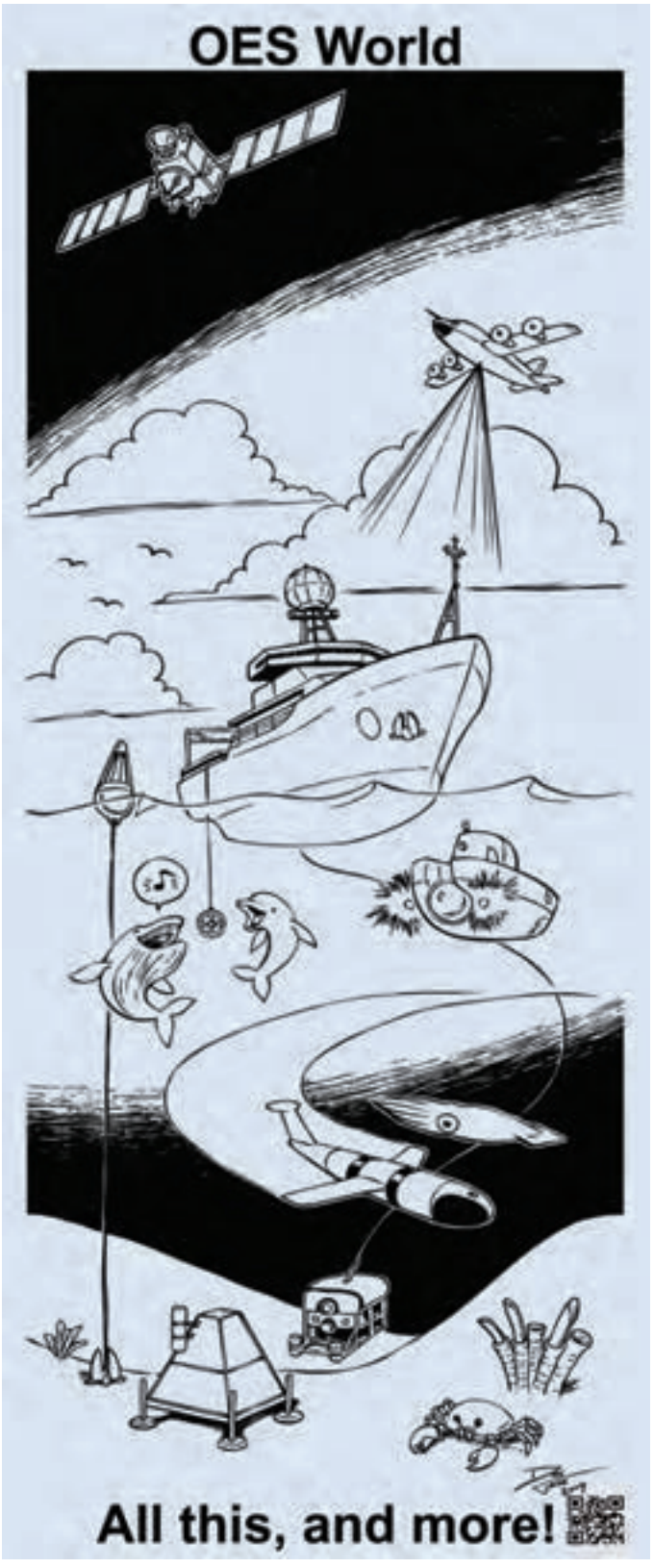
The passions of that little boy hunting for crabs are still present today, even stronger, and have always been the polar star that has guided my steps through new challenges, ideas, difficulties, defeats and great achievements.

The significance of this continuing journey has been acknowledged by IEEE OES with the 2023 Distinguished Technical Achievement Award. I am deeply honored for this award and I want to respectfully thank all my mentors and collaborators, and also those who have criticized my activities. This was the decisive incentive to go ahead.

Even more, I want to gratefully dedicate this award to the memory of the person who has always been my greatest supporter, and has inspired all my life and career: my father Antonio.

Eventually, I have fallen very far from the original tree.

And I hope to go farther in the next years, supporting with even greater energy and enthusiasm the community as a newly elected OES AdCom Member, together with IEEE OES and with all of you, whom I heartfelt thank for the confidence I have been granted.



