

# THE OCEANS CONFERENCE



## Sixty and Counting

# Dedication and Acknowledgments

## Dedication

This document is dedicated to those individuals who have given their time and energy to making the OCEANS conference series the preeminent international forum regarding Earth's most precious resource. We honor their contributions and thank them for their devotion.

## Acknowledgments

This document was assembled by Joseph Czika with a combined effort of its primary supporting editors: Stanley Chamberlain, Joseph Vadus, Robert Wernli, and Andrew Clark. Major contributions were made by: James Collins, Harumi Sugimatsu, Rene Garello, Barbara Fletcher, Diane DiMassa, Thomas Wiener, Robert Spindel, Albert Williams, and James Barbera.

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*OCEANS Welcomes You*

# The OCEANS Conference: Sixty and Counting

The Marine Technology Society and the IEEE Oceanic Engineering Society welcome you to MTS/IEEE OCEANS '17 Aberdeen, the 60th OCEANS conference in the series. We thank the loyal authors, attendees, exhibitors, sponsors, speakers, and volunteers who have contributed to the continuous success of MTS/IEEE

OCEANS, and made it the premier global ocean engineering and marine technology forum that it is today. Throughout 2017 we celebrate our enduring co-sponsorship of this conference series, and we look forward to welcoming you at number 61: MTS/IEEE OCEANS '17 Anchorage.



**Donna Kocak**  
President of the Marine Technology Society



**Christian de Moustier**  
President of the IEEE Oceanic Engineering Society

## Table of Contents

<i>OCEANS A Service to Humanity</i> .....	4
<i>OCEANS Sponsor: Oceanic Engineering Society of IEEE</i> .....	6
<i>OCEANS Sponsor: Marine Technology Society</i> .....	8
<i>OCEANS Serves the Ocean Community</i> .....	10
<i>OCEANS is International</i> .....	14
<i>OCEANS History</i> .....	16
<i>OCEANS Student Posters</i> .....	32
<i>OCEANS Exhibition</i> .....	34
<i>OCEANS Attendees</i> .....	36
<i>OCEANS Honors Outstanding Achievements: OES</i> .....	38
<i>OCEANS Honors Outstanding Achievements: MTS</i> .....	42
<i>OCEANS Looks Ahead</i> .....	46

# OCEANS in the Service of Humanity

The OCEANS conferences arose out of a desire of the ocean community to respond to a series of national and world events starting in the 1950s. Some of these events are described in this section. Some responses are highlighted in following sections of this report. These events provided the impetus for the ever-changing content of the conference. Because the oceans are influential in the welfare of most people and nations, the community's collective response is aimed at improving the welfare of everyone and thus OCEANS serves the interests of humanity.

**Ocean Policy Studies** The launch of the Sputnik satellite by the U.S.S.R in 1957 sent a shock wave throughout the rest



*Sputnik*

of the world. The U.S. reacted with the formation of many advisory science committees, including one on ocean policy. In 1969 the Stratton Commission produced a report containing over 120 specific recommendations, including the creation of the National Oceanographic and Atmospheric Administration (NOAA), which was established under the Department of Commerce in 1970 and the establishment of the National Sea Grant College program. NOAA proved to be a powerful generator of advanced ocean technology and systems.

The U.S. has continued to examine ocean policy in a series of studies culminating with the U.S. Committee on Ocean Policy study lead by Adm. Watkins in 2004 and President Bush's response in the "U.S. Ocean Action Plan." These studies lead to policy changes often implemented with new governmental resources. Some of those resources found their way as incentives for new technology and systems, including substantial support for the U.S. Integrated Ocean Observing System (IOOS). These resources filtered down to the industrial and academic institutions developing the needed technologies.

**Naval Leg of the Triad** A strong initial motivation for the content of early OCEANS conferences was the concern over the effectiveness of the U.S. Naval leg of the nuclear deterrent.



*U.S. Nuclear Submarine*

Effective protection of U.S. submarines involved knowing the spatial and temporal

variability of ocean parameters affecting the detection of acoustic waves and other submarine signatures. Much of the information of that era was initially classified, but the sensing and characterization of the ocean environment was not. Measurement of ocean properties provide key data for understanding the detectability of acoustic and non-acoustic submarine signatures.

**Offshore Oil Exploration** Offshore oil exploration was nearly worldwide in the early 1960s. Unfortunately, so were accidents from oil drilling and oil spills from shipping.



*Oil Drilling Rig*

Concern arose over the understanding of the distribution of the oil contaminant and its containment and disposal. New technologies were needed for not only the tracking, containment, and disper-

sional of the oil, but also the inspection of underwater drilling infrastructure. Underwater inspection and repair was performed in ever deeper water, which inhibited diver access. Potential use of remotely operated vehicles (ROVs) and autonomously operated vehicles (AUVs), initially developed for underwater ordnance applications, captured the interest of companies. It motivated the development of many new technologies.

**Deep Submergence** The 1960s witnessed the loss of the submarines USS Thresher in 1963 and USS Scorpion in 1968. In addition, several other submarines from the U.S.S.R. and other countries were lost in this and subsequent years.

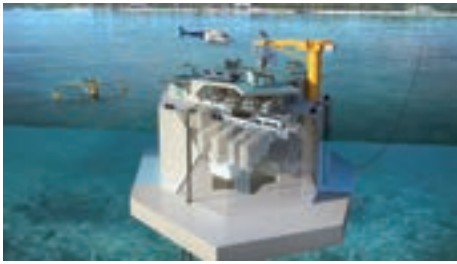
The bathyscaph Trieste, designed by A. Piccard, built in Italy, and purchased in 1958



*Trieste*

by the U.S., was used in the search for the Thresher, led by Dr. John Craven. The successor, Trieste II, was used for the Scorpion search. These events opened the door to deep sea exploration. In addition, there was a budding interest in ocean mineral mining. Undersea archeology and survey were strong, partly because of the continuing interest in understanding the sinking of the Titanic in 1912. These events motivated the development of technologies for underwater survey, inspection, and artifact retrieval.

**Ocean Energy** Deriving the energy needs of civilization from the ocean has always been an allure of humans. Efforts of exploitation date back to the nineteenth century. In



*OTEC concept*

and riverine capture of water flow energy.

**Ocean Space Utilization** Japan, The Netherlands, and other coastal countries have always been concerned with



*Kobe Ocean Space*

U.N. Conference on the Law of the Sea (UNCLOS) by nearly the rest of the world. Increasingly, citizens were concerned about coastal safety, protection against hurricane damage, tidal waves, and wildlife preservation. In addition, citizens wanted safe access to nearshore areas for recreation and boating.

**Ocean Wildlife Resources** Part of the recommendations



*Oceans Wildlife*

of economic concern. The Fishery Conservation and Management Act, followed by the Magnuson-Stevens act established a multifaceted regional management system where State and local resources could be coordinated and focused. This focus helped motivate new technologies in fishery and marine mammal surveys, management techniques, data bases, and pollution assessment.

**Undersea Communications** Undersea communication cables have been used for nearly 150 years. They provide essential intercontinental communication, including internet connections. There are nearly 1 million kilometers of undersea cable in use today. Their construction and maintenance has been of primary concern since the

the 1970s ocean thermal energy conversion (OTEC) became attractive. More recently wave and tidal energy was added to the list as well as ocean based wind farms

ocean space utilization. The U.S. interest was magnified greatly in the 1980s with President Reagan's announcement of the 200-mile Exclusive Economic Zone and the adoption of the

of the policy study panels concerned fisheries, aquaculture, and sea mammals in coastal, continental shelf, and deep waters. The conservation of the U.S fishery resources had long been a focus

beginning. These cables and the larger set of technologies, such as connectors, couplings, and subordinate electronics used in them have long been the "nuts and bolts" of undersea infrastructure.

**Remote Sensing** With the launch of Sputnik, it was clear that space would be a critical place to monitor the world's oceans and weather. That focus provided strong impetus to develop new sensing technologies for spacecraft, aircraft and shore based sensors. A particular focus was the investigation of Arctic and Antarctic regions to help assess global warming.

**Computation Technology** Innovations, starting in the 1950s with the silicon transistor and the Metal Oxide Field Effect Transistor, lead to a revolution in electronics that still influences us today. Printed circuits, microelectronics, integrated circuits, and a host of technical improvements lead to Moore's Law and the exponential growth of computing capability, including computational speed and memory capacity.

These innovations were to have a profound impact on maritime and ocean technology, as well as data management and processing.

**International Collaborations** Seafaring nations have many common elements in their policies and technology needs. The desire to learn from others and share findings is prevalent in the ocean community. Many international treaties and the United Nations have encouraged the sharing of knowledge. Among the international forums established was the OCEANS conference. But its sponsoring societies, the Oceanic Engineering Society and the Marine Technology Society, were yet to be created.

Images in this section are from public Web sites.



*Undersea Cable Technology*



*Remote Sensing Systems*



*Early Computer Chip*

# OCEANS Sponsor: Oceanic Engineering Society of the Institute of Electrical and Electronics Engineers

The Oceanic Engineering Society (OES) is one of forty-six technical societies and councils constituting the IEEE Technical Activities Board (TAB). IEEE is the largest technical association in the world with more than 400,000 members. The OES is the representative technical group for the study of the world's ocean systems which cover about three quarters of the world's surface. The OES provides access to science, engineering, and technology that addresses research, development, and operations pertaining to all bodies of water. Membership benefits include: 1. Access to world class peer-reviewed publications of the IEEE Journal of Oceanic Engineering (JOE), 2. Participation in technology committees, 3. Member rates to all OES sponsored conferences including OCEANS, 4. Easy access to historical JOE and OCEANS proceedings through the IEEE Xplore system, 5. Quarterly newsletter highlighting upcoming events and news, 6. Participation in IEEE-wide endeavors such as the IEEE Women in Engineering (WIE) Committee and the IEEE Young Professionals (YP) program.

The eighteen OES technology committees provide the technical backbone of all OES activities. The committees are the center for: 1. Recruiting papers for OCEANS and other conferences, 2. Recruiting and reviewing papers for the JOE, 3. Holding specialty workshops, 4. Providing expert researchers to speak at local chapter meetings.

In addition to being a cosponsor of the OCEANS conference series, OES also sponsors, cosponsors, and partners with a large number of information exchange forums. A major conference supported by the OES since 1969 is the Offshore Technology Conference (OTC) held annually in Houston. Cosponsored with 12 other professional societies, including MTS, this conference has a large exhibit component with more than 2700 exhibitors. The conference provides a networking focus for equipment suppliers to the offshore petroleum, energy and mineral production business. The attendance frequently exceeds 100,000.

