OES BEACON

Newsletter of the Oceanic Engineering Society

DECEMBER 2014, Volume 3, Number 3 www.ieeeoes.org (USPS 025-095) ISSN 2164-8042

PHOTOS BY STAN CHAMBERLAIN

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

Table of Contents

From the President

Greetings to you all for this winter time holiday season.

I'm presenting these greetings to you for the third time. Indeed, as the majority of you may know, I have been reelected for a second two-year term. And one of the promises I can make for 2015 and the following years, is that we will greatly improve our communication to you. We will soon have all of our news accessible through a smartphone application with hopefully almost instant information.

This 2014 year has again been very busy for OES. We have had our usual two very successful OCEANS conferences in Taipei, Taiwan (Spring) and St John's, Canada (Fall) with a strong attendance. We again participated at two OTC (in Kuala-Lumpur, Malaysia and in Houston, TX) running technical sessions and displaying a booth and finally we had several successful workshops all over the world: Baltic Symposium in Tallin, Estonia, Underwater Communications in Sestri Levante, Italy, Techno-Ocean in Kobe, Japan, Sensor Systems for a Changing Ocean in Brest, France, AUV in Oxford, Mississippi.

And we are still supporting the student community through our "Student poster Competition" held at the OCEANS conferences, our scholarship program and our grants to student activities (NOSB, MATE, ISR, …). We are also supporting the WIE (Women in Engineering) activities through a grant and with students participating to our OCEANS conference.

Finally, this year we had our IEEE Journal in June and our Society Review in November. This review happens every 5 year for each Society. Since 2009, the Journal of Oceanic Engineering has shown lots of improvement, especially in the timeliness. At the time of this writing we haven't had the comments on our Society Review, but we are very optimistic.

In 2015, we will have some new officers for supervising all the upcoming activities: Diane Di Massa, elected Vice-President for Conference Operations and Marinna Martini, elected Secretary. Thank you again for the outgoing ones: Todd Morrison and Christian de Moustier.

Again, I wish you the best for this new year.

René Garello,
OES President

Welcome New and Reinstated Members

David Aadeniran	Nigeria
Moustafa A. Abdelael	Egypt
Mohamed H. Abdelrazek	Egypt
Abdel Rahman S. Abovelfath	Egypt
Mohamed M. Abu-El-Maaty	Egypt
Joyce Adri	Israel
Himasnhu Agrawal	India
Nourhan H. Ali	Egypt
Ibrahim Arafa	Egypt
Umapathy Arunachalam	India
Ahmed K. Ayyad	Egypt
Xiaoshan Bai	China
Raul Bardaji	Spain
Christopher M. Barron	Netherlands
Jennifer M. Bell	USA
Vittorio Bichucher	USA
Mark Bushnell	USA
Faye M. Campbell	United Kingdom
Yosser A. Chahadeh	USA
Paul E. Chandler	USA
Anna T. Chang	USA
Lillian Chen	USA
Chin-Yin Chen	Taiwan
Yanglong Chen	China
Clayton R. Chinn	USA
Jae-Weon Choi	Korea (South)
Robert L. Cody	USA
Christos Constantinou	Cyprus
Nolan R. Conway	USA
Pascal A. Craw	Australia
Andrew D. D'Amore`	USA
Anthony L. Davis	USA
Emrecan Demirors	USA
Tai Ding	Australia
Wolfram Donat	USA
Yifan Dong	China
Glenn Donovan	USA
Barry J. Doust	USA
Ruj Duan	China
Gregory R. Duncan	USA
Jeff Dusek	USA
Mohamed M. El-Kasaby	Egypt
Khaled M. Elmekawy	Egypt
Mohamed F. Elsayed	Egypt
Amy M. Elsekilly	Egypt
Hani Elshahawi	USA
Robert Engel	Germany
Brendan Englot	USA
Eferoghene Erhuen	United Kingdom
Daniel J. Ernstmann	USA
Milad Fatehnia	USA
Theodor G. Fernau	USA
Kathleen Fontaine	USA
Georges Fournier	Canada
Liu Fuqiang	China
Seif E. Gad	Egypt
Peng Gao	China
Samuel Garcia	USA
Izaskun Garrido	Spain
Aitor J. Garrido	Spain
Richard T. Gieske	USA
Scott M. Glenn	USA
Simone Grechi	Italy
Camilamaria G. Gussen	Brazil
Mostafa H. Hafez	Egypt
Jun Han	China
James L. Hanlon	Canada
John W. Hansen	Canada
William R. Harris	USA
Vahid Hassani	Norway
Yijun He	China
David J. Hetherington	USA
Thomas T. Hoover	USA
Timothy L. Howard	USA
Sheng-Wei Huang	Taiwan
Benjamin Humas	USA
Remy C. Izendooren	Singapore
Elijah S. Jacobs	USA
Anuj Jain	India
Jeremy E. Johnson	USA
Stephen Jones	USA
Saraswathi Karanam	India
Lin S. Kayser	Germany
Dave Keil	USA
Cindy L. Kettler	USA
Amr A. Khalil	Egypt
Nakwan Kim	Korea (South)
Minsung Kim	Korea (South)
Danielle S. Kolber	USA
Danielle S. Kolber	USA
Liu Kun	China
David J. Le	USA
Chong Lee	Korea (South)
Mats A. Leijon	Sweden
Ran Liao	China
Cheah Siang Lim	Singapore
Jacob E. Littley	USA
Hongda Liu	China
Shugen Ma	Japan
Khaled S. Maamoun	Egypt
Richard M. Mack	USA
Aaron M. Macneill	Canada
Subhendu Maity	India
Vladimir Maksimov	USA
Ramaiya Manoranjan	Sri Lanka
Yilun Mao	USA
Kevin Martin	USA
Paula I. Martinez	USA
Jason A. Mathews	India
Michael S. Matsko	USA

Douglas Mcclintick	United Kingdom
Jonathan Mccolgan	United Kingdom
Thomas Meurling	USA
Ahmed F. Mohamed Zki	Egypt
Kazuyoshi Mori	Japan
Ashley J. Morton	Canada
Allen L. Moser	USA
Amr A. Moussa	Egypt
Ling-Jr Mu	Taiwan
Darayus H. Nanavati	Australia
Premrudee Noonsang	Thailand
Tony Nordstrom	Canada
Thomas C. O'Reilly	USA
Aaron Ofapohunda	Nigeria
Jonathan I. Ogbekhilu	Nigeria
Clay Oliver	USA
Graham S. Oren	USA
Achyuth K. P	India
Sanaz Paran	USA
Priyansh V. Patel	USA
Antonio Penalver	Spain
Marta Ramirez Perez	Spain
Javier Perez	Spain
Omar M. Ramos	USA
Richard B. Ravenell	USA
Ivan M. Rusinyol	Spain
Moataz T. Sadek	Egypt
Yosuke Saito	Japan
Masahiro Saito	Japan
Mohd S. Samsudin	Malaysia
William C. Sandberg	USA
Ravishankar Sankaranarayanan	India
Lori A. Schendera	USA
Jill Schoof	USA
Robert L. Schwebel	USA
John Scully	United Kingdom
Lim Sehan	Korea (South)
Ersin Selvi	USA
Liu Shaojun	China
Ahmed S. Sherif	Egypt
Amani Shokry	USA
Raj K. Shori	USA
Evan J. Snapp	USA
Ossama F. Soliman	Egypt
Hong Song	China
Pittawat Sricharurn	USA
Sabah Takbani	USA
Neal Taylor	USA
Minh Q. Tu	USA
Jacie Unpingco	USA
Haico Van Roeden	Netherlands
Bala Naga Jyothi Vandavasi	India
Abdal Majeed B. Waleed Shublaq	Saudi Arabia
Andrew C. Walsh	Canada
Honglei Wang	China
Bo Wang	China
Bo Wang	China
Jintao Wang	China
Sarah Webster	USA
Donald R. Wells	USA
Worathan J. Wichakoon	Thailand
Karl R. Wick	USA
Hans P. Widmer	USA
Emma E. Williams	Canada
Michael Wiseman	United Kingdom
Brooks B. Wood	USA
Yaozhen Wu	China
Peng Xiao	China
Yiing-Jang Yang	Taiwan
Gerald Yuan	China
Omar A. Zahra	Egypt
Zulkifli B. Zainalabidin	Malaysia
Evin Y. Zhao	USA
Xingra M. Zheng	USA
Rachel S. Zoll	USA
Lei Zuo	China

OCEANS'15 MTS/IEEE Genova: You are Invited!

Prof. Andrea Caiti, General Chair; Prof. Andrea Trucco, General Co-Chair

Don't miss the chance to take part in the OCEANS'15 MTS/IEEE Genova conference and exhibit, a unique opportunity to showcase your latest research results, products and prototypes, and to establish relations and promote networking with fellow researchers in the oceanic engineering and marine technology field.

On behalf of the Local Organizing Committee, we are pleased to welcome you to the MTS/IEEE OCEANS event that will be held in the historic harbor of the town of Genova, Italy, on May 18–21 2015.

Genova, *La Superba,* situated in the middle of the Italian Riviera, has a long history of marine and maritime activities, dating back from the medieval times, when, as one of the Maritime Republics, had commercial and military fleets dominating the whole Mediterranean Sea. Christopher Columbus, born in Genova, was the first great sailor of the age of discoveries, opening up the route to the New World.

In late 19th and early 20th century, the region's economic growth was remarkable: steel mills and shipyards flourished along the coast from Imperia to La Spezia, while the port of Genoa became the main commercial hub of industrializing Northern Italy.

Rich from his glorious past (Genova has the widest medieval historic center throughout Europe, and his Palaces

Discovering Sustainable Ocean Energy for a New World.

Vernazza, 4th town of the famous Cinque Terre.

Camogli fishing village inthe province of Genova on the Italian Riviera.

are part of the UNESCO World Heritage), the town is the capital Liguria region, world-wide renown for her beauties that include *Portofino* and the *Cinque Terre*. The Liguria region hosts many of the most relevant high-tech activities in Italy, electrical engineering and electronics, petrochemicals, aerospace, marine and maritime industries, important commercial harbors like Imperia, Savona, Genova and La Spezia, civilian and military shipyards, joint industry-research technological Clusters (DLTM "Liguria Cluster on Marine Technologies", and SIIT "Cluster on Integrated Intelligent Systems and Technologies"), the Italian Navy Hydrographic Institute, international research centers (CMRE), the University of Genoa, and many national research labs (CNR, ENEA, INGV, IIT).

Jointly sponsored by MTS and IEEE Oceanic Engineering Society, the OCEANS conference and exhibit is the major international forum gathering together scientists, engineers, responsible ocean users and decision makers to present their cutting-edge research results, ideas, and applications in Oceanic Engineering and Marine Technology. The exchange of knowledge and the opportunities offered to new fruitful collaborations are crucial to the development of innovative technologies to meet the Blue Growth Challenge: harness the huge potential of the world-wide oceans for jobs and growth in a sustainable, environmentally conscious, and responsible way.

Conference Topics:

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

The event website, oceans15mtsieeegenova.org, describes the rich program of this event: stimulating plenary and technical sessions, timely tutorials, exhibit opportunities, a poster competition for students, an exciting social program and attractive post-conference visits. A New Age of Discovery is starting to bring the potential of sea resources to the benefit of the future generations—come to Genova, and offer your contribution!

Chapter News

Providence, Rhode Island—New Chapter

Sandy Williams, OES VP, Conference Development, Photos by Stan Chamberlain

On June 20, 2014, Dr. Atmanand, Director of NIOT (National Institute of Ocean Technology) in Chennai, India presented a seminar to Woods Hole Oceanographic Institution on Ocean Technology in India.His visit coincided with the "Our Oceans" conference at the U.S. Department of State. In addition to an excellent presentation of the work being done at NIOT in the Bay of Bengal, the Arabian Sea, and the Indian Ocean, Dr. Atmanand announced the UT15 International Symposium on Underwater Technology 2015 to be held in Chennai on February 23–25, 2015.IEEE/OES Japan Chapter, NIOT, and IEEE/Oceanic Engineering Society will sponsor this symposium. Dr. Atmanand's presentation also marked the first meeting of what will soon become the OES Providence Chapter (about one third of OES members in the Providence Section are on Cape Cod so it might become the Cape Cod Sub-Chapter if additional members join from Providence and Newport Rhode Island).

Dr. Atmanand addresses the newly forming Providence chapter at Woods Hole Oceanographic Institution (WHOI).

Todd Morrison, Dr. M.A. Atmanand, Sandy Williams.

San Diego Chapter

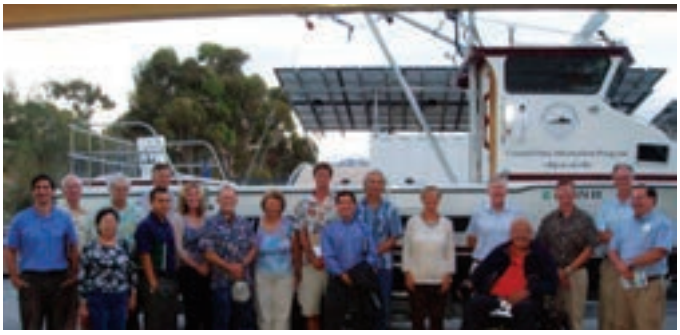
Kevin J. Delaney

On June 23, 2014 Dr. M. A. Atmanand, director of India's National Institute of Ocean Technology, briefed the San Diego OES Chapter about development of deep-sea technology in India. Hosted by the Scripps Institution of Oceanography, the lecture covered the mission of the NIOT, its research fleet and specific technologies such as deep-sea crawlers and sampling systems. In addition, Dr. Atmanand gave a preview of the Underwater Technology 2015 conference, to be hosted by NIOT in Chennai, India.

Dr. Atmanand addresses the San Diego chapter [Photo by Dr. Reza Jafarkhani].

On September 3, 2014 the San Diego Chapter enjoyed a fascinating presentation and tour regarding the Southern California Coastal Ocean Observing System (SCCOOS) and the Coastal Data Information Program (CDIP) at the Scripps Institution of Oceanography. Julie Thomas, director of SCCOOS, explained the mission of the two programs and the instrumentation they provide for continuous coastal oceanographic observations. As an example, the exact wave height forecasts provided by CDIP are of critical importance to the safe operation of large cargo vessels in Southern California ports. The presentation was followed by a tour of the CDIP buoy maintenance and test facilities, which featured a continuous real-time display of buoy data from across North America.

SCCOOS Director Julie Thomas describes the use of small wave buoys used by US Navy oceanographers. [Photo by Kevin J. Delaney].



San Diego OES chapter members and guests pose near a wave buoy deployment boat used by the Coastal Data Information Program. [Photo by Kevin J. Delaney].

Julie Thomas explains the refurbishment and deployment of large wave buoys for CDIP. [Photo by Kevin J. Delaney].

Canadian Atlantic Chapter

Joshua Fritz

On July 17th 2014 Dalhousie University's department of electrical and computer engineering hosted the 23rd annual robot competition. This competition occurs annually as part of the third year electrical engineering curriculum. Students are tasked with designing and building an autonomous vehicle. The competition this year was pirate-themed. The robots had to navigate 'the ocean' with the goal of finding buried treasure. For this competition the vehicles were simplified as being a differential drive robot with a third castor wheel. The following are the necessary components in designing an autonomous vehicle:

- A circuit to drive the two motorized wheels of the robot
- Sensory input
- An algorithm to use the sensory input and control the motion of the robot

There are various mediums of sensory input located along the obstacle course. Detecting light, detecting strips of metal, detecting walls, or determining the angular velocity of each wheel are examples of potential sensory input that can be obtained from either the obstacle course or the robot itself.

The performance of the robots was determined on a point system. This point system accounted for how far the robot had travelled from the starting point and how many objectives had been met.

65 electrical engineering students competed in the project this year and IEEE Canadian Atlantic Students Branch and IEEE OES Chapter sponsored the event.

Visit http://www.dal.ca/news/2014/07/31/robot-ships-of-plunder.html for additional details of this event.

The students gave the robots names like Jolly Rogers, Pirates of the Caribbean, Pegasus and The Punisher.

In teams of two, the students each designed a pirate robot that had to navigate the course under its own power. The goal: to reach the end of the maze and collect the treasure.

Victoria Chapter

Nick Hall-Patch

Dr. Donald G. Dansereau gave a talk at University of Victoria "Underwater Imaging with Light Field Cameras" to an audience of about 20 people on 6 August 2014. It was co-sponsored by the university's Department of Computer and Electrical Engineering, and the OES Victoria Chapter.

It is well known that the underwater environment features some of the greatest challenges to visual processing: low light, turbid water, caustics, and light shafts all decrease visual fidelity while frequency-dependent attenuation makes accurate color reproduction difficult.

This talk investigated the application of light field cameras, also known as plenoptic cameras, in dealing with the challenges of underwater photography. Such cameras have gone through a great deal of development in the last decade, with companies such as Lytro and Raytrix now selling them at relatively inexpensive prices.

Dr. Dansereau starting his talk at University of Victoria.

These cameras gather large amounts of light with an extended depth of field, allowing the user to focus on different portions of a saved image. As Dr. Dansereau put it, they are an array of cameras, a window on the world, rather than through a peephole.

He presented methods for exploiting the capabilities of the cameras, describing a class of filters which exploit the redundancy in the light field camera's saved data, allowing mitigation of the effects of turbid water and low light and removing dynamic distractors from complex 3D scenes without introducing artifacts. He pointed out that the processing developed for underwater imaging using light field cameras has applications in other challenging imaging environments, such as in fog, rain, or snow.

He also described recent fieldwork including marine archaeology on a sunken Bronze Age city in Greece, as well as work in Lake Geneva.

Question time at the end of the talk.

Dr. Dansereau is with the Australian Centre for Field Robotics at the University of Sydney in Australia.

The Victoria Chapter held its second technical meeting of 2014 at the University of Victoria School of Earth and Ocean Science on Wednesday, Nov. 19. Dr. Julien Bonnel of Lab-STICC, ENSTA Bretagne, Brest, France, presented a seminar on his work entitled:

"CHARACTERIZATION AND UTILIZATION OF VLF (0-200 Hz) TRANSIENT SIGNALS USING A SINGLE HYDROPHONE IN SHALLOW WATER: dispersion-based time-frequency analysis, geoacoustic inversion and whale localization"

Dr. Bonnel began his seminar stating that oceans contain many VLF (VLF : 0–200Hz) acoustic sources, both natural or man-made. VLF waves propagate at large ranges both into the water column and into the seabed. They thus can be used for environmental inversion and/or source localization. In shallow water, VLF propagation is described by normal mode theory. Modal propagation is dispersive: different frequencies travel at different speeds. While dispersion transforms a broadband signal during propagation and makes it harder to study, it also allows characterizing the propagation medium and localizing sources.

Dr. Julien Bonnel of Lab-STICC, ENSTA Bretagne, Brest, France.

In his talk, Dr. Bonnel presented single-receiver processings allowing characterization of the modal dispersion in a passive context. In particular, he presented physics-based warping and time-frequency representations that are adapted to the dispersed signals and allow for modal filtering using a single receiver [1]. He then showed that the filter modes can be used to perform single receiver geoacoustic inversion (i.e. estimation of the seabed properties) [2] and passive whale localization [3]. The whole methodology was illustrated on several experimental datasets: airguns, light bulb implosions and whale vocalizations. He concluded by emphasizing that signals recorded using a single hydrophone in shallow water may contain much more information than is usually exploited! For more information contact: julien.bonnel@ensta-bretagne.fr. Tel. +33 (0)2 98 34 89 69

References

[1] Bonnel et al., Physics-Based Time-Frequency Representations for Underwater Acoustics, IEEE Sig. Proc. Mag., 30(6):120–129 (2013).

[2] Bonnel et al., Bayesian geoacoustic inversion of single hydrophone light bulb data using warping dispersion analysis, J. Acoust. Soc. Am., 134(1):120–130 (2013).

[3] Bonnel et al., Range estimation of bowhead whale (Balaena mysticetus) calls in the Arctic using a single hydrophone, J. Acoust. Soc. Am., 136(1):145–155 (2014).

Korea Chapter

Son-Cheol Yu

First Chapter Meeting

On April 16, 2014, members of the Korea Chapter held their first meeting at the Korea Research Institute of Ships and Ocean Engineering (KRISO), in Daejeon, South Korea. On the same day the sinking of the Sewol ferry occurred. Many members of the Oceanic Engineering Society (OES) Korea chapter, who were expected to attend the meeting, could not join because their services were needed to support research and recovery efforts for the ferry. Representatives of three major institutions of the Korea chapter (KRISO, KAIST, and POSTECH) and student members who did attend discussed an urgent matter: the election of deputy board members for the chapter. During the meeting, the history and progress of the OES Korea chapter were recounted. For the communication of IEEE OES headquarters and in preparation for the next meeting, board members were elected. In summer 2014, the official chapter meeting will be held with all OES Korea chapter members.

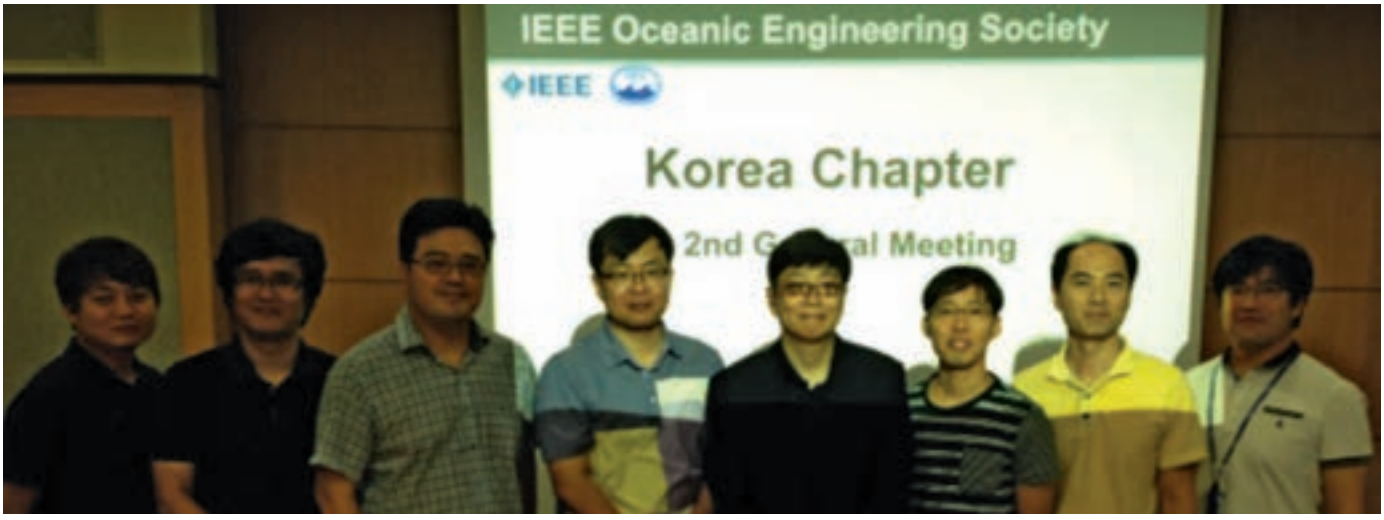
Among other topics discussed, attending members agreed that it is difficult to manage the chapter without board members. Board members who are elected will determine the rules of the chapter and prepare the general meeting. Considering the current composition of the chapter, at least one board member must be elected from each major institution to balance the fields of specialization. The following board members were elected:

Chapter Chair:	Prof. Son-Cheol Yu (POSTECH)
Vice Chairs:	Prof. Jinwhan Kim (KAIST),
	Dr. Sea-Moon Kim (KRISO)
Secretary:	Dr. Hyeonwoo Cho (POSTECH)

Second Chapter Meeting

At the second meeting of IEEE OES, Korea chapter, the following deputy board members were officially approved: chair, vice chairs, and secretary. The first set of regulations for the Korea chapter was discussed and officially approved. To stabilize the chapter, a fundraising strategy and networking with international OES chapters were discussed. As a first step toward integrating with other chapters, members agreed to network with the Japan chapter.