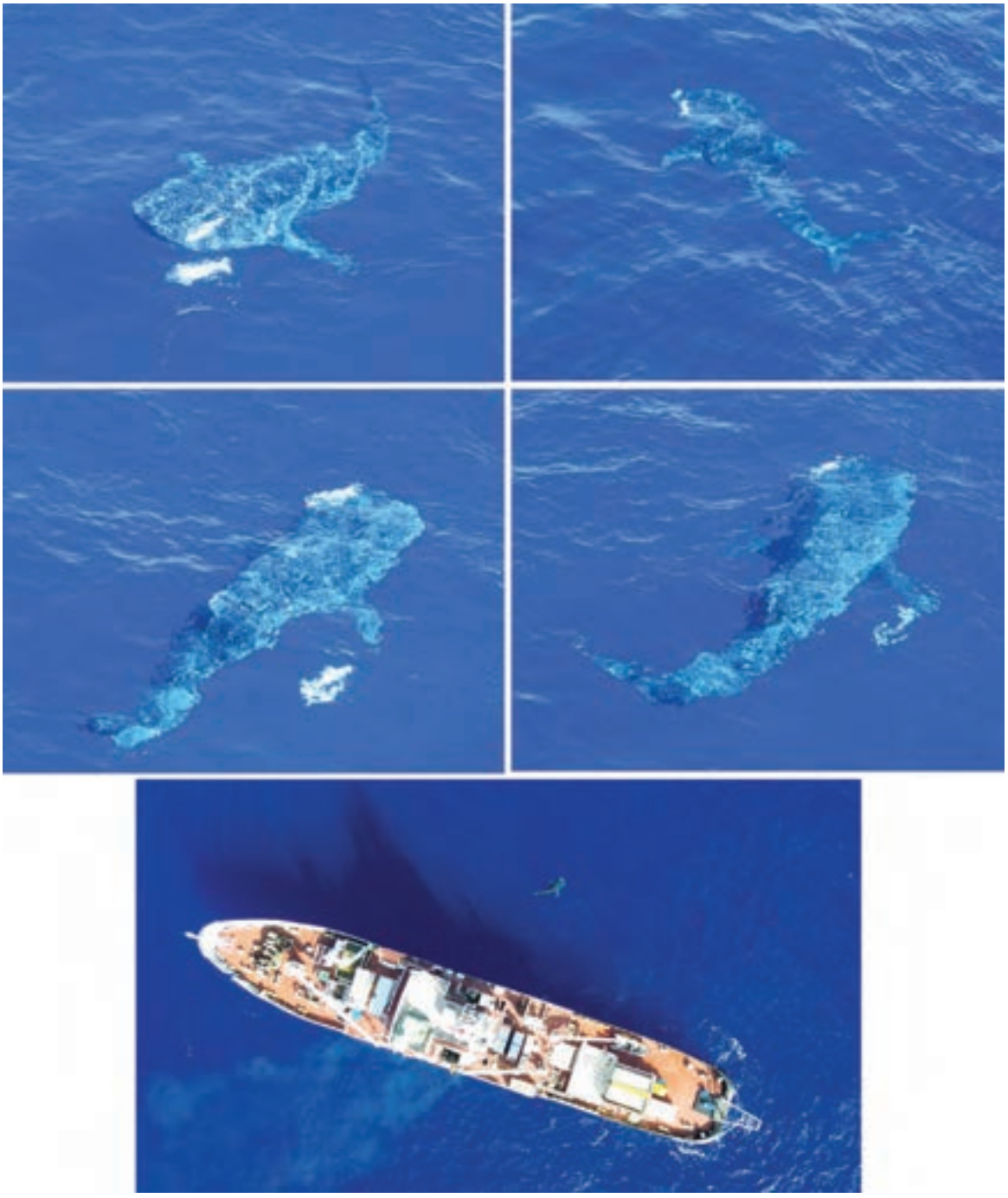
Member Highlights

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

Close Encounter of a Whale Shark

Harumi Sugimatsu, BEACON Editor-in-Chief, AdCom member

During the AUV research voyage this November, I encountered a whale shark in the wild for the first time in my life. The whale shark with two suckfishes migrated near the surface around our ship about 20 minuets. Enjoy the photos.



The whale shark with two suckfishes migrating around our ship.The photo in the bottom was taken by a drone.

Request for OES AdCom Nominations

Nominees for the Term 2025 January 1–2027 December 31

Jerry Carroll, Chair of IEEE OES Nominations and Appointments Committee, past-president@ieeeoes.org

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

This year, the Nominations and Appointments Committee is chaired by the Past President. The committee is charged with proposing a slate of nominees each year. For this election, twelve members of the OES will be nominated to fill six positions on the AdCom for the three-year term: 2025 January 1–2027 December 31.

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

The nomination Packet should include a Letter of Nomination accompanied by a one-page biographical sketch of the proposed candidate with picture and one-page statement from the proposed candidate giving:

- Their views of the opportunities and challenges facing the Society
- Steps to be taken to advance the IEEE Oceanic Engineering Society, including Ideas for potential initiatives and projects
- How they plan to contribute to standing and ad hoc committees
- Volunteering experience both within and outside OES

Elected Ad Com members should expect:

- To represent the OES membership by attending board meetings, reviewing and accepting reports, and making decisions on Society policy and financial matters
- To participate in administrative activities required to run the society (tasks will be assigned, including participation in standing, and/or ad hoc committees)
- To spend two or more hours per week on average on communications (email, phone, virtual meetings) which may not be evenly distributed throughout the year

OES AdCom Meeting 2023 January

- To attend four to six teleconferences, and travel to at least one and up to two in person AdCom meeting per year. In-person meetings are typically two days in duration before or after the OCEANS conferences.

The election will be conducted in accordance with our Bylaws. Follow this link to read the Bylaws:

https://ieeeoes.org/about-us/bylaws-of-the-ieee-oceanic-engineering-society/).

The Bylaws specify that general nominations close on **March 1**, and nominations by petition close by **April 15**, 2024.

Please submit nominations to the undersigned starting 2024 January 1. Please do not delay your efforts in finding and nominating qualified candidates. Send your nominations to:

*Jerry Carroll
*Chair of IEEE OES Nominations and Appointments Committee
past-president@ieeeoes.org

AdCom Commitment

- Attend AdCom meetings and decide on Society matters
- Participate in work to run the Society
- 2+ hours per week on average
- 4-6 Teleconferences, 1-2 in-person meetings

Welcome New and Reinstated Members

From 16 August through 14 November, 2023
Total: 113(Incl 56 Student)

Australia
Amy Nau

Bosnia and Herzegovina
Zlatan Jakic
Amina Pojskic
Adna Sestic

Brazil
Gustavo Gomes Cabral

Canada
Asher Barnsdale
Maxime Bouffard
Andrea Gardella
Catherine Martineau
Marc Perron

Chile
Jorge Barria
Atlant Nicolas Correa Cusso
Roberto Andres Moreno

China
Chunle Guo
Guang Zou

Croatia
Albert Gregl
Luka Klaic
Natko Krasevac
Magdalena Simunec

Ecuador
Marcos Ricardo Cevallos

France
Nathan Fourniol
Andrew Lucky Igberaese

Germany
Semir Coemertpay
Lan Karez
Sven Lack
Johannes Richard Marx
Marcus Josef Neuer

