

OES BEACON

Newsletter of the Oceanic Engineering Society



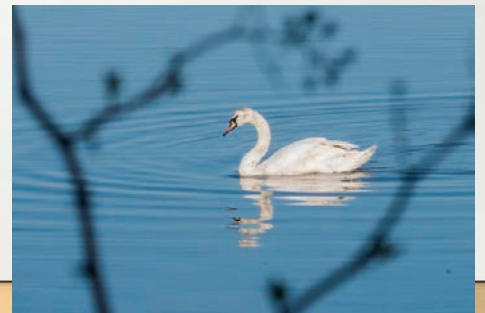
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Stan's Photo Gallery



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Editor-in-Chief:

Harumi Sugimatsu—harumis@iis.u-tokyo.ac.jp

Co-Editor-in-Chief:

Robert L. Wernli—wernli@ieee.org

Associate Editors:

Masakazu Arima
Kenichi Asakawa
Toshihiro Maki
Takumi Matsuda
Katsunori Mizuno
Takeshi Nakatani
Hisashi Shiba
Farley Shane
Blair Thornton

Contributing Editors:

Australia—Mal Heron
China—Lian Lian
Canada—Ferial El-Hawary
France—Philippe Courmontague
Germany—Christoph Waldmann
India—M. A. Atmanand
Japan—Blair Thornton
Korea—Son Cheol Yu
Scotland—John Watson
Singapore—Venu Pallayil
Taiwan—Jenhwa Guo
USA—Stan Chamberlain

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Member Benefits—Did You Know?

Earn Educational Credits with On-Demand Training

Through Resource Centers, IEEE provides you the opportunity to earn educational credits (CEUs/PDHs) and stay on the forefront of your field. These educational credit opportunities are designed to help working engineers maintain their licenses and add in-depth technical courses to their

training library. All Resource Centers provide users on-demand access to tutorials, conference slides, webinars, and other educational publications. Go to IEEE Resource Centers or visit: <https://connect.ieee.org/WG0AfUP130T3Hap00f0K100>

From the OES BEACON Editors

Harumi Sugimatsu and Robert Wernli

Welcome to the September 2020 issue of the Beacon. Well, your editors wish we were passing out issues of the Beacon to attendees at one of our great conferences, but, in 2020 hindsight, that isn't going to happen till next year ... hopefully. But we're doing our best to ensure you receive, in the mail and on line, the latest news regarding your society and its members.

The effects of the virus have not been pleasant; however, we did receive a few reports regarding what some of our members did, and dealt with, as they remained hunkered down at home. From photography to sailboat repair, from the Cape Cod seashore to Purgatory, and how well remote teaching works at universities in the U.S. and Japan ... as the articles attest, our members are always active. And be sure to read the article as two of our members educate the young minds of potential future ocean engineers on line in the TryEngineering webinar.

And the activity isn't just by our individual members as shown in our reports from the Providence and Malaysia chapters, research and educational activities under the Japan chapter, and an excellent report of our newly established IIT Delhi OES student Chapter. Also, an article is provided on the support by the IEEE OES Victoria chapter for a student project at the University of Victoria.

The Journal EIC again provides recently released papers that are available to our members and our VP for Technical Activities provides the latest on our technical committee activities and how you can get involved. Also, with the everchanging conference plans, our VP for OCEANS gives us the latest on the virtual GLOBAL OCEANS conference and upcoming plans for when they again return to face-to-face events. Be sure and review the associated conference ads in this issue for the latest dates and deadlines. And, although our next OCEANS conference is virtual, as described herein, we'll still be holding the student poster competition with appropriate cash prizes for the winners.

We also take pride in our members. Be sure to see the latest articles including "Who's Who in the OES" that showcases our



Well, your Beacon editors haven't been doing much traveling lately, like we're sure the same for the rest of you, so here's a flash back to the OCEANS 2009 Biloxi conference. Happier times.

WIE representative, recent awards received by our members, our newly elected AdCom members, and the VPPA report with the latest on our Young Professionals and our Women in Engineering and information on the related virtual activities planned for the upcoming GLOBAL OCEANS conference.

Finally, if not already obvious, the effects of the virus have a negative impact on all aspects of OES activities. Our conferences are not the only society work that is going virtual. Because of the loss of conference revenue, all travel to meetings for your elected officers has been cancelled and meetings are now held virtually. Budgets have been cut back in many other areas while we balance the books and work thru the effects of the virus. However, the brighter side of all this is, that for those who like to live and work on line, it is *nirvana*. As described in this issue's articles, there are plenty of opportunities for members who want to support our virtual events and on line activities.

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.

VPTA Column

Malcolm Heron, OES Vice President for Technical Activities



Malcolm Heron

Gerardo Acosta, the Chapters Coordinator, had the pleasure of welcoming a new OES Chapter in the Delhi Section on 7 August, chaired by Monika Aggarwal. Monika will be the Interim Chapter Chair until elections can be held by the Delhi Section later in the year. This is the first Chapter to be formed in India after the India Council passed the administration of Chapters over to the Sections. The new Delhi Chapter will have a broad responsibility

for ocean-related activities in India until other Chapters can be formed. In particular, there is a focus in India in preparation for the OCEANS 2022 Conference coming up in Chennai on 21–24 February 2022. The formation of the Delhi Chapter is an indication of OES support for our members in India and the next 18 months promises to highlight Oceanic Engineering in that country.

The IEEE structure brings support for Chapters from two directions. The Section (or Council) is the Administrative Unit for reporting to IEEE MGA (Member and Geographic Activities Board) while the technical affiliation is with the Oceanic Engineering Society. While the concept of two bosses is some-

times frowned upon, it does let Chapters Coordinator, Gerry Acosta, focus on the interesting bits like workshops, technical meetings and, in this case, preparation for OCEANS. For most Chapters the use of webinars and technical talks through meeting apps will be the only way to meet the goal of two technical meetings during 2020. There is opportunity here to broadcast your technical talks more widely, beyond your normal patronage. If you think your Chapter's e-meeting has wide interest, please contact coordinator Gerry to have it promoted in newsletters or by direct emailing to specific OES membership groups (while maintaining privacy protocols). This is one way in which a Chapter can link into the wider OES community: and, of course, the reverse flow from other Chapters will bring benefits to your members. A specific example of this is that any e-meetings of the new Delhi Chapter could be offered to all the Sections in India.

If you are looking for lasting benefits from the CV-19 restrictions then this is one!

As a final comment here, I remind everyone that when you renew your membership for next year, you will be automatically invited to register for membership in one or more of the OES Technology Committees. The TCs are listed as "products" in the IEEE Memberships and Subscriptions Catalog under Technical Committees, and registration is free for all OES members.

Keep safe.

Professional Activities, Gone Virtual

Brandy Armstrong, VP of Professional Activities

Remember all those grand plans we had back in the spring? A lot has changed since then... with the world gone viral, IEEE Oceanic Engineering Society has gone virtual. We are working hard to virtualize and there are still plenty of opportunities to get involved this year, remotely.

Women in Engineering and Young Professional Programs at OCEANS

You will see in the Global OCEANS 2020: Singapore–U.S. Gulf Coast program we will be holding our Women in Engineering panel as well as a Young Professionals program virtually. Both programs are included with registration to our first ever, virtual OCEANS conference.

The WIE panel is for Women in Engineering and their supporters. The IEEE Women in Engineering panel will feature women



Brandy Armstrong

presenting on how their careers have evolved including difficulties overcome, lessons learned, and successes and support received along the way. This ongoing series of panels held at OCEANS encourage support and mentorship of women in engineering and provide an opportunity for women to see other women succeeding in their field and hear their narratives.

The Young Professionals program is geared towards those under 35 or 5 years out of their highest degree. The opening panel will focus on career paths, with discussion and audience questions on how panelists have come to their current position and field.

Panelists are from diverse backgrounds and communities (Non-profit, Entrepreneur, Industry, Government). The second YP program session will focus on soft skills such as communication, strategy, self-management, team work and leadership.

IEEE OES Testimonials Campaign

What is your story and why are you a member of OES? Everyone wants to know! Social media coordinator Manu Ignatius has spearheaded a campaign to collect testimonials from IEEE OES members. Several of our dedicated members have submitted their videos already. If you are interested in sharing your experience with IEEE OES members, please contact me at vp-professional-activities@ieeeoes.org. The first video compilation will debut soon on our membership page!

Senior Membership Drive

Are you or a colleague an IEEE member who has been in professional practice for at least 10 years and shown significant performance over at least five of those years? You deserve recognition! Are you interested in making a difference by holding

higher office within the IEEE OES? Then you must be a senior member. You can self-nominate by following the instructions at <https://www.ieee.org/membership/senior/senior-requirements.html>. You should contact the Section or Chapter chair for assistance in finding qualified references, but if you need additional assistance please contact me at vp-professional-activities@ieeeoes.org.

See You at Global OCEANS!

I hope to “run into you” at our first ever virtual and GLOBAL OCEANS conference. IEEE OES and MTS are joining forces to develop our virtual booth where you can find digital giveaways, information on the latest opportunities, or schedule a meeting with society leaders, like me.

Until then,
Brandy Armstrong

**IEEE OES
MEMBER TESTIMONIALS
2020**

“ Our oceans are much less explored than we think they are and much less explored than they should be.
Dr. Fausto Ferreira

Dr. Hari Vishnu

I am totally, totally, totally in love with the sea.
Dr. Roberto Petroccia

No defeat, no surrender, keep looking for opportunities and continue on treasuring the journey.
Dr. Rosmiwati Mohd-Mokhtar

If you want to make an impact on the world, join us!
Dr. Fausto Ferreira

WATCH NOW!

IEEE Oceanic Engineering Society

• ARE YOU AN ENGINEER, SCIENTIST, EDUCATOR, TECHNICAL EXECUTIVE OR ORIGINATOR IN AN IEEE-DESIGNATED FIELD?

• HAVE YOU BEEN IN PROFESSIONAL PRACTICE FOR AT LEAST TEN YEARS?

• HAVE YOU SHOWN SIGNIFICANT PERFORMANCE OVER A PERIOD OF AT LEAST FIVE OF THOSE YEARS?

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IEEE Oceanic Engineering Society

A NEW OCEANS!!

John Watson, FIEEE, OES Vice-President for OCEANS

In January of this year we were all looking forward to OCEANS in Singapore—registrations were made, flights reserved, accommodation booked... and then without much warning it all came collapsing down around us as we began to realise the significance and impact of the COVID-19 virus. Firstly, we hoped that a postponement of the Singapore meeting to August or September might get us through the crisis; but we soon realised that, as many countries imposed lockdowns for residents and forbade foreign travel, we were facing an entirely new situation in our lives. Even the Gulf Coast event scheduled for October now became at risk.

So, what are we doing? In conjunction with our MTS colleagues we have devoted considerable time and energy into developing new approaches that will enable us to keep OCEANS as one of the premier events in the Oceanic Engineering and Science calendar. Many of you will have noticed that we have joined the Singapore and Gulf Coast events together into one composite GLOBAL conference, which will be run entirely as a virtual event. On a positive side, this has actually given us the opportunity to look at OCEANS Conferences with fresh eyes; to adopt new approaches as to how an OCEANS is conducted while still retaining the traditional “family atmosphere” of OCEANS. Our two Singapore and Gulf Coast organising committees have joined forces, and are enthusiastically putting in an enormous amount of effort to bring you an outstanding conference; one that, while different in many aspects, still retains as much of the traditional OCEANS flavour that you have come to expect. So get onto the **Global OCEANS 2020: Singapore–U.S. Gulf Coast** web-site and see what is happening, (<https://global20.oceansconference.org/global-oceans-2020/>).

Following the Global Virtual event, the next two OCEANS for 2021 are Porto and San Diego. It is too early to say in detail how the virus pandemic will affect these meetings, but it is true that there will be some considerable impact and knock-on effects. The Porto management team are already considering what they term a “hybrid” conference: one that combines ele-



Your VP OCEANS staying at home.

ments of person-to-person with aspects of virtual content. The San Diego group are also considering how much virtual content can be adopted into their programme, but are still hoping for a largely traditional face-to-face event. What is certainly clear is that both of these meetings will be novel in their own right.

Both Gulf Coast and Singapore person-to-person meetings have been rescheduled for 2023 and 2024 respectively. This has meant some rearrangements of the OCEANS schedule, however Chennai and Hampton Roads are still on schedule for 2022.

So, in these uncertain times, as Vice-President of OCEANS Conferences and Expositions, I urge you to continue to support OCEANS and attend in whatever manner works for you. OCEANS may never be the same again, but regardless of the format, your technical societies will be there to ensure that we continue to bring everyone together, in whatever fashion, to support the advancement and exchange of ocean technology! Stay tuned!

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

Mandar Chitre, Journal Editor-in Chief

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

- V. Baron; A. Finez; S. Bouley; F. Fayet; J.I. Mars; B. Nicolas, "Hydrophone Array Optimization, Conception, and Validation for Localization of Acoustic Sources in Deep-Sea Mining."
- Z. Zheng; J. Zhang; T.C. Yang; X. Pan, "Spatial Diversity and Geoacoustic Inversion Using Distributed Sources and Receivers."
- S. Kragelund; C. Walton; I. Kaminer; V. Dobrokhodov, "Generalized Optimal Control for Autonomous Mine Countermeasures Missions."
- X. Tu; X. Xu; A. Song, "Frequency-Domain Decision Feedback Equalization for Single-Carrier Transmission in Fast Time-Varying Underwater Acoustic Channels."
- J.Falcão Carneiro; J.B. Pinto; F. Gomes de Almeida; N. Cruz, "Variable Buoyancy or Propeller-Based Systems for Hovering Capable Vehicles: An Energetic Comparison."
- T. Alam; G. Murad Reis; L. Bobadilla; R.N. Smith, "A Data-Driven Deployment and Planning Approach for Underactuated Vehicles in Marine Environments."
- O. Axelsson; C. Rhén, "Neural-Network-Based Classification of Commercial Ships From Multi-Influence Passive Signatures."
- Y. Miao; J. Li; H. Sun, "Multimodal Sparse Time-Frequency Representation for Underwater Acoustic Signals."
- S.-J. Kim; W. Koo, "Numerical Study on a Multibuoy-Type Wave Energy Converter With Hydraulic PTO System Under Real Sea Conditions."
- J.A. Bowker; M. Tan; N.C. Townsend, "Forward Speed Prediction of a Free-Running Wave-Propelled Boat."
- J.R. Bates; S.M. Murphy; B.H. Maranda; D.A. Abraham, "Signal-to-Reverberation Ratio Comparison of Linear Frequency Modulated Continuous Active Sonar and Pulsed Active Sonar."
- T. Wang; S. Gao; F. Bi; Y. Li; D. Guo; P. Ren, "Residual Learning With Multifactor Extreme Learning Machines for Waveheight Prediction."
- M. Miron-Morin; D.R. Barclay; J.-F. Bousquet, "The Oceanographic Sensitivity of the Acoustic Channel in Shallow Water."
- S. Heshmati-Alamdari; C.P. Bechlioulis; G.C. Karras; K.J. Kyriakopoulos, "Cooperative Impedance Control for Multiple Underwater Vehicle Manipulator Systems Under Lean Communication."
- C.D. Monaco; S.F. Johnson; D.C. Brown; S.N. Brennan, "Motion Estimation From Doppler and Spatial Data in SONAR Images."
- K. Mizuno; P. Cristini; D. Komatitsch; Y. Capdeville, "Numerical and Experimental Study of Wave Propagation in Water-



Saturated Granular Media Using Effective Method Theories and a Full-Wave Numerical Simulation."