First General Meeting of the Korea Chapter of OES.



Second General Meeting of the Korea Chapter.

France Chapter

Philippe Courmontagne

IEEE/OES French Chapter Participation at Sea Tech Week

From October 13 to October 17, the Sea Tech Week conference (international marine science and technology week) took place in Brest (France). The main focus of this event was around Deep Ocean.

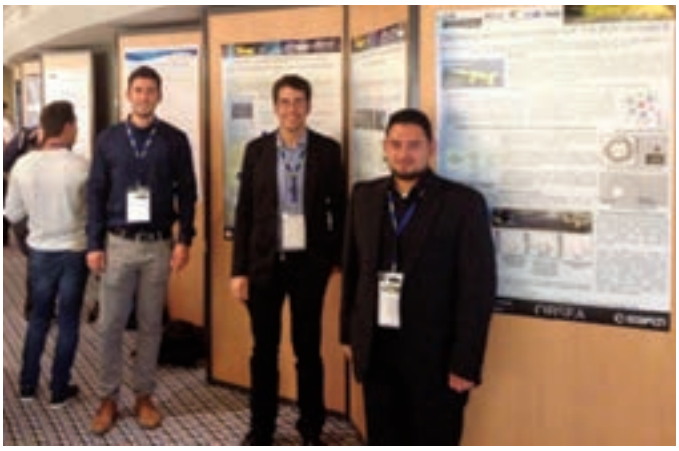
In the context of this conference, the IEEE/OES French Chapter played a significant role:

- Participation to the plenary session;
- Organization of the Student Poster Competition;
- Signature of Memorandum of Understanding between IEEE/OES and Sea Tech Week.

Concerning the plenary session, René Garello, IEEE/OES President, explained the mission and governance of IEEE and described the role of the different IEEE/OES boards. He presented the upcoming OCEANS conferences and IEEE/OES workshops, too. This plenary session was reachable all over the world by webcast.

President René Garello addresses the conference during the plenary session.

For the first time, Sea Tech Week decided to include in its program a Student Poster Competition. Philippe Courmontagne, the IEEE/OES SPC Chair, organized this contest. 17 abstracts were selected, coming from France, Belgium, Spain and UK. IEEE/OES, IEEE/OES French Chapter, Brest Métropole Océane (BMO) and ISEN-Toulon engineering school supported this contest. The three award winners were announced at the Wednesday Gala banquet. Marylène Faure, the Sea Tech Week organizer, presented the third place award to Laura Lallier, from Belgium. Next, René Garello, IEEE/OES President, presented the second place award to Ugo Moreaud, from France. Pierre Karleskind, BMO Vice President, presented the first place award to Sébastien Olaya, from France, for his poster entitled "*Optimal Energy Absorption for a Self-Reacting Point Absorber*". All the students received a round of applause for their accomplishments and participation in the Student Poster Program of Sea Tech Week.



Sea Tech Week Student Poster Competition.

The award winners.

First Place Winner: "*Optimal Energy Absorption for a Self-Reacting Point Absorber*"

This poster deals with the optimal control of a generic wave energy converter (WEC) of the self-reacting point absorber type. A WEC simulator have been developed in order to evaluate its performance under control strategy, attempting to optimize the energy absorption. Due to the simplicity of the model geometry, a dedicated code based on a semi-analytical method has been developed in order to evaluate hydrodynamic parameters required for modeling the WEC dynamics. Regarding the control strategy, it is well established now, that it is an important WEC design aspect to make it more efficient. Model Predictive Control (MPC) is based on a receding horizon concept where optimal control sequence is obtained solving an constrained optimization problem. In this presentation, an objective function attempting to optimize the power generation is directly formulated as an absorbed power maximization problem based on a phenomenologically one-body equivalent model derived using the well-known Thévenin's theorem.

Second Place Winner: "*Signal Analysis Method Based on the Use of Modular Ellipse*"

This paper presents a new way to analyze signal using modular ellipse on time-frequency representation. For each coefficient of the

time-frequency representation, the algorithm will "watch" through estimators in every direction up to a distance given by the operator (with respect to time and frequency) and then return information about the surrounding coefficients. This information can then be used in different ways. Some possibilities with the results are to cancel the noise by detecting the signals coefficients, to obtain linear chirp properties, to define signal features or to track narrowband signal. The algorithm is vectorized by construction and therefore requires little computing time compared to the number of operation. Currently the main application developed is a noise canceling algorithm based on a statistical approach using modular ellipse on the time-frequency representation. Compared to the well know denoising method like Wiener filter and Ephraim and Mallah algorithm, the proposed approach result in less residual noise (still colorless) and better conservation of the signal components.

Third Place Winner: "*Common Heritage of Mankind—When Science Challenges Legal Concepts*"

By demonstrating the role of marine organisms in the formation and composition of deep-sea mineral resources, the aim of this poster is to demonstrate that legal definitions can sometimes be relatively simplistic and limited. Considering that on the deep seafloor, the meaning of legal terms can determine the applicable legal regime, this study represents an important aspect of academic legal research. The overall goal is to introduce the interpretation methodology that will be used in the author's PhD research project on the legal framework of deep-sea mining.

Pierre Karleskind, BMO Vice President, and René Garello, OES President, signing the Memorandum of Understanding for a partnership between BMO and IEEE/OES for the OCEANS and Sea Tech Week conferences.

New South Wales, Australia Chapter

Brian Ferguson

The IEEE NSW Section's Joint Chapter of the Oceanic Engineering/Signal Processing/Communications Societies held its end-of-year technical meeting, followed by its administrative meeting, at Engineers Australia in Chatswood on Thursday 13th November 2014. The evening marked the culmination of a successful twelve-month program with two new initiatives implemented. These initiatives highlighted and recognized the diversity and depth of talent of the student and women-in-engineering members of our Joint Chapter.

Our technical meeting on 28th November 2013 at the Sydney Mechanics' School of Arts featured Daniel Bongiorno, whose presentation was titled Dynamic Spectral-Based Underwater Colour Correction and Eric Ferguson, Sensors, Signals and Algorithms for Passively Localising Dolphins in the Wild. Both students acknowledged the student-friendly IEEE Oceanic Engineering Society, which has been a source of encouragement and support of their research in marine science and ocean systems engineering. Daniel has just submitted his PhD thesis, which he completed at the University of Sydney's Australian Centre for Field Robotics under the supervision of Professor Stefan Williams, who is also a member of our Joint Chapter. Daniel was awarded first prize in the OCEANS'13 MTS/IEEE Bergen student poster/paper competition. Eric, who graduated from the University of Sydney in May with B.Sc and B.Eng (Hons) degrees, expressed his pride and gratitude in being the recipient of IEEE OES Scholarships, which enabled him to pursue his research on dolphin biosonars. Also, as the youngest finalist, Eric remarked on the guidance and reassuring confidence he received from Norm Miller during the OCEANS'10 IEEE Sydney poster/paper competition. Over the years and around the world, Norm was able to engage and encourage students who had an interest in Oceanic Engineering and he left an indelible impression on many of the IEEE OES student members and early career scientists and engineers.

Our second technical meeting was hosted by the Joint Electrical Institutions Sydney - Engineers Australia, IEEE, IET and featured Dr Gunilla Burrowes from ATSA Defence Services and the School of Electrical Engineering and Computer Science, University of Newcastle, together with Dr Weizhen Zhou, who is a research engineer with Australia's Defence Science and Technology Organisation. The presenters were introduced by Sherry Moghadassi, who is the Chair of the Electrical and ITEE Colleges Sydney Branch, Engineers Australia. Gunilla's presentation concerned Underwater swarm sensor networks and the design of short-range acoustic communication protocols. Gunilla noted that the implementation of swarms of autonomous underwater vehicles will greatly improve the current approach of using single vehicles to survey and explore the oceans. The field of Underwater Swarm Sensor Networking (USSN) requires combining formation (swarming) algorithms and underwater mobile wireless sensor network (WSN) technology. The area of swarming algorithms continues to advance and can be directly adapted from terrestrial to underwater environments. It is however the developments of underwater mobile WSN technologies that still face many challenges which are substantially different from terrestrial settings. USSN progress has required the development of new approaches and understanding of short-range mobile acoustic underwater communication. This communication is essential in USSN to coordinate the manoeuvring of closely operating vehicles as well as to transmit data within the swarm to gain the benefits of operating as a team. The second presentation on 3D visual SLAM for unstructured domains was delivered by Weizhen, who noted that before the Microsoft Kinect sensor revolutionized the gaming industry, the robotics community had long used similar schemes which combine ranging and vision sensors to tackle traditional robotic problems such as simultaneous localization and mapping (SLAM). The presentation provided a novel solution for building three-dimensional dense maps in unknown and unstructured environments using one of the earliest Kinect-alike sensor packages. This sensor package includes an information maximization algorithm which handles large data sets collected at realistic

sampling rates. Although generic to any 3D feature-based SLAM problem, the strategy was demonstrated on a lightweight mobile platform in the context of Urban Search and Rescue for which the sensors were originally developed.

Dr Gunilla Burrowes presenting the results of her research in underwater swarm sensor networks at Engineers Australia, Harricks Auditorium, Chatswood on 13th November 2014.

A bonus for the year was the seminar in February on Coastal Ocean Radars: Principles, Results and Applications, which was presented by Professor Mal Heron. Mal is an IEEE/OES Distinguished Lecturer and he is affiliated with the Marine Geophysical Laboratory, James Cook University. Mal provided a review of the principles of HF ocean radar and how it measures surface currents. A descriptive overview of the Australian Coastal Ocean Radar Network followed with some background about how sites are selected and configured. A suite of results and applications emanating from the ACORN network was presented, including Lagrangian Tracking; assistance to management in the Great Barrier Reef Marine Park; assistance in the salvage of a grounded ship; and the observation of cold fronts in the Southern Ocean. Looking into the future, Mal foresees applications in port management, search-and-rescue, and early observation of tsunamis.

Following a submission by the Joint Chapter in March, the IEEE Signal Processing Society's Chapters Review Committee notified us in August that the IEEE Signal Processing Society's New South Wales Chapter had been awarded Certification. This Certification will be valid for four years, so the Chapter will be certified from 1 January 2015 through 31 December 2018. In relation to the IEEE SPS, Kam Lo and Brian Ferguson have submitted a paper on A ballistic model-based method for ranging small arms fire using a single acoustic sensor node to the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2015 to be held in Brisbane from the 19th–24th April 2015.

Also, IEEE OES members, Gunilla and Darren Burrowes, participated in OCEANS '14 MTS/IEEE St. John's September 14–19, 2014. Dr Burrowes presented a paper titled Impact of reverberation levels on short-range acoustic communication in an Underwater Sensor Swarm Network and application to transmitter power control. The paper was well received with several questions adding to an interesting final session in the conference timetable. Prior to the conference Gunilla and Darren joined the IEEE tour to the Centre for Cold Ocean Resource Engineering (C-CORE). The tour visited several laboratories in the facility and gave a fascinating insight into the challenges and opportunities for oceanic engineering in the Arctic region. The highlight of the tour was standing beside a room-size test rig designed to slam an ice ball into a simulated ship-side to gather data to inform icebreaker design. The test rig was student designed and built and videos of the impact were played in slow time providing impressive imagery of the impact action. The exhibition hall at St John's was busy with many exhibitors demonstrating the breadth and depth of oceanic engineering in the Canadian Atlantic maritime region. Innovative companies included Seaformatics, Agile Sensor Technologies, SubNero and Maritime BioLoggers.

Finally, the scientific paper by Kam Lo and Brian Ferguson on Flight parameter estimation using instantaneous frequency measurements from a wide aperture hydrophone array was published in the IEEE Journal of Oceanic Engineering, Vol. 39, No. 4, October 2014. As noted by the Editor-in-Chief, Ross Chapman, the October issue of volume 39 is a watershed issue of the IEEE Journal of Oceanic Engineering, as it will be the last issue that will be provided as a hard copy printed version of the journal.

Local Interest Topics Announced for OCEANS '15 MTS/IEEE Washington, DC

Liz Corbin

In addition to the Core Topics common to all OCEANS conferences, the Local Organizing Committee (LOC) for OCEANS '15 MTS/IEEE Washington, DC, October 19-22, 2015, has selected five topics with special local interest, as well as broad international significance. According to Technical Program Chair Doug Wilson, "These topics were chosen by the LOC in keeping with the conference theme, *Sea Change: Dive into Opportunity*. Starting in February, abstracts can be submitted on the conference website under these topics, in addition to the Core Topics, and they can be the focus for special technical sessions, workshops and panel discussions."

Emerging Arctic Challenges

Rapid changes in Arctic conditions are impacting Defense, Energy, and Transportation sectors, creating a need for new science and technology applications. OCEANS '15 will bring together strategic, scientific, and technical considerations to address this pressing challenge.

Marine Resiliency

Changing climate and ocean conditions are impacting the coastal and ocean environment.The mid-Atlantic region is still recovering from Sandy, and is one of the highest risk regions

from sea level rise. OCEANS '15 will address advances in marine and coastal resource protection, hazard forecasting and mitigation, and other aspects of resiliency.

Environmental Intelligence

The ability to make critical decisions - tactical, management, economic, or scientific—in the marine environment requires accurate observations and forecasts. OCEANS '15 will address observations, sensors, platforms, forecast models, and data management and delivery systems necessary to support marine enterprises.

Offshore Wind and Marine Renewable Energy

The growth of Offshore Wind and Marine Renewable Energy development, globally and in the Mid-Atlantic Region, has created opportunities for supporting science, technology, and engineering. OCEANS '15 will highlight the present and future states of these energy sectors, from policy to technology.

Important Dates	
Call for Abstracts	February 2015
Call for Tutorials	February 2015
Abstract Submissions Closed	May 2015
Author Notifications	June 2015
Final Papers Due	July 2015
Conference	October 2015

Law of the Sea

The United Nations Convention on Law of the Sea has relevance to energy, research, exploration, defense, and fisheries.The OCEANS '15 meeting in Washington, D.C. provides a forum for discussion of UNCLOS in the context of the science and technology that support the impacted sectors.

The list of Core Topics can be found at www.oceans-15mtsieeewashington.org. For more information, contact techprogchair@oceans15mtsieeewashington.org.

Exhibition and Patron Opportunities: Companies and organizations looking to increase their market presence have a great opportunity to reach a highly qualified target audience at OCEANS '15 MTS/IEEE Washington, DC. The significant maritime presence in the area is expected to draw a strong local attendance from ocean-related industry, US government agencies, NGOs, the military, and students. Details of these opportunities can be found on the conference website.

Student Phytoplankton Research Team Detects Algal Bloom

Sydney Holt, Anna Culpepper, Kenzie Endreson, Megan Munson
[Photos by Todd Morrison and Sydney Holt]

In 2005, First Flight High School AP Environmental and Biology teacher, Katie Neller, founded a Phytoplankton Research Team, the Phytofinders. Students from her classes joined the club to monitor, research, and examine different phytoplankton species in the coastal waters of the Outer Banks. Throughout the school year and during the summer, members of the club frequently visit Jennette's Pier in Nags Head, NC, and the Army Corps of Engineers FRF Pier in Duck, NC, to take water and plankton samples, perform tests on the water, and microscopically examine and categorize the plankton.

For the past five years, the Oceanic Engineering Society of the Institute of Electrical and Electronics Engineers (IEEE/OES) has provided the group with a $5,000 annual grant to further the exploration and research goals of the First Flight High School (FFHS) Phytoplankton Research Team. The money is used to purchase supplies and consumables. It also supports student travel to the OCEANS Conference when held close to the Outer Banks. A condition of the grant is that students submit abstracts to the regular technical program, write and upload papers if the abstracts pass the review process, and present their findings in the technical sessions of the conference.

"The group has benefited greatly from OES. They have provided us with educational opportunities, financial support, and 'real world' science experiences," said Ms. Neller.

The main focus of the club is to keep watch for algal blooms, particularly toxic blooms, in the coastal waters of

FFHS Science teacher Katie Neller being interviewed on the Army Corps of Engineers FRF Pier in Duck, NC, for an article in the FFHS student newspaper.

Experienced students regularly instruct new members of the phytoplankton team.Here the proper deployment, towing, and recovery procedures for a plankton net are demonstrated on the FRF Pier.

In a classroom at Jennette's Pier in Nags Head, NC, FFHS phytoplankton students discuss their observations and continue to examine the samples acquired earlier in the day. Toxic pseudo-nitzschia had just been tentatively identified on a few microscope slides and the students were preparing and searching additional slides to confirm the observation before reporting to NOAA.

A FFHS student extracts a small quantity of water from a sample bottleThe water in the eye dropper will be transferred to one or more microscope slides for visual examination. Depending on what is found, the sample bottle may be sent to NOAA for further analysis.

the Outer Banks. Last February (2014), students examining plankton samples by microscope detected the presence of *pseudo-nitzschia*. This organism, which emits domoic acid, can cause harmful algae blooms that sicken and kill marine animals and degrade local fishery programs. It is a well recognized health and economic hazard for humans. This was the first detection of the organism along the Outer Banks in several years. The previous detection is also credited to the FFHS team.

"I think the most exciting part about finding *pseudo-nitzschia* in the waters was the fact that we were actually conducting science and compiling data," junior member Stephen Peters said. "Being able to send our results to NOAA for further analysis was the cherry on top. I felt like I was making a difference."

Students work closely with scientists and staff members of the National Oceanic and Atmospheric Administration (NOAA). NOAA researchers analyze samples supplied by the FFHS team and combine their observations with those of other volunteers in a wider network. In 2012 NOAA personnel and OES volunteers guided the students through the abstract preparation and submission process for OCEANS '12 Hampton Roads. Four papers, authored by the students and Ms. Neller, were successfully presented in Virginia Beach and published in the conference Proceedings.[1] A new set of abstracts will be submitted this winter for OCEANS '15 Washington and the team is looking ahead to OCEANS '18 Charleston.

"The presentations were well done and everyone was well received by the other scientists that came to watch it," phytoplankton alumni Benjamin Lam said. "Many of the scientists had many interesting questions that we didn't think about at all applying to our work. Their criticism has helped in our decision making into the next few years of the program."

"The original, two year award from OES ran out in 2012, but OES was very pleased with the results of our investment in

Students pour a fresh seawater sample into a 1 meter glass tube to check turbidity using a variation of the traditional Secchi disk technique.

A long line of students examine samples, searching for pseudo-nitzschia and more than a dozen other organisms of interest.

FFHS students deploy a plankton net from the FRF Pier.

this program, these students, and their teacher. The AdCom voted unanimously to support an additional three year grant with abstracts to be submitted to OCEANS '15 Washington", reported Todd Morrison, OES Vice President of Conference Operations.

Many dozens of students have benefited from this unique program. Lead students from the Phytofinders now attend Duke University, UNC Chapel Hill, NC State, and East Carolina University. 2013 Phytoplankton President, Sam Eure, feels he has benefitted from the leadership experience and the scientific research opportunities he has enjoyed as part of the team and that these skills will aid him in the future. All current members, as well as Ms. Neller, alumni, and IEEE/OES, have high hopes for the continuing success for this accomplished club.

The authors are all students or graduates of First Flight High School and members of the Phytoplankton Club.

References

[1] Neller, K., "The Educational Benefits of an Inquiry Based Scientific Collaboration", *Proceedings OCEANS '12 MTS/IEEE Hampton Roads*, IEEE/OES, October 2012.

[2] Morgenroth, J., Harrell, A., Neller, K., "Assessing the Potential for Chronic Exposure to Low Levels of Domoic Acid Through the Use of Solid Phase Adsorption Toxin Tracking", *Proceedings OCEANS '12 MTS/IEEE Hampton Roads*, IEEE/OES, October 2012.

[3] Hamill, H., Pace, O., McPherson, T., Neller, K., "Phytoplankton Community Structure on the Outer Banks of North Carolina", *Proceedings OCEANS '12 MTS/IEEE Hampton Roads*, IEEE/OES, October 2012.

[4] Butcher, A., Lam, B., Neller, K., "Temporal Distribution of *Pseudo-Nitzschia spp.* Along the Outer Banks of North Carolina", *Proceedings OCEANS '12 MTS/IEEE Hampton Roads*, IEEE/OES, October 2012.

Arctic Technology Conference 2015

The Arctic Technology Conference (ATC) 2015 makes a move to Copenhagen, Denmark, for its fourth conference, building on the highly successful conferences held in Houston, Texas. ATC 2015 will provide easier access for European and Asian Arctic practitioners, while still allowing easy access from North America. This will create an opportunity for unprecedented communication and collaboration about challenges and solutions for the global exploration and development of onshore and offshore Arctic basins. ATC 2015 will be held 23–25 March 2015 at the Bella Center in Copenhagen. ATC will return to North America in 2016 and the plan is to alternate between continents every year.

"There is a huge amount of Arctic activity currently being planned and executed in regions of Scandinavia, Greenland and Russia," said Han Tiebout, ATC 2014 Technical Program Chair. "Copenhagen's central location and broad accessibility make it a strategic choice to host ATC 2015 and attract these international professionals who wouldn't normally attend in Houston."

ATC is an Arctic-focused expansion of the Offshore Technology Conference (OTC), the world's foremost event for the development of offshore resources in the fields of drilling, exploration, production and environmental protection, founded in 1969. ATC is built upon OTC's successful multidisciplinary approach with 14 technical societies and organizations working together to deliver the world's most comprehensive Arctic event. The annual Arctic Technology Conference has a proven success record in providing a worldwide platform for industry colleagues, vendors and academia to network, share ideas, research and cutting edge technology to overcome the challenges for producing in the world's harshest climate.

"ATC represents the culmination of years of growing and successful Arctic sessions happening at OTC and expanding the event to the international arctic regions will keep energy professionals on the cutting edge of its exploration and development" said OTC Board Vice-Chairman Joe Fowler.

About ATC

ATC is a part of the Houston-based Offshore Technology Conference portfolio of events. Historically, ATC attracts an average of 1,300 attendees from more than 20 different countries. ATC's technical program features international scientists and engineers sharing their ongoing research and development and execution experiences in the key areas of Geology and Geophysics; Exploration and Production; Physical Environment; Logistics and Marine Transport; and Regulatory, Environment and Social Responsibility. It also includes Panel Sessions, as well as Topical breakfasts and luncheons offering insights from top executives and technical experts into Arctic themes, both from a technical as well as a socio-economic point of view. On average, the ATC exhibition hall boasts 80+ exhibitors showcasing the very latest innovations, products and services.

ATC is managed by the American Association of Petroleum Geologists and is supported by fourteen of the leading scientific organizations.

Sponsoring Organizations

- American Association of Petroleum Geologists
- American Institute of Chemical Engineers
- American Institute of Mining, Metallurgical, and Petroleum Engineers
- American Society of Civil Engineers
- ASME International Petroleum Technology Institute
- Institute of Electrical and Electronics Engineers—Oceanic Engineering Society
- Marine Technology Society
- Society of Exploration Geophysicists
- Society for Mining, Metallurgy, and Exploration
- Society of Naval Architects and Marine Engineers
- Society of Petroleum Engineers
- The Minerals, Metals & Materials Society

Endorsing Organizations

- International Association of Drilling Contractors
- Petroleum Equipment Suppliers Association

Visit: www.arctictechnologyconference.org

Contacts

Samantha Knowlton, Events Marketing Manager
T: +1 918 560 2618 | E: sknowlton@aapg.org

Vern Stefanic, Communications Manager
T: +1 918 560 2657 | E: vstefan@aapg.org

Request for Nominations to the Administrative Committee Class of 2016

Jerry Carroll, OES Junior Past President

The IEEE OCEANIC ENGINEERING SOCIETY is governed by an Administrative Committee of 18 members. Six are elected each year to serve three-year terms. Members are limited to two consecutive terms, although they may be reelected after a lapse of one year.

The Nominations and Appointments Committee is chaired by the Junior Past President with the Senior Past President completing the Committee. They are charged with proposing a slate of nominees and with conducting the election, which is done electronically to the entire membership. The electronic election requires

each member that wishes to vote to have an IEEE account. Therefore, visit IEEE.org to establish your account if needed.