India
Jeswin Arputhabalan
Paul D
Ayyadurai G K
Venkatesan Gopalakrishnan
Raman M K
Selvaraju K
Mohd Imran Khan
Prashant Kumar
Salim Mia
Kousalya N
Chandra Shekhar Nishad
Rajaprasanna R
Krishnavelu Ramachandran
Kasiviswanathan M S
Thirunisha S
Deepali Singh
Sivakaran T
Palani Thiruvengadam
Muthamizhan Thiyagarajan
Manikandan U
Rajeswari V
Ramya V
Yuvaraj V
Nidhi Varshney

Ireland
Jose Alvarez
Ben Bartlett
Sagar Dalai
Gerard L Dooly
Cillian Fahy
Luke FitzGerald
Mahammad Irfan
Marco Alan Moreno Leon
Matheus Cardoso Santos
Hedieh Pourbagheri Sigaroudi
Anthony Weir

Israel
Rebeca Chinicz

Italy
Farah Rasheed Abbasi
Muhammad Adil
Benedetto Allotta
Roberto Francescon
Antonio Montanari

Japan
Tomonari Akamatsu
Yuichi Ikeda
Marie Angelyn Tolentino Mercado

Malta
Stephen Sammut

Norway
Lukas Thiem

Peru
Diego Quiroz

Singapore
Gabriel Chua
Yong Han Yong Goh
Kexin Li
Shuangshuang Wu

Switzerland
Felix Schill

Turkiye
Batuhan Ozer

United Kingdom
Alberto Consensi
Jane Nyokabi Njeri
Kaiser Saeed

USA
Mujeeb Akanbi Abdulfatai
Karen Elizabeth Aguirre
Shaun D Anderson
Peter Oswald Clifford Austin-Small
Corina Barbalata
Leslie Birch
Megan Carroll
Marcus Chevitarese
Frederick E Crofut
Nicholas Custer
Jack Gallegos
B J Gross
Timothy C Havens
Christopher Scott Hawkinson
Jack Huang
Javier Itriago
Ali Emre Koruk
James William McMahon
Erin Menezes
Hafeez Opeyemi Oladejo
Derek R Olson
Tanner Harvey Poling
Shishir P Rao
Amelia L Ritger
Sophia Rossow
Farris M Stevens
Nilsen H Strandskov
Grant Suzuki
Bill Wahl
Robert Watson

How to Receive Paper Copies of Each Beacon

Although digital versions of the Beacon newsletter are available on the OES website (https://ieeeoes.org/publications/oes-beacon/), only OES members can receive printed copies of each Beacon.

Here is how to get your paper copies of the OES Beacon in the future. Introduction is also on the above OES website.

1. OES members need to contact the IEEE Contact Center at 1-800-678-4333 or 1-732-981-0060- Monday thru Friday- 8:00 AM- 4:30 PM EST.

2. Or . . . send the IEEE Contact Center an email at contact-center@ieee.org with your name, IEEE member number and your request to receive your paper copy of the OES Beacon.

Please enjoy the BEACON newsletter.

BEACON Newsletter archive website

Student Chapter Activities

The Experience from the Global Members of the IEEE Oceanic Engineering Society-Student Branch Chapters at the OCEANS 2023 Gulf Coast Conference

Ardian Rizal, Ali Emre Koruk, Mujeeb Abdulfatai, Nathan Fourniol, Jhon Bermudez and Atlant Correa, OES SBC members

OES invited the OES members of Student Branch Chapter (SBC) around the world to the OCEANS 2023 Gulf Coast. Their experiences attending the OCEANS conference are described below.

The OCEANS 2023 Gulf Coast Conference, sponsored by the IEEE Oceanic Engineering Society (OES) and Marine Technology Society (MTS), was held at the Mississippi Coast Coliseum & Convention Center from September 25–28, 2023. The conference brought together global maritime stakeholders from academia, industry and government to learn, foster innovation, and enhance collaborations to protect and explore the ocean's resources.

Among the approximately 1500 attendees were OES student members. Some of the students are members of OES Student Branch Chapters (SBCs) at the University of Southern Mississippi and Pontificia Universidad Católica de Chile, while others are learning about the OES SBCs. When the students were asked to comment on their experience at the OCEANS Conference, they provided the following observations.

Ardian Rizal, an OES member and graduate student from the University of Southern Mississippi (USM), commented that "this meeting has broadened my horizon and deepened my understanding of my research from a technology perspective. Using streaming of data from ocean observation instruments, such as Saildrone, and autonomous underwater vehicles, will improve the quality of the modeling product that will be beneficial to society. I also connected with valuable networking that allows me to do potential collaboration in the future."

Ali Emre Koruk, another OES member and graduate student from USM, commented on the wide variety of topics and activities that were available to him during the conference: "Over 500 technical presentations, 100 exhibitors, numerous panels, workshops, and town halls on topics related to the ocean and its protection and utilization, access to the Advanced Naval Technology Exercise (ANTX) at the Port of Gulfport, where participants could witness the latest technologies in action, such as uncrewed maritime systems, sensors, and data analytics and to educational and training sessions on project management, cybersecurity, leadership essentials, advanced technology, and interpersonal skills, facilitated by experts from the USM School of Leadership," Ali Emre Koruk concluded his thoughts on his experience at OCEANS Gulf Coast with "I am very grateful for the opportunity to attend the OCEANS 2023 Gulf Coast conference in Biloxi, Mississippi. It was an amazing experience to learn from the global maritime professionals and experts who shared their insights and innovations on the ocean and its challenges and opportunities. I also enjoyed networking with the exhibitors, speakers, and fellow attendees who came from various fields and sectors related to the ocean. I gained valuable knowledge and skills that will help me advance my career and contribute to the ocean's sustainability and prosperity. I would like to thank the organizers, Student Branch Chapter of the IEEE-OES, and volunteers who made this conference possible and successful. I look forward to attending the next OCEANS Conference and continuing my lifelong learning journey."