The OES also sponsors specialty conferences, workshops, and symposia, as shown in the following table:

## Conferences, Symposia, and Workshops

Baltic Conference  
Underwater Technology symposia  
Current Measurements Technology Conference  
Autonomous Underwater Vehicles  
Submarine Cables Workshop  
Homeland Security Technology  
Rio Acoustics  
OTC Brazil and OTC Asia  
South American symposium  
International Symposium on Ocean Electronics (SYMPOL) (India)  
AUV Workshop  
Arctic Symposia

In addition to the above conference activity the OES publishes a quarterly professional journal, the *Journal*

## OES TECHNOLOGY COMMITTEES

- Airborne and Spaceborne Ocean Remote Sensing
- Current, Wave, and Turbulence Measurement
- Environmental Acoustics
- Environmental Technology
- Environment and Observation Systems
- Information Processing and Data Fusion
- Innovative Technology
- Numerical Modeling, Simulation, and Data Visualization
- Ocean Energy
- Ocean Policy and Education
- Ocean Signal and Image Processing
- Oceanographic Instrumentation, Communication, Navigation, and Positioning
- Standards
- Subsea Optics and Vision
- Underwater Acoustics
- Underwater Cables and Connectors
- Underwater Communication, Navigation, and Positioning
- Unmanned Maritime Vehicles and Submersibles





Some of the IEEE OES leadership and chocolate aficionados: From the left, Marinna Martini, Diane DiMassa, Elizabeth Creed and Barbara Fletcher.



Jim Collins at the OES Booth at OCEANS 2000 Providence.



The Beacon Editors, Harumi Sugimatsu and Bob Wernli, in front of the OES exhibit at OCEANS '16 Monterey

of *Oceanic Engineering* (JOE). Manuscript reviews are handled by a team of about 35 Associate Editors. Approximately 80 papers annually result in 1000 pages

of publication. Any JOE article and proceedings from OES-sponsored or co-sponsored conferences, workshops and symposia can easily be accessed through the IEEE *Xplore* online archive.

The OES also supports its members locally in areas where they are highly concentrated. Chapters, formed from these concentrations of OES members, hold meetings and seminars of common interest. These meetings also provide the opportunity to network with other local non-members and students who may be interested in membership. Chapters currently active in the USA include Providence, Washington DC, Houston, San Diego, Seattle and Hawaii. Canada has Chapters in Halifax, St. John's NL, Ottawa, Quebec, Toronto, Vancouver, and Victoria. In Europe and Africa there are Chapters in France, Italy, Spain, Tunisia, and the United Kingdom. One Chapter exists in South America in Argentina. Very active Chapters also exist in the Asia Pacific region in the countries of Australia (2), India, Japan, Korea, Malaysia, China (Shanghai), Singapore, and Taiwan. Chapters often serve as a focal point for hosting conferences, symposia, and workshops.

IEEE supports a number of international endeavors including: 1. Women in Engineering, of which OES plays a significant role, 2. IEEE fellowship awards, 3. IEEE Young Professionals Program, helping newly minted engineers to network in their technical and geographical areas, 4. Consultants network, and 5. IEEE Standards Association

Encouraging student activity and interest is crucial to promoting the viability of the OES. This is achieved by including potential student members in the Chapter activities, student posters in OCEANS, technology committees, and by publishing student papers in the Beacon. Students are also given the opportunity to apply their new engineering skills in several of the challenging competitions which the OES sponsors annually, including the semi-annual human powered submarine races, AUV competitions, and technical paper competitions describing their research activity at their university, college, or school.

The OES newsletter, The Beacon, is published quarterly. The editors produce a first rate coverage of all OES activities.

Joining OES is easy. Use the website at [www.ieeeoes.org](http://www.ieeeoes.org) or visit the OES booth in the exhibit area of any OCEANS conference.

## OCEANS Sponsor: Marine Technology Society (MTS)

The Marine Technology Society (MTS) is a 501(c)3 non-profit corporation established in June 1963 to give members of academia, government and industry a common forum through which to share their discoveries and developments in the exploration, understanding, utilization and protection of the oceans. Its guiding purpose is to promote awareness, understanding, advancement and application of marine technology. Today, MTS is a growing organization, boasting an international membership more than 3500 strong, comprised of businesses, institutions, and individuals who are ocean engineers, scientists, technologists, practitioners, policy makers, educators and students.

The MTS mission is to:

- Facilitate a broader understanding of the relevance of marine technology to wider global issues by enhancing the dissemination of marine technology information
- Promote and improve marine technology and related educational programs
- Advance the development of the tools and procedures required to explore, study and further the responsible and sustainable use of the oceans.

In its formative years, the Society developed a structure of regional Sections (versus Chapters) as well as Professional

Committees representing the prevailing disciplines in the field and these now thirty Committees are continually updated to represent the state of technology and the membership. In addition to the two (one North American and one alternating between Europe and Asia/Pacific) annual OCEANS Conferences that are cosponsored with IEEE/OES, MTS is also one of the original plank owners of the annual Offshore Technology Conference, the world's largest ocean technology event. Each year, MTS also holds two other major technical conferences, Underwater Intervention and Dynamic Positioning Conference. In addition to these major annual symposia, MTS convenes multiple focused workshops, student camps and competitions and other regional events around the U.S. and around the world.

In addition to 13 regional MTS Sections around the USA, MTS has expanded its international footprint through MTS Sections and Student Sections in Canada, China, India, Japan, Korea, Norway and Singapore. These Sections allow MTS to customize benefits to its member base by focusing on events and programs unique to their geographic areas, enhancing networking among local colleagues, businesses, universities and government/military offices.



Photo Credit: The Link Collection Archives, Florida Institute of Technology.

Ed Link with his 4-man JSL Sub. Link was a member of the DSSRG investigating the USS Thresher incident and Founding Member of MTS



MTS publishes the peer-reviewed *MTS Journal* bimonthly in addition to its monthly newsletter *Currents*, both distributed worldwide. Throughout the MTS 55 year history, the membership of the society has come from diverse marine and oceans backgrounds. MTS leadership is comprised of captains of our industry, key government and military leaders, eminent academicians and entrepreneurs. The Marine Technology Society is key to bringing together these diverse groups who share a common interest in the oceans, and provides them a broad range of services, supporting a vast array of professional needs.

Of the three legs of the MTS triad (Industry, Government, Academia) it is the latter—education—that represents the future of both the society and the community; therefore, it is here where a substantial amount of our investment of both time and treasury is made. MTS has established and sponsors more than 15 Student





*Students and Mentors Deploying Gear During MTS Sea Camp, Lake Michigan 2016. Photo by Liesl Hotaling.*

### **MTS PROFESSIONAL COMMITTEES**

- Arctic Technology
- Buoy Technology
- Cables and Connectors
- Cyber Infrastructure and Security
- Deepwater Field Development Technology
- Diving
- Dynamic Positioning
- Manned Underwater Vehicles
- Marine Archaeology
- Marine Education
- Marine Geodetic Information Systems
- Marine Law and Policy
- Marine Materials
- Marine Mineral Resources
- Marine Security
- Moorings
- Ocean Economic Potential
- Ocean Exploration
- Oceanographic Instrumentation
- Ocean Observing Systems
- Ocean Pollution
- Physical Oceanography and Meteorology
- Remote Sensing
- Remotely Operated Vehicles
- Renewable Energy
- Ropes and Tension
- Seafloor Engineering & Offshore Structures
- Underwater Imaging
- Unmanned Underwater Vehicles

Sections, both at some of the world's leading universities as well as community colleges around the country. Each of these colleges and universities operate substantial programs of study in the marine sciences or technology and each Student Section is counseled by an MTS member who is also a member of the faculty of the institution. MTS Student Sections are encouraged to produce their own newsletter and/or website and to participate in and attend meetings of the professional MTS Sections and MTS conferences. MTS also has established both internship and formalized mentoring programs and provides more than \$200,000 annually in scholarships, sponsorships and awards.

### **MTS CONFERENCES, SYMPOSIA and WORKSHOPS**

- MTS-ONR Buoy Workshop
- Dynamic Positioning Conference
- Underwater Intervention (ROV) Conference
- Underwater Archeology Workshop
- Cables and Connectors Workshop
- Underwater Imaging Workshop
- Offshore Energy and Power Workshop
- Cyber Security and Infrastructure
- Manned Underwater Vehicle Workshop
- Capitol Hill Ocean Technology Briefings
- Offshore Technology Conference Brazil, Asia

### **MTS STUDENT SECTION COLLEGES AND UNIVERSITIES**

- Alpena Community College
- Arizona State University
- The College of William and Mary
- Florida Atlantic University
- Florida Institute of Technology
- National Institute of Technology Tiruchirappalli (India)
- Rutgers University
- SRM University (India)
- Texas A&M University – College Station
- Texas A&M University – Galveston
- University of Florida
- University of Houston
- University of Puerto Rico
- University of South Carolina
- University of Southern Mississippi
- University of Washington
- Webb Institute

## OCEANS Serves the Ocean Community

**Value of OCEANS** Part of the broad American and international response to the world events led to the establishment of the Oceanic Engineering Society of IEEE and the Marine Technology Society. Because the ocean interest community was rather small, technically diverse, and geographically dispersed, it was recognized that an annual information exchange forum was needed to facilitate effective responses to emerging, ocean related, international events. It was recognized that the most effective forum would involve government, industry, and academia. Thus, from the beginning, OCEANS was designed to be an international open exchange forum for interested communities.

The OCEANS conferences have become the preeminent forum for academic, commercial, and government organizations to meet and exchange ideas, technology, and products to advance the exploration, understanding, and protection of the world's oceans and water resources. This collaboration between the OES and MTS has worked well because both societies have a wide range of technical committees, 18 in OES and 29 in MTS, that when combined, cover virtually every aspect of ocean science and technology including policy, education, and outreach.

**OCEANS Policy and Education Forums** OCEANS routinely provides forums for ocean policy, education, and economics discussions. It has become routine for OCEANS to have policy makers as honorary chairs or plenary speakers. For example, OCEANS '76 was focused on involving the political community. Special events included a congressional panel session of six U.S. Representatives presenting their views and priorities on marine science and technology.

To further recognize the importance of marine science and technology, a special international plenary panel session was held featuring ocean leaders from Canada, Egypt, Federal Republic of Germany, France, India, Japan, Kenya,

Netherlands, Sweden, Union of Soviet Socialist Republics, United Kingdom and the United States. Another example was OCEANS '05 in Washington D.C. where there were many presentations and discussions of the then recently published Watkins Report. Nearly all OCEANS conferences have education and outreach sessions as well as tutorials and student poster sessions.

**Ocean Environmental Properties** Many of the early OCEANS were focused on ocean properties affecting detection of naval acoustic and non-acoustic signatures. That application has broadened to include pollution assessment, ocean bottom inspection and charting, ocean current and parameters associated with global warming such as: sea ice coverage, sea surface temperature, and average ocean temperature. The conferences now routinely feature sessions on oceanographic properties.