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

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

The election will be conducted in accordance with our Bylaws. You can read them by going to the Society's Web Site (www.ieeeoes.org), and pointing to Bylaws under About > Governing Documents. The Bylaws specify that general nominations close on March 1, 2015, and nominations by petition close by April 15, 2015.

Please submit nominations to the undersigned. Please do not delay your efforts in finding and nominating qualified candidates.

Jerry Carroll
Chair, IEEE/OES Nominations and Appointments Committee
411 Country Club Drive
Picayune, MS 39466 USA
+1 601-798-0277
jerrycortez@charter.net

AUV 2014—Oxford, Mississippi

Blair Thornton, OES Member
[Photos by Javier Busquets and Adrian Bodenmann]

No obstacle was left un-avoided as autonomous underwater vehicle (AUV) researchers from around the globe followed their planned trajectories to arrive in Oxford, Mississippi, the venue of the OES sponsored AUV 2014 workshop.

Since its revival in 2008, the biennial AUV workshop has quickly established itself as one of the most important events on the AUV researchers' calendar, and this year saw participants from nearly a dozen nations gather at the Inn at Ole Miss conference center for this, the 4th installment of the workshop. With more than 230 nautical miles to the nearest drop of ocean, it was left to members of the local organizing committee, Geoff Wheat, Max Woolsey and Arne Diercks of the National Institute for Undersea Science and Technology (NIUST) to assure the participants that they were in the right place to take part in a 3 day crash course in advanced underwater robotics.

Diversity is what makes multi-disciplinary fields click, and with backgrounds in academia, industry and the military, this year's crowd truly represented the broad spectrum of researchers involved in a field that is growing in maturity at a rate few could have guessed just a decade ago. Communication bandwidths were set to maximum as the single track technical program got under way with sessions discussing the challenges that face AUVs as they are applied in ever more demanding fields and their performance is judged against ever growing levels of expectation.

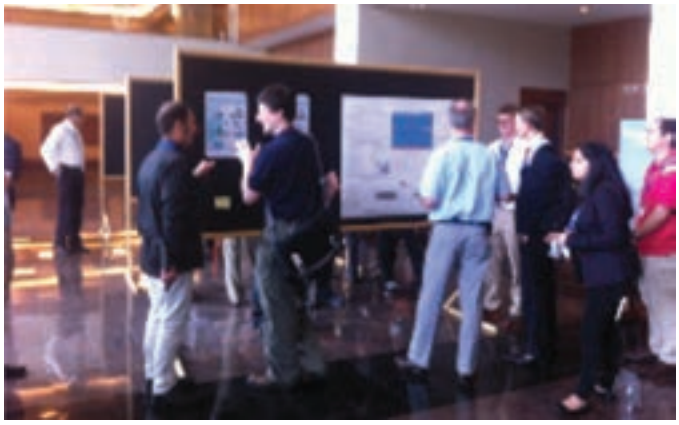
The back-to-back sessions explored vehicle technologies, sensor development, real-time data interpretation, acoustic communication, long-term deployments, mission planning and data visualization and management. The assortment of backgrounds guaranteed a rich exchange of ideas in the wake of each talk, with several of the sessions going an extra round during the breaks as crowds congregated around the nearest coffee dispenser for live demonstrations of complex underwater scenarios using paper cups, chocolate éclairs and filo pastry.

Technical program chair Max Woolsey welcomes participants to AUV 2014 during the conference ice-breaker.

In addition to the technical sessions, a series of organized talks were given over the course of the workshop from industrial groups that stand on the frontline of AUV technology and application. Chris Roper of SAAB Seaeye introduced the latest technology on offer from the Swedish giants, including rapid developments in the area of hybrid AUV/ROVs, underwater docking systems and integrated control system architectures for multiple different platforms. The workshop's keynote was held during the gala dinner by James McFarlane, Sr. of International Submarine Engineering, Inc. (ISE), who gave the young audience a lesson in unmanned submersible history as he shared some of the

Arne Diercks (left) introduces ISE president James McFarlane, Sr. (right) to gives his keynote lecture at the gala dinner.

'Eagle Ray' on show during a tour of the NIUST AUV facility.



Students present their latest research at the poster competition.

personal experiences and episodes that have shaped his organization during over 40 years of dedicated efforts in the field.

Day two kicked off with an invited talk from Joshua Elvander of the Bluefin robotics cooperation who described Bluefin's involvement in the search for Malaysia Airlines Flight 370. The talk highlighted the weight of hope and expectation that now lies upon AUVs in the field, bringing home how much the technology has matured in recent years. At the same time, each and every member of the audience appreciated the importance of efforts behind the scene such as setting up reliable support infrastructure, flexibility of management, lateral thinking of AUV developers and the skill of dedicated operators, all of which are as important as the technology that now fills an irreplaceable role in solving real-world problems regarding the ocean.

While veterans of the field taught the younger generations a thing or two about AUV technology, the youth had lessons of their own, teaching the veterans a thing or two about… AUV technology. This year's student poster competition saw the latest developments in topics ranging from AUV navigation and path planning to mooring AUVs and gliders with sampling capabilities. After much deliberation, the judges finally decided to award this year's prize to Alex Popescu of the Georgia

Institute of Technology for his poster entitled 'Design of an under-ice autonomous underwater vehicle for deployment in Antarctica'. In addition to the poster competition, the prize for best student presentation was awarded to David Pearson of the Florida Atlantic University for his talk on 'High-level fuzzy logic guidance system for an unmanned surface vehicle (USV) tasked to perform autonomous launch and recovery (ALR) of an autonomous underwater vehicle (AUV)', which also won the unofficial awards for longest title and most acronyms used in a single sentence.

A tutorial on MB Systems, an open source multi-beam sonar mapping library developed and maintained by the Lamont-Doherty Earth Observatory of Columbia University and the Monterey Bay Aquarium Research Institute, held on the morning of the third and fina l day of the workshop, taught participants how to compile, dress and color code their bathymetry and back-scatter data in ways limited only by their imagination. This was followed by an impromptu tour of the AUV facility of the

NIUST, who develop and operate the ISE explorer class AUV 'Eagle ray' and the Woods Hole Oceanographic Institution's Seabed class AUV 'Mola Mola' for mapping missions. Footage of missions using these vehicles and the in-house built 'SSD' (Station Service Device) ROV was shown with a live narration that covered the backgrounds of the missions, the engineering experiences and future plans. This was followed by an exchange of gallant tales of the sea between the hosts and participants that marked the end of AUV 2014.

Scribbled notes and fresh inspirations no doubt found their way into a more digital format as participants tracked their paths home with their networks expanded and memory banks full of new ideas. The fruits of some of these will undoubtedly be shared in Tokyo, Japan, during the next AUV workshop that will be held on November 6–9, 2016 at the University of Tokyo, to which we welcome your participation.

OES Supports Mate Rov Competition

Bob Wernli, VP, Professional Activities

The Marine Advanced Technology Education (MATE) Center held its 13th International ROV Competition for students at the Thunder Bay National Marine Sanctuary in Alpena, Michigan, USA. As one of the sponsors, OES provides financial support to the competition. Bob Wernli attended the event and promoted society membership on site at the society booth. OES visors and T-shirts were also awarded to one of the winning teams.

The competition is open to K-12, community college and university students. Over 600 students from 13 countries participated in the competition. Competing teams were challenged to complete various mission tasks that included collecting trash, identifying a simulated shipwreck, inventorying invasive species and collecting microbial samples.

The teams also had to prepare a technical engineering report, create a poster display and make a presentation to a panel of judges. The teams must pass a safety inspection prior to the competition. They're evaluated on the design, construction and performance of their ROV, their ability to communicate what they've learned, how that knowledge was used in the development of their ROV, and the scores achieved in the in-water missions.

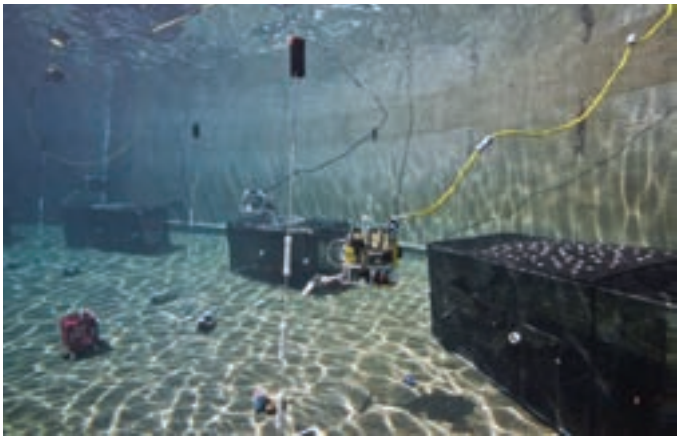
Competition is held in two classes: Explorer and Ranger. The winners were:

Explorer Class

- First Place—Jesuit High School, Carmichael, CA, USA
- Second Place—Bauman Moscow State University, Moscow, Russia
- Third Place—Far Eastern Federal University, Vladivostok, Russia

Ranger Class

- First Place—Clarenville High School, Clarenville, Newfoundland and Labrador, Canada
- Second Place—Cornerstone Academy, Gainesville, FL, USA
- Third Place—Greater New Bedford Regional Vocational Technical High School, New Bedford, MA, USA



ROV closing in on target.

OES will continue to support the competition and expose the benefits of the society to the international student participants. The next competition will be held in St. John's, Newfoundland and Labrador, Canada, on 25–27 June 2015.

Explorer class winner – Jesuit High School.

Ranger Class winner – Clarenville High School.

The Robert Gordon University team from Aberdeen, Scotland prepare to launch their ROV.

Techno-Oceans 2014—Kobe

Blair Thornton, OES Member
[Photos by Mitsuo Matushima, Hayato Kondo and Kenichi Asakawa]

'Beef' may be the first thing that comes to mind when you think of Kobe, but the city is also the proud host of the biennial Techno-Oceans conference. Held against a backdrop of container ships and ferries amongst the bustling trade at Kobe's Port Island, this year's conference marked the 15th Techno-Oceans since it started in 1986, and like the beef, it was packed with flavor.

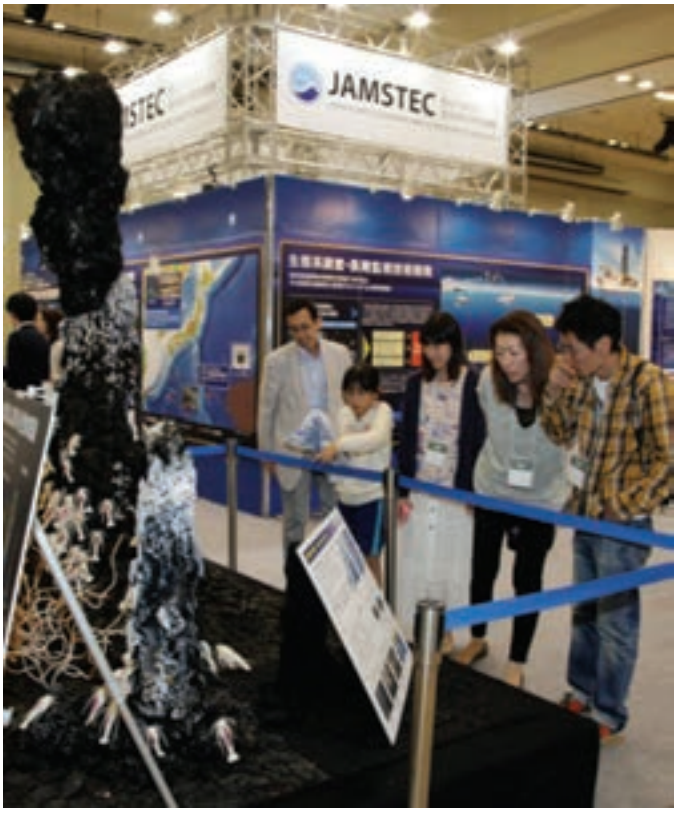
Over 9000 attendees strolled through the No. 2 Kobe International Exhibition Hall over the course of 3 days, and thanks to the organizers Techno-Oceans Network, with the support of OES, MTS, the City of Kobe, and a number of local associations and national research institutes, the venue was jam-packed and bulging out the sides with cutting-edge ocean research and glimpses of what lies ahead in the near future.

The theme 'Mother Oceans', chosen for this year's conference, holds a place close to the heart of Japan, an island nation that has not only embraced the ocean as the source of life and resources to support our existence, but has also recently experienced ocean-related natural and technological disasters that have led not just its individuals and communities, but also its parliament to contemplate the complex relationship that exists between our kind and our ocean.

The conference kicked off with a welcome address from its chair, Professor Koji Otsuka of the Osaka Prefecture University as well as remarks from the sponsors. Inside the building, 64 booths filled the venue with models of deep-sea environments, core samples, underwater robots and instruments that wouldn't look out of place on the set of a sci-fi blockbuster. The technical sessions were given a running start with 4 keynote lectures that explored the past, present and future of research in marine biodiversity, deep-ocean water, fisheries and gave an overview of the Japanese government's strategies for sustainable use of ocean energy and mineral resources. The technical program that followed consisted of 8 organized parallel track sessions. Again, diversity was the name of the game, with each session bringing together the latest research on deep-sea energy and minerals, offshore geotechnics, satellite remote sensing, super-computer simulations and even Japanese eels.

In addition to the technical program, Techno-Ocean Awards were presented to Yuichi Shirasaki of Marine EcoTech for his contribution to the realization of submarine cable networks and observatories in Japan, and Hee-do Ahn of the Korea Institute of Ocean Science and Technology for his dedicated efforts that have enabled international collaboration between ocean related communities in Japan and Korea. This year's Kenji Okamura Memorial Award for Pioneering the Ocean Frontier was presented to Blair Thornton of the University of Tokyo, for the development of in situ measurement technology to survey the continuous distribution of radioactive material in marine sediments, and for his contribution to our understanding of the effects of the Fukushima-Daiichi nuclear disaster on the marine environment.

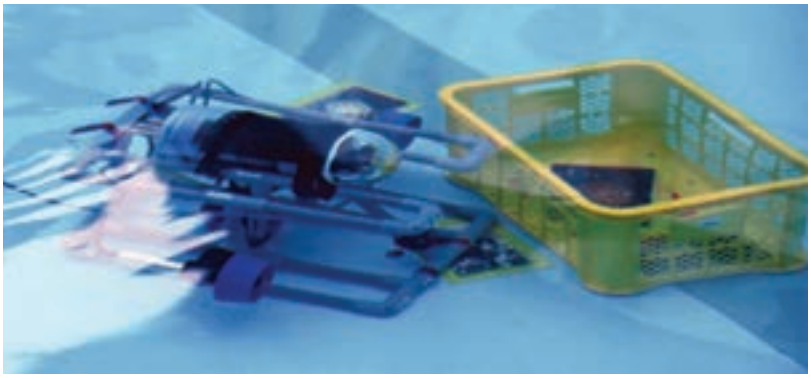
Yoshihisa Shirayama of JAMSTEC sets the pace with his keynote address on Ocean Biodiversity.



A model deep-sea vent with its weird and wonderful creatures, capturing the imagination of onlookers.

The opening ceremonies were followed by a 9-person simultaneous ribbon cut that left strands of red and white sprawled about the entrance of the exhibition hall.

Teams from three high schools competed in the underwater robot competition.



High school students show adults a thing or two about ROV operation during the underwater robot competition.

While it is not unusual for conferences to host events for the younger generations, this year's Techno-Oceans took this to a level that left keynote speakers and award winners with sweaty palms for fear of being upstaged by the wealth of up and coming talent. The poster session provided an opportunity for students to promote their ideas in front of seasoned veterans and industrial giants. The quality of posters this year was so high that the judges could not separate Shinpei Gotoh's (University of Tsukuba, Japan) poster entitled 'Sound propagation simulation by the new deep sea profiling float "Deep Ninja" in the Antarctic Ocean on ice

season', and W. P. Kyaw's (Osaka University, Japan) 'Numerical Study on Behavior of Sediments under the Effect of a Single Thruster'. Instead, the committee opted to make a quick call to the trophy manufacturer to order an extra prize as they awarded both posters a well-deserved joint 1st place.

Other events for the next generation of ocean researchers included the 'Ocean World Discovery Program', a series of study classes for elementary and junior-high school students that was attended by more than 350 budding researchers, and a gallery of over 1200 ocean-themed paintings by elementary and junior-high school students that lined the walls of the exhibit hall.

An underwater robot competition was held for high school students at the Port Island Sports Center, just a stone's throw away from the main exhibit. This year's underwater robot competition saw 3 high schools battle it out, operating low-cost remotely operated vehicles (ROVs) developed by the Kyushu Institute of Technology.

On the social scene, the conference reception was held at the 4 star Portopia Hotel, where international guests were welcomed with a traditional Japanese tea ceremony and entertained by a spectacular calligraphy show put on by students of Kobe University. Not to be outdone, Chris Capus of Scottish Development International presented gifts of salmon and Scotch whiskey, which were well appreciated by all members present at the reception. After the celebratory *Kagami Biraki* ceremony, Jerry Carrol, Jr. Past President of OES, presented the Techno-Ocean 2014 organizing committee with an award for their efforts to mark the end of the ceremonies.

If you feel you may have missed out on the action, you'll be pleased to know that the City of Kobe is scheduled to host the 16th Techno-Oceans on October 6–8, 2016, and is also gearing-up to host the OCEANS conference in 2018, which will follow OCEANS'04 and OCEANS'08 as the third joint venture between the OCEANS conference and Techno-Oceans in Kobe. We look forward to your participation in what promises to be a gargantuan event that will provide the opportunity for researchers from universities, private institutes and industry from around the world to get together and expand the network.

Learning is a hands on experience as elementary and junior-high school students take part in the Ocean World Discovery Program.

A cask of rice wine opened using wooden mallets at the conference reception during a traditional Japanese 'Kagami Biraki' (literally translating to 'Opening the mirror') celebratory ceremony.

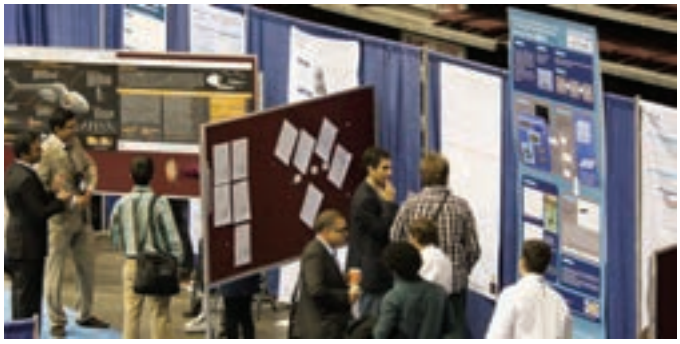
Students from Kobe University put on a spectacular calligraphy show during the conference reception.

Student Poster Competition

[Photos by Stan Chamberlain]

The student poster competition at OCEANS'14 MTS/IEEE St Johns was held at the St Johns Convention Center September 14–19. The following students presented posters:

- Loic Bernicola, Telecom Bretagne
- Ahmed Nait Chabane, ENSTA Bretagne
- Brian Claus, Memorial University of Newfoundland
- Antonella Colucci, Univeristy of Exeter
- André Figueiredo, University of Porto
- David Illig, Clarkson University
- Violeta Skoro Kaskarovska, Florida Atlantic University
- Jie Li, University of Michigan
- Hannan Lohrasbipeydeh, University of Victoria
- José Melo, University of Porto
- Tushar Mohan, Singapore University of Technology and Design
- Jean-Christophe Morgére, Telecom Bretagne
- Parvathy K.G., National Institute of Technology Karnataka
- Himansu Pradhan, Indian Institute of Technology Delhi
- Juan Ramirez, Florida Atlantic University
- Ignacio Sánchez-Gendriz, University of Sao Paulo
- Ken Sooknanan, Trinity College Dublin
- Anthony Sylvester, University of Hawaii at Monoa
- Jeffrey Walls, University of Michigan
- Bo Li, Zhejiang University



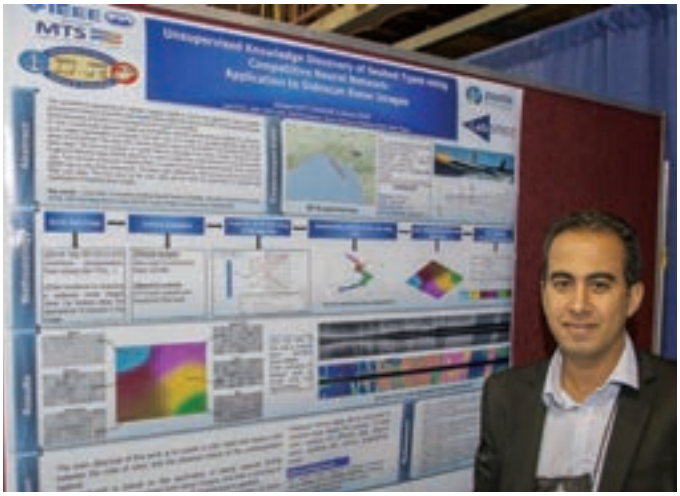
The winners of the competition were:

First Place:	Loic Bernicola
Second Place:	David Illig
Third Place:	Brian Klaus

Loic Bernicola, Telecom Bretagne, *A Hybrid Registration Approach Combining SLAM and Elastic Matching for Automatic Side-Scan Sonar Mosaic*

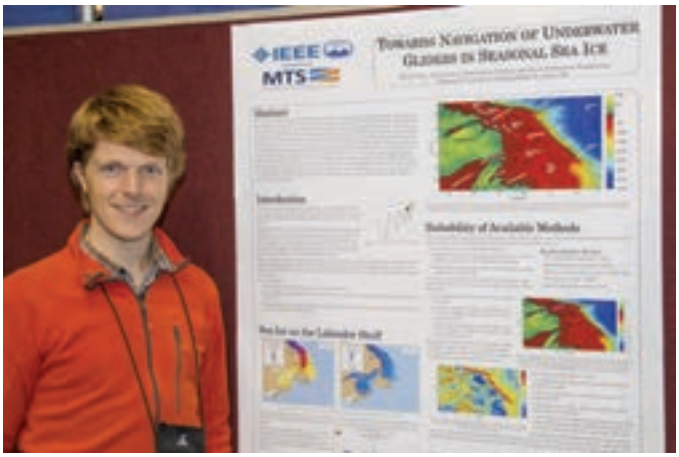
Abstract—This paper introduces a hybrid registration approach to build mosaics from side-scan sonar images. Due to specific acquisition procedure during surveys, standard SLAM techniques may not be robust enough to globally take into account a complete survey and correct sensor trajectories in order to properly georeference every pixel from all these images. iSAM algorithm has been fed with real side-scan images and shows interesting capabilities to produce corrected sensor trajectories allowing relevant coarse image registration, based on landmarks extraction and pairing. These trajectories will then guide a blockmatching procedure that will refine these trajectories by finely matching only sonar images relevant areas.

Ahmed Nait Chabane, ENSTA Bretagne, *Unsupervised Knowledge Discovery of Seabed Types using Competitive Neural Network: Application to Sidescan Sonar Images*



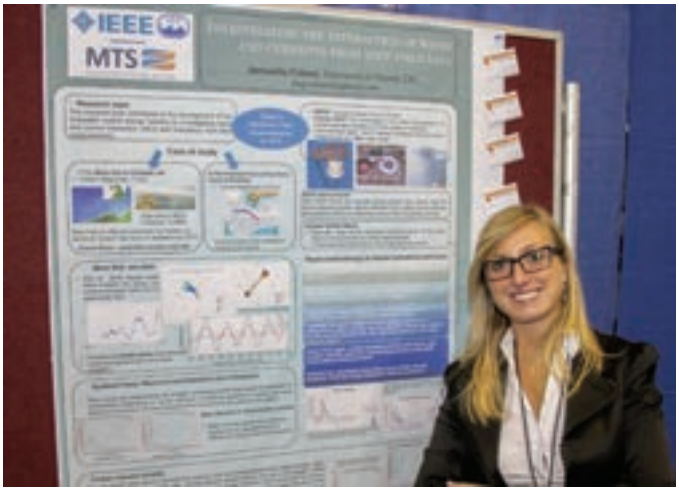
Abstract—The conventional approaches for habitats mapping based on supervised algorithms need a seabed ground truth classes to know the entire seabed types before the training phase. These approaches give satisfying results only when a comprehensive training set is available. If the training set lacks a particular kind of seabed, it will be unknown for the classifier and the classification will be reduced to the closest known sediment class. In addition, it is not always feasible to have a ground truth samples and generally costs are very important. This is what, automated sonar systems classification are becoming widely used. This paper is concerned with automated discovery of seabed types in sonar images. A novel unsupervised approach based on competitive artificial neural network (CANN) for sidescan sonar images segmentation is proposed. The main idea is to create an unsupervised color table which allows linking between the class color and the physical nature of the seabed. This process is based on these steps. The first one consists on texture features extraction from sonar images. Secondly, Self-Organizing features maps (SOFM) algorithm is used to project the vector features on two dimensional map. Then principal component analysis (PCA) is applied to reduce the dimensionality of the result of SOFM map to only three components. The three axes obtained by PCA process will be present the RGB color table. The final result of the color table can be used for supervised or unsupervised classification of sidescan sonar images.