- T.D. Ngo; C. Sultan; J.H. VanZwieten; N.I. Xiros, "Constrained Control of Moored Ocean Current Turbines With Cyclic Blade Pitch Variations."
- X. Ji; B. Yang; Q. Tang, "Acoustic Seabed Classification Based on Multibeam Echosounder Backscatter Data Using the PSO-BP-AdaBoost Algorithm: A Case Study From Jiaozhou Bay, China."
- L. Li; H. Wang; Y. Gao, "Development of a Real-Time Latching Control Algorithm Based on Wave Force Prediction."
- S. Fan; K. Chan; C.K.H. Chin, "Motion Analysis of an Autonomous Underwater Vehicle Tethered With an Optical Fiber for Real-Time Surveillance."
- F. Liu; H. Zhou; W. Huang; B. Wen, "Submesoscale Eddies Observation Using High-Frequency Radars: A Case Study in the Northern South China Sea."
- S. Kumar Sahu; P. Shanmugam, "Improving the Link Availability of an Underwater Wireless Optical Communication System Using Chirped Pulse Compression Technique."
- J. Boehm; E. Berkenpas; C. Shepard; D.A. Paley, "Tracking Performance of Model-Based Thruster Control of a Remotely Operated Underwater Vehicle."
- C. Zhang; J. Wu; Y. Mo; B. Sun; L. Ma, "The Same Reflective Characteristics for Different Effective Geoacoustic Parameters in Different Models."
- U. Neethiyath; B. Thornton; M. Sangekar; Y. Nishida; K. Ishii; A. Bodenmann; T. Sato; T. Ura; A. Asada, "Deep-Sea Robotic Survey and Data Processing Methods for Regional-Scale Estimation of Manganese Crust Distribution."
- Y. Zhang; B. Kieft; B.W. Hobson; B.-Y. Raanan; S.S. Urmy; K.J. Pitz; C.M. Preston; B. Roman; K.J. Benoit-Bird; J.M. Birch; F.P. Chavez; C.A. Scholin, "Persistent Sampling of Vertically Migrating Biological Layers by an Autonomous Underwater Vehicle Within the Beam of a Seabed-Mounted Echosounder."
- A.F. Davis; B.C. Fabien, "Wave Excitation Force Prediction of a Heaving Wave Energy Converter."
- N. Bore; J. Folkesson, "Modeling and Simulation of Sidescan Using Conditional Generative Adversarial Network."
- T. Kasetkasem; Y. Tipsuwan; S. Tulsook; A. Muangkasem; A. Leangaramkul; P. Hoonsuwan, "A Pipeline Extraction Algorithm for Forward-Looking Sonar Images Using the Self-Organizing Map."
- J. Xi; S. Yan; L. Xu; C. Hou, "Sparsity-Aware Adaptive Turbo Equalization for Underwater Acoustic Communication in the Mariana Trench."

Awards for OES Members

Contact the Editors with Your Submissions.

Dr. M. A. Atmanand received the National Award of excellence in Ocean Technology of the Ministry of Earth Sciences (MoES), Government of India

In recognition to the outstanding contributions in the field of Ocean Technology, Dr. M.A. Atmanand, OES AdCom. member, received the National Award of excellence in Ocean Technology of the Ministry of Earth Sciences (MoES) Government of India for the year 2020. Congratulations!

Details are: <https://www.moes.gov.in/awards>.



Dr. M.A. Atmanand, is the Director of the National Institute of Ocean Technology (NIOT), Chennai. He has done pioneering work in the area of deep sea technologies in India. He led a team of Engineers for the design and development of an underwater crawler for deep sea operation. He and his team developed the in-situ soil tester,

which was tested at a depth of 5,200 m in the Central Indian Ocean Basin for the first time in the country. Dr. Atmanand has taken this challenge further to design and implement a work class Remotely Operable Vehicle (ROV) that can be used for assisting in mining operations, gas hydrates site for validation of presence of methane, pipeline inspection, etc. This was later tested at a depth of 5,289 m. It was under his supervision that India's first Polar underwater mooring observatory and the Polar Remotely Operable Vehicle (PROV) was developed and tested. The mooring was established at Kongsfjorden in the Arctic region. The Polar ROV was tested successfully at the Priyadarshini lake at Antarctica and used for observing the corals in Andamans.

Many societal projects were taken up under his guidance, like shore protection at Kadalur Periakuppam in Tamil Nadu and Puducherry, setting up of desalination plants at the Lakshadweep islands, ocean energy, cage culturing, etc., at various locations. He spearheaded the technology transfer of various systems developed at NIOT to public and private sector industries successfully. He has steered various indigenization programmes for Ocean observation and underwater systems.

He has contributed in the area of Ocean technology internationally. He is elected as the Chair of the Intergovernmental Oceanographic Commission Regional Committee for the Central Indian Ocean (IOCINDIO) of the Intergovernmental Oceanographic Commission (IOC), UNESCO. He is also a member of the Executive Planning Group for the preparation of the UN Decade of Ocean Science for sustainable development (2012–2030) of the IOC, UNESCO. He is the founder chair of the Institute of Electrical and Electronics Engineers (IEEE) Oceanic Engineering Society (OES) in India and is the Co-chair of the MTS/IEEE OCEANS conference to be held in February 2022 at Chennai, India. His contributions has earned him awards like the National Research Development Corporation (NRDC) National Societal Innovation Award—2018, for “Underwater Remotely Operated Vehicle for Polar and Shallow Water Research”; Presidential Award in 2016 of the IEEE OES; the National Geoscience Award 2010 from the Ministry of Mines for the work on Remotely Operable Vehicle under the category of Oil and Natural Gas Exploration, etc., to name a few.

Dr. M.A. Atmanand has published more than 144 papers in International Journals, International conferences, Book chapter, National Conference and others. He has 7 patents to his credit. He has delivered more than 300 invited lectures in conferences.

An Opportunity to Inspire Young Minds Towards Oceanic Engineering—TryEngineering Webinar

**Hari Vishnu, Earthzine Editor-in-Chief, Research Fellow,
Acoustic Research Laboratory Singapore**
Grace Chia, CEO of BeeX

Wikipedia defines Engineering as the use of scientific principles to *design and build* machines, structures, and other items [1]—one could add on ships, software, computers, chemicals, materials and many more. Oceanic engineering could be called the application of engineering to study the Ocean and its related bodies using engineering principles, tools and solutions. It is often multi-disciplinary, and involves using a combination of mechanical, electrical, civil, acoustical, software and chemical engineering, coupled with a basic understanding of how the oceans work [2].



Hari Vishnu

How does one choose whether to become an ocean engineer, or for that matter, what career path to take at all? With proper career guidance, it would be easier for young minds to identify what field in science or engineering appeals to their interests. It can help students decide whether they want to aim for a career in this field and tune their education strategy accordingly. Career guidance is important in increasing people's interest in education and training, and encouraging participation in learning [3]. It leads to positive effects on learning outcomes, including better decision-making skills and better awareness of learning opportunities; increased job exploration and information search activities; and result in increased motivation to seek work [3].

Recently, we were given the opportunity to talk about how we ended up choosing our careers in Oceanic engineering and what we like about our jobs, on a webinar hosted by TryEngineering Live Virtual series. IEEE Try Engineering is an IEEE portal focused on empowering educators and inspiring Engineers of the future. The blog and webinar aim to get young minds interested in science and engineering and making them aware of their career options, by showcasing tips from engineers involved in various streams.

Personally, the webinar was a wonderful experience for us. It gave us an opportunity to inspire younger minds to join oceanic engineering by showing them what appealed to us in our respective jobs, while allowing us to showcase our careers and work. It also allowed us to describe our volunteering experience as part of OES, including science outreach activities such as Earthzine and conducting student robotics competitions as part of OES. Our satisfaction was amplified when many people reached out to us, even after the event, for guidance on various ocean-related careers, and on how to plan their child's education.



Grace Chia

Based on a poll, the webinar received 150 registrants. 68 people have watched the video on-demand so far, whereas 38 watched it live, of which two-thirds were students and almost one-third were engineers. The organizers received 28 audience questions during the webinar. Unfortunately, due to lack of time, we could not get through all the questions by the end of the interview. The feedback received from the attendees was very positive – 85% said the quality of the event was *excellent* or *very good*, and 100% responded at least *good*. Also, 85% of the attendees said the event was either *a lot better than expected* or *better than expected*.

You can catch the interview on-demand at the TryEngineering website by registering for the webinar at this link. The following is a brief transcript of the interview, which was hosted by Ray Alacantara.

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Q (Ray): Welcome, Grace and Hari. Can you tell us a little bit about yourself and what got you interested in Engineering?

Grace: I am the CEO of BeeX and based in Singapore. I started my ocean engineering journey by participating in an Autonomous Underwater Vehicle (AUV) student competition organized by IEEE Oceanic Engineering Singapore. Whilst we were seeking sponsorships, a corporation decided to help us dream bigger and go further. They sponsored our team to participate in Robosub, a global AUV competition held in San Diego. At Robosub, I was exposed to and fortunate to learn from many international research teams, the U.S. naval divers, and speak with many cool organizations like SpaceX and Blue Robotics working in this space. And they were all passionate and enthusiastically sharing their work in advancing marine robotics. It was a unique learning experience, and my Bumblebee team went to this competition year after year, improving our technology.

Hari: I am a Research Fellow in the National University of Singapore. I study underwater sound physics and signal processing—I try to understand how sound travels in the ocean, and use that to better sense the Oceans and study them. I'm also a member of IEEE OES and involved in activities under it. As part of that, I am the Chief editor for our science outreach magazine Earthzine, which aims to spread science to a broader public. I'm involved in student outreach as part of OES, and

help conduct student robotics competitions (like the Singapore AUV challenge), with the 2 OCEANS conferences that OES conducts per year, and support some of the global change programs the society is a part of.

What got me interested in Engineering—firstly, I had a childish idea that Engineers ‘build’ things and solve problems. I always thought that was cool and wanted to end up like that.

My Mom also had an influence on me—she was a high-school Physics teacher. Also, engineering is a very common profession in India. Furthermore, through the course of my UG, I completed some very rewarding final year projects and I got a taste of going deep into Engineering. So, at that point I decided I needed to dig deeper into this field as a researcher and find ‘new things’ for myself.

Q: What makes up this field of Oceanic Engineering? Does it essentially deal with ‘anything that touches water’?

Hari: Broadly speaking, it refers to applying an engineering approach to Oceanic environments. Just like the oceans, oceanic engineering is a vast field, spanning fields as varied as climate change, weather forecasting, ship navigation systems, sonar, studying marine animals using engineering, oil and gas exploration, underwater robotics and communication.

Grace: My initial exposure is via underwater robotics, but as I continued my work, I realised that it is way bigger. It is a very broad field with a closed knitted community, and that is why I think it is exciting, because there are just many things you can be working on. The ocean is very big!

Q: For young students interested in the field, what classes or activities did you take up as a pre-university student that helped the most in your field? Any advice for students wanting to become Oceanic Engineers?

Grace: Other than Robosub, there are various competitions for students to participate in, such as SeaPerch for high school students. I think it is important for students to try to have some form of hands-on work, i.e., project-based learning. It gets you started, and learn whilst building. You then can apply your understanding of what you have learnt from online and offline classes; such as physics and engineering models, to iterate what you have built.

Hari: Let me try to shed light from a different angle. For me, topics that turned out to be important in hindsight were Physics and Math, though all topics were useful to some extent. They may not be the most crucial things to know to get into oceanic engineering, but they were useful for me. I think it’s important we are taught these topics with a feel of where they will be applied. Coding/programming is an essential skill, and for me, my coding course definitely paid off. It’s like a language—the sooner it sets into you, the better. Also, coding is important and useful everywhere, not just in any field of engineering, but even beyond—finance, media and communication.

For Oceanic engineering specifically, I wish there are more courses, but unfortunately there aren’t many UG courses. I would suggest to get into project-based learning. Lots of resources out there—so get into reading blogs and science communication sites like Earthzine, for example. Keep yourself up-to-date

about what’s fun on oceans—that itself is a good start. At some point, interest and passion will translate into knowledge.

Q: Yes, I do see many coding camps being organized nowadays, and also project-based learning. What are you currently working on, and what technologies you are using to accomplish this?

Hari: My research involves a combination of physics, signal processing and machine learning. I dabble in a couple of projects. One is to understand how fast Arctic glacier ice is melting by listening to its sound. When glacier ice melts underwater, it produces this crackling sound. Have you heard the sound of French fries being made, or frying vegetables?—it sounds like that when you get close to a melting glacier. So, we figured—when more ice melts, there’s more crackling, so why don’t we listen to this sound and figure out how fast the ice is melting? This eventually helps us with climate change studies.

Another problem that I am working on in Singapore—also on noise, and connected to the previous one in a funny way. It turns out that the noise in warm Singapore waters comes from a certain shrimp called snapping shrimp. They produce this pop sound by snapping their pincers. There are thousands of these creatures in the waters, leading to a large crackling background. And guess what, the sound you eventually hear in Singapore waters feels very similar to that of ice melting, in the Arctic, so that’s a funny link between these 2!

My lab in National Univ. of Singapore has been specializing in mitigating this noise problem. Previously, people have deployed sonars in Singapore and found they don’t work as expected because of this shrimp noise. We focus on how to work around this noise, or sometimes even use it for applications. We develop underwater modems that can talk to each other despite this loud interference, and thus in a sense we try to bring internet underwater. I also work a bit with dolphin bio-acoustics.

Q: How about you, Grace?

Grace: So, after my competition days as an undergraduate, we started thinking about how AUVs can be used in the commercial domain. In my area of offshore energy, operators have offshore assets which need to be inspected, but this is very expensive because of the vessels required. It is also quite dangerous for personnel and we believe that autonomous systems can help reduce the costs and risks. BeeX was born as a spin off from my university NUS because of that. Autonomous vehicles can conduct the inspection without the connecting cable, and hence can remove its reliance on vessels. To achieve autonomy, we look at perception, path/mission planning, i.e., making sense of things underwater, knowing how to track or avoid objects underwater. As a robotics company we also look at the hardware layer, how to optimise the vehicle to be more efficient and work in wider weather conditions.

Technology is a major component for us, we use NVIDIA GPUs to achieve the computational power required on vehicles to execute on tasks that just were not possible 10 years ago.

Q: Is oceanic engineering a growing field?

Hari: Ocean engineering as a field has been around for quite a while. Man always wanted to explore the oceans, and in the

last century, events like sinking of the Titanic, and World War 1 and 2, really boosted development in this field. But I think what we are realizing more nowadays is that Oceans are part of the solution to many of man's problems, but they are not as explored as they should be. Consider, for example, this comparison: we know more about the surface of the Moon and Mars than we understand the depths of our Oceans! Can you believe that?

I'll allow the profoundness of that message to sink in for a bit. It's like knowing your neighbour's house but not your own wardrobe. If a lunar lander goes missing on the Moon, NASA can find it for you, like they just did recently. But if a flight like MH370 goes missing in the ocean, we can't find it even using our best tech, and we're still looking for it.

So, I think there's this realization that more needs to be done in Ocean exploration, and the interest is growing. In that sense, I think it is a growing field.

Grace: I think it is a growing field, there are many tech companies going into this space, realising the importance of our oceans. It is about sustainability; understanding that the ocean we shouldn't be using it just as an infinite resource. There are a few interesting projects, such as one in Australia built for monitoring the Great Barrier Reef and kill bacteria on the corals. There are also other teams such as Tidal from GoogleX, working in the aquaculture space, looking at tracking salmon using machine vision techniques.

Q: Can you tell us a little about your IEEE society and its activities? Does it have any programs that may assist students interested in Oceanic Engineering in the future?