**Offshore Oil Exploration** Drilling for oil offshore motivated the development of remotely controlled undersea vehicles and many companies became interested in the development of Remotely Operated Vehicles (ROVs), Autonomous Underwater Vehicles (AUVs) and many variants. These vehicles carried sensors to inspect the underwater drilling structures. Later variants also carried tools and systems to repair the structures. The growing interest in ROVs was increased by a 200 page book in 1978 by Joe Vadus and Frank Busby. As a result of that book, based on over 200 interviews with companies and institutions already working with the technology, the term ROV became commonplace and universally accepted worldwide. In 1983, Bob Wernli organized and conducted the first ROV conference in San Diego, CA. These trends were also motivated by deepsea exploration for sunken naval assets and the expanding interest in shipwreck archeology. Autonomous vehicles were also used for underwater



Left to right: Rep. William V. Alexander (Arkansas), Rep. John B. Breaux (Louisiana), Rep. Thomas N. Downing (Virginia), Rep. Edwin A. Mosher (Ohio), Rep. P. E. Ruppe (Michigan), Rep. Leonor K. Sullivan (Missouri) and moderator Dr. Robert Frosh, Assistant Navy Secretary for R&D. Photo by official OCEANS '76 photographer.



*RMS Titanic Session Participants: Jean-Louis Michel of IFREMER was on the WHOI ship Knorr with Bob Ballard when they found the Titanic in September 1985, P.H. Nargeolet was the pilot of IFREMER's submersible Nautilie and piloted the first dive on Titanic in 1986, George Tulloch of RMS Titanic Inc. which later collected some Titanic artifacts, Dominique Girard of IFREMER and retired from the French navy, Joseph Vadus of NOAA and IEEE Fellow was the U.S. Chair of the U.S.-France Cooperative Program in Oceanography sponsoring this project, Anatoly Sagalevitch of the Russian Academy of Sciences was the Principal Pilot for the Russian submersibles Mir-1 and Mir-2 used in many dives to the Titanic, and William Garzke, Jr. of Gibbs and Cox who conducted studies of the structural failure of the Titanic hull's plate rivets. Photo by Gloria Vadus.*

search and ocean parameter sensing. In 2002, the Slocum profiler was introduced as an unmanned system that was capable of self-propulsion across a wide span of ocean, collecting oceanographic data along the way.

OES and MTS have been major partners in support of the Offshore Technology conference (OTC) since 1969. Exposure to the massive structures needed in that industry promoted the development of new technology that was often first exhibited in the OCEANS conferences. That relationship extends to the present and now it has expanded to cover offshore technology in frontier regions.

**Deep Submergence** Interest in deep sea sensing was motivated by the sinking of U.S. and Soviet submarines. Much of the information was classified, but other interests in ocean surveillance drove the advancement of deep submergence technology, remotely operated vehicles, and bottom scanning sonars. When these capabilities became generally known, interest expanded to include ocean archeology of ancient shipwrecks, and relatively modern ones too, such as the RMS Titanic, which sank in 1912. The Titanic was discovered in 1985 as a result of a collaborative U.S.-France program. Papers regarding the Titanic were presented at OCEANS '94 in Brest, France, at a special session with principal participants describing its loss and location at over 4000-m depth. For his leadership in the joint U.S.-France program that discovered the Titanic, Joseph Vadus was awarded the French

National Order of Merit by the President of France and received the award in 2000 at the French embassy in Washington D.C.

At OCEANS '95 San Diego, deepsea videos of the Titanic were shown by film producer James Cameron, taken during the filming of the block buster movie on the Titanic.



*Search for the Titanic*

**Ocean Energy** The Marine Technology Society conference in 1979 was one of the early conferences on ocean energy, a topic that was continued in the OCEANS conferences. In the mid-1980s ocean energy included OTEC, offshore wind systems, and tidal power. Many companies became interested and papers appeared at the OCEANS conferences. In particular, OCEANS '83 in San Francisco highlighted several sessions on OTEC with papers representing interests in ocean thermal energy conversion from France, Netherlands, Japan, Taiwan, Jamaica, Sweden, USA, and the USSR.

Current OCEANS conferences include many more recent ocean energy concepts such as ocean wave energy



*Artist Rendition of the Osaka Bay Plan*

coupled with mechanical or electromagnetic linkage and ocean current turbine conversion.

**Ocean Measurements** Sensors and measurements are always an important track with several sessions at OCEANS conferences. Underwater optical imaging systems, from ROVs, AUVs, and human occupied vehicles require lighting and image processing from image flattening to image mosaicing. Spectral measurements of radiation and backscatter are used for biological and sedimentological studies, and optical communication is now being used for extremely high bandwidth data transmission albeit for

modest link distances. Current, wave, and turbulence measurements have at least one session at every OCEANS conference covering surface current observations by HF radar and acoustic velocimeters and their applications beneath the surface. Mass spectrometry, in situ flow cytometry, stimulated emission from radiation used for chemical determination, and lab-on-chip in situ chemical and RNA analyzers are included. Cabled observatories have extended our observational longevity but power reduction and in situ power generation have helped to give such benefits to autonomous instruments as well.

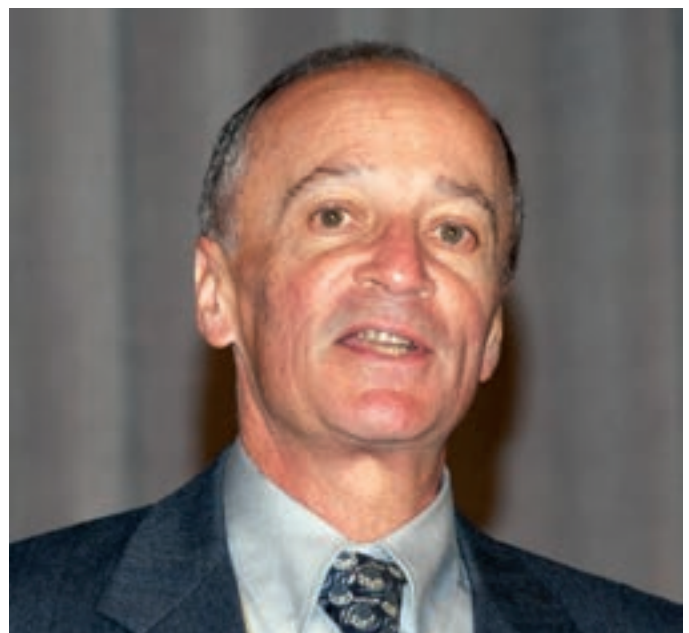
There are always novel measurements reported at OCEANS and what is a new technique today may

become a new measurement industry tomorrow. Acoustic Doppler velocity measurements are such a success.

**Underwater Acoustics** Underwater acoustics has been a central theme in all OCEANS conferences and in the journals of its two sponsoring societies. The rosters of OES's Distinguished Technical Achievement Award and Fellows, and MTS's Fellows is a Who's Who of pioneers in underwater sound. They include Robert Frosch, Alan Berman, Ira Dyer, and Walter Munk to name a few. In the early days and all throughout the Cold War the focus was on naval applications, and while this continues, today there is more emphasis on



*Sandy Williams Leading an Ocean Measurements Session at OCEANS '12 Hampton Roads*

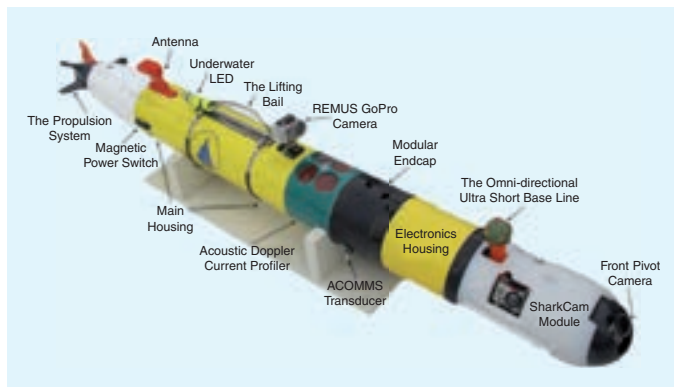


*Robert Spindel presented over 20 acoustics articles at OCEANS starting in 1972, here speaking as General CoChair of OCEANS '10 Seattle*

using sound as a remote ocean sensing tool either alone or as a component of a system of sensors (an ocean observatory), for example, to monitor currents, temperature, and bottom properties. Much attention is now given to methods for high data rate robust acoustic communications and data transfer, and on underwater communication networks.

**Ocean Space Utilization** Japan's interest in ocean space was on display at OCEANS '08 Kobe. Japan undertook the Marine Corridor Project to link seven cities in Osaka Bay. The Osaka harbor area is testament to the wise use of technology to increase habitable land. Japan's interest was also based on their need for more coastal ocean space to expand and develop marine resources including aquaculture, marine minerals, recreational use, and expanded ocean living space. In the U.S., President Reagan extended the U.S. Exclusive Economic Zone (EEZ) to 200 miles and the territorial limit to 12 miles. These actions promoted interest in shoreline ocean research and greatly protected fishery resources.

**Ocean Wildlife Technology Support** Some of the technology used in the fields of fisheries, ocean mammal husbandry, and coastal wildlife investigations, as well as in oceanography, was developed by the OCEANS community. Papers in these areas are routinely presented at OCEANS. Many studies of ocean creatures by the Monterey Bay Aquarium Research Institute were featured at OCEANS '16 Monterey.

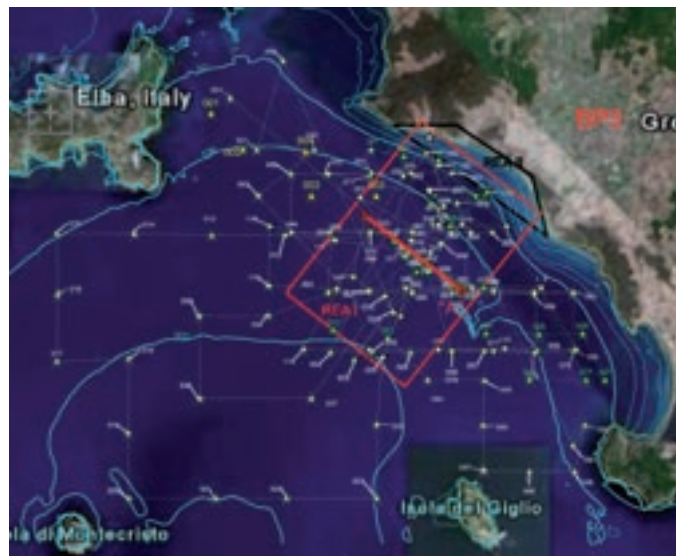


WHOI Developed REMUS AUV SharkCam

**Undersea Communications** In the late 1980s, Bell Telephone Laboratories (BTL) designed a Fiber Optic underwater cable which was installed across the Atlantic. OCEANS '86 authors presented papers on the cable characteristics and lay-down details of these transoceanic cables. R. Bannon and BTL Engineers adapted ROVs to recover, repair and re-bury these fiber optic cables. Papers on the progress of new high capacity submarine cables, associated tools and new burial techniques were presented at OCEANS conferences throughout the 1990s and continuing today.

