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Wishing Everyone a Happy New Year!



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From the President

To all Members of the Oceanic Engineering Society (OES), your vote of approval is requested by January 19, 2018 to modify the designation of OES Officers in *Article V-1.2.2.1—Officers Named* of the OES Constitution as follows:

- Vice President for Conference Operations to Vice President for OCEANS
- Vice President for Conference Development to Vice President for Workshops and Symposia

Voting instructions were sent to you by regular mail or via email. If you did not receive them,



please sign in with your IEEE account to <https://eballot4.votenet.com/IEEE> and vote.

Why bother? Because, thanks to your participation and engagement in a growing number of OES technical forums, it has become necessary to distinguish the flagship biannual OCEANS conference (61 and counting) that OES co-sponsors with the Marine Technology Society, from the many topical OES-sponsored or co-sponsored

(continued on page 36)

From the OES BEACON Editors

Harumi Sugimatsu and Robert Wernli

Welcome to the December 2017 issue of the Beacon. And, once again, we'd like to thank all of the contributors to our quarterly newsletter. As you can see by the content, this is your newsletter, and we try to cover all aspects of the society activities from our workshops, symposia and conferences to what our individual members, chapters and committees are up to.

Our last issue covered the OCEANS '17 Aberdeen conference, and following close behind was the OCEANS '17 Anchorage conference, which is covered in this issue. As you'll see in the article by Bob Seitz, conference chair, and also a report from our student guest, Mboza Lukindo, from IEEE Women In Engineering, the conference was a multi-faceted success. As Philippe reports, this success was also heralded by the students chosen for the Student Poster Competition, and especially those who won the top three prizes. You will also enjoy the article by Joshua Baghdady, winner of the SPC at OCEANS '16 Monterey, as he discusses his OCEANS conference experiences, including becoming an SPC judge. Another event at the Anchorage conference was the annual OES awards to outstanding members and also those who have completed their terms in the Administrative and Executive committees.

And the OCEANS conferences aren't the only ones that have been happening. Included in this issue are reports from Jean-Pierre's Rio Acoustics Symposium held in Brazil, and the OTC conferences held in Houston and also Brazil. And your editors held member/chapter/society meetings in Anchorage in the OES/MTS booth (see photo) that included planning for the Underwater Technology 2019 symposium to be held in Kaohsiung.

The chapter activity has certainly been picking up as reported by the Victoria, Providence, Seattle, Houston, Malaysia and Australia chapters. Are we becoming competitive? Which chapter will have the most reports in the Beacon next year? And, speaking of competition, enjoy the article on how the University of Tokyo's "Minty Roll" won the Underwater Robot Competition.

In past issues we reported on member activities that have ranged from sailing, hiking, and zip lining to biking during international travel and pedal-to-the-metal racing. This issue



(L to R) Venugopalan Pallayil, Tamaki Ura, Harumi Sugimatsu, R (Venkat) Venkatesan, Robert Wernli, Hsin-Hung Chen, Yu-Cheng Chou, Masanori Kyo, Donna Kocak.

will continue with articles on members that range from the depths of the oceans to the top of mountains . . . literally!

You'll also get the latest on the organizational changes within OES by both outgoing and incoming officers. In addition, read the article by Brandy on our OES social media efforts, an area where the society is working hard to expand and optimize. Feel free to get involved. And that goes for the Young Professional who should definitely check into the YP-BOOST program that Fred reported on in the last issue on the Beacon.

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.

CORRECTION—We're good, but not perfect. Missed removing part of a title in Bill Kirkwood's racing article on page 62. Bill is our lead-footed Treasurer, at least till the end of this year, but he is not the OES Past President and Chief Editor of "The OCEANS Conference—60 and Counting," which was correctly reported in the title of Joe Czika's article on page 59.

Member Benefits—Did You Know?

UPS Discounts

Let IEEE help improve your bottom line with competitive rates on UPS shipping services. Save on a broad portfolio of shipping services including air, international, ground, and freight services. Receive these discounts even with a current UPS account.

Canadian UPS Discount for Members

Members can now save 40% on UPS shipping services in Canada.

To set up your account and start saving on every shipment, simply visit UPS to take advantage of this new exclusive offer, or call +1 800 MEMBERS (+1 800 636 2377), Monday through Friday, 8:00 a.m. to 6:00 p.m. ET.

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Through the UPS Savings Program, members may save up to 35%* when they ship with UPS, plus 50%* off select services

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Save on a broad portfolio of shipping services, including:

- Up to 35%* on UPS Air letters
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- Savings begin at 75%* on UPS Freight® shipments over 150 lbs.
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To enroll and start saving, visit savewithups.com/ieee or call **+1 800 MEMBERS (+1 800 636 2377)**, Monday through Friday, 8:00 a.m. to 6:00 p.m. ET.

VPTA Report

Malcolm Heron, OES Vice President for Technical Activities

Each year IEEE Technical Activities Board (TAB) creates innovative Ad Hoc Committees to review specific 'hot topic' areas. Each Ad Hoc committee is given a small budget and commissioned to investigate what IEEE's role might be in the area and report back by the end of the year. In 2017 TAB Chair Marina Ruggieri set up four Ad Hocs, one of which was IEEE at the North and South Poles (INSP) under the leadership of Adriano Camps (who is a member of GRSS). The challenge was to discover what IEEE should/could do for our members and for the benefit of the wider community. The Arctic is experiencing new challenges with activities following the retreat of the ice cap. The Antarctic has a community of over 4,000 people in the Sum-



mer and 700 in winter from a widespread group of nations.

As members of the Ad Hoc, Tony Milne from GRSS and your VPTA convened an Antarctic and Southern Ocean Forum (ASOF) in Sydney on the day prior to IEEE Sections Congress in August. Tony delivered an Ignite talk at Congress and we set up a Booth for INSP in the exhibition space. ASOF was remarkably successful. We discovered an element of concern among project scientists that planning and budgeting for necessarily very large infrastructure by the institutions (think billions and decadal time scales) somewhat swamped the 3, and 5-year projects that scientists focus on. The outcome was an enthusiastic call for an IEEE symposium or workshop for scientists and engineers to share results and connect with each other. The original ASOF group decided to retain the name ASOF and requested the first full ASOF meeting on 27-28 August 2018 in Hobart.

In the meantime, a separate group in Manitoba, led by Witold Kinsner, has been working on a parallel meeting in the north to be held on 2-3 July in Churchill, with the title Arctic and North Oceans Forum (ANOF). While the technologies are similar in the extreme conditions of the poles and polar oceans, the issues are mostly quite different with a well-established international treaty governing the Antarctic continent and the more industrial activities in the Arctic. The two forums in 2018 will self-determine whether IEEE should retain them separately, or merge into one Polar IEEE Forum. Perhaps that can be held on the equator!

In response to these activities, OES AdCom re-established its Polar Oceans Technology Committee at the meeting in Anchorage, and appointed Dr. Andreas Marouchos from Hobart as the first of the Co-Chairs. This whole ASOF/ANOF development shows how the Technology Committees (TC) structure within OES can work when a TC can pick up on the kernel of an initiative and give it momentum within the wider IEEE structure. If you are active in Polar Oceans, then run a search for ANOF and ASOF. By the time this issue appears there should be web sites.



Marina Ruggieri and Mal Heron at the INSP Booth at Sections Congress in Sydney.

VPPA Report

Robert Wernli, OES Vice President for Professional Activities

This will be my last report as your VPPA as I term out the end of this year. Jim Collins will replace me beginning 1 January 2018. I have enjoyed my four years as your VPPA and I feel we've made excellent progress in the areas assigned to the VPPA. In my last article in the June issue of the Beacon, I covered all of these activities in detail so will not repeat them in this issue.

Under the VPPA are two primary areas of responsibility: Membership and Chapters under Jim Collins leadership, and Outreach and Promotions under Steve Holt. Beginning next year, it has been determined that the Chapter responsibility will transfer to Mal Heron, VP for Technical Activities. I've asked both Jim and Steve to provide updates on their activities and plans; their reports follow this one. You'll see Steve's description of our promotion efforts to include the future plans for our website modernization along with Jim's advice to the Chapters. Holding meetings and events and reporting on them is an easy way to get financial support to the chapter. Don't pass up this opportunity. You'll see a lot of such activity reported in our Chapter News section.

Another change that has been approved is the transition of the scholarship program and funds to two different programs: YP-BOOST and a still to be implemented "Student Council" program. Both will stand up next year with the intent to provide funds to get YPs and Students to future OCEANS conferences to participate and to learn the operation of the OES. These programs will hopefully lead to future memberships and activities focused on our younger members.



Finally, we will learn soon if we have received funding from IEEE for our Social Media initiative. Our goal is to provide funds to get all of our social media up and running at a high level with increased participation. This will then transition to a team of volunteers to keep the momentum going. If you're a social media person and would like to help, please let us know.

Again, it's been my pleasure serving as your VPPA. However, I'm not leaving the team; I'll begin my return to the Administrative Committee (thanks for voting for me) next year and I'll continue to work with Harumi as her Co-Editor-in-Chief on the Beacon. Cheers.

VPCD—End of an Era

Albert (Sandy) J. Williams 3rd, OES Vice President for Conference Development

OCEANS Conferences command a position of great importance in OES. Consequently, there have been two officer positions detailed to the OCEANS Conferences. The VP for Conference Development (VPCD) is focused on selecting and bringing along venues that serve the members of the OES, that provide a conference in areas with a potential future membership, and that serve humanity in marine fields even when membership is not active. Generally, this starts about five years out with consideration of possible venues by RECON. An effort is made to gain information necessary to select a likely venue without creating a competition between prospective venues. When there is a favored candidate there is an invitation issued to send a letter of application and then a process is begun that, if successful, results in a vote by both the MTS Board and by the OES AdCom to proceed.

Recently, the OES selection has been delegated to RECON with a report to AdCom for their confirmation, thus saving the time formerly spent listening to presentations by the applicants. RECON has been under the cognizance of the VPCD.

When a venue has been selected and approved, the VPCO takes over and Conference Operations handles the continuation of the conference oversight through the actual conference and the closing of the conference. Since 2005, OCEANS Conferences have been jointly sponsored by MTS and OES and the jointness of our Conferences is fundamental to OCEANS. JOAB has administered the implementation of the joint policies of the two Societies in the operation of OCEANS and the OES part of JOAB is under the cognizance of the VP for Conference Operations.



VPCD, Sandy Williams in float plane in Anchorage in 2017.

In 2016 it was decided by the OES ExCom that it made more sense, and permitted greater continuity, to change the former arrangement to one that followed the OCEANS Conference from birth to closing under the cognizance of a single



VPCD, Sandy Williams with Christophe Waldmann in the background having their outdoor lunch in Monterey in 2016.

officer. Therefore, in 2017 a change in the By Laws of OES was approved and the VPCO position became VP OCEANS (VPO) which included cognizance of both RECON and JOAB. The former VPCD now became VP Workshops and Symposia (VPW&S). Formal restructuring of these two officer positions will commence in 2018 with replacement of the VPCD, this reporter, by the newly elected VPW&S, Philippe Courmontagne. So, it is the end of an era, but should benefit the smooth functioning of OCEANS Conferences through greater continuity and eliminating the hand off of our former responsibilities.

Thanks to everyone for your support during my four years as your VP for Conference Development.

Let Me Tell You a Little Story

Philippe Courmontagne, Newly Elected Vice President for W&S

In 2004, I participated in a small workshop during the SeaTech Week event in Brest. The name of this workshop was JASM and it was organized by Manell Zacharia and René Garelo. It was about underwater acoustics and about 36 scientific presentations were made during this event. During this workshop, I received a flyer about an IEEE conference I had never heard of before. It was OCEANS 2005 Brest. As it was an IEEE conference, and because of the standing of these conferences, I decided to try to participate to this event, with my two PhD students. Just to be sure, we submitted 4 abstracts to OCEANS. All of them were accepted. In this way, we discovered what an OCEANS conference is. This was the beginning of a long story. After that, I participated in 25 OCEANS conferences, became an IEEE OES member; my students too, first as student members and next when they became Young Professionals as members. Next, I was involved in the Student Poster Competition (SPC), first as a



Philippe Courmontagne

judge and next as the SPC Chair. I became the IEEE OES French Chapter Chair, have been elected to the AdCom and now I am the new VP for Workshops and Symposia (W&S). And why? Simply because in 2004, I had participated in a small workshop sponsored by IEEE OES. During my term as VPW&S beginning in

2018, I want to keep in mind this little story. Indeed, workshops and symposia are not only a place to present new research results, but the showcase for our society. This is the place where we will find new members, future attendees for OCEANS, new authors for JOE, and in a nutshell . . . new blood for our society.

From the EIC's Desk

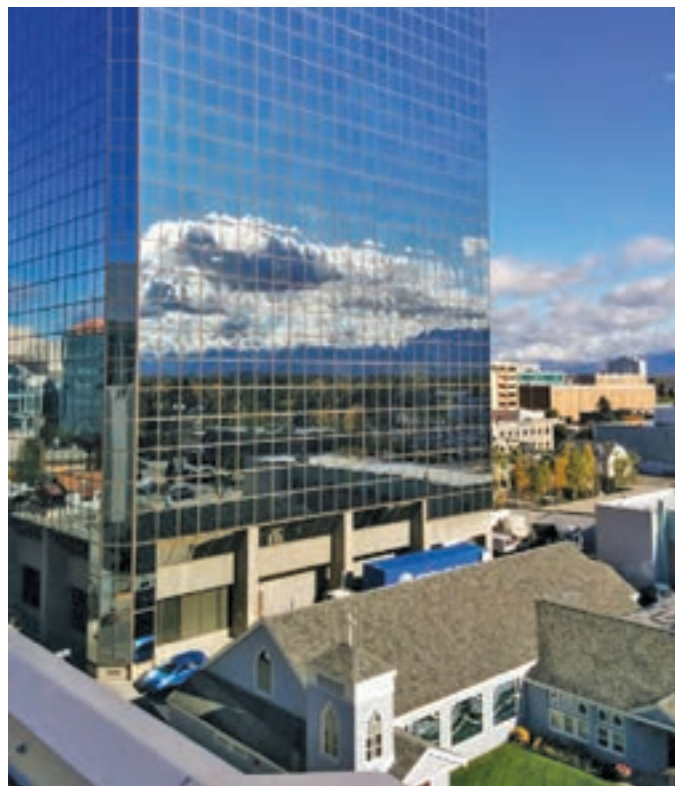
Ross Chapman, Journal Editor in Chief

Now that the October issue is comfortably in our email boxes, I hope everyone appreciates the two special issues that are featured, UCOMMS16 and the second part of TREX13. UCOMMS16 is a collection of papers from the conference of the same name that was held in Lerici, September 2016. I have to take my hat off to John Potter who once again delivered on time a collection of papers at the forefront of research in underwater communications. When I took over as EIC, I was not convinced that special issues could be tidied up in time for publication on schedule, but John provided the proof that it could be done. The Journal has partnered with the UCOMMS conference organizers in each conference since 2012 to arrange for a special issue, and I trust that the link will continue.

The other special issue is the second part of the collection of papers from the TREX13 experiment on underwater acoustic reverberation and propagation that was carried out in shallow water off the Florida coast near Panama City. I am very pleased that the organizers chose to publish the research results from this experiment in the Journal of Oceanic Engineering. We can look ahead to a similar special issue from the most recent Office of Naval Research experiment, the Sea Bed Characterization Experiment that was carried out last March. The announcement of the Special Issue will be published in the January issue of the Journal. Chief Scientists David Knobles and Preston Wilson will serve as Guest Editors.

One of the things I do at OCEANS conferences and other meetings that I attend is to trawl the floor for suitable candidates for the Editorial Board. Conferences turn out to be a great source of good material, and I'd like to introduce here the most recent candidates from these 'trawling expeditions'. There's quite a long list of new folks who have been appointed as Associate Editors (AEs) for three-year terms. First of all, Drs. Charalampos (Harry) Tsimenidis and Konstantinos Pelekanakis. Dr. Tsimenidis is Reader (Associate Professor) in digital communications in the School of Engineering at Newcastle University, Newcastle, UK, with research interests that include Underwater Acoustic Communications and Array Signal Processing. Dr. Pelekanakis is a Research Scientist at the NATO Centre for Maritime Research and Experimentation in La Spezia, Italy. His research experience is in underwater acoustic communications and networks, including development of standards. Both of these appointments strengthen the expertise on the Editorial Board for handling reviews of manuscripts in underwater acoustic communications and sonar and array signal processing.

Next are two appointments that provide assistance on the Editorial Board for handling the increasing number of manuscripts that



*From the patio at the conference centre.
A reflection on Anchorage.*



Outside at the Native Heritage Centre.



The Raven greeting at the Alaska Native Heritage Centre.

are submitted in research related to autonomous underwater vehicles. Drs. Joao Borges de Sousa and Nuno Cruz, both from the University of Porto, have research interests including co-ordination, dynamic control and optimization, and systems engineering related to underwater vehicles. If all goes well, the Journal can work with these two new AEs to generate a special issue based on papers from the AUV workshop that will be held in Porto next year.

And the last one, but by no means least important, is John Watson, our Highland friend, who joins the Editorial Board with his extensive expertise in underwater optics and optical imaging. John becomes our first kilted member on the Board. I welcome all these new folks to the Editorial Board. Recruitment of AEs has been a major focus for me, because the reputation of the Journal depends on the work of a strong cohort of dedicated experts on the Editorial Board who volunteer their time.

Before I leave this part of my message, I have to write about a disturbing problem that we have been dealing with more and more often these days at the Journal. I'm talking about the many instances of authors adding new material to their papers *after the peer-review process has been completed*. To give you the background, at this stage of the review the paper has been recommended for publication by an Associate Editor, and the authors have been requested to submit their final version that we will send to IEEE for typesetting. We check the final version as a matter of quality control, and unfortunately, we are finding that some authors are adding new material in the final versions of their papers. This practice is unacceptable, it undermines the purpose and the function of the peer-review process that is the basis of ensuring the technical correctness of scientific writing. I'm going to repeat here, for a wider audience, the warnings that we need to send to authors when we find this problem.

The IEEE Journal of Oceanic Engineering considers the practice of adding new material to a paper following completion of

the peer-reviews as a serious breach of ethics in scientific publishing. There are several consequences that could occur as a result, depending on the severity of the case. Actions that could result vary from requiring, in more benign cases, a statement from the authors that explains the value added by the inserted material to even rejection of the paper itself in more serious cases.

Authors who add new material in their final versions are sent a warning about the practice that should be taken very seriously. Authors are given two options. One is to remove the additional material and re-submit the 'final' version of their paper. The other is to send a cover letter that describes the additional material and explains the value that it adds to the paper. Their paper is set aside until we receive their response.

Our general policy at the Journal is that if authors feel it is necessary to add new material after the paper has been recommended for publication by an Associate Editor, the authors should indicate this intention in a cover letter that describes the new material and explains the reason for including it in the paper. Authors should provide such a letter when the final version is submitted. Another option is to add a 'Note added in Proof'. Either way, the final decision of whether to accept the additional material rests with the Editor in Chief.

Well, that's enough on the Journal for now, I'll move on to say a few words about Anchorage. The OCEANS '17 conference buffet at the Alaska Native Heritage Centre was a real highlight. Thanks to the good weather that evening, we had the chance to wander around the displays outdoors as the sun set on the trees that were already changing colour. I hope everyone had the chance to talk to some of the native artists who were showing their work in the Centre later that evening. The Native display in the museum downtown in Anchorage was just as good. It's not difficult to develop a great respect for the people who first lived there and managed well in very harsh conditions that bring about 2 m of snow in the winter.

Anchorage is also about earthquakes. The city shows an excellent film at the park's museum in the Courthouse about the Good Friday earthquake in 1964, one of the largest magnitude quakes ever recorded. I used to teach a course in earthquakes and natural hazards at University of Victoria, and it would have been very useful to have shown the film in the classes. We can read from books about the damage that was done, but to see interviews with people who lived through all the shaking and hear the story of what happened when an entire neighbourhood and all the houses slid into Cook Inlet is much more dramatic. Don't know if anyone else caught the film, but it was something to see. You can visit the site where the neighbourhood was, it's called Earthquake Park. I had a chance to see it, on what turned out to be the very last tour of the season on the little red tour bus that took folks around the city. The bus stopped at the site for a moment, the neighbourhood was not ever rebuilt. There were lots of other earthquake stories from the driver/guide, I hope some of you had the chance to hear them too. If you took the trip, you would have found out a lot of other tidbits. For instance, did you know that the airport is

actually built on permafrost? Or that about half the number of private airplanes in the country are registered in Alaska?

Finally, I would like to take this opportunity to say farewell. This message is the last one that I'll send to the Beacon in my tenure as Editor in Chief of the Journal. In saying farewell, I would like to acknowledge the support given by all the Associate Editors on the Editorial Board over the past five years, and thank them for the generous donation of their time and expertise. Without their dedicated efforts in managing reviews of papers, we could not have achieved our goal of maintaining the archive of highest quality research papers for which the Journal is known and respected.

It has been a great privilege to serve this research community as Editor in Chief. I believe that the Journal is being passed to good hands in the new Editor in Chief, Mandar Chitre. I trust that he will continue to receive the same degree of enthusiastic support that was given to me.

Ross Chapman
Editor in Chief

Distinguished Lecturer Program: Jan–Jun 2018

Malcolm Heron, OES Vice President for Technical Activities

When Distinguished Lecturers (DLs) take long-haul flights, there is often an opportunity for the DL Program to help with stopovers or side trips to deliver lectures. In the table below we have listed such travel for each DL for the next six months. If your Chapter or Section would like to take advantage of this, simply make contact with the relevant DL to devise a Plan. You should CC VPTA (mal.heron@ieee.org) to keep me in the loop and remember you MUST ask for any funding support

and get approval from your friendly VPTA PRIOR to making any commitments. This is simply so that I do not have to arm-wrestle with the auditor. The URL for information about Distinguished Lecturers is <http://www.ieeeoes.org/page.cfm/cat/16/Distinguished-Lecturers>. Don't overlook the possibility of inviting a DL who is located near to you. Also, please think laterally about calling on DLs for keynotes at Workshops or non-IEEE meetings.

DL & location	Key Words (refer web site for details)	Destinations and dates
Sandy Williams Woods Hole, Massachusetts	Technology of flow measurement; Oceanographic instrumentation; Microstructure and mixing; Bottom boundary layer turbulence and sediment transport.	Charleston South Carolina 19–29 October 2018
Mal Heron Townsville, Australia	HF Radar Technologies; HF Radar Applications; Coastal Oceanography.	Orlando, Florida February 2018 Kuala Lumpur, Malaysia 20–23 March 2018 Kobe, Japan 27–31 May 2018 Charleston, South Carolina 21–25 October 2018 Hobart, Tasmania, Australia 14–17 August
Milica Stojanovic Boston, Massachusetts	Underwater acoustic communications • Statistical characterization of underwater acoustic communication channels • Signal processing for acoustic communications: synchronization and channel equalization • Multi-carrier modulation/detection for acoustic channels • Reliable transmission over acoustic channels	Washington, DC 19–20 March 2018

Jim Candy San Jose, Oakland, San Francisco, California	Model-based signal processing; Bayesian signal processing; Acoustic signal processing; Nonlinear filtering; Time-reversal signal processing; Radioactive contraband detection.	Kobe, Japan Charleston, South Carolina	27–31 May 2018 21–25 October 2018
Kenneth Foote Woods Hole, Massachusetts	Underwater sound radiation and scattering; Marine resource quantification; Sonar performance evaluation	Kobe, Japan	May–June, 2018
Kelly-Benoit-Bird Monterey Bay, California	Acoustics; Ocean ecology; Predator prey; Autonomous platforms.	Unconfirmed	
Marcia Isakson Austin, Texas	Ocean acoustic propagation and scattering in complex environments; Finite Element Modeling; Sediment Acoustics.	New Orleans, Mississippi Sandestin, Florida Washington, DC South Bend, Indiana Hood Canal, Washington Minneapolis, Minnesota Monterey, California	4–8 Dec 2017 29 Jan–1 Feb 2018 27–30 March 2018 13–15 April 2018 23 Apr–4 May 2018 14–18 May 2018 14–18 May 2018
	Ocean surface monitoring from space: sea—state, pollution and ship detection	Milan, Italy Kobe, Japan	12–14 March 2018 27–31 May 2018
Paul Hines Halifax, Nova Scotia, Canada	Aural perception and acoustic classification; High duty cycle/continuous active sonar.	Unconfirmed	

OES Chapter and Membership Development

Jim Collins, OES Chapters and Membership Chair

The following includes the latest on our Chapter activities, funding support based on meeting reports and an overview of our Membership Development status.

Chapters

At present there are 30 regular Chapters in the IEEE OES. The newest of these is the Portugal Chapter formed this year. A recently implemented program encourages Chapter technical meetings and reporting of them in the OES Beacon magazine. When finances permit, the OES provides a financial incentive to Chapters that have held and reported on at least two technical meetings in a year starting on November 1st and ending on October 31st of the following year. As of October 31, 2017, nine Chapters had qualified for this incentive program. The objective is to assist active Chapters in improving their programs and perhaps encourage the formation and operation of Student Branch Chapters in the same Sections. For more detail on this program, see the prior issue of the Beacon, pages 10–11. The nine qualifying Chapters were Providence, Seattle,



Canadian Atlantic, Victoria, Australia, India, Japan, Malaysia, and Singapore. Actually, a total of 86 technical meetings were held by the society's 30 Chapters. Unfortunately, only the nine chapters listed reported theirs in the Beacon. About another six would have qualified if they had reported on their meetings.

Several areas like Boston as well as the Monterey and Santa Clara area have more than enough members to petition for a Chapter in their respective areas. Twelve signatures are required.

OES Student Branch Chapters (SBC's) have recently been approved at the Shanghai Jiao Tong University, the Panimalar Institute in Madras, India, the City University of Hong Kong, and most recently the Esculir Superior Politecnica Del Littoral in Guayaquil, Ecuador. Presently for the OES to financially support a SBC, funding must be managed by passing it to a local OES Chapter which has qualified through its technical meeting reports. SBC executives change over very rapidly compared to regular Chapters and the latter can provide some underlying management continuity for the former.

Membership Development

Last summer Paul Racette of NASA, and Joseph Dowling a summer student with Paul, and myself prepared a report on IEEE OES Member Demographic information in an effort to better understand the makeup of the OES and how better to serve its members' needs.

Highlights of the reported information follows:

- As of May, 2017, there were 1,498 Higher-Grade Members and 99 Students and Affiliates for a total of 1,597
- In the fields of study reported by 1,043 members:
 - 57.4% are in Engineering
 - 10.8% in Physical Sciences

- 5.7% in Computer and Information Sciences
- 26.1% in Math, Education, Bio and Med, and other
- Gender composition is reported as 9.2% female, 81.6% male and 9.2% unspecified
- Membership geographic distribution percentages over IEEE's 10 Regions as of 8 May 2017 were:
 - R1-6, USA 48.7%
 - R7, Canada 5.8%
 - R8, Europe and Africa 18.2%
 - R9, Mexico and South America 2.2%
 - R10, Asia and Australia, 25.0%

Activities for the IEEE OES Promotions Committee and OES Web Modernization Committee

Steve Holt, OES Promotions Chair

The two main responsibilities for the OES Promotions Committee was to (a) coordinate efforts for press releases of several OCEANS conferences and (b) disseminate information through our quarterly Beacon newsletter, a more frequent electronic newsletter, which has current information of interest, and a journal known as Earthzine.

The press release information includes reporting on conference student poster competition activities, and the top three student winners, for several oceanic magazines. These magazines include: Sea Technology, Marine Technology News, Ocean News and Technology, Hydro International, International Ocean Systems, ECO Magazine, and ROV Planet magazine. These magazines have used our information, including photos, from different conferences which have appeared in both printed and electronic form. Some examples from previous student poster



competitions that appeared in Hydro International and ROV Planet web sites are shown in the following three figures:

In addition, the OES Promotions Committee included other very important contributions from Ms. Harumi Sugimatsu, who is the Editor in Chief for our quarterly Beacon journal, Mr. Toshihiro Maki for our electronic newsletter, and Mr. Paul Racette for the Earthzine journal. These publications are displayed on our OES website. The activities for Steve Holt, Harumi Sugimatsu, Toshihiro Maki, and Paul Racette

were reported directly to the Vice President for Professional Activities, Bob Wernli.

Another activity undertaken via the Promotions Committee, for the last four years, were efforts at modernizing the OES website have continued with input to the web developer being made by an OES Web Modernization Committee (WMC). The



(1) Photo and write up of Student Poster Competition at the MTS/IEEE OCEANS'16 Shanghai Conference.



(2) Photo of the Student Posters judging area at the MTS/IEEE OCEANS'16 Shanghai Conference.

existing OES website was last overhauled and redesigned in the Spring of 2011, and new improvements and updates have been ongoing to the existing website. Some examples of improvements include setting up a development server for the new OES WordPress website for site migration. Also, a working model of the new OES phone app has been developed. Further development of this application will continue in coordination with the new website, to ensure a seamless integration of the two outlets with regard to content organization, presentation, and the push for quicker dissemination of news. Also, efforts are ongoing to develop a new website with fresh content, in a way that appeals to a broad audience that projects a vibrant energy, and employs current technologies while maintaining a professional tone and approach.

Other future activities and plans include developing a modified, streamlined main navigation menu that highlights the prominent activities of the society (conferences, publications, committees, etc.), content that is frequently changing with continual updates. In addition, other future plans include placing prominent icon links to the various social media accounts in the website header because social media accounts



(3) Photo of the Student Award Winners for the MTS/IEEE OCEANS'16 Shanghai Conference.

should be established and maintained with fresh, current and recurring news and announcements directly related to OES and ocean engineering.

Social Media, What is it Good For?

Brandy Armstrong, Elected OES AdCom member, OES WIE Liaison

Social media is a great tool for sharing ideas, networking, and marketing to new members. The mobile nature of social media apps can even make it a useful tool for tracking scientific phenomena [1]. Still, about 30% of Americans are not members of social media, so it is likely there are some among our readership who think social media is good for absolutely nothing. I hope to persuade the hold-outs that even if they don't ever join social media, it can still be a useful tool for the IEEE Oceanic Engineering Society (OES) and that member time spent promoting OES on social media can be a worthwhile investment for the society.

Those of us who are already on LinkedIn know that professional social networking groups provide an opportunity to connect with peers, share information and develop professionally. Today 70% of Americans are using social media, 50% of employers are prepared to research job seeking candidates on social media, and 80% of job seekers use social media to research and prepare for an interview. [2], [3] This shows that most professionals are already using social media, which makes it the perfect low-cost platform for promoting and showcasing OES while maintaining a high quality of content. A majority of U.S. associations have recognized this and responded by increasing their investment in digital advertising, while maintaining the amount of time spent managing social media, (10 hours or less per week) [4], [5].