Hari: Sure. Ocean engineering is broad, and so our society's involvements are also broad. It spans interests related to all fields of ocean exploration. A common joke we say is that "If it gets wet, you'll find the experts here."

We do place emphasis on students and young professionals, and we have a big social media presence as well. One aspect of our student involvement is through student robotics competitions around the world—examples are Singapore AUV Challenge in Singapore and the European Robotics League in Europe. We hold two OCEANS conferences per year to encourage networking between students, professionals, industry and academia. You can get to meet your peers and topic experts and know what's happening in the field, and understand if other people are facing the same kind of problems as you, or whether others have similar interests. OCEANS also have Student Poster competitions aimed at encouraging students. Students can submit a poster to OCEANS on their work. If selected, they get to travel to the conference, all expenses paid by OES. And if they win, they get a cash prize too.

We also place emphasis on scientific publication and communication. We run the IEEE Journal of Oceanic Engineering and a science outreach magazine called Earthzine, so if students want to contribute, that's another avenue they could consider.

Grace: Right now, it is much easier to gain access to information. The thing I appreciate about this whole industry is the community support. There are many researchers at NUS Tropi-

cal Marine Science Institute and Acoustic Research Lab working on different aspects of marine science, all very helpful to share their knowledge. I think this is very important for a student just starting out, for people to give you advice and the community to support you. Having people to continually contribute to the ecosystem is equally important. Hari and I have been talking about article contributions to Earthzine, sharing more about the published papers that the Bumblebee team has written, that details their design considerations so that future developments can be better. I still recall my first Robosub, the team captain at ETS SONIA highlighted that it is not us against each other but against the challenges in engineering complex autonomous systems for the underwater environment. It is about collaboration and working together to innovate on new solutions.

Audience Questions

Q: What is the newest tech for underwater robots?

Grace: I think underwater SLAM is interesting. The algorithms must be tuned for unique environments.

Q: What are the best companies to work with, in relation to marine robotics?

Grace: NOAA could be considered to be one. Of course BeeX too.

Hari: If you were interested in exploring underwater robotics from the academic POV, National University of Singapore does quite a bit. In USA, Scripps Institution of Oceanography does a bit of underwater robotics, and Woods Hole Oceanographic Institute too takes a lead on research in this field. There's Monterey Bay Aquarium Research Institute in California. In terms of companies, there are many, and it might be unfair to mention just a few. But off the top of my head, I know Kongsberg does quite a bit of work on the marine robotics side, and there's Maritime Robotics in Europe and BeeX in Singapore.

Q: Does Oceanic Engineering require longer to study and graduate, or does it require a little bit more to study?

Hari: There aren't many UG programs in OE, but if there were one, I think it wouldn't take much longer than regular engineering programs. This is because existing standard programs like Mechanical/Electrical engineering provide a lot of courses, but you may not really need some of these courses in your career. For example, I did EE, and there were many useful courses but many which I didn't end up using. So, if we were to design an OE course, I'm sure we could design it to finish in almost the same time, while equipping students with the skills required to 'face the ocean'. It's just a matter of picking and choosing the right courses to put together the required skillset.

Q: What do you think about using Artificial Intelligence and Machine Learning underwater?

Grace: I think this is a very interesting field, there are many researchers working to improve the performance across many different problem statements. I think it will require some time before the industry adopts it at scale. The decline in oil prices might accelerate this but it is important to understand deeper

about when it is truly helpful. You can use AI for everything today, but it might not really address the root issues. Traditionally it has been difficult to obtain underwater data. One of the ways to overcome this is with underwater simulators.

Q: Can you distinguish undersea animals based on sound emissions?

Hari: This is a problem that many people have been focusing on, and the field is known as bio-acoustics. Machine learning also plays a significant part in this. The short answer is yes, you can distinguish animals based on sound cues, using certain features like frequencies and time signatures. For example, dolphins operate at high frequencies and send out high-frequency clicks and also whistles in the human-audible range. Whales also sing low-frequency songs. Within species, it may not be straightforward to distinguish animals, because we need to identify nuances or detailed features in their sounds to make out the difference. But the way the research is going, hopefully we'll get a handle on it in a decade or so.

Q: What programming languages would you suggest to students for underwater robotics?

Grace: So, I am not a programmer, but I see a lot of Python, C. We then have programming middleware such as Robot Operating System (ROS). I think it is more about coming up with the algorithms, working with new datasets and understanding whether that piece of software really can be used to address the problem effectively.

Q: What's the difference between the technology you use to listen to the crackling noise underwater, and that used for other tech like sonar?

Hari: In a broad sense, when you're working with active sonar, you know what signal you're transmitting. So, you only need a sensor capable of listening to that particular sound frequency or signal-type. On the other hand, when listening to ambient crackling noise, we are dealing with sound spanning a large range of frequencies (think of it like the 'white noise' you hear during TV static). So (in this case), our sensors need to be able to operate in a larger range of frequencies.

We also need sensors with longevity and hardness (for this application). When listening to the ice melting sound, the environments are harsh and dangerous, and we can't get close to the source. Also, we may need to monitor the sounds in this region for a long time—days or months altogether. So, we need a device that can record sound data for a long time and put it into a storage system. These are some considerations when choosing a sensor for this kind of monitoring.

Q: Any final thoughts, or advice you would like to give to our student audience, or others listening today?

Grace: I want to tell students to not worry about all the things that they think they cannot do, because the most important thing is to start, and learn along the way, and not to give up. Discipline and grit are personally important skill sets that might be difficult to hone if you have not failed before or attempted new stuff. Your student days are the best time to fail.

For me being in this engineering space has been very exciting for me. I think the type of people that we are surrounding ourselves with has a large impact on the things that we can do in our lives.

"Surround yourself with the dreamers and the doers, the believers and thinkers, but most of all, surround yourself with those who see the greatness within you, even when you don't see it yourself."

So, I have this quote pasted on my bedroom wall that I look at it every day because I think that for the challenges that we are trying to overcome in this space, we really need to have a lot of positivity, encouragement, and inspiration from each other. That is why I encourage students to really get into groups, project groups, because that's when they build up this kind of strong community bonds and you realize that they are not in this alone. My community is what got me through the very hard times and being able to do what I want to do today. Thank you.

Hari: Current circumstances (COVID-19) apart, I feel kids today live in a blessed world, where valuable information is available online at no cost, as webinars, blogs, etc. For example, I love TryEngineering and what a job you're doing. It's important that kids try to use these resources at this time. Not just kids—I too watch at least one webinar per week, it keeps me going on and learning. I can even do it from the comfort of my home. So, this is a good time to avail these online resources and come out with a skill or two.

Get involved in science communication and the scientific dialogue. Science and tech have led to a lot of human development over the centuries, and even in the current corona situation, we are so reliant on it. And scientific knowledge cannot be built overnight. So, get involved in science communication, read science blogs like Earthzine. If you're interested, write articles, Facebook posts or tweet and debate science. Don't worry about coming across as a geek—the more you discuss science, the more you'll realize how cool it is. Geeking out is fun, especially if you find the right calling!

Developing a scientific hobby is important—you can use competitions like SAUVC to get involved. A science hobby can be like a cult and define your whole life. It can help you learn science without feeling like it's work. Citizen science is also a good way to get involved while having fun.

Find a good mentor. Don't be afraid to ask what you think are stupid questions. I know that asking what I thought were silly questions got me some of the best things in life. Go read, write, talk science, and I think we will come out of this Corona season much better than ever.

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Research and Education Activities Under the Coronavirus Pandemic

Takumi Matsuda, Meiji University, IEEE OES Japan Chapter, BEACON Associate Editor

Introduction

I have been studying the navigation methods of the multiple autonomous underwater vehicles (AUVs) for ocean surveying such as seafloor mapping or environmental monitoring. It is essential for the AUVs to cooperate with each other to realize efficient surveying. In underwater environments, there are more restrictions than on land because sound waves, which have narrow bands, are used for positioning and communication among the AUVs instead of radio waves. To overcome this problem, I have studied cooperation algorithms among the AUVs. I recently studied a navigation method of multiple AUVs in which one AUV serves as a survey leader (parent AUV) and the other AUVs (child AUVs) build a wireless positioning and communication network centered on the parent AUV [1]. Since the parent AUV has high positioning performance and navigational capability, other child AUVs can achieve accurate surveying through the parent-centered network. Sea experiments were conducted with 3 AUVs last year. Figure 1 shows the deployment scene of 3 AUVs.

From this April, I moved to Meiji University from the University of Tokyo, and have been studying with Professor Yoji Kuroda while applying the idea of parent-child robots to land robots to develop security technology by robots for airports, stations and other environments.

Research and Education Activities Under the Coronavirus Pandemic

Due to the coronavirus pandemic, research and lectures are being conducted online in Meiji University. Research in robotics is also conducted mainly based on simulators. Particularly, the middleware called ROS (robot operating system) has been used widespread. ROS makes it possible to simulate algorithms using data close to actual one. It is also possible to model the real environment and to simulate robot processing with Gazebo, which is a virtual simulator of a 3D model for a robot and an

environment [2]. Figure 2 shows the example of the robot simulation using Gazebo [3].

Regarding the lecture, I am in charge of the experimental lecture, which involves controlling a motor. It is difficult to conduct such an experiment online. Thus, a simulation model to control a motor was developed using MATLAB and Simulink, which are software products developed by MathWorks (Figure 3) [4]. The model can output the result of the motor rotation speed according to the time transition for each student (Figure 4). Since each student has different results, they can face the data with a fresh mind. The purpose of this experiment was to allow students to think freely based on the results even if online. As a result, various discussions were obtained from the students. In addition, by utilizing the simulation and taking the advantages of software, it was

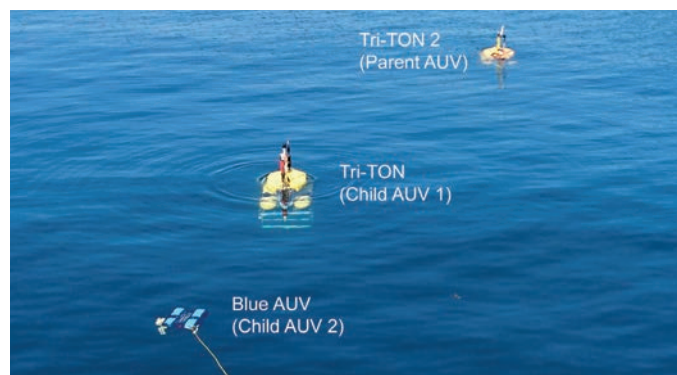


Figure 1. Deployment scene of 3 AUVs in the sea experiments.

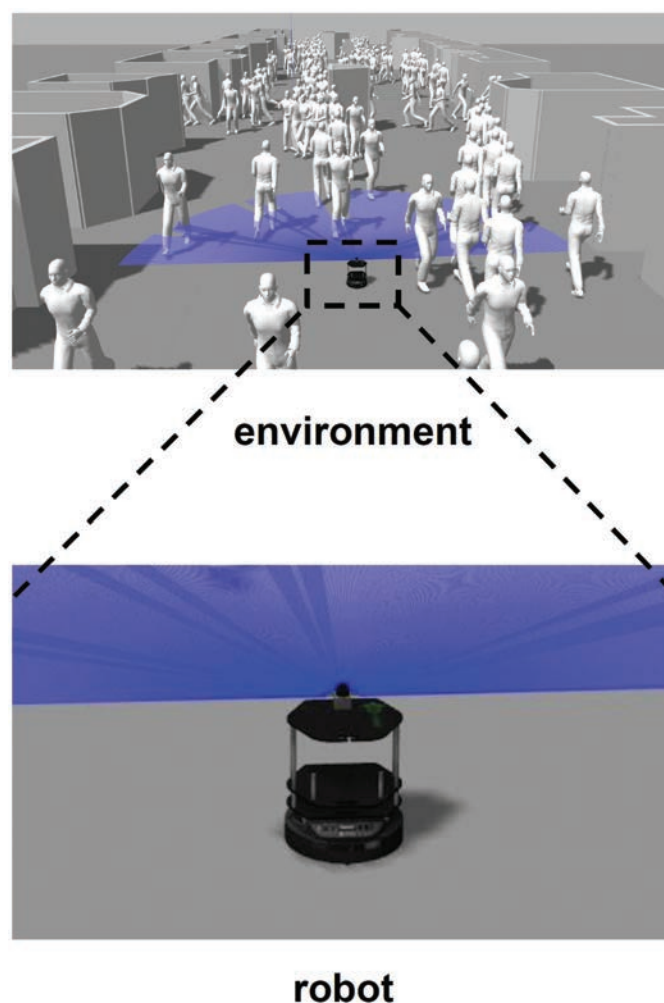


Figure 2. Robot simulation in the environment with both static obstacles and moving pedestrians using Gazebo [3].

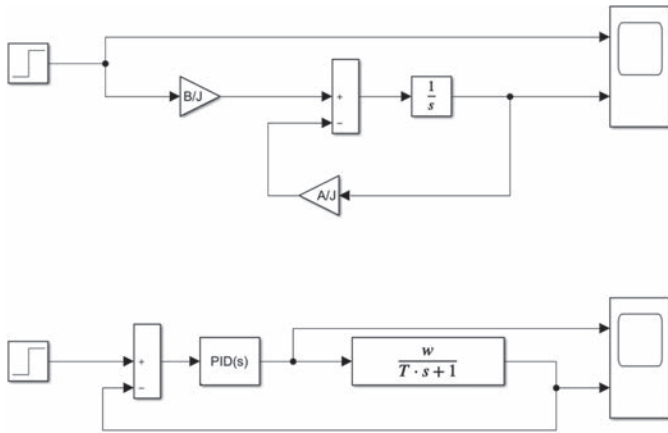


Figure 3. A simulation model for the motor control using MATLAB and Simulink. The above model can simulate the step response of the motor. The below model can simulate the motor response by adding the PID controller.

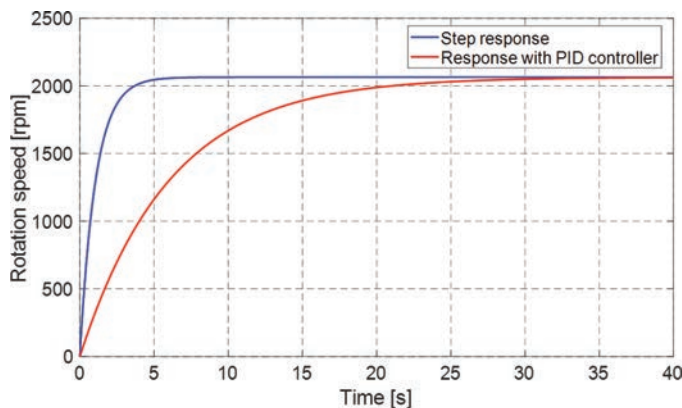


Figure 4. Simulation results for the motor control. The blue line shows the result of the step response of the motor. The red line shows the response by adding a PID controller.

possible to perform the experiment under various conditions that are difficult to prepare with actual objects.

Students were surveyed about the experiment. Following are some answers from the students:

- It was able to analyze and discuss the data carefully, even in the online experiment.
- It was able to understand the relationship between the contents of the experiment and the products.

On the other hand, there were some answers that pointed out the improvements:

- I wanted to collaborate with other students to conduct the experiment.
- It was unfortunate that I could not experiment with the real machine.