A third OES University of Southern Mississippi SBC member who attend the conference is Mujeeb Abdulfatai. Among his takeaways from attending the OCEANS conference, is that "Ocean and Technology cannot be separated. To create the science we need for the ocean we want, advanced sustainable technology needs to be developed and our future is in bright hands judging from the poster competition and the OES/MTS Awards Ceremony." Mujeeb was able to network with the Student Poster competitors and believes that "this networking will foster future collaboration in my research."

Nathan Fourniol, PhD candidate from ENSTA Bretagne, France, discovered both OES and SBC at this OCEANS conference. He presented a paper on data muling and was impressed by how autonomous surveys by a single vehicle seemed mature. As a roboticist, he hopes to see and contribute to field tests of collaborative autonomous multi-vehicle exploration in a complex environment. Meeting OES student members let him believe in conference follow-up collaboration, which according to him is a way to fully embrace key ideas of Blue Economy.

OES-SBC members from various countries discussing potential collaborations and sharing ideas on projects (Photos by Jhon Bermudez).

Finally, Master's student Atlant Correa, a member of the OES Pontificia Universidad Católica de Chile SCB, also participated in the OCEANS conference. Atlant found the conference to be a rewarding experience. The event introduced him to new topics and offered different ways to get involved and participate, especially through the OES Young Professionals programs. The conference, also, provided Atlant with a great opportunity to connect with people who share similar research interests.

Overall, the students concluded that the conference allowed them to upgrade their skills and broaden their collaboration opportunities. Ultimately, the OCEANS Conference experience will provide valuable insight into their research and further their career opportunities. Additional information on student participation at the conference can be found in the Student Poster Competition article in this issue.

OES Provides Gold Sponsorship to Region 9 Student Branch Regional Meeting (SBRM) 2023

From OES VPPA

The Region 9 SBRM 2023, held in Cartegena, Colombia October 29–31, 2023, was a high energy, activities packed event. Over 150 students from Region 9 Student Branch Chapters (SBCs) and volunteers from across IEEE attended.

Region 9 SBRM 2023 attendees. (Photo courtesy of the SBRM Organizing Committee).

After the introductions and opening comments early Sunday afternoon, the students were assigned to multi-national teams for the remainder of the meeting's activities. Team building exercises centered on problem solving, soft skills and leadership were interspersed with inspirational talks by successful professionals, presentations by the sponsoring organizations, discussions by IEEE volunteers on how their involvement in IEEE has improved their leadership skills, and cultural events.

The OES was one of the seven event sponsors. Presentations by the sponsors were broken into two sessions and the order of the 30-minute presentations was determined by the spin of a wheel. The OES drew 6th speaking spot (third talk in the second session of talks). By then, the students were a bit weary and not fully focused on the presentations. However, full attention of the students was regained by the OES presentation which concentrated on our student activities. The majority of the questions asked at the end of the presentation and throughout the remainder of the Congress were about the Student Poster Competition (SPC) held at each OCEANS Conference, the Berth of Opportunity, a partnership between IEEE Oceanic Engineering Society (OES) and Schmidt Ocean Institute (SOI), our Ocean Decade Initiative. Also discussed were the OES WIE Propel Program and our robotics competitions (RAMI, SAUVC, and RAMI).

Presently, we have three SBCs in Latin America, one each in Chile, Colombia, and Ecuador. There was keen interest at this meeting to establish several more and this interest has not faded since the event. In fact, several groups are in the beginning stages of forming a new OES SBC in Latin America.

This event was very successful for the OES. It increased our visibility in Latin America as many students and sponsors admitted to being unfamiliar with the OES prior to this meeting and the prospects for increasing our Latin America membership is high.

IEEE Oceanic Engineering Society Organizes Student Activities at IEEE Sri Lanka Section Congress

Suleman Mazhar, Chair of OES Student Activities and Co-Chair of Underwater Acoustics Technical Committee

Spending winter in snowy Harbin, China is a pretty tough job. Hence, when asked if I could represent the OES at the IEEE Sri Lanka SYW Congress 2023, the flagship event of the IEEE Sri Lanka Section, I was quick to say a Yes!

Sri Lanka, historically known as Ceylon or Serendib, and famous for the finest tea and exotic spices, can truly be termed as the pearl of the Indian Ocean. However, currently, the country ranks high on the global climate risk index. Variations in temperature are disrupting rainfall patterns, exacerbating water scarcity and water quality. The country is rich in water resources but faces serious water management issues. In this context, there seems a unique opportunity for local IEEE chapters and IEEE-OES to join hands to address Sri Lankan challenges with technological strengths available from OES platform.

The IEEE Sri Lanka SYW Congress 2023 was held from the 3rd to 5th of November, at Carolina Beach Hotel in Chilaw, a small but beautiful suburban coastal town about 2 hours' drive from Colombo. The event also hosted the annual award ceremony to recognize the outstanding volunteer

Sri Lanka SYW Congress 2023 participants. Photo courtesy of the Sri Lanka SYW Congress 2023 Organizing Committee.

activities of student members of the IEEE Sri Lanka Chapter. During the congress, IEEE OES was represented by Dr. Venkatesan (Co-chair, TC on Ocean Observation Systems and Environmental Sustainability, IEEE OES) and myself. Dr. Venkatesan delivered a key note talk on "Sustaining the Blue Planet: Climate Change and Oceans" with a relevance to the Indian Ocean. He emphasized the role of young engineers to find solutions for climate change challenges such as cyclones, marine heat-waves, and floods. The congress also featured an expert panel discussion on future technologies for youth careers. The panel included two industry managers and myself, where I shared my perspective on the role of education and the importance of the blue economy and Information and Communication Technology (ICT) for future job markets as well as for climate change management. The next day, I presented an orientation talk about IEEE OES and told the audience about many opportunities available at the society's platform, such as SBC grants, student poster competitions, Berth of Opportunity program, and Oceans Decade program. Over 200 students and senior IEEE members attended all these events at the Chilaw Beach Resort with a nice ambience, thanks to the volunteer efforts of IEEE Sri Lanka chapter under the leadership of Prof. Buddhika Jayasekara (Chair IEEE Sri Lanka Section 2023 and Professor, University of Moratuwa, Sri Lanka), Mr. Dhammika Marasinghe (Chair Elect IEEE Sri Lanka Section Student Activities Committee), Mr. Dinuka Thathsara and Mr. Shakil Arifeen (Vice-chairs IEEE Sri Lanka Section Student Activities Committee).