Recruiting Young Professionals (YPs) is of great interest to OES. In order to support the next generation of ocean engineers



In November, IEEE Earthzine looked at how social media can aid science and benefit society; this image of an Aurora Australis ran with a story about NASA scientists using Twitter to track aurora sightings. [1] Image Credit: Keith Vanderlinde, National Science Foundation.

and scientists we need YP input and participation. Did you know that greater than 75% of Americans age 25–49 use social media? [2] Online networking tools are recommended to graduate students and postdocs by career advisors for making connections, exchanging scientific ideas and career advancement [6]. It is necessary for OES to have an active social media presence to recruit more YPs [5]. Engaging members on social

DIGITAL MARKETING TOOLS THAT GET MOST NEW MEMBERS				
	Total (n = 240)	Individual (n = 119)	Trade (n = 58)	Condominium (n = 63)
Association-sponsored social networking websites (e.g., Facebook, LinkedIn)	56%	53%	64%	45%
Search engines(organic)	38%	34%	36%	45%
Facebook Paid Advertising	26%	30%	21%	24%
Search engine ads (pay-per-click)	16%	16%	12%	21%
Lead generation content marketing (White Papers)	15%	13%	19%	13%
Paid banners on other websites	13%	14%	12%	10%
LinkedIn Paid Advertising	8%	9%	10%	6%

In a marketing survey of 1005 unique associations, association-sponsored social networking websites were ranked the top digital marketing tool for recruiting new members. When asked which recruitment marketing channels resulted in the most new members, digital marketing ranked higher than direct mail, events/meetings, chapters, exhibiting at conferences, free membership offering, advertising in outside publications and radio/TV ads. Table credit Marketing General Incorporated, 2017 Membership Marketing Benchmark Report.[5]

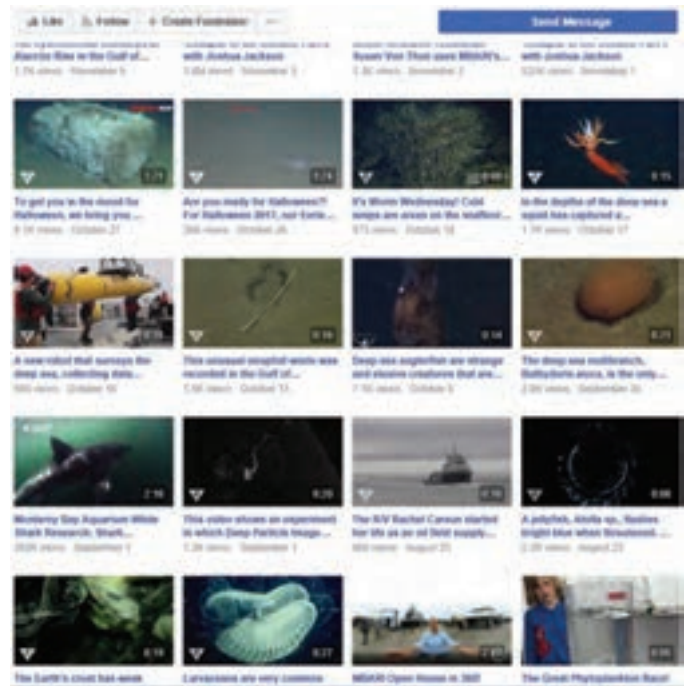
media creates a sense of community and provides a route of direct contact to OES, allowing for improved member insights and increased participation in the society. Social media followers become invested in our vision and mission. Even non-member fans can help highlight the social relevance of our society and increase the visibility of OES to potential members.

In an era of declining funding for science and for coverage of science and technology at major news outlets, social media can be an inexpensive and effective tool to reach potential members, stakeholders, and the public at large [7]. Many scientific agencies and associations are taking advantage of this by putting forth a terrific social media presence, including the National Oceanic and Atmospheric Administration, the Woods Hole Oceanographic Institute, the Monterey Bay Aquarium Research Institute, IEEE Women in Engineering and many others.

We Need OES Members to Become First Followers

Did you know that the Oceanic Engineering Society (OES) has an active social media presence? The OES has put some effort into developing a social media presence, but we do not want our message to fall on deaf ears. Even an active social media presence, if no one is following, contributing and responding, will be a waste of resources.

The first follower theory is the idea that attracting first followers will make a movement that might seem a little out-of-step with the general population seem more believable. OES needs first followers to help build a following on social media and endorse the OES to potential members. There are many



Some Monterey Bay Aquarium Research Institute videos on facebook have hundreds of thousands of views [8].

benefits to be gained from Joining, Liking or Following the Oceanic Engineering Society on social media:

- Get notified of the latest OES news, important dates and activities.
- Peruse articles from the latest issues of Beacon and IEEE Earthzine.
- Keep up with news and trends that impact your profession and organization
- Interact with like-minded professionals
- Post job opportunities and recruit top candidates
- Find your next career opportunity

To Get Started

- 1) If you haven't already, sign up for LinkedIn, Facebook, and/or Twitter
- 2) Join, Like, and Follow

IEEE Oceanic Engineering Society

Request to join the IEEE OES LinkedIn group—<https://www.linkedin.com/groups/1519807>

Like the IEEE OES Facebook page—<https://www.facebook.com/IEEEOES/>

Follow the IEEE OES on Twitter—https://twitter.com/ieee_oes

IEEE Earthzine

Follow IEEE Earthzine on LinkedIn—<https://www.linkedin.com/company/1798028>

Like the IEEE Earthzine Facebook page—<https://www.facebook.com/Earthzine/>

Follow IEEE Earthzine on Twitter—<https://twitter.com/earthzine>

- 3) Share OES with your friends and colleagues

Share OES posts, articles and tweets.

Tag posts and photos of OES events and announcements.

Share testimonials about the benefits of OES membership.
Share photos from annual events and chapter meetings showing current members enjoying the benefits of OES.

You Don't Want To Sign up for Social Media?

You can still help spread the word. Many accounts on Twitter and Facebook can be viewed even by non-members. To increase OES visibility you can:

- 1) Share OES online content with your friends.
- 2) Add a link to OES social media to your @ieee.org email signature.
- 3) Send recommendations for content you would like to share on social media to brandy.armstrong.us@ieee.org
- 4) Submit content to the OES Beacon and IEEE Earthzine.

I hope you will join the conversation and help contribute to the OES social media buzz. Your participation is the next step in spreading the word about this great organization.

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OES Society Awards

Photos by Stan Chamberlain

The OES Society Awards Ceremony was held at the Tuesday Plenary at OCEANS '17 Anchorage. We are honored to introduce the following 2017 OES award recipients. Congratulations!

2017 Distinguished Technical Achievement Award: Peter N. Mikhalevsky

Dr. Peter N. Mikhalevsky is presented the Distinguished Technical Achievement (DTA) award for advances in Arctic acoustics, oceanography and tomography. He will receive the award at the OCEANS'18 Kobe because of his schedule.

Dr. Peter N. Mikhalevsky is in the 45th year of his career in oceanic engineering spanning the military, academia and private industry. He earned his B.A. in Engineering and Applied Physics and his M.S. in Applied Mathematics in 1972 from Harvard University and his Ph.D. in Ocean Engineering from the Massachusetts Institute of Technology in 1979. He was commissioned in the U.S. Navy in 1972 specializing in anti-submarine warfare (ASW). He was instrumental in the fleet introduction of tactical towed arrays for destroyers. He applied and was accepted at MIT for doctoral studies in 1975 and sub-

sequently was the technical lead on a major advanced ASW development program. He left the Navy in 1983 to join the faculty of MIT where he taught acoustic signal processing. He joined SAIC (now Leidos) in 1985 to start a new division and built a successful \$200M/year business in advanced ocean undersea systems, underwater acoustics and signal processing which supported the U.S. Navy and other customers for over 30 years. Highlights include developing the Navy’s first unmanned ship (ACTUV aka Sea Hunter), supporting advanced undersea acoustic trainers, and the design, development and installation of the hydro-acoustic stations of the Comprehensive Test Ban Treaty Organization (CTBTO) while engaging actively in ocean research and experimentation.

With his expertise in long range acoustic propagation and fluctuations, matched field processing (MFP), array processing, acoustic tomography and thermometry, Peter Mikhalevsky was Chief Scientist and Principal Investigator of some of the first successful experimental applications of MFP and acoustic thermometry in the ocean. He successfully demonstrated MFP at 1000 Km in the Pacific in 1987.

In 1994 he transmitted the first trans-Arctic (2,600 Km) coherent source acoustic spread-spectrum waveforms and detected basin scale warming in the Arctic Intermediate Water resulting from warming Atlantic water entering the Arctic in the West Spitzbergen Current via the Fram Strait. He repeated that experiment in 1998–99 and measured continued warming. These results were subsequently confirmed by ice breaker and submarine transects. He created the triad design for the hydro-acoustic stations of the CTBTO global monitoring system significantly improving each station's localization capability, false alarm rejection, and improved use of reflected phases enabling applications beyond nuclear testing deterrence including localization and tracking of calving icebergs from Antarctica. He has 22 published papers in books and journals and 52 in conference proceedings.

For his work Peter Mikhalevsky received the Decibel Award (Naval Undersea Warfare Center, New London, CT), the A.B. Wood Medal and Prize (Institute of Acoustics, U.K.) and the R.Bruce Lindsay Award (Acoustical Society of America). Peter Mikhalevsky is a Leidos Fellow, Fellow of the Acoustical Society of America and Fellow of the Institute of Electrical and Electronics Engineers (IEEE).

2017 Distinguished Service Award: Robert L. Wernli

Robert L. Wernli is presented the Distinguished Service Award (DSA) for contributions to the governance of the Society as a member of the Administrative Committee, for service as Vice President Conference Development and Vice President Professional Activities and for the organization of OCEANS conference.

Robert Wernli is a Senior Member of the IEEE OES and has served as an elected Administrative Committee member ('03-'08 and 10-'12) and was elected to serve again during '18-'21. He was also elected to the Executive Committee as VP for Conference Development ('12-'14) and VP for Pro-



Robert Wernli receives the Distinguished Service Award from OES president Christian de Moustier.

fessional Activities ('15-'17) where he is presently responsible for membership, chapters and the promotion of the society, which includes conferences, the OES website and Beacon newsletter, of which he is presently the Co-Editor-in-Chief. As a member of, and then chair of, the OES Reconnaissance (RECON) committee, his efforts over the past 15 years has resulted in OCEANS conferences being held in Germany, Australia, Spain, Korea, Italy, Norway, Taiwan and China.

Robert has chaired 20 international conferences that include: OCEANS MTS/IEEE'95, '03, and '13, all in San Diego, and Underwater Technology '04 (Taiwan), '07 (Tokyo), '09 (Wuxi, China), '11 (Hawaii with OCEANS), '13 (Tokyo), '15 (Chennai, India) and '17 (Busan, S. Korea).

He received the B.S. degree in mechanical engineering from the University of California Santa Barbara in 1973 and the M.S. degree in engineering design from San Diego State University, San Diego, CA in 1985.

He retired in 2005 from his career at a navy laboratory in San Diego where he specialized in the field of underwater robotics research and development. As president of First Centurion Enterprises, he began his second career as an underwater technology consultant and a writer. His most recent technical publication is The ROV Manual, 2nd edition; in fiction, he has published three novels. He has over 30 technical publications and was also editor and co-author of the book on CD-ROM—Operational Effectiveness of Unmanned Underwater Systems.

2017 Institution Award: Japan Agency for Marine-Earth Science and Technology (JAMSTEC)



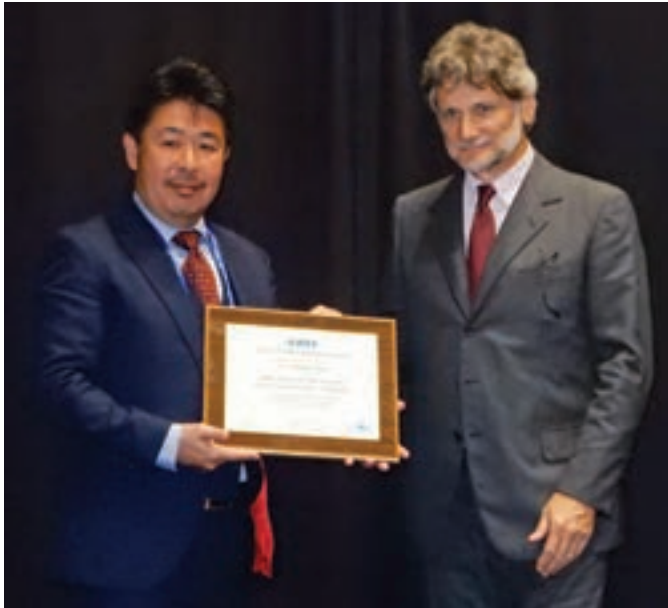
Japan Agency for Marine-Earth Science and Technology (JAMSTEC) is presented the Institutional award for its enduring and contributions to the goals of the Society in advancing ocean research science and technology.

JAMSTEC was established in 1971 on the recommendation of national and economic organizations to promote marine development, under the umbrella of the Science and Technology Agency.

For the first 10 years, between 1971 and 1980, JAMSTEC focused mainly on the development of diving technology. A saturation diving project known as "Seatopia" was developed, to enable long-term underwater habitation and diving operations.

From the 1980's to the mid-1990's, JAMSTEC made a quantum leap in the development of technology. JAMSTEC had started deep-sea research and built a manned submersible named "Shinkai 2000" in 1981. 9 years later, in 1990, work was completed on the submersible "Shinkai 6500", one of the world's premier ultra deep-sea manned submersibles. During this phase, JAMSTEC grew into an organization that possesses the world's most advanced deep-sea research technologies.

During the period 1996–2010, JAMSTEC underwent a phase of scientific research development, which was achieved



Dr. Katsuyoshi Kawaguchi receives the OES Institution Award on behalf of Dr. Asahiko Taira, President of JAMSTEC.

through a transition from purely technological development to an expansion of scientific research, combined with technological development. In 2002 the Earth Simulator supercomputer took the No. 1 spot with a performance of 35.86 Tflop/s and in 2005, the deep-sea drilling vessel, *CHIKYU* was completed. She features the most advanced drilling capabilities in the world (riser drilling in 2,500 m water depth) to contribute to the International Ocean Discovery Program (IODP). JAMSTEC's research and development capability has come to equal that of major foreign research institutions, and JAMSTEC has made great contributions to projects such as the Intergovernmental Panel on Climate Change (IPCC) evaluation report.

By actively sharing the results and knowledge gained from a study of the ocean, Earth, and life with society, JAMSTEC hopes for the development of a mutually enlightened relationship between society, and science and technology. As an example, *DONET* (Dense Oceanfloor Network System for Earthquakes and Tsunamis) was completed in 2011, and a long-term borehole observational system installed in the drilling hole by *CHIKYU* is connected to *DONET* system and data can be distributed in real-time.

Moreover, based on the philosophy that information and knowledge obtained by research and development is considered the common heritage of all people everywhere, JAMSTEC will do its best to convey these achievements globally.

2017 Presidential Award: Philippe Courmontagne

Philippe Courmontagne is presented the Presidential Award with appreciation and thanks for his outstanding service to the Society, especially for OCEANS students poster competition program.



Philippe Courmontagne receives the Presidential Award from OES Junior past president René Garelo.

2017 Emeritus Award: Joseph Czika

Joseph Czika is presented the Emeritus Award with appreciation and thanks for his outstanding service to the Society as an elected member of the Administrative and Executive Committee.



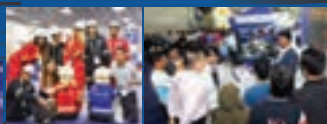
Joseph Czika receives the Emeritus Award from the OES president, Christian de Moustier.



Christian de Moustier, OES president, thanks Joseph for his service as Chief editor of "The OCEANS Conference-60 and Counting."



OFFSHORE TECHNOLOGY CONFERENCE ASIA



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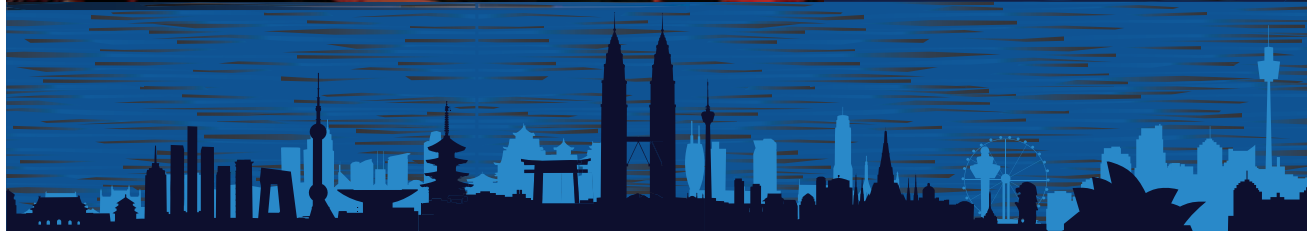
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Chapter News

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

Please note: chapter reports which were submitted from October 31 to November 14 (BEACON article due date) are put into the next BEACON issue and counted as the next year's incentive fund.

Victoria Chapter—Technical meeting

Reported by Nick Hall-Patch

Dr. Kevin Heaney of OASIS Inc. (<http://www.oasislex.com/>), who has had an extensive career modeling long range underwater acoustic propagation, presented a seminar “Three-dimensional modeling in global acoustic propagation” at the University of Victoria on 25 July 2017. The event was co-sponsored by Oceans Networks Canada and by the OES Victoria Chapter.

He began his presentation with a brief refresher on underwater acoustic propagation theory, particularly concerning sound channels, noting that at low frequencies (<100 Hz), sound can propagate for extremely long distances underwater. He also described diffraction and refraction of sound in water, pointing out that once sound interacts with bathymetry for example, “things happen in all dimensions.” A brief description was also given on computational approaches that have been used to model how sound propagates in the ocean, specifically ray tracing, normal modes, and Parabolic Equation (PE) modeling, though it was pointed out that hybrid approaches are often used as well.

Dr. Heaney then went on to describe several examples of the effectiveness of 3D modeling, drawn from different acoustic experiments in which he had taken part, starting with the Heard Island Feasibility Test where observations were made of underwater sound travelling long distances in the ocean, but for which, when using 2D ray tracing, there had been no explanation as to how certain observed sound paths were occurring.

He gave a clear illustration of the different outputs from two and three-dimensional models used when predicting coverage for a new Comprehensive Test Ban Treaty Organization (CTBTO) hydroacoustic monitoring receiver. With the 2D model runs, shadow zones beyond seamounts persisted to the end of the run, while with the 3D runs, the shadow zones were filled in, indicating that coverage would be better than initially expected.

Sound generated by earthquakes occurring in the South Orkney Islands could be detected at a CTBTO monitoring station on Ascension Island despite the direct path being blocked by South Georgia and South Sandwich Islands. In addition, a Japanese experiment using underwater explosive sources were detected in Chile despite being blocked by Midway and the Hawaiian Islands. In both cases, received sound was attenuated, and took

longer to arrive than a direct path would have, and observed results could be simulated with 3D but not 2D modeling.

Dr. Heaney concluded the talk discussing the future of 3D acoustics, and describing situations where the use of 3D models is important, for example, where underwater sound is interacting with fronts and eddies, where there are blockages to sound such as seamounts and islands, and where underwater sound is generated in constricted waterways.



Dr. Heaney describing computational approaches to modeling underwater sound.

Providence Chapter—Chapter Talk October 5, 2017

Albert J. William 3rd., Providence Chapter chair

Dr. James Miller of University of Rhode Island, USA, provided 14 attendees with a presentation of his underwater acoustic and seismic measurements of noise generated by installation and operation of the first offshore wind farm in US waters. Five wind turbines of 6 MW capacity each were installed by driving piles into the bottom at a water depth of about 30 m to a driven depth of 90 m. The four sloped legs radiated shock wave sound at 13.5 degrees from the angle of the legs that was monitored at locations from 500 m to 50 km away, the last fortuitous from an independent scientific experiment since the planned hydrophone locations were at 1.5 km, 3 km, 5 km, and 7.5 km in addition to the end points. The array was just SE of Rhode Island state waters at 3 mi from Block Island at locations acceptable or attractive to fishermen for dragging and reef fishing. Dr. Miller educated us about the underwater reference level from which dB is



reported and which is 62 dB lower than the acoustic reference in air. This difference has caused much confusion when a layman reads the sound pressure levels and equates a sound with a jet plane taking off when it is actually the same sound pressure level as heavy automobile traffic. An unanticipated energy propagation was observed as an interface wave propagating on the sediment surface.

Operation noise underwater was narrow band 72 Hz but such low intensity that even only 50 m away was drowned out by any nearby motor boat traffic. This low noise may result from the gear-less direct drive of these generators. While making these observations a fin whale was monitored from 14 km away to close approach and was as loud as the pile driving. Monitoring in air from boats is continuing and an underwater acoustic monitoring set of moorings has been proposed to allow unattended marine mammal monitoring with localizing capability for more efficient and capable detection of their presence than by observation from ships.

The figure shows the collaboration of this project. The visibility of the team has created a demand for their expertise in other offshore installations in Maryland, Georgia, and Florida.

Malaysia Chapter—Meeting Report and Activities

Prepared by Rosmiwati Mohd Mokhtar and Mohd Rizal Arshad

1. Chapter Meeting

As of October 2017, IEEE OES Malaysia Chapter has conducted six Chapter's meetings for 2017.

Date	Meeting
25 Feb 2017	12th IEEE OES MY Meeting (Shah Alam, Selangor)
10 Mar 2017	13th IEEE OES MY Meeting (MJIIT, UTM, Kuala Lumpur)
19 May 2017	14th IEEE OES MY Meeting (MJIIT, UTM, Kuala Lumpur)
14 June 2017	15th IEEE OES MY Meeting (USM Engineering, Pulau Pinang)
8 Aug 2017	16th IEEE OES MY Meeting (IIUM, Gombak Selangor)
10 Oct 2017	17th IEEE OES MY Meeting (MJIIT,UTM, Kuala Lumpur)

2. National Seminar on Underwater System Technology (NUSYS'17)

Reported by Wan Mariam Wan Muda & Rosmiwati Mohd Mokhtar

The 9th National Technical Seminar on Underwater System Technology 2017 (NUSYS'17) was organized by the School of Ocean Engineering, Universiti Malaysia Terengganu (UMT), and technically supported by the Institute of Electrical and Electronic Engineers Oceanic Engineering Society (IEEE-OES) Malaysia Chapter. It was also supported by the Universiti

Teknologi Malaysia (UTM), TATI University College, PETRONAS, and Fugro Geodetic (Malaysia).

The event was conducted on the 11th and 12th of September 2017 at the Universiti Malaysia Terengganu (UMT). This seminar marks the successful continuation of eight previous seminars starting from 2008. The seminar aims to provide a platform for the scientists, scholars, engineers and students from the universities in Malaysia and the industry to present ongoing research activities, and hence to foster research relations between the universities and the industries.

The NUSYS'17 opening ceremony was officiated by the Deputy of Vice Chancellor (Research and Innovation) UMT, Professor Dr. Mazlan bin Abdul Ghaffar. The two-day seminar was attended by almost 50 researchers and professionals from various higher learning institutions, agencies, and industries. The seminar was divided into four keynote speakers, eight plenary speakers and eight slots of parallel sessions which have accommodations for 36 oral presentations.



NUSYS'17 Program Book.



During opening ceremony of NUSYS'17.

The seminar keynote speeches were:

- 1) **"The Promise of Marine Renewable Energy in Malaysia: Too Good To Be True?"** by Professor Dr. Omar Yaakob (Technology Marine Centre, Universiti Teknologi Malaysia)

- 2) **“Autonomous Underwater Vehicle (AUV): Technical Insight and Operational Experiences”** by Mr. Mohd Fairuz Nor Azmi (Fugro Geodetic Malaysia)
 - 3) **“Offshore Wind Energy Potential”** by Associate Professor Dr. Mohd Zamri Ibrahim (TATI University College)
 - 4) **“Metocean and its Engineering Challenges”** by Mr. Mohd Nasir Abdullah (METOCEAN PETRONAS Malaysia)
- The plenary speeches were:
- 1) **“New Generation Patrol Craft-Underwater Features”** by Professor Dr. Wan Mohd Norsani Wan Nik (Universiti Malaysia Terengganu)
 - 2) **“Designing an Autonomous Robotic System for Extreme Environment”** by Professor Ir Dr. Mohd Rizal Arshad (USM / IEEE-OES Malaysia Chapter)
 - 3) **“Deep Seabed Mining: Is Malaysia Ready to Embark?”** by Professor Dr. Wan Izatul Asma Wan Talaat (Universiti Malaysia Terengganu)
 - 4) **“Assessing 100 Years of Ocean Data from World Ocean Database (WOD) and Its Application in Understanding the Oceanography Characteristics of the South China Sea”** by Associate Professor Dr. Mohd Fadzil Mohd Akhir (Universiti Malaysia Terengganu)
 - 5) **“Data Handling From Underwater System Application”** by Associate Professor Ir. Dr. Rosmiwati Mohd Mokhtar (Universiti Sains Malaysia)
 - 6) **“Hydrodynamic Analysis on Total Resistance of a Ship’s Coefficient”** by Associate Professor Ir. Dr. Ahmad Fitriady (Universiti Malaysia Terengganu)
 - 7) **“Roadmap for Sinergizing Underwater Technology Knowledge to the Young Scientists via Stem Programme”** by Dr. Ahmad Faisal Mohamad Ayob (Universiti Malaysia Terengganu)
 - 8) **“Optimal Acquisition and Aggregation of Offshore Wave Power from the Cluster of Linear Wave Energy Converters”** by Dr. Ahmad Zaki Annuar (Universiti Malaysia Terengganu)



Professor Rizal delivering his plenary speech.

The NUSYS'17 closing ceremony was officiated by the Vice Chancellor of UMT, Professor Dato' Dr. Nor Aieni binti Haji Mokhtar. Overall, this technical seminar has successfully given participants and presenters the opportunities to exchange new ideas and application experiences face to face, establishing business and research relations and finding new partners for future collaboration.



Professor Dato' Dr. Nor Aieni during the closing ceremony.



Participants during parallel session.



NUSYS'17 participants.

3. Research Visit to Bumi Subsea Malaysia

Reported by Mohd Shahrieel Mohd Aras & Rosmiwati Mohd Mokhtar

On 16th of August 2017, delegates from Universiti Teknikal Malaysia Melaka (UTeM) and the IEEE OES Malaysia Chapter, led by Dr. Mohd Shahrieel Mohd Aras, visited Bumi Subsea Malaysia at Gelang Patah, Johor Baharu. Bumi Subsea Malaysia Sdn Bhd was incorporated in Malaysia by a group of dedicated mariners and oil and gas professionals back in 2009. The Bumi Subsea Group has built up competencies to deliver offshore engineering, construction works, and other services to various international and local oil & gas players.

Bumi Subsea operates through 3 offices in the Southeast Asia Region—Malaysia, Indonesia and Singapore. It caters to the

offshore Oil and Gas industry, and also a wholly owned Bumiputera company and a holder of required PETRONAS Licenses. Bumi Subsea is led by more than 30 years total professional experiences in Subsea industry. Bumi Subsea has a fleet of versatile Multipurpose Support Vessels with DP2 or DP3 dynamic positioning capabilities. With diesel-electric propulsion, these vessels are highly fuel-efficient and allow the clients to enjoy cost savings in terms of fuel consumption. Well-equipped with active heave compensation (AHC) subsea cranes and large deck area, these vessels also feature significant accommodation capabilities needed to give clients the flexibility in each of their different oil and gas projects.

Additionally, Bumi Subsea has also a variety of ROVs suitable for use in various offshore subsea operations including pipe laying support, touchdown monitoring, structural & pipeline inspection, repair & maintenance, debris removal, video survey & monitoring. Bumi subsea own and operate a total of 6 units of ROVs, which includes Observation Class ROVs- Sea-eye Tiger, an Inspection Class ROV—Sea-eye Panther and Work Class ROVs- C-ROVs. These ROVs are capable of deepwater installation projects with up to 150 HP. Bumi Subsea has an experienced team fully capable of operating each of 6 ROVs for various scopes of work. With careful routine checks, all equipment is maintained and operationally ready.

With this visit, collaborations in terms of underwater research can be carried out between Earth Subsea and IEEE OES Malaysia Chapter. Bumi Subsea offers consultancy services and facilities for researchers from the University to do research and also offer prototype testing services in real situations such as testing sensors used as well as underwater platforms developed by the University.



Photo taken in front of the company.



Photo with Bumi Subsea ROV.



In the control room.

4. Education Outreach with Secondary School Students

Reported by Rosmiwati Mohd Mokhtar, Nur Syamimi Amir & Muhammad Faiz Abu Bakar

The IEEE OES Malaysia Chapter has also organized an education outreach activity with secondary school students in Malaysia. The project entitled “Underwater Robotics for Search and Rescue Mission” has received a fund from the IEEE Region 10 Educational Activities (EA) Support Fund and the IEEE Malaysia Section. The objectives of the project are:

- i) To share knowledge and educate the high school students on underwater robotics and its applications.
- ii) To provide hands on activity on design and development of robotic platform.
- iii) To nurture younger generations on developing creative and innovative skills via exposing them to knowledge on present technologies.

Ocean Search and Rescue (SAR) mission in Malaysia is not clearly known and explored until the incident of MH370, which disappeared on 8th March 2014 at the Southern Indian Ocean. Since then, people started to talk about SAR and how the underwater robotics has been used in the SAR mission. The Underwater Robotics for Search and Rescue Mission is proposed to high school students in order to give another view of knowledge and technological implementation, which currently the exposure is quite limited among us in Malaysia.

This activity involves the process of knowledge sharing where-by expertise from IEEE OES Malaysia Chapter conduct a seminar on developing the underwater robotics platform to the students. Next, the activity continues by the students which will be formed into a group. They will design and develop the underwater platform which is able to complete the task and mission as required. For this educational outreach initiative, five secondary schools have been involved in this activity. This event will greatly benefit students in challenging themselves towards the higher level of engineering and technology, which will definitely give a good impact to the student and community. To the IEEE OES Malaysia Chapter members, this will become another initiative in engaging themselves with the society and to share knowledge that they have to the benefits of advancing the technological usage to others.



EA activity with Sekolah Tahfiz Al Islah.



Pool testing of self-made ROV by students.



EA activity with SMK Convent Klang.



EA activity with SMK Bandar Tasik Putri.

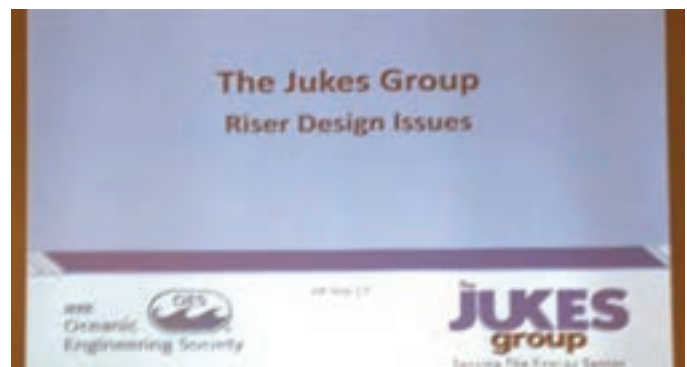


Students designing their own robot.

Houston Chapter—Technical Meeting

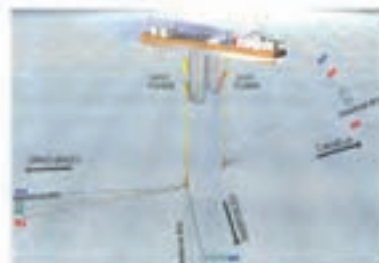
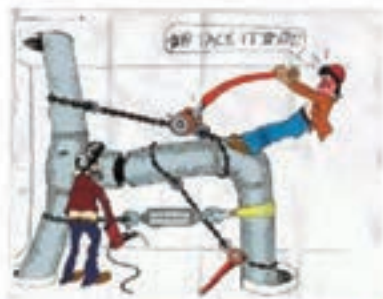
Reported by Celsa Canedo, chair.

On Thursday, September 28th, 2017, Saadat Mirza, Ph.D. Subject Matter Expert in Subsea Umbilicals, Risers and Flowlines (SURF), Pipelines and Assets Integrity Management for The Jukes Group established in Houston, Texas, presented “Riser Design Issues”. Also present was the CEO and founder of The Jukes Group, Dr. Paul Jukes.