**Modeling, Simulation, and Analysis** Modern computers and other electronic devices have made a profound impact on ocean science through improved sensing, data acquisition, and information display. In addition,

mathematical and analysis techniques were applied to understand complex data sets. Early OCEANS conferences were concerned with modeling acoustic propagation using normal mode and parabolic wave equation techniques. The OCEANS conferences routinely hold many sessions on computational results. Many of the papers first presented at OCEANS find their way into the technical journals, such as the Marine Technology Journal or the IEEE Journal of Oceanic Engineering.



From the "Range-resolving shallow water acoustic tomography by ensemble Kalman filtering" by Carriere, Hermand, and Candy in OCEANS 2008 Proceedings

**International Collaborations** The internationalization of the OCEANS conferences is a natural consequence of the growing ocean community, which is described elsewhere in this document. But that was not the only thrust to broaden the exposure of new technology to other nations. There was a growing interest in IOOS by nine Baltic nations. The first of seven Baltic International Symposia was initiated in Klaipeda, Lithuania 2004 by Joe Vadus, and the venue later rotated between Lithuania, Latvia and Estonia. The nations bordering the Baltic Sea were concerned over the World War II dumping of dangerous munitions and poison gas weapons in over 100 hot sites. These and other collaborations continue with South American, Indian, and Asian nations.

**OCEANS Administrative Systems** Perhaps unnoticed by OCEANS attendees is the efficiency provided by the conference software system. Over the years OES's Todd Morrison has worked with Matthew Gelis of Veraprise, Inc. to create an integrated system to handle: participant registration, abstract submission and review, conference session and schedule composition, finished paper submission, and proceedings preparation. This system has saved countless hours and costs, historically involved in these activities, thereby minimizing the administrative costs of OCEANS and minimizing the difficulty that the registrant historically faced. They have made a significant contribution to OCEANS.

## OCEANS is International

**Initial International OCEANS Conferences** The conference theme for the first six OCEANS conferences was “IEEE International Conference on Engineering in the Ocean Environment.” However, the first twenty-five OCEANS conferences were held in North America at U.S.

or Canadian sites. While “international” meant that people from any nation could attend, there was little effort to locate the conference at sites outside North America until 1994, when OCEANS '94 OSATES was held in Brest, France. Since OCEANS sites are chosen about 5 years in



*OCEANS' 94 OSATES Committee L to R Back: Jean Vicario (Arrangements Chair), Jean-Luc Lambla (Conference Chair), Jim Collins (OES VP for Technical Activities), Alain Hillion (Tutorials Chair), Stan Chamberlain (OES Past President and Technical Program Vice Chair), Glen Williams (OES Rep to the Steering committee and Past President under whose leadership the conference became a reality), Joe Czika (OES President)*

*L to R Front: Bruno Barnouin (Technical Program Chair), Roger Le Prohon (Exhibits Chair), Edmund Sullivan (OES Distinguish Technical Achievement awardee), Dan Alspach (OES Distinguished Service Awardee), Ferial El-Hawary (OES VP for International Activities), Pierre Sabathe (General Chair), Norman Miller (OES VP for Professional Activities and Student Program Chair). Photo by Technopole Brest Iroise.*



*Yashuro Kato (Pres. JAMSTEC), VAdm. Conrad Lautenbacher (NOAA Administrator), Ted Bockett (Pres. MTS), Tatsuo Yada (Mayor Kobe), Naohika Namba (Chair CJO), Tom Wiener (Pres. OES), Joseph Vadus (VP OES), Tamaki Ura (U. of Tokyo and Chair OTO'94)*



advance, it is clear that the true internationalization began in the late 1980s, motivated in part by the expressed internationalization of IEEE and led by Glen Williams, then President of OES. That conference was sufficiently successful to attract MTS support for future international sites. OCEANS '98 was held in Nice, France. It was chaired by Pierre Sabathe, who, along with Rene Garello, Jean-Yves Jourdain, and Jean-Luc Lambla brought seasoned experience from the Brest conference.

The first Asian OCEANS conference was held in 2004 at Kobe, Japan. It was combined with an on-going ocean Japanese conference, Techno-Ocean, under the Consortium of the Japanese Organizers (CJO) and given the name OCEANS/Techno-Ocean'04, or OTO'04. It was the result of the long association of Joseph Vardus, working at NOAA, and various members of JAMSTEC and of Tamaki Ura of the University of Tokyo working with OES members to hold the Underwater Technology symposia, held biannually since 1998.

**Planning for OCEANS Conferences** OES and MTS formed the Committee on Conference Policies, affectionately known as CoCoPo, for proposing a scheme of two conferences per year. A model was developed for holding

an OCEANS in North America, normally in September/October, and alternating between Europe and Asia Pacific, normally in March/April. This pattern started in 2005 with the Apr-Jun OCEANS conference in Brest, France and the Sep-Nov conference in Washington, DC, USA. Along with long range planning for OCEANS, the societies committed to forming sufficiently strong local chapters to generate the talent and enthusiasm needed to support the hosting functions for the conference. Conference attendance and author data show that there is strong local regional support for all OCEANS conferences including, and, especially, the international conferences, thereby fulfilling expectations that OCEANS is a forum for the benefit of all people and nations.

**Future OCEANS International Conferences** At present, OCEANS continues to increase its presence in Europe and Asia-Pacific, with planned conferences in Japan, France, Singapore, Portugal and India. There will be pressure in the future, as globalization gains momentum, to extend OCEANS to South America and Africa. This will be the challenge for the coming decade for bringing OCEANS from the status of international conference to worldwide event. And, as the OCEANS Shanghai photo says: Our Future Is With OCEANS.

# OCEANS History

The OCEANS conference was designed to be a forum that appealed to a broad technical base and a geographically dispersed community. Since its beginning, the OCEANS conference has become the premier ocean engineering and marine technology forum for exchanging new ideas and seeing the latest technology.

The origin of today's OCEANS conference is as rich as the history of ocean engineering itself, and came together as the result of the partnership of two pioneering organizations. In 1963, in the aftermath of the tragic loss of the nuclear submarine USS Thresher, a newly minted professional organization, the Marine Technology Society (MTS), was established to create a forum for engineers, scientists and practitioners to share their developments and discoveries in ocean technology. MTS founding president, RADM E.C. Stephan had chaired the Deep Submergence Systems Review Group (DSSRG), a blue ribbon committee commissioned by President John F. Kennedy to investigate the Thresher incident and the difficulty locating its wreckage and remains. Coincidentally that same year, with the space race spawning advances from lasers to integrated circuits, two venerable professional societies would combine to form one powerful institution to support this burgeoning new era of technological development. The American Institute of Electrical Engineers, (AIEE) with such distinguished past presidents as Alexander Graham Bell and the Institute of Radio Engineers (IRE) among whose past president was William Hewlett (of Hewlett-Packard) merged to form the Institute of Electrical and Electronics Engineers (IEEE). Concurrent with the frenetic "outerspace" race, a parallel strategic emphasis was also underway, intent on developing the technologies required to access and explore "hydrospace"—the ocean's depths. In recognition of this, IEEE formed the Oceanography Coordinating Committee (OCC) a predecessor to today's Oceanic Engineering Society (OES).

In 1965, MTS convened the first ever national conference in the U.S. for the ocean science and technology community, called the "1965 National Marine Technology Conference-Convention-Exhibition" and held at the new Washington, DC Hilton Hotel. (then, still under construction). This became an annual event. In 1970, the IEEE/OCC convened its first annual conference simply named "OCEAN" in Panama City, Florida, and continued to hold the OCEAN conference annually. After five years running their separate events, these two pioneering ocean technology organizations, IEEE/OES and MTS, joined forces to jointly convene the internationally heralded OCEAN '75, held in San Diego. The following year, then OCEAN '76 Executive Chair Joe Vadus instituted a change to the OCEAN name, adding the letter "S". This was intended both to acknowledge that there is more than



1970 Panama City, Florida

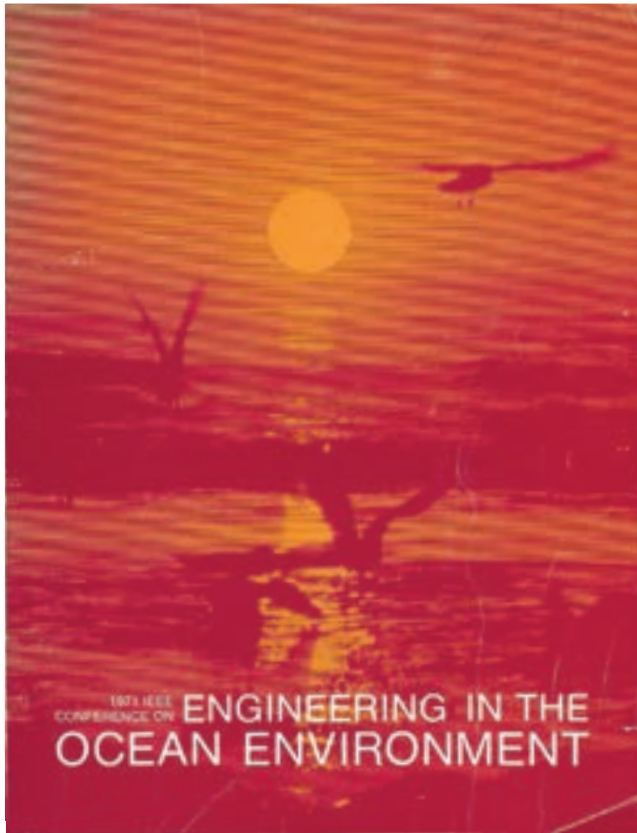
only one ocean and thereby emphasize the growing international scope of the conference. This change stuck and finally, in 1995, the conference name was officially branded as OCEANS 'YY MTS/IEEE to memorialize the partnership of its two sponsoring societies. From time to time, especially for conferences outside North America, an additional sponsor's name was added to the conference title to acknowledge their contribution. The conference has grown from less than 100 papers presented at the first conferences to over 500 today.

In the following pages every conference, 61 this year, is honored by exhibiting an iconic image of each, mainly by reproducing the cover of that conference's proceedings or program. OCEANS '17 MTS/IEEE Aberdeen Scotland is precisely the 60th edition of the conference, but we celebrate the entire year so OCEANS '17 MTS/IEEE Anchorage is also included among the images provided.