During the event, I met many student volunteers and faculty members from Sri Lankan universities. They took a great interest in engineering and climate change aspects of IEEE-OES. In addition, I visited Colombo International Nautical and Engineering College (Colombo city) and gave a talk about IEEE-OES and future career opportunities for engineering students in the field of Ocean Engineering and Climate Change Management. During these visits and talks, participants showed a keen interest in technical activities and opportunities offered by IEEE-OES due to their relevance to Sri Lankan economic and geographical context. Therefore, in the coming days, we look forward to an enhanced presence and activities of the IEEE-OES in Sri Lanka.

I shall like to say special thanks to Dr. Venkatesan for accompanying and delivering the invited talk and the IEEE Sri Lanka chapter for hosting us during the congress.

Lecture at Colombo International Nautical and Engineering College (CINEC), Colombo.

Njord Challenge 2023 Technical Report-Team Aritra

Mohammed Ibrahim M, Amar Nath Singh, Akash V, Rakshin Ramesh, IEEE OES Madras Chapter

The Aritra Team of IIT Madras has won the Njord Challenge. We submit the report in appreciation of the support provided by IEEE OES.

Abstract—Aritra is a marine autonomy competition team from Marine Autonomous Vessels (MAV) LABS, Dept. of Ocean Engineering, IIT Madras. Our autonomous surface vehicle (ASV) is a catamaran autonomous boat manufactured in Central Fabrication Facility in IIT Madras by Aritra Team in order to participate in Njord Challenge 2023. The team includes 3rd year undergraduates Mohammed Ibrahim, Amar Nath singh, Akash V, Rakshin Ramesh from department of ocean engineering.

1. IIT Madras

Indian Institute of Technology (IIT) Madras is known both nationally and internationally for excellence in technical education, basic and applied research, innovation, entrepreneurship and industrial consultancy. The Institute is proud to bear the laureate of being the No.1 engineering university in India. More recently, IIT Madras has been given the title of Institute of Eminence.

2. MAV LAB (Marine Autonomous Vessels Lab)

One of the finest laboratories in IIT Madras has been innovating in the field of marine autonomy from 2019. Major works include Hydrodynamic Response Analysis tool (Hydra) for prediction of dynamic motion of ships during its service life, Data driven control of ASV with Deep Reinforcement Learning for path following and obstacle avoidance with agents such as DQN, DDPG and PPO in the presence of unmodelled dynamics and environmental disturbances. Data driven system identification of Maneuvering Model using free running model testing is one of the major works by MAV Labs.

3. Njord Challenge

Njord—The Autonomous Ship Challenge is a student driven competition held in Trondheim. They aim to give students the opportunity to challenge themselves and put theory into practice, gaining valuable experience on their journey. Njord's mission is to inspire students to become world leading engineers in maritime autonomous solutions. Njord was established in the spring of 2019 by two students, Paal Arthur S. Thorseth and Kaja Juel Solheim, and Innovation Manager Jan Onarheim from *NTNU - Norwegian University of Science and Technology.*

4. Competition Overview

The Njord Challenge spanned three days, featuring a range of tasks, including **maneuvering, docking, and obstacle challenges**. Each day presented specific challenges, and teams were assessed by a specialized jury. This rigorous competition allowed teams to showcase their skills in marine autonomy while being evaluated on criteria such as accuracy, efficiency, and innovation, providing a comprehensive assessment of their capabilities.

Dynamic Obstacle Avoidance task, Day 3, Njord 2023.

The Aritra Team of IIT Madras at Award ceremony.

Despite being a smaller team, Team Aritra, guided by Professor Abhilash Sharma, Dr. M A Atmanand supported by sponsors like **IEEE OES** and **the ROYAL NORWEGIAN EMBASSY New Delhi**, clinched the **3rd prize** in a fiercely competitive field that included MIT and other top international teams.

The competition days were a test of resilience. Overcoming hurdles like battery issues and unfavorable weather conditions, they adapted and learned from each experience. Their outstanding performance in the obstacle avoidance challenge set them apart, earning them ***the Sustainability Award*** and ***a cash prize of 10,000 NOK.***

Looking forward, Team Aritra's sights are set on future challenges, including the Virtual Robotics Competition by RoboNation and RobotX. Their journey has not only expanded their technical knowledge but also their international connections.

In conclusion, Team Aritra's remarkable journey at the Njord Autonomy Challenge showcases the power of dedication, innovation, and collaboration in the realm of marine autonomy. Their story inspires and highlights India's growing presence in this field, emphasizing the importance of pushing boundaries and forging global connections in pursuit of cutting-edge marine technology.

5. Technical Details

Our approach involves YOLO V8 Nano for buoy detection, chosen for its speed and accuracy. Initially, we considered clustering point clouds for detection, but we opted for the YOLO model, trained with provided and generated CAD model datasets.

We employ a PD controller with multiple modes for precision. The Behavior Planner selects the appropriate control and guidance strategies for tasks, including collision avoidance through LiDAR. We translate cardinal markers for navigation tasks.

Our testing strategy encompasses simulations (VRX Gazebo, RVIZ) and real-world evaluations in controlled facilities. Modularity allows independent ground testing.

We opted for a stable catamaran design with flat-bottom displacement hulls, advantageous for thruster mounting. Aluminum brackets connect hulls and serve as control box platforms. Four thrusters in an X configuration grant independent surge, sway, and yaw control.