From the answers, I believe that the purpose of the experiment, which is for students to analyze and discuss the data, has been achieved. However, I think that improvements are also necessary. Although it is difficult for all students to experiment with real machines online, I think it is necessary to make an experimental environment in which students can experience the movement of

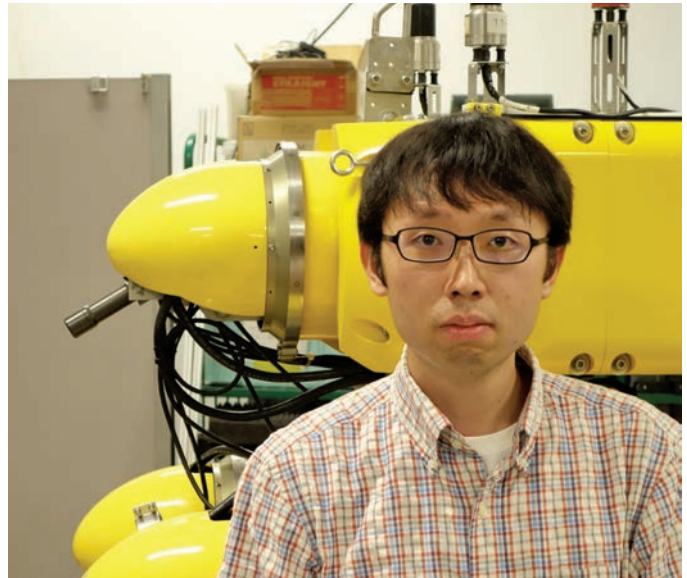


Figure 5. The author's photo taken together with AUV Tri-TON.

the machine through simulation. The experiment was conducted individually in this time, but I would like to consider an online experiment, which includes the perspective of group work.

Conclusion

Due to the coronavirus pandemic, research and education activities in my university are conducted mainly online. Although it has become inconvenient in some aspects, the value of various existing tools is being re-evaluated and new tools are also being born. I think that this change in lifestyle will lead to the creation of new technology. Robots and virtual technology will also be becoming important. Thus, I believe that, in addition to unmanned automation technology by robots, fundamental technology that supports from development to practical use of robots online and virtually will generate new value in the future.

Figure 5 shows the author's photo taken together with AUV Tri-TON.

For more details about the activity of Meiji University and Autonomous Mobile Systems Laboratory (Kuroda Laboratory), visit the links shown in the references [5] and [6].

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Fostering Discovery in a Remote World

Jeff Dusek, Olin College of Engineering

Right now, as I am preparing for a primarily remote fall semester, I am filled with optimism. It is an optimism born of watching a group of undergraduate researchers learn, grow, and find joy in ocean engineering, in spite of the challenges presented by entirely remote summer research. Earlier this spring, I wrote an article for the Beacon titled “Finding Connectedness through the OES” in which I reflected on the rapid shift to online education by Olin College during the spring 2020 semester, and the challenges of maintaining a sense of connectedness during this time of global disruption. While that article was largely focused on the role that OES can play in helping students develop and maintain a connection with the broader marine engineering community, this summer provided an opportunity to face these challenges within my own lab group.

Like many campuses around the country and the world, Olin College was still largely closed this summer, with dorms shuttered and no students living on campus. Having recently initiated a new research project in the space of marine robotics and offshore aquaculture, I found I had a choice to make—delay my research agenda until we return to “normal,” or forge ahead into the unknown world of completely remote undergraduate research. Working with my students, we devised a plan to move the project forward, and decided to explore the possibilities of distributed, remote research.

When talking about summer research projects with my students, we focused on two objectives. First, was making sure we selected sub-projects for each student that moved our overall research agenda forward, even if integration tasks had to be delayed to an in-person future. To do this, we took a systems engineering approach of identifying “showstoppers”—key technical questions that could severely hinder our project in the future. Demonstrating that solutions exist to these “showstopper” problems, even if they are not final solutions, created relatively self-contained sub-projects that held strong value to our overall project objectives.

Second, and equally important, was having each student identify personal learning objectives for the summer, and articulate how their project addressed these objectives. It was not sufficient for an individual sub-project to solely move the overall research forward. Instead, they needed to connect to the student’s development, and that connection needed to be articulated and explained. The developmental component is a critical part of the undergraduate summer research experience, and regularly reflecting on progress towards developmental goals was especially important in a virtual setting.

The actual logistics of conducting marine robotics work with a research team spread across five states was challenging, but the students rose to the challenge with creativity, flexibility, and a genuine enthusiasm for their work. I met with each student and each project team weekly for conversations focused on personal development and technical mentorship. I shipped



Marine robotics research at home requires being creative—like building a test bed for visual fish recognition in your living room using bed sheets and stuffed fish models! (Photo from Sander Miller, Olin '22).

components directly to my students, and they developed innovative ways to carry out their research while following local health and safety guidelines. Some examples of this creativity included Sander Miller (Olin '22) building an undersea environment in his living room using toy fish and bed sheets to explore visual fish recognition using stereo cameras. To characterize transmission errors during short-range underwater image transmission using RF modules, Samuel Cabrera Valencia (Olin '23) setup a mini testing tank in a plastic storage container on his back patio, carrying sea water two liters at a time from the beach near his home. As an advisor, seeing the enthusiasm and dedication of my students was the best possible antidote to the challenges and unease of the disrupted summer and planning for an uncertain fall.

In addition to research progress and individual student development, a key personal goal for the summer was to con



No testing tank, no problem! A plastic storage bin and some seawater creates a great setup to start benchmarking underwater wireless transmission. (Photo from Sam Cabera Valencia, Olin '23).

tinue fostering a culture of inquiry, connectedness, and activism within my lab group. To this end, we dedicated time each Friday to a full-lab meeting devoted to conversations about lab culture, science culture, and our role as scientists, engineers, and young researchers. We watched videos from Professors Uri Alon and Radhika Nagpal interrogating academic and science culture, and discussed #ShutDownAcademia and the role our lab should play within Olin College and beyond. Because my lab had projects in both marine robotics and assistive/adaptive technology this summer, these conversa-

tions were rich, thoughtful, and a highlight of my week. By creating opportunities for genuine conversation with my students, we grew closer as a group, and I'm confident our research benefitted.

So, after a full summer of fully remote undergraduate research, what did I learn?

- 1) We focused on personal growth and well being, and the research results that followed exceeded my expectations.
- 2) We identified sub-projects that contributed to our overall project objectives, but were self-contained to allow for individual exploration and development.
- 3) We were able to grow the connectedness of our lab by intentionally devoting time to conversations outside of the traditional scope of research activities.
- 4) The creativity, tenacity, and enthusiasm of young researchers, even in the face of incredible uncertainty, gives me hope that we can tackle the challenges facing our world.

As we move towards a fall semester that will again see a large percentage of students engaging in course work and research remotely, the lessons learned from this summer give me hope that we can continue to create an environment for our students that emphasizes discovery and personal growth. I cannot wait for a time when I can be back in the classroom and lab enjoying the very best part of my job—helping students discover a love of scientific inquiry and the ocean. But until that time, I will continue taking advantage of the opportunities presented by remote interactions (like Global OCEANS 2020!) and draw inspiration from my students.

From your Chapter Coordinator

Gerardo “Gerry” Acosta, OES Chapter Coordinator

It is really very encouraging to see various activities in the chapters, even in these times of COVID-19. A positive feature, (yes! you always can see something positive even with a pandemic), is that virtual presence was growing up as travels from one place to another were restricted. The Providence Chapter, for instance, has organized very interesting activities during this strange 2020, including virtual talks. Also, in the OES we have the pleasure to welcome a new Chapter in the north region of India, precisely within the IEEE Delhi Section. We wish Monika Aggarwal the best of luck to chair it. And of course, as with all of the chapters around the world, please do not hesitate to contact me for any help organizing your local activities. Even when they are far from Chennai, we hope this new chapter will be of great support for the organization of the next OCEANS in 2022, as our VPTA, Mal Heron, has pointed out in his pleasant column in this Beacon.



Gerardo Acosta, Chapter Coordinator

The students at ESPOL and the WIE in Ecuador Section are also organizing a webinar for next September about “*La Nueva Era de la Oceanografía*” (The New Era of Oceanography). The Malaysia Chapter has also organized very interesting webinars on “*How to think in time of crisis?*” and arranged a VDLP (Virtual Distinguished Lecture Program) about *Swarm Robotics* (see the interesting reports also in this Beacon).

Even when this new world of pandemic had changed our minds, and then our every day activity, it would be great to share from these pages how we copped with the new situation. Conferences and workshops became fully virtual, like

the classes. Some people changed the focus of their activity to help health services. I know for instance that Nuno Cruz and his team in Porto, Portugal, has been putting in service their knowledge to build respirators. Something similar to what has happened here in Olavarría, Argentina, with my working group in the Engineering Faculty. It is good to keep close in difficult

times, so it would be very nice to have news of all the chapters to share.

I would finally like to remind you about the funding opportunities for your chapters: Chapter Chairs are invited to request support for specific planned events or activities. Proposals are invited up to 2 years ahead to allow planning for Workshops or Symposia, or on a shorter time scale for conference special sessions or streams, and on an even shorter time scale for technical meetings and events. The funding can support planning or promotion activities and assistance, where appropriate, for a volunteer who is a Chapter Member to attend an activity. Note that formal meetings, like Workshops and Symposia, must be

approved by the OES Administrative Committee at least one year in advance and that approval includes budget estimates and possibly requests for funding. The Chapter Coordinator, jointly with the VPTA, will administer the funds requests. There is no closing date because this scheme operates on a rolling schedule. For proposals that are approved, funds will be transferred to the designated Chapter's Bank Account. OES will require an expense report, the L31 report, and an article in this Beacon Newsletter for each funded project. Each activity or event should have an outreach element that promotes the Society and its membership.

Stay upbeat and healthy!

Chapter News

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

Providence Chapter

Reported by Cathy Ann Clark & David Leslie

On March 5, 2020, the Providence Section, OE22 Chapter, met at the Westerly Education Center in Westerly, Rhode Island for a combined technical talk and dinner meeting. Roy Manstan gave a presentation on "The Listeners: U-Boat Hunters During the Great War."

Mr. Manstan was well qualified to tell the tale of U-boats and the acoustical technology, which was developed in the USA to detect them. He worked as a field engineer at the U.S. Navy Underwater Sound Lab in New London, qualified as a Navy diver, and eventually became the Lab's Command Diving Officer. His team of engineer/divers has been sent around the world supporting Navy RDT&E and maintaining fleet ASW

readiness. Retiring from the Naval Undersea Warfare Center in January 2006, Manstan began writing about submarine and antisubmarine warfare history. His books include *TURTLE: David Bushnell's Revolutionary Vessel* (2010); *Cold Warriors: The Navy's Engineering and Diving Support Unit* (2014); and *The Listeners: U-boat Hunters During the Great War* (2018).

The twentieth century saw the introduction of new modes of warfare on and above the battlefields of Europe. These included aircraft, rapid fire machineguns and massive artillery, which could fire half-ton shells from 20 miles. In August 1914, Germany's mechanized armies rolled across Belgium and established the Western Front along the border with France. Anticipating that England would attack from the sea, Germany sent an obsolete U-9 submarine to scout the North Sea. It was devastatingly effective.

In his talk, Manstan documented the rise of German submarines in World War I and the Allies' successful response of tracking them with innovative listening devices—precursors to modern sonar. Technology defined the relationship between submarine predators and their prey. Success or failure was in the hands and minds of the scientists and naval personnel at the Naval Experimental Station in New London, Connecticut, and



Roy Manstan, emerging from the replica of David Bushnell's Revolutionary War submarine, Turtle.



GE Haliade-X 12 MW offshore wind turbine generator.

this may well have determined the outcome of the Great War, 1914–1918.

On July 21, 2020, due to the COVID-19 pandemic and local guidelines for public gatherings, the Ocean Engineering OE22 Chapter hosted its first Remote Technical Talk of the year. Andrew Zalay, P.E, spoke from California about problem solving in today's technology for sea-based wind power. Mr. Zalay was responsible for the design, development, completion and/or operation of over 3GW of greenfield wind farms for leading developers in the U.S., Germany and Australia over 30+ years. This experience enabled him to offer us a broad perspective on the status and prospects for power from offshore wind (OSW). There are several innovations on the horizon that can advance the state of the art of OSW at deep water sites. New designs can reduce the cost and construction timeline for placing stable, spar buoy floating foundations and wind turbine generators (WTG) can be installed more simply and less expensively with a new barge design integrated with hoisting equipment. The wind industry will benefit from oil industry knowledge and job transfer. He discussed the potential for OSW in the USA, current limitations and exciting new technology to enable the more widespread deployment of this renewable energy source.

The prospects for OSW are good. Capital spending on sea-based wind is expected to eclipse offshore oil off Europe within several years. In the USA, the offshore wind power potential has been estimated to be 86 GW by 2050, with 33% of that available near population centers along the Northeast Atlantic coast. However, the USA is just getting its feet wet. Most of the existing and planned projects are for shallow-water, bottom-mounted foundation turbines, designed and operated by European companies in partnership with U.S. electricity networks. The greatest wind resource lies further offshore in deeper water where floating turbine foundations will be required. Candidate technologies include large/low water plane floaters, tension-leg platforms and spar buoys. Current limitations in the USA include the need for Jones-Act compliant installation vessels and the development of supply chains and port facilities. The design challenge is also considerable and goes to the heart of ocean engineering. Researchers are simulating the aero/hydro/electro/mechanical systems over a range of scales to account for external meteorological and oceanographic conditions—wind inflow, waves and currents—which act as applied aero dynamic and hydro dynamic loads, acting in feedback with wind turbines. WTG control systems must account for power generation and rotor, drivetrain, nacelle, tower, platform and mooring dynamics. This is a multi-disciplinary effort that requires broad engineering expertise. Mr. Zalay noted that European companies are poised to dominate in this arena and called for the application of Yankee ingenuity and 500 years of seafaring history.

Malaysia Chapter

Tech Talk

Reported by Khalid Isa & Mohd Rizal Arshad

On May 20th, 2020, IEEE OES Malaysia Chapter organized an online technical talk (webinar), which entitled How to Think in



The online technical talk (webinar) session via Google Meet.

Time of Crisis? The speaker of this talk is Prof. Ir. Ts. Dr. Mohd Rizal Arshad, Deputy Vice-Chancellor (Academic and International) of UniMAP cum the Past Chair of IEEE OES Malaysia. More than 40 attendees all around the world joined this talk.

The talk focused on the ability to think well, which is important in this turbulent and uncertain pandemic times. Engineers, researchers, and other professional vocations alike must be able to use the most appropriate thinking tools to analyse the available data and observations to make the best decisions. Sometimes poor judgement and decisions were made not because of insufficient information or data but due to haphazard and random thought-processes and the steps taken to reach a decision. Engineers, and many researchers alike, are well-known as typical vertical thinkers. They prefer structured processes and proven facts before moving to the next step in decision-making. It is a good habit, by the way. But, sometimes, knowledge of some readily available thinking tools will allow engineers to make quicker and faster decisions without having to risk the repercussion of ill-judgement, or at least minimising a faulty decision.

In this talk, Prof. Mohd Rizal shares some available tools which researchers and engineers can use to make better decisions, especially in time of crisis.

Virtual Distinguished Lecture Program (VDLP)

Reported by Khalid Isa & Mohd Rizal Arshad

On June 29th, 2020, IEEE OES Malaysia Chapter has organized a Virtual Distinguished Lecture Program (VDLP) via the Google Meet platform. The VDLP topic entitled Swarm Robotics—Concepts and Its Potentials, has been presented by Prof. Ir. Ts. Dr. Mohd Rizal Arshad. This VDLP was attended by 45 attendees, which include academicians, students, and industrial people. The DLP has been held for two hours, starting from 2.00 pm until 4.00 pm.