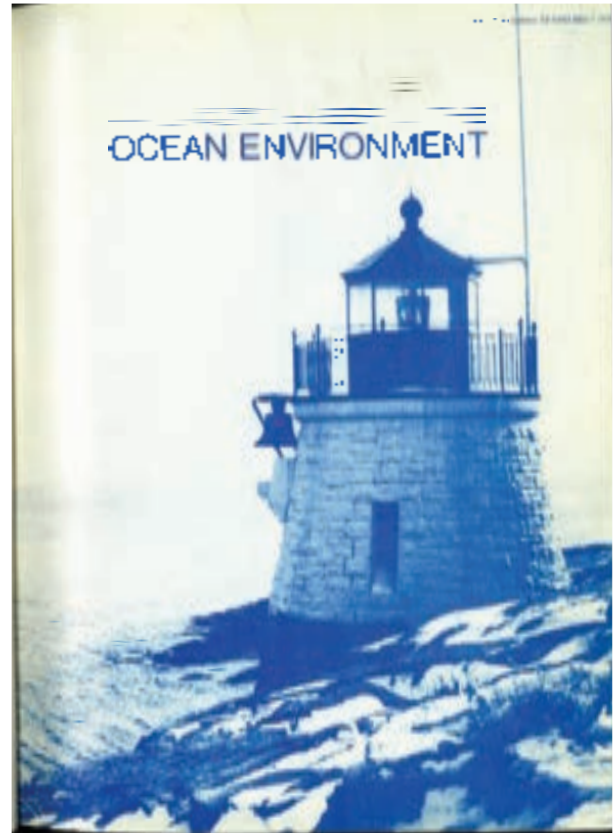
Conference venues are usually selected five years in advance of the event by a joint committee of the two sponsoring societies. Often the conference returns to a prior location about every ten years. In 2005, to expand the international footprint, the sponsoring societies decided to begin convening two OCEANS conferences every year. An annual North American conference is held, usually in Sep-Nov, continuing the tradition set by the first 37 conferences. Each April-June, a second conference is now also convened, its location alternating between Asia-Pacific on even years and Europe on the odd numbered years. The OCEANS venues are usually chosen to be coastal cities, having strong ocean-related industrial, governmental, or academic presence. In addition strong MTS or OES local chapter support is necessary as well as local, regional, city, or state support.

The Executive Chair of the 1970 OCEAN conference held in Panama City was Wayne Burt of the David Taylor Naval Research and Development Center. In the 1960s, the cold war was important to the U.S. and its allies, and the naval component of the nuclear triad was of major concern. Hosting many U.S. Naval facilities, Panama City, with its naval research lab, was a hotbed of ocean sensing technology. The theme for the first six OCEANS conferences was "Engineering in the OCEAN Environment." Themes for later conferences varied with location and often reflected local interests. The theme of each year's OCEANS conference adapts to reflect both current events and the present and emerging state of technology. Fittingly, looking ahead to the next millennium, the theme for MTS/IEEE OCEANS '96 in Ft Lauderdale, Florida was "Prospects for the 21<sup>st</sup> Century," Co-Chaired by Andrew Clark (Past President of MTS) and Claude Brancart (Past President of OES).





1971 San Diego, California



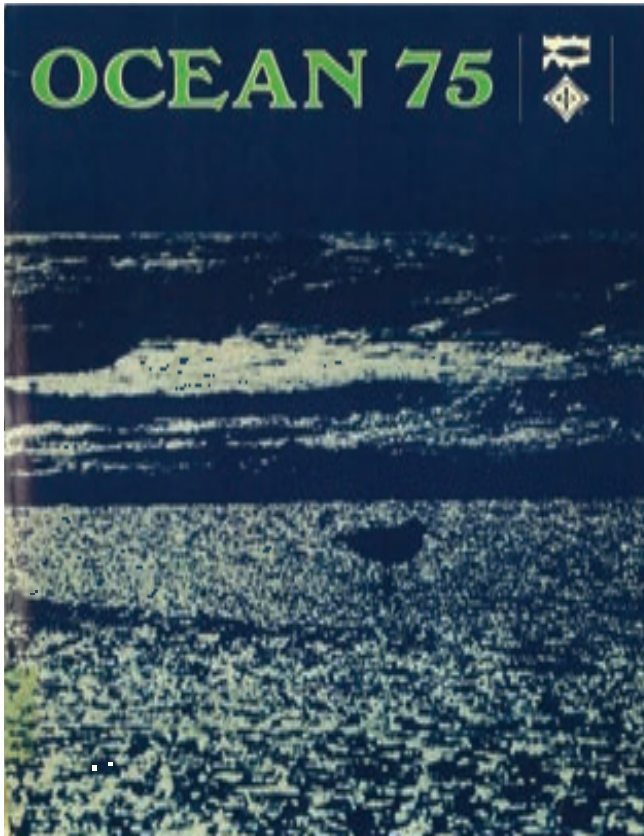
1972 Newport, Rhode Island



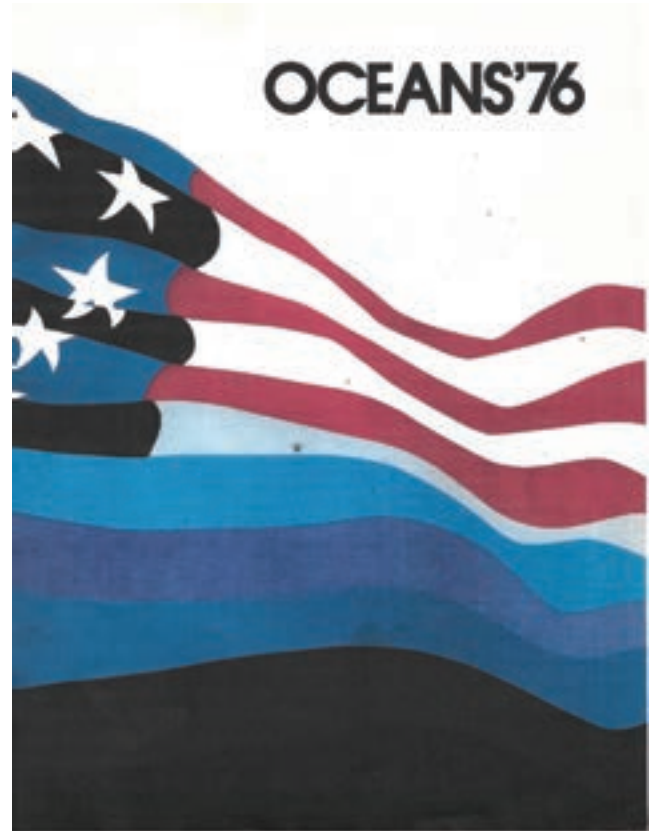
1973 Seattle, Washington



1974 Halifax, Nova Scotia



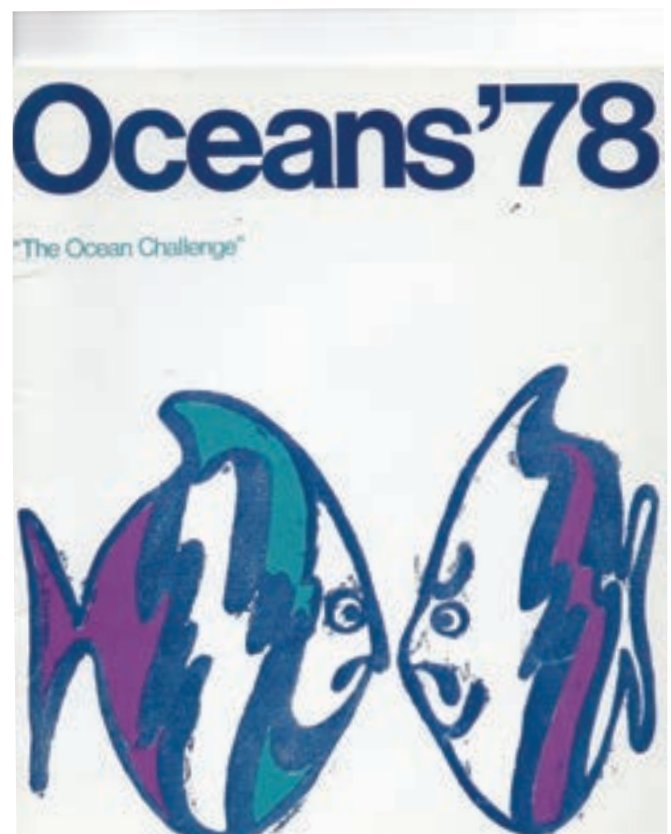
1975 San Diego, California



1976 Washington, D.C.



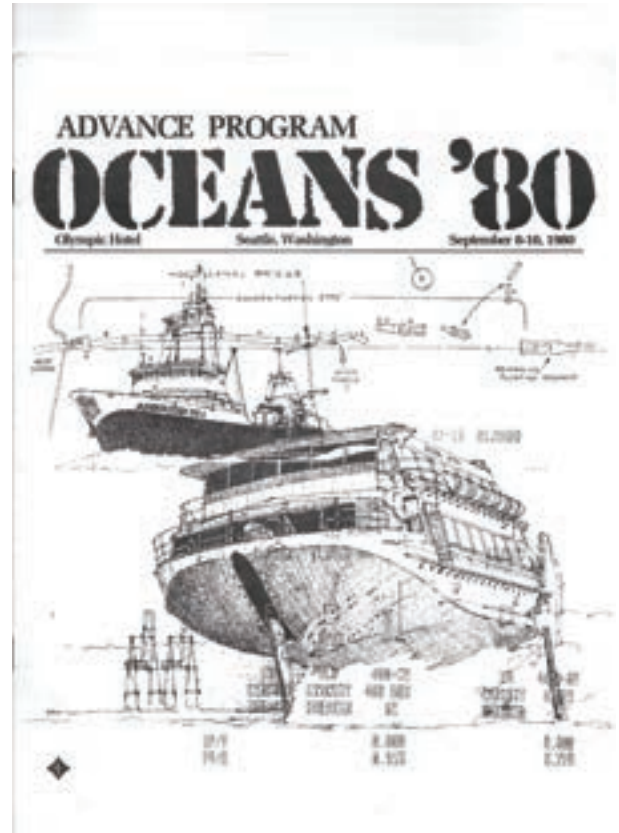
1977 Los Angeles, California



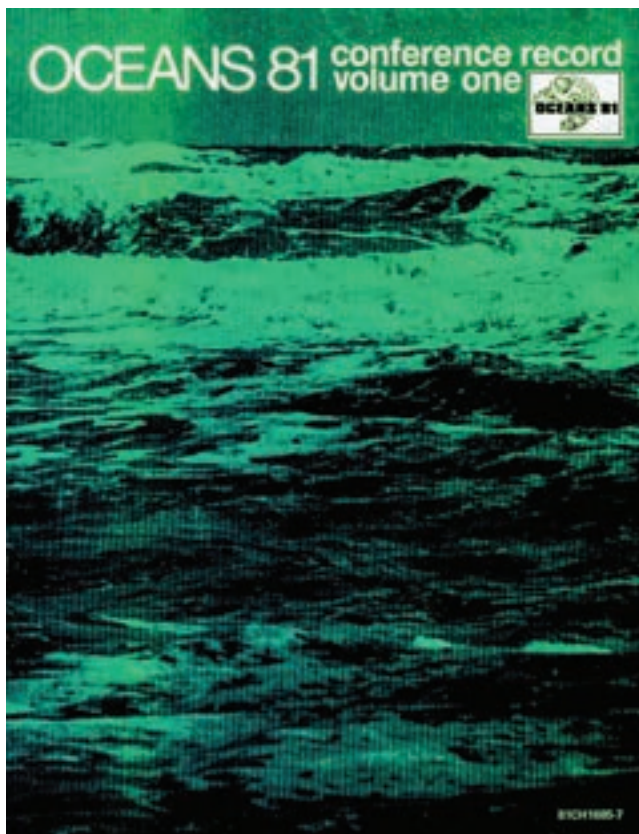
1978 Washington, D.C.