Mr. Mirza focused on Safety and Challenges of Design of Risers and Field Development. One of the most challenging issues in safety are the mooring lines failure. The causes are diverse, mainly abrasion, corrosion, excessive tension, among others. The mooring system has the function of reducing the vessel movement for riser integrity. A suggested approach is Design for the Unknown, where a robust design contributes so that the facilities can withstand

How do we design a riser



Total Block 32 –
Star-Marine

Humor from The Jukes Group, A typical Subsea Field.

unknown dangers. When designing for the known risks, the safety factor indicates how unlikely a main failure is to happen. Some companies and countries follow different safety factors scales, which can be misleading while working in a global market.

As an example, Saadat mentioned Floating Production Storage and Offloading vessels (FPSOs) carrying flexible pipe with no protection, and how some companies handle this risk very differently. Another source of failure is when using repurposed vessels, which may have qualified as safe for their prior purpose (cargo, military, etc.) but have not been properly evaluated and assessed for their new purpose of producing in a subsea field.

Failure Modes

The most common failure mode for flexible risers is collapse mode, as in ovalization shape and heart shape. This failure has many possible causes like external pressure, leaks, or a combination of other failures.

Risers and Subsea Fields

The most common type of risers are: Steel Catenary Risers (SCR), Top-Tension Risers (TTR), Flexible Pipe Risers, and Riser Towers / Hybrid Risers. Which to use is very dependent on the field to be developed, depth, and other geophysical and metoceanic conditions. Gulf of Mexico (Significant wave height 15.8 m, winds of 100 knots (W100-s)) and West of Shetland (Agincourt), North of UK, (Significant Wave height 16.5 m, winds of 75 knots, W100-s) have some of most challenging world metocean conditions.

Current Fields

A common Subsea field consists of an FPSO vessel, manifolds to distribute production, Umbilicals, Risers and Flowlines (SURF), and the necessary power to feed hydraulics and electronic controls. The Rosa subsea field in Angola (West Africa) has a Bundled Hybrid Offset Riser (BHOR), a new generation of complex riser systems to properly serve the particular characteristics of the field and tieback conditions. The umbilical has 4 main cables: Production Bundle, Water Injection, Central Tendon, and Buoyancy Foam. The Shell Perdido field in the Gulf of Mexico has a

Riser Base Subsea Separator / Boosting System (SBS). Perdido is moored at approx. 2,450 meters, the deepest spar in the world. Flexible Risers have been used for a number of years for both flowline and riser applications in shallow or deep waters. They are built up of independent spiral laid steel and thermo-plastic layers.

Riser Design Methodology

The most common guidelines for Riser Design are:

- Analysis—Complex, 40 plus Strength load cases
- Failure Driven Design, Hull motions induced into riser, Vortex Induced Vibrations (VIV), and Riser Damage from Currents.
- Interference analysis does not allow clashing
- Engineering Critical Assessment (ECA) to confirm Weld Acceptance Criteria through Fracture Mechanics Analysis
- API-2RD (Risers) Industry Code
- High Fatigue Life Service Requirements calls for Very High-Quality Welding and Fabrication and Very Tight Inspection and Acceptance Criteria.
- Design Verification of Components and Fabrication Procedures is Required

Dynamics of Steel Catenary Riser

The most common dynamics or loads that impact riser design are:

- Payload/Hang-off weight
- High Riser weight/Increased payload
- Hang-Off Zone (HOZ) fatigue—Tension + Bending
- High Pressure gradient—hydrate formation and flow assurance risks
- High Dynamic Response
- Touch Down Zone (TDZ) fatigue—bending

To mitigate these dynamics, some successful practices are:

- SCR configurations—Buoyancy Supported Risers
 - Decouple FPSO motions from Risers
 - Effectively decreased top tension at FPSO or floating structure
- An easier installation program would include:
- Decoupled from FPSO
 - Completed without FPSO in field

The Guara Lula field in Brazil (OTC 25857 2013-2014) is an example of this kind of installation.

Deep Water Creatures

Any Subsea presentation wouldn't be complete without a brief mention of the rarest creatures the ROVs capture while on operations under water.



What's ahead

Collaboration with IEEE and students for research in Subsea Power generation and AUV's.

The evening closed with the attendees asking a lot of questions about the fields and production conditions. Mr. Mirza and Mr. Jukes were there answering to all questions till very late.



Ernest X. Njouondo, Awards & Arrangements IEEE Houston presenting awards to Saadat Mirza, The Jukes Group.



IEEE Houston Section and Paul Jukes (CEO The Jukes Group).



Paul Jukes (left), IEEE WIE Houston Alice Wang and Ting Chen (Right, Center).

Seattle Chapter—Technical Meetings

Reported by John Hager, Secretary, Seattle Chapter

1. Technical Meeting: MH370

At the February 23, 2017, monthly meeting of the Seattle Chapter, guest speaker Mr. Paul Jubinski presented firsthand experience, technical details, and findings from the search for Malaysian Flight MH370. He focused on why it required 10,000 hours of deep-tow operations and what the hours taught us about the UNOLS-standard fiber optic tow cables. When Malaysian Flight MH370 went missing, the initial search effort was chaotic and poorly directed, due, in large part, to an almost total lack of credible information as to the flight path of the aircraft. Within a few days after the disappearance, data supplied by Inmarsat indicated that the aircraft had probably been moving along a southward path and had remained airborne long enough to exhaust its fuel supply. Subsequent refinement of the Inmarsat data, over a period of months, resulted in the selection of a primary underwater search area for the MH370 aircraft—an area in the Deep Ocean, southwest of Australia and totaling 120,000 square kilometers. Given the size of the presumed target on the seafloor, the underwater search effort utilized high-frequency mapping sonars on deeply-towed vehicles. The necessarily limited ship speeds yielded low coverage rates, so the coverage of the primary search area required that the deep-tow vehicles be operated at depth for more than 10,000 hours.



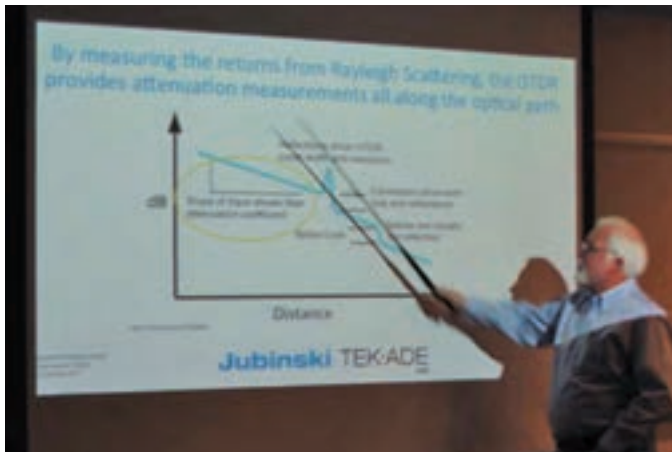
Inmarsat time/distance data.



Possible target locations.



RCRV Concept.



Fiber-optic characteristics vs. distance.



Q and A with Liz White.

These hours, accumulated through year-round survey operations in the Indian and Southern Oceans, were an endurance test for the equipment, vessels and personnel. Mr. Jubinski focused on two topics. First was an overview of how the Inmarsat data was used to select the boundaries of the primary search area. Second was a challenging, but unanticipated, equipment endurance issue—progressive changes in the UNOLS standard fiber-optic tow cables that knocked out some of the digital telemetry channels. Equally unanticipated was the fact that the changes were reversible, slowly dissipating when the tow cables were stored on a drum under low tension.

2. Technical Meeting: RCRV

At the June 8, 2017, monthly meeting of the Seattle Chapter, guest speaker Ms. Elizabeth White from Glosten, Inc., presented “RCRV: Research Vessel of the Future.” In 2012, the National Science Foundation (NSF) selected Oregon State University (OSU) to lead the coordination of the design of up to three new “Regional Class” research vessels (RCRV). The project is part of a long-term strategy to renew the UNOLS (University-National Oceanographic Laboratory System) fleet, with delivery of the first RCRV slated for 2020. The vessel design includes state-of-the-art propulsion for dynamic positioning, and acoustic sensors for seafloor mapping. Other critical concept elements

include: Excellent seakeeping properties; Low underwater radiated noise properties; Ice class C0; and Hull optimized to reduce resistance while maintaining good bubble sweepdown performance. These vessels will serve a multitude of research “customers” for several decades. Anticipating and accommodating the needs and desires of present and future users is, perhaps, the greatest challenge in the project.

Australian Chapter—Distinguished Lecturer visit to the Australian Chapter

Reported by Malcolm Heron, Chapter Chair

The Australian Chapter of OES is under the auspices of the Australia Council and involves six Sections, each of whom nominates one member to the Chapter Executive. This is our way to be sure that the Chapter is truly national and diverse. The Chapter took advantage of OES Distinguished Lecturer (DL) Paul Hines’ professional visit to Australia to engage him in a mini-tour. His plan was to land in Brisbane for his final destination in Adelaide. We negotiated for him to present a DL in Brisbane and then in Adelaide, and finally in North Queensland before his return to Canada. The OES Distinguished Lecturer Program supported the domestic flights and the local Sections covered the local costs.

His host in Brisbane was Navinda Kottege who is the Chapter Executive member for the Queensland Section, and



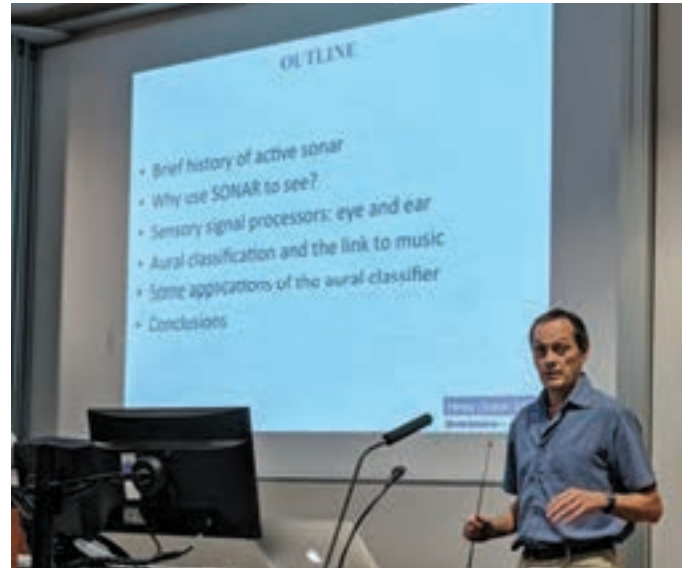
Paul Hines (centre) with Melanie Olsen, Mal Heron, Iain Morrison and Ken Leong at the DL talk. The jar of pure Nova Scotia Maple Syrup, donated by Paul, will be the excuse for a pancake bake later in the year.

works for CSIRO in Brisbane. Paul was taken on a tour of the CSIRO lab in the afternoon where he found mutual interest in sensor acoustic development. His lecture was at the University of Queensland at 6 pm on 19 October and hosted by the Queensland Section, the QLD Chapter on Control Systems/Robotics & Automation, and the Australian Chapter of Oceanic Engineering Society. It was attended about equally by university and government lab people; and some students. The infrastructure in the Hawkins Auditorium are excellent and a video link was established to Sydney. This was an interesting inversion of normality because we usually video link into small remote communities. Paul's talk inspired a lively round of questions and discussion that continued over sandwiches and drinks.

Paul's primary reason for his visit to Australia was to consult with staff at DSTG (Defence Science & Technology Group) but his host for IEEE was Karl Sammut who is the South Australia appointee to the OES Australia Chapter Executive. Karl works at Flinders University and the lecture was held in the CBD of Adelaide, which is roughly midway between Flinders U. main campus and DSTG. Attendance was almost equally divided between folk from the two institutions. Again a lively discussion, which was dominated by hard target issues.

After spending the weekend experiencing the rainforest and coral reefs of North Queensland, Paul delivered a talk to the Northern Australia Section, and the university's TropWater facility where his host was Mal Heron, Chair of the OES Australia Chapter. This was a lunchtime talk at 1 pm on 30 October at the James Cook University campus with a more diverse audience with folk from engineering, physics and water ecology areas within the university as well as from the Australian Institute of Marine Science. Here the discussion and questions had a flavour of acoustic classification in the strong multi-path and noisy environment of the Great Barrier Reef.

Paul Hines' DL was capriciously titled "Stop, Hey, What's that Sound, Everybody Look What's Goin' Down—How



Paul Hines introducing his lecture in Brisbane.

Sound and Music are Used to Find Things in the Dark Ocean" which reveals a bit of his immersion in Blues and Classical Jazz. It is also a perfect segue into his talk. He persuaded us that the human ear has a remarkable technical specifications sheet in both the time series and spectral domains. Then he followed the historical trend of sonar detection from operators with headphones in the '50s, using the full auditory capacity of the human ear, to the later development of spectral properties, after the Fast Fourier Transform came available in the '70s, that mostly skipped the time series. His thesis is that we may have lost something in those decades of 'progress'. Starting with a set of aural-based classification features used by humans to discriminate different musical instruments, and an acoustic model inspired by the human auditory system, he and his team developed an automatic aural classifier that discriminates submarines from seamounts or humpback whales from bowheads. One question that he says recurs after his talk is to ask if the filters based on the human ear are in fact the optimum; what about the auditory response of the Dolphin, for example? The entertainment for me was to be forced to think whether the human ear detects phase—and you will have to listen to his talk yourself to find out.

The speaker, Dr. Paul C. Hines was born and raised in Nova Scotia, Canada. He attended Dalhousie University, Halifax, Nova Scotia, graduating with a B.Sc. (Hon) in Engineering-Physics, in 1981. He joined Defence R&D Canada, in Dartmouth, in 1981. From 1985–1988, he attended the University of Bath, UK where he received his PhD in Physics. During his career he has conducted research in anti-submarine warfare, mine and torpedo countermeasures, rapid environmental assessment, acoustic scattering, sound speed dispersion, vector sensor processing, sonar classification and tracking, continuous active sonar, and the application of aural perception in humans, to target classification in sonar. He currently works as an independent consultant in ocean science and technology and also holds a senior research post at Dalhousie University.

XVIIth Workshop on Information Processing and Control—Mar del Plata, Argentina

Dr. Gerardo G. Acosta—Argentina Chapter Vice-Chair



Sponsored by the Argentinean Chapter of the Oceanic Engineering Society of the IEEE, the XVIIth Edition of the Workshop on Information Processing and Control (RPIC) took place in Mar del Plata, Argentina, on September, 20–22, 2017. A special track on Oceanic Engineering, chaired by Gerardo Acosta, was devoted to acoustic applications and energy extraction from the seas. The venue was the Engineering Faculty of the Universidad Nacional de Mar del Plata, the local host organizers, mainly with people from the ICYTE-CONICET Institute for Research and Development. This workshop is one of the biggest in the country for the meeting of electrical and electronic engineers and it usually receives the sponsorship of many chapters of the IEEE.

In parallel with this event, the kick-off meeting of the joint laboratory Argentina-Italy for the Sea Sciences (CAIMAR) was also developed during those days in Mar del Plata. It was organized by the Argentinean Ministry for Science and Technology. CAIMAR is a forum devoted to improve the knowledge of the sea surrounding Argentina to approach interdisciplinary studies

of its biodiversity and ecosystems. Another important objective of CAIMAR is the generation of qualified human resources in these areas.



Engineer Bruno Menna, OES Member, is presenting his talk in RPIC 2017 about a positioning system for mobile robotics.



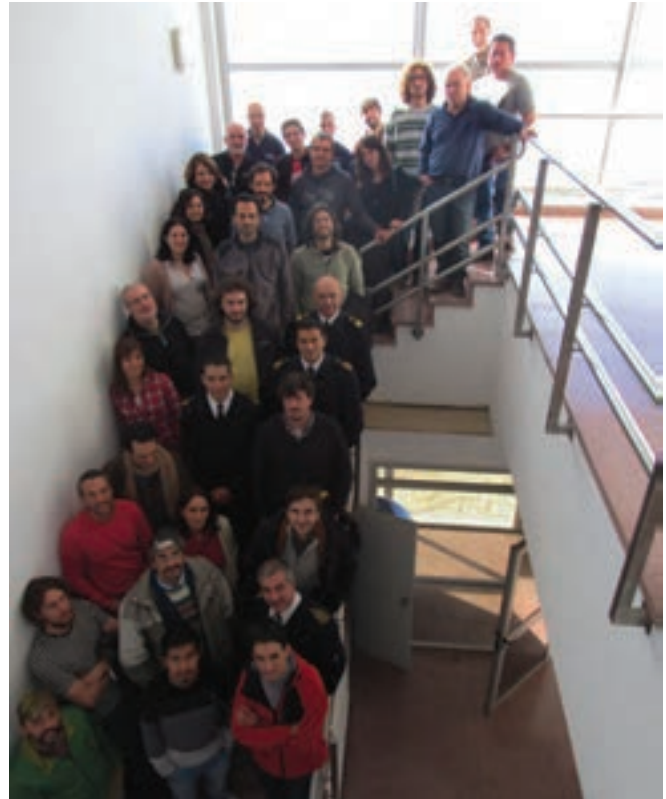
Picture of the attendees to the workshop.

2nd Workshop in Advances in Underwater Acoustics—Mar del Plata, Argentina

Dr. Gerardo G. Acosta—Argentina Chapter Vice-Chair



During the last 8–9 of June, 2017, the Argentinean Chapter of the Oceanic Engineering Society of the IEEE sponsored the 2nd Workshop on Advances in Underwater Acoustics. The workshop was organized in Mar del Plata, Argentina, taking as venue the building by the sea of INIDEP, the National Institute for Research and Development of Fishery. About 40 attendees, mainly from INIDEP, Universidad Nacional de Defensa, Universidad Nacional de la Patagonia, Universidad Nacional de Mar del Plata, and Universidad Nacional del Centro de la Provincia de Buenos Aires, presented their current works related to underwater acoustics, sonar data processing, marine biology studies with echoic records and marine technology in general. Several researchers, engineers and students spent a couple of days discussing about their core works in the study, comprehension, modeling and technology generation of underwater acoustics. Topics like acoustical scattering using boundary elements method, hydrodynamic model for fish attitude determination, acoustical signatures of phitoplankton, ADCP processing, underwater platforms, underwater communication systems, underwater noise recording, among others, were presented in different 30 minutes talks. A special attention deserved the description of the new vessel for oceanographic studies recently acquired by the INIDEP, the Víctor Angelescu, technically described by Gustavo Álvarez Colombo and Adrián Madirolas.



Picture of the attendees to the workshop.



Eng. Adrián Madirolas, from INIDEP, one of the host organizers is presenting his talk.

The French Transatlantic Telegraph Cable, 1898

René Garelo, Ekaterina Mironova, Stéphane Méar Garcia

On Friday, September 29, 2017, the IEEE represented by the Oceanic Engineering Society (OES) and the IEEE France Section, in partnership with the French local association Les Amis de Déolen and the Town of Locmaria Plouzané, celebrated an IEEE Milestone dedication ceremony commemorating the French Transatlantic Telegraph Cable of 1898, known as Le Direct. It was the first successful direct connection between Europe and the United States. The event took place at the former telegraph station at Déolen in Locmaria Plouzané, near Brest (France).

Background

In 1869, the first French cable was laid by the once world's largest vessel 'Great Eastern' from Le Minou near Brest to Duxbury, Massachusetts, via the French island of St. Pierre, a few miles away from Canada. The cable was not by definition a French cable, since it was largely manufactured, financed and laid by British companies. The Anglo-American Telegraph Company finally took over the cable in 1873.

In 1879, the second French cable was laid by the British cable ship 'Faraday'. The 2,242 nautical mile cable was installed between the small cove of Déolen-Brest (France) and the island of Saint-Pierre. Then another 827 nautical mile cable was added to reach Cape Cod in the US. It belonged to La Compagnie Française du Télégraphe de Paris à New York founded by M. Pouyer-Quertier at the request of the French government. The cable was meant to thwart the Anglo-American monopoly. As neither France nor the USA had a cable-making factory, Siemens Brothers Telegraph Works was contracted to fabricate and lay the cable on the same route as that of the first French transatlantic cable. In 1896, in the wake of bankruptcies, this submarine telegraph cable was transferred to the newly created French company La Compagnie Française des Câbles Télégraphiques (CFCT). It became known as an independent transatlantic cable system providing services to prestigious customers such as the New York Times.

Le Direct Cable

In 1898, the third French Atlantic Cable was laid directly between Déolen (Brest) and Orleans (Massachusetts). The objective of this venture was to create a communication line entirely under the control of the French entities. This cable, known as 'Le Direct', was 3,173 nautical miles long. It was the longest cable ever laid at the time. In fact, it was the first successful transatlantic cable that did not require a relay stop in the Atlantic provinces of Canada.

Cable Manufacturing and Laying Expedition

The cable was entirely manufactured in French plants (Montesson, Calais, Bezons) and installed by the Société industrielle des Téléphones (SIT). François de Nerville—who worked for SIT—was in charge of engineering Le Direct, as well as its execution. Crossing the ocean with such a long cable was a real challenge. Three cable vessels were necessary to connect directly the old

and the new world. The French cable ship 'François Arago' undertook most of the cable-laying and the rest was installed by the British telegraph ships 'Dacia' and 'Silvertown'. As a result, both English and French were spoken on the ocean. François de Nerville worked on some of the ships that laid Le Direct cable and kept a diary of his time onboard. His memoirs give a taste of life at sea: 'Oh my Atlantic my Atlantic, I have often been dreaming of you since October and November of 1897 when I was living in your frightening intimacy. And very often, when I close my eyes, I can still see your shimmering waters in the setting sun or your wild and aggressive waves rising stunningly'.



Cable route map of Le Direct.

Operations at Déolen (France) and Orleans (USA)

When a message was sent, it came through a small copper wire of over 3,000 miles long. The electrical energy received at the other end of the Atlantic was just strong enough to move a hollow glass tube known as a siphon pen. Different electrical signals sent over the cable would move the pen in opposite directions. If the pen wrote up, that was a dot in Morse code. If it wrote down, that was a dash. The short and long signals of the Morse code were sent out with the help of a key. On arrival, the message was recorded on a paper roll. A clerk had then to translate dots and dashes and write the "wire". Two instruments were commonly in use at Déolen—the Siphon Recorder and the Heurtley Magnifier (see photos below by Stéphane Méar Garcia).



Siphon Recorder.

Heurtley Magnifier.

The siphon recorder monitored the signals that passed through Regen, and was used to determine what had gone wrong if a fault occurred. Incoming signals were translated into a series of ink lines on paper tape, which correspond to the dots of cable code.

After the First World War, Heurtley Magnifiers were used to amplify weak electric signals. Received signals warmed a first wire. Then, a very close wollaston wire was warmed, too, so that an electrical current going through would increase or decrease in the same way. It was then possible to perforate a paper tape that could be used to forward to the next station or print messages automatically. Le Direct cable was capable of transmitting 380 signals per minute (40 words).

Historically Significant Achievement

Le Direct cable carried thousands of messages for over 60 years. It was made available to financiers, diplomats and news service organizations. It was only interrupted by wars and cable breaks. During World War I, General Pershing used Le Direct cable to communicate with the US government from France to send secure messages to Washington. In 1918 a German submarine tried to destroy the cable by sinking 4 barges off the coast of Orleans. The attack did not disrupt service. In 1927, the news of Charles Lindbergh's successful transatlantic flight from New York to Paris came through Le Direct, as well as the German invasion of France during World War II. But soon, other technologies, like wireless telegraphy, began competing with submarine telegraph cables. And in 1956, the first transatlantic telephone cable was laid—a technology that swiftly made telegraph cables obsolete. The French cable sent its final message on November 24, 1959: “Have a happy Thanksgiving. Station closed”.

IEEE Milestone Inauguration Ceremony at Déolen-Brest (France)

The plaque, in French, is erected at Déolen along the coastal path, near the shoreline where Le Direct came ashore in 1898 (see photograph).



The Milestone plaque mounted on a granite stone marker on the coastal trail, along with more detailed information on the cable history.



Inauguration ceremony at the city hall in Locmaria-Plouzané.

The IEEE Milestone plaque in English is mounted on the visible outside wall of the townhall of Locmaria Plouzané and was inaugurated on the previous day (October, 28) by the city mayor, Viviane Godebert and René Garello, past president of the IEEE OES.

The IEEE Milestone plaque reads: The French Transatlantic Telegraph Cable, 1898

The submarine telegraph cable known as Le Direct provided communication between Europe and North America without intermediate relaying. In a remarkable feat of oceanic engineering, the cable was laid in the deepest waters of the Atlantic Ocean between Brest, France, and Orleans, Massachusetts. When completed in 1898 by La Compagnie Francaise des Cables Telegraphiques, it spanned 3174 nautical miles, making it the longest and heaviest cable in service.

The IEEE award ceremony, blessed with fine weather, gathered over sixty attendees. René Garello was the master of the ceremony. The non-profit association Les Amis de Déolen was responsible for the organization of the venue, catering and showcased a telegraph exhibition in the former cable station. The participants included Phillip Cousins, Chair of IEEE Milestone Award Initiative, Frédérique Vallée, President of IEEE France Section, Diane Downs, great-granddaughter of the superintendent Thomas Downs at Orleans, Viviane Godebert, Mayor of the municipality of Locmaria Plouzané, André Talarmin, Chairman of the Pays de l'Iroise Community of Municipalities, Paul Friedel, Director of IMT Atlantique engineering school, board members of the associations Les Amis de Déolen and Locmaria Patrimoine, descendants of the founders of the Transatlantic Cable, scientific researchers from Ocean Data Lab and various journalists covering the news.

René Garello took the floor and explained the importance and honor of receiving an official recognition by IEEE for Le Direct, the first direct transatlantic telegraph connection that went through the deepest part of the Atlantic from Brest, France to Orleans. Then the roster of speakers began with greetings and best wishes from the political leaders at the



The different guests in front of the IEEE plaque at Déolen. From left to right: Viviane Godebert, Frédérique Vallée, René Garelo, Paul Friedel, André Talarmin (talking with Janick Bodénès and Marie-Renée Cren), Stéphane Méar Garcia discussing with Gabriel and Marta Francheteau, and Philip Cousins at the far right of the picture.

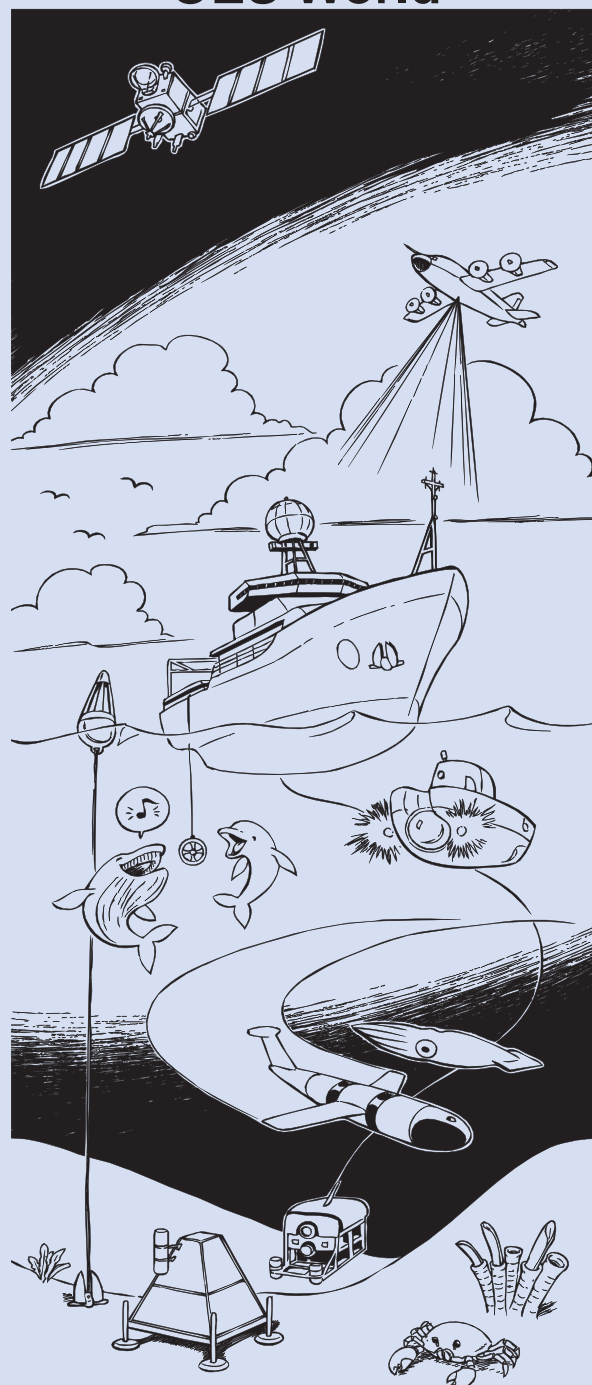


municipal and local levels—Mayor Viviane Godebert and Chairman of the Pays de l'Iroise André Talarmin. After the different speeches, the guests went down to the cove of Déolen to view the memorial plaque.

Then, René Garelo cracked open a bottle of champagne to mark the occasion and the reporters took pictures to immortalize the event. The dedication ceremony was followed by a reception in front of the former cable station house. All enjoyed refreshments and hors d'oeuvres during this excellent social networking opportunity.

The IEEE historic marker will also be installed at Orleans, MA, in September 2018 to celebrate 120 years of communication history. At the other end of the cable, the association Les Amis de Déolen is also preparing a festival for the 120th anniversary of Le Direct cable. It will take place during the annual French Heritage Days on the second week of September 2018.

OES World



All this, and more!



The Singapore Autonomous Underwater Vehicle Challenge (SAUVC) 2018 Dates Have Been Announced

The Singapore AUV Challenge (see page ??) will be held from 9–12 Mar 2018. This is a swimming pool based autonomous underwater robotic competition open for international tertiary students. The objective of the competition is to engage and educate students on the design challenges associated with autonomous underwater vehicles and also develop an appreciation

for related technologies. The competition is organised by the IEEE OES Singapore Chapter in collaboration with the Singapore Polytechnic. The event is well supported by IEEE OES, National University of Singapore, DSO National Laboratories and Centre for Sensing and Monitoring, NUS Singapore. For more details visit www.sauvc.org



IEEE OES SINGAPORE CHAPTER PRESENTS

THE SINGAPORE AUV CHALLENGE

9-12, MARCH 2018
SINGAPORE



WWW.SAUVC.ORG



CO-HOSTED BY:
SINGAPORE
POLYTECHNIC



2018

November 6 - 9
Porto, Portugal

Call for Papers AUV 2018

2018 IEEE OES Autonomous Underwater Vehicle

Rectorate Building, Porto University, Porto, Portugal

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

In 2018 this diverse group from around the world will meet in Porto, Portugal, at the University of Porto for AUV 2018.

Topics

AUV2018 invites the authors to submit contributions in the following topics.

- Vehicle Design
- Vehicle Navigation
- Sensor Fusion
- Vehicle Control
- Vehicle Planning and Execution
- Control
- Multi Vehicle Systems
- Vehicle Applications
- Open Source Robotics

Important Dates

Abstract Submission Page Open	April 9, 2018
Deadline for Abstract Submission	June 22, 2018
Notification for Authors	July 27, 2018
Deadline for Full-paper Submission	September 7, 2018

Student Poster Competition "AUV conceptual design challenge"

Students are invited to submit proposals to address an AUV conceptual design challenge
The winners will receive incentive fund and travel support!