Brian Claus, Memorial University of Newfoundland, *Towards Navigation of Underwater Gliders in Seasonal Sea Ice*



Abstract—The suitability of the available navigational aids for underwater gliders for year round use in waters which experience seasonal sea ice is evaluated and a path towards an operational system on the Labrador Shelf is presented. The extent of ice coverage is generally found to be limited to the shelf areas and with a duration of up to 20 weeks. For a desired navigational accuracy of 100 meters over a potential trackline in from the shelf break and back out again, around 400 kilometers, a series of low frequency sound sources or geophysical navigational methods are proposed. Acoustic methods require more maintenance and are more prone to loss, while geophysical methods require additional evaluation in the operational region and potential digital elevation model refinement. A three phase strategy is proposed to enable under ice observations. The first phase involves operating the gliders in the ice free season over the proposed track-lines. This data collection phase would allow the evaluation of the available methods and build confidence for later under ice operations. The second phase involves the refinement of the available DEMs both bathymetric and magnetic to the degree that successful navigation by geophysical methods is achieved during the ice free season. Upon the success of the vehicles navigation without surface access during the ice free season, the third phase would commence, that of under ice observations.

Antonella Colucci, Univeristy of Exeter, *Investigating the Interaction of Waves and Currents from ADCP Field Data*



Abstract—This paper characterises wave and current fields at two different marine energy site with investigation of WCIs (wave current interactions) and turbulence. The features of a 5-beam ADCP are utilised whereby it is found to accurately measure wave spectra up to high frequencies as well as providing directional wave data. Deployments were conducted in 2010 and 2011 using a Teledyne RDI 5-beam ADCP (Acoustic Doppler Current Profiler) recording waves and currents at 2Hz at the North Cornwall Wave Hub site in the UK. While the one

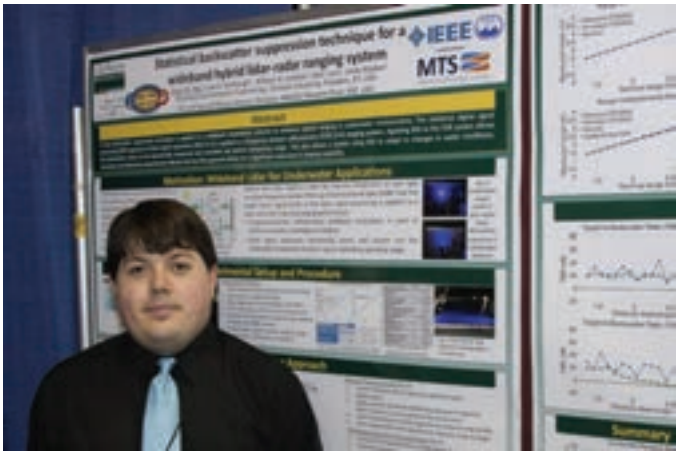
conventional four beam 600 kHz unit ADCP was deployment at The Pentland Firth off the North coast of Scotland in March 2013. Current velocity off the North Cornwall coast is influenced principally by the semi-diurnal variation in tidal flow and by the regular cycle of spring and neap tides, with a maximum of 1 m/s Current Magnitude. The interaction between waves and currents has been studied and the important of the direction angle between wave of current has been under light in order to find appreciate interaction in the site. In the second site up of Scotland there are completely different sea state with the current magnitude up of 5 m/s where it is shows clearly the Doppler Shift effect and the wave direction influenced by the current. Most places in the world we can safely assume that the water velocity we measure is predominantly a superposition of waves and currents, but in the Penland Firth, The new assumption is that the measured velocity is really a superposition of waves, currents and turbulence, it is fundamental to investigate for the design of Marine Energy Converters (MECs).

André Figueiredo, University of Porto, *Tracking Of An Underwater Visual Target With An Autonomous Surface Vehicle*

Abstract—This paper presents the development of a first approach to a vision-based target detection. The ultimate objective of this work is to position an autonomous surface vehicle relative to a target. Experiments in a controlled indoor environment were conducted to test the developed system. The experimental results are analyzed and show that the tracking performances achieve errors in the order of a few centimetres.

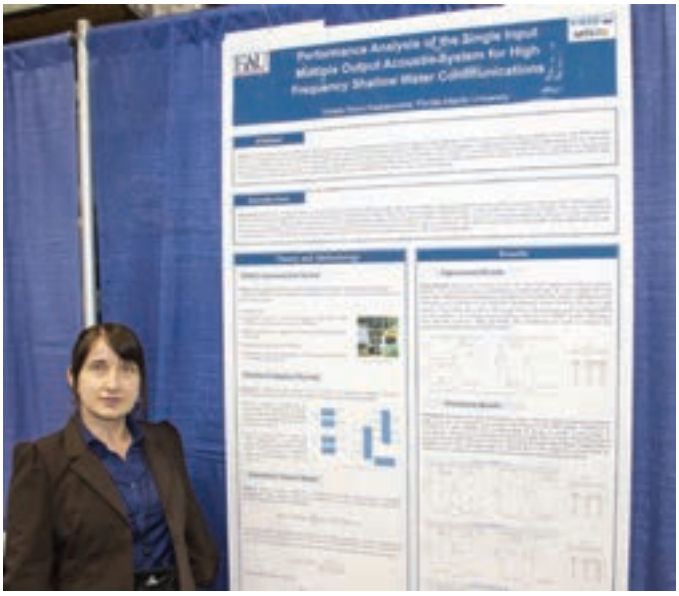
David Illig, Clarkson University, *Statistical Backscatter Suppression Technique For A Wideband Hybrid Lidar-Radar Ranging System*

Abstract—A new backscatter suppression technique is applied to a wideband modulation scheme to enhance optical ranging in underwater environments. The statistical digital



signal processing (DSP) approach of blind signal separation (BSS) [1-2] is applied to a frequency domain reflectometry (FDR) [3-4] ranging system. Applying BSS to the FDR system allows the backscatter return to be dynamically measured and cancelled out before computing range. Results from simulations and laboratory experiments are presented to demonstrate the combined FDR/BSS approach.

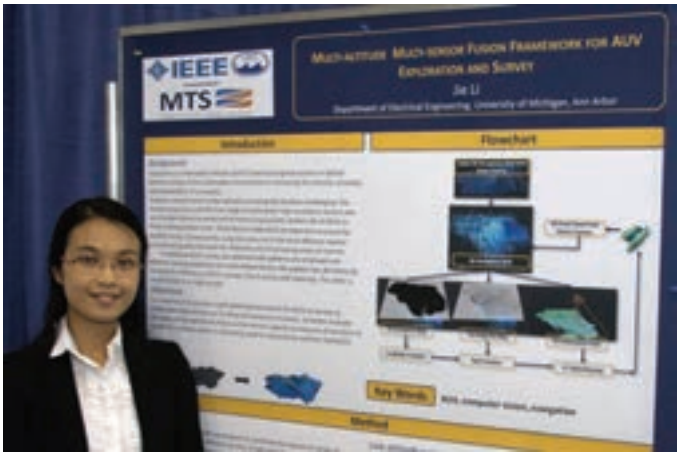
Violeta Skoro Kaskarovska, Florida Atlantic University, *Performance Analysis of the Single Input Multiple Output Acoustic System for High Frequency Shallow Water Communications*



Abstract—A Single Input Multiple Output (SIMO) acoustic communication system has been developed to improve high data rate communications at short range in the shallow water acoustic channel. The proposed communication system operates at very high frequency and combines an adaptive spatial diversity and parallel Decision Feedback Equalizer (DFE). Experimental results using selective combining with three, four and five receivers demonstrate ability to improve the quality of the acoustic channel in terms of Bit Error Rate (BER) and Signal-to- Noise-and-Interference Ratio (SNIR). The work presented in this article focuses on statistical evaluation of the proposed SIMO system using simulated data. For that purpose,

a simulation channel model is developed based on experimental channel model and Rician fading channel. Adaptive multilevel combining is performed on simulated messages with high individual BER before SIMO processing. The simulation results achieved with selective diversity and SIMO system with three, four and five receivers show that the BER and SNIR of the combined message improve dramatically, compared to the BER and SNIR of the individual message and demonstrate that the proposed SIMO system can significantly improve the reliability of the shallow water acoustic channel.

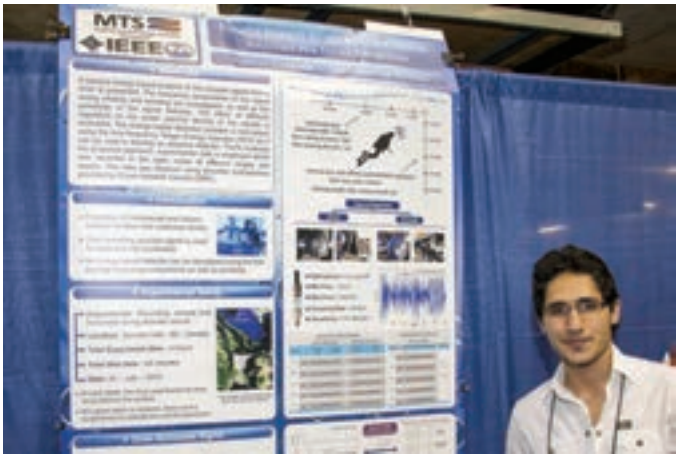
Jie Li, University of Michigan, *Multi-altitude Multi-sensor Fusion Framework for AUV Exploration and Survey*



Abstract—In this paper, we propose a path planning framework for underwater exploration and rugosity estimation using Autonomous Underwater Vehicles (AUVs). Rugosity, a measure of variation in the height of a surface, is commonly used to characterize seafloor habitat. The goal of this work is to optimize the survey of an unknown area in order to efficiently estimate its rugosity. To this end, we propose a novel rugosity approximation on 3D voxel grids and a novel framework for using that approximation to adaptively plan AUV paths. The proposed method employs a heterogeneous set of sensors – multibeam sonar and stereo cameras – whose varied resolution and range make them complimentary for this task. For broad-scale exploration, sonar is used to produce a coarse sense of the area's structure. Fine-scale exploration is completed using the stereo cameras to refine the high-resolution estimate of rugosity. Results display the simulation of two scenarios on real structural data gathered with an AUV and diver held sensor. The first scenario explores the situation where no broad-scale information is available and the robot must explore the terrain optically. The second simulates the two-pass case and demonstrates our method's ability to achieve high accuracy rugosity estimation faster than other survey planning approaches.

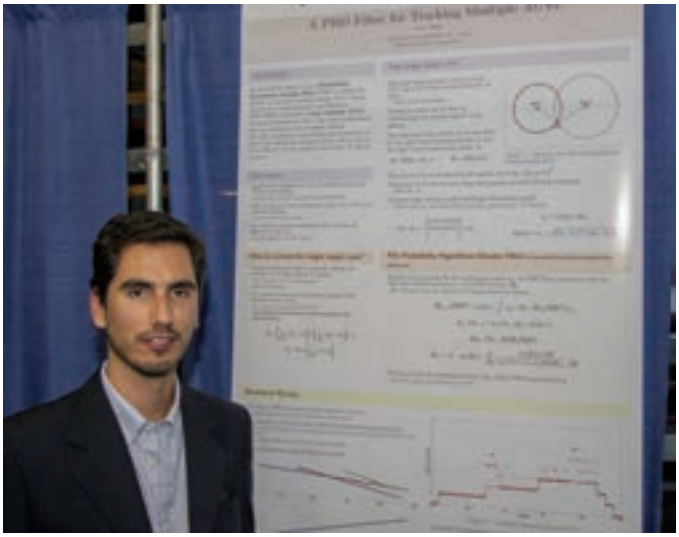
Hannan Lohrasbipeydeh, University of Victoria, *Passive Energy Based Acoustic Signal Analysis for Diver Detection*

Abstract—A passive energy based analysis of the acoustic signal from a diver is presented. The frequency components of the signal during inhaling and exhaling are investigated, as well as the periodicity of the signal features. The effect of different regulators



on the power spectral density of the signals is evaluated. The energy based detection problem is formulated using the timefrequency Teager Energy Operator (TEO) as it can be used to develop an adaptive detector. To evaluate the proposed approach, experimental data is employed which was recorded in the open ocean at different ranges and depths. This data was obtained using accurate hydrophones provided by Ocean Network Canada (ONC).

José Melo, University of Porto, *A PHD Filter for Tracking Multiple AUVs*



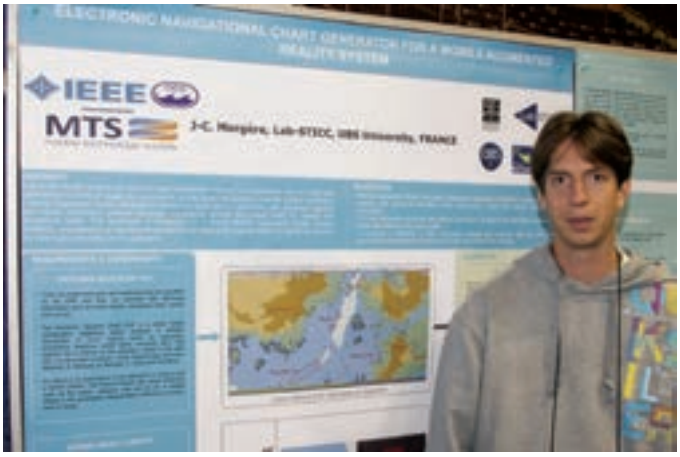
Abstract—In this paper we address the problem of tracking multiple AUVs using acoustic signals. Using For this challenging scenario, we propose to use a Probability Hypothesis Density Filter and present a suitable implementation of the Sequential Monte Carlo PHD filter. It will be demonstrated that a particle filter implementation of the aforementioned filter can be used to successfully track multiple AUVs, changing in number over time, using range measurements from the vehicles to a set of acoustic beacons. Simulation results will be presented that allow to evaluate the performance of the filter.

Tushar Mohan, Singapore University of Technology and Design, *Modular Autonomous Robotic Fish*

Abstract—The paper is subjected to a novel design of an autonomous biomimetic robotic fish. The novel approach

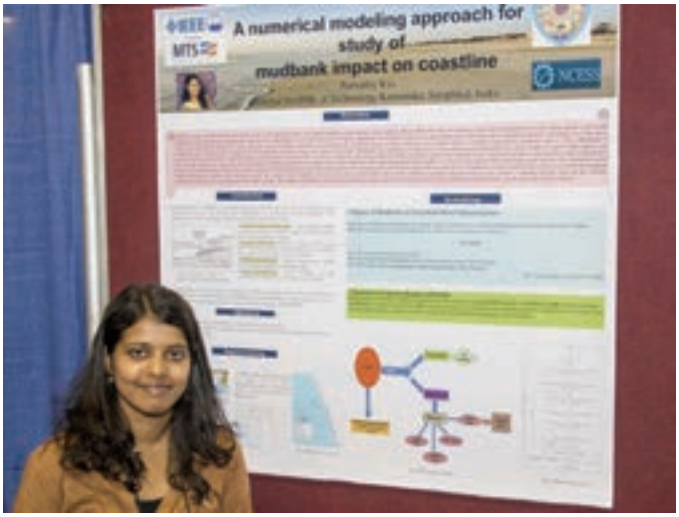
culminates in the usage of cable mechanics to mimic aquatic life form in specificity the Koi fish. This paper presents a holistic study and design architecture of the underwater robot. The modularity and accessibility of the design set it apart from any previous bio-mimicry experimentation or productization. This is chiefly due to the use of a polycarbonate spine maneuvered by a single servo motor and a separate module for the head to contain the microprocessor controlling the sensory data. Reduction of complexity for the common user and number of day to day underwater applications without disrupting the ecosystem are few of the real-world outcomes with the implementation of this principle of robotic fish.

Jean-Christophe Morgére, Telecom Bretagne, *Electronic Navigational Chart Generator for a Marine Mobile Augmented Reality System*



Abstract—Augmented Reality devices are about to reach mainstream markets but applications have to meet user expectations in terms of usage and ergonomics. In this paper, we present a real-life outdoor Marine Augmented Reality Navigational Assistance Application (MARNAA) that alleviates cognitive load issues (orientation between electronic navigational devices and bridge view) for vessels and recreational boats. First, we describe the current application and explain the requirements to draw relevant and meaningful objects. Secondly we present the 3D chart generator that extracts and provides the meaningful information to the application. Then, we detail our Marine Mobile Augmented Reality System (MMARS) and a generic architecture that can embeds MARNAA application. Finally, we present results and implementations.

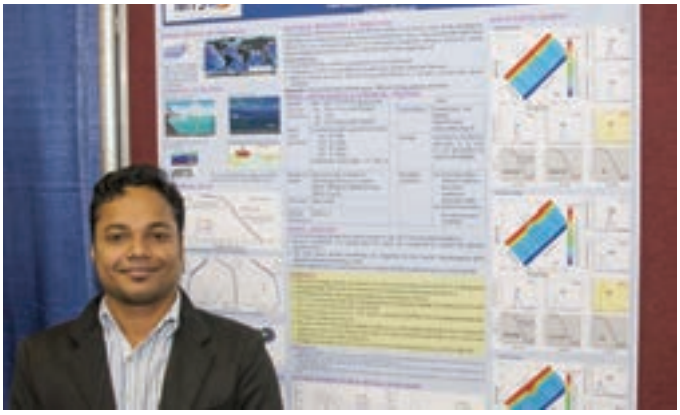
Parvathy K.G., National Institute of Technology Karnataka, *A Numerical Modeling Approach for Study of Mudbank Impact on Coastline*

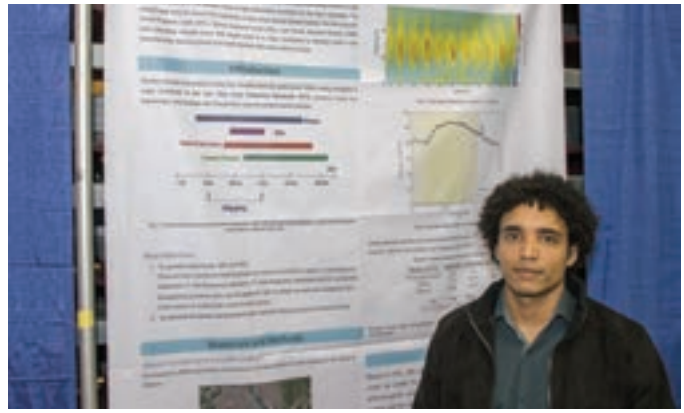


Abstract—Coastal zone is the triple interface of land, ocean and atmosphere. Any developmental activity along the coastal zone requires a clear understanding of the dynamic processes controlling its very existence. When most of the processes, which are common to all coastlines are quite well known, there are some localized, but important processes requiring further research for developmental planning. Mudbanks are such an inquisitive coastal phenomenon which occur only at a few locations in the nearshore waters of the world ocean. Mudbanks, its occurrence, nature, properties and characteristics are interesting subjects from engineering point of view. The objective of the study is to provide an insight of mudbank impact on coastal morphology through a numerical modeling approach. For a better understanding of the influence of mudbanks on coastal morphology, Munambam to Chettuwa sector of Thrissur coast, which is a part of Southwest coast of India, is considered. In the present study the description of coastline evolution due to impact of mudbank is calculated using LITLINE module of LITPACK software package. It is observed that the occurrence, non-occurrence and migration of mudbanks influence the coastal dynamics significantly along mudbank influenced coastal stretch of Kerala.

Himansu Pradhan, Indian Institute of Technology Delhi, *Internal Wave Simulation For Different Angles and shapes of continental shelf*

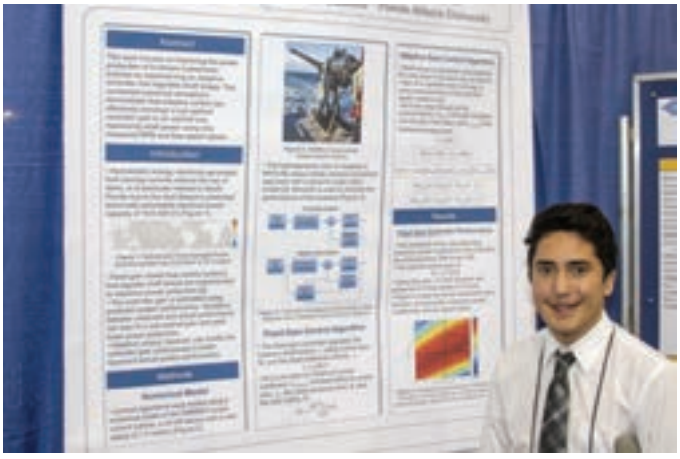
Abstract—The average slope of the continental shelf in the world ocean is 0.5° and its width varies considerably. This paper illustrates experimental studies describing the internal wave run-up on different gradients of continental shelf varying from 0.2° to 0.5°. MIT general circulation model is configured with a variable grid, tidal information in the momentum equations and background stratification of density as initial fields to simulate internal waves. The model simulated density and temperature





time-series is subjected to Fast Fourier Transform to compute the energy spectra of internal waves. The results reveal that the peak of internal wave activity varies spatially for different angles of the continental shelf. The experiments are further continued for concave coastline geometry to look at the internal wave energy distribution over the shelf. The results show that in a concave coastline the energy is large compared to a straight coastline inferring convergence of internal wave energy.

Juan Ramirez, Florida Atlantic University, *Adaptive Torque Control of In-Stream Hydrokinetic Turbines*

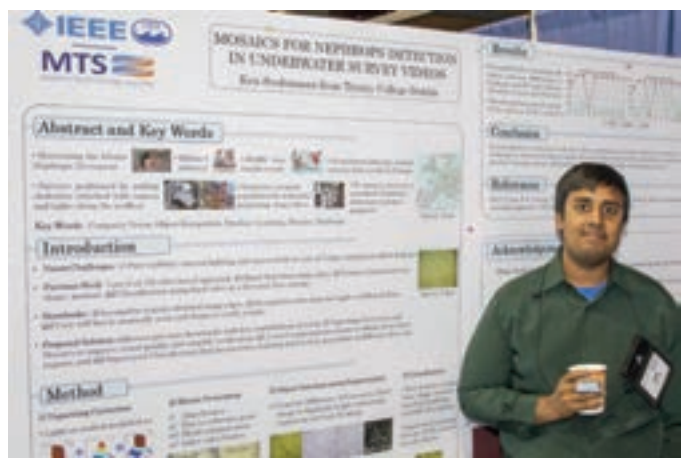


Abstract —In-stream hydrokinetic turbines, devices that generate electrical power from moving currentswithout the use of dams, have the potential to significantly impact the electrical power portfolio of many countries. This work focuses on improving the power production of in-stream hydrokinetic turbines by implementing an adaptive controller that regulates shaft torque. This controller is evaluated using a numerical rotor simulation that utilizes a blade element momentum approach with a dynamic wake in-flow model. The conducted numerical simulations demonstrate that adaptive control can effectively converge a sub-optimal controller gain to an optimal one that maximizes shaft power using only measured RPM and flow speed values.