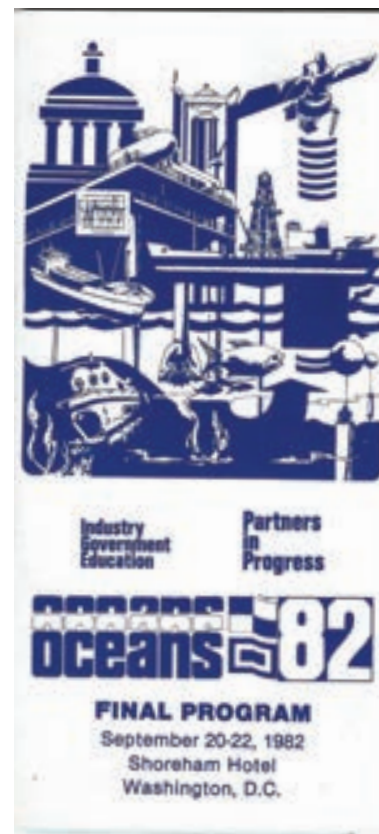
1979 San Diego, California



1980 Seattle, Washington



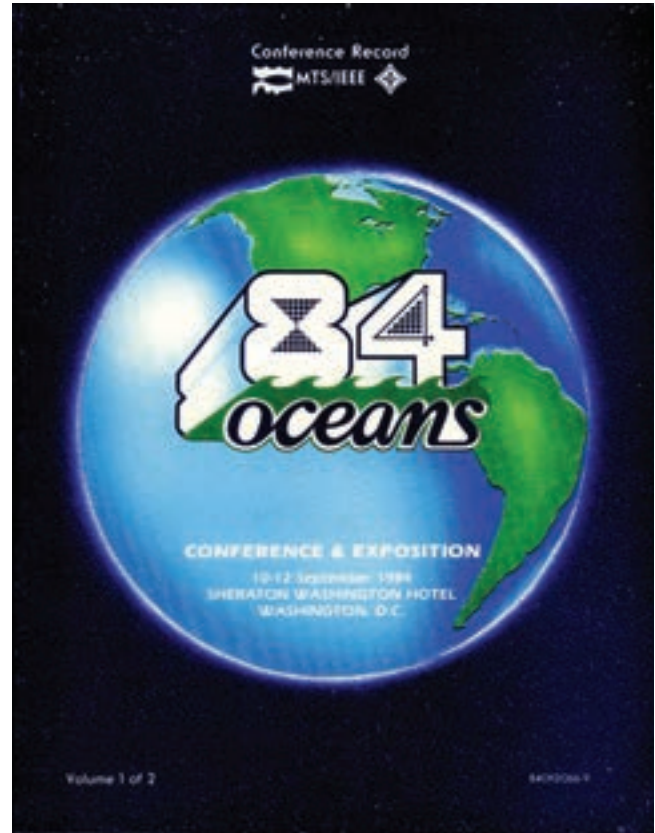
1981 Boston, Massachusetts



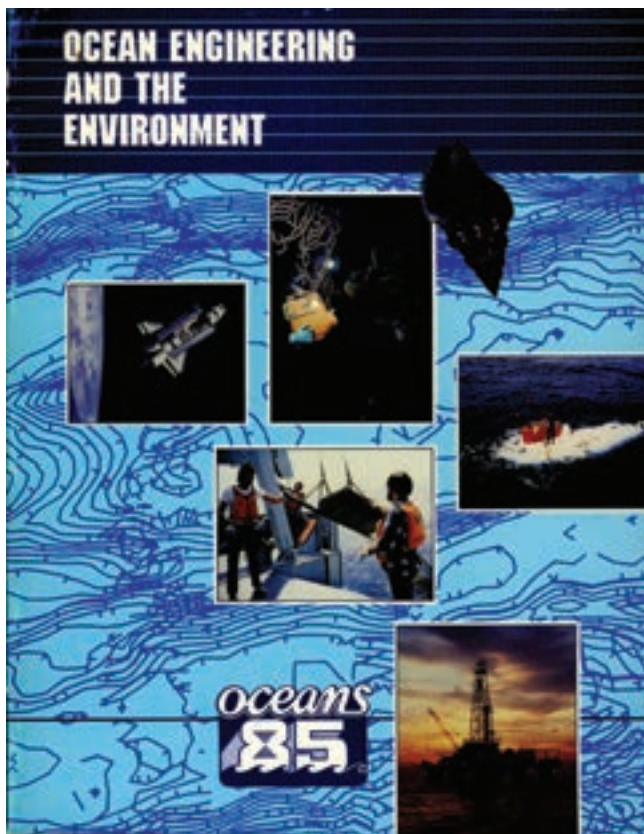
1982 Washington, D.C.



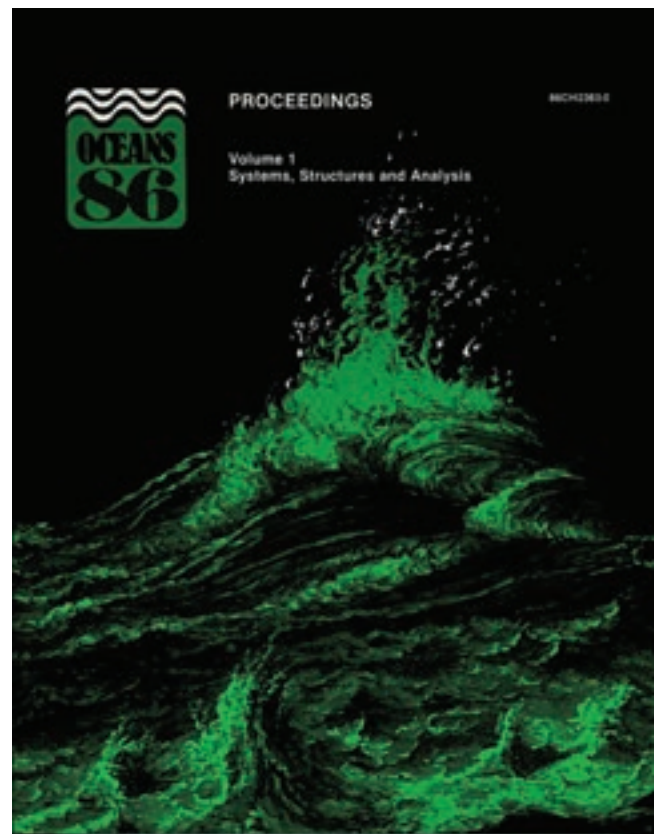
1983 San Francisco, California



1984 Washington, D.C.



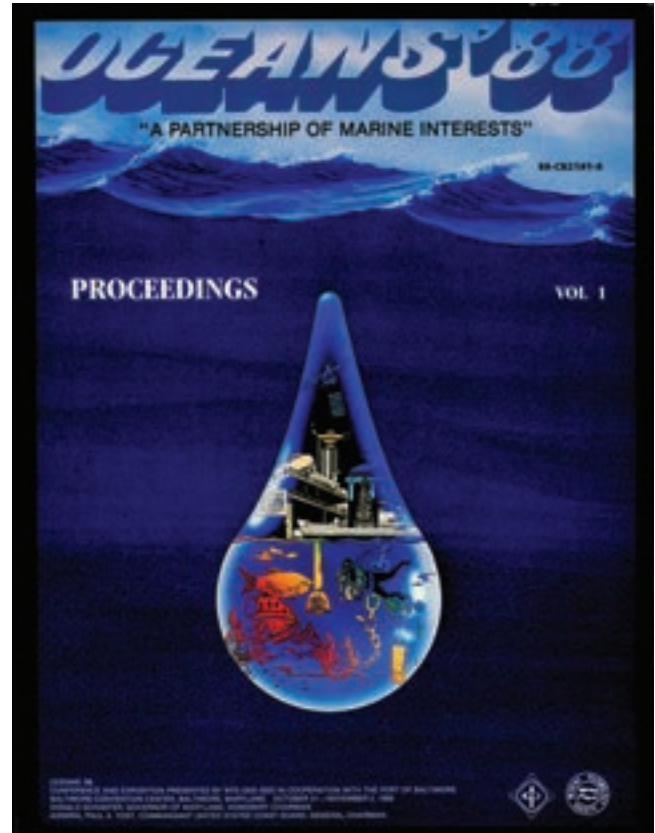
1985 San Diego, California



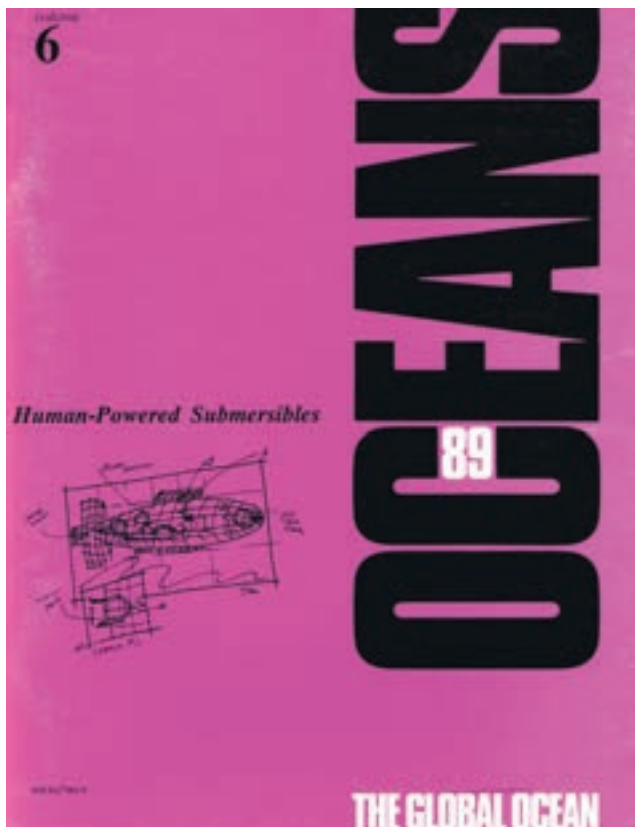
1986 Washington, D.C.