Organizers



IEEE Oceanic
Engineering Society



U. PORTO
FEUP FACULDADE DE ENGENHARIA
UNIVERSIDADE DO PORTO

For Inquiries, please contact AUV2018 Secretariat: auv2018@lsts.pt

auv2018.lsts.pt

OES and OTC—A Perfect Match

Robert Wernli, VP for Professional Activities

OES, under the guidance of Jerry Carroll, our OTC Committee chair, continues to provide full support to the three Offshore Technology Conferences (Houston, Brazil and Asia-Pacific) and the Arctic Technology Conference as one of the sponsoring organizations. Although a bit smaller in recent years due to the downturn in oil prices, they are still the world's number one event for offshore technology. Following are excerpts from the press releases of our two most recent OTC events—Houston and Brazil.

OTC Houston, Texas, USA (1–4 May 2017)—Offshore energy industry experts and leaders from across the world came together at NRG Park in Houston 1–4 May for the 2017 Offshore Technology Conference (OTC).

As it has since 1969, the 49th edition of the conference convened professionals from more than 100 countries to make critical decisions, share ideas, and develop business partnerships to meet global energy demands. In addition, OTC directly benefitted the advancement of the energy sector, by supporting the conference's 13 not-for-profit sponsoring organizations (such as OES) and the Houston community.

OTC 2017 featured nearly 350 technical papers, 44 technical sessions, 13 panels, multiple poster sessions, and 24 topical breakfasts and luncheons. The sessions focused on subjects such as how deepwater projects can compete with shale developments, automation's role in increasing on-site safety, and new ways to utilize AUV technology (one of OES's leading technology committees). Speakers, including representatives from key U.S. agencies, international energy ministries and company executives, addressed a wide variety of pressing issues.

"The energy industry is continuing to be transformed by the technological revolution taking place, and downturns tend to be

the ultimate driver of the type of innovation that is often launched or showcased at OTC. Today, OTC is more important than ever as a venue for the type of learning and idea sharing necessary to propel greater efficiencies and safety," said Joe Fowler, OTC 2017 chairman. "Thanks to the hard work of the OTC staff and volunteers, the conference once again upheld its commitment and delivered an unparalleled amount of information on new technologies as well as global developments to its attendees."

OTC also launched an expanded version of its Women in the Industry Sharing Experiences (WISE) event. Previously a two-hour networking session, it was elevated to a half-day program to include three sessions where men and women discussed how diversity enhances the industry. And OTC's annual *The Next Wave* program, "Building Tomorrow's Leaders in Oil and Gas: Strategies and Ideas to Excel in the Present Day Climate," helped young industry professionals with open communication between the generations. Attendees were able to share, learn, and network with their peers.

Exemplifying OTC's commitment to energy education, 10 teams of local high school students participated in a new OTC Energy Challenge where they were asked to solve real-world energy challenges. This event joined programs such as the Energy Education Institute, a daylong workshop for teachers of grades 4–12, and a STEM Event for high school students.

OTC also hosted a networking event for individuals seeking to jumpstart or restart their careers. It encompassed a panel and roundtable discussions and provided attendees with resume building and interview tips.

More than 64,700 attendees gathered at the annual conference. 78 percent of attendees were domestic and 22 percent were international.

The exhibition floor covered 599,295 sq. ft., including outdoor exhibits. This year's conference also had 2,470 companies exhibiting. These exhibitors represented 43 countries. Additionally, nearly 267 were new exhibitors, and international companies made up 50 percent of exhibitors.

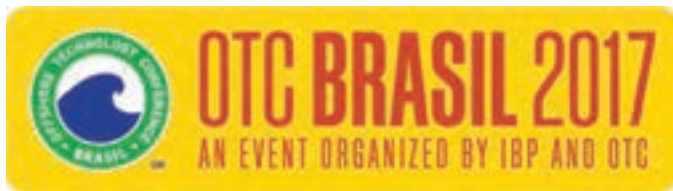
OTC 2018 takes place 30 April–3 May 2018 at NRG Park in Houston.



OES booth manned by (L-R) Jim Barbera, John Lucey and Jerry Carroll.



The "Fashion Aficionados" in Houston.



Rio de Janeiro, Brasil (24–26 October, 2017)—The fourth edition of OTC Brasil demonstrated the optimism that oil and gas executives and professionals around the world have for the industry’s rebound. More than 8,500 professionals representing operating and service companies gathered at the event. The Offshore Technology Conference (OTC) and the Brazilian Institute of Oil, Natural Gas and Biofuels (IBP), organized the event, which was held 24–26 October in Riocentro, Rio de Janeiro.

The conference was pleased to receive Fernando Coelho Filho, Brasil’s Minister of Mines and Energy. The Minister emphasized the government’s efforts to bring Brazil back on the road to success. “There are still many things to be done, and having industry events such as OTC Brasil shows we are on the right track. The energy industry in Brazil is going to get greater by the end of this week,” he said.

The good prospects for the pre-salt were also highlighted during OTC Brasil. In the panel “Pre-salt development—1 billion bbl cumulative production: concepts, implementation and first results”, Joelson Mendes, Petrobras Executive Manager, said “Pre-salt reservoirs exceeded expectations.” According to Joelson, the area is very profitable and offers low production costs, with significant competitive advantages for the companies. Currently, the exploration in the region accounts for 51% of the



OES members, Gerardo Acosta (L) and Prof. Antonio Amorim, prepare for their OTC Brasil session on “Advanced Computation and Simulation—Reservoir”.

state company production, while the other 49% goes to post-salt and offshore operations.

João Carlos De Luca, OTC Brasil general chairman, said that the conference was a success and timely for the second and third rounds of the pre-salt, “I am sure that OTC Brasil has generated great opportunities for the entire oil and gas value chain and has enshrined this moment of resumption. The event was a stage for top executives of the world’s largest oil and gas companies to network and advance the development of new businesses and strategic partnerships that are bound to happen among the consortia participating in ANP’s bid rounds,” De Luca concluded.

The international exhibition featured 120+ exhibitors from 20 countries.

From the President *(continued from page 3)*

symposia, and workshops [e.g. Autonomous Underwater Vehicles (AUV 2018); Baltic 2018; Current, Waves and Turbulence Measurements (CWTM 2019); Underwater Communications and Networking (UComms 2018); Underwater Technology Symposium (UT2019)].

In addition, OES Chapters organize technical forums that foster communication and networking among OES Members in a defined geographic area. In March this year, Student Members at the City University of Hong Kong created an OES Student Branch Chapter in the IEEE Hong Kong Section. More recently, emboldened by their participation in the OES-sponsored Rio Acoustics 2017 symposium, Student Members at La Escuela Superior Politécnica del Litoral (ESPOL) created a Student Branch Chapter in the IEEE Ecuador Section. Meanwhile, OES

Members in Porto, Portugal, created an OES Chapter of the IEEE Portugal Section, in preparation for hosting the OCEANS 2021 Porto conference.

Opportunities abound for your involvement in OES at any level—from attending, to helping organize recurring workshops and Advanced Study Institute events. Incidentally, once you have recovered your IEEE login and password in order to vote, your OES membership gives you access via IEEE *Xplore*, to all peer-reviewed articles ever published in the *IEEE Journal of Oceanic Engineering* (42 years), and to papers published in all archived proceedings of OES-sponsored conferences, symposia, and workshops.

Happy reading and best wishes for 2018 and beyond.

Christian de Moustier



2017 IEEE/OES Acoustics in Underwater Geosciences Symposium

Inspiring Students and Researchers of the Latin America and the Caribbean to Meet the Global Challenge of Sustainable Development of Our Oceans and Spinning off a First IEEE/OES Student Branch Chapter in Ecuador

Jean-Pierre Hermand and Arthur Ayres Neto

“Never two without three”, as goes the old proverb. For the third time since 2013, the IEEE/OES Acoustics in Underwater Geosciences Symposium took place in the city of Rio de Janeiro, Brazil. “RIO Acoustics” did not disappoint. About 140 delegates from the Americas and Europe gathered on the last week of July in the *Cidade Maravilhosa* (Marvelous City) where lushly forested mountains meet the sea with shimmering stretches of sand. The event was held from Tuesday thru Thursday, 25 to 27 July 2017, in a venue of the Brazilian Geological Survey headquarters, located in the Urca neighborhood at the foot of the *Pão de Açúcar* (Sugarloaf) mountain, an iconic landmark of Rio and a World Heritage Site declared by UNESCO in 2012.

The symposium’s objective is to foster interdisciplinary exchange of knowledge, experience and best practices on using acoustics to investigate underwater environments and ecosystems, from inland to the deep-ocean floor, covering a wide spectrum of applications, from marine geophysics to fisheries. Since 2013, RIO Acoustics has gained the attention of scientists and professionals, first from Brazil and then from all over Latin America and the Caribbean. Although focused on this region, the symposium is already an international event. Thirty-four countries from four continents (Europe, North America, Oceania, Asia) have been represented. The forging and nurturing of this community has raised the interest of forward-thinking companies that are shaping the deployment of the needed technology in the region. Held under the auspices of the IEEE Oceanic Engineering Society, the symposium is the fruit of a longstanding cooperation between Universidade Federal Fluminense, Brazil, and Université libre de Bruxelles,

Belgium. This year, the organizing and scientific committees are honored to welcome the Acoustical Society of America among the supporting societies.

Despite socio-economic difficulties and political turmoil in the region, the organizers decided to go ahead with the third edition of the symposium to keep the momentum going. There was a plan to organize the symposium elsewhere in the region but it was finally decided to stay in Rio once more. While the

first RIO Acoustics had its main focus on geophysics in marine shallow waters and inland waters, the scope has been extended since 2015 to other areas including fisheries, bioacoustics, habitat mapping, deep sea mining and underwater archaeology to name a few. With 84 papers, including oral (45) and poster (22) technical presentations, keynote addresses (4) and companies’ presentations (13), the event brought together students and researchers from 34 universities and research institutions from Latin American countries—Argentina, Brazil, Chile, Colombia, Ecuador, Mexico and Peru—and from Australia, Belgium, Canada,

Denmark, Finland, France, Iceland, Israel, Norway, Spain and the United States. Two-thirds (18) of the symposium topics (27) were explored covering approaches, methodologies and technologies in marine geophysical surveys and geohazards, fisheries and plankton acoustics, bioacoustics and acoustical oceanography for the most popular. New covered topics were acoustic ecology and coastal management.

Spotlights of RIO Acoustics 2017 were directed at two brand new research vessels Latin America is getting to support its research programmes. Built in Spain and recently delivered to Argentina, R/V “V́ctor Angelescu” is a modern and innovative





Welcome to RIO Acoustics 2017.

vessel for fisheries and oceanographic research. She features extensive platforms for fishing and research work, multipurpose laboratories and low radiated noise levels. Brazil gets R/V “Vital de Oliveira”, a state-of-the-art vessel in hydrography for mapping the atmosphere, water column, sea bottom and sub-bottom. With a capacity of 40 scientists, she is fully equipped for oceanography, geology, geophysics, biology and meteorology.



The oral presentation room was full at every session.

The use of acoustic tools for investigating the physical environment was showed up in many diverse forms. Igor Drummond Alvarenga’s keynote described the use of interferometric and synthetic aperture sonars to map subsea oil and gas production structures, showing acoustic images of pipelines and wellheads with stunning resolution. With the expected shutdown of several oil platforms around the world, these techniques have proven most valuable for estimating the environmental impact of decommissioning activities. Environmental monitoring of coastal waters was a recurrent topic with study cases dealing with quaternary sediment dynamics and sedimentation processes, marine habitats, detection of gas seepages and dispersion of contaminants. Papers on seismic signal processing aiming at a better definition of seabed and sub-seabed geological structures exemplified how these techniques can



Student volunteers at the reception desk getting ready to welcome the participants.

enhance resolution with large implications on engineering projects. Enhancement of multibeam echosounder data was also much discussed. The mapping of submerged Stone Age sites and archaeological pole structures as well as the 3D reconstruction of medieval shipwrecks from 2D chirp surveys were contributions from the archaeology group. The Brazilian Navy demonstrated the use of highly instrumented AUV’s as platforms for hydrographic surveys aiming at debris clearance of anchoring areas. Another trendy topic discussed at the symposium was the use of legacy seismic data acquired for oil and gas exploration to map thermohaline stratification in the water column. This also benefits the monitoring of changes in the position of water masses near the production platforms. Regarding inland waters, it was shown how regular bathymetric surveys can be used to monitor the change of river beds to create a specific layer on Electronic Nautical Charts for navigation safety along the Paraguay River. Low-cost approaches to water reservoir mapping in Ecuador and sediment classification in SE Brazil were presented showing the versatility of acoustic tools in solving specific problems.

Besides its mineral resources, Latin America is gifted by the richness, importance and wide diversity of its marine



Attendees’ behaviors showed a genuine interest in learning more. Some presentations led to engaging discussions.



Members of Latin American scientific committee. Standing from left to right: its chair Mariano Gutiérrez, Peru (1); Ariel Cabreira, Argentina (4); Arnaud Bertrand, Brazil (5); Lauro Madureira, Brazil (8); Jorge Paramo, Colombia (9) and Héctor Villalobos, Mexico (15).

ecosystems. This time, the keynotes' focus was on the Atlantic Ocean. Arnaud Bertrand and his 'Abraços' group highlighted the role of underwater acoustics in studying tropical ecosystems off Northeast Brazil while Lauro Madureira and his group from the Institute of Oceanography, Rio Grande, presented an original paper on fishing skipjack with pole and line in Brazil using binocular, sonar and echo sounders searching for ideal fishing areas and predator-prey landscapes. Thanks to the coordination of our scientific committee chair, Mariano Gutiérrez, we had a comprehensive set of interesting papers on acoustics applied to fisheries in the Humboldt Current System. A researchers' concern was finding out the environmental factors controlling the distribution of the 'anchoveta' and the changes that followed the '97-'98 El Niño event. A study of spatio-temporal variability of the distribution and abundance of red squat lobster and anchovy according to the water masses of the Peruvian Sea is a good example of the coupling between biology and physics. A Chilean multidisciplinary acoustic survey was reported which surveyed krill and mackerel icefish in an area that has been closed to fishing for more than two decades to provide evidence of how effective it can boost ecosystem recovery. Determining the recovery of this fish species is of particular relevance for the adoption of conservation measures to be implemented in Antarctic resources. Chilean and Argentinean researches were directed at the Fuegian sprat, respectively investigating target strength and spatio-temporal pattern in fjord and channel. In Peru, it is the need to estimate the biomass of jack mackerel, which motivates the determination of its target strength in situ. Since 1983, scientific hydroacoustic surveys have played a key role in estimating the biomass of the main pelagic resources for fishing management, and since 2014, the use of multifrequency echosounders enables the identification of species that could not be discriminated before. There is an increasing concern on the impact of human activities on living resources. In Southeastern Brazil, the behavior of a threatened estuarine dolphin species was studied. From Argentina came an example of how to use passive acoustics to monitor the position of fishing nets during catching. Another important topic was related to the use of information technology in fisheries and bioacoustics. Spanish researchers discussed the application of machine learning for

future localization of cetaceans. Besides a behavioral study of small pelagic fish schools in the Gulf of California, another paper from Mexico focused on the use of open source environment for processing multi-frequency hydroacoustic data and testing algorithms for species discrimination. An example for cost reduction in fisheries research came from the Peruvian Sea where collaboration between researchers and the fishing industry is increasing the amount of data by installing scientific equipment on industrial fishing vessels. A study of the scattering response of phytoplankton at ultrasonic frequencies was presented, which can be useful for the early detection of harmful algae blooms. In the Colombian Caribbean, a study aims to correlate hydroacoustic backscatter of mesozooplankton with biomass dry weight in the coast of Magdalena. Hydroacoustics is also applied in the shallow waters of the Seaflower Biosphere Reserve to assess its fisheries resources, bathymetry and bottom types. As in 2015, the mixing of physics- and biology-oriented papers in the programme schedule was effective in stimulating new discussions and ideas.



Companies' representatives displayed brochures and products in the table top area of the coffee break room.

This year, eleven companies participated in the Patron's Day, which was dense and well attended. Introduced by our patronage chair Cesar Pimenta, the company representatives demonstrated new equipment features and innovative technologies for acoustic remote sensing of the water column, seafloor and the

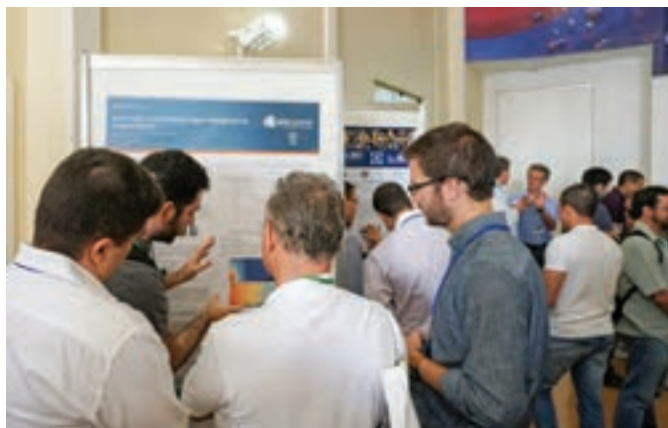


Patronage chair Cesar Pimenta; co-chairs Jean-Pierre Hermand and Arthur Ayres Neto.

sediments beneath it. Multibeam echo sounders mapping the seafloor provide “water column data” that are not only important to the hydrographer for quality assurance, but, thanks to ever increasing resolution and precision, are becoming more and more effective for mapping habitats, hydrocarbon seeps and hydrothermal vents, inspecting structures and detecting fluid/gas leaks (Kongsberg Maritime). As essential tools for sustainable fisheries management, scientific echosounders are largely present on the modern research vessels surveying marine ecosystems. But the pressing need for data series with finer coverage in space and time, requires alternative platforms instrumented with wideband transceivers (Simrad). Stationary lander, CTD frame, glider, AUV, ROV, and USV now give access to unprecedented information to untangle the complexity of all processes at play in an ecosystem. The ability to reach deep scattering layers with higher frequencies will increase our knowledge about mesopelagic zones. The future of hydrographic surveying with manned and autonomous vehicles was discussed by Teledyne Caris, which develops a streamlined workflow for real-time data processing to final products. Smart hydrophones and arrays were introduced by Ocean Sonics as convenient solutions for, e.g., monitoring seismic activity, listening to sea mammals or detecting pipeline leaks. A company based in Rio (ProOceano) proposed solutions for passive acoustic monitoring of oceanic areas using gliders and Lagrangian acoustic profilers. The integrated use of multiple acoustic frequency bands for sub-bottom profiling was revisited with the addition of ultra-high frequency chirp for identification of thinner surface sediment layers in harbor basins and dredging sites (Meridata). The Brazilian company (Gardline) presented its methodology for evaluating installation routes of submarine cable installations over landfall areas. Geospectrum presented a wide range of acoustic technologies including particle motion sensors, towed systems, harbor surveillance systems, wireless communication and sensors for unmanned vehicles. Acoustic Doppler current profilers were also represented with instruments capable of measuring multiple processes at once: turbulence, wave-current interaction, eddy correlation and/or covariance, mixing between stratified layers and energy dissipation (Nortek). AML oceanographic, known for its sound velocity probes among others, presented its recently-acquired moving vessel profiler product line.

Well illustrated by case studies, the presentations on technology captivated the students who could familiarize them-

selves with hi-tech gears and have a direct insight into the job market. The previous day’s presentations were largely attended by the company representatives, who then exchanged experience and ideas with researchers and promoted their equipment at the breaks. Thanks to their close interaction with industry, students in underwater geosciences are gaining interest for acoustics as they realize its key role for a multitude of measuring needs.



The poster presentations were well attended at every coffee break.

This year, thanks to IEEE/OES and ASA, master and PhD students from Latin America and the Caribbean had the opportunity to compete for scholarships to participate in the event. Twelve students from eight Latin American countries were selected by the scientific committee. The scholarships covered airfare, hotel and symposium registration fees. The ASA scholarships were reserved for ASA student members.



Delicious Brazilian coffee and pão de queijo at the break.

Eleven companies financially supported to the event. On the institutional side, the Global Office of Naval Research provided generous support as well as research funding agencies from Belgium, WBI Wallonie-Bruxelles International and FNRS Fonds de la Recherche Scientifique, respective partners of Brazilian CAPES-Ministerio da Educação and CNPq. CPRM provided access to its premises. The Sociedad Nacional de Pesquería from Peru made a significant contribution by



Dinner with the lead representatives of Latin American countries at Rio's churrascharia Fogo de Chão.



Jorge Paramo and Jim Barbera at the social dinner.

supporting the travel expenses of Peruvian researchers. The following Brazilian societies endorsed the symposium: Geophysical Society (SBGf), Association of Engineering Geology, Association for Quaternary Studies (ABEQUA), Acoustical Society (SOBRAC) and Diretoria de Hidrografia e Navegação da Marinha do Brasil (DHN).

Following Ecuadorian student Karen Aguirre's participation, an OES Student Branch Chapter was recently formed at the Escuela Superior Politécnica del Litoral—ESPOL, Guayaquil. Karen wrote "One of the main objectives when entering the university is to be part of something big and if possible, to found that big thing. Thanks to my teacher and tutor, I had the opportunity to know about IEEE. Later, while we were working on an acoustic project, the call to participate in the RIO Acoustics symposium came to our hands. Thanks to our effort and the support of the organizers of the event, we obtained one of the nine twelve scholarships for Latin American students. When I arrived in Brazil and observed the magnitude of the event organized by IEEE/OES, I knew that my goal was to be part of IEEE/OES, but

I also felt that I should share this experience with my colleagues and professors in Ecuador. That is why the idea of creating our chapter was born, where everyone can access the sea of opportunities and benefits offered by IEEE and OES, enter the world of ocean engineering society and contribute with new ideas and projects from the researcher profile. Our current goal is to continue integrating members into the IEEE/OES family and open the doors to a host of new experiences and opportunities that will enrich our professional life."



A spinoff of RIO Acoustics 2017: The OES-ESPOL Student Branch Chapter in Ecuador.



Student party organized at the Bar Urca in front of the bay for watching the best sunset of the city on the last day of the symposium.

For this third edition, RIO Acoustics kept its promises. The symposium has definitely succeeded in fostering greater interaction between students, researchers, practitioners and companies sharing common interests. On one hand, people involved in closely related activities that are carried out at different institutions and geographical locations found it most useful. On the other hand, people had a genuine interest in learning about other people's ways of using acoustics for different applications. The company representatives were delighted with their participation and quite satisfied with the programme organization and venue setup. Since July, other companies



The student volunteers enjoying pastelzinhos, bolinho de bacalhau and ice cold beer on the Mureta da Urca.

have manifested their interest to join us. In closing, we would like to thank our symposium secretary Arlette Grave who has largely contributed along the first six years to the challenging development of this event and our student volunteers who have done an outstanding job on the spot.

With RIO Acoustics 2017, our wish to create the circumstances enabling the development of a strong interdisciplinary network that connects the Pacific Ocean, the Caribbean Sea and the Atlantic Ocean across South America around the science of acoustics has now become reality.

Will there be a RIO Acoustics 2019? Yes! Watch future issues of the Beacon for the symposium announcement.



Website: <http://www.rioacoustics.org>



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OCEANS '17 Anchorage Covers Arctic Issues

Robert Seitz, Co-General Chair

When offered the opportunity for Anchorage to be the host city for OCEANS '17, IEEE Alaska Section members and others worked to bring this event about. Climate change and the Arctic have become prominent topics in the news and conversations; in recent years, Royal Dutch Shell was doing exploratory drilling for oil in the Chukchi Sea and things were going well. Therefore, OCEANS '17 Anchorage should do well. At OCEANS '13 San Diego the Anchorage proposal was accepted and everything looked really good.

The OCEANS '17 Anchorage team reached out to the various commercial fishing associations, tour boat operators, the Harbormasters Association, fish processors, Oil and Gas producers with offshore operations, offshore surveyors, coastal communities, local universities and anyone else with a marine or ocean interest. The theme selected for the conference was OUR HARSH AND FRAGILE OCEAN with a subtheme of "Modern technology and Traditional Knowledge working together to protect the fragile from the harsh." The Orca logo was developed and things were still doing well.



But first, in 2015, Royal Dutch Shell pulled out of the Chukchi and ceased exploration. Then in 2016 the price of crude oil dropped significantly and Alaska's economy began to collapse. To compensate, the Local Organizing Committee (LOC) sought opportunities for Alaska to be the draw for attendees. Discounted fares and fees were posted on the OCEANS '17 Anchorage website, and destinations within Alaska and tourist opportunities in Anchorage were highlighted.



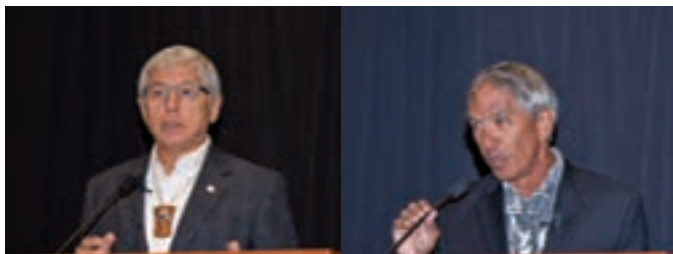
Denali-a great draw.

The Technical Program Committee worked hard to get the technical program put together. Special topics for OCEANS '17 Anchorage with emphasis on things Arctic were developed, Special Sessions were created to help emphasize certain aspects of operations in the Arctic, and subarctic, as well as some topics more global. The economy continued to have an impact as attendees, presenters and exhibitors pulled out after they had already signed up.

As we entered the last three months before the conference the interaction between people involved with the various Special Session and the Local Committee increased tremendously; things were getting real, interest spread and things were beginning to look good again. We are still waiting to hear from the various Sessions of any breakthroughs, continuing future work that results from the Sessions, or new academic or research opportunities, but we have heard that most if not all the sessions went well.

IEEE OES Plenary Session

There were two speaker slots at the OES plenary session with the first presentation being by two speakers; Lt Gov. Byron Mallott of Alaska and Nainoa Thompson from Hawaii, Pwo (Polynesian Master navigator) and leader of Hōkōlē'a (voyage canoe) voyage around the world. The pair represented the traditional knowledge and emphasized the importance of protecting our oceans.



Lt Gov. Mallott

Nainoa Thompson

The second speaker slot was filled by Vice Admiral (ret) Tom Barrett, President of Alyeska Pipeline Service Company, representing industry and modern technology and he also emphasized the importance of caring for our oceans



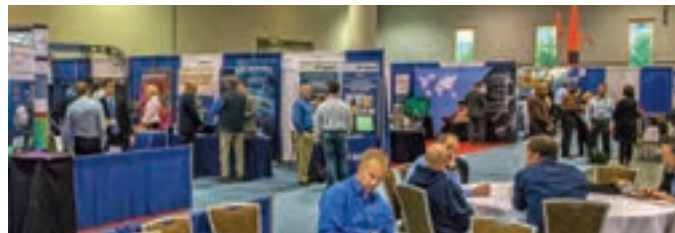
Tom Barrett

Both presentations emphasized preparedness when venturing into the harshness of the ocean or the arctic, whether the venture is by traditional methods or with modern technology.

Men are fragile when confronted with the power of the ocean or the cold of the Arctic. The presentations fit well with the conference theme.

Exhibitors

While many of the exhibitors we had hoped to have were not able to attend, the exhibits were well received.



A busy exhibit hall.

One of the great successes of the conference was the demonstration of the separation of oil from icy water. The phrase “game changer” was heard more than once over the three days of demonstrations. We hope this becomes one of the sustainable successes of the conference.

Social Events

The Leadership Dinner, the Icebreaker and the Gala at the Alaska Native Heritage Center were all well attended, the weather was good for all the events and permitted attendees to be outdoors to enjoy the scenery as they visited and met new friends.



PPR Alaska-Oil Separation.

Compliments about the food were voiced by many for all three events



Ice Breaker Reception.



Food at the Gala.



Bob Wernli & the Native Dancers.



LOC members present at the conference: (L-R) Bill Lee, Jim Kendall, Carol Janzen, Mike Pinto, Jana Lage, Bob Seitz.

Local Organizing Committee

The efforts of all who were a part of the local committee, and others who helped, are greatly appreciated. Most of the members of the LOC ended up working harder at their day job during the preparations for the conference, so were not always available for meetings, but worked late into the nights to get things done.

While the number of exhibitors and attendees was not as high as we would have liked, the conference came out financially in the black, many attendees came a week early and toured Alaska, went whale watching on the available discounted tours, the plenary sessions went well, presentations and discussions at the sessions were interesting and productive. So we consider the conference a complete success.

Thank you to the LOC members, to Visit Anchorage and to all who traveled to Alaska to participate in OCEANS '17.

Photographer in OCEANS '17 Anchorage

Harumi Sugimatsu and Robert Wernli, Beacon Co-Editors in Chief

Do you know him? You can meet him at OCEANS conferences around the world, but it is a bit difficult to find his photos in the current OCEANS Photo Gallery on the OES website (<http://www.iceeo.es.org/photos.cfm>). YES, Stan is the photographer of our OCEANS Conferences. Most photos on the reports of OCEANS conferences in the BEACON are distributed from him.

If you meet him in any OCEANS conference, please take his photo and distribute to us (harumis@iis.u-tokyo.ac.jp, rwer-nli@san.rr.com) for our OES photographer's photos!



Taking photos.



Stan Chamberlain, our photographer!



Photographer at the OES Awards Ceremony.



Photographer at the Exhibition Hall.

Student Poster Competition, OCEANS '17 MTS/IEEE ANCHORAGE

**Philippe Courmontagne, Student Poster Contest Committee Chair,
Photos by Stan Chamberlain**

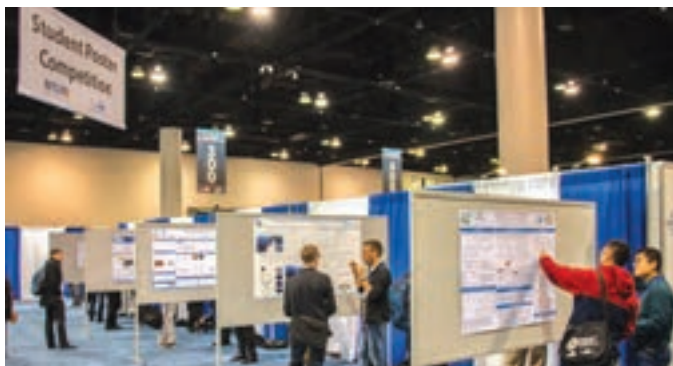


This 41th Student Poster Program of the OCEANS Conferences was held at OCEANS '17 MTS/IEEE Anchorage, at the Dena'Ina Convention Center, from September 18 to September 21. The program was organized by Liesl Hotaling (MTS SPC Chair) as local coordinator and Philippe Courmontagne, SPC Chair, from IEEE OES. The program was funded by grants from the Office of Naval Research. For this edition, 20 student abstracts were selected for this contest, not without difficulty given the high quality of the received abstracts. Students came from Brazil, Canada, China, France, Italy, Japan, Korea, Portugal, United Kingdom and the United States.