Ignacio Sánchez-Gendriz, University of Sao Paulo, *Harbor Sound Level Estimation For Assessment Of Underwater Ship Noise*

Abstract—It is well known that rising anthropogenic underwater noise has chronic impacts on marine fauna. Since the contribution of navigation is particularly important to this kind of noise, areas near big harbors can be critically affected. One case of great environmental concernis the Port of Santos, the largest harbor in Latin America that, additionally, is expected to be expanded. The port is located on the brazilian southeast coast, a region with rich marine biodiversity including marine mammals, close to two marine conservation areas. Although evaluating impacts of ship noise in the area is a true concern, there is little information available on the topic nowadays. In this context, the present work aims to assess the magnitude of ship noise in a delimited geographical area around Santos harbor. For this purpose, Sound Pressure Level (SPL), Sound Exposure Level (SEL), and Power Spectral Density (PSD) were calculated. The SPL and SEL were similar to levels reported from other studied regions, reaching values that could interfere with some marine species. Results show that vessels noise is a major contributor to the ambient noise in the area assessed.

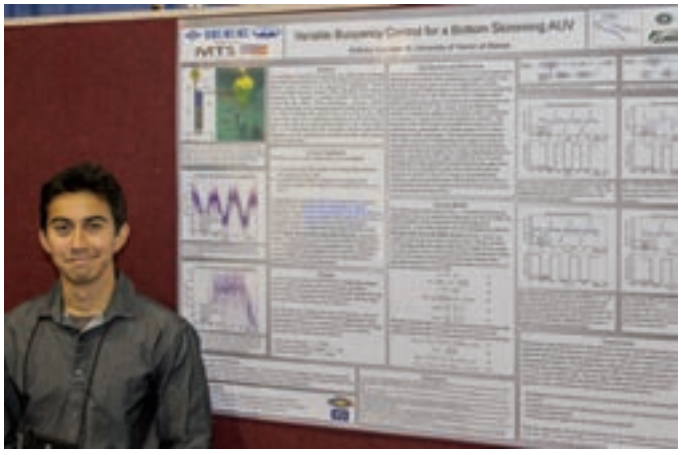
Ken Sooknanan, Trinity College Dublin, *Mosaics For Nephrops Detection in Underwater Survey Videos*



Abstract—Harvesting the commercially significant lobster, Nephrops norvegicus, is a multimillion dollar industry in Europe. Stock assessment is essential for maintaining this activity but it is conducted by manually inspecting hours of underwater surveillance videos. To improve this tedious process, we propose an automated procedure. This procedure uses mosaics for detecting the Nephrops, which improves visibility and reduces the tedious video inspection process to the

browsing of a single image. In addition to this novel application approach, key contributions are made for handling the difficult lighting conditions in these kinds of videos. Mosaics are built using 1-10 minutes of footage and candidate Nephrops regions are selected using image segmentation based on local image contrast and colour features. A K-Nearest Neighbour classifier is then used to select the respective Nephrops from these candidate regions. Our final decision accuracy at 87.5% recall and precision shows a corresponding 31.5% and 79.4% improvement compared with previous work.

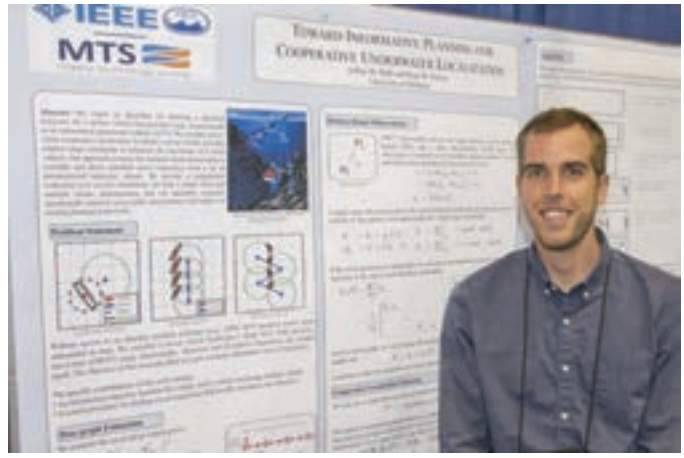
Anthony Sylvester, University of Hawaii at Monoa, *Variable Buoyancy Control for a Bottom Skimming Autonomous Underwater Vehicle*



Abstract—Two feedback controllers are presented that utilize data averaging and model-based estimation to offset the effects of sensor noise and achieve precise control of an autonomous underwater vehicle (AUV) variable buoyancy system (VBS). Operation of the bottom skimming AUV requires a constant reaction force between the seabed and the vehicle. While performing a mission, variable seafloor topography and a changing payload weight requires the use of a VBS to maintain the reaction force. Two traits of the VBS system that make this a challenging problem are the presence of sensor noise and fast on/off actuation relative to the sensor update rate. It was discovered that both controllers function under these conditions but the model-based controller provides more precise control of the system. This paper presents a comparison between these two control algorithms based on both simulation results and field experiments in a coastal environment.

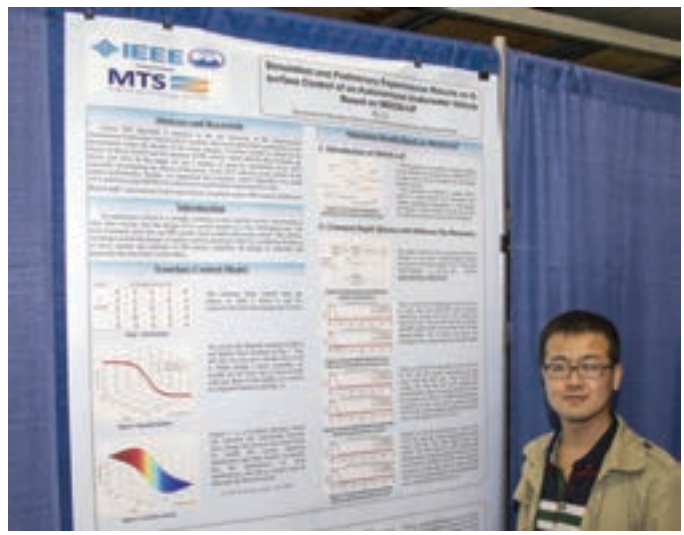
Jeffrey Walls, University of Michigan, *Toward Informative Planning for Cooperative Underwater Localization*

Abstract—This paper reports on an algorithm for planning a practical trajectory for a surface vehicle that provides range measurements to an autonomous underwater vehicle (AUV). We consider server-client cooperative localization in which a server vehicle provides relative range constraints to minimize the uncertainty of a client vehicle. Our approach assumes the nominal client mission plan is available and draws potential server trajectories from a set of parameterized trajectory



classes. We provide a comparative evaluation over several simulations, for both a single client and multiple clients, demonstrating that our algorithm computes operationally practical server paths and performs well relative to existing planning frameworks.

Bo Li, Zhejiang University, *Simulation and Preliminary Experimental Results on S-surface Control of an Autonomous Underwater Vehicle Based on MOOS-IvP*



Abstract—Classic PID algorithm is sensitive to the net buoyancy in the underactuated Autonomous Underwater Vehicle (AUV) control, and can be particularly problematic in the environment where the density of the water changes. S-surface control is based on the theory of fuzzy control and the structure of PD control, which shall be able to handle the above case well. It also simplifies the design of the controller and can improve the performance of non-linear control. In this paper, we test a number of cases by simulations of an underactuated AUV, especially investigating the effects of buoyancy of the AUV and the ocean current on the control performance. Further, we implement the S-surface control algorithm on a small AUV platform using MOOS-IvP, and present a preliminary experiment in a lake. The results show that the S-surface control has better performance compared to the PID in the case that the net buoyancy changes.

INTERNATIONAL SYMPOSIUM ON UNDERWATER TECHNOLOGY 2015

FEBRUARY 23-25, 2015

National Institute of Ocean Technology, Chennai, India Sustainable Technology Development for Ocean

National Institute of Ocean Technology (NIOT) was established during 1993 as an autonomous society under the Ministry of Earth Sciences, Government of India. The mandate of NIOT is to develop reliable indigenous technologies to solve the various engineering problems associated with harvesting of non-living and living resources in the Indian Exclusive Economic Zone (EEZ). Also to provide competitive, value added technical services and solutions to develop a knowledge base and institutional capabilities in India for management of ocean resources and environment.

The symposium is being organized by IEEE/OES, IEEE/OES Japan Chapter and IEEE/OES India Council. The vision for this symposium is to provide a thematic umbrella for the researchers working in underwater systems across world to discuss the problems and potential long term solutions that concern not only the Indian Ocean regional countries, but the world ocean in general.

The abstract submission page is now open. Do not miss the chance to attend the symposium !

http://www.niot.res.in/UT15/

THEMES OF THE SYMPOSIUM

The symposium consists of keynote talks, double-track technical sessions and poster sessions. It will feature advanced underwater technology and its applications. Topics for oral and poster presentation are:

- Underwater Vehicles
- Ocean Resources – Energy – Gas hydrates – Fresh water
- Ocean Mining
- Ocean Observation Systems
- Ocean Acoustics and Applications
- Marine Sensors / Optical sensors / Bio-sensors / Survey Equipment
- Special Theme: Ambient Noise Underwater Navigation and Communication systems

Important Dates

- Deadline for Abstract Submission November 15, 2014
- Notification of Acceptance December 5, 2014
- Deadline for Paper Submission January 5, 2015
- Registration January 31, 2015
- Symposium Dates February 23-25, 2015

A Report on the Singapore Autonomous Underwater Vehicle Challenge 2014 (SAUVC-2014)

Pallayil Venugopalan

The Singapore AUV Challenge 2014 was organised from 14th–16th Mar 2014 at the Olympic size swimming pool of Nanyang Technological University, Singapore. IEEE OES Singapore Chapter led the event with National University of Singapore, DSO National Laboratories and CENSAM, Singapore-MIT Alliance Research & Technology (SMART) as co-organisers. Ten teams from various parts of the region registered for the competition initially. However, only four teams, two local and two from overseas, showed up for the competition as some of the teams faced problems with travel grants availability and also technical problems with their AUVs at the last minute. The teams who participated were the Bumble Bee team from the National University of Singapore (NUS), the Lucy AUV team from Singapore Polytechnic (SP), Naughty Boy AUV team from the University Sains Malaysia (USM) and Ceaser AUV team from the St. George's School, Canada (SGS).

The AUVs were required to complete various tasks (see Figure 1) including submerging autonomously from a start zone, passing through a rectangular gate located 8m from the start zone, dropping a ball into a basin kept on the floor of swimming pool, bumping against a flare and dropping a ball and finally navigating autonomously to surface in a designated zone. The AUVs were permitted to navigate optically or acoustically to achieve the specified tasks. The route from start point to the flare was marked with a black line on the floor of the swimming pool; there was no marking from the flare to the 'surfacing zone'. Points were awarded when the AUV completed each of the tasks and the team with the maximum number of points in the shortest time was declared as the winner. A time limit of ten minutes was imposed on each team to complete all the tasks. The complete rulebook is available on the website www.sauvc.org.

Dr Bill Kirkwood, Senior R&D Engineer from MBARI was the IEEE OES representative and Chief Guest at the event. Dr Bill gave a talk on the AUV technologies related work at MBARI immediately after Chairman's opening remarks. This

Students from the St. George's High School Canada sharing their AUV design.

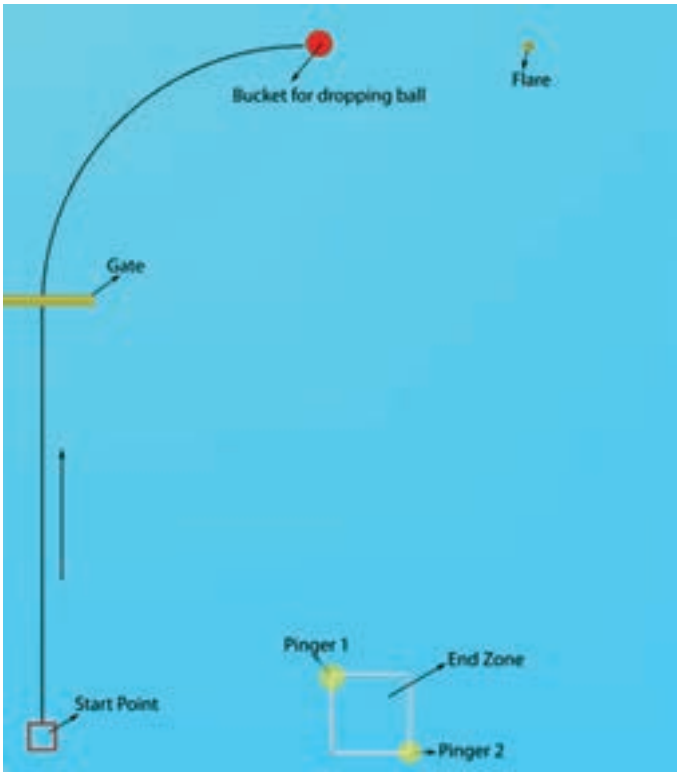


Fig. 1—Game plan showing the various tasks the AUV was required to complete. Each task carried points and the team with maximum number of points with shortest time was selected as the winner.

Team Bumble Bee, the winners of SAUVC2014, with their AUV.

Fig. 2—The USM team during prize presentation ceremony.

Bill Kirkwood interacting with the team from Singapore Polytechnic.

was followed by the team introduction and presentations by the team members on their AUV designs. A special video recording session was organised where the students shared their experiences and challenges faced during the course of their AUV design. Dr Bill gave away prizes for the winners at a concluding BBQ function held near the Acoustic Research Laboratory, National University of Singapore.

The successful conduct of the competition was largely due to the support received from many organisations, both in Singapore and from overseas. The organising committee wish to express our sincere gratitude to all the following sponsors and supporters:

- Office of Naval Research (Global)
- ATLAS ELECTRONIK GmbH, Germany
- IEEE Oceanic Engineering Society, USA
- Thales Solutions Asia Pte Ltd, Singapore
- EvoLogics GmbH, Germany
- National University of Singapore
- Liquid Robotics, USA
- CENSAM, Singapore-MIT Alliance for Research & Technology
- ST Electronics, a company of ST Engineering
- National Instruments (Singapore) Pte Ltd
- Nanyang Technological University, Singapore

The next AUV competition, the Singapore AUV Challenge 2015, will be organised at the Singapore Polytechnic's Olympic size swimming pool from 6th-8th Mar 2015. We have about 18 teams registered for the competition so far and we hope to have an exciting competition. Details about the competition can be found at our website *www.sauvc.org*.

OES Supports Women in Engineering

Marinna Martini, OES Women in Engineering Coordinator

IEEE Women in Engineering is an organization within the IEEE to to facilitate the global recruitment and retention of women in technical disciplines.OES is just one of many IEEE Societies who designate liaisons to WIE.OES has been exploring how it can help WIE acheive its mission.Students seemed like a good place to start.OES has funded students to attend it's premier OCEANS conference.Our latest candidate writes about her experience.Keep an eye on WIE's web page and Facebook stream for future OCEANS opportunities. For more information about WIE, visit http://www.ieee.org/women.

I am so thankful for the opportunity to attend the OCEANS Conference! I have been involved in research in the Underwater Sensor Network Laboratory at the University of Connecticut for the past year and a half. My research there has included working with the localization of unmanned underwater vehicles and ranging between acoustic modems. I was very excited at the prospect of attending the conference to learn more about emerging technologies in underwater research from graduate students, professors, and professionals from all over the world.

The conference included a wide range of technical sessions and an exhibitor's hall, as well as some social events. Many of the technical sessions were quite interesting. I chose to attend several sessions on underwater vehicle localization and navigation as well as air/sea interaction, iceberg localization, and underwater communications. I enjoyed perusing the many exhibitor tables and collecting information about various types of underwater vehicles, modems, and other equipment as well as oceanic engineering publications and societies. I especially enjoyed the privilege of meeting and conversing with leaders from the IEEE Oceanic Engineering Society and IEEE Women in Engineering as well as representatives from companies such as Teledyne Benthos and Ocean Aero. In addition, I was able to question some graduate students about their work with the localization and tracking of underwater vehicles. Everyone I talked to was very friendly and excited to share their experiences with me. The food at the luncheons and Gala Dinner was delicious and these events afforded great networking opportunities. I thoroughly enjoyed the conference and my stay amidst the beautiful scenery of Newfoundland!

Katherine Domrese at the top of Signal Hill in St. Johns overlooking the harbor. Katherine was invited to the conference by OES and shares her experiences here.

The Fisheries and Marine Institute—On the Edge of Opportunity

Leslie Earle

Students looking for an edge in their careers continue to find it at the Fisheries and Marine Institute of Memorial University of Newfoundland based in St. John's, Newfoundland and Labrador, Canada. They find this edge not just because the institution's main campus is located on the rugged western edge of the North Atlantic, but because the Marine Institute is one of the most comprehensive marine educational and applied research facilities in the world. What began fifty years ago as the College of Fisheries, Navigation, Marine Engineering and Electronics is today a leader in marine and ocean-related career education and research.

Whether students have an interest in preserving waterways, working on a ship, or applying their expertise in food safety, the opportunities are abundant. That is a key reason why more than 9000 academic and industrial program students enrolled at the Institute in 2012–2013. The credentials students earn at the Marine Institute are recognized around the world.

The Institute offers 20 industry-driven programs ranging from technical certificates to master's degrees through three schools—the School of Fisheries, the School of Maritime Studies, and the School of Ocean Technology. Students enrolled in the School of Fisheries are focused on aquaculture, fishing, marine environmental and food industries. The School of Maritime Studies offers education and training in the operation and design of ships and associated systems while the Institute's

School of Ocean Technology develops and delivers education, training, applied research and development programs in various aspects of ocean technology, such as ocean instrumentation, underwater vehicles, and ocean mapping.

Today, the Marine Institute's alumni are working around the world in the fields of marine transportation, firefighting, food technology, water quality, aquaculture and the protection of coastal environments. Recent graduates are also working with remotely operated vehicles and mapping the ocean using the latest technology.

It doesn't stop there though. The Institute is also making its mark internationally. Through MI International, the Institute engages in development projects, contract training and consultancies across the globe varying in size and length from short consultations to multi-year, multi-partner projects. The Institute's Bachelor of Technology Program is now being delivered in China and the team is looking to expand its programs to other countries.

In addition to providing comprehensive education and training programs, the Institute is proud to work with industry partners on applied research and development, and technology transfer initiatives. In fact, much of the Institute's success is founded on solid industry partnerships and collaborations to meet the ever-changing needs of the industry.

A student gets hands-on experience with a Remotely Operated Vehicle (ROV) in the Marine Institute's Flume Tank. The Flume Tank is the largest in the world and is used to carry out performance evaluations, gear tests and other observations on newly developed or existing fishing gears and other related equipment in simulated underwater and near surface conditions.

The Marine Institute's Full Mission Ship's Bridge Simulator is used to replicate operations conducted on a ship's navigation bridge. The simulator is mounted on a six degree of freedom (DOF) aviation motion base and is one of two full-motion ship's bridge simulators in the world.

The Institute is blessed with some unique and technologically advanced facilities focused on marine training and research. The students, faculty and industry partners are the beneficiaries of these facilities, including the world's largest flume tank, one of the most comprehensive suites of marine simulation capabilities in the world, modern aquaculture research laboratories, food pilot plant facilities and one of the largest and internationally recognized marine safety and emergency response facilities in the world.

In addition to its main campus, the Institute boasts four additional training facilities across the province of Newfoundland and Labrador where students participate in helicopter underwater escape training in a pool that can simulate storm conditions, controlling and extinguishing shipboard fires, practical ocean survival training and marine and industrial safety and emergency response training.

It's a big world and MI helps students get to the center of it. But don't just take our word for it. Look no further than our graduates around the world who are employed and making a difference in their chosen careers.

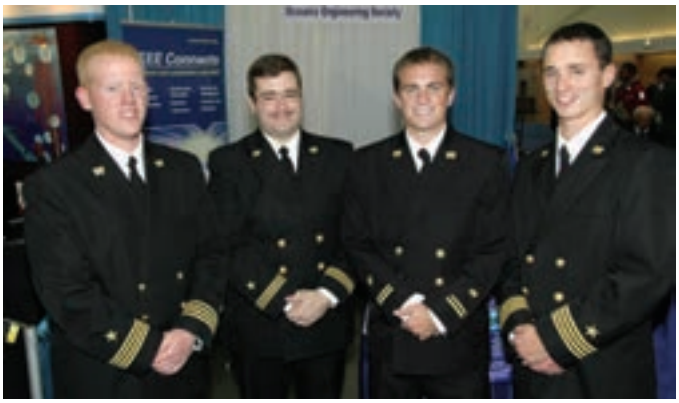
Massachusetts Maritime Supports Oceans Conference for 9 Years

John Danby

Oceans '14 St. Johns was the 9th year that the cadets from Massachusetts Maritime Academy (MMA) have volunteered in support of the conference. Student involvement began in 2006 when the conference was in Boston. Under the guidance of engineering professor Diane DiMassa, 4 cadets have served as volunteers at the conference doing tasks such as assisting in the registration booth, providing directions, collecting tickets to events, giving tours of the exhibit hall to high school students, and aiding in the behind-the-scenes administration of the conference. One year the engineering students were even called upon to fix the sole printer at the on-site registration desk.

Massachusetts Maritime Academy is a fully accredited, four year, co-educational state university, located on Cape Cod, at the mouth of the scenic Cape Cod Canal. The Academy offers Bachelor and Master of Science degrees that are highly

Cadets at OCEANS 14 in St. Johns, Canada. Alex Geist, Jillian Stronk, Sarah Lewis, Gale McGilvray.



Cadets at OCEANS 07 in Vancouver, Canada. William Campbell, Nathaniel Munafo, John Van Dolson, Brandon Kent.

regarded in the world-wide maritime industry and beyond. The schools motto at one time was Learn-Do-Learn emphasizing the importance of the internship and apprenticeship programs that are required parts of every degree. While that strong industry experience is still a major part of the education, the current motto is Discipline, Knowledge, Leadership.

Discipline: The Regiment of Cadets and military-style uniforms play an important role in campus life at Massachusetts Maritime Academy; however, only cadets who volunteer for commissioning programs have military obligations during and after their time at MMA.

Leadership: The campus is equipped with state-of-the-art technology to train the next generation of engineers, and the facilities are expanding all the time. The Academy is also a leader in green energy having its own wind turbine on campus, solar panels atop the dormitories, and a LEED Gold certified information commons/ library that also houses the 360 bridge simulator. All students are also required to participate in leadership classes conducted by the regimental staff.

Knowledge: In addition to the rigorous academic requirements (minimum of 127.5 credits for engineers), all graduates log a minimum of 6 months of career experience through sea terms or internships. Engineering students are required to have at least 3 independent experiences and the Academy is always looking for new companies to collaborate.

Vision: The new **Bachelor of Science in Energy Systems Engineering** program is the third undergraduate engineering degree to be offered at MMA and began in fall 2012 with the class of 2016. This program will prepare graduates for careers in the many varied segments of the fast growing energy industry that support the generation, management and distribution of electrical power. The curriculum is designed to include all aspects of the energy sector – from the mainstay oil and gas industry to the new developments in alternative energy such as wave, tidal, and wind.

Full-Mission 360-degree Ship Simulator.

Massachusetts Maritime Academy is proud to support the IEEE Oceanic Engineering Society!

Japan Chapter Hosts Underwater Robot Convention

Kenichi Asakawa, Senior Member

About 150 people gathered and enjoyed the 2014 Underwater Robot Convention in JAMSTEC held this summer, one of the most productive and exciting underwater robot conventions ever held in Japan, exhibiting the flourishing progress underway this field.

Twice every year since 2006, the IEEE OES Japan Chapter has co-sponsored underwater robot conventions and underwater robot festivals in Japan. This was the 20th Convention/Festival in Japan. The number of teams has increased gradually: this year, 27 teams participated in the convention. In fact, this year it became an *international* convention because one team from Taiwan participated. The convention was held on August 30 and 31 at the Japan Agency for Marine–Earth Science and Technology near Tokyo.