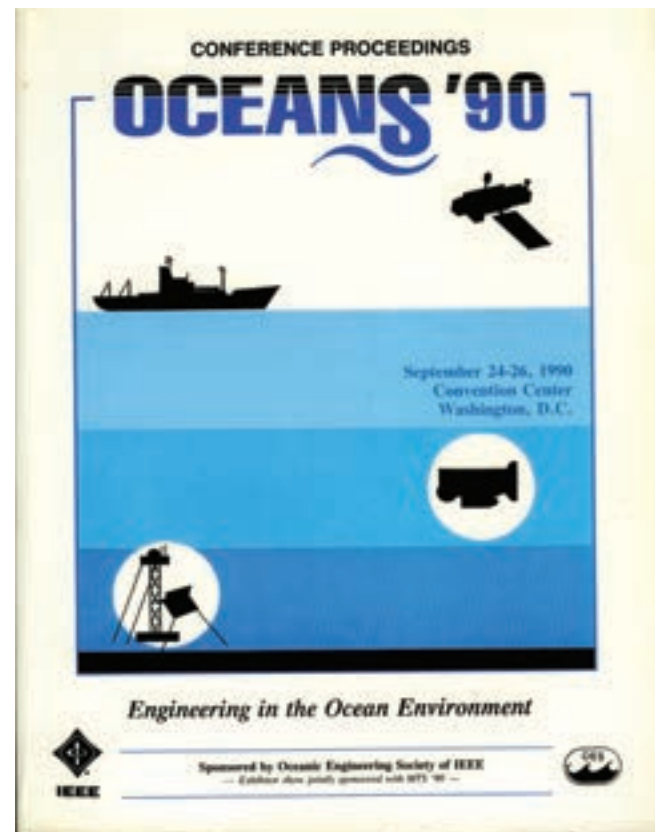
1987 Halifax, Nova Scotia



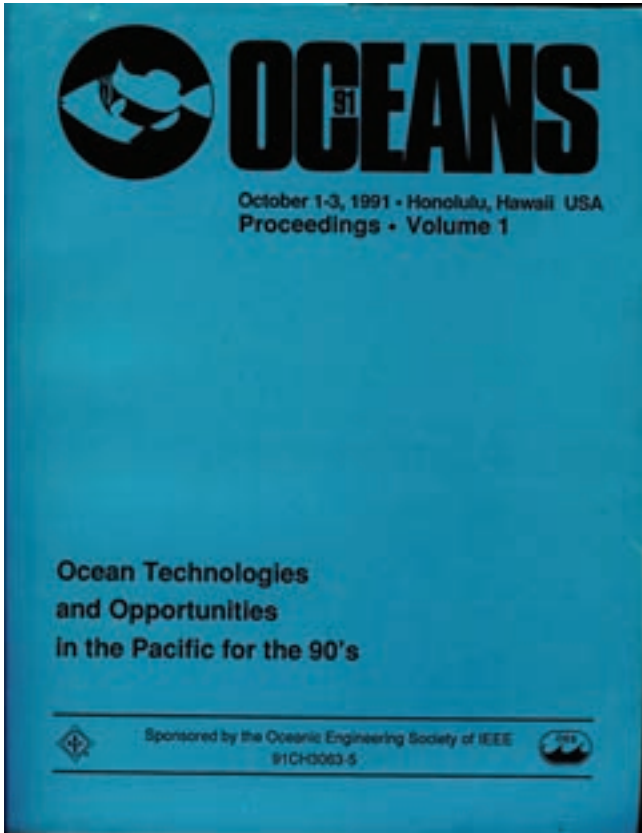
1988 Baltimore, Maryland



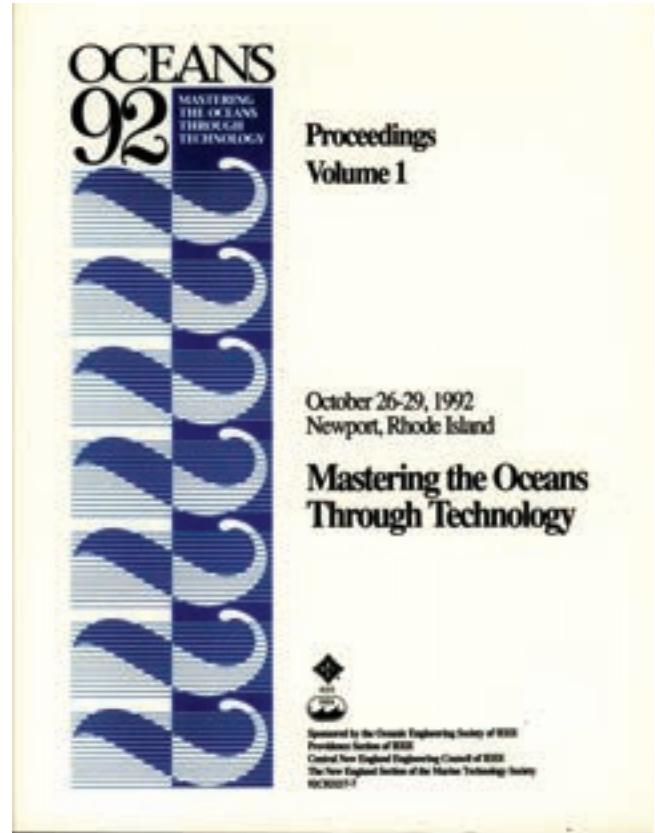
1989 Seattle, Washington



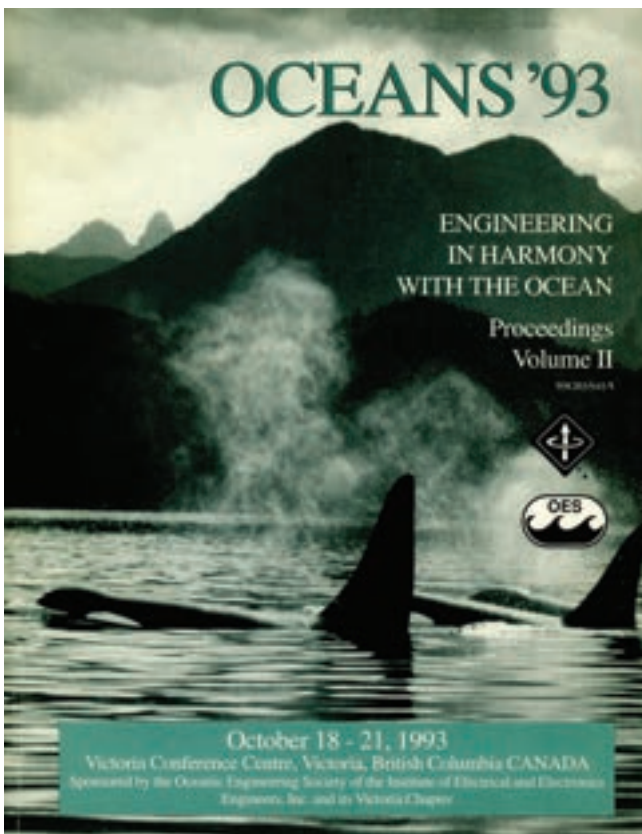
1990 Washington, D.C.



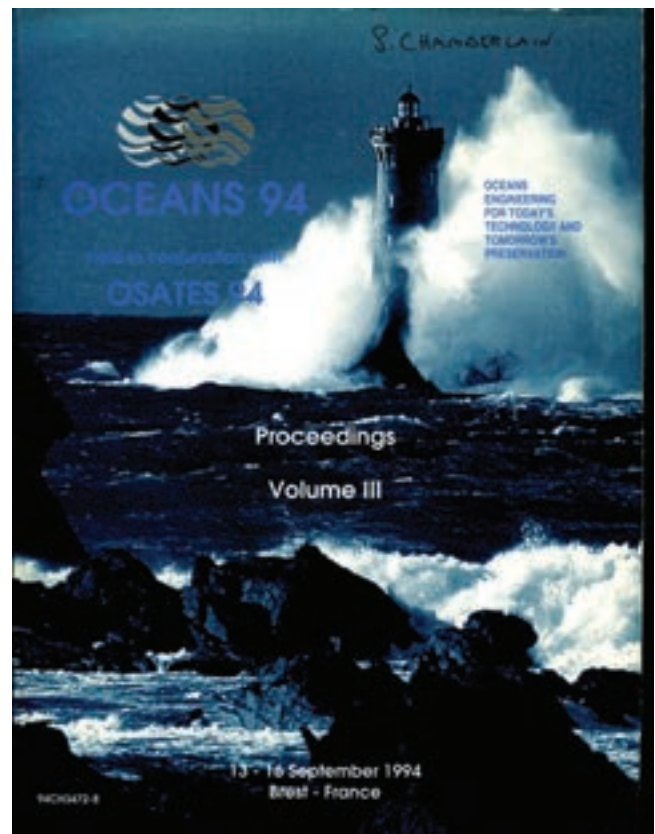
1991 Honolulu, Hawaii



1992 Newport, Rhode Island



1993 Victoria, British Columbia



1994 Brest, France

# OCEANS '95 MTS/IEEE

"CHALLENGES OF OUR CHANGING GLOBAL ENVIRONMENT"



October 9-12, 1995  
Town and Country Convention Center  
San Diego, California, USA



1995 San Diego, California

# OCEANS 96 MTS/IEEE Conference Proceedings



*The Coastal Ocean -  
Prospects For The 21st Century*

23 - 26 September 1996  
Broward County Convention Center  
Fort Lauderdale, Florida