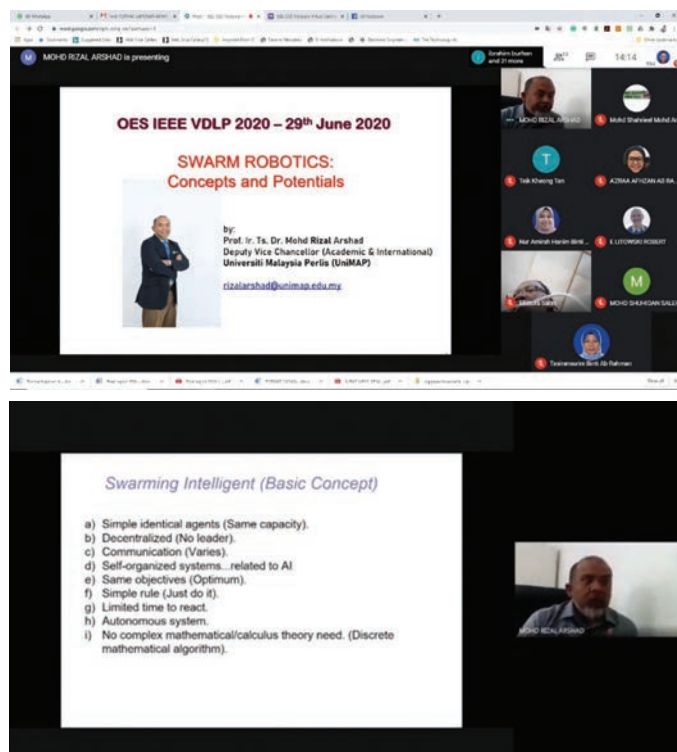
The objective of this program is to present and discuss the concepts and potentials of swarm robotics. This is because the main aim of every research endeavor is ultimately to develop and produce output, which will add benefit to human life. They can either by helping, simplifying, optimizing, or even replacing human tasks. Robotic is one of the examples which have been widely used to assist human in solving different types of tasks. However, a traditional robotic system either manually

control or autonomously control has many technical limitations such as high structural complexity, low level of fault tolerance, and constrained by the limited task performing capabilities. As a result, many complex tasks are out-of-reach and, in most cases, failed to be executed especially in large and unstructured

workspaces. To overcome these limitations, a new approach in robotic research called swarm robotics has been actively researched over the last few decades.

ExCom Managerial Meeting Reported by Khalid Isa

On July 23rd, 2020, IEEE OES Malaysia Chapter organized a managerial meeting with all the executive committees and members. The meeting agenda is to discuss regarding hosting the 12th National Technical Seminar on Unmanned System Technology 2020 (NUSYS'20) Virtual Conference, the new date and venue of the IEEE 9th International Conference on Underwater System Technology: Theory and Applications (USYS 2020/2021), and other activities such as Malaysia Autonomous Underwater Vehicle Challenge, Technical Talk and Distinguished Lecture Program. The meeting was held via Google Meet.



DLP presentation by Prof. Ir. Ts. Dr. Mohd Rizal Arshad via Google Meet.



Photo session with the ExCom and members of IEEE OES Malaysia.

COVID-19, Keel Bolts, Engine Mounts & 474 Blows

**Albert J. Williams 3rd, IEEE Life Fellow, Woods Hole Oceanographic Institution.
Woods Hole, MA 02543 USA. awilliams@whoi.edu**

For all of us dealing with the effects of the corona virus, not all aspects of the social lock-downs are bad, as explained in Sandy's article on keel bolt replacements on his sail boat. As the former VP for Technical Activities, Sandy provides quite an educational discussion for those society members who enjoy sailing their boats on the world's oceans.

Abstract—Social Distancing and closure of Woods Hole Oceanographic Institution (WHOI) imposed restrictions on many of us professionally but I had a project that kept me fully engaged at home. This is a tale of the keel bolt replacement on my sailboat, Shadowfax, in 2020.

Introduction

When my wife, Izzie, and I returned from Borneo on March 21, a pre OCEANS Singapore trip cut short by Malaysian flight

restrictions, we immediately went into self-quarantine at home in Woods Hole. But I was engaged in preparing my 30' sailboat for launch on April 30, the latest date permitted at our boatyard for a boat not kept there. Being trapped at home was just what I needed. This was the year for replacing my keel bolts; did them in 1980, 1997, and now it was a little overdue in 2020.

Keel Bolts

Old Bolts

Two of the four old keel bolts were driven out. I had made replacements and had them hot dip galvanized before leaving for Borneo. Two bolts are 42" long and the other two are 38" long, 7/8" in diameter, and each went through wooden floors, about 12" of dead wood, and about 18" of cast iron ballast keel. Fig. 1 shows two new ones and two old ones that did



Figure 1. Two new hot dipped galvanized 7/8" keel bolts with old (23 year) keel bolts driven out, cut off when they reached the ground beneath the supported boat, and stacked next to the new bolts ready to replace the next two old bolts when they are driven out. The hex nut is on the top (left) of bolt #4 to illustrate its length compared to the 38" bolt similar to the one that has replaced it. Bolt #3 is 42" and was replaced by a similar one to the longer bolt ready to replace bolt #2. It was expected that the shorter one would replace bolt #1.

come out. The lower end (right) has been upset by mushrooming them while red hot after excess was cut off and then the bolt was drawn up into a socket in the cast iron with a nut at the top. The socket had been filled with epoxy before bottom paint had been applied.

Pile Driving

I knew that it took a heavy hammer to drive the old keel bolts out and in 1997 I set up a pile driver with 5" diameter PVC pipe, 5' long, into which I initially dropped a 20 lb. steel weight. The eventual arrangement is shown in Fig. 2. But bolt #1 and bolt #2 stopped moving after only about 1 3/8" when driven down by pile driving with a 20 lb. weight dropped 5' repeatedly onto a driver resting on the bolt. Thinking the lower end might be hitting the blocking under the keel, new blocking was acquired along with a 6 ton hydraulic jack and the boat was lifted and the original blocking replaced by new

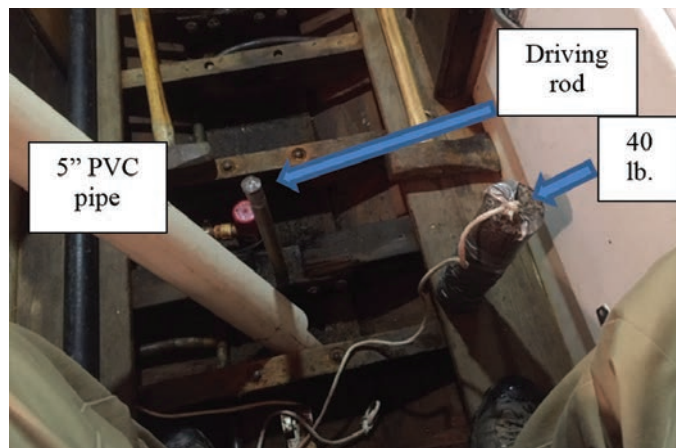


Figure 2. The driving rod extending up from the floor is being driven by the steel 40 lb. weight (right) dropped through the PVC pipe which is placed over the rod. The weight is picked up and dropped through the pipe. When the driving rod is about to disappear below the top of the floor, a longer driving rod is substituted until at the end, after the driven keel bolt has been cut off to permit continued driving, the last piece of bolt falls out and the new bolt, well-greased, is driven into the hole.

blocking farther aft shown in Fig. 3. But even with the mushroomed heads exposed up in the socket, there was no movement. Over the next six weeks various approaches were tried. On the principal that if it doesn't work, use a bigger hammer, I acquired a second 20 lb. weight and taped the two together to make a 40 lb. driving weight, the one shown in Fig. 2. No improvement. The characteristic was that the bounce of the weight off the rod was elastic until movement started and then became inelastic and the bounce stopped. But it didn't stop. A long 1/2" bolt was tapped into the bottom of keel bolt #1 and with a jack and 4' lever an attempt was made to pull it out. Oil was run into the bolt hole. It was clear that something must be resting on top of the cast iron keel, possibly a splinter of iron from the keel bolt. There was no progress.

A Window into the Deadwood

Finally a window was cut into the deadwood where the distortion of bolts #1 and #2 was revealed. The sections of distorted bolt were removed by sawing as shown in Fig. 4 with the bright cut at the top and a cut at the bottom.

Extracting the Top Section

The top end of the bolt was tapped for a 1/2" bolt and the keel bolt was drawn up and out with the jack and lever as shown in Fig. 5.

Driving out the Bottom Section

A high strength steel 3/4" rod was used to drive the lower piece out the bottom.

Filling the Window in the Deadwood

Finally the window was filled with pieces of fir cut to fit and epoxied in around the replacement bolts as shown in fig. 6.



Figure 3. Because the blocking supporting the boat covered the sockets for keel bolts #1 and #2, it was necessary to move the supports farther aft. A six ton hydraulic jack lifted the boat so that a new stack of blocking could be installed and the original stack removed. However, there had been no movement of the lower ends of bolts #1 and #2.



Figure 4. Deadwood was plunge-cut away to reveal the region where the keel bolt was distorted. Then the bolt was cut at the top and bottom of the window with the plunge cutter and removed.



Figure 5. A 1/2" Bolt was drilled and tapped into the top of the #2 keel bolt and drawn up and out with a 4' steel channel and hydraulic jack.

Secondary Consequences of Keel Bolt Replacement

Floor Damage

Driving the keel bolts with short rods, and then longer rods, using 20 lb. weight and then 40 lb. weight took a toll on the wooden floors supporting the keel bolts. During keel bolt replacement in 1997 two of the floors showed damage on their aft surfaces and 3" x 3" x 1/4" steel angles were hot dip galvanized and bolted to the floors to strengthen them and provide a surface for the nuts of the keel bolts to rest upon. In this new replacement, the floor for keel bolt #2 became so damaged that it required replacement as well. I had a large piece of American white oak remaining from a mast step replacement project five years ago and this provided material for a new floor as shown in Fig 7.

Access under the interior finished work was limited by fresh water tanks on either side so that the wings of the new floor had to be cut and assembled in parts under the finished work. Carriage bolt holes were drilled before cutting so that the wings could be bolted on under edges of the sole. This is shown dry assembled in Fig. 8.

Floor for Keel Bolt #4

Keel bolt #4 passes through the floor that also supports the engine bearers and this floor also saw extensive damage from



Figure 6. Pieces of fir were cut and shaped to fill the window in the deadwood and after the new bolts were in place, these pieces were bedded in place with thickened epoxy.



Figure 7. White oak replacement floor above and damaged floor below that it was copied from. Width exceeded available opening so the wings were drilled for carriage bolts and then cut for assembly after insertion in the bilge.

the keel bolt driving. The extent of the damage was only realized as the nut was tightened after the lower end of the bolt was upset and drawn back into the socket in the ballast keel. A remainder of the 3" x 3" x 1/4" steel angle provided a 12" piece that was machined for the keel bolt and placed under the nut. This has allowed the nut to be torqued down to 300 ft. lb. as for the others without continuing to bury itself into the floor. Replacing this floor will be a major job because it holds the engine bearers and the engine will need to be removed to replace it. Perhaps it will be on the agenda for the next keel bolt replacement in 2040.

While the engine ran fine when the boat was launched and produced expected speed through the water and expected maximum engine rpms at full throttle, there was a certain irregularity to the sound. But it was only on the third excursion that something serious happened. After throttling back the engine to await the raising of the drawbridge for our access to Eel Pond, Woods Hole, where we keep the boat, there was a load clattering and inspection showed the starboard engine bearer moving.



Figure 8. New floor for keel bolt #2 before the old steel angle was attached. Diagonal cuts to the wings permitted insertion beneath the sides of the sole and under the coverings of the fresh water tanks. The floor was bedded in 3M5200 High Strength Adhesive Sealant and screwed from the outside with #12 silicon bronze wood screws. The external screw holes were plugged with 1/2" mahogany bungs.

Propeller Shaft Coupling

With so much work on the keel bolt replacement and damage to floors, it is advised to check alignment of the propeller shaft coupling but this is a very hard place to see. There is a hand hole in the inboard side of the aft starboard bunk and a place to get another hand in beneath the aft end of the inboard berth panel, but it is hard to see and even harder to work on the coupling. However, inspection showed that one of the bolts holding the coupling together had sheared off and the remaining three bolts were only finger tight after removing the wire preventing them from unscrewing. Separating the coupling revealed a misalignment of about 5° and a small vertical misalignment. These should be adjusted with the four vibration isolating engine mounts. My three cylinder diesel engine is expected to produce more vibration than the four cylinder gasoline engine it replaced so the vibration isolating mounts are required.

Engine Mounts

In order to remove the 5° misalignment the forward engine mounts had to be raised about 1" which required moving the aluminum angle brackets and re-drilling the bolt holes connecting them to the wooden engine bearers. This was done and while at it, a 15" section of 3" x 3" x 1/4" bridged the space between the port and starboard engine bearers tied to the forward engine



Figure 9. The mount that was hammered out on the 474th blow. The drift is in the 3/8" drilled hole and the top of the stud sawed off is beside the drift on top of the vibration damper.



Figure 10. The coupling is open and above the exhaust pipe. The propeller shaft enters the shaft log through a green shaft seal that is lubricated by grease in the copper tubing entering the seal from the left. The shift cable bracket has been detached to allow more swinging room for the wrench on the jam nut of the starboard mount, which has the top nut removed exposing the 5/8" stud just beneath the heat exchanger at upper right. Lower right is the starboard drain hose from the cockpit liner. The diagonal wooden beam supports the cockpit liner and provides a seat for working on the mounts. The black object at the bottom is the Hydro Hush muffler.



Figure 11. Painted and ready for launch on April 30, 2020 as required.

mount bolts. This last removed the possible motion of the starboard wooden engine mount where apparently the bracket connecting it to the floor timber had failed. But raising the forward end of the engine while making the two halves of the coupling parallel increased the vertical offset and the aft engine mounts needed adjustment. The jam nuts on these could not be moved.

Driving Out Frozen Engine Mount

Access to the aft end of the engine is obtained by removing the cockpit footwell liner, a moderately difficult task but it was done without damage. This allowed removal of the starboard vibration isolating mount where at home the jam nut was loosened with a long wrench. But the port mount could not be removed despite taking off the top jam nut. And application of Kroil, guaranteed to free stuck metal parts, failed to improve the situation in 9 days of repeated application. So the top part of the stud was sawed off with my plunge cutter (three days) and then a 3/8" hole was drilled into the 5/8" stud stuck in the unthreaded clearance hole. Finally a 3/8" drift was machined from one of the keel bolt driving rods. Hammering on this drift was commenced with the target of 1000 blows to drive the stud out. First day had 300 blows with a rest after each 100. The second day picked up with the 400 series but on blow 474 there was a thunk. This was the mount falling into the bilge. Fig. 9 is the mount with the drift and the top of the stud that was sawed off.

The replacement mount I had ordered had been delivered and it easily went in the hole and was adjusted to remove the vertical misalignment. One more adjustment of all four mounts got the halves both parallel and vertically aligned and new coupling bolts were inserted, torqued down, and wired through their nuts to prevent unscrewing. Fig. 10 shows the aft end of the engine with limited working space between the exhaust pipe, the heat exchanger, and the transmission.

Conclusion

Shadowfax was launched April 30, all painted and ready to sail as in Fig. 11. The post launch work on the coupling and the engine mounts has displaced most sailing and allowed growth to somewhat slow the boat. Full throttle now gives 6.0 knots and maximum of 3300 rpm. But most important is that leak rates are less than any time in the last 20 years.