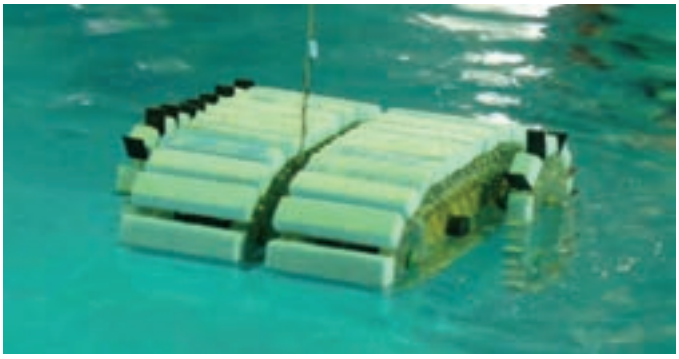
The convention hosted three divisions. In the AUV division, AUVs competed to exhibit their intelligent and dynamic

A group photograph, showing all the participants.

The opening ceremony was held poolside.

All participants took part in the workshop, with mutual communication and discussion.

The National Taiwan University team UVLAB, led by Prof. Jen-Hwa Guo, was awarded First Prize. They achieved the challenges perfectly and drew everyone's applause.



A crawler-type robot produced by the Tokyo High School of Science and Technology team, MT4, was awarded First Prize.

performance. Eleven AUVs took part in the competition, following a red line laid on the floor of the pool, passing through a gate, touching a balloon, and finally touching down on a plate. The team from Taiwan was declared the winner.

The second division included underwater robots of every kind: ROVs, bio-mimic robots, and crawler-type robots. Participants demonstrated their products in the pool and competed in terms of performance and originality. Eleven teams displayed their own robots. A wide range of amateurs and specialists, from middle-school students to engineers, participated in the exhibitions.

The third division, an underwater robot classroom, was intended especially for junior and high school students. The object of this class was to provide opportunities for young students to experience the fun of constructing underwater robots. Six teams took part in the classroom. Each team assembled their own mini-ROV using an ROV-kit on the first day. On the next day, they mutually competed to pick up cans from the floor of the pool.

On the evening of the first day, a workshop was held in which each team presented their products. They also explained the features of their robots using a loudspeaker while competing in the pool on the second day.

Another underwater robot competition in Japan was held in Kobe as a part of Techno-Ocean 2014 in October. This competition was introduced in another report of Techno-Ocean2014-Kobe by Blair Thornton.

These underwater robot conventions/competition were co-sponsored not only by IEEE-OES Japan Chapter but also by other bodies including NPO Japan Underwater Robot Network, JAMSTEC, MTS Japan Section, Techno-Ocean Network, Office of Naval Research Global and the Japan Society of Naval Architects and Ocean Engineers. These events, which have an eight year history, are still growing today.

OES Awards Student Scholarship

OES recently awarded a student scholarship to Murat Aykin, a PhD candidate at the University of Miami. The following statement was written by the scholarship recipient describing his background, work, academic interests, and plans for the future.

Personal statement by scholarship recipient Murat Aykin

Both my parent's being electrical engineers, my curiosity and fascination about technological advancements section of any science magazine as a child, and having a solid education on a math and science oriented program during high school years led my path toward pursuing an engineering degree at Middle East Technical University (METU), a research institution in Turkey, from where I graduated as a valedictorian in 2006.

In my Master's studies at METU I focused on robot vision, signal processing, and camera systems. I attended lectures that furthered my skills and knowledge in areas of robotics and vision. As a teaching assistant, I worked with the seniors at the process control laboratory. As a graduate student, I worked on the RHex project which unites a group of 20 researchers from Bilkent University, another research university in Turkey, METU's Electrical and Mechanical Engineering Departments, and private companies like Yenel Electronics. The necessity of a ground truth system for an accurate experimental evaluation of the six legged robotic platform (RHex) directed me to focus my work on a multi camera setup. I wrote an MS thesis on efficient calibration of a multi-camera measurement system using a target with known dynamics. In my thesis, the problem of procedurally effective and high performance calibration of such a system is considered.

At Stanford University, I received a second Master's Degree. I solidified my applied mathematics and computer programming skills by attending a variety of courses on signal processing, computer vision, two-dimensional imaging, machine learning, linear dynamical systems, convex optimization, and approximate dynamic programming. Challenging class projects such as detection of door handles from 3D point cloud images obtained by a visible light laser (machine learning),face/event recognition methods to play a Wii game (computer vision), and testing of a simulator for ultrasound imaging (two dimensional imaging) pruned and improved my independent research skills.

Currently I am continuing my PhD education at the University of Miami. Given my earlier vision related background it was natural for me to quickly get involved with a distinguished faculty in the area, Professor Shahriar Negahdaripour. It has been a privilege to have the opportunity to work within his underwater vision and imaging laboratory to research the image formation principles of the state-of-the art high-resolution forward-looking sonar systems and to develop algorithms on image registration, mosaicing, and 3-D reconstruction.

Personal and Professional Goals

Throughout my middle and high school years, besides my course work, I read almost all of the books of the world's maestro of science fiction, Isaac Asimov. His Three Laws of Robotics attracted my attention and imagination. I found myself seized by his fascinating robot stories and gradually realized that I was craving to become an expert in artificial

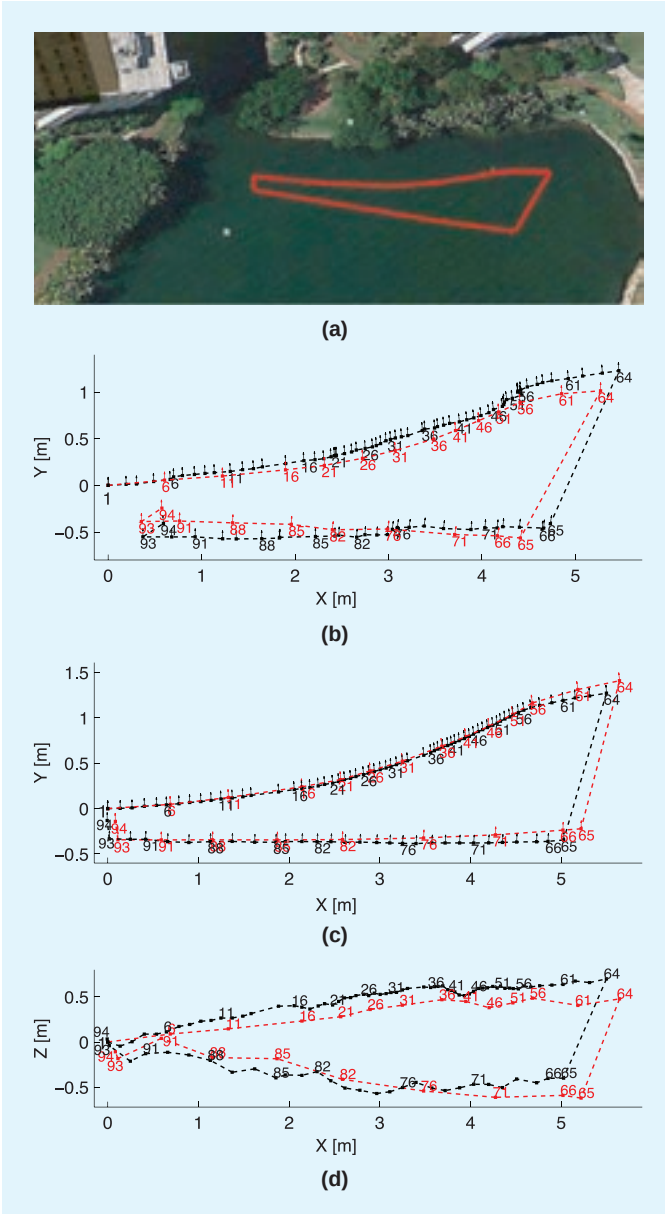


Fig. 1—(a) On an image (Google Earth, 2012) of Osceola Lake at UM, the approximate region where the data were collected is marked by red. (b) Trajectories obtained with the state-of-the-art method deviates about 0.71 [m] from expected. (c, d) Trajectories computed with our registration method are nearly closed paths as expected. Final deviation is only about 0.13 [m].

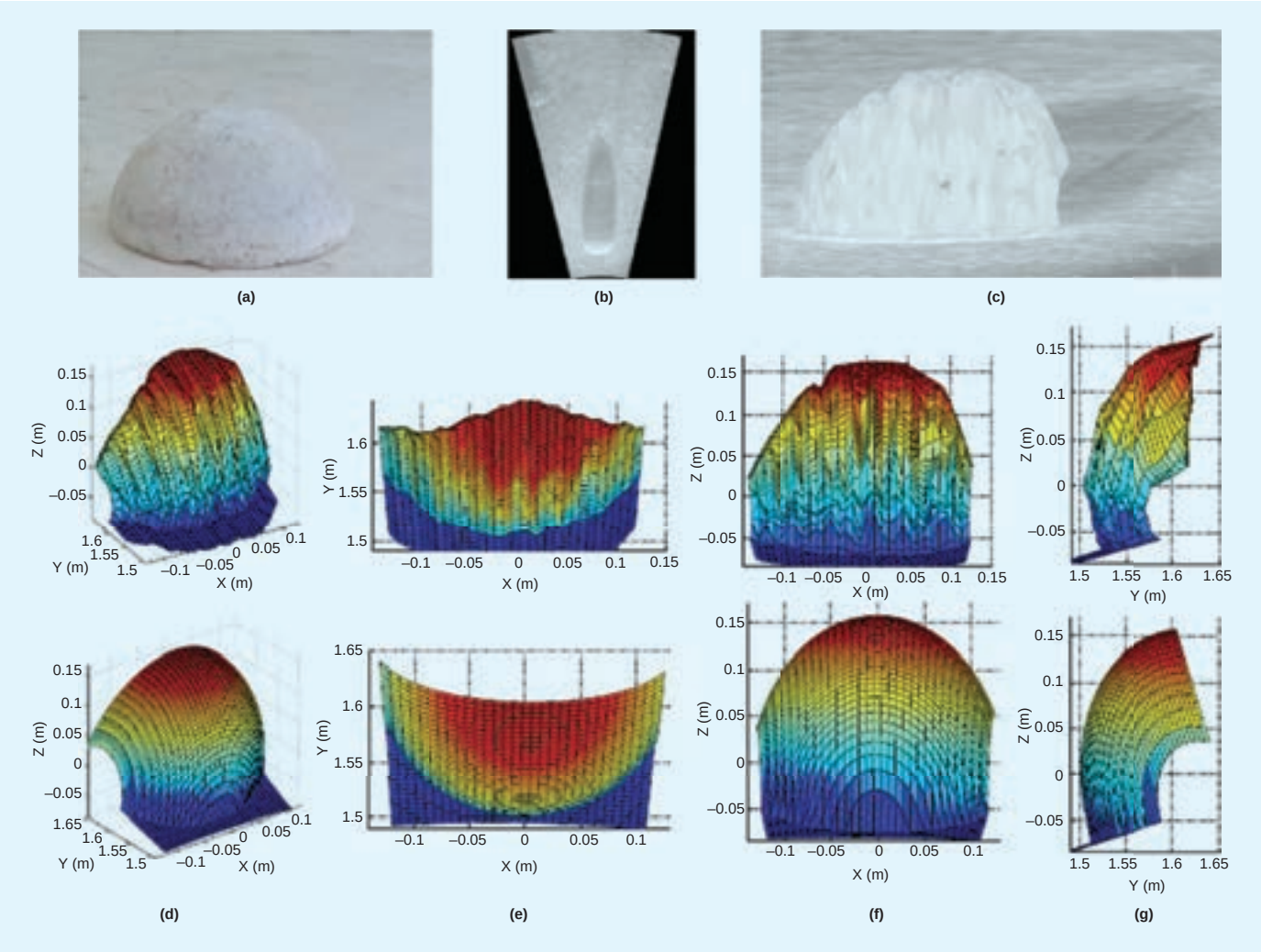


Fig. 2—Reconstruction of hemi-sphere. (a) Hemi-spherical rock. (b) DIDSON image of hemi-sphere. (c) Reconstructed hemi-sphere. (d-g) Projections of 3–D reconstruction for hemi-spherical target are compared to object model (bottom).

intelligence and humanoid robots. I do feel the developments in robot vision, pattern recognition and path planning will enable robotics to be as important in the future as the steam engines were to the 19th Century. Robots will revolutionize manufacturing and service systems, ocean and space exploration, medicine, human services, and even education. My main goal is to further advance my analytical skills and creative abilities in order to develop new technologies that will enhance productivity, boost safety, and improve living conditions.

I am increasingly fascinated by the fact that most feedback we receive from our surroundings happens as a result of a wave-propagation phenomenon. Light and sound waves or *signals* are essential for us to interact with our environment, our world and the universe. Understanding the nature of this information transfer process is an enormous passion for me. Thanks to the rapid advancement in electrical technology, today we can form images, not only through the propagation of visible light, but also within the whole electromagnetic spectrum and through propagation of sound, heat, and even electrons. I believe in a broad sense, *vision* will become more crucial for robotic exploration than it has been for humans.

My graduate education has given me the opportunity to

1) work with a distinguished expert in underwater image processing and computer vision, namely Professor Shahriar Negahdaripour, who I take not only as my mentor but also as a role model;
2) interact with a number of technology leaders at both the University of Miami (UM) and Stanford University.

The unique experiences and exposure to education at these two leading research universities with distinct and distinguished missions, as well as research in an area on the frontiers of technology have equipped me with the knowledge and skills for my life-long passion to become a cutting edge research leader in a field with a key impact on science, technology, and society at large. I envision doing so as a research team leader, either as a faculty member at a research university or within a company specialized in robot vision applications for underwater.

Areas of Oceanic Engineering of Interest to you

I am interested in signal processing and the application of computer vision to underwater technologies. In my PhD dissertation work, I am exploring problems dealing with the development of algorithmic methods for sonar image understanding and interpretation, video registration, and determining the shape of natural and manmade objects.

It is well-known that optical cameras generally suffer from low visibility in turbid waters, i.e., rivers, lakes, marine sanctuaries, ports, and therefore, alternative sonar systems can be our eyes under turbidity. In my work, I have focused my research on the recent generations of high-frequency, high-resolution forward-scan sonar systems, such as, DIDSON and BlueView, which are of special interest for a range of applications in marine sciences, namely, fisheries, archeology and geophysics, as well as inspection and surveillance. Working on such an innovative technology enables my research to have a direct impact on a variety of marine studies such as building environmental maps and mosaics to study the ecological patterns and dynamics of underwater ecosystem; fish/target tracking, obstacle avoidance, path planning and positioning for AUVs; inspection of man-made structures such as ship hulls, pipelines and underwater archeological sites.

I had the opportunity to publish a journal paper, entitled "On Feature Matching and Image Registration for Two-dimensional Forward-scan Sonar Imaging" with Prof. Negahdaripour in Journal of Field Robotics. In this work we present a novel method for forward-look sonar image registration by employing a more accurate motion transformation representation. Our formulation allows estimation of vertical motion (i.e. along z-axis), which is not possible with earlier similarity based methods that assume in-the-plane motion. As shown in Figure 1, over a long, closed (i.e. start and end points are the same) DIDSON sequence captured on Osceola Lake at UM, trajectory estimation by our method provides much less deviation at the final position. In Figure 1(a) the approximate trajectory is marked on a picture taken from Google Earth. The trajectory computed by matching 94 frames (black) for the similarity based state-of-the-art is given in (b) where the estimated path ends about 0.71 [m] away from the origin whereas our method results in only about 0.13 [m] total deviation as shown in (c) and (d). Furthermore, the smoother X-Y trajectory displayed in (c) is more consistent with the executed sonar motion. The experiments are repeated by skipping some frames to reduce the overlap (equivalent to larger sonar motions) in between frames. New trajectories are obtained by matching 24 frames, which are plotted in red and superimposed on the previous path shown in black. Not surprisingly, the accuracy decreases with less overlap.

Some potential applications of our registration method for the realization of key robot vision capabilities in turbid waters are comprised of improving accuracy in positioning and local navigation; more efficient video coding; and the construction of environmental maps, models, and mosaics to study the ecological patterns and dynamics of underwater ecosystems.

Our work on "Forward-Look 2-D Sonar Image Formation and 3-D Reconstruction" was selected for "Student Poster Competition" in San Diego, OCEANS 2013 conference. In this work we develop a model to describe the formation of a 2-D forward-look sonar image for Lambertian reflectors, and show how one may recover the unknown third dimension, namely, the elevation angles from a single image, under some conditions. Selected 3-D reconstructions of a well-known geometrical shape, are respectively displayed in Figure 2 and Figure 3: a hemisphere, by using a DIDSON image collected in a pool facility and three fish in the water column captured in Lake Osceola at UM. Comparison of the reconstruction with the ideal object model of a semi-sphere in Figure 2 demonstrates the accuracy of the approach. Regarding Figure 3, our method is shown to equally apply for free swimming objects within the water column as long as their shadows cast on the sea-floor are distinguishable. The side and front views of the reconstruction verify a sufficiently complete representation of the scene characteristics, in terms of object sizes, locations, shapes, and in fact some details of the larger fish (i.e. fin and tail). For objects with smooth, monotonic surfaces, whether resting on the sea-floor or moving within the water column, the results can be rather accurate. Such a reconstruction can play a key role in landmark detection, object recognition, and obstacle avoidance as well as improving performance of image registration, mosaicing, and precision navigation.

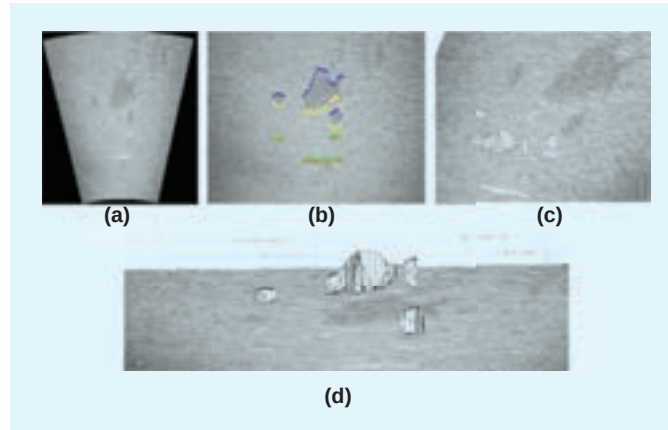


Fig. 3—Reconstruction of fish in the water column. (a) DIDSON image of three fish with distinct shadows. (b) Close and far ends of the highlights and shadows are marked. (c–d) Reconstructed image.

I plan to submit a paper to the Journal of Oceanic Engineering titled "Modeling two-dimensional lens-based forward-scan sonar imagery for targets with diffuse reflectance". In this work we present a detailed derivation of the image model for Lambertian targets by using radiometric definitions within wave propagation/reflection equations. We validate our model by using intensity measurements (with DIDSON) of an isolated cylindrical target and then demonstrate how it accounts for certain common multi-path reflections for both semi-cylindrical and semi-spherical targets resting on a flat bottom, possibly in shallow water. Our results demonstrate a better fit on real data compared to earlier models; therefore, the approach may enable more accurate sonar image simulation.

Finally in summer 2014 I had the opportunity to work at CMRE as a visiting research fellow. Our purpose was to build

both optical and acoustic image mosaics respectively for the GoPro and Marine Sonic side-scan sonar data-sets captured during a Remus mission. I learned about the geometry of side-scan sonar imaging and how to relate the navigation information to the data and also feature detection, feature matching, image transformation and mosaicing for optical camera videos in underwater.

Plans for the Future

As many of my colleages, I dream to have a global impact in my field. For this purpose, once I receive my PhD, I see myself as a research team leader at a research institution or within a company specialized in robotic exploration. I would like to work with a team of highly skilled scientists, engineers and students to advance robot vision capabilities for underwater exploration by building the next generation high-resolution sonars with direct 3-D imaging capabilities; to improve techniques to generate large scale maps and mosaics of ocean-floor; to combine optical and acoustic images to provide a better picture of the sub-sea environment; and to develop automatic control techniques for remotely operated underwater vehicles equipped with various sensors including sonars and optical cameras.

My dream job is to work within an expert team to develop the state-of-the-art automated underwater vehicle (AUV) to be deployed at Europa, one of the moons of Jupiter. It is estimated that under the deep icy surface of Europa, there is an ocean of liquid water, which can best be explored by an AUV. Application of robot vision and machine learning to build an intelligent AUV will become extremely crucial given that such a vehicle will make its own decisions and operate under the thick icy surface. If the project can be realized in my lifetime, I would be delighted to take part in such a historical research and development effort.

Call for scholarship applications

The IEEE Oceanic Engineering Society recognizes that the future of ocean engineering depends on the recruitment of talented, engaged young people.To encourage advanced education in ocean engineering, OES offers up to eight awards annually for $5,000 each.Graduate students are encouraged to apply for these grants at any time.Selections are made twice each year, with deadlines of 1 March and 1 September. Information on the application process is available on the OES website:

http://www.oceanicengineering.org/page.cfm/cat/81/OES-Student-Scholarship-Program/

Applications for OES scholarships are reviewed. This requires the time of volunteer members. The following have served in 2014: Christophe Sintes, Chair; Kenneth G. Foote, Liesl Hotaling, Marinna Martini, and Sophie Scappini.

Winning Poster Paper

A Hybrid Registration Approach Combining SLAM and Elastic Matching for Automatic Side-Scan Sonar Mosaic

Loïc Bernicola Didier Guériot Jean-Marc Le Caillec
{loic.bernicola, didier.gueriot, jm.lecaillec}@telecom-bretagne.eu
Institut Mines Telecom - Telecom Bretagne, CNRS UMR 3192 LabSTICC,
Technopôle Brest-Iroise - CS 83818 - 29238 Brest Cedex 3 - France

***Abstract*—This paper introduces a hybrid registration approach to build mosaics from side-scan sonar images. Due to specific acquisition procedure during surveys, standard SLAM techniques may not be robust enough to globally take into account a complete survey and correct sensor trajectories in order to properly georeference every pixel from all these images. iSAM algorithm has been fed with real side-scan images and shows interesting capabilities to produce corrected sensor trajectories allowing relevant coarse image registration, based on landmarks extraction and pairing. These trajectories will then guide a block-matching procedure that will refine these trajectories by finely matching only sonar images relevant areas.**

***Index Terms*—Side-scan Sonar, Image Registration, Image Mosaicing, SLAM, iSAM, Block Matching.**

I. Introduction

Exploring seabed with imaging sonars is quite common nowadays. Side-scan sonar (SSS) produce high resolution images characterizing sea bottom nature and contents (objects,...), along the vehicle path, over a limited range. Thus when building a global view of the surveyed area, all these acquired images need to be registered before merging them into a global mosaic. However, these images represent large amount of data, and fully automatic mosaicing using side-scan images is still a challenge. Indeed, a human operator often has to guide the matching process between sonar tracks, by pairing local portions of different images representing same seabed locations. Thus, a fully automatic registration algorithm, working on a survey complete set of images, is the key feature to achieve the mosaic construction.

This paper presents the first step of such a full automatic registration algorithm as it focuses on the use of *simultaneous localization and mapping* techniques (SLAM) to roughly anchor overlapping tracks. Once the sonar trajectories from these tracks have coarsely been registrated, image matching can then locally and relevantly be applied to finely combine those images into a full mosaic.

II. How to perform side-scan sonar image registration ?

Registration approaches on pairs of SSS images can be split up into two main families : image matching or trajectory oriented techniques.

978-1-4799-4918-2/14/$31.00 ©2014 IEEE

A. Image matching approaches

These first methods use only information extracted from the collected images for the registration process. Thus, features are extracted and matched between two images in order to estimate the geometrical transformation model parameters. For instance, Chailloux [1] used iconic features to determine an elastic transformation model through block-matching techniques.

These approaches are usually very resource consuming due to the huge sets of possible combinations between local features extracted from the two images. Thus, to reduce the amount of potential combinations, strategies to remove obviously non-relevant pairing, have been developed. Pham [2] proposed to guide the block matching algorithm to only consider relevant areas through a non-supervised neural network. Indeed, the computed Kohonen map built clusters of similar sea bottom regions, allowing to search for fine matching only on relevant pairs of areas.