1996 Fort Lauderdale, Florida



1997 Halifax, Nova Scotia



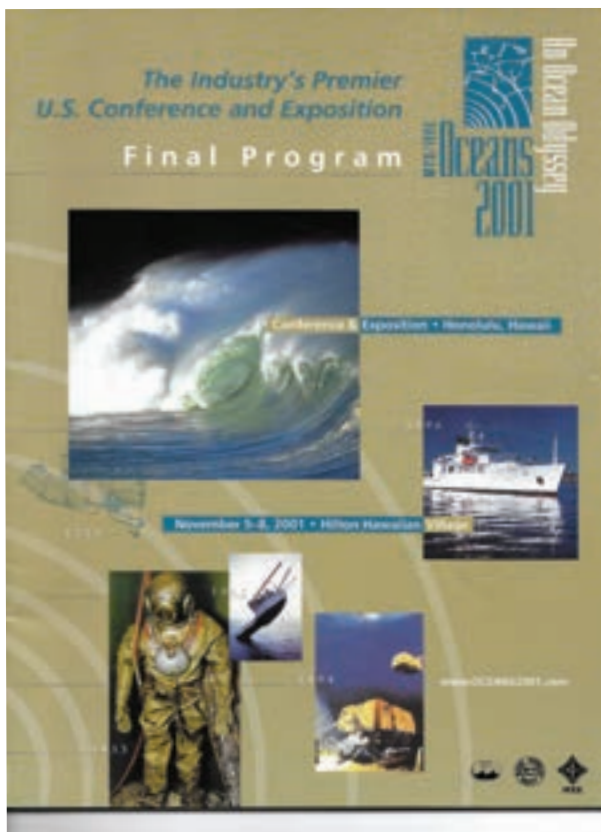
1998 Nice, France



1999 Seattle, Washington



2000 Providence, Rhode Island



2001 Honolulu, Hawaii

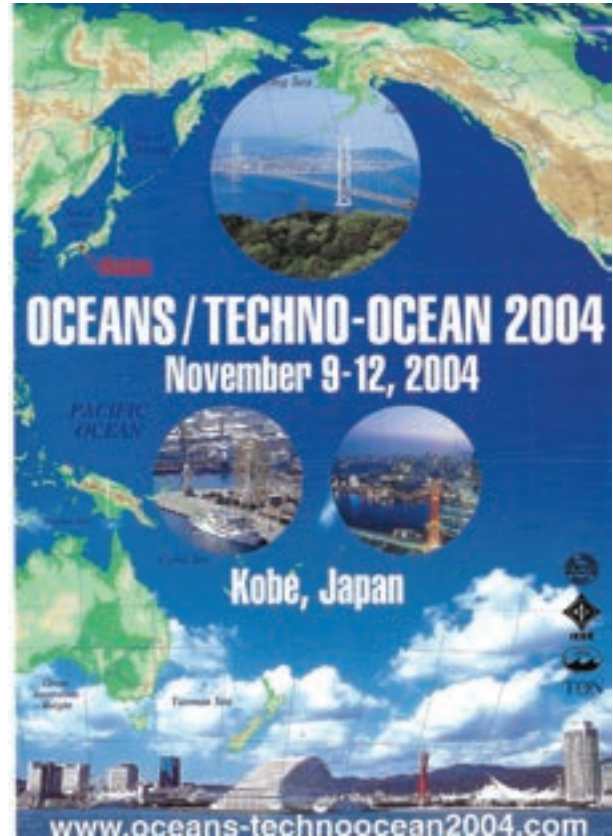


2002 Biloxi, Mississippi





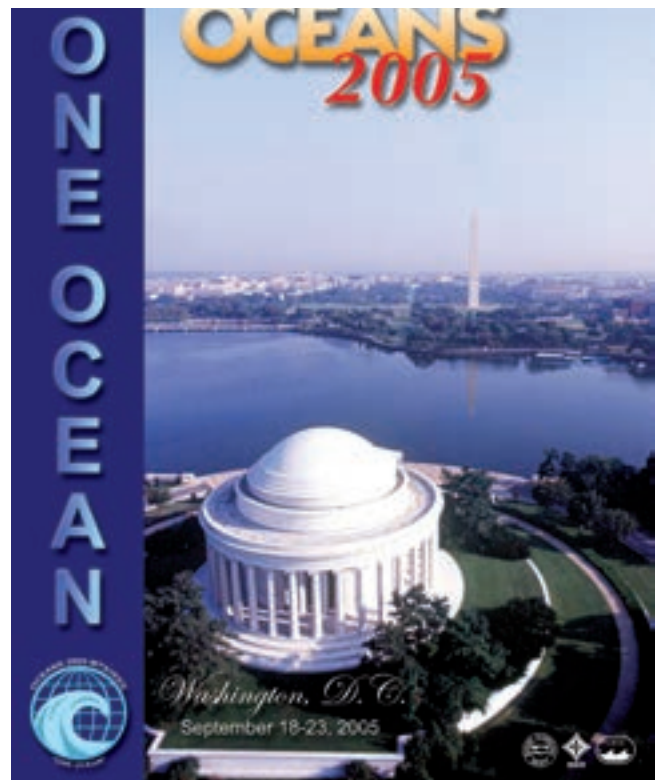
2003 San Diego, California



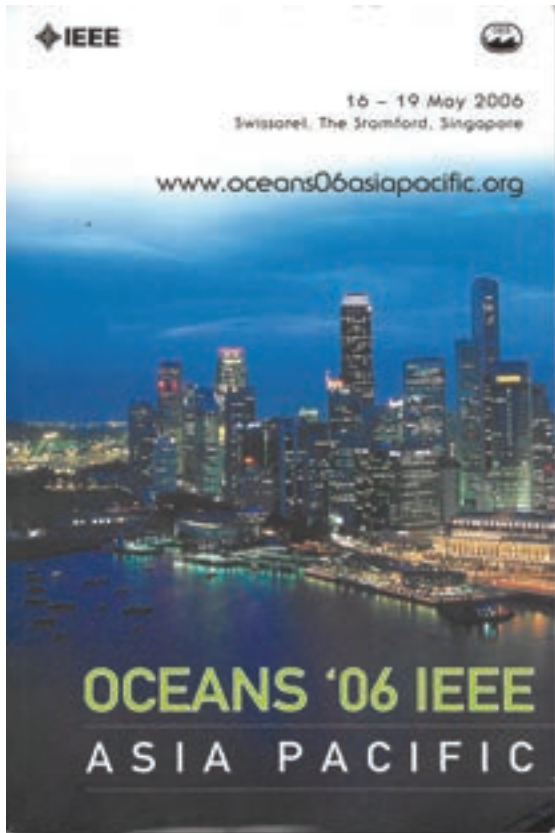
2004 Kobe, Japan



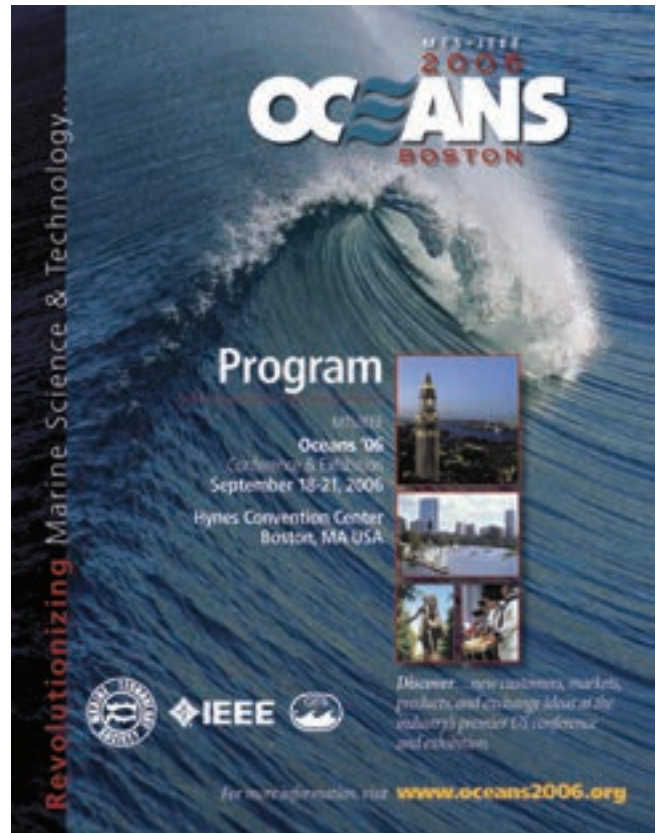
2005 Brest, France



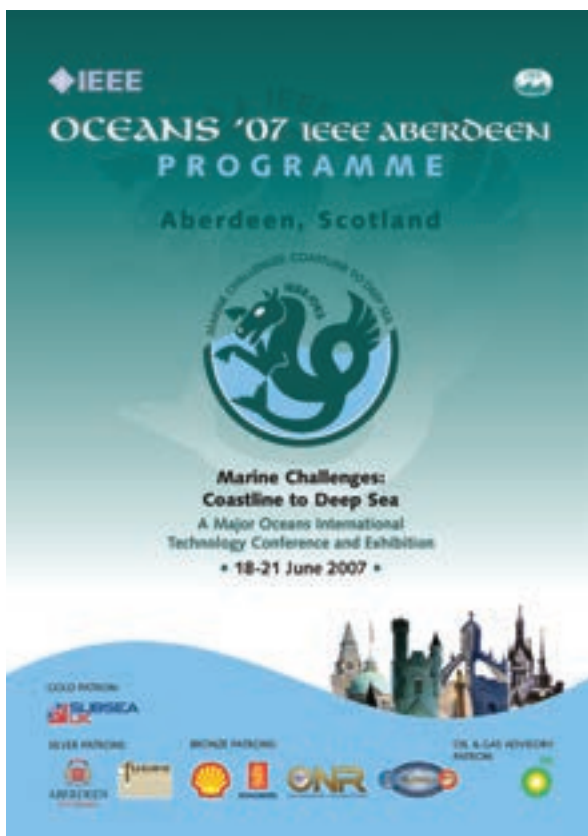
2005 Washington, D.C.



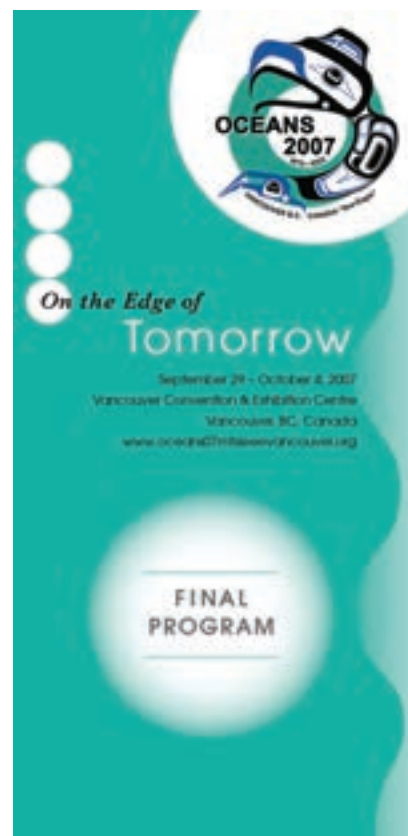
2006 Singapore



2006 Boston, Massachusetts



2007 Aberdeen, Scotland



2007 Vancouver, British Columbia



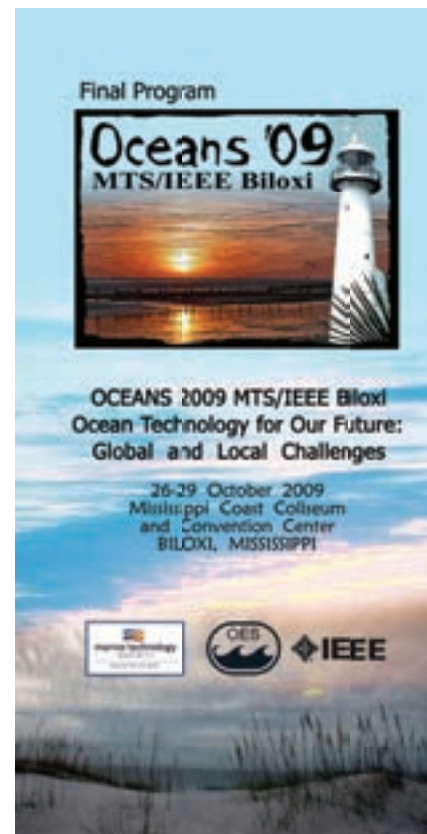
2008 Kobe, Japan