The posters were on display in the Exhibition Hall. As for the previous Student Poster Competitions, outstanding posters describing the work of the students were presented and were particularly appreciated by the attendees of the conference. Moreover, the student participants greatly appreciated the opportunity to display, exchange and describe their

research work to the community. The posters were judged by a team organized by IEEE OES and MTS. The roster of students and their schools are (in order of appearance of the Program Book):

- Takayuki Nishimura, University of Tokyo, Japan
- Renzheng Che, Ocean University of China
- Arnold Kalmbach, McGill University, Canada
- Yiheng Wang, Missouri University of Science and Technology
- Jiale Zhang, Huazhong University of Science & Technology, China
- Taeyun Kim, KAIST, Korea
- Zhuoyuan Song, University of Florida
- Thanh Huy Nguyen, IMT Atlantique Bretagne-Pays de la Loire, France
- Seonghun Hong, KAIST, Korea
- Gonçalo Cruz, Instituto Superior Técnico, Portugal
- Byeongjin Kim, POSTECH, Korea



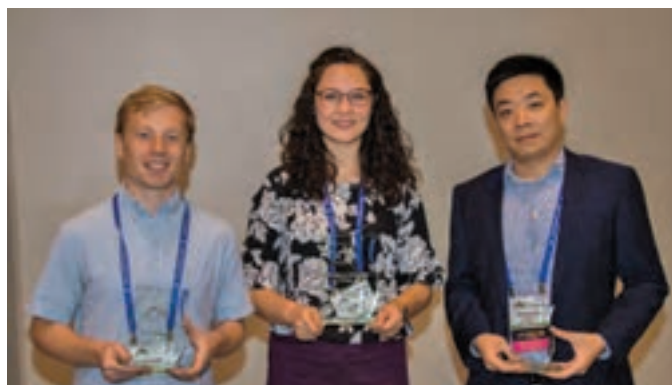
- Kaitlyn Morgan, Clemson University
- Cassidy Gonzalez-Morabito, Rutgers University
- Adham Sabra, Robert Gordon University, United Kingdom
- Jonathan Soli, Duke University
- Muhammad Fahad, Stevens Institute of Technology
- Bruno Florian, PE-CAPES, Federal University of Santa Catarina, Brazil
- Andrea Petroni, “La Sapienza” University of Rome, Italy
- John McKay, Pennsylvania State University
- Eduardo Iscar, University of Michigan

The judging was completed by noon on Thursday and the prizes were awarded in the Exhibition Hall. The ceremony began with some few words from Liesl Hotaling, recalling the history of this Student Poster Competition, initiated and championed by Norman Miller, who passed away in July 2015.



Liesl Hotaling

Then, Philippe Courmontagne called all of the students on stage and presented each student with a certificate for their participation in the program. Christian de Moustier, IEEE OES

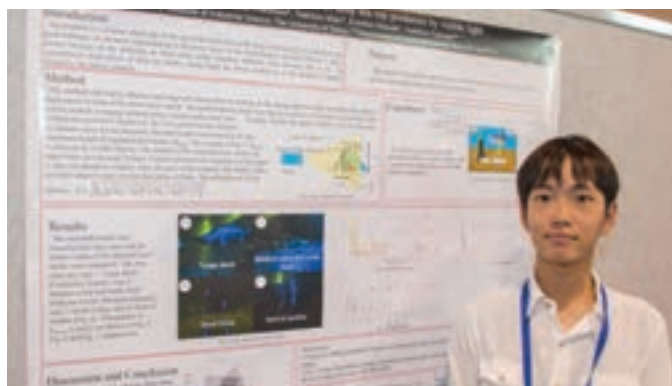


The awards ceremony.

President, and Donna Kocak, MTS President, were called up to present the awards. The third prize was awarded to Zhuoyuan Song, from the United States, the second prize to Arnold Kalmbach, from the United States and the first prize, the “Norman Miller’s Prize” to Kaitlyn Morgan, for her poster entitled “*Higher Order Bessel Beams Integrated in Time (HOBBIT) for Free Space Underwater Sensing and Communication*”. As with previous years, monetary prizes were awarded for the posters collectively ranked 1st, 2nd and 3rd place by the judges (\$3000, \$2000 and \$1000 respectively). The audience gave the students a big hand following the awards presentations. The session ended with a photograph session.

The roster of students and their poster titles are given below with an abstract of their paper.

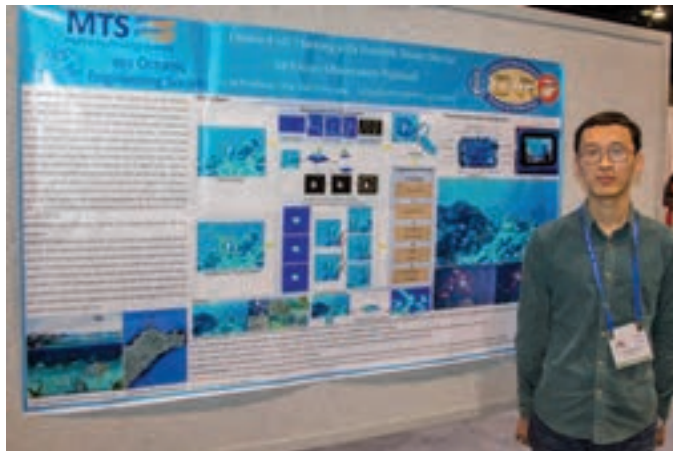
Takayuki Nishimura, University of Tokyo
Toward automatic detection of deep sea top predators by visible light



In this paper, we propose an automatic shark detection method in deep sea by light section method, in order to realize shark observation with much less energy. This method detects sharks on the basis of cross-sectional shape obtained by light section method. To analyze the performance of the proposed method, experiments at aquariums was conducted. It was observed that detection accuracy became high by setting thresholds considering physical characteristics of shark. Future work includes additional sampling and sea trial.

Renzheng Che, Ocean University of China

Online Fish Tracking with Portable Smart Device for Ocean Observatory Network

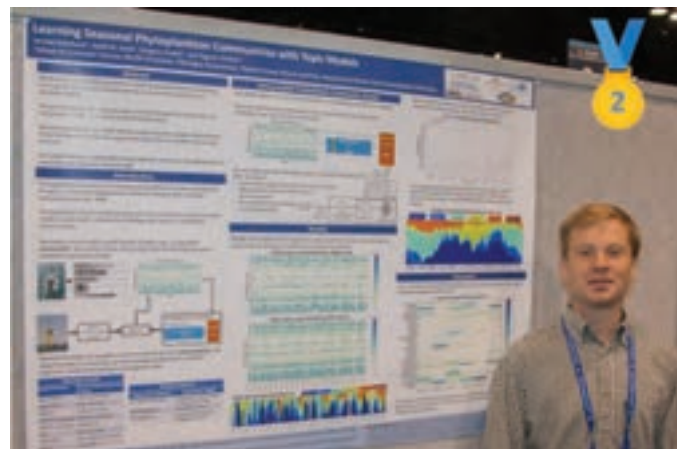


Nowadays, ocean observatory networks, which gather and provide multidisciplinary, long-term, 3D continuous marine observations at multiple temporal spatial scales, play a more and more important role in ocean investigations. In this paper, we try to develop a portable smart device with online fish detection and tracking strategies by ARM7 microprocessor for ocean observatory networks, combining the deformable fish body description with compressive sensing together. A fish detection system is introduced to represent highly variable objects using mixtures of multiscale deformable fish body description which include three parts: (1) root filter, which describes the global contour feature of underwater fish. (2) fish body part filter, which capture finer resolution features of underwater fish. (3) spatial model, which describes the relationship between the fish body part filters and the root filter. And then, we apply a simple yet effective, real-time and robust of fast compressive tracking algorithm with an appearance model to focus on the motion trajectories of underwater fish. It has been shown in the simulation experiments that the developed scheme of this paper achieves consistent performance improvements on online fish tracking for ocean observatory network.

Arnold Kalmbach, McGill University

Learning Seasonal Phytoplankton Communities with Topic Models

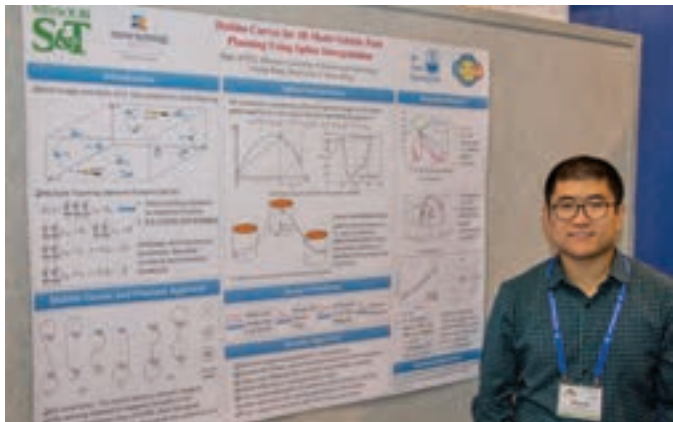
In this work we develop and demonstrate a probabilistic generative model for phytoplankton communities. The proposed model takes counts of a set of phytoplankton taxa in a timeseries as its training data, and models communities by learning sparse co-occurrence structure between the taxa. Our model is probabi-



listic, where communities are represented by probability distributions over the species, and each time-step is represented by a probability distribution over the communities. The proposed approach uses a non-parametric, spatiotemporal topic model to encourage the communities to form an interpretable representation of the data, without making strong assumptions about the communities. We demonstrate the quality and interpretability of our method by its ability to improve performance of a simplistic regression model. We show that simple linear regression is sufficient to predict the community distribution learned by our method, and therefore the taxon distributions, from a set of naively chosen environment variables. In contrast, a similar regression model is insufficient to predict the taxon distributions directly or through PCA with the same level of accuracy.

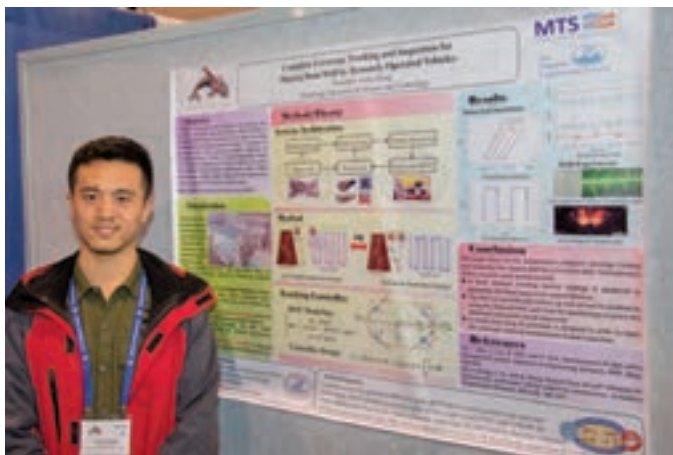
Yiheng Wang, Missouri University of Science and Technology
Dubins Curves for 3D Multi-Vehicle Path Planning Using Spline Interpolation

This paper proposes a spline interpolation method to map 2D Dubins paths into 3D for multiple Autonomous Underwater Vehicles (AUVs) to visit multiple targets. The multitarget assignment and path planning problem is first modeled as a multiple Traveling Salesmen Problem (mTSP) and a three-step algorithm is used to solve the NP-hard integer programming problem with affordable computational complexity. Step 1 uses the Genetic Algorithm (GA) with the 3D Euclidean distances as the fitness function to assign multiple tasks to multiple AUVs; Step 2 designs the 2D Dubins paths for each AUV target sequence; and Step 3 maps the 2D Dubins paths to 3D paths via



cubic spline interpolation. Finally, potential collision is detected among the resulting paths of the multiple AUVs and paths are discarded if any AUV is within the close vicinity of another AUV at any time. The simulation results show that the proposed algorithm yields shortest Dubins paths most of the time and guarantees the G1 continuity. The probability of collision is very small if the multiple AUVs start the mission at the geometric center of the multiple targets.

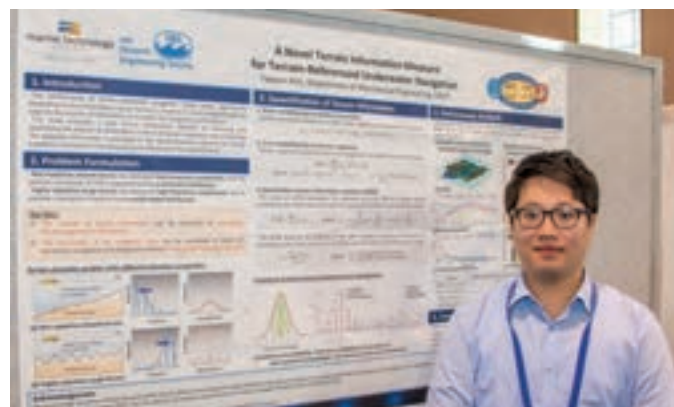
Jialei Zhang, Huazhong University of Science & Technology
Complete Coverage Tracking and Inspection for Sloping Dam Wall by Remotely Operated Vehicles



This paper focuses on the inspection for sloping dam wall by a remotely operated vehicle (ROV). First, a dedicated ROV for dam inspection is described. Second, a fixed-distance tracking control strategy is proposed to guarantee the fixed camera-to-subject distance in sloping dam inspection, which is instrumental in sonar image fusion for the large-scale dam wall with a certain inclination. In addition, the ROV can periodically surface up and correct its position by using the onboard GPS, such that the positioning accuracy of the ROV and its detected crack point can be improved. Third, in order to reject the unknown hydrodynamic coefficients, water intake and currents, a model-independent fuzzy PI controller is designed for robust tracking in dam inspection. Finally, some numerical and experiment results are given to illustrate its performance.

Taeyun Kim, KAIST

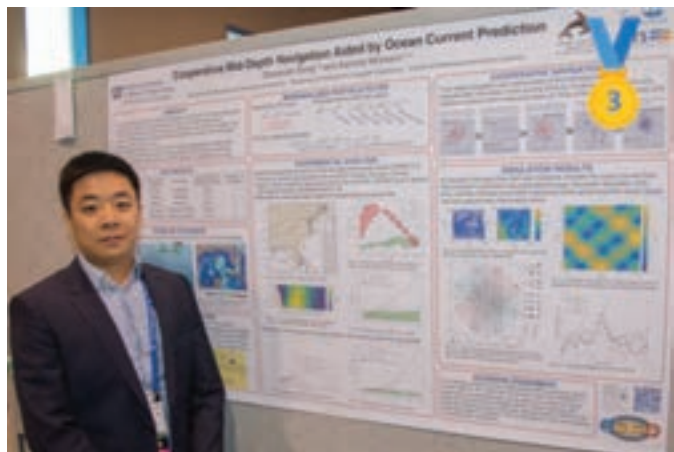
A Novel Terrain Information Measure for Terrain-Referenced Underwater Navigation



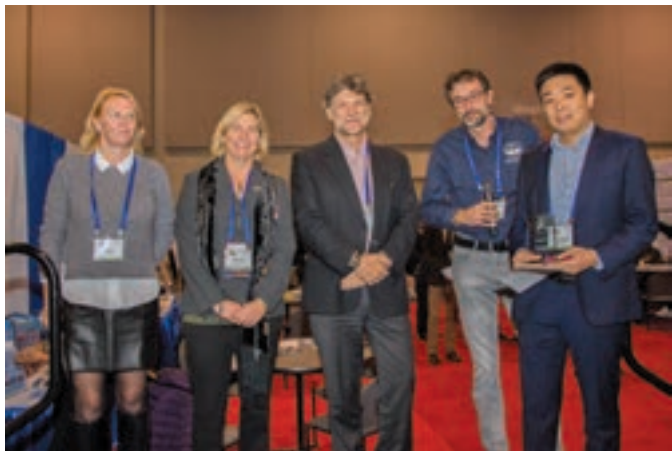
The use of elevation changes in an undulating terrain surface can be an effective alternative for vehicle navigation in GPS-denied underwater environments, since subsea terrain elevation data can be obtained using sonar systems. The performance of terrain-referenced navigation varies significantly depending on how informative a given terrain is, however it is not straightforward to quantify the amount of information that can be provided by the terrain and predict the navigation performance. This study proposes a new terrain information measure by analyzing and quantifying the amount of information in terms of terrain roughness and uniqueness. The expected information is evaluated in the spatial frequency domain via Fourier transforms to maximize the computational efficiency of the quantification. To demonstrate the performance and utility of the proposed ideas, terrain-referenced navigation simulation results are shown and discussed.

Zhuoyuan Song, University of Florida

Cooperative Mid-Depth Navigation Aided by Ocean Current Prediction

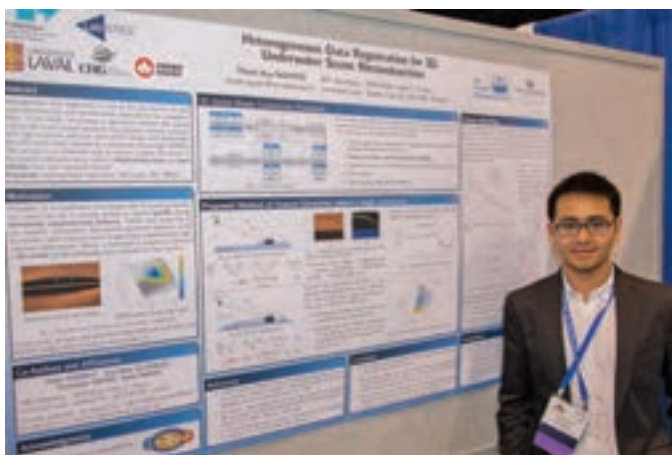


A novel inertial navigation system is proposed for small autonomous underwater vehicles in long-duration, large-scale operations where frequent surfacing and consistent bottom-locking are not



desirable. This strategy utilizes the dynamics of the background flow to significantly mitigate the dead-reckoning error of an inertial navigation system. This is achieved by comparing the local ambient flow velocity against the velocity field prediction pre-calculated through solving the background flow dynamics. The vehicle's attitude and linear velocity are estimated along with the vehicle's position in order to obtain an in-situ estimation of the absolute background flow velocity. Estimation errors of the vehicle's location, attitude and linear velocity are mutually correlated through continuously incorporating relative flow velocity measurements into state estimation. The proposed navigation system is implemented as a marginalized sequential Monte Carlo estimator, where the vehicle's position is estimated through samples, and the vehicle's attitude and linear velocity are inferred by Gaussian filters. Opportunistic information fusion among neighboring vehicles are achieved using covariance intersection. The performance of the proposed navigation system is analyzed in simulation within a turbulent multi-gyre flow field.

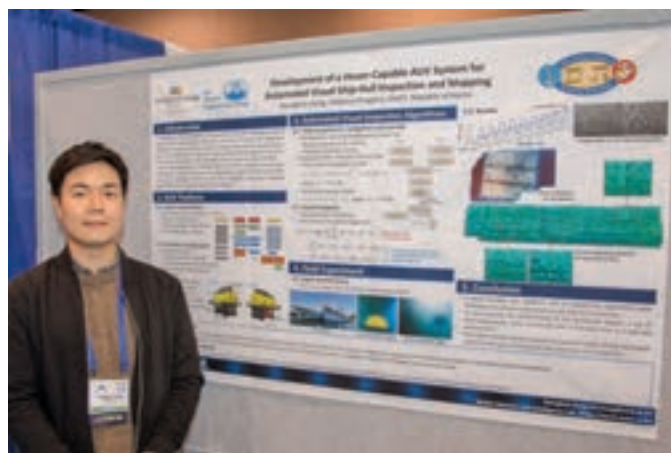
Thanh Huy Nguyen, IMT Atlantique Bretagne-Pays de la Loire
Heterogeneous Data Registration for 3D Underwater Scene Reconstruction



This paper addresses the heterogeneous data registration problem, which is one of the key features for any scene reconstruction and representation, especially for the underwater environment. In this study, we propose a registration method

built around a 2D-to-3D feature-based approach that registers high-resolution side-scan sonar images with bathymetric data (topographic 3D point cloud) obtained by multibeam echosounder. This process enables us to achieve a global 3D mosaic of the studied underwater scene, which is informatively richer and more reliable than each individual dataset. Indeed, the interest of this data fusion representation is that it combines the benefits of using each sensor: bathymetric information provides the geometric structure of the sea-bottom, while side-scan sonar images contribute a complementary observation with better resolution of the sea-bottom reality (e.g. sedimentology, bottom-laying object, etc.).

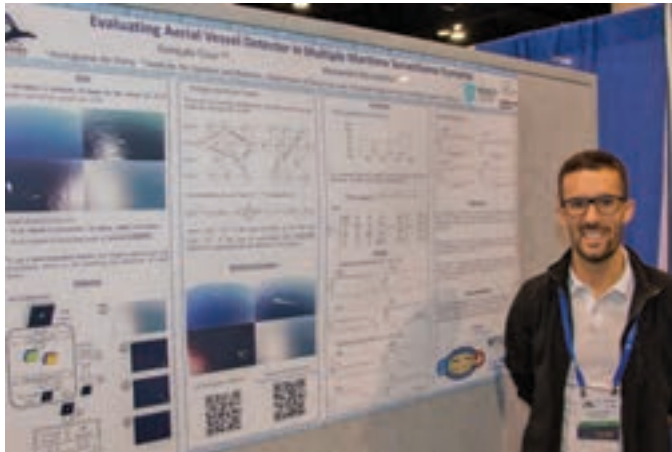
Seonghun Hong, KAIST
Development of a Hover-Capable AUV System for Automated Visual Ship-Hull Inspection and Mapping



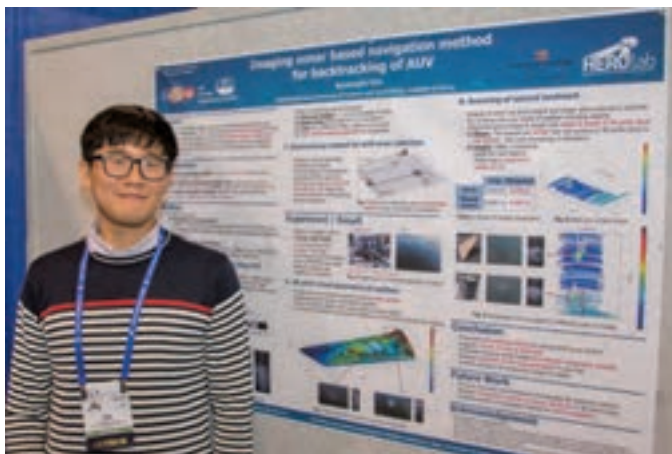
Generally, underwater hull inspection have been conducted by human divers. It is an extremely dangerous task, and hence, can be a potential application for unmanned underwater vehicles. The operational safety and performance of in-water inspection can be significantly improved by introducing unmanned vehicle systems. This study addresses the development of an hover-capable autonomous underwater vehicle system and its operational algorithms for automated visual ship hull inspection with no (or minimum) human intervention. The feasibility and practical performance of the developed system and algorithms are demonstrated by conducting field experiments with a full-scale ship in a real sea environment.

Gonçalo Cruz, Instituto Superior Técnico
Evaluating Aerial Vessel Monitoring In Maritime Surveillance Scenarios Using Convolutional Neural Networks

In this paper we present an autonomous detection approach for airborne surveillance in maritime scenarios. This approach is robust to sun glare, waves and scale variation. Additionally, we introduce a new metric to evaluate detection and tracking results that is more adequate for these scenarios. The proposed detection method is evaluated using videos from different monitoring missions and its results are compared with a state-of-the-art neural network. This comparison is done using a traditional and the proposed evaluation metric.



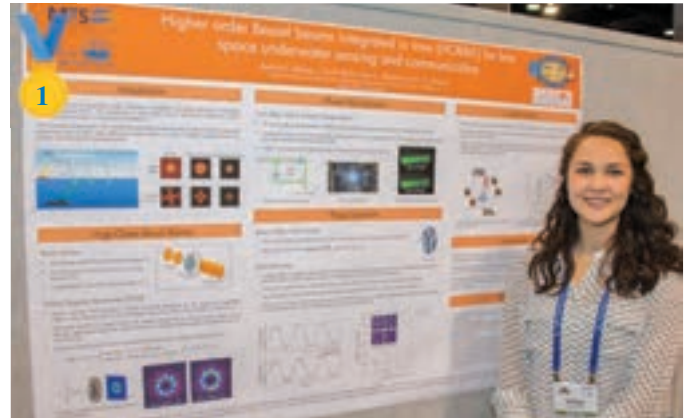
Byeongjin Kim, POSTECH (Pohang University of Science and Technology)
Imaging sonar based navigation method for backtracking of AUV



We propose an imaging sonar-based backtracking method as a navigation strategy for an underwater investigation of AUVs. The purpose of backtracking method is to reduce a drift error caused by the inaccuracy of navigation sensors when an AUV returns to its previous position. The AUV divides the trajectory into several intervals and returns to the previous position while correcting small drift error for each interval. For the backtracking, we suggest a method obtaining terrain information using an imaging sonar. We create a 3D point cloud by scanning the seafloor. We can use the 3D point cloud to detect objects and to select natural landmarks. The selected natural landmark can be used as a reference in the backtracking process. To verify the feasibility of proposed methods, we conducted field experiments using a hovering-type AUV 'Cyclops'.

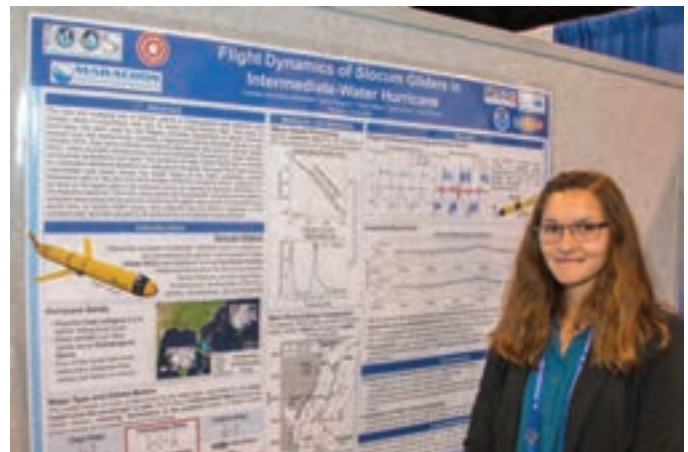
Kaitlyn Morgan, Clemson University
Higher Order Bessel Beams Integrated in Time (HOBBIT) for Free Space Underwater Sensing and Communication

This work presents the generation, dynamic phase modulation and phase detection of interfering composite optical vortices. This technique demonstrates a new method for encoding information onto an optical beam for potential use in underwater



communication as well as sensing applications including object detection and channel characterization.

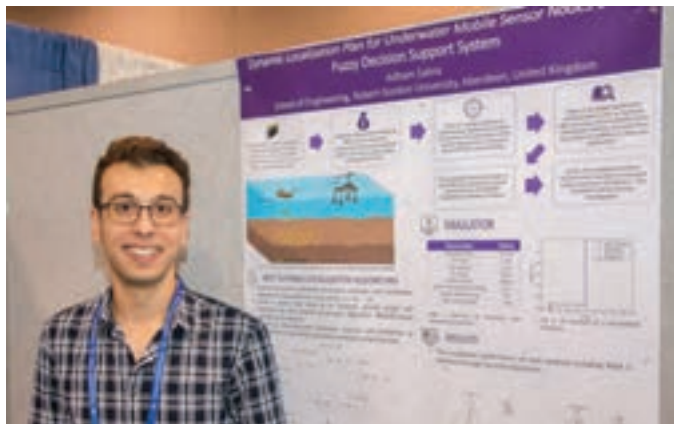
Cassidy Gonzalez-Morabito, Rutgers University
Flight Dynamics of Slocum Gliders in Intermediate-Water Hurricane



The new and emerging use of Slocum gliders in oceanographic data collection has brought about a progressive new way to record in-situ oceanic data. This piece of technology has been used by the Rutgers University Department of Marine Science through over 400 deployments, including a deployment during Hurricane Sandy in late October 2012. Data being collected during this deployment was done by Slocum glider RU23, which recorded measurements such as backscatter, fluorescence, water velocity, conductivity, temperature and depth. The dynamics of water motion RU23 flew

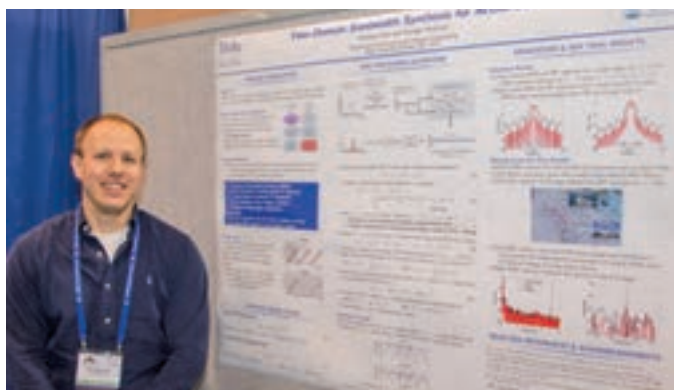
in caused an unforeseen additional dataset to be collected by the glider. Because RU23 flew during intermediate type ocean waves, the orbital motion of the water potentially caused fluctuations seen in the dive and climb profiles of RU23's pressure record. Analysis can be done on the signal seen in the pressure record, by viewing its pressure fluctuation in the frequency spectrum. From this, wave period can be extracted. Accuracy of the glider's extracted wave period will be done by comparing the glider wave period to recorded wave period done by nearby NDBC buoys. Also analyzed was the glider's response to the turbulent water dynamics gauged by its performance in its attitude measurements.

Adham Sabra, Robert Gordon University
Dynamic Localization Plan for Underwater Mobile Sensor Nodes using Fuzzy Decision Support System



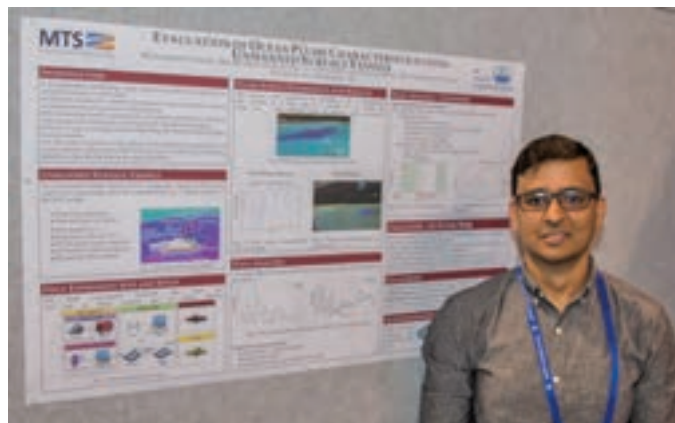
Underwater mobile sensor node localization is a key enabling technology for several subsea missions. A novel scalable underwater localization scheme, called Best Suitable Localization Algorithm (BSLA), is proposed to dynamically fuse multiple position estimates of sensor nodes using fuzzy logic, aiming at improving localization accuracy and availability along the whole trajectory in missions. Numerical simulation has been conducted to demonstrate significant improvement in localization accuracy and availability by using the proposed fuzzy inference system. The proposed method provides a cost-effective localization system by harnessing all available localization methods on-board.

Jonathan Soli, Duke University
Time Domain Bandwidth Synthesis for Active Sonar



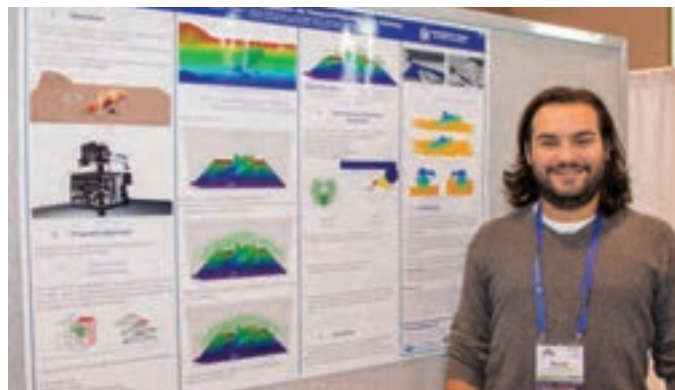
This paper presents a technique for extending the bandwidth of chirped active sonar signals. Bandwidth synthesis (BWS) results in improved range resolution, increased signal-to noise ratio (SNR) and reduced fading due to delay-spread multipath. The approach demonstrated uses a low-order autoregressive (AR) process to model de-chirped segments of the received signal, which are then extrapolated using linear prediction (LP). Both simulated results and an initial sea trial result confirms BWS performance.