OFFSHORE TECHNOLOGY CONFERENCE ASIA

P.O. Box 10054, 50700 Kuala Lumpur, Malaysia

Telephone: +60.3.2182.3000 • Facsimile: +60.3.2182.3030 • Email: otcasia@otcnet.org • Website: www.otcasia.org

OTC ASIA 2020

2-6 November 2020 VIRTUAL

ANNOUNCEMENT: Offshore Technology Conference Asia 2020 To Go Virtual

The Offshore Technology Conference Asia (OTC Asia) recognises the unprecedented and ongoing global challenges associated with the COVID-19 pandemic. The health and safety of our partners, attendees, exhibitors, and staff are of utmost importance.

Considering the rapidly changing guidance and restrictions by governments and companies, and following consultation with key partners and stakeholders, the decision has been made to transition OTC Asia 2020 to a virtual event in the fourth quarter of 2020. We are actively working to confirm dates in October or November.

By shifting to a virtual event, we are committed to providing the industry a platform for continued knowledge-sharing and professional development to preserve the significant work of the programme committee and authors to prepare for this conference. In addition, it will provide opportunities for businesses to showcase solutions, network and engage with long standing and potential clients during this challenging time.

We are excited to be a part of this pioneering effort by the not-for-profit professional associations that organise OTC Asia. We look forward to the solidarity and collaboration of our industry and its leaders to support this inclusive opportunity to bring the industry together through digital innovation to share and discuss the latest insights on the challenges we are facing.

We understand there will be many questions about what a virtual OTC Asia will entail. OTC Asia will be communicating more information as plans are finalised.

We thank you for your patience and understanding given these complex circumstances.

We look forward to your participation in OTC Asia 2020 later this year.

Cindy Yeilding

OTC Board Chair

Senior Vice President
Strategic Initiatives
BP America, Inc.

Neil Kavanagh

OTC Asia 2020

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Conference Programme Committee Vice Chair
Managing Director,
Global Solutions, Malaysia
Shell

About OTC Asia

Since the maiden OTC Asia was held in March 2014 in Kuala Lumpur, it has established itself as Asia's premier offshore energy event. OTC Asia, which is programmed to benefit the industry in the region and around the globe, is a collaborative effort amongst 13 sponsoring non-profit academic, scientific and professional organisations dedicated to the advancement and diffusion of scientific and technological knowledge of offshore resources and related environmental matters.

For further information please contact otcasia@otcnet.org or visit 2020.otcasia.org.

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2020 IEEE OES Autonomous Underwater Vehicle Symposium

PLEASE NOTE: The IEEE OES AUV2020 Symposium will proceed in remote mode. AUV2020 will feature asynchronous presentations to ensure that you can participate, regardless of the time zone you live in. Our new discounted registration pricing structure is now available.

Every two years the IEEE Oceanic Engineering Society (IEEE OES) sponsors a collaborative symposium to bring together those working in the field of autonomous underwater vehicles.

In 2020, this diverse group from around the world will meet online for the first time.

For inquiries, please contact AUV2020 Secretariat: info@auv2020.org

Organizers



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UT21 Online - SPECIAL EVENT MARCH 2 2021 UNDERWATER VIDEO COMPETITION

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Chang-Kyu Rheem, IIS, The University of Tokyo

Masanao Shinohara, ERI, The University of Tokyo

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Katsunori Mizuno, The University of Tokyo

Blair Thornton, IIS, The University of Tokyo /University of Southampton

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Weilin Hou, ONRG Singapore

Secretariat

Harumi Sugimatsu, IIS, The University of Tokyo

We are delighted to announce a special online event for UT21, to fill the gap years until the next face-to-face meeting planned in March 2023.

Competition Outline

This project aims to stimulate research and development in undersea technology and oceanographic monitoring by providing intellectual stimulation to researchers and engineers by introducing their research and attractive videos to each other. In addition, we aim to build momentum for UT21, which has been postponed for two years.

Scope of Application

UT21 calls for videos designed to promote the appeal of Underwater Technology (Undersea Engineering) to a wide audience. Specific themes for the videos are as follows:

1. Environmental Monitoring
2. Marine Robotics
3. Marine Mineral Resources
4. Renewable Energy
5. Marine Construction
6. Observatory and Disaster Mitigation
7. Fishery Engineering
8. Acoustics and Communications
9. Sensors
10. Underwater Technology with Covid-19

Competition Categories

Category 1 Research Presentation

Video is expected to be of an applicant speaking on research, however as long as the video describes the research, the format is not limited to conventional presentation style. Please provide a clear and interesting summary of your research.

Category 2 General

Any style of presentation is acceptable. For example, trouble, funny or unusual scenes, beautiful or exciting scenes captured on video during underwater experiment.

Eligibility

Applicants must register for this event. Failure to register by the date separately specified may result in cancellation of the application. Applicants must agree to the terms and conditions of competition. Only one (1) entry per person in each category may be submitted.

How to Apply

Apply through the competition website to be available from October 1.

Video Requirements

- Video must be between one to three minutes (between 1'00" and 3'00").
- Only videos uploaded to YouTube will be considered for the competition. The privacy setting for the video must be "Unlisted". If you wish to apply the video previously uploaded to YouTube as "Public" for this competition, you must change the privacy setting to "Unlisted" or make a new upload.
- Sound is not required.
- The language must be English. For non-English speech, English subtitles must be provided.
- Include required information in the description section of the YouTube upload. (such as title, author, note that the video is submitted to UT21 Online Video Competition, etc. Details to be announced later.)
- If the video has been previously published at another conference, on YouTube, or other social networking sites, please specify the date and medium of publication at the time of entry.
- Videos that have been or will be submitted to other video competitions are not acceptable.

Selection Guidelines

Research Presentation Category: Clarity and communication.

General Category: Impression made on committee members

Results

Winners will be announced on March 2, 2021 during UT21 Online event.

Prizes

The following prizes will be awarded in each category.

Grand Prize (1 winner per category)

Runner-up (1 winner per category)

Young Researcher Prize (2 winners per category)

Schedule

Application Period Tuesday, October 1 - Friday, December 18, 2020

Announcement of selected finalists: Early February 2021

Advance voting deadline, final judging: Late February 2021

Online event with awards ceremony: March 2, 2021 (JST)

For inquiries, contact: info@ut2021.org

<http://www.ut2021.org>



Welcome to COA 2021!

2021 IEEE/OES China Ocean Acoustics Conference - COA 2021, Harbin, China

27-30 May 2021 **The conference has been shifted from 2020 to 2021 due to COVID-19*

The second IEEE/OES China Ocean Acoustics Conference (COA 2021) will be held from 27th May to 30th May, 2021 at Harbin, China. Conference chair, Professor Yang Desen, welcomes all colleagues in marine acoustics and related fields to submit latest research in the up-coming conference. COA 2021 will focus on discussing, exchanging and sharing the cutting-edge research topics, by well-known scholars worldwide, creating new opportunities for cooperation. The conference will present the latest research in marine and underwater acoustics through invited and contributed papers. For more info, please visit the URL as below.

URL: <http://www.chinaoceanacoustics.cn/COA2021>

The 2016 IEEE / OES China Ocean Acoustics Symposium (COA2016), initiated by Professor Yang Desen (Harbin Engineering University) and Professor Jean-Pierre Hermand (Université Libre de Bruxelles) was a great success and established a high-level platform for international cooperation and scientific exchange. COA 2016 attracted extensive attention from academic circles in the mainland and abroad.

Continuing this tradition, second IEEE/OES China Ocean Acoustics Conference (COA 2021) will be held from 27th May to 30th May, 2021 at Harbin, China. Conference chair, Professor Yang Desen, welcomes all colleagues in marine acoustics and related fields to submit latest research in the up-coming conference. COA 2021 will focus on discussing, exchanging and sharing the cutting-edge research topics, by well-known scholars worldwide, creating new opportunities for cooperation. The conference will present the latest research in marine and underwater acoustics through invited and contributed papers.

All accepted and presented full-papers will be submitted for publication in the IEEE Xplore and will be indexed at EI Compendex. Selected papers will be recommended for review and publication in IEEE journal. Scholars and students are welcome to submit contributions and participate in the conference to exchange new ideas, new technologies and new methods.

The conference program will also include tutorials by well-known experts on topics relevant to marine acoustics research. A technology exhibition will also be held during the conference to show-case advanced marine and underwater acoustic instruments, equipment and systems from Chinese and international manufacturers.

Conference Dates: May 27-30, 2021

Registration: May 27, 2021

Technical Sessions: May 28-29, 2021

Tutorials: May 30, 2021

VENUE: Harbin, China

ORGANIZING COMMITTEE

Honorary chair: YANG Shi-e

Co-Chair: YANG Desen

Technical Committee Chair: YIN Jingwei, QIAO Gang, Suleman Mazhar

Finance Chair: HU Bo

Secretary: WU Yingzi

Treasurer: FENG Xuan

Local Coordinator: LIU Songzuo

Student Affairs Chair: WANG Jianan

Publication Chair: ZHOU Tian

Social events Chair: MENG Yu

IMPORTANT DATES

Abstract submission date: Mar. 20, 2021

Notification of acceptance date: Apr. 20, 2021

Full paper submission date: Apr. 30, 2021

Please submit extended abstract (in English) online. The abstract should consist of minimum 500 words and can be up to 2 pages including necessary diagrams or tables. Final paper requires 4-6 pages.

CONTACT: Wu Yingzi, 18846070800 (Harbin Engineering University)

EMAIL: COA2020@hrbeu.edu.cn, wuyingzi@hrbeu.edu.cn

A Blast from the Past! . . . We Love Our Music!

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

Another look back at our OCEANS conferences, where, no matter what country we're in, we love the music!



OCEANS 2018 Charleston



OCEANS 2019 Marseille



OCEANS 2014 St. John's



OCEANS 2012 Yeosu



OCEANS 2010 Sydney



OCEANS 2014 Taipei



OCEANS 2013 Bergen



OCEANS 2009 Bremen



OCEANS-TECHNO-OCEAN 2004 Kobe



OCEANS 2017 Aberdeen



OCEANS 16 Shanghai



OCEANS 2009 Biloxi



OCEANS 2006 Singapore

Student Poster Competition Going Virtual

Shyam Madhusudhana, OES Student Poster Competition Chair

A flagship event at every MTS/IEEE OCEANS conference is the Student Poster Competition (SPC) in which student researchers are invited to submit their research work for consideration. On the basis of two stages of abstract reviews, 15 to 20 students are selected to participate and present a poster of their work. The students are paid travel, accommodation and free registration at the conference. In light of the prevailing COVID-19 related lockdowns and travel restrictions around the globe, merger of this year's Singapore and Gulf Coast OCEANS conferences into a unified virtual event, Global OCEANS 2020, is ensuring continuity in the OCEANS conferences series. Addressing the 'whats' and 'hows' of effectively conducting the various facets of the conference was a daunting task, which the joint local organizing committee (LOC) has tackled brilliantly, with support from the sponsoring societies IEEE-OES and MTS. While the technical sessions are set to be combined, the SPCs of the constituent editions of the conference will be retained separate and independent. Both SPCs will now occur in parallel, with 15 shortlisted candidates from each edition. Prizes will be awarded to the top three ranked posters in each pool. Kudos to the LOC General Chairs and the LOC SPC Chairs for ensuring sponsorship of the SPC programs as well as the monies for cash awards to competition winners. I take this opportunity to also thank the sponsors—Office of Naval Research, Office of Naval Research-Global, Schmidt Ocean Institute and National Oceanic and Atmospheric Administration—for their support of this year's SPC and also for their continued support for OCEANS conferences in general.

Moving past the executive decisions, ironing out the implementation details of conducting the SPC in the virtual format exacted concerted decision-making from the SPC leadership in ensuring that the quality and standards of the competition were maintained while making sure that any added workload on the students and the judges remained minimal. The SPC leadership included Too Yuen Min and Ahmed Mahmood from the Singapore LOC, Stephan Howden and Capt. Craig Peterson from the Gulf Coast SPC, Josh Kohut and Liesl Hotaling from MTS, and Shyam Madhusudhana from IEEE-OES. For this SPC, participating students are required to switch to electronic posters with formats prescribed to make it conducive for online presentations. The students are also required to submit a pre-recorded 5-minute



Shyam with a newborn painted turtle that he rescued from a parking lot a few months ago.

video of their presentations providing a quick overview of their study orally. The participants and the judges will also have a one-on-one Q&A time (at a mutually agreed upon timeslot) during the conference.

We are excited about the SPC at Global OCEANS 2020 and are looking forward to beating all the pandemic-related predicaments. Hoping you will come out and support our budding oceanic engineers in these challenging times.

OCEANS

CONFERENCE & EXPOSITION

Global OCEANS 2020: Singapore – U.S. Gulf Coast

Live Virtual: October 5-14, 2020
On-Demand: October 5-30, 2020
global20.oceansconference.org



Gulf Coast



Singapore


marine technology
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IEEE
Oceanic
Engineering Society



OCEANS 2021 San Diego

September 20-23, 2021

Sustaining our Oceans . . . Sustaining our Future



*the latest in new and
emerging technologies*



*innovative research
and science*



*investment strategies and
spending priorities*

200+ Exhibitors
10+ Technical Tracks
Extensive Scientific Sessions
Tutorials
Student Poster Competition
Golf Tournament
Underwater Film Festival

OCEANS
CONFERENCE & EXPOSITION



sandiego21.oceansconference.org

The OCEANS 2021 San Diego Conference will give you the tools and knowledge to advance...

San Diego Technical Sessions, Special Topics:

- Artificial Intelligence: New opportunities
- Big Data: Generation, Management, and Exploitation
- Autonomy: Yesterday, Today, and Tomorrow
- Ocean Clean Up: Micro to Macro
- Alternative Energy from the Sea
- Sustainable Blue Economy
- Ocean Acidification: Causes and Mitigation
- Ocean Inspirations for STEM
- Government / Industry / Academia Synergy

OCEANS Technical Sessions, Standard Topics:

- Underwater Acoustics and Acoustical Oceanography
- Sonar Signal/Image Processing and Communication
- Ocean Observing Platforms, Systems, and Instrumentation
- Remote Sensing
- Ocean data Visualization, Modeling, and Information Management
- Marine Environment, Oceanography, and Meteorology
- Optics, Imaging, Vision, and E-M Systems
- Marine Law, Policy, Management, and Education
- Offshore, Structure and Technology
- Ocean Vehicles and Floating Structures

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OCEANS 2021 PORTO

MAY 17 - 21, 2021

Opening the Ocean Frontier: A New Age of Discoveries

You are cordially invited to the beautiful city of Porto for lively sessions and discussions on ocean-related issues and to experience the magic of the oceans spanning centuries of maritime history.

The innovative OCEANS 2021 Porto program will include technical sessions, invited sessions on specialized topics, plenary sessions, a student poster competition, outreach and media sessions, discussion panels, live feeds, tutorials, and exhibits. OCEANS 2021 Porto is all about connecting the world-wide community with the goal of opening the ocean frontier at the dawn of a new age of discoveries for the benefit of mankind.

OCEANS 2021 Porto is being planned as a hybrid conference enabling in-person as well as remote participation. The richness of face-to-face sessions and events cannot possibly be replaced by remote meetings, but the latter allow for new forms of participation, namely of young students from distant communities bordering the world's oceans.

For periodic updates on the format and scope of the event, please consult the conference website.

Ocean science and technology
for the benefit of humankind.