Moreover, when operating on wide and numerous images with rather poor overlapping rates, local features alone may not be discriminant enough to be associated and build a common sea-bottom representation. Acquisition conditions like sensors trajectories, may provide the *glue* information between these features in order to build such a global representation (here a mosaic).

B. Trajectory oriented approaches

The second family gathers Simultaneous Localization and Mapping (SLAM) also called Concurrent Mapping and Localization (CML), techniques. In this case, the final solution of the registration problem is not to build a set of matched features, but to retrieve the actual trajectory of the vehicle supporting the sonar, during the whole survey.

Thus, these techniques maintain a global knowledge (the trajectory) that can be used either to register images for building a mosaic, or for autonomous navigation purpose [3][4][5]. Indeed, every pixel of acquired SSS images may be spatially referenced in a local map, according to this trajectory.

For side-scan mosaicing, Tena [6] proposes to use an EKF-RTS[1] filter to correct the vehicle trajectory and build a

[1]Extended Kalman Filter - Rauch-Tung-Striebel

map of features with the SSS observations. However, on full surveys, drifts may affect the corrected trajectories. Reducing those drifts requires multiple observations of same sea bottom locations. When building mosaics from surveyed data, the amount of redundant observations (when any) is often limited to 2, which represents the main drawback for such techniques. Moreover, such approaches often do not rely much on seabed features specificities.

III. Proposed hybrid registration algorithm

As our goal is to define a reliable and automatic method for side-scan sonar images registration to further build mosaics, we propose to take benefit from both families in order to suggest a hybrid image registration approach, combining SLAM-like techniques and elastic matching, into a two-step algorithm. First, SLAM techniques will be used to perform a first coarse image registration by estimating sonar trajectories based on a set of image extracted features. Then, the elastic matching task will be launched locally only on relevant regions, to refine the coarse estimated trajectories. Figure 1 shows the full proposed algorithm.

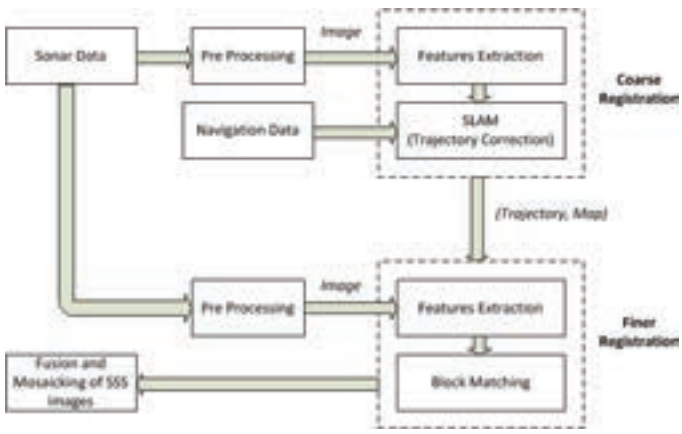


Fig. 1. Global structure of the proposed hybrid approach.

A. A classical SLAM approach for coarse registration ?

SLAM techniques are widely used for autonomous vehicle navigation purpose as they improve vehicle geographic localization. They use vehicle inertial navigation systems (INS) data and observations from side-scan sonars to estimate/correct sonar effective trajectory, as only the surface vessel trajectory is collected through GPS systems.

Most implementations using SSS observations are based on EKF filters and give good results [5][6]. However, the major drawbacks of EKF-based SLAM are the update complexity for large amount of landmarks. Sub-mapping SLAM approaches [7] can partly deal with the complexity burden.

All these approaches are trying to solve the *online SLAM* problem that roughly requires to estimate for each instant t, the vehicle pose x_t and the landmarks map L knowing only previous pose x_{t-1}, observations $z_{1:t}$ and control inputs $u_{1:t}$.

However, drifts are often observed with online SLAM algorithms in case of long term utilization due to linearization hypotheses, heading variations or low landmark observation frequency [8].

B. Survey mosaicing : a full SLAM problem ?

In fact, building a mosaic offline may also be seen as a non-incremental process as the full set of tracks is available. This problem can be then formulated as a *full SLAM* problem [9, chapter 10] requiring the estimation of

$$p(X, L, Z) = p(x_0) \cdot \prod_{i=1}^{\mathcal{T}} p(x_i|x_{i-1}, u_i) \cdot \prod_{k=1}^{\mathcal{K}} p(z_k|x_{ik}, l_{jk}) \quad (1)$$

where

- $X = [x_{1:\mathcal{T}}]^T$ is the full set of vehicle poses,
- $L = \{l_1, l_2, \ldots l_{\mathcal{L}}\}$ is the map containing all the $\mathcal{L}$ landmarks,
- Z is the full set of observations,
- $\{0 : \mathcal{T}\}$ represents the instants where vehicle poses are considered,
- K is the number of observations made at instant time t,
- $x_t = [xc_t, yc_t, \theta_t]^T$ describes the state vector of the vehicle at instant t,
- $u_t = [v_t, \omega_t]^T$ is the input control of the vehicle (v_t being the vehicle speed and ω_t, its rotational speed),
- x_{ik} is the state of the vehicle at instant time i, making the kth observation,
- z_k is the kth observation,
- l_{jk} is the jth landmark observed by the kth observation.

In (1), $p(x_i|x_{i-1}, u_i)$ corresponds to the motion model and can written as $p(x_i|x_{i-1}, u_i) = f_i(x_{i-1}, u_i) + \beta_i$ while $p(z_k|x_{ik}, l_{jk})$ corresponds to the measurement model and can be written as $p(z_k|x_{ik}, l_{jk}) = h_k(x_{ik}, l_{jk}) + \nu_k$ where β_i and ν_k denote white Gaussian noise and f_i and h_k, some functions to be defined. The actual models used for the presented experiment are described in section IV-A.

An other problem for survey mosaicing comes from the way of collecting sonar images. A side-scan survey mainly consists of multiple independent tracks as the vessel path is not recorded between survey tracks. Moreover, as the sonar is mounted on a tow-fish vehicle, no GPS data is available to reliably link one track to an other. A single robot SLAM approach cannot deal with such gaps.

C. Towards multi-session iSAM

Recently, Kaess & Dellaert have developed an incremental and smoothing technique called incremental Smoothing and Mapping (iSAM) [10]. They use a factor graph representation for the pose graph SLAM and solve it through a Least Square problem using QR factorization as previously done in [11]. Equation (2) sums up iSAM main principle and describes how X^* and L^*, the sensor trajectory and landmark map are estimated.

$$X^*, L^* = \arg\min_{X,L} \left\{ \sum_{i=1}^{\mathcal{T}} ||f_i(x_{i-1}, u_i) - x_i||^2_{\Lambda_i} + \sum_{k=1}^{K} ||h_k(x_{ik}, l_{jk}) - z_k||^2_{\Gamma_k} \right\} \quad (2)$$

In (2), $||a-b||^2_\Gamma$ denotes the squared Mahalanobis distance with covariance Γ.

The main advantage of this method is to solve the *full SLAM problem* and thus provide an exact solution unlike EKF approaches. This technique is also a response to drift problems affecting previously described full SLAM techniques. Thus, iSAM has been recently successfully applied to optical problems [12] and AUV navigation using SSS [13, chapter 8].

Morevover, in [12] and [14], iSAM was adapted to support multiple robots acquisitions, through anchor nodes. Considering each track as acquired by a different robot, building a mosaic can relevantly be modeled using an iSAM approach. That is why, we choose this iSAM approach to perform the coarse registration step of our mosaic building.

Using previous notations, Figure 2 illustrates the basic principle of a multi-session iSAM. Each vehicle builds its own map $L = \{l_1, l_2\}$ of landmarks using a single session iSAM. Then correspondences between each vehicle (or track here) are computed using landmark association from each map. Constraints between poses x_i^1 of track 1 and poses x_j^2 of track 2 result from these correspondences.

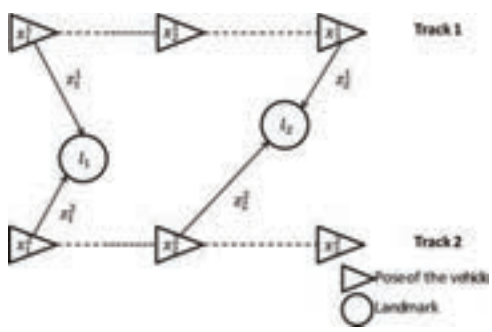


Fig. 2. Basic notations for multi-session iSAM.

Next section will show how an iSAM approach has been developed to perform trajectories corrections that allow multiple views of a landmark to match and side-scan sonar images to be subsequently registered.

IV. Experimental results

The experiment described in this section, has been performed in order to check whether an iSAM approach can be used as an effective way to integrate sensor acquisition constraints (through its trajectories) in the image registration process.

Thus to validate our approach, we use side-scan images acquired by a KLEIN 5400 sonar mounted on a tow-fish, during a survey near the Brittany french coast. Images with tow-fish attitude information have been recorded along several tracks, producing redundant observations of same sea-bottom regions. However, tow-fish actual positions during acquisitions remained unknown, due to the layback cable length and behavior.

A. Motion & measurements models

As already mentioned, the vehicle was equipped with sensors providing local navigation data relative to the vehicle frame :

- h : distance between sonar and sea-bottom (altitude),
- $\hat{v}$: velocity intensity (speed),
- $\hat{\omega}$: rotational speed intensity,
- ϕ : vehicle pitch angle,
- θ : heading from compass.

Thus, as given in (3), we choose a rather classical motion model which can be compatible with various kinds of vehicle (tow-fish, AUV, ...).

$$x_t = x_{t-1} + \begin{pmatrix} \hat{v}\cos\theta dt \\ \hat{v}\sin\theta dt \\ \hat{\omega} dt \end{pmatrix} \tag{3}$$

Equation (4) gives the measurement model (within the sonar frame) used in this experiment. It describes the standard side-scan sonar images acquisition geometry. Indeed, along the sonar path, the location of an observed landmark i depends on the current vehicle altitude h and pitch ϕ. Across the sonar path, the location of an observed landmark depends on the slanted range r of the pixel where the landmark feature has been extracted from.

$$z_i = \begin{pmatrix} h\sin\phi \\ \sqrt{r^2 - h^2} \end{pmatrix} \tag{4}$$

B. Real side-scan sonar images & features extraction and pairing

For this first experiment, we only use two tracks from the survey. These tracks exhibit sonar images collected over sea-bottom overlapping areas.

Each track is about 1 Km long. Along track image full resolution is around 10 cm while across track resolution is 3 cm. However, we actually used 10 times sub-sampled versions of these images.

Figure 3 presents these images on which features extraction and pairing (data association) are done manually. Indeed, the goal of this experiment is only to check how an iSAM may behave with side-scan sonar images.

C. Corrected sonar trajectories after iSAM based registration processing

Landmarks extraction and pairing introduce constraints on the sonar trajectories as a landmark seen several times on various tracks should have a unique global position. Using sensor trajectories computed from attitude recorded data, this is clearly not the case. The purpose of iSAM optimization is to correct the sensor trajectories in order to minimize for each landmark, the distances between the positions of this landmark estimated from the trajectories that brought these observations.

Figure 4 shows the results of such an iSAM processing on the two selected tracks on which 5 landmarks have been extracted. Along with the raw sensor trajectories, iSAM corrected ones have been displayed within a global frame which origin is set to the starting point of the first track. Landmarks positions estimated from both raw and corrected trajectories are also included.

Figure 5 zooms in the area close to landmarks 4 and 5, revealing the corrections brought by iSAM optimization to the sensor trajectories.

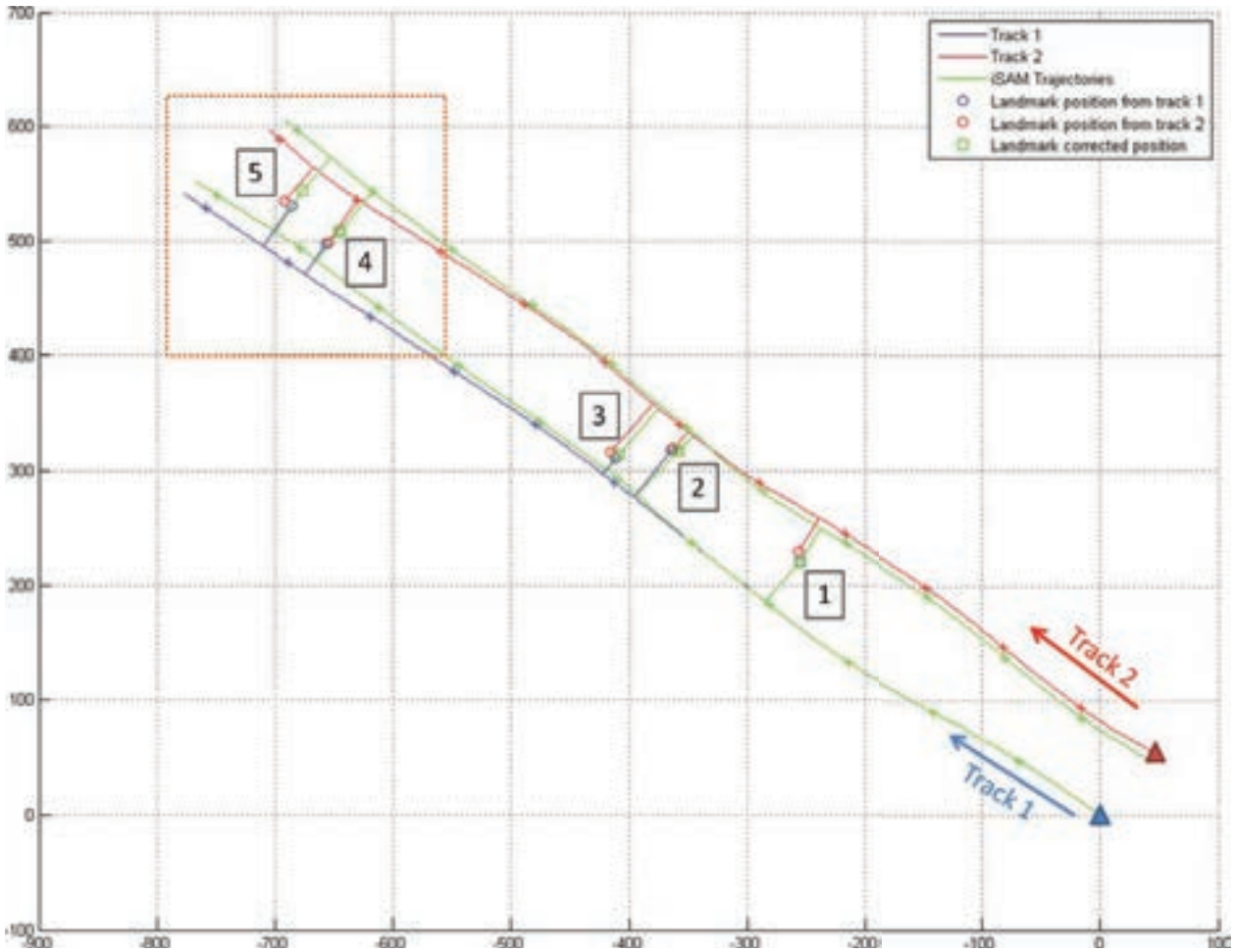
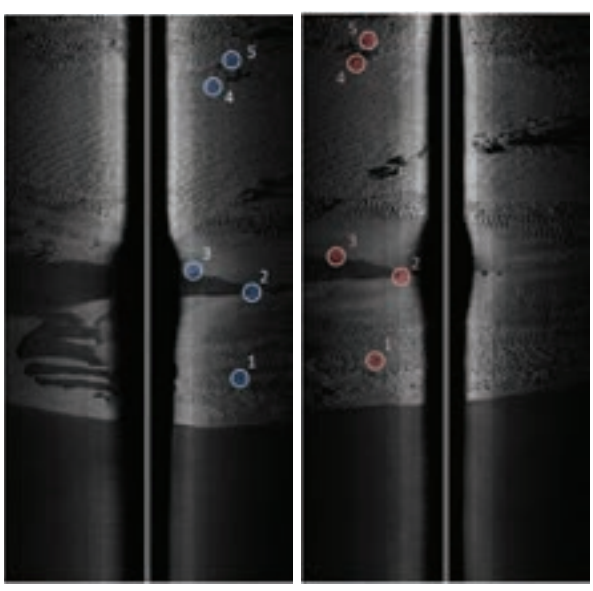


Fig. 4. Track 1 & 2 raw (blue and red) and corrected (green) trajectories through iSAM processing. Paired landmarks are also displayed according to raw (blue and red circles) and corrected (green square) trajectories. Orange dots delimited area is shown in Figure 5.



(a) Track 1 (b) Track 2

Fig. 3. Raw sonar images from two tracks with extracted and paired landmarks

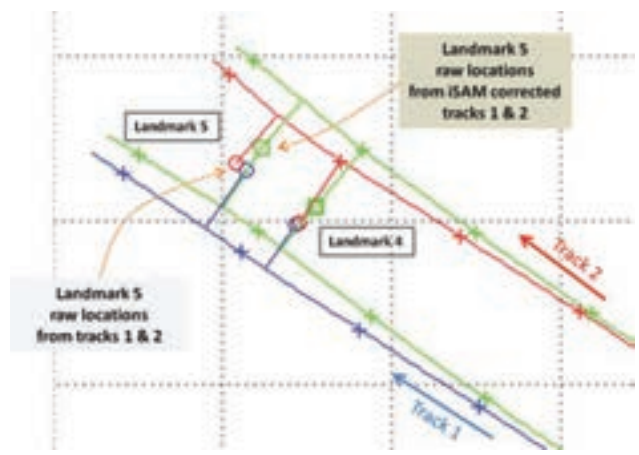


Fig. 5. Figure 4 zoom around landmarks 4 and 5.

For every landmark n, Table I presents the distance between Track 1 and Track 2 landmark coordinates. Track k landmark coordinates are computed using either the raw or iSAM corrected sensor trajectory from track k. Raw trajectory is computed from raw sensor measurements (INS, compass) giving sonar speed, pitch and heading. Corrected iSAM trajectory

results from feeding iSAM algorithm with both sets of raw trajectories and paired landmarks.

TABLE I
DISTANCES BETWEEN LANDMARKS COORDINATES COMPUTED FROM TRACK 1 AND TRACK 2 SENSOR TRAJECTORIES.

Landmark	Using raw trajectories (m)	Using iSAM corrected trajectories (m)
1	8.68	0.22
2	1.30	0.23
3	7.23	0.33
4	2.26	0.51
5	8.32	0.54

This experience confirms that iSAM algorithm is able for every landmark n, to reduce the distance between Track 1 and Track 2 landmark coordinates. Indeed, using raw trajectories, the landmark distances mean is 5.5 meters while after iSAM trajectory correction, the mean distance between Track 1 and Track 2 landmarks is reduced to 0.38 meter. This distance corresponds roughly to the on-the-ground footprint size of one sonar pixel, as this experience has been performed on 10-times subsampled raw images.

The correction brought by iSAM algorithm seems to be interesting for coarse image registration (at least around the landmarks), as it reduces the distance between same landmark positions to one pixel (image resolution).

V. CONCLUSION AND PERSPECTIVES

This paper introduces the concept of a hybrid registration approach combining *simultaneous localization and mapping* techniques and elastic matching for building side-scan sonar mosaics.

The first step of this registration approach consists in estimating sensor trajectories from track to track in order to roughly anchor overlapping tracks. In this paper, it has been discussed and checked that an iSAM approach can successfully perform such a task with at-sea survey specific acquisition constraints: all images may be known prior to perform mosaicing and only some parts of the sensor trajectories have measurements with no relative position information between those parts.

However, using only a reduced amount of landmarks may not be enough to correct the full length sensor trajectories in order to directly produce a full mosaic. Nevertheless, the corrected trajectories clearly provide a relevant coarse support for sonar images registration. Indeed, these trajectories may feed locally applied elastic registration algorithms, to estimate finer local corrections to the iSAM corrected trajectories. Future works will then build a guided block-matching procedure that reduces irrelevant matching trials, by focusing on areas where relevant and accurate matching can be estimated, according to the iSAM corrected trajectories.

Next work will also replace the manual features extraction and pairing by automatic detection of punctual (objects), curve (crest lines) and surface (texture-based) features reflecting specific sea-bottom characteristics.

Finally, combing symbolic features matching with a sensor trajectory-based registration strategy allows to integrate other sources of information. Indeed, mosaicing side-scan images (with no other source of information) can only be done through a flat sea-bottom hypothesis which introduces features localization errors in the produced mosaic [15]. Embedding vehicle altitude and pitch in the current model, jointly with 3D features extraction and heterogeneous pairing will be crucial to build more reliable 3D mosaics.

REFERENCES

[1] C. Chailloux, J.-M. Le Caillec, D. Gueriot, and B. Zerr, "Intensity-based block matching algorithm for mosaicing sonar images," *Oceanic Engineering, IEEE Journal of*, vol. 36, no. 4, pp. 627–645, 2011.

[2] M. T. Pham and D. Guériot, "Guided block matching for sonar image registration using unsupervised Kohonen neural networks," in *OCEANS 2013 - San Diego : MTS/IEEE international conference*, 2013, pp. 1–5.

[3] T. Maki, H. Kondo, T. Ura, and T. Sakamaki, "Photo mosaicing of tagiri shallow vent area by the auv" tri-dog 1" using a slam based navigation scheme," *OCEANS 2006*, pp. 1–6, 2006.

[4] M. Pfingsthorn, H. Bulow, A. Birk, F. Ferreira, G. Veruggio, M. Caccia, and G. Bruzzone, "Large-scale mosaicking with spectral registration based simultaneous localization and mapping (ifmi-slam) in the ligurian sea," *OCEANS-Bergen, 2013 MTS/IEEE*, pp. 1–6, 2013.

[5] S. Reed, I. Tena Ruiz, C. Capus, and Y. Petillot, "The fusion of large scale classified side-scan sonar image mosaics," *Image Processing, IEEE Transactions on*, vol. 15, no. 7, pp. 2049–2060, 2006.

[6] I. Tena Ruiz, S. de Raucourt, Y. Petillot, and D. M. Lane, "Concurrent mapping and localization using sidescan sonar," *Oceanic Engineering, IEEE Journal of*, vol. 29, no. 2, pp. 442–456, 2004.

[7] J. Aulinas, X. Lladó, J. Salvi, and Y. R. Petillot, "Feature based slam using side-scan salient objects," *OCEANS 2010*, pp. 1–8, 2010.

[8] T. Bailey, J. Nieto, J. Guivant, M. Stevens, and E. Nebot, "Consistency of the ekf-slam algorithm," in *Intelligent Robots and Systems, 2006 IEEE/RSJ International Conference on*. IEEE, 2006, pp. 3562–3568.

[9] S. Thrun, W. Burgard, and D. Fox, "Probabilistic robotics," 2005.

[10] M. Kaess, A. Ranganathan, and F. Dellaert, "isam: Incremental smoothing and mapping," *Robotics, IEEE Transactions on*, vol. 24, no. 6, pp. 1365–1378, 2008.

[11] F. Dellaert and M. Kaess, "Square root sam." in *Robotics: Science and Systems*, 2005, pp. 177–184.

[12] J. McDonald, M. Kaess, C. Cadena, J. Neira, and J. Leonard, "Real-time 6-dof multi-session visual slam over large-scale environments," *Robotics and Autonomous Systems*, vol. 61, no. 10, pp. 1144–1158, 2013.

[13] M. L. Seto, "Marine robot autonomy," 2012.

[14] B. Kim, M. Kaess, L. Fletcher, J. Leonard, A. Bachrach, N. Roy, and S. Teller, "Multiple relative pose graphs for robust cooperative mapping," in *Robotics and Automation (ICRA), 2010 IEEE International Conference on*. IEEE, 2010, pp. 3185–3192.

[15] D. Guériot, "Bathymetric and side-scan data fusion for sea-bottom 3d mosaicing," in *OCEANS 2000 MTS/IEEE Conference and Exhibition*, vol. 3, Providence, Rhode Island, USA, Sep. 2000, pp. 1663–1668.