Our electrical system is power-efficient and modular, with three 4-cell 14.8V batteries, a common kill-switch, and buck converters for voltage regulation. Sensors are powered from the Jetson Nano, except for the LiDAR. The IP box operates within a power range of 15 to 20 Watts.

In summary, our approach encompasses robust object detection, precise guidance control, adaptable odometry, smart testing strategies, a well-designed vessel, efficient thruster configuration, and a thoughtful electrical system. These elements underscore our commitment to building a versatile and reliable autonomous vessel.

6. Conclusion

Participating in the njord autonomy challenge has been an incredible learning experience for us. The challenges we faced during the competition, from technical hiccups to rapidly changing norwegian weather, have taught us invaluable lessons that will guide us in our future projects.

One of the most eye-opening aspects of this competition was witnessing even established teams struggle due to norway's unpredictable climate.

Meeting people and companies with a deep interest in marine autonomy was truly inspiring. It reinforced our commitment to continue down this path of innovation. It also revealed that india is right there on the front lines of marine autonomy development alongside other nations.

Through Njord, we've forged international connections that will undoubtedly shape our future endeavors. These collaborations will foster innovation and help us contribute meaningfully to the global marine autonomy community.

As we look ahead, we're eagerly anticipating the possibility of participating in Njord 2024. Our Njord journey has been transformative, and we're excited to continue pushing the boundaries of marine autonomy in the years to come.

Visualization of Channel Navigation task, Day 1, Njord 2023.

Team Aritra's ASV being tested in Trondheim River.

Sebastian, the AUV Won First Place in Underwater Robot Convention in JAMSTEC 2023!

Hiroshi Kasuga, Lisa Hakataya, Hiroki Yokohata, The University of Tokyo

Introduction

On August 26 and 27, students and enthusiasts gathered at JAMSTEC headquarters in Yokosuka, Japan, to participatethe Underwater Robot Convention in JAMSTEC 2023. The convention, hosted by NPO Japan Underwater Robot Network, serves as a place for participants to exchange technical ideas and make connections through the competition and presentations of self-made underwater robots. The overview of the convention can be found on the official website [1] (in Japanese), and the conventions in previous years are reported in [2], [3], [4], [5], and [6].

We, the authors, are master's course students in Prof. Maki's laboratory at the University of Tokyo. We participated in the AI-challenge division as team "MakiLabM1" [Figure 1]. Our main objective was to acquire basic knowledge and skills on underwater robotics in preparation for future research works. We also learned about teamwork, which is important in the development and operation of underwater robots.

Figure 1.The group photo of "MakiLabM1" Team and the AUV, Sebastian.

Competition Rules

The AI-challenge division was established to encourage the introduction of AI (Artificial Intelligence) into underwater robotics. Robots were required to autonomously break balloons placed in the water tank. There were three types of balloons: red, yellow, and blue, and multiple balloons were set up for each. The height from the bottom of the water tank at which the balloons were placed, and the score obtained by breaking them, differed depending on their color [Table 1]. The arrangement of them was random. Figure 2 shows the overview of the setup of the water tank. The only tool allowed to break them was one thumbtack. Each team was given 4 minutes to perform, and the higher the score obtained, the higher the competition score. In addition to the competition score, the judges also evaluated the degree of autonomy of the robots and the presentations in the poster session, and the final ranking was determined by the total of these scores.

Table 1. Height and score of balloons

Color	Height [m]	Score
Red	0.3	30
Yellow	0.8	20
Blue	0.6	–10

Strategy

Sebastian is an AUV that can move nimbly in surge, heave, and yaw directions. We implemented various algorithms in order to break more red balloons within the time limit and get a higher score. The following is a description of the algorithm implemented along with the competition flow. At the beginning of the competition, Sebastian is at the edge of the pool. At the signal to start the competition, Sebastian moves to the center of the pool where the balloons are densely packed. Once in the center of the pool, Sebastian uses the heave thruster to land on the bottom of the pool. Sebastian, with an altitude of 0 cm at this landing point, rises to an altitude of 30 cm, where the red balloons are located. This makes it easier to recognize the red balloons with the highest score. After surfacing to an altitude of 30 cm, Sebastian starts autonomous navigating and searching for balloons. Fig. 3 shows a conceptual diagram of the balloon search mode. Sebastian

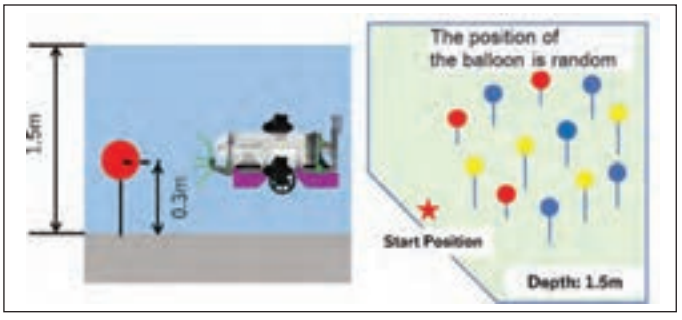


Figure 2. Overview of water tank setup.