Technical program topics

Special Porto topics

- P1. Cultural heritage and underwater archeology
- P2. Affordable ocean systems and technologies
- P3. Extension of the continental shelves
- P4. Deep sea exploration and parallels to outer space
- P5. Extreme environments: science and technology
- P6. Ship automation and green propulsion systems
- P7. Non-living resources: exploration and exploitation
- P8. Natural hazards and early warning systems
- P9. Offshore aquaculture
- P10. Ocean literacy and outreach
- P11. Ocean health monitoring
- P12. Artificial intelligence in ocean science and technology
- P13. Drones in marine applications
- P14. Azores: the sentinel of the atlantic
- P15. Sustainable exploitation of ocean resources

General OCEANS topics

- 1.0 Underwater acoustics and acoustical oceanography
- 2.0 Sonar signal / image processing and communication
- 3.0 Ocean observing platforms, systems, and instrumentation
- 4.0 Remote sensing
- 5.0 Ocean data visualization, modeling, and information management
- 6.0 Marine environment, oceanography, and meteorology
- 7.0 Optics, imaging, vision, and e-m systems
- 8.0 Marine law, policy, management
- 9.0 Offshore structures and technology
- 10.0 Ocean vehicles and floating structures
- 11.0 Other

Important dates

Abstracts submission opening:	September 18th, 2020
Deadline for abstract submission:	December 18th, 2020
Announcement of results:	February 19th, 2021
Opening registration:	March 12th, 2021
Final paper submission:	April 9th, 2021
Deadline for early bird registration fee:	April 16th, 2021



Conference venue

Alfândega Congress Centre (former Porto Customs House)
Rua Nova da Alfândega
Edifício da Alfândega
4050-430 PORTO

Facing the Douro river and combining a unique urban and natural landscape, the hundred-year-old building served as the Customs House until 1987, when it was restored and converted into a Congress Center under the guidance of architect Eduardo Souto Moura, a Pritzker Prize award winning architect from the Porto School of Architecture. Conveniently located in the heart of Porto's historic city centre, which has been designated a World Heritage Site by UNESCO, the Alfândega Porto Congress Centre is also within walking distance of the house of Henry the Navigator and a number of tourist attractions including the Dom Luís Bridge, the Clérigos Tower with its magnificent views of Porto, and the Livraria Lello & Irmão, which is considered the third most beautiful bookstore in the world.

Who's who in the OES

Farheen Fauziya, OES WIE Liaison and a Newly Elected AdCom Member (from 2021–2023)

The literal meaning of my name is “*a wise lady who emerged triumphant*.” When I have lived my life, I hope I would have done justice to my name, which my parents so lovingly chose. Today, however, I see myself a determined and perceptive human who is diligently working towards achieving her life goals despite all the prejudices and hardships. Life for a person with my background has been a challenge, and that is what makes it exciting. The reason for choosing these unconventional opening statements is that I want to motivate my fellow WIE; I want them to believe in themselves and to know that whatever their goal *it can be achieved*.

I was born in a small town in the poor and populous state of Bihar in India, hundreds of miles from the nearest ocean. I developed a love for numbers while still in school, it was further enhanced in college where I was drawn towards signal processing. Luckily for me I got an opportunity to hone my signal processing skills by applying them to one of the most challenging applications, viz. underwater wireless communications. I explored vector sensors and directional transducers, as potential devices for enhancing the performance of underwater acoustic communication systems, during my doctoral studies at Indian Institute of Technology Delhi. I continue to actively pursue research in the area of underwater acoustic communications in particular and signal processing in general.

Over the years, I have lived in multiple cities and towns around India and, of late, my research and my association with IEEE OES has taken me around the world. I love visiting new places and learning new things. I have been a keen learner throughout my life and have been blessed with great mentors throughout my life. My family, my teachers, my supervisors, my learned mentor at IEEE OES, all deserve a special mention for making me who I am today.

I have no special hobby; I have gone thru a fair number of them over the years. However, what is important for me is to give my complete attention to whatever I am engaged in at that particular phase of my life. I believe faith gives us strength and an open-mind presents us with opportunities. A combination of the two has been the driving force of my life. I live with my husband and his family in Patna, Bihar and love to spend free time with them at home.

I have been engaged with IEEE OES for five years now and have been actively contributing to the society in different roles and responsibilities. I have volunteered as social media reporter



*After receiving certification of appreciation
at OCEANS'19 Seattle.*

at multiple OES events, I have judged student poster competition at OCEANS multiple times, I have contributed to *The Beacon* and in *Earthzine*. In addition to serving on OES AdCom, I am the current IEEE OES WIE liaison and an active member of the Delhi Chapter of IEEE. I have established a student branch chapter at Indian Institute of Technology Delhi and served on its executive team.

I look forward to a continued association with IEEE OES and hope to motivate women researchers to make significant contributions to Oceans Engineering. On a personal front I intend to continue learning and working towards turning my parents hope into reality. I will be happy to support or advise anyone who wishes to participate in IEEE OES activities.

Member Highlights

We Introduce What OES Members Did to Survive the Stay-at-Home Period of the Pandemic. Please Enjoy!

The following newspaper article, by Josh Bickford of the Barrington Times (July 8, 2020), highlights Stan Chamberlain's photography. Congratulations.



Stuck at Home, Resident Photographs Dozens of Birds

Stan Chamberlain made the most of his time during the state's stay-at-home order.

Confined to his house and surrounding property, the Barrington resident photographed dozens of birds as they visited his feeders, compiling an extensive photographic portfolio.

Using his Nikon Z6 camera with a telephoto lens, Mr. Chamberlain captured images of cardinals, sparrows, chickadees, blue jays, grackles and many other birds in various stages of flight and feasting. He adjusted the shutter speed on his camera to one-five-thousandth of a second to photograph a hummingbird as it hovered above a feeder in his yard: the normally blurred buzzing of its wings frozen in time.

"I took hundreds of photos," Mr. Chamberlain said during a recent interview. He said he was surprised by how many different species of birds frequented his Heritage Road home.

At times, Mr. Chamberlain would also bring his camera on trips to the Osamequin Bird Sanctuary located off the Wampanoag Trail. Careful to keep a safe distance from any other people visiting the sanctuary, Mr. Chamberlain spotted—and captured in flight—images of herons, egrets, osprey and mallard ducks.

"It kept me busy. It kept me occupied," he said, of his new-found interest.

Some of the images surprised Mr. Chamberlain: the spread of a bird's wings as it landed at a feeder and the color of their plumage.



Cardinal (male)



Robin



Blue Jay



Tufted Titmouse



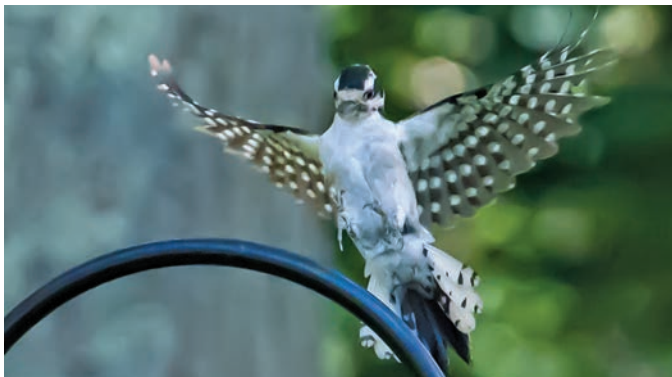
Goldfinch



Hummingbird



Cowbird



Woodpecker

“The cardinal was brilliant, at least the male was,” Mr. Chamberlain said.

“The woodpeckers are very beautiful.”

Mr. Chamberlain considers himself a photo enthusiast. For years he has served as the photographer at conferences for IEEE (Institute of Electrical and Electronics Engineers), of which he is a member taking photos of presenters and honorees.

Photographing birds, however, provided a different challenge. Mr. Chamberlain said he would sit on his deck and wait patiently for the birds to approach the feeders. He said he enjoyed the activity greatly.

More recently, Mr. Chamberlain’s son has been visiting and he brought along his dog. Mr. Chamberlain decided to move the bird feeders farther away from his deck, reducing the odds for any dog-and-bird interaction.

It is the least he can do for the feathered friends who kept him busy during his time at home.

Following Three Illustrated Clan Morrison COVID Adventures was Written by Archie Todd Morrison III, Ph.D., Senior Ocean Engineer, Woods Hole Group.

Cape Cod National Seashore Atlantic White Cedar Swamp Trail and Marconi Wireless Station

In early April, not quite a month into our COVID work-from-home odyssey, a socially distant, quite literally anywhere out of the house and out of the immediate neighborhood, mental health break was urgently needed. And what better for two PhDs, a molecular biologist and ocean engineer, than the Atlantic White Cedar Swamp Trail and the remains of the Marconi Wireless Station, located in the dunes of the Cape Cod National Seashore.



Figure 1. Through the scrub oak and pine woods.

Equipped with warm clothing and masks made by Hilary, and fortified with hot coffee (Guatemalan, Coffee Obsession) and sandwiches (baguette, tomato, mozzarella, pesto, Maison Villatte), we set forth from Falmouth, MA, and headed along the spine of Cape Cod for the Town of Wellfleet.

The Atlantic White Cedar Swamp Trail is a combination of earthen path through scrub oak and pine (Figure 1) and



Figure 2. Entering the swamp.



Figure 3. A clear water pool deep among the cedars.



Figure 4. Natural beauty and a timely reminder.

newly refurbished boardwalk through the cedars (Figure 2). While there were other hikers, social distancing was not a major problem.

We spent a couple of leisurely hours, slowly walking through the swamp, admiring the moss, fungi, and seriously twisted cedars (Figures 3 and 4). If, like us, you enjoy a good swamp, don't miss this one.

From the swamp we walked across the parking lot and into the dunes overlooking the Atlantic Ocean. This was the location of the Marconi Wireless Telegraph Station, the first transatlantic wireless telegram station in the United States. Its inaugural telegram, sent on January 19, 1903, was from Teddy Roosevelt to Edward VII.

While of great historical significance, sadly, the transmission towers and most other physical evidence of the Marconi Wireless Station are long gone. The views, however, particularly on a windy early spring day, are spectacular.



Figure 5. Looking north past the site of the Marconi transmission towers.

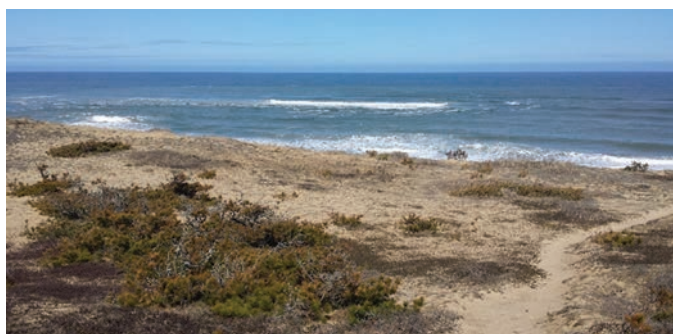


Figure 6. The view to the east, out over the open Atlantic.



Figure 7. Walking south along the beach at the foot of the Marconi dunes.

Fostering in the Time of COVID

As many know, Hilary and I have been hotline foster parents for the Massachusetts Department of Children and Families for about 20 years now. Hotline placements are typically only for a night or a weekend. They happen, all too frequently, on an emergency basis while the Department investigates the case and tries to sort out a path forward. Just before the lockdown started here in mid-March, we took in two sisters, ages 11 and 6, nominally for the weekend.

Sunday night I called the case worker to schedule the Monday morning pickup and was told there would be no pickup. The governor had closed all state agencies earlier that evening, without warning and without any chance to formulate backup plans. Minutes before I called, the worker had received instructions from her supervisor that she was not allowed to pick up any of the children in care and could not go to the DCF office in the morning. There was no end date for those instructions, just stand down and leave everything and everyone hanging because that was the only option the powers on high had left to them.

I spent the next three hours making and fielding calls with case workers and supervisors. Our collective options had narrowed to (1) handing the sisters to the police, who really have other things they need to be doing, (2) handing them to an emergency worker, who would be prohibited from taking them to the DCF office or anywhere else, who would then just drive them around in her car all day, and who would, come evening, then not be able to place them for the night, or (3) keep them with no known end date. After nanoseconds of careful consideration, we selected Option C. Thus began our ever-lengthening work-from-home odyssey (156 days and counting at the time of this writing).

We hired a young woman, a high school classmate of our son and essentially a now grown foster daughter of ours. We had just helped her get certified to babysit foster kids and now her first gig, working around her day job, which was in an ill-defined partial COVID shutdown, was to come entertain the sisters during the day while we tried to keep up with work. That was great for two days beyond the nominally weekend only hotline placement. On the third day the sitter received an email from her day job announcing that a co-worker had been tested for COVID-19. Recall that, in March, unless you played in the NBA, you had to be clearly symptomatic to get tested, so we had to assume we were all exposed and put ourselves and the sisters in strict quarantine.

Friends shopped for us (and for the two very picky eaters), delivering groceries to our front stoop while we waited inside. Once they were done unloading and had retreated to the driveway, we could “talk” over a 5- to 10-meter separation and then move the groceries inside. One couple was able to score a desperately needed pack of toilet paper for us by getting to a store before 0600 one morning. I found it by the door, unannounced and unexpected, when I got up early to let the dog out. My definition of real friends gained a new requirement that morning (Figure 1).

After a week of quarantine, the co-worker’s test results came back negative and we were able to do our own shopping again. But we still had the girls, who were desperately bored and getting on each other’s nerves. But DCF couldn’t place them



Figure 1. Remember when all of the paper goods aisles looked like this most of the time?

anywhere because workers were not allowed to conduct home inspections nor any of the other investigatory tasks necessary to sorting out problems and developing solutions.

In a bid to preserve Hilary’s sanity, if not my own, I reduced my daytime work hours (replacing them with late night work hours, it’s WFH, so not the issue it might have been except for missing sleep, but that’s a different adventure) and took the girls on socially distant walks and to the (then) empty beaches and dunes of Outer Cape Cod. Stress levels were reduced, though not eliminated (Figure 2).



Figure 2. Wandering the dunes of Outer Cape Cod in a cold March wind.

Finally, after a weekend placement that had gone on for three weeks and more, a bureaucratic miracle of sorts occurred. Those powers on high agreed to authorize the case workers to perform home inspections using video conferencing software. Both grandmothers were willing to take the girls and, when the smoke of investigation had cleared and after a desperate last-minute flurry of phone calls, the girls were placed with the grandmother who had the shorter rap sheet. Hilary and I were a family of two once again. You can’t make this stuff up.

To Purgatory and Back through Misery (Yes, Really)

At the end of July, then four and a half months into our COVID work-from-home journey, Hilary and I gathered our local bubble, two grown foster daughters and a presumptive future son-in-law, and drove to Purgatory. Literally.

Purgatory Chasm in Sutton, MA, is a mad scramble of boulder caves and overhanging precipices. The chasm may owe its existence to a burst ice dam and a raging torrent of glacial meltwater that ripped up blocks of granite bedrock roughly 14,000 years ago at the close of the last Ice Age. Or maybe not. However it formed, our mad scramble through the maelstrom of the chasm floor and back over and along the cliffs above was in turn coolly refreshing and warmly satisfying.

Several views of our masked and socially distant progress along the granite block strewn floor of the chasm can be seen in Figures 1 and 2. The bottom of the chasm is up to 25 meters below the overhanging cliffs, and reasonably cool and shaded, even on a hot summer day.

After reaching the end of the chasm, we looped back, climbing through the woods to the tops of the cliffs (Figure 3).

Which brought us to our only passage out of Purgatory, the narrow crack through the granite cliffs known as Fat Man's

Misery. One by one we entered and one by one we crossed over to the other side (Figures 4 and 5).

To Purgatory and Back through Misery, a recuperative journey in the time of COVID.



Figure 3. Abbey Road, socially distant version, climbing the back side of the cliffs.



Figure 1. Hiking along the deep floor of the chasm.