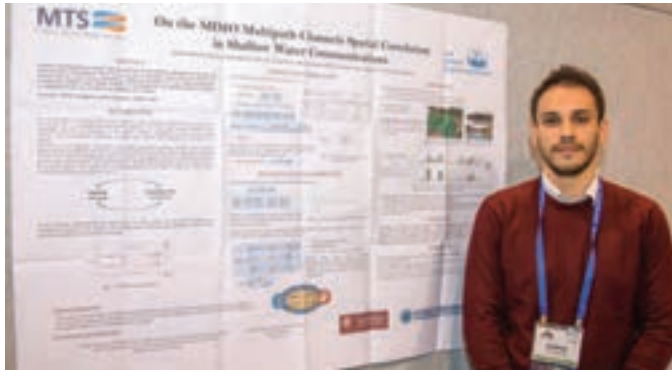
Muhammad Fahad, Stevens Institute of Technology
Evaluation of Ocean Plume Characteristics using Unmanned Surface Vessels



We present results from a series of tracer dye experiments where ocean plume concentration is measured using unmanned surface vessels. The goal of the study is to characterize the fine-scale spatiotemporal plume structure which is used for developing and evaluating autonomous robotic sampling strategies. We present a description of the qualitative characteristics of experimentally generated marine plumes namely intermittency, sinuous structure, and the time varying near-source concentration profile. We also present a data reduction process and a set of summary statistics to describe the fine-scale plume structure as evidenced by the time series measurements. These summary statistics provide a comparison benchmark for the development of future plume simulation models that capture the fine-scale plume structure.

Bruno Floriani, Federal University of Santa Catarina
Model-Based Underwater Inspection via Viewpoint Planning using Octomap





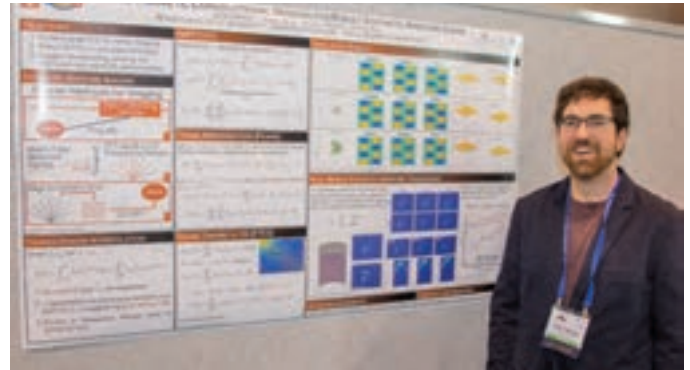
During the last years, the underwater inspection of industrial assets, archaeological shipwrecks or geological/ biological structures has become an area of interest. Nowadays, these inspections are done by divers or remotely operated vehicles (ROVs). This paper presents a preliminary solution for planning automatic underwater inspections for an autonomous underwater vehicle (AUV) assuming an a priori known environment. The proposed algorithm computes the viewpoints that an AUV has to reach in order to completely scan the region/ structure of interest. Then, two optimization steps are taken into account: the number of viewpoints to cover the object and the order and path to reach them. Despite the algorithm uses a brute force approach, the utilization of octree based structures to represent the environment allows to obtain satisfactory results in a short time. The proposed method is evaluated in simulation using Gazebo and the Girona 500 AUV.

Andrea Petroni, “La Sapienza” University of Rome
On the MIMO Multipath Channels Spatial Correlation in Shallow Water Communications

Acoustic communications in underwater environment are considerably influenced by the physical characteristics of the medium. This is even more true in the polar regions where the presence of icebergs and icy water layers represent an additional dependence to the signal propagation. Considering a MIMO scenario, we investigate how the channels spatial correlation is conditioned in the case of both frozen and fluid water surface. More, we evaluate the impact of the medium changes on the signal delay spread.

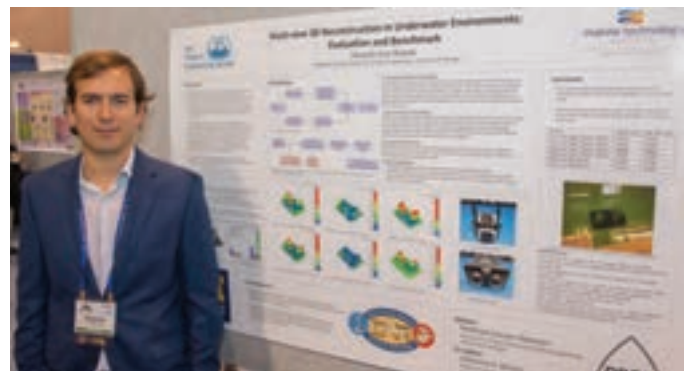
John McKay, Pennsylvania State University
Using Frame Theoretic Convolutional Gridding for Robust Synthetic Aperture Sonar Imaging

Recent progress in synthetic aperture sonar (SAS) technology and processing has led to significant advances in underwater imaging, outperforming previously common approaches in both accuracy and efficiency. There are, however, inherent limitations to current SAS reconstruction methodology. In particular, popular and efficient Fourier domain SAS methods require a 2D interpolation which is often ill conditioned and inaccurate, inevitably reducing robustness with regard to speckle and inaccurate sound-speed estimation. To overcome these issues, we propose using the frame theoretic convolution gridding (FTCG) algorithm to handle the non-uniform Fourier



data. FTCG extends upon non-uniform fast Fourier transform (NUFFT) algorithms by casting the NUFFT as an approximation problem given Fourier frame data. The FTCG has been shown to yield improved accuracy at little more computational cost. Using simulated data, we outline how the FTCG can be used to enhance current SAS processing.

Eduardo Iscar, University of Michigan
Multi-view 3D Reconstruction in Underwater Environments: Evaluation and Benchmark



A blind test? Not really that ... After many years and hundreds of students being chaired, as the SPC chair, new responsibilities come to me. So, it is just the time to give the mike to a new one: Prof. John Watson. I will still be there, no more as the SPC chair, but probably as a judge (I feel that I will regret having written this). Keep in mind: Do not forget to join our huge family!

Mapping of underwater environments is a critical task for a range of activities from monitoring coral reef habitats to surveying submerged archaeological sites. In recent years, optical reconstruction methods developed for terrestrial (in air) applications have increasingly been applied to the underwater environment by the marine science community. However, assumptions such as the brightness constancy constraint (BCC) and traditional camera pinhole models, which hold in air, do not

apply in the underwater environment. There is a lack of literature about how the violation of these assumptions affects the accuracy of the reconstruction. The main contributions of this paper is to develop a quantitative evaluation of computer vision-based 3D reconstruction methods applied to the underwater domain. Comparisons are presented between low- and high-cost camera systems to quantify the tradeoff between equipment cost and performance.

Winning Poster Paper Higher Order Bessel Beams Integrated in Time (HOBBIT) for Free Space Underwater Sensing and Communication

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Abstract—This work presents the generation, dynamic phase modulation and phase detection of interfering composite optical vortices. This technique demonstrates a new method for encoding information onto an optical beam for potential use in underwater communication as well as sensing applications including object detection and channel characterization.

Keywords— *orbital angular momentum; coherent; underwater; turbidity; interference*

I. Introduction

Current state of the art underwater optical links for sensing and communications applications employ amplitude modulation to encode information onto a beam [1]. Previously we have demonstrated an underwater free space optical link employing space division multiplexing of Bessel-Gauss modes [2]. This allows for an increased data rate in a bandwidth-limited environment. In this work, phase-modulated HOBBIT as an alternative modulation technique for underwater communication and sensing applications as well as diffractive optics for detection of the phase-only modulation technique is explored. This technique demonstrates the groundwork for a coherent quadrature-amplitude modulation scheme without the need for a local oscillator.

A. Bessel Beams

Ideal Bessel beams are radially symmetrical with a central spot surrounded by concentric rings with an infinite total radius. Therefore, they require infinite power. In reality, approximations of Bessel beams are achieved because optical systems will always

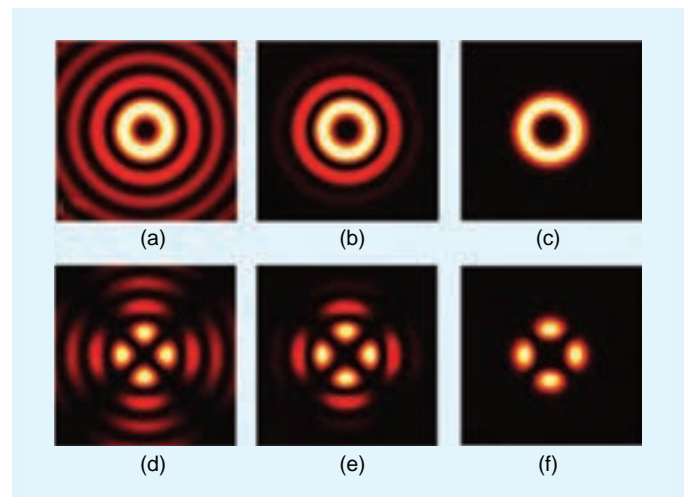


Figure 1. Simulated intensity profiles of a (a) Bessel beam, (b) Bessel-Gaussian beam, and (c) Laguerre-Gaussian beam with $p = 0$ and mode indices given by $l = 2$. And interference between two (d) Bessel beams, (e) Bessel-Gaussian beams, and (c) Laguerre-Gaussian beams each with mode indices given by $l = |2|$.

have a limiting aperture. A comparison of ideal Bessel, Bessel-Gaussian, and Laguerre-Gaussian beams is shown in Fig. 1 and are simulated using the equations given in [3], [4]. These non-ideal Bessel beams retain several advantages over equivalent Gaussian beams when used in long distance communication application, including self-healing capabilities and power delivery at the receiver [5]. These capabilities lend Bessel beams the potential to improve signal quality in underwater environments where absorption severely limits propagation distance or sediment and marine life blocks and scatters photons.

*Funding for this research was provided by ONR N00014-141-0264, N00014-16-1-3090.

This work examines HOBBIT in the form of interference between composite optical vortices. These optical vortices are high-order Bessel-like modes that are coherently combined so that the structured light can be dynamically manipulated using phase-modulation. Such manipulation temporally shifts the phase structure of the beam and is apparent as a rotation of the intensity profile.

B. Optical Vortices

Optical Vortices are a type of beam that carries orbital angular momentum (OAM). OAM is a term used to describe the angular momentum that results from an azimuthal phase distribution of light [6]. This typically refers to a helical wavefront that twists about the axis of propagation and can be described by an extra phase term of $\exp(il\phi)$, where i is the imaginary unit, l is the azimuthal mode index, and ϕ is the azimuthal coordinate. Some examples of beams carrying OAM can be seen in Fig. 1. This unique helical wavefront results in an annular intensity profile with a central null due to an on-axis phase singularity.

Due to the unique wavefront properties of beams carrying OAM there is a growing research interest in their use in sensing application such as object rotation detection [7], fluid vorticity measurements [8], communication [9], and particle manipulation [10]. Rotation and fluid vorticity measurements can provide insights into underwater channel properties and information about the motion of an object being interrogated.

C. Composite Optical Vortices

Composite optical vortices are a form of structured light that is generated through the coherent combination of various optical vortices. One method for generating such a mode is through the collinear superposition of two coherent OAM modes using an interferometric approach such as the Mach-Zehnder setup illustrated in Fig. 2. In this work, we first generate composite modes by propagating a Gaussian beam through a single concentric phase plate (CPP) and then use the Mach-Zehnder interferometric approach to combine the composite modes. These phase-only CPP elements impart two opposite helical wavefronts onto the planar wavefront of a Gaussian mode. The output is approximately Bessel-Gaussian in nature due to propagation through the diffractive CPP. As

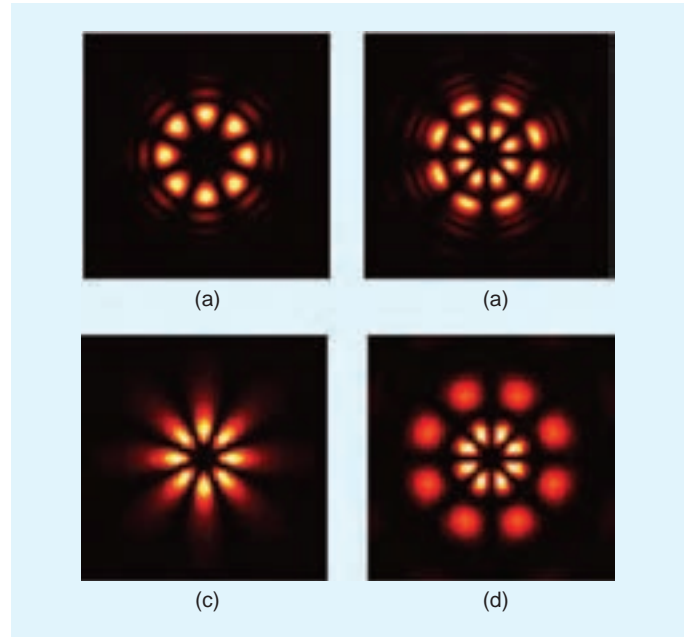


Figure 3. Simulated near and far-field images of the two interfering composite vortex modes produced by CPP with different phase delays. Near field images with phase delays (a) $\Delta\phi = 0$, (b) $\Delta\phi = \pi$ and far field images with phase delays (c) $\Delta\phi = 0$, and (d) $\Delta\phi = \pi$.

the beam propagates, the two helical wavefronts apodize, generating a petal-like pattern due to the constructive and destructive interference of the helical wavefronts [11]. In addition, amplification of these high order modes has been successfully demonstrated [12].

Composite optical vortices are produced through the coherent superposition of differing OAM modes. In this work, two conjugate composite modes generated using CPPs are coherently combined using a Mach-Zehnder interferometry setup. The resulting output is a uniquely structured beam that alternates between 8 and 16 lobes that counter-rotate as seen in Fig. 3. Information can be encoded onto these beams by altering the phase delay $\Delta\phi$, between the interfering modes and

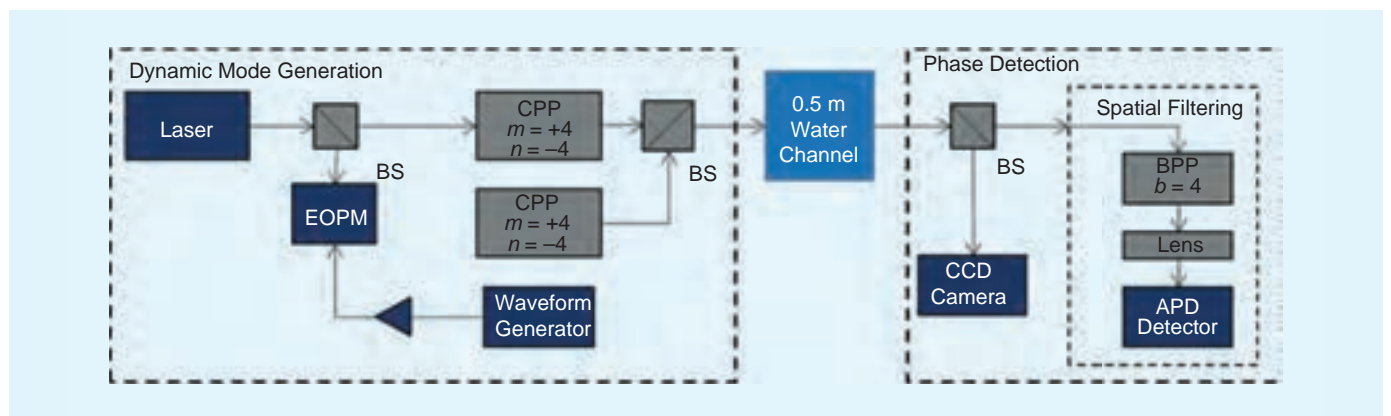


Figure 2. Schematic diagram of mode generation and detection. 532 nm Laser, EOPM – electro-optic phase modulator, CPP – concentric phase plate, BS – beam splitter, BPP – binary phase plate, APD – Avalanche photodiode.

illustrates how the beam profile changes when $\Delta\phi$ is set to 0 and π .

D. Detection Optics

Detection of the relative phase delay has been demonstrated through image processing [9], [10], [13] and spatial light modulators [11]. Image processing limits the phase modulation signal frequency due to the slow framerate of imaging devices. On the other hand, spatial light modulators have the potential to be damaged by high power incident light and diffraction efficiency is limited by pixel pitch of the modulator. In this work we demonstrate signal recovery using passive phase-only optics for the detection of phase modulation. These optics are custom fabricated in-house using photolithographic techniques. The detection optics are designed for operation at 532 nm and are etched into Fused-Silica glass wafers. These optics have the same design as the detection optics demonstrated in [14] for the phase modulation detection of interfering OAM modes, similar to those illustrated in Fig. 1, where the profile is given by

$$P_1(\phi) = \text{squarewave}(b\phi) \quad (1)$$

where squarewave describes a square wave that alternates between 0 and π , and b describes the number of periods over the azimuthal angle ϕ .

Underwater optical links are primarily photon-limited due to scattering and absorption. Absorption by the environment can be minimized by utilizing light in the blue/green regime. Therefore, it is important to further explore methods that circumvent effects of scattering. Previously we have studied the propagation of composite optical vortices generated with CPPs for use in free space underwater optical links where it was found that the beam structure was minimally affected by underwater turbidity [15]. Additionally, we have explored phase modulation of composite modes for use in underwater links at low rates [13]. In this work, the propagation dynamics of phase-modulated interfering composite vortex beams generated with CPPs will be examined through turbid underwater conditions. Furthermore, we utilize binary phase plates (BPP) to detect the induced phase modulation, pushing the data rate to 3 MHz which is only limited by the available voltage amplifier.

II. Methods and Results

A. Generation of Dynamic Modes

A Mach-Zehnder interferometry setup is used to coherently and collinearly combine two composite optical vortices, a simplified schematic diagram of the setup is shown in Fig. 2. High-order Bessel beams are generated with CPPs. The output from a 532 nm laser source is split into two coherent legs. Each leg is then passed through identical CPPs. The CPPs used in this work have helical phase profiles defined by

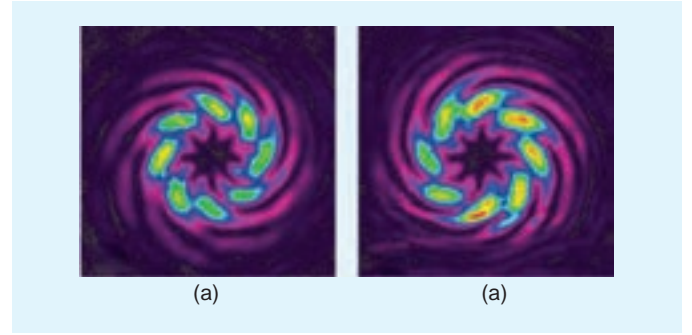


Figure 4. Experimental images of concentric vortex modes produced by CPPs with (a) $m = +4$ and $n = -4$ and (b) $m = -4$ and $n = +4$. These individual modes are coherently superimposed to form the dynamic modes to be transmitted.

$$P_2(\phi) = \begin{cases} \exp(im\phi), & 0 < r \leq 0.625 \text{ mm} \\ \exp(in\phi), & 0.625 \text{ mm} < r \leq 2.5 \text{ mm} \end{cases} \quad (2)$$

where r is the radial distance from the beam center, $m = 4$, and $n = -4$. The $1/e^2$ beam diameter incident on the CPPs is approximately 2 mm. The composite modes are then coherently combined using a cube beam splitter (BS). The reflection off the beam splitter cube causes one of the identical modes to become the conjugate of the other. The concentric vortex intensity profiles are shown in Fig. 4, captured before the combining BS. When compared with interference patterns shown in Fig. 1, it is apparent that there is an additional parabolic phase in the near field that can be seen in the spiral of lobe pattern.

The wavefronts then combine to produce the interference patterns shown in Fig. 5. Dynamic mode generation is achieved by varying the relative phase delay between the two interfering legs and is explained in further detail in [12]. These combined modes are then transmitted through 0.5 m of water with varying turbidities.

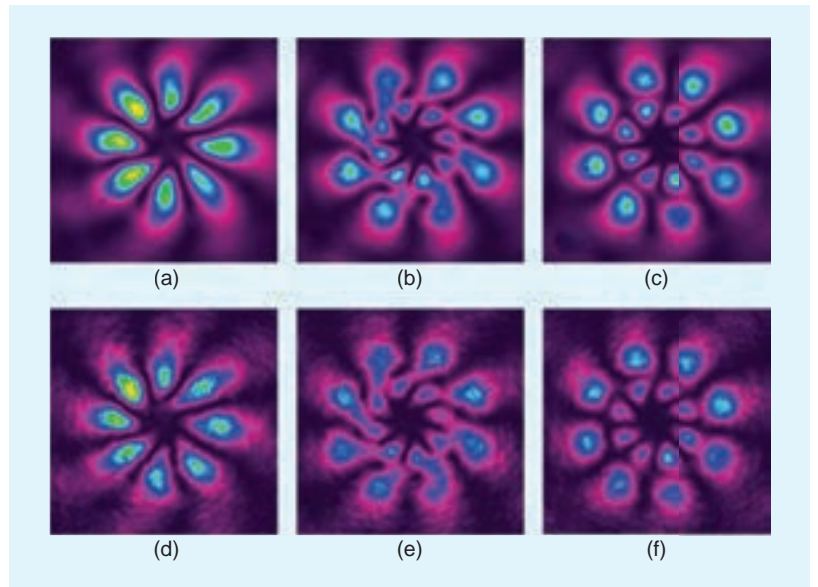


Figure 5. Experimental images through 0.5 m clean water with $c = 0.09 \text{ m}^{-1}$ for a phase delay of (a) 0, (b) $\pi/2$, and (c) π radians and through 0.5 m turbid water.

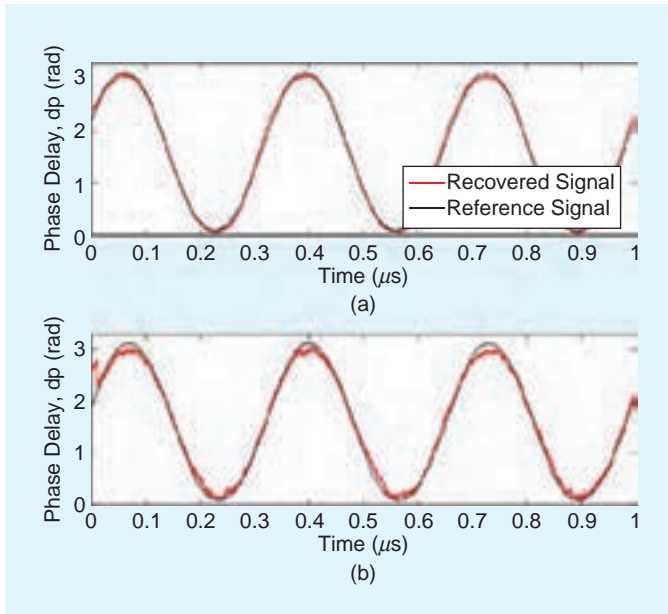


Figure 6. Phase signals recovered at 3 MHz through 0.5 m of turbid water with (a) $c = 0.96 \text{ m}^{-1}$ and (b) $c = 5.4 \text{ m}^{-1}$.

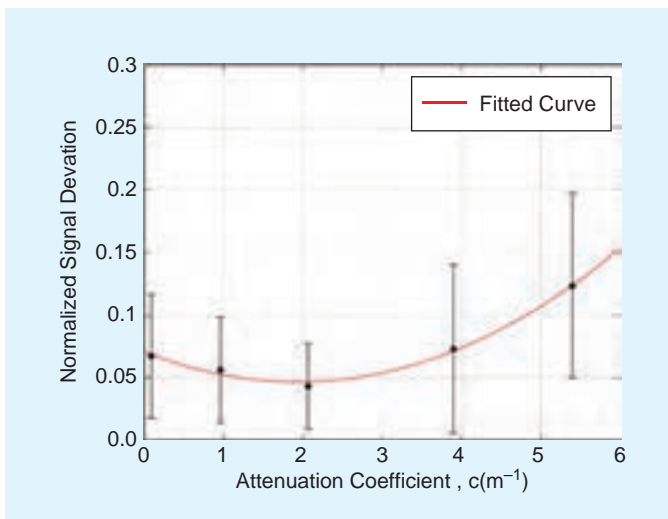


Figure 7. Recovered phase modulation signal recovered through underwater turbidity.

B. Detection of Dynamic Modes

After transmission through a turbid water environment, the dynamic mode profile is imaged and detected. Reference work has a phase profile defined in (1), where $b = 4$. This phase-only element is designed to produce a correlation peak when the two interfering modes are in-phase, and a null when the two modes are out-of phase ($\Delta\phi = \pi$).

The correlation is measured using the spatial filter setup shown in Fig. 2. The on-axis correlation peak was collected on an avalanche photodiode (APD) with a pinhole designed to pass only the diffraction-limited spot. In addition, the applied reference signal was collected for comparison. Fig. 5 shows a comparison of the recovered phase signal to the applied reference signal for two turbidities. The normalized signal Figure

shown in Fig. 7 is determined by taking the absolute value of the difference between the reference and recovered signals and normalizing using the mean of the reference signal. The signal quality degrades as turbidity increases while still maintaining enough coherence for successful signal recovery demonstrated beyond an attenuation coefficient of $c=5\text{m}^{-1}$, corresponding to over 18 m in clean ocean water or over 9 m through coastal ocean conditions.

III. Conclusion

In this work, the generation and detection of phase-only modulated HOBbit is demonstrated. Phase modulation information is encoded and recovered through a range of underwater channel turbidities. This phase detection technique can potentially be applied to underwater sensing and communication applications in the future. To further characterize the beam propagation characteristics propagation through turbulence will be explored. In addition, a new architecture that will replace the Mach-Zehnder interferometry setup is under investigation to demonstrate higher speed phase modulation in the GHz range.

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Student Poster Competition: From Participant to Judge

Joshua Baghdady, OES Student Poster Competition winner OCEANS’16 Monterey

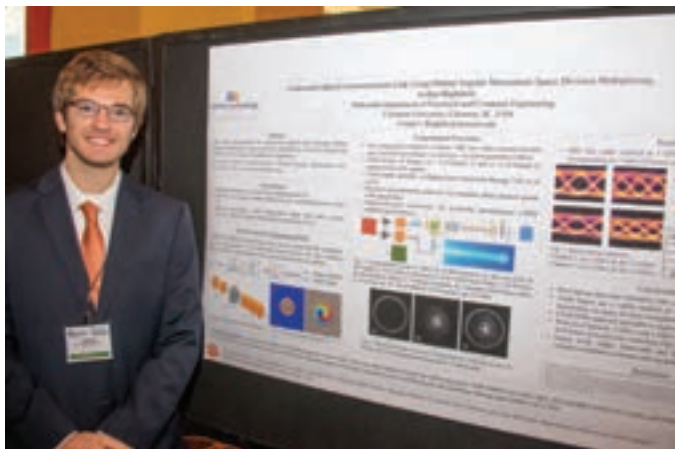
I first learned of the OCEANS Student Poster Competition (SPC) as a first-year graduate student through my advisor at Clemson University. Since my research was centered on the topic of underwater optical communications, I had already been to a handful of optics-centric meetings, but I had not as yet had the opportunity to share my work with the marine technology community. My advisor thus encouraged me to submit an abstract for consideration for inclusion in the SPC. Having noted that the next meeting was scheduled to take place in the beautiful Monterey, California, I was more than happy to oblige. A few weeks later I learned that my abstract had been accepted, and I began preparing my poster and making my travel arrangements to Monterey.

Over the week of the conference itself, I was pleased to see six countries represented among the 16 competitors and a wide variety of work across the spectrum of marine technology on display. As I passed the hours staffing my poster, I was able to mingle with my fellow competitors and introduce myself to the many professionals who stopped to digest my research. While not manning my poster, I was able to

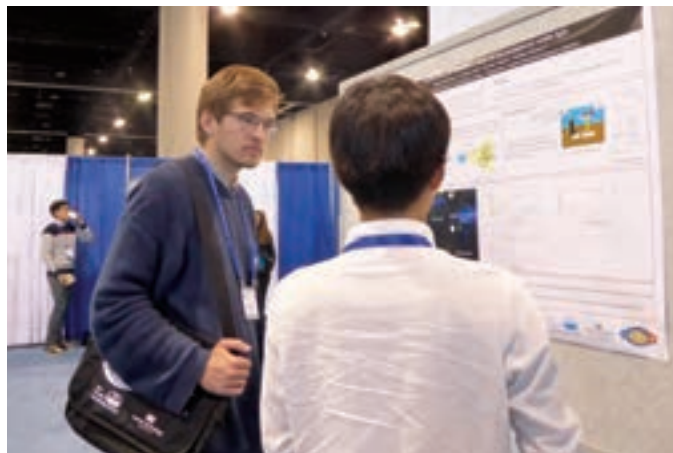
participate in the various other conference events such as the technical sessions, the industry exhibition, and the food-truck luncheons.

The gala at the Monterey conference was hosted on Wednesday night at the acclaimed Monterey Bay Aquarium on Cannery Row in the heart of the old downtown area. It was there, during the public opening remarks, that the SPC awards ceremony was held and I was awarded the Norman Miller Prize for first place in the competition. As a result, the full text of the conference proceedings accompanying my poster was published in the December 2016 edition of the OES BEACON newsletter and may be found there on pages 46–49 under the title “Underwater optical communication link using Orbital Angular Momentum Space Division Multiplexing,” as well as on the digital IEEE Xplore® repository under the DOI 10.1109/OCEANS.2016.7761479.

Having gleaned much from the conference in Monterey, I returned to Clemson interested in attending future OCEANS meetings. Fortunately, an opportunity to do so presented itself ahead of the very next meeting and I jumped at the chance. The



Staffing my poster in Monterey.



Interacting with a student in Anchorage.

international OCEANS conference of 2017 took place in Aberdeen in Northeastern Scotland on the edge of the North Sea. Shortly after my arrival at the convention center Liesl Hotaling, the coordinator of the SPC, approached me in the atrium and asked if I would be willing to serve the competition as an additional judge. I gladly accepted this new role and shortly began mingling with the 20 students presenting work from 11 countries. Just as had been the case in Monterey, I was impressed with the depth and breadth of the work on display. Unlike my experience as a student, however, I was now able to spend time with each competitor and try to understand the solutions to the various problems that each had attempted to tackle in their own research. As a young judge, I enjoyed the unique advantage of viewing the students not as my successors but as my peers, conscious that the work that these young luminaries are doing is shaping how we all will interact with the oceans of tomorrow.

Even though I was a judge at this time, I was also still a graduate student myself. Consequentially, I was eligible to apply for the Marine Technology Society's Dieter Family Scholarship, which awards travel and registration to one graduate student each year to the North American OCEANS conference. Shortly after returning from Scotland I learned that I had been awarded this scholarship for the upcoming meeting in Anchorage, Alaska, and so volunteered to serve as a judge there as well.

At the meeting in Anchorage, 20 students competed in the SPC from 10 different countries. Unlike in Aberdeen, in Anchorage the competitors did not know *a priori* that I was one of the judges. This allowed me to strike a more casual stance with the students and allowed them to present their work to me as they would to a colleague.