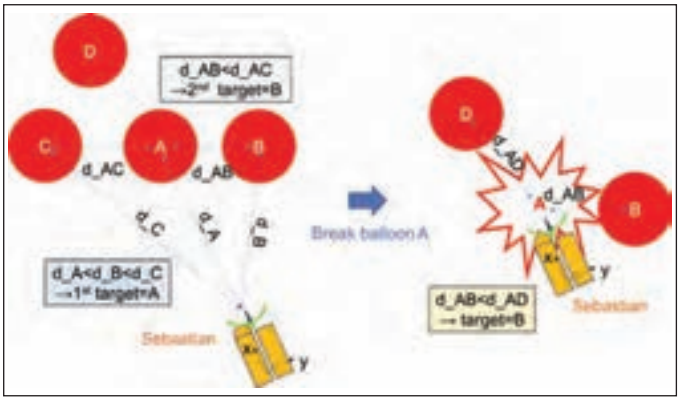


Figure 3.The process of breaking balloons.

remembers the nearest balloon A and the nearest balloon B from balloon A. While approaching A, another balloon C is seen. If balloon C is farther away than balloon A and closer than balloon B, the second target is changed from B to C. Otherwise, the second target remains B. Even if Sebastian lost sight of balloon B, the location information of B is preserved, and after breaking A, it rotates in the direction of B. The direction of rotation is determined by the x and y coordinates of balloons A and B, and the relationship between y_A/x_A and y_B/x_B. Similarly, if a new balloon D is seen after balloon A is broken, the distance to balloon D is compared with the distance to balloon B, and the closer balloon B is selected as the next target. When breaking a balloon, it rushes toward the center coordinates of the balloon. Sebastian approaches the balloon, and when the balloon is too close to be recognized, Sebastian accelerates to gain momentum and break the balloon with the forward pin. The above is the basic flow of breaking a balloon, but in order to more accurately aim for a high score, the following algorithm was implemented. Based on the RGB value of the balloon's center coordinates and the altitude at which the balloon exists, the algorithm recognizes what color the balloon is, and prioritizes high-scoring red balloons, while blue balloons with negative points are excluded from the target. Similarly, if the altitude at which a balloon exists exceeds the altitude of the water surface, it recognizes that the balloon is in a situation of total reflection on the water surface and does not aim this as a target. Similarly, the weight holding the balloon at the bottom of the pool is also excluded from the target because it is not at the altitude where the balloon should be, thus preventing Sebastian from mistaking the weight for a balloon.

AUV

This mission used the original cruising autonomous underwater vehicle "Sebastian" [Fig. 4]. This AUV is based on the wAriel AUV that participated in last year's competition.

Sebastian is equipped with two Heave and two Surge thrusters and can be controlled in four degrees of freedom (Surge, Heave, Pitch and Yaw). The acrylic hull, which is a buoyant body, is positioned on the left and right sides and the center of gravity is designed in the center downwards to maintain stability in the roll direction. As sensors, a depth sensor for depth estimation and a camera module for recognizing balloons in the water were used. The AUV was also equipped with leg parts for landing on the bottom of the pool and guides for pushing the balloon against the pushpins from the front to destroy it.

Sebastian is controlled using a Raspberry Pi 4 computer and a Teensy driver. As a control tool, Sebastian uses a common open source tool for robotics control called Robot Operation System (ROS) on the Raspberry pi, and sends PWM commands to the motor drivers with the Teensy driver.

In this mission, circle detection is performed by OpenCV Hough transform of the USB camera image [Fig. 5]. The Hough gradient method can be used to recognize objects by changing the parameters and the processing of the image data to be captured. The results of balloon recognition using the blue part of the BGR image were output to an external PC for confirmation and showed sufficient recognition results to control the system. This shows that circle recognition using the Hough transform is effective for recognizing balloons in water.

The position of the balloon in the camera coordinate system was calculated from the size and position of the balloon as seen from the camera [2]. Assuming a balloon diameter of 20 cm, the relative position was calculated using the following equations (1), (2) and (3) [Fig. 6]. The actual depth and horizontal

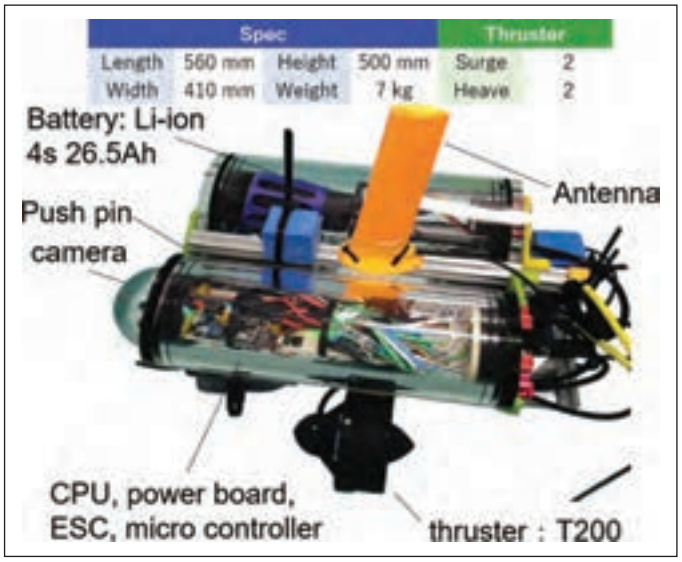


Figure 4. General arrangement of AUV Sebastian.

Figure 5. The system in Sebastian detecting a balloon using a USB camera.

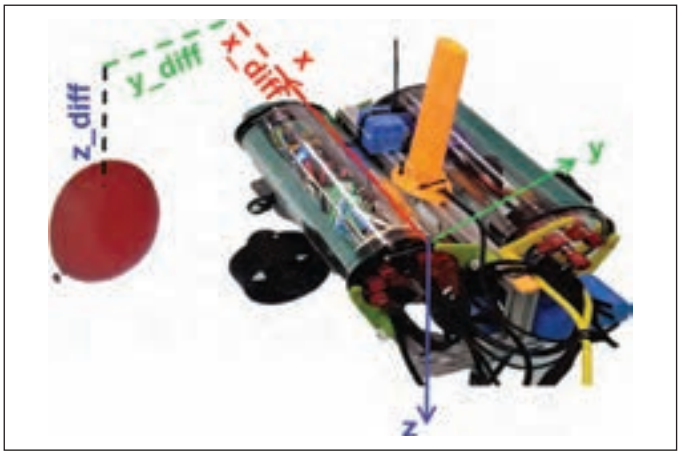


Figure 6. Calculate the position of the balloon considering the attitude of the AUV.