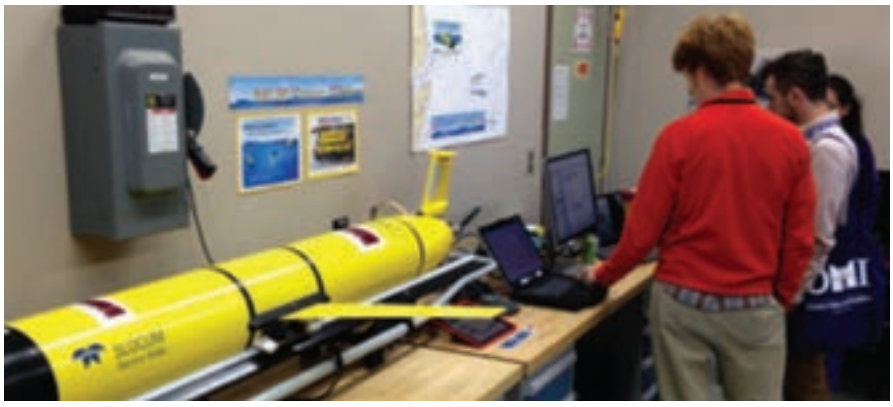
A Day in the Bay in Holyrood, Newfoundland

Natacha Fudem

A Day in the Bay, a pre-conference event to the OCEANS '14 conference was held at the Marine Institute Holyrood Marine Base (MIHMB) on September 13. The Oceans Holyrood Initiative (OHI) in partnership with the Marine Institute of the Memorial University of Newfoundland hosted about 165 people from around the world that came to see the featured static and in-water product demonstrations from 15 marine related companies and organizations.

The Holyrood Marine Base, a campus facility of the Marine Institute, provides a venue for practical and hands-on experience for students in a variety of degree and diploma programs including marine environmental studies, marine biology, marine ecotourism, diving and oil spill response. MIHMB is the first phase of a major maritime infrastructure development that will eventually include a marginal wharf, breakwater and 40,000 square foot interdisciplinary research and teaching facility. The harbour supports underwater vehicle development and testing, at-sea survival training, oceanographic research, experiential learning, and floating classrooms alongside of offshore supply vessels,

Holyrood is nestled among rolling green hills and cascading rivers, and has a deep, sheltered cold arctic pristine harbor on its doorstep.



The Holyrood Marine Base (HMB), on the shore of Holyrood bay, supports Memorial University's at-sea research and training priorities, which are primarily targeted at improving the safety, efficiency and profitability of ocean enterprise, and the sustainability of the ocean environment and resources. HMB serves as a platform for industry to field test and demonstrate innovative new products and services.

Representatives from 15 organizations displayed and demonstrated their products and services.

In addition to the live demonstrations, OHI hosted a network reception, boat tours, and presentations throughout the day.

pleasure crafts and fishing boats; all under the watchful eye of whales, dolphins, and eagles.

A Day in the Bay delivered on its promise to being a unique technical and cultural experience with some of the world's most innovative and advanced oceans-related products in the waters of magnificent and historic Conception Bay, Newfoundland.

For more information on OHI go to www.ComeAshore.ca.

2014 Distinguished Technical Achievement Award

Christian de Moustier is presented the IEEE Oceanic Engineering Society's Distinguished Technical Achievement Award for his long-standing contributions to acoustic remote sensing of the ocean volume and boundaries with sidescan sonars and multibeam echosounders. In the early 1980s at the Scripps Institution of Oceanography, his Ph.D. thesis work demonstrated the capabilities of multibeam sonars for seafloor acoustic backscatter imaging applications "beyond bathymetry". Synchronous swath bathymetry and seafloor acoustic backscatter imagery are now standard features in most seafloor mapping sonars sold today. In the late 1980s, he used multibeam echosounders to image the deep scattering layer, and he developed a technique to infer the angular dependence of seafloor acoustic backscatter from measurements made with a 12 kHz multibeam echosounder. In the 1990s, he carried out the first open ocean calibration of the source level, receive sensitivity, and beam patterns of hull mounted multibeam sonar transducer arrays using a remotely operated vehicle equipped with a calibrated transducer and navigated under the vessel. More recently, he has led the development of a monopulse sonar prototype that produces seamless bathymetry and acoustic backscatter imagery across a swath width ten times the sonar's altitude. In January 2014, Christian de Moustier founded 10dBx LLC, a scientific consulting company specializing in underwater acoustics and ocean engineering. Previously, he was a Principal Scientist at HLS Research, Inc. (2009–2013); a tenured full professor of Electrical and Computer Engineering/Ocean Engineering at the University of New Hampshire, Durham, NH (2002–2008); and he held combined positions of associate researcher, lecturer, and academic administrator for shipboard technical support, at the Scripps Institution of Oceanography (1986–2001). He earned his Ph.D. in Oceanography at Scripps in 1985. He is Member of the American Geophysical Union, a Fellow of the Acoustical Society of America (1996), and a Senior Member of the IEEE. He served 6 years as Editor in Chief of the IEEE Journal of Oceanic Engineering (2005–2010).

Request for Nominations for the Distinguished Technical Achievement Award 2015

The IEEE Oceanic Engineering Society is hereby soliciting nominations for the society Distinguished Technical Achievement Award for significant accomplishments in oceanic engineering. A nomination form can be downloaded from the OES website under Professional Activities—Honors and Honorees—Award Forms. Nominations should be forwarded to the Awards Chair, Jerry Carroll at jerrycortez@charter.net. The dead line for nominations is 1 May 2015.

2014 Distinguished Service Award

The recipient of this year's Distinguished Service Award is Diane DiMassa for her contributions to the governance of the Society. She kept the Society's finances in good standing during five turbulent years in IEEE financial management practices.

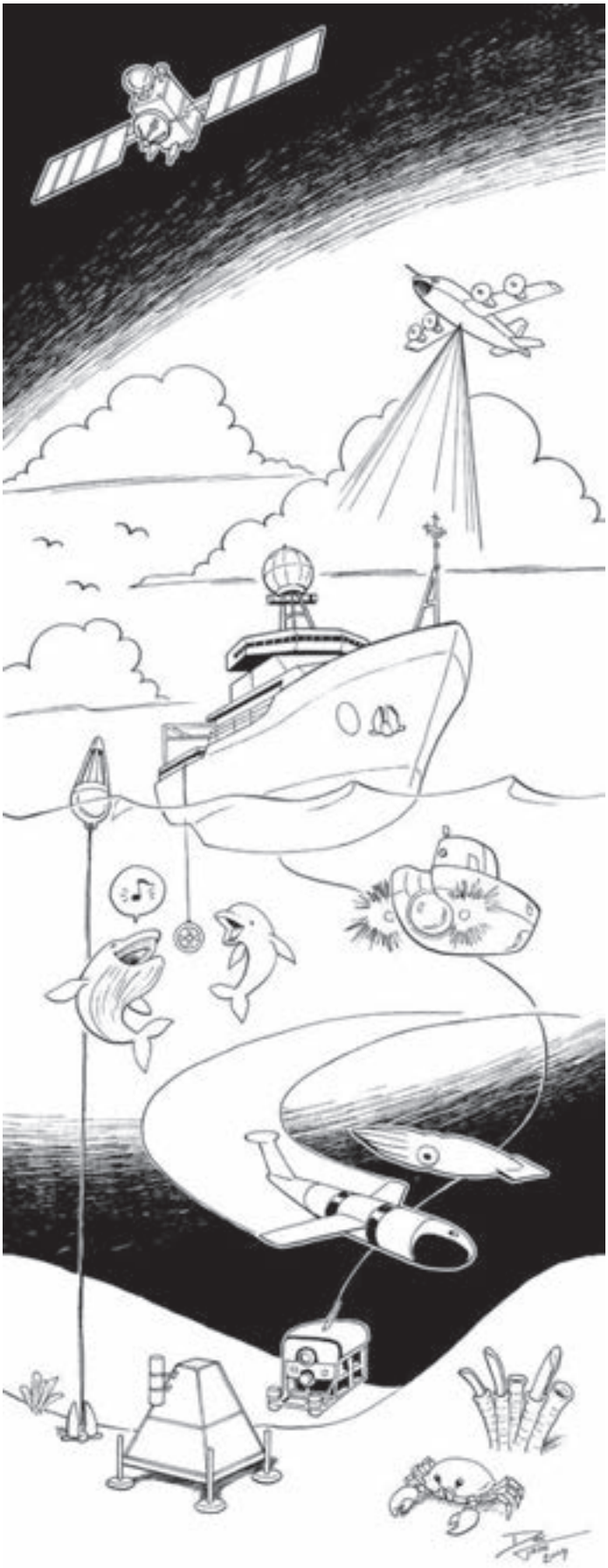
Diane DiMassa's service to the IEEE Oceanic Engineering Society (OES) includes: five years (2009–2013) as Treasurer and elected member of the Executive Committee; three terms as an elected member of the Administrative Committee

Diane Dimassa receives the Distinguished Service Award from OES Junior Past President Jerry Carroll (left) and OES President René Garello (right).

(2002–2007, 2009–2011); member of the Constitution and Bylaws Revision Committee (2004–2005); founding Editor of the Society's eNewsletter, three years as coordinator of Oceans Conference tutorials; student program coordinator for Current, Wave, and Turbulence Measurement workshops (2011, 2015). In 2007, she initiated a program to have four meritorious Massachusetts Maritime Academy cadets help with the logistics of North American OCEANS conferences. She currently serves as Assistant to the OES president for all IEEE matters, and as liaison for OCEANS '15 Genoa. Diane DiMassa is a tenured professor of engineering at the Massachusetts Maritime Academy. She earned four engineering degrees at the Massachusetts Institute of Technology (MIT), including a Ph.D. in Oceanographic Engineering through the Joint Program between MIT and the Woods Hole Oceanographic Institution (WHOI). Previous appointments include: professor at the University of Massachusetts Dartmouth, guest investigator at WHOI, consultant at Woods Hole Group, and research assistant at the NATO Centre for Maritime Research and Experimentation (CMRE) in La Spezia, Italy. She has participated in three scientific expeditions in Antarctica and was awarded the Antarctic Service Medal (2001). She is a Senior Member of the IEEE and a Life Member of Sigma Xi.

Request for Nominations for the Distinguished Service Award 2015

The IEEE Oceanic Engineering Society is hereby soliciting nominations for the society Distinguished Service Award to honor an individual IEEE member for outstanding contributions towards furthering the objectives of the Oceanic Engineering Society. A nomination form can be downloaded from the OES website under Professional Activities—Honors and Honorees—Award Forms. Nominations should be forwarded to the Awards Chair, Jerry Carroll at jerrycortez@charter.net. The deadline for nominations is 1 May, 2015.



The Ryans and the Pittmans

Traditional Newfoundland Folk Song

Chorus:

We'll rant and we'll roar like true Newfoundlanders
We'll rant and we'll roar on deck and below
Until we see bottom inside the two sunkers
When straight through the Channel to Toslow we'll go.

My name it is Robert, they call me Bob Pittman
I sail in the *Ino* with Skipper Tom Brown
I'm bound to have Polly or Biddy or Molly
As soon as I'm able to plank the cash down.

I'm a son of a sea cook, and a cook in a trader
I can dance, I can sing, I can reef the mainboom
I can handle a jigger, and cuts a fine figure
Whenever I gets in a boat's standing room.

If the voyage is good, this fall I will do it
I wants two pounds ten for a ring and the priest
A couple of dollars for clean shirts and collars
And a handful of coppers to make up a feast.

There's plump little Polly, her name is Goldsworthy
There's John Coady's Kitty and Mary Tibbo
There's Clara from Brule and young Martha Foley
But the nicest of all is me girl from Toslow.

Farewell and adieu to ye girls of Valen
Farewell and adieu to ye girls in the Cove
I'm bound to the westward, to the wall with the hole in
I'll take her from Toslow the wide world to rove.

Farewell and adieu to ye girls of St. Kryan's
Of Paradise and Presque, Big and Little Bona
I'm bound unto Toslow to marry sweet Biddy
And if I don't do so I'm afraid of her da'.

I've bought me a house from Katherine Davis
A twenty pound bed from Jimmy McGrath
I'll get me a settle, a pot and a kettle
And then I'll be ready for Biddy, hurrah!

Newfoundland Cod Fishery—Fishing on the Banks, Harpers Weekly, October 1891.

Steam ships similar to 'City of Halifax' in the Newfoundland seal fisheries during the 1860s or 70s. These ships had thick wooden hulls to resist the ice, and were still in use in the 1930s.

O, I brought in the *Ino* this spring from the city,
Some rings and gold brooches for the girls in the Bay;
I bought me a case-pipe —- they call it a meerschaum
It melted like butter upon a hot day.

I went to a dance one night at Fox Harbour,
There were plenty of girls, so nice as you'd wish;
There was one pretty maiden a-chewin' of frankgum
Just like a young kitten a-gnawing fresh fish.

Then here is a health to the girls of Fox Harbour
Of Oderin and Presque, Crabbes Hole and Brule
Now let ye be jolly, don't be melancholy
I can't marry all or in chokey I'd be.

"**The Ryans and The Pittmans**" is a popular Newfoundland folk song. It tells of the romantic entanglements of a sailor named Bob Pittman, and his desire to sail home to finally marry his "sweet Biddy". The song is also known as "**We'll Rant and We'll Roar**", after the first line of the chorus; however, this is also the name by which some foreign variants are known.

It is based on a traditional English capstan shanty, "Spanish Ladies", which describes headlands sighted on a sailor's homeward voyage through the English Channel. "Spanish Ladies" has a number of variants: New England whalers sang of "Yankee Whalermen", while their Pacific counterparts sang of Talcuhano Girls. A more landlocked drover's version surfaced in Australia as "Brisbane Ladies".

Verses 2, 8, 9, and 10 of the Newfoundland version are adapted from that of the whalers; the remainder were composed around 1875 by W.H. LeMessurier. It was printed in *Old Songs of Newfoundland* (1912) by James Murphy. The places mentioned in the song are outports in and around Placentia Bay, Newfoundland.

Wikipedia contributors. "The Ryans and the Pittmans." *Wikipedia, The Free Encyclopedia*. Wikipedia, The Free Encyclopedia, 24 Jul. 2014. Web. 28 Oct. 2014.

OCEANS ’15 MTS/IEEE Washington, DC Announces Honorary Co-chairs

Liz Corbin

CONGRESSMAN SAM FARR AND NOAA’S DR. RICK SPINRAD TO SERVE AS HONORARY CO-CHAIRS OF OCEANS ’15 MTS/IEEE WASHINGTON, DC

Washington, DC—December 8, 2014. The Local Organizing Committee of the OCEANS ’15 MTS/IEEE Washington, DC conference and exhibition is pleased to announce that Rep. Sam Farr, co-chair of the House Oceans Caucus (HOC), and Dr. Rick Spinrad, National Oceanic and Atmospheric Administration (NOAA) Chief Scientist, will serve as Honorary Co-chairs. “We’re extremely fortunate that two such notable figures in the ocean community have agreed to provide their knowledge and experience in marine technology and policy to help us plan an outstanding program,” remarked General Co-chairs Rusty Mirick and Jim Barbera.

The annual OCEANS North America conference and exhibition, jointly sponsored by the Marine Technology Society (MTS) and the IEEE Oceanic Engineering Society (OES), rotates among locations with significant maritime communities. October 19–22, 2015, the event will once again be located in the Washington, DC area at the Gaylord Convention Center on National Harbor. It expects to attract over 3,000 attendees and will feature over 500 technical presentations and workshops. The exhibition will showcase the latest equipment, products and services in up to 200 commercial and informational exhibits.

“Sea Change: Dive into Opportunity,” was selected as the conference theme to focus on the opportunities related to economic challenges and oceanic changes and the ability to mitigate and adapt to these changes with the application of the best research, technological developments and policy decisions.

Rep. Sam Farr

Rep. Farr said, “The OCEANS conference and the House Oceans Caucus share common goals of building awareness, exchanging information and ideas, and exploring the important issues related to our oceans. The conference theme of how we address the impacts of oceanic and coastal change is integral to our policy discussions in Congress. I encourage all members of the House and Senate Oceans Caucuses and their staff to attend this informative conference. Nowhere else can we gain greater exposure to the latest research and observe first-hand the technology needed to inform the policy discussions concerning our greatest natural resource.”

Congressman Farr has represented California’s Central Coast for almost 22 years and is its longest serving member in Congress. His district includes the Monterey Bay National Marine Sanctuary and the majestic Big Sur coastline. Known for his passion for ocean issues, he has worked tirelessly to bolster the nation’s land and ocean resources. As the founder of the bipartisan House Oceans Caucus, Rep. Farr continuously works to educate Congressional Members about the issues

facing our world’s oceans. Congressman Farr has fought for funding and development of ocean programs and has introduced countless pieces of ocean legislation, including the Oceans Conservation, Education, and National Strategy for the 21st Century Act, also known as “Oceans-21.” Many of this bill’s provisions were included in President Obama’s Executive Order that established the first National Ocean Policy.

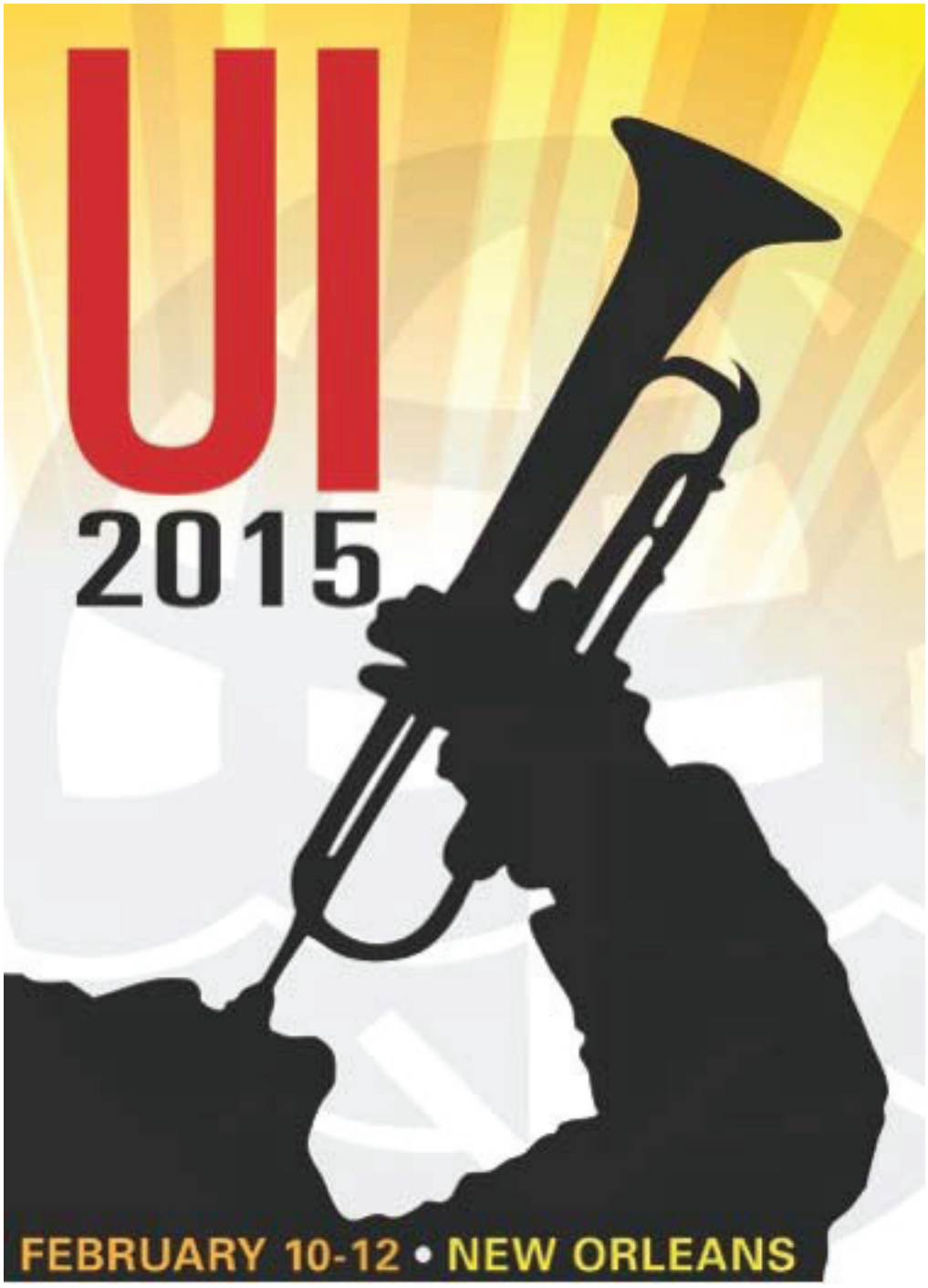
Dr. Rick Spinrad

“I’m looking forward to working with the Technical Program Committee to shape a program that will bring together experts in the disciplines that address some of our most important coastal and ocean challenges,” said Dr. Spinrad. “NOAA’s mission includes conducting research to address critical issues ranging from increasing frequency of severe weather events to the effects of climate change on our communities and shifts in marine ecosystems that may be under stress. The OCEANS ’15 conference next October will be a great way to add to our knowledge base on these issues.”

Dr. Spinrad is an internationally recognized scientist, with degrees in earth and planetary sciences and oceanography, and an executive with more than 30 years of experience in academia, the non-profit sector and government. Before being named as NOAA’s Chief Scientist in May 2014, he served as vice president for research at Oregon State University in Corvallis, Oregon, and from 2005 until 2010, was the head of NOAA’s Office of Oceanic and Atmospheric Research and the head of the National Ocean Service. From 1994 to 1999, Dr. Spinrad served as executive director for research and education at the Consortium for Oceanographic Research and Education, Inc. in Washington, DC. When tapped for his new role at NOAA, Dr. Spinrad was serving as the President-elect of the Marine Technology Society.

Information about the sponsoring societies can be found at: Marine Technology Society (www.mtsociety.org) and IEEE Oceanic Engineering Society (www.oceanicengineering.org). MTS is an international non-profit professional society of ocean engineers, technologists, policy-makers, and educators with the mission to promote awareness, understanding, advancement and application of marine technology. IEEE/OES is an international non-profit professional society that focuses on all aspects of science, engineering, and technology that address research, development, and operations pertaining to all bodies of water.

For more information on the conference, visit www.oceans15mtsieeewashington.org.



The world's premier event for Commercial Diving Contractors, Remotely Operated Vehicles, Manned Submersibles, and all other aspects of the Underwater Operations Industry will take place at the Morial Convention Center in New Orleans, LA. February 10-12, 2015.

Underwater Intervention's sponsoring organizations are non-profit, membership supported professional organizations. By supporting Underwater Intervention, you are supporting and giving back to the Industries and communities represented at Underwater Intervention. Proceeds from the annual conference go back into member driven programs that support education and training, provide scholarships and support safety initiatives throughout the underwater operations industry.

www.underwaterintervention.com

UI 2015 Technical Program by Track Subject

Work Class ROVs
Commercial Diving
Manned Submersibles
Instruments and Sensors
Marine Education/Academia
Observation Class ROVs
Ocean Research and Marine Archaeology Technology
Deepwater Field Development
AUV Technology
ASV Technology
Advanced Underwater Engineering

Feature Presentation: International Trade Regulations - How to Avoid Federal Prison

WHO ATTENDS?

- Oil & Gas industry professionals / Operators
- Information and technologies futurists
- Senior International and Regional underwater operators
- Underwater Operations Service and equipment suppliers
- Ocean Engineering and construction companies
- Commercial Diving and ROV Contractors
- Underwater Operations Consultants
- Engineers, Project managers, Purchasing Agents
- Law Enforcement Dive Teams
- Fire Department Dive Teams
- Public Safety and Rescue Teams
- Military Specialists and Purchasing Agents

UI IS THE COMBINED ANNUAL CONFERENCE OF:

Association of Diving Contractors International & The Marine Technology Society's ROV Committe