Having now attended three OCEANS meetings in a row, I hope to continue serving the conference in the future after I transition from graduate student to young professional. Unlike many topical conferences, OCEANS brings together thinkers from diverse professional backgrounds and allows them to mingle through a variety of social and technical programs. One such popular and recurring program is the Student Poster Competition, which gives visibility both to the work being done on the forefront of marine technology and to the students performing that work. The SPC not only gave me access to OCEANS, but also introduced me to the wider community of scientists and engineers working to improve and protect the ways in which we interact with our marine environments. I have been happy to volunteer as a judge at the 2017 meetings and I hope that my contributions help keep this program alive for future students to glean from the valuable interactions that OCEANS affords, just as I have begun to do myself.

Save the Date!

OCEANS '18 MTS/IEEE Charleston

Charleston, South Carolina

Charleston Area
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October 22-25, 2018

For more information, visit:
www.oceans18mtsieecharleston.org

OCEANS 2018 Charleston

Dr. Jeffrey Payne, Conference Co-Chair



OCEANS '18, the annual joint conference of MTS and IEEE, will be held October 22–25, 2018, at the North Charleston Convention Center in Charleston, South Carolina. The theme is Healthy Oceans, Resilient Communities, Robust Commerce... Strong Nations. The conference will draw strongly on local and regional to international issues of interest, including ocean technology, working waterfronts, marine transportation and security, ocean and coastal ecosystems and fisheries, vulnerable populations, energy development and other ocean uses, coastal hazards and climate change, as well as other topics. We will explore how science and technology must inform and enable the challenges of a 21st Century where environment, society, and economics are highly interconnected.



Arthur Ravenel Jr. Bridge—Charleston Harbor.

The port city of Charleston, founded in 1670, is a thriving metropolis defined by its beauty, charm and hospitality, diversity of peoples and cultures, unparalleled recreation and tourism, leading business, technology and academic atmosphere, abundant natural resources, and as the birthplace of the Civil War. The southeastern region of the United States is one of the most dynamic areas of the nation, with Charleston, Myrtle Beach and Hilton Head at the vanguard of fastest growing cities on the East Coast, producing rapid coastal change. These attributes have led to surging economic growth in manufacturing,

port development, information technology, maritime industries, and tourism and recreation, which in turn is creating a significant increase in resident and visitor populations. At the same time, the region is subject to numerous natural hazards, both chronic and episodic, including hurricanes, coastal storms, nuisance flooding, sea level rise, salt-water intrusion, earthquakes, and tornados.



Shrimp Boats on Shem Creek.

One of the greatest challenges for the region is to create an environment that fosters safe and healthy communities, where growth and sustainability are synonymous, where critical infrastructure can support economic development and increasing populations, where resilience and sustainability are valued as guiding principles, and where people of all kinds can benefit. Innovations in technologies, information systems, communications, science, and human engagement represent the foundation of this future, and the sessions below provide evidence that we are well on our way.

Local Technical Sessions will include:

- Enhancing Coastal Resiliency with New Technologies and Community Design
- Maritime and Port Logistics, Resilience and Security in an Era of Ever-Bigger Ships, Deeper Ports, Increased Commerce, and Stronger Storms
- Building Coastal Resilience In The Face Of Rising Seas and Intense Storms
- Tools and Technologies for Better Assessing Ocean, Community and Human Health
- Social Challenges Intensified with a Changing Climate
- Educating a Workforce Ready for Future Technologies
- Special Sessions:
 - Measuring and growing your Blue Tech Economy
 - Tsunami Warning Systems

For more information on the standard OCEANS topics, visit the conference website at: oceansconference.org/charleston18.

A Blast from the past

Bob Wernli—Vice President for Professional Activities

Is there fun at an OCEANS conference...see for yourself in this **Blast from the Past!** from OCEANS '10 Sydney



Brian Ferguson (Chair), Mary O'Kane, Neville Smith, Craig McLean, Commander Bruce Kafer.



Sydney Opera House.



Tamaki Ura, Harumi Sugimatsu, Lian Lian, Jerry Carroll.



Christian de Moustier, Andy Lim, Bob and Bev Wernli.



Andy Lim, Liz Creed and Todd Morrison in the IEEE OES Booth.



Jerry Carroll and Milica Stojanovic (New IEEE Fellow).

A Writer's Ocean Adventure

Jenny Woodman, a Science Writer and Writing Fellowship Coordinator for IEEE Earthzine

On Aug. 5, I joined oceanographer Robert Ballard's Corps of Exploration as a science communication fellow for the Ocean Exploration Trust. Founded by Ballard in 2008, the trust is an organization dedicated to ocean exploration and marine science, with an emphasis on biology, geology and archeology.

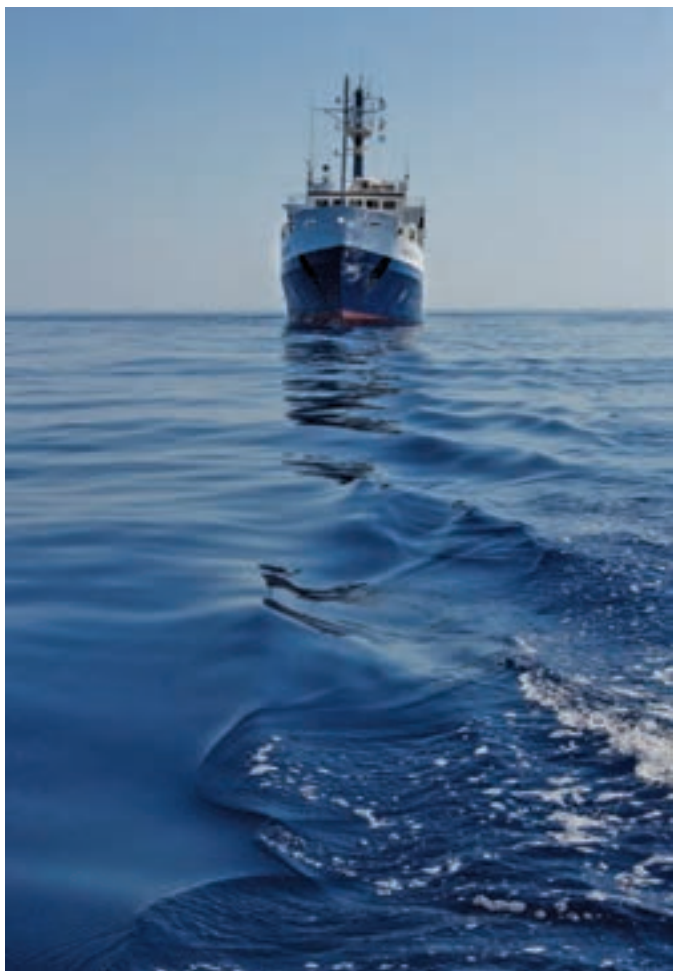
As a writer, much of my research is done on a laptop. I don't often get the chance to visit distant locations for reporting. I applied for a fellowship that would get me on a research or exploration vessel, so I could gain first-hand knowledge of the work I've been covering for IEEE Earthzine. When I received word that I had been accepted as a science communication fellow for 2017, I felt like I had been selected to be an astronaut. This represented a chance to experience life and science at sea.

The Nautilus's 2017 expedition season runs from May through November; the team travels up and down the West Coast of North America studying a variety of unique landscape features including paleo-shorelines, hydrothermal vent fields, methane seeps, and deep sea coral communities.

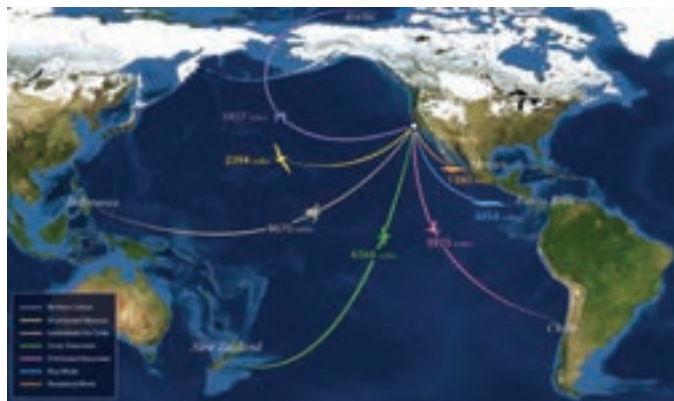
Once on board, we spent a week exploring newly mapped regions in Cordell Bank National Marine Sanctuary, 57 miles northwest of San Francisco, California, to help sanctuary managers better conserve this precious natural resource. The sanctuary was expanded in 2015, and managers had no idea what was contained within much of the boundaries of the 1,286-square-mile territory. Using remotely operated vehicles (ROVs), we spent our time in underwater canyons, deep below the surface, looking for and collecting samples from rocky habitats, which are hotspots for marine life, because this terrain gives organisms something to hold on to.

Thanks to upwelling—a process generated by surface winds and currents, which helps bring cold, nutrient-rich water from the deep ocean up to the upper layers of the water column—the region is a magnet for marine mammals and seabirds; these creatures travel great distances for an all-you-can-eat buffet each August.

Underwater, we spotted numerous species of octopuses, skates, rockfish, and lots of squishy invertebrates that I found utterly mesmerizing like the comb jellies we saw each night.



E/V Nautilus at sea in 2015. Image Credit: OET/Nautilus Live.



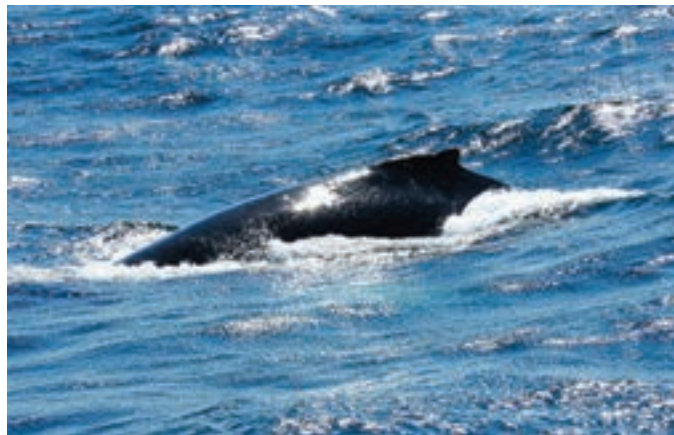
A map of the distances traveled to reach Cordell Bank National Marine Sanctuary each summer. Image Credit: NOAA National Marine Sanctuaries.



These deep sea octopuses, Graneledone boreopacifica, were abundant in the area; they are known to brood eggs over four years. Image Credit: OET/Nautilus Live.



A scientist from NOAA watches the video feed from the ROVs in the control van and confers with scientists on land about collecting samples. Image Credit: OET/Nautilus Live.



Humpback whales spent the afternoon with us in Cordell Bank on Aug. 12. Image Credit: Jenny Woodman.

These jellies have lived in our ocean for 500 million years and their combs generate a rainbow of colors as they drifted past our camera lens.

We found abundant corals, sponges, and associated organisms—some of which may unlock the next wave of anti-cancer drugs like the small unassuming green sponge found in the Gulf of Alaska in 2005; this sponge contains compounds capable of “selectively targeting and killing tumor cells,” according to the National Oceanic and Atmospheric Administration (NOAA).

In my work as a science writer for IEEE Earthzine, I’ve learned that 50 percent of the cancer-fighting drugs on the market today come from marine resources. This knowledge made each watch shift I served while on the Nautilus feel that much more pressing. Given that we’ve only explored about 5 percent of the ocean, imagine what we will discover in the coming years, as technology takes us deeper and closer toward knowledge of our home planet?

We didn’t get much sun during our week at sea. Gray skies dominated, but it was of little concern to us. Our eyes weren’t fixed on the horizon, rather they were glued to the many television and computer screens found all over the ship. In particular, we sat in the control van—two cargo shipping containers joined atop the E/V Nautilus—in the dark for eight hours each day as we performed our various jobs as Corps of Exploration members. As science communication fellow, my primary responsibility was to moderate the conversations taking place between the scientists on the ship and viewers tuning in live, from all over the world, to watch our adventures.

On Aug. 12, our dives were canceled due to 20-foot waves. The sun finally appeared—nudging our collective disappointment aside. We lingered on the social deck, watching the seabirds watch our boat in the hopes that we were a fishing vessel. Exhausted ROV engineers and interns reclined on the upper deck, basking in the warm rays after days of 20- to 24-hour

dives. The ROV team never seemed to rest. When they weren’t piloting the ROVs, they were furiously at work maintaining and repairing Hercules and Argus—our remotely operated vehicles of exploration.

In the distant horizon, a whale exhaled forcefully, sending a small geyser of air and water above ocean surface. Then another appeared and another. Over three hours we scurried from one side of the ship to the other as hundreds of humpback whales surrounded us—cresting gracefully above the surface and disappearing again like dancers crossing a stage. It was breathtaking and awe-inspiring. Two blue whale sightings got even the most experienced marine wildlife spotters on board jumping up and down, shouting and pointing at the water where they appeared for an instant.

It was like they knew we had something to celebrate.

In more than 92 hours of diving during our expedition, we collected 10 push core samples; 89 biological samples, divided up in to 233 samples for researchers all over the country; filled 22 Niskin bottles, providing 54 water samples for environmental DNA analysis and other research about changing ocean chemistry; expanded known ranges for marine organisms like ctenophores, fish and coral species; and collected a sample of a corkscrew coral (for which there is no previous record in North America).

The expedition offered an “entirely new way to think about this area and an entirely new way to talk about this area,” said Dani Lipski, lead scientist for the expedition and research coordinator for Cordell Bank National Marine Sanctuary.

In other words, it was a huge success.

Jenny Woodman is a science writer, editor and educator; she lives in Portland, Oregon. Follow her on Twitter @JennyWoodman.

This article was adapted from Jenny’s live blog for IEEE Earthzine during her time on the E/V Nautilus; you can read more here.

IEEE Earthzine Wants to Hear from You

Jenny Woodman, IEEE Earthzine

IEEE Earthzine is an online source for news, articles and educational materials about Earth science, Earth observations and users of Earth information for the international Earth-observing community. We feature stories, essays, reviews and technical papers from around the world about research, environmental policy, and new and emerging technologies. We specialize in mentoring students and early-career professionals interested in science communication.



How Can You Contribute?

Guest Editor(s): Quarterly Themes last about three months. Leading up to and during the theme, a Guest Editor (GE) assists in designing the theme's call for papers, soliciting content, providing final review of theme submissions and verifying the scientific information in each story or paper. The number of GEs per theme varies, and it is not uncommon for several GEs to divide the work between them. The time commitment is largely determined by the GE but anticipate 15-20 hours of commitment spread over three months.

Volunteer Reviewer(s): IEEE Earthzine strives to assure that its articles are scientifically accurate as well as engaging. When we cover a technical topic, we seek out professionals from the field to conduct a review. From geology to satellite observations, ecology to education, we are in need of volunteer reviewers. The time commitment is low, and you can accept or decline reviewer assignments on a case-by-case basis.

Write for us: Have you designed a platform that can process Earth observation data from satellites in a new and innovative way? Is your organization launching an initiative that will reduce marine debris in our oceans? Do you have unique insights in the arena of ocean health public policy? Consider pitching us your idea for a technical paper, article, or op-ed. Articles should be

geared for a general audience from a variety of Earth science disciplines.

For more information about writing for Earthzine, please see our Editorial Policy, Writer Guidelines and Reviewer Guidelines. We are interested in hearing from experts, professionals, and academics. We also enjoy working with students and are willing to help provide guidance toward meeting our journalistic standards.



Earth. Water. Life.

Writing Fellowship: If you are a college student or early-career professional interested in developing as a science communicator, consider applying for IEEE Earthzine's Writing Fellowship. It is a 10-week online course designed to help

you develop and hone your skills. For more information, email writingfellowship@earthzine.org.

Email Managing Editor Jeff Kart for information about volunteering for IEEE Earthzine: jkart@earthzine.org

2018 Editorial Calendar

Quarterly Themes: Via our quarterly themes, we connect readers to the people and institutions working to advance our understanding of the complicated world we call home. We look for original research, feature articles, reviews or op/eds, and other narratives, as deemed appropriate by the editor.

- Ocean Plastic and Marine Debris (Jan.–March)
- Forestry Management (April-June)
- From STEM to STEAM: The Intersection of Science and Art (July-Sept.)
- Seafloor Mapping (Oct.–Dec.)

Monthly Focus Topics: Monthly focus topics complement our in-depth quarterly themes, with timely content that highlights developments and news within topical areas. Articles included within our monthly focus topics are generally 500-1,000 words in length and must have a clear alignment with the designated topic. They must be submitted no later than the first week of the month associated with that topic. Contributing to a monthly focus offers a chance for researchers and others working on relevant topics to share their work or observations with an interdisciplinary and global audience. Our 2017 monthly focus topics are listed below; more detailed descriptions of these topics can be found here.

- January: Agriculture and Aquaculture
- February: Marine Technology for disaster preparedness, prevention, mitigation
- March: Space Weather
- April: Earth Day
- May: Great Lakes
- June: Big Data
- July: Ocean Networks Canada Cabled Observatory
- August: Arctic Ocean
- September: OES Oceans '18
- October: Women in STEM
- November: GEO
- December: Essays on Hope

Email Science Editor Jenny Woodman for information about submitting content to IEEE Earthzine: <http://jwoodman@earthzine.org>

Nurturing the Integration of Marine Robots in Multi-Domain Systems: The European Robotics League (ERL) Emergency Robots 2017

Gabriele Ferri¹, Fausto Ferreira², John Potter³

¹ERL Emergency 2017 Director ²ERL Emergency 2017 Deputy Director ³CMRE Principal Strategic Development Officer

Inspired by the 2011 Fukushima accident, European Robotics League (ERL) Emergency Robots is an outdoor robotics competition funded by the European Union with a focus on realistic cooperative search and rescue response scenarios for land, sea and air robots. After the success of **euRathlon 2015 Grand Challenge**, the first land, sea and air robots competition, the ERL Emergency Robots Major Tournament took place again in Piombino, Italy.

A novelty with respect to the euRathlon 2015 was the introduction of a new scoring and benchmarking methodology harmonised with one of the other ERL competitions (Service and Industrial Robots). In all four Task Benchmarks, the task can only be fulfilled when the three (or two) domains of robotics are working cooperatively. Multi-disciplinary and multi-organisation teams of about 130 students and engineers met in Piombino, Italy, from September 15-23, to tackle this unique challenge. A total of fifteen teams from thirteen different countries, formed 8 multi-domain teams with ~30 robots, were required to survey the scene, collect data, search for missing workers, identify critical hazards, and more, all in a race against the clock.

The event was locally organised by the NATO STO Centre for Maritime Research and Experimentation (NATO CMRE), supported by the ERL Emergency partners, the University of the West of England, Bristol, the Centre for Advanced Aerospace Technologies (CATEC), the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE and the University of Oulu. The ERL Emergency Robotics competition is part of the RockEU2 Coordination Action, led by euRobotics and it is supported by SPARC.

The roots of this project lie in the euRathlon 2015 Grand Challenge for which IEEE OES was a Platinum Sponsor as well as this year and in the Student Autonomous Underwater Vehicle Challenge—Europe (SAUC-E) which IEEE OES sponsored last year. The SAUC-E competition has been running since 2006 and organised since 2010 by NATO STO CMRE at CMRE's on-site sea basin and was this year included in ERL Emergency Robots 2017.

The euRathlon 2015 Challenge was held in Piombino, Italy, in the area surrounding the Tor del Sale building, and in the Enel-owned thermal power plant sheltered harbor, Fig. 1. The area was set up to simulate a Fukushima-like disaster area.

The competition presented several missions to multi-domain robotics teams composed of land, air and sea robots. The missions were to find missing workers (simulated with mannequins), deploy first-aid kits to the workers (by air and land), survey the disaster area to identify dangerous leaks and to close valves inside the Tor del Sale building and underwater to stem leaks.



Figure 1. Sea scenarios took place in the harbour of the Enel power plant, Piombino, Italy (top panel). The lower panel shows the nearby Tor del Sale building, which simulated the Machine room which the land robots, supported by UAVs, had to reach and to explore. Photo credit: ERL Emergency.

The competition was designed as a 9-day event, in which teams had four days of practice before starting to compete in the scenarios. Each scenario corresponded to a Task Benchmark (TBM) within the ERL benchmarking framework.

There were two different types of Task Benchmarks: Three-domain TBM (The Grand Challenge): a three-domain air, land and sea scenario, and two-domain TBMs: two-domain scenarios; serving as preparation to the Grand Challenge TBM.



Figure 2. One of the two underwater piping assembly structures and the valve to be closed (red circle).
Photo credit: euRathlon.

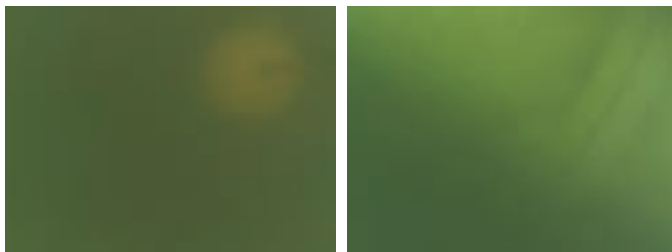


Figure 3. Left panel; An orange buoy is hardly visible. Right panel; the pipe structure is hardly visible. Photo credit: Universitat de Girona.

The competition was arranged in increasing order of complexity, with the practice days first (4 days), followed by the two-domain Task Benchmarks (3 days) and finally the three-domain Task Benchmark (2 days).

The main goal of the teams was to complete the tasks, for which autonomy and cooperation between domains were essential. The environmental conditions and difficulties presented in the scenarios were intended to be as realistic as reasonably possible, while remaining safe for competitors and spectators alike. The success criteria reflected straightforward end-user priorities such as task completion and minimal manual intervention by operators.

In particular, for the marine domain, tasks like an environmental survey (debris inspection), worker (mannequin) detection, leak localization by finding a plume of orange buoys and pipe following and manipulation were proposed. An underwater photo of a simulated valve closing task apparatus is shown in Fig. 2.

The Land and Sea TBM had similar tasks for the marine robots, but in this case, they had to cooperate with the land robots to know which valve they had to close. Marine and land robots had to close, in a coordinated way, an underwater valve and a land-based valve located inside the Tor del Sale building.

In the Land and Air TBM, the marine robots had to cooperate with aerial robots. After finding the missing worker, marine robots needed to surface on the top of the mannequin to communicate the position to the aerial robot for later recovery of

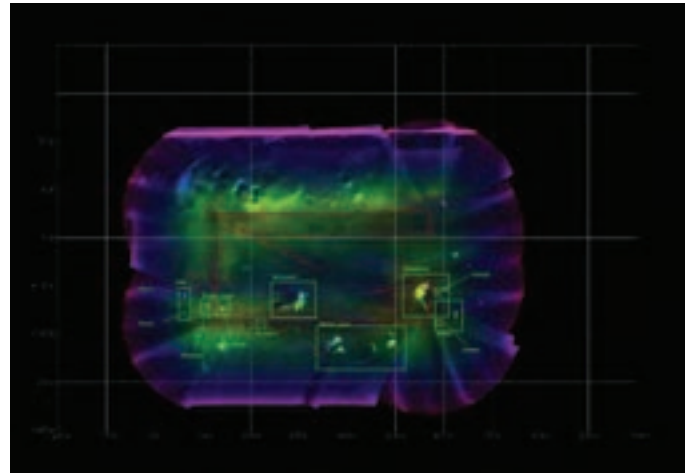


Figure 4. The 2D sonar map from the AUV Team TomKyle. Photo credit: AUV Team TomKyle.

the body in a real scenario. The underwater vehicle could also relay the message through a surface vehicle.

The Grand Challenge TBM was successfully met if all three missions were accomplished within 100 minutes. Strategy was important as the teams were free to tackle the mission goals in parallel or in sequence, and to choose the order. Teams were also free to choose which types of robots to deploy, as well as how and when to deploy them. Taking place over two days, the Grand Challenge was designed to encourage and reward cooperation between ground, marine and aerial robots, while allowing maximum flexibility in participation and innovation; testing not just the robots, but the human-robot teams.

Regarding the marine domain, the conditions were harsh. Although the area was in a protected harbour with shallow water, the visibility was very poor and this influenced the results. Fig. 3 illustrates the poor visibility encountered. Even though the objects were bright orange or yellow, in some cases they were hardly visible.

Nonetheless, several teams were able to perform the tasks mainly by using acoustic sensors, mostly achieving their goals. As an example, the AUV Team TomKyle produced an outstanding 2D sonar map of the area (Fig. 4).

The Participant Teams

Of the 8 multi-domain teams that participated in ERL Emergency Robots 2017, 7 included the marine domain. Of these, all had participated previously in euRathlon 2015 and only one did not participate in previous editions of SAUC-E. This demonstrates how well established in Europe this multi-domain competition at its second iteration (after euRathlon 2015) is. This is especially true for the marine domain for which SAUC-E has been for many years a great opportunity of testing and practicing with underwater robotics.

As in 2015, CMRE loaned a vehicle for free to less experienced teams. This was the SPARUS II AUV and was done in order to expand the number of teams in the marine domain, give them a sort of “jump start” as building an underwater robot is not a trivial task and to promote rapid development and innovation. The chosen team, OUBOT team from Obuda University (Hungary),



Figure 5. Winner of ERL Emergency Robots 2017 Grand Challenge TBM: Team Telerob (Land) + Universitat de Girona (Sea) + INESP/INESC TEC (Air). Photo credit: European Robotics League.

performed well with a second and a third place in two TBMs and the special navigation award for adapting their algorithms to work without a Doppler Velocity Logger (DVL). Another success story is the case of Robdos Team which had a loaned SPARUS II in euRathlon 2015 and now came back with their own built platform after grasping the necessary know-how from the loan experience.

The participant teams with a marine robot were:

- 1) AUV Team Tom Kyle; From the University of Applied Sciences of Kiel, Germany. Second place in SAUC-E'16 and euRathlon 2015.
- 2) ENSTA Bretagne Team; One of the 2 multi-domain teams coming from the Institute of ENSTA Bretagne, France. Regular participant and winner of SAUC-E'16.
- 3) ENSTA Team; A joint team from the Institute of ENSTA Bretagne and the Institute of ENSTA ParisTech. First time for the ParisTech Institute.
- 4) OUBOT; From Obuda University (Hungary), participating with the loaned SPARUS II UAV.
- 5) Robdos Team Underwater Robotics; Formed by a group of students from the University Polytechnic of Madrid (UPM) and the company Robdos SRL. Built their own vehicle after having a loaned SPARUS II in euRathlon 2015.
- 6) UNIFI Team; From the University of Florence (Italy). Regular participant in SAUC-E and euRathlon 2015.
- 7) Universitat de Girona; Formed by students and researchers of the Underwater Vision & Robotics Research Centre (CIRS). Winner team of euRathlon 2015.

The Winners

From the 7 multi-domain teams that participated in the Grand Challenge TBM, the multi-team (Fig. 5), composed of Team Telerob (Land), Universitat de Girona (Sea) and INESP/INESC TEC (Air), won over the second-placed Robdos-IMM Team (Land + Sea) + IIS Piombino CVP Team (Air) and the third-place Raptors, Poland (Land and Air + Oubot, Hungary (Sea).

The Land + Sea TBM was won by Telerob + Universitat de Girona and the Sea + Air was won by Universitat de Girona and INESP/INESC TEC.

For the SAUC-E competition, the best student team was AUV Team TomKyle. This team has been improving from year to year, starting with a Rookie Award in euRathlon 2014, second place both in euRathlon 2015 and SAUC-E'16, and now

winning SAUC-E'17. They also won the Mapping special award for their outstanding sonar map.

Sponsors and Exhibitors

As for the past two years, IEEE OES played a fundamental role as Platinum Sponsor, contributing to the competition awards. Texas Instruments and SBG Systems contributed as Silver sponsors on a smaller scale for the prizes. The University of Newcastle provided acoustic modems to track the underwater vehicles in real-time. This proved to be very useful, not only for judging but also in recovery situations, e.g. lost vehicle. At the same time, it provided an opportunity to teams to test new hardware and to the University of Newcastle to try out their prototype. This is part of the effort that CMRE has been doing through robotics competitions in getting companies and manufacturers closer to the student teams to increase their synergy. Finally, many local companies sponsored or supported the event in different ways.

Many (mainly marine) exhibitors took the opportunity to display their activities at stands at Tor del Sale, including:

- Biorobotics Institute, Scuola Superiore di Sant'Anna di Pisa, Italy
- NATO-STO Centre for Maritime Research and Experimentation (CMRE), Italy
- European Robotics League (ERL), Belgium
- IEEE OES
- H2O Robotics—UNIZG-FER spin off, Croatia
- Iqua Robotics, Spain
- Marine UAS, Norway
- National Institute of Standards and Technology (NIST), United States
- National Oceanography Centre (NOC), United Kingdom
- SBG Systems, France
- STRONGMAR EU Project, Portugal
- School of Robotics, Italia
- University of Newcastle/Blueprint Subsea, United Kingdom
- Worthington Sharpe, United Kingdom

ERL Emergency Robots 2017: More than a Competition—An International Robotics Event for the General Public

ERL Emergency Robots 2017 was not only a complex and challenging robotics competition, involving more than 120 young and creative researchers, but it was also an international robotics event for the technical and general public, creating outreach to increase awareness of the role and potential of robotics in our society.

Several satellite events were organised around the competition.

- A demo of the TRADR project (human-robot teams for robot assisted disaster response) was conducted by DFKI, University La Sapienza and Italian Firefighters in Piombino downtown on the 17th together with the opening ceremony and plenary talks of projects SHERPA, WALK-MAN and TRADR.
- A series of conferences on robotics were held at the Piombino Castle in the evenings of the 18th and 19th.
- Robotics workshops for children took place in Piombino downtown on the 17th and at Tor del Sale from 20th to 23rd



Figure 6. (Top) TRADR robot demo. (Bottom) Robotics workshops for children using LEGO WeDo. Photo credit: European Robotics League.

In total, around 1,500 people attended the public programme, including several large parties of school students who visited the competition, from elementary to high school groups. The robotics workshops for children provided by School of Robotics were part of an effort to involve the local community which included also local associations and other students participating as staff and one local high school team. Over 350 robotics experts were also present during the event, including participants, staff, judges and international guests, among them Kris Kydd, from TOTAL, the ARGO Challenge organiser. ERL Emergency Robots 2017 attracted also a great interest in national TV and local and national newspapers.

Dr. Bill Kirkwood, Treasurer of IEEE OES, was present and awarded the SAUC-E award together with Dr. Kelly Cooper from Office of Naval Research (ONR), Daryl Davidson and Hitesh Pavel from AUVSI Foundation. As in past years, ONR supported the competition by providing judges as well as SPAWAR. Dr. Bill Kirkwood presented also a plaque in appreciation for the



Figure 7. Dr. Bill Kirkwood (Treasurer IEEE OES) during the award ceremony in Piombino presenting the plaque to the local organising committee. Photo credit: Fotoclub Il Rivelino.

organisation of the competition to the local organising committee (Fig. 7).

We are extremely satisfied with the outcome of the ERL Emergency Robots 2017. It continued the success already reached by euRathlon 2015 and kept its status as a leading robotics competition in Europe, with IEEE OES as a core founding sponsor. ERL Emergency Robots 2017 was not only a great competition, but also a robotics event that produced significant exposure in the scientific community and in the general public. A significant effort was put in the public dissemination including YouTube live streaming of the Grand Challenge TBM and a live video feed shown in a maxi-screen with transmission of the competition, interviews to judges, teams, sponsors and exhibitors. The 9 days of the competition saw inter-domain cross-fertilisation with research groups expert in different domains working together to solve complex tasks that may not be solved only by using a single type of robot. This kind of collaboration between researchers from different domains is essential to start thinking about complex multi-robot systems capable of providing an effective answer to the search and rescue tasks raised by a disaster such as the Fukushima 2011 nuclear accident. This year this cooperation was improved as teams knew each other since 2015 and started preparing in advance their cooperation schemes, e.g. how to communicate, which kind of messages.