distance of the balloon was calculated by calculating the following equations (4), (5) and (6) using the internal IMU sensor and depth sensor.

$$x_{diff} = \frac{r \cdot f}{2r_{detect}\mu c} \#(1)$$

$$y_{diff} = \frac{x_{diff}\,\mu}{f}\left(y_{pixel} - y_{pixelcenter}\right)y_{offset} \#(2)$$

$$z_{diff} = \frac{x_{diff}}{f}\mu(z_{pixel} - z_{pixelcenter})z_{offset} \#(3)$$

$$\begin{pmatrix} r: the\ radius\ of\ set\ balloons\ (m) \\ f: focallength\ (m) \\ r_{detect}: the\ circle\ radius\ detected \\ \mu: pixceltom\ constant\ a \\ c: compression\ ratio\ of\ pixeltocm \\ y_{pixel}: detected\ location\ y\ in\ image \\ y_{pixelcenter}: center\ location\ y\ in\ image \\ y_{offset}: offset\ constant\ for\ y \\ z_{pixel}: detected\ location\ z\ in\ image \\ z_{pixelcenter}: center\ location\ z\ in\ image \\ z_{offset}: offset\ constant\ for\ z \end{pmatrix}$$

$$x = x_{diff}\cos\phi + y_{diff}\sin\theta\sin\phi + z_{diff}\cos\theta\sin\phi \#(4)$$

$$y = x_{diff}\cos\theta - z_{diff}\sin\theta \#(5)$$

$$z = -x_{diff}\sin\phi + y_{diff}\sin\theta\cos\phi + z_{diff}\cos\theta\cos\phi + D \#(6)$$

$$\begin{pmatrix} \theta: Roll\ of\ the\ AUV\ in\ ground\ coordination \\ \Phi: Pitch\ of\ the\ AUV\ in\ ground\ coordination \\ D: depth\ of\ the\ AUV\ (m) \end{pmatrix}$$

For color recognition of balloons, the BGR score of the center of the balloon was used due to the computational limitations of the Raspberry Pi. If the center of the balloon was outside the camera's field of view, the point in the field of view closest to the center was used for color recognition [Fig. 7]. The depth of the balloon was also used to aid color estimation.

The competition rules were presented in June 2023 and a development project was initiated. Software development was divided into balloon recognition and target determination algorithms, vehicle control and state transition algorithms, and firmware development. by July, hardware improvements and control code for minimum functions were completed. As of early August, balloons could be destroyed under a certain condition.

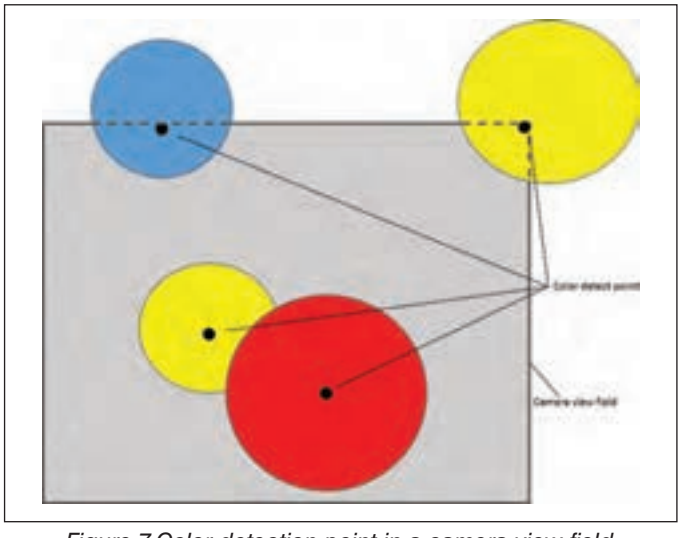


Figure 7. Color detection point in a camera view field.

In August, debugging, parameter adjustments and exception processing were added to improve the robustness of the system. In parallel, the algorithm for determining which balloon to break next to the currently approached balloon was also implemented.

Finally, the color recognition success rate and the approach success rate were confirmed to be more than 90% against blue, red, yellow, green and pink balloons.

Result

On the first day of the convention, each team presented a poster session and answered questions from the judges and other participants. We also tested the operation of Sebastian in the water tank. The second day of the convention consisted of a water tank competition, which concluded with an awards ceremony. We were awarded first place out of all four teams for breaking the most balloons and for our high degree of autonomy to operate without tether cables.

Through this competition, we were able to realize the difficulty of underwater robot development, the importance of teamwork, and networking with people in the community. The experience we gained through our three months of intensive development and participation in the competition will certainly be a great source of inspiration for our future research activities.

Acknowledgement

The Underwater Robot Convention in JAMSTEC in 2023 was supported by The Japan Society of Naval Architects and Ocean Engineers, IEEE/OES Japan Chapter, MTS Japan Section, Techno-Ocean Network, Kanagawa Prefecture, Yokosuka City, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Center for Integrated Underwater Observation Technology at Institute of Industrial Science, the University of Tokyo, FullDepth Co., Ltd., Nortek Japan LLC, Japan Branch of Robotiz, Inc, ARAV Co., Ltd., Sea challenge Co., Ltd., Space Entertainment Laboratory Co., Ltd., Matsuyama Industry Co., Ltd., IWAKITEC Co., Ltd., Chick Co., Ltd., Misago Co., Ltd., and Aqua Modelers Meeting. We would like to express our sincere appreciation to the sponsors for their strong support and cooperation in realizing this convention.

Comments

Hiroshi Kasuga: I am pleased that we won, but there are many points that can be improved upon. I hope to make use of this experience in my research.

Lisa Hakataya: I'm glad we won. However, there were many things we could not do. We would like to increase what we can do in the future.

Hiroki Yokohata: I'm very happy to have achieved another great result of winning the first place this year, as we did last

year. I would like to thank my teammates for leading the team to this height.

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