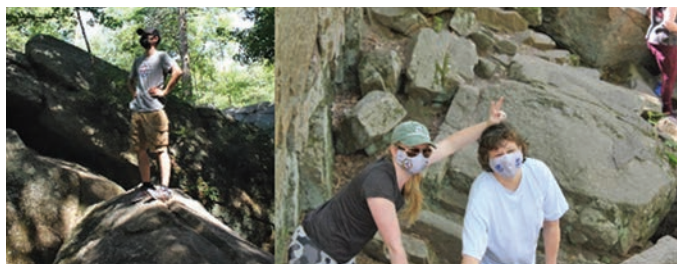


Figure 2. Working our way over, through, under, and around the blocks of granite piled haphazardly in our path.



Figure 4. Masked party members, one by one, edging sideways through Fat Man's Misery, our passage out of Purgatory.



Figure 5: Exit from Purgatory complete, ready to return home.

AdCom Election Results



The election results are in for the 2021–2023 Administrative Committee members. This year we had a great list of 12 candidates from around the world (see their bios in the last issue of the Beacon) and the results were very close. Congratulation to the following six candidates who were elected:



Gerardo Acosta



Farheen Fauziya



Fausto Ferreira



Malcolm Heron



*Katsuyoshi
Kawaguchi*



*Venugopalan
Pallayil*

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

Welcome New and Reinstated Members

Australia

Dinuka Doupadi Bandara
S Hall

Canada

Bret D Davis
Robert Mackenzie

China

Yuzhu Kang
Jingyang Liu
Yuan Liu
Xiangzhao Qin
Xuandi Sun

Chao Wang

Hua Yu

Ecuador

Cesar Andrez Enderica
Posligua
Sully Edita Rivas

France

Patrice Brehmer
Ludovic Noblet

India

Deepak Kumar

Muthuvel Panayan
Vijayakumar R
Nilanjan Saha
Sriram V

Indonesia

Henry Manik
Eko Prayetno

Nigeria

Chinyere Emuchay

Taiwan

Min-Kang Chao

USA

Blake Ian Barry Cole
Donald P Eickstedt
Joseph Frank Fanto
Diana V Haass
Stephen B Lockhart
Rick Metzbower
Thomas S Peterson
Britney E Schmidt
William G Stevens
Juan Mario Sutija
Howard Velasquez
Artur Wolek

Open Ocean Robotics ASV Winch: University of Victoria Student Capstone Project

Ryan Foxall, University of Victoria

Open Ocean Robotics is a Victoria based start-up that designs, builds, and operates autonomous surface vessels (ASV) for scientific data collection. A team of six engineering students from the University of Victoria (Figure 1) were tasked to design an automated winch to be mounted to an ASV for sensor deployment as seen in Figure 2.

The winch was required to deploy an AML Base•X₂ SVP sensor package from the vessel down to depths of up to 300 m, avoid line tangling, and securely stow the sensor payload away, with ability to add inductive charging in the future. The plan was to develop a working prototype and provide testing results. However, because of machine shop closures due to COVID-19, the design was pivoted to a theoretical based design, with more emphasis on analysis and concept iteration. Stress analysis simulations were completed on a number of components to ensure structural integrity. This enabled weight reductions in parts and geometrical optimization.

The winch uses a 12 V brushless DC motor to drive a spooling system (details in Figure 3). The line is neatly arranged onto the spool using a self-reversing diamond lead screw. To avoid line tangling, a tensioning device was implemented at the end of the static arm. This consisted of two counter rotating pulleys, mounted vertically on top of one another, with a downward force between them provided by springs. Line counting is done using a magnet and Hall effect sensor mounted to the

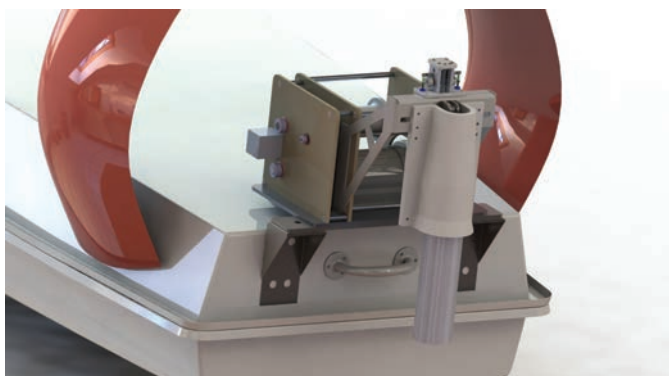


Figure 2. Render of the final winch design.

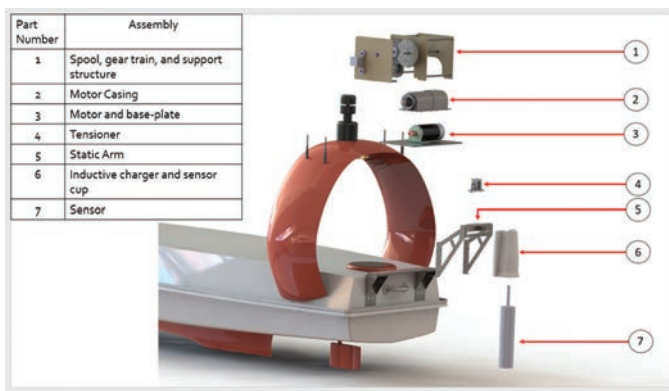


Figure 3. Exploded subassemblies of winch.

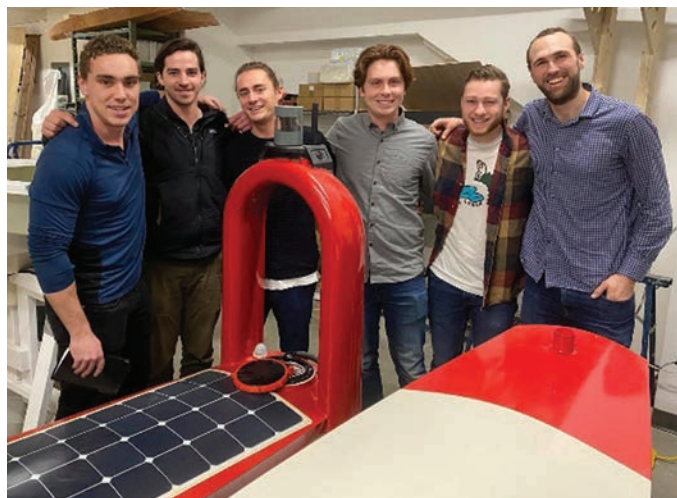


Figure 1. Team photo with the Open Ocean Robotics autonomous surface vessel. Names left to right: Robert Scarth, Nic Mercier, Bret Davis (OES student member), Braidon Joe, Josh Stang, and Ryan Foxall.

tensioner. A 3D printed cup was mounted at the end of the static arm to guide sensor docking, to provide a secure location for the sensor when not in use, and to position the sensor against an inductive charging plate. Highly corrosion resistant materials, such as stainless steel and various plastics, were chosen due to the saltwater environment. Rapid prototyping methods, such as laser cutting and 3D printing, are central to the design methodology to reduce costs and production time.

Open Ocean Robotics is keen to bring this concept to life and provide their clients with reliable sensor deployment in the near future.

The team would like to thank IEEE OES Victoria Chapter for their contribution, Open Ocean Robotics for their mentorship, and their instructors at the university for their guidance and feedback.

Oceanic Engineering Society IIT Delhi, India

Puja Dubey, IIT Delhi Student Chapter Chair



Group photo

Indian Institute of Technology Delhi (IITD)—OES STUDENT CHAPTER

The Centre for Applied Research in Electronics (CARE) established in 1971 has been engaged in focused, goal-oriented applied research and specialized manpower training in the areas of Microwaves & Millimetre Waves and Underwater Electronics/Signal Processing and has served several important requirements over the past five decades.

Our signal processing group endeavors to provide real-life problems in underwater scenarios as research theses to encourage technology development and generation of new application ideas in the oceanic domain. The ocean is one of the richest and most underutilized resources on Earth and one should work on technology that increases our ability to tap it as a resource for food, energy and trade—without harmful consequences. **IEEE OES student chapter** has been formed with the following aims:

- To devise the tools and techniques necessary to study and make use of the oceans
- Probe unexplored corners of the ocean and refine true and tested research methods and develop innovative new ones.
- To provide a platform and administer scholarship funds for students to showcase the work and learn more in naval architecture, marine engineering, ocean engineering and other marine fields
- To extend educational facilities and train the manpower from industry, R & D organizations, and other educational institutions to enable them to carry out tasks in areas of Ocean Engineering.
- To collaborate with user organizations on need-based problems

- So, we can build meaningful professional relationships, encourage diverse dialogue, and strengthen technical and professional ties in the local area through different activities such as workshops and distinguished lectures arranged by the OES Student Chapter.



Underwater Acoustic Lab, CARE, IIT Delhi.

Events by IITD STUDENT CHAPTER: Inauguration of IITD—OES STUDENT CHAPTER

The “Inauguration of IITD-OES STUDENT CHAPTER was organized on 7th February 2020” in IIT Delhi. The student chapter conducted a **student symposium on Ocean technology** on the inauguration day. We received many entries and 6 students were shortlisted for presentation in IIT Delhi. **Prof. Monika Aggarwal**, Faculty advisor, briefed the audience about mission and vision of newly formed chapter. **Prof. Arun Kumar** (Head of Centre of Applied Research in Electronics) also gave a talk on ‘**An Overview of Underwater Acoustic Vector Sensor**’ which is one of great research area one can explore. The students also got the opportunity to have an informal discussion with dignitaries. Selected students shared different ideas in field of ocean science and technology such as **Ocean Vehicles and Structures, Marine Pollution, Markerless Pose estimation of Aquatic Animals in Video Feed**, etc.



Speech by Prof. Monika Aggarwal.



Talk by Prof. Arun Kumar.



Talk by Cdr. Gaurav Sharma.



Students Representing Their Ideas.

Cdr. Gaurav Sharma (an alumnus of National Defense Academy) and Dr. Sharbari Banerjee (Assistant Professor at Amity University) also shared their research work as well as real time problem existing in oceanic field. **The winners got chance to present their views in MTS TECHSYM-2020, Chennai.**

Distinguished Lectures

The student chapter has organized distinguished lectures on different topics. The first lecture was conducted by **Prof. Sukumar Mishra** on 10th February, 2019 at IIT Delhi. Prof. Sukumar Mishra is a Professor at Indian Institute of Technology, and recipient of INSA medal, INAE young engineer award, and winner of the Samanta Chandra Shekhar Award. In his lecture Prof. Mishra discussed about Microgrids, which are being regarded as “**elementary units**” of smart grid Technologies.



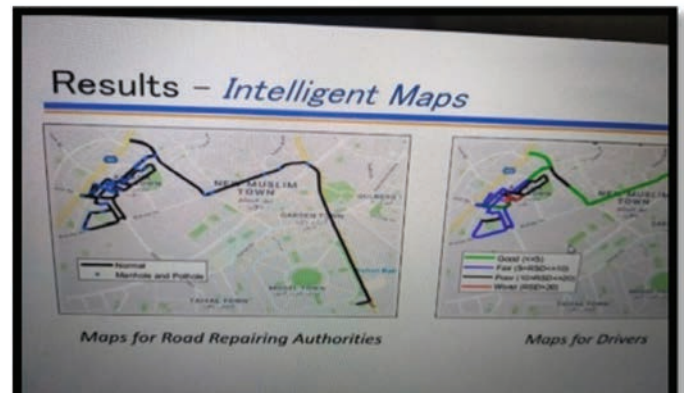
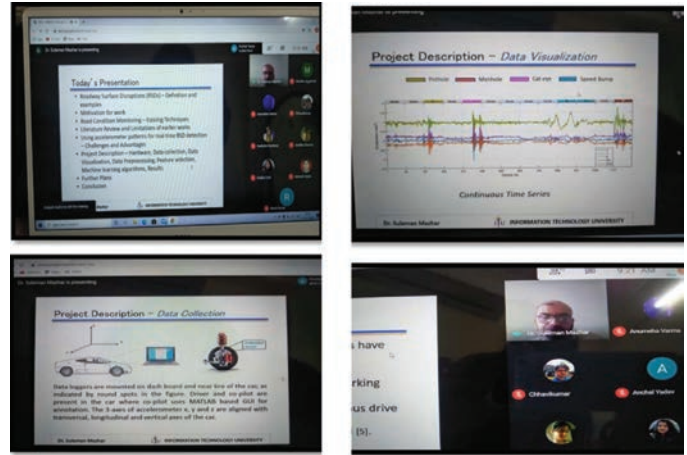
Talk by Prof. Sukumar Mishra.

On 4th March, another lecture was addressed by **Prof. A. D. Rao** of IIT, Delhi on **Storm surges and associated coastal inundation due to tropical cyclones: Recent development**. Prof. Rao joined the faculty of Centre for Atmospheric Sciences at IIT Delhi. His research interests are in developing numerical models for ocean state prediction system. He is an elected member of the National Academy of Sciences and an associate editor for International Journal of Ocean Climate Systems.

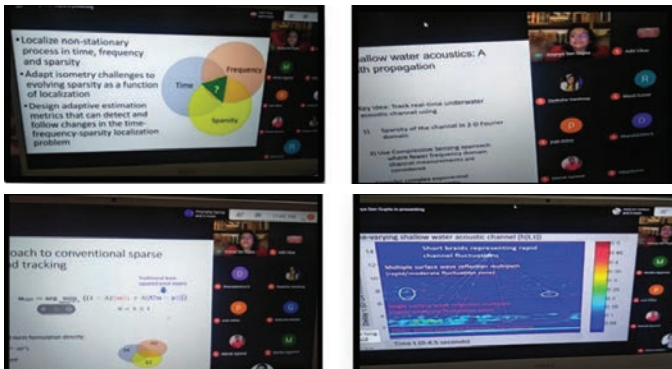


Talk by Prof. A D Rao.

On 10th July, another distinguished webinar talk was arranged by student chapter which was presented by **Dr. Ananya Sen Gupta**, assistant professor in University of Iowa, on “**Harnessing Geometric Techniques for Robust Real-time Estimation of Shallow Water Acoustic Channels.**” She also worked in Woods Hole Oceanographic Institution. Dr. Sen is an Associate Editor of IEEE Access, a guest editor of IEEE Journal of Oceanic Engineering Special Issue in “Underwater Acoustic Propagation Physics and Signal Processing Techniques for Shallow Water Acoustic Communications” and a Technical Committee participant in IEEE OES. In particular, she presented the efficacy of employing geometric signal processing techniques to adaptively track the shallow water acoustic channel and interpret the channel scattering events under divers oceanic conditions.



Webinar Talk by Dr. Suleman Mazhar.



Webinar Talk by Dr. Ananya Sen Gupta.

On 25th July, distinguished webinar talk was presented by **Dr. Suleman Mazhar** on “**Road Anomaly Classification for Low-Cost Road Maintenance and Route Quality Maps.**” **Dr. Suleman Mazhar** is a professor at HEU, China. He was also heading **BISMiL** Lab and worked as assistant professor at GIK Institute, Topi. He is a senior member of IEEE, TYSP fellow and State alumni. In his lecture, he presented anomaly classification system used as a low-cost road maintenance solution by road repairing authorities and the road quality maps, which solution by road repairing authorities, and the road quality maps, which can provide the passengers and drivers with the information of most comfortable route for their journey.

Such student chapter activity is widely considered the key element leading to increased participation and retention of students, and women and minorities, in the field of ocean engineering. We have been trying to increase mentorship opportunities for students and IEEE OES provides a support network, access to role models and personal interaction with experienced professionals to engage its students, helping them advance.

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