The public interest that the event raised has also helped to create robotics awareness, illustrating to people how sea, land and air robots can be of fundamental importance in responding to natural and man-made disasters. Finally, the interest demonstrated by young children shows how the upcoming generation is ready and keen on using and supporting novel technologies such as robotics.

We are very proud of these results made possible by the strong support of IEEE OES and other sponsors, together with all the teams, judges, exhibitors, visitors and indeed everyone involved, who made ERL Emergency Robots 2017 such as a successful event.

But what about the future? Future plans include more multi-domain competitions. For 2018, the plan is to again hold SAUC-E at the CMRE, continuing the tradition to keep a strong interest by the marine community in the competition.

We invite you all to participate in our next events! YouTube videos are available at:

<https://www.youtube.com/watch?v=GaUdmILrCig>

Member Highlights

Contact the Editors if you have Items of Interest for the Society

Somewhere in the Mont Blanc massif

Philippe Courmontagne

If we do some research about my last name, we can discover that a few centuries ago, it was spelt as Courtmontagne, with a « t » in the middle. Considering this point, and literally speaking, the translation of my last name could be Short (“court”) Mountain (“montagne”), or Ko Yama for my Japanese friends. Moreover, the place where I live in France, Provence, is the place where the Mediterranean Sea meets the cliffs. Taking these points into account, what’s more natural than for me finding mountain sports very attractive? I do not speak about snowball fights or sliding sports, such as alpine skiing, but about alpinism or mountain climbing.



Seems high, doesn't it?

I began climbing, when I was a long haired PhD student. First, alone without a rope (I know: when I was younger I had not only long hair but recklessness too), but after two falls, with more fear than damage, I realized that a rope was the thread of life. Thus, with a group of friends, I started practicing the real climbing. From the beginning of September to the end of June, each weekend, we were climbing cliffs from twenty meters high to one hundred meters. Sometimes, as shown in the photo, our equipment was really restricted, but sometimes too, we were climbing with a backpack full of rocks in order to develop our muscles.

Next, during summer, we were going to the Alpine chain, both in Italia and in France to practice alpinism. It was definitely not the same story. First concerning the equipment, it was no longer just a matter of shorts, t-shirts and climbing shoes, but crampons, ice axes, helmets, warm clothes, and high mountain boots in addition to climbing shoes, backpack with the necessary material to spend a night in the mountains, just in case. So with all that, our total weight went from 70–80 kg to 90–100 kg (hence, the training with a bag full of rocks).



Two of my friends (Laurent (left), Roland (right)) and me, during a break while ascending the Petite Aiguille Verte.



When I speak about equipment ...



Patrick and me waiting for our turn.



Not the time to fall!

The risk was also not the same. You have to take care when you walk on the ice . . . perhaps under your feet there is a crevasse. The weather is not your friend: icy wind, snow storms (yes, even in august!). Even the sun is a perverse friend. Because of its heating rays, the ice can melt causing stones to fall (remember: a helmet is stronger than your head), or weakening the ice under your feet. For this reason, during summer, alpinism is synonymous to “wake up early;” it is safer trying to reach the top of a mountain around 7–8 AM, than in the middle of the afternoon!

On the topic of risk, I would like to share two strong memories from my climbing trips. The first one was during the ascent of the *Aiguille Verte* (4,122 meters, which is a mountain in the *Mont Blanc* massif in the French Alps (this French name could be translated as “Green Needle”). We were a cord of four and the first one fell, dragging the second in his fall . . . more than 200 kg in free fall! I was the third, but fortunately my attachment point resisted. My second memory corresponds to a day when we were beginning the ascent of the *Mont Blanc*. Because of the weather conditions (a snow storm



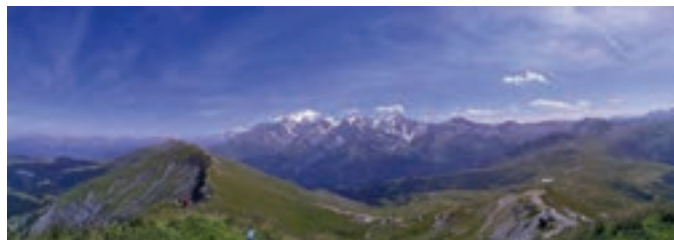
This is me while ascending the Aiguille Verte.



Alpine cough.



Comfort after the effort: see Christophe opening a bottle of red wine.



Striding edges between the Aiguille Croche and the Mont Joly.



The Aiguille du Midi.



Marine and the Aiguille Croche summit.



The Mont Blanc du Tacul (4,248 meters) just behind me.

making it impossible to see something, even only at a distance of two meters), we decided to stop this ascent. During the descent, we encountered a cord of two beginning the ascent. The next day, in the newspapers, we were able to read that only one of them had reached the refuge, the body of the second one was never found (two is definitely not a good number in mountain climbing!). Nevertheless, the practice of this sport offers a lot of marvelous things. How fantastic to observe a chamois or an ibex, or to contemplate the flight of an alpine chough (this bird, in the crow family, may nest at a higher altitude than any other bird).



Left: my daughter, right: my son.

How wonderful to admire the alpine chain while sitting on the top of a mountain that has just been climbed, drinking some *génépi* (a strong alpine alcohol ... comfort after the effort ... have I said recklessness before?).

Last summer, I came back to the French Alps with my girlfriend Marine. We practiced a lot of hikes. In particular, we realized the ascent of the *Aiguille Croche* (2,487 meters). From the summit, going along striding edges, where the steep slopes cause a sensation, we reached the *Mont Joly* (2,525 meters). From the summit of this mountain, the view over the *Mont Blanc* Massif was so amazing, that we decided to go on to the top of the *Mont Blanc*.

It was not really the top of the *Mont Blanc* but the *Aiguille du Midi* (that can be translated as Needle of the Mid-day). To



The *Mont Blanc* massif.

access the *Aiguille du Midi* (3,842 meters), we used a cable car directly from Chamonix (do not use it if you are subject to vertigo). The panorama on the *Mont Blanc* massif we had, arriving on the top of this mountain, was breath taking (literally and figuratively).

During these holidays, what I have found really amazing was that we can easily evaluate the climate change: no more *névé* (a young, granular type of snow, which has been partially melted, refrozen and compacted) except on the top of the higher mountains, no more snow storm, a strong retreat of the *Mer de Glace*, a valley glacier located on the northern slopes of the *Mont Blanc* massif (the snout of this glacier loses 4 to 5 meters each year).

Last summer, I did not use climbing shoes ... perhaps too old for that now ... I do not know. But I am happy, because I know that the next generation is here, when I look at my children (my son Elouen, 12 years old, and my daughter Eva, 8 years old) practicing climbing.

Having read this article, you may be wondering: “why is this guy working on marine systems?”. The answer is quite simple. For me, oceans and mountains are quite the same. When you reach your goal, it is not because you dominate nature, but simply because nature lets you go where you want to go. We have to be respectful of nature and try to preserve it for our children.

Who's who in the OES and what do they do...outside OES?

Blair Thornton, Beacon Associate Editor

Blair Thornton is an Associate Professor at the University of Southampton in the UK, with an adjunct position at the University of Tokyo in Japan. With over 15 years of international research experience in the field of marine autonomy and sensing, Blair has participated in more than 40 scientific research expeditions (26 of which as chief scientist) and has spent over 350 days at sea.

Blair was born and raised in London, UK. He studied Naval Architecture at the University of Southampton, UK and was awarded a Ph.D. in underwater robotics in 2006. As part of his Ph.D. training, he spent 2 years at the URA laboratory, Institute of Industrial Science (IIS) of the University of Tokyo funded by the Japanese government (MEXT). After completing his Ph.D., Blair spent a further 2 years at the IIS as a JSPS Postdoctoral Fellow before being appointed Assistant Profes-



sor in 2009, and Associate Professor in 2012. Blair adopted his current position in 2016 where he splits his time between the UK and Japan and accumulates a large number of air miles. Blair has been a member of IEEE since 2006, and is an Associate Editor for the IEEE Journal of Oceanic Engineering.

Blair's research has focused on the development of optical sensors to perform both visual and in situ chemical observations of benthic environments and figuring out how to integrate these sensors on underwater platforms to make useful measurements over large scales. In his spare time, Blair enjoys spending time with his wife and 3 young children. When they do not

want to spend time with him, Blair enjoys going to the gym, reading books that are non-fictional, watching films that are fictional, looking at things using either a telescopes or a microscope (depending on which is more appropriate) and trying very hard to commit interesting facts to memory.

Blair (far right) with a team of Japanese engineers (>50% members of IEEE/OES) during a recent deployment of the AUV TUNA-SAND. Having been involved in over a hundred AUV deployments, Blair is convinced that the use of duct tape, tie wraps and rubber bands is an unavoidable part of AUV research.

OES Thanks Outgoing AdCom and ExCom Members

Each year at the North American OCEANS conference, this year it was OCEANS '17 Anchorage, the OES thanks the outgoing members of the Administrative and Executive Committees for their time and support as volunteers. This year we thanked the following for their service to the society:

Administrative Committee:

- Barbara Fletcher
- Stephen Wood
- Stephen Holt
- Ferial El-Hawary
- Robert Bannon

Executive Committee:

- Rene Garelo—President, 2013–2016
- Robert Wernli—VP for Professional Activities, 2014–2017
- Bill Kirkwood—Treasurer, 2014–2017
- Albert (Sandy) Williams III, VP for Conference Development, 2014–2017



Chris de Moustier presents plaques to Barbara Fletcher, Stephen Wood and Stephen Holt.



Chris de Moustier presents plaques to Rene Garelo, Bob Wernli and Bill Kirkwood.

Welcome New and Reinstated Members

Australia

Hung D Nguyen

Robert Mackenzie

Murilo Teixeira Silva

Di Lu

Chengke Xiong

Jialei Zhang

Jeremy Jaime Ger

Lady Nicole Macas

Grace Maria Mena

Jacqueline Rivas Oviedo

Daniela Alexandra Ramirez

Brazil

Marco Reis

Chile

Marygrace Balinos

Ecuador

Karen Elizabeth Aguirre

Luis Altamirano

Ricardo Vera Del Castillo

Maria Esther Espinoza

Germany

Susan Matinfar

Canada

Andrew Dobbin

Christopher Olayinka Ilori

China

Peng Chen

Chao He

Iceland
Torfi Thorhallsson

India
Panneer Selvam
Rajamanickam
Sannasiraj
Sannasiannamalaisamy
Sriram V

Ireland
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Italy
Nicola Secciani

Japan
Marie Angelyn Tolentino
Mercado

Kei Okamura
Tian Song

Mexico
Ernesto Olguin Diaz

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OCEANS '17 Anchorage, Alaska

Mboza Lukindo, 2017 IEEE Women in Engineering and Ocean Engineering Society Travel Grant Award Winner, Dalhousie University

Anchorage is a small city, which makes it ideal for such an event as the whole place was buzzing from it. It was really easy to navigate around and the locals were all very friendly and helpful when it came to finding your way around or recommending activities for tourists. The Dena'ina Convention Centre, where the conference was held, was in downtown. It was close to several nice hotels—just a 7-minute walk from where I was staying. I was also fortunate to have time to visit the Anchorage museum after the conference, where they had amazing artifacts from the Alaska Native people who once inhabited all of Alaska.

The OCEANS Conference is known to be the biggest meeting for stakeholders in underwater and oceanic research. Companies from around the globe came to exhibit their products and the theme, “Our Harsh and Fragile Ocean,” or “How to protect the Fragile from the Harsh with application of modern technology and traditional knowledge working together” was reflected throughout the conference. The plenary speakers, distinguished professionals in their field, gave us little nuggets of their wisdom during their speeches. I signed up for two workshops, and it didn't hurt that they also earned me some IEEE professional continuing learning credit. They were both organized by NOAA, the National Oceanic and Atmospheric Administration. They gave a digital showcase of everything they had in terms of software, data and apps. They had all kinds of maps for different applications, from fishing trips to scientific sea trials. They also had digital map platforms that you



Mboza Lukindo.



Food for Cocktail Reception (Ice Breaker).

could customize to only show the information you needed. It was amazing to see how much information had been gathered and how much was yet to be explored in Alaska. The limitations of timing, money and the seasonal accessibility to most of rural Alaska was made vivid by the missing areas on the maps that are yet to be documented.

The student poster competition was engaging, with students from different universities around the globe. Subjects ranged from AUVs to sonar communication. These were of interest for me, having done research projects in the field of underwater communications. It was great to see their range of great ideas, similar to what I have been exposed to. Different professionals I had spoken to over the course of the exhibit hall and the lunch breaks also made me interested in attending other technical sessions. The work presented in the papers was not just interesting, but was also increasingly relevant to the ongoing challenges faced by coastal cities around the world. One of the papers presented a hydrodynamic model that showed how infrastructure was affected by hurricane impacts on the U.S. coast, something that would be useful for recovery workers in the case of hurricane Irma, which was causing devastation at the time. With data from NOAA provided from their emergency response time imagery, the government could use this to recover sooner from the impact of a hurricane, and possibly reduce the damage that the city would have to go through.

The food was of course delicious, from the cocktail to the banquet, with Alaskan delicacies like fresh salmon served. The banquet was held at the beautiful Anchorage Heritage Centre, where we were able to walk around the heritage site and were welcome to some lively acrobatics for entertainment as the evening progressed. It was really interesting to find out the diverse culture of different clans of the Alaska Natives and how



Brandy Armstrong and Mboza Lukindo (L to R).

important their family ties meant to them, even after the times have changed, including their lifestyle.

I had the opportunity to network with many professionals during the cocktail and the lunch with the exhibitors. Most of them have had years of experience in ocean science and engineering. It was rewarding to be able to hear how they went through school pursuing their subject of research, leading into fascinating projects like working with munitions and seeing how they sometime bury themselves under the sand at the innocent looking beaches. I was privileged to see some work in research labs providing support to federal agencies, and I even got to meet the founders of interesting start up companies focused on underwater technologies. This was an eye opener to the size of the industry and the revenue generated from the ocean. It was also amazing to find out all the different technologies that were being tested and published each day, all suitably tailored to a different ocean demand. I even got into a conversation of a potential co-op offer with a major Canadian research group, that is a leader in ocean monitoring and research. It gave me the desire to one day join grad school and go into underwater research on a larger scale and hopefully come up with something that would help us tame our harsh, yet fragile, ocean.

I would like to acknowledge Brandy Armstrong, the liaison for WIE to OES, and Bob Wernli from OES, who I had the opportunity to meet while I was there. Special thanks go to them and the WIE and OES from IEEE for making my trip to Alaska possible. I would most certainly love the chance to attend another OCEANS Conference and see what is new and exciting in the ocean community. I am also grateful to all my professors at Dalhousie University for being so accommodating while I was away. This exposure motivates and inspires me to work to see the realization of the knowledge I learn in class, which is the basis for most of the great ideas that are serving our oceans.

AUV “Minty Roll” and results of “Underwater Robot Convention 2017 in JAMSTEC”

Hiroumi Horimoto, Takayuki Nishimura (master course students of U-Tokyo), Takumi Matsuda (OES Beacon Associate Editor)

Minty Roll is an AUV (c.f. Fig. 1) which has been developed by the students in the Maki laboratory at the Institute of Industrial Science, at the University of Tokyo. Last year the students of the laboratory competed with the Minty Roll in the “Underwater Robot Convention 2016” at JAMSTEC (Japan Agency for Marine-Earth Science and Technology). Difficulties with hardware resulted in the team being unable to win the competition. In order to be competitive in this year’s competition, it was essential for the new student competitors to make changes and improvements to the systems of the AUV. This article describes the improvements made to Minty Roll and the results from this year’s AUV convention.

The Underwater Robot Convention is held annually at JAMSTEC. Students use their AUVs to compete in several timed tasks. In addition to the competition, a primary objective is for the students to become more motivated to pursue STEM (science, technology, engineering and mathematics) skills and to experience the fulfillment of creating and operating an AUV. Working with other students in the competition also teaches interpersonal relationship skills. There are two teams competing against one another. They must complete the following 5 tasks on the competition field as shown in Figure 2:

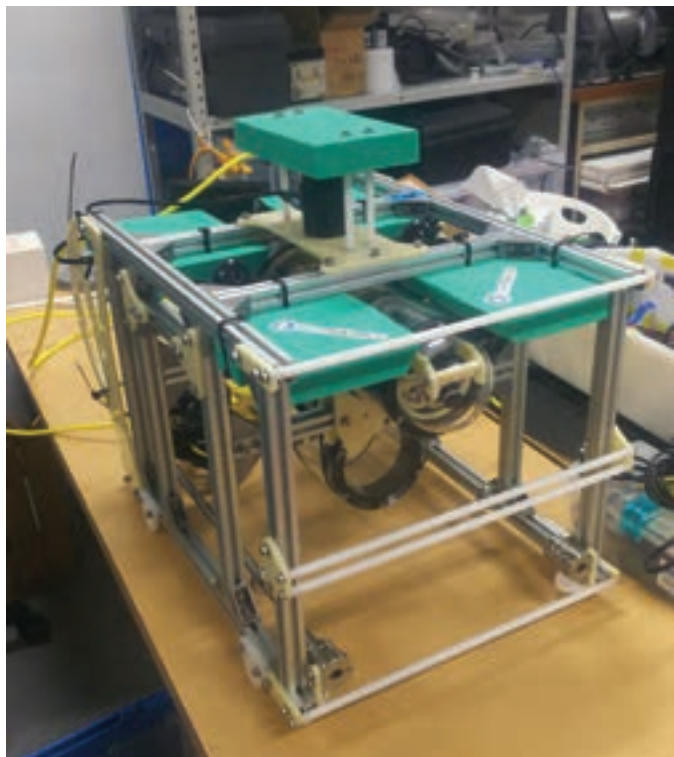


Figure 1. AUV “Minty Roll”.

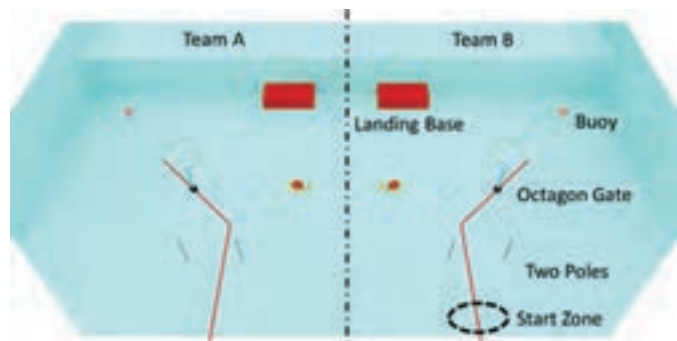


Figure 2. Overview of the competition field (Source: Underwater Robot Convention 2017 Official Guidebook, partially edited).

- 1) Pass between two poles
- 2) Pass through an octagon gate
- 3) Touch a buoy
- 4) Land on a base
- 5) Launch a child machine

For the 2017 competition, we used the improved “Minty Roll”. Minty Roll is a hovering-type AUV which has a main hull, a battery hull, 4 thrusters, a scanning sonar, a front camera, a depth sensor, and an Inertial Measurement Unit (IMU) sensor. After the last year’s competition, we made the three major improvements in Minty Roll indicated below.

- 1) Upgraded circuits and computer
- 2) Added particle filter localization using the scanning sonar, a dynamics model, and the IMU
- 3) Configured a buoy touching algorithm using the front camera

Initially we renewed all circuits and computer in order to improve reliability, and to make enough space to easily maintain the system. Last year, we used Raspberry Pi 2 for the AUV computer and two Arduino Megs for the I/O controllers, resulting in a highly restricted maintenance space. This year, we replaced the components with an Intel Compute Stick for the AUV computer and two Teensy 3.2 for the I/O controllers. These changes resulted in providing the needed additional space in the main hull. Secondly, in order to move freely and achieve the requisite mobility for the landing/passing gate task, we developed the particle filter localization algorithm using data from the scanning sonar, the dynamics model and the IMU. This technique revealed that the particle filter localization using the above system does not have enough accuracy to touch the buoy. This problem was resolved by using the buoy touching algorithm in addition to images obtained from the front camera. The second and the third points are explained below in detail.

Vehicle specifications are shown in Table 1.

To develop and implement our algorithm, we used the ROS (Robot Operating System) for Minty Roll and the Gazebo simulator.

Table I. Specifications of Minty Roll.	
Vehicle	
Size	67cm (L) × 40cm (W) × 46cm (H)
Mass	14 kg
Actuators	100W Thrusters × 4
Power	Li-Ion 11.1V 8000mAh × 1
Communication	Wireless LAN (in air) or Wired LAN (Tether cable)
PC	Intel® Compute Stick STK1AW32SC
OS	Ubuntu 16.04 LTS
Manual controller	DUALSHOCK 4
Sensors	
Depth	Blue Robotics MS5837-30BA
IMU	InvenSense MPU-9250
Camera	MicroVision MCM-4350FISH
Wall detection	Tritech Micron

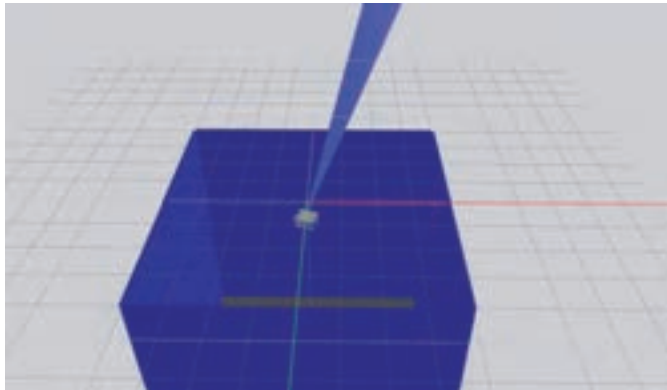


Figure 3. AUV simulation in the test pool using Gazebo.

Thanks to this, we could easily share the software with other robots which are operated by the same ROS. In addition, test data were easily recorded as rosbag and debugging became efficient with visualizer rviz. The Gazebo simulator also made our development efficient because simple software mistakes could be fixed before testing with the actual robot. The simulation image and the ROS node structures are shown in Figs. 3 and 4.

To move around the pool freely, we used a particle filter algorithm for the robot localization. The particle filter algorithm expresses the state by a set of particles. Particles are estimated through the prediction and observation phases. In the prediction phase, at first, the velocity of the robot is estimated by the dynamics model and the thruster force calculated by the PWM (Pulse Width Modulation) from the ESC (Electronic Speed Controller). Next, each particle is estimated by the orientation from the IMU and the estimated velocity. In the observation phase, we calculate each particle's likelihood with the map obtained by using the data from the scanning sonar and pre-given map data. After that, we resample the particles according to the likelihood and estimate the robot position as a mean of particles.

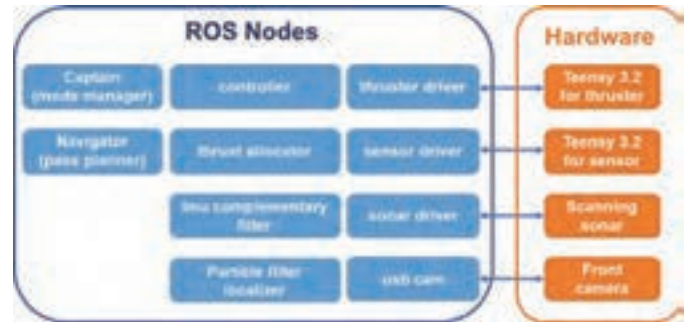


Figure 4. ROS Node structure of Minty Roll.

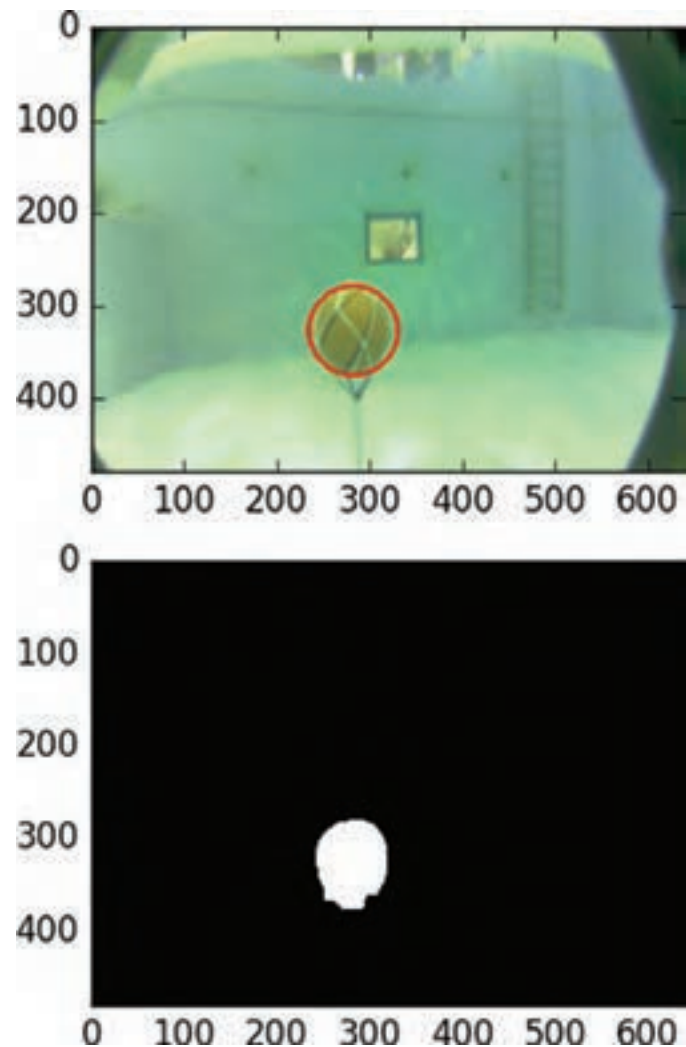


Figure 5. (UPPER) Buoy image from the front camera and the detected buoy position (red circle)
(LOWER) Binarized image after noise reduction.

In order to achieve the “buoy touching” task, we implemented the buoy detection and tracking algorithms as shown in Fig. 5. We used OpenCV library to process the images. The image acquired from the front camera is binarized by HSV thresholding. As the wall of the pool was blue and the buoy was orange, it was possible to binarize by using the H parameter. Secondly, noise is reduced by contraction and expansion. Next, contours are found, and each contour's circularity is calculated.

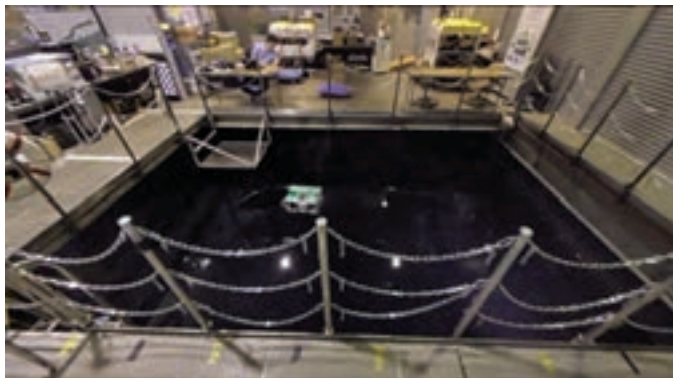


Figure 6. Robot testing at the test pool in the University of Tokyo.



Figure 7. Tethered Minty Roll testing at JAMSTEC pool (day 1).

Finally, the biggest contour which has the larger circularity than the threshold is determined to be a buoy. The AUV controls its center to that of the detected buoy and moves forward by PID control.

Preparation for the competition started in May with two Master's students: Hiroumi Horimoto, and Takayuki Nishimura. The first task priority was for circuits and computer to be upgraded and operationally checked. In June and early July, most software was developed and tested in simulation. Matthew Parent, a student intern from MIT (Massachusetts Institute of Technology), also joined the team in July. This increased the number of team members to three. During the latter half of July, we also tested the AUV in the test pool shown in Fig. 6. In early August there was no work able to be done due to summer vacation. In the middle of August, we repeated robot tank testing and prepared spare parts.

The competition "Underwater Robot Convention 2017 in JAMSTEC" was held on August 25 to 27. August 25 and 26 were the days for preparation and testing. Competition matches were conducted on August 27.

On the first day, we assembled the AUV with the Ethernet cable and collected sonar and camera data of the pool by controlling the AUV manually. Thanks to this, we could select optimal parameters for buoy detection and particle filter localization. Additionally, the positions of the objects in the pool (the buoy, the gate, and the landing base) were able to be measured



Figure 8. Untethered Minty Roll testing at JAMSTEC pool (day 2).



Figure 9. The starting scene of the competition (day 3). Matthew Parent, Hiroumi Horimoto, Takayuki Nishimura (From Front to back).

relative to the poolside. On the second day, after purging the Ethernet cable, we set the parameters which were decided from the test on the first day and attempted to conduct a series of tasks several times. While repeating, the parameters were refined.

On the last day, the final competition was held with 6 teams competing in the tournament. Our team won three competitions and were awarded the championship for the competition. Throughout the day, all 5 tasks were completed by the re-designed and upgraded Minty Roll.

As a result of the competition and our extensive preparation, we became increasingly adept in AUV technology, and much more aware of the difficulties encountered in operating an AUV. The improvements to Minty Roll lead us to win the championship, but we think that the biggest factors resulting in our win were the earlier preparations for the competition, and a lot of testing. Finally, we greatly appreciate all the members of the Maki laboratory who helped us in developing Minty Roll.

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The Student Chapter—Shanghai Jiao Tong University

Zheng Zeng, Oceanic Engineering Society Shanghai Chapter Secretary

A New Multi-modal Underwater Vehicle from Shanghai Jiao Tong University

The chapter has been working on a novel multi-modal underwater vehicle with fast dynamic positioning, sustainable ocean energy supply, self-adaption regional high-resolution 3D profiling technologies under supervision of Prof. Lian Lian (Chair of OES Shanghai Chapter) in the past few months. The new vehicle integrates a variety of sensors, including physical, acoustical and biogeochemical sensors and it can reach depths to 4000m with high spatial coverage of global oceans. The development of this novel multi-modal underwater vehicle provides a unique opportunity for our research in the deep ocean to achieve a great leap-forward in development and support to prevent and reduce natural disasters, utilize marine resource and safeguard maritime operations. The multi-modal underwater vehicle is about 3 meters long, the outer diameter is 0.296 meter, and in weights 196 kilograms in air.

Tank Experiment and Field Trial of the New Multi-Modal Underwater Vehicle

A tank experiment of the multi-modal underwater vehicle was held between 29th June and 9th July at State Key Laboratory of Ocean Engineering in Xuhui District, Shanghai. The purpose of the tank experiment was to adjust the vehicle to upright status, and to examine the gas tightness and buoyancy adjusting mechanism of the vehicle. During the test, IEEE OES student team members assembled buoyancy material on the vehicle to provide extra buoyancy. In addition, the mode switch between glider mode and Argo mode was successfully tested.



IEEE OES student team members assembling the multi-modal underwater vehicle.



IEEE OES student team members and the multi-modal underwater vehicle in the tank.



The novel multi-modal underwater vehicle launching from shore.

Field trials of this new multi-modal underwater vehicle was held at the Qiandao Lake between 18th of August and 2nd of September. During the 16 day experiment, the vehicle completed several tests, including depth and motion control, buoyancy adjustment, emergency jettison system, positioning, communication and data transmission, which provided reliable data support to further improve the new multi-modal underwater robotic platform.

As a long-term plan, the SJTU OES student team members with marine scientists plan to test the multi-modal underwater vehicle in the South China Sea next year. The new vehicle will provide multidisciplinary, long-term and high spatial-temporal resolution observations for the deep ocean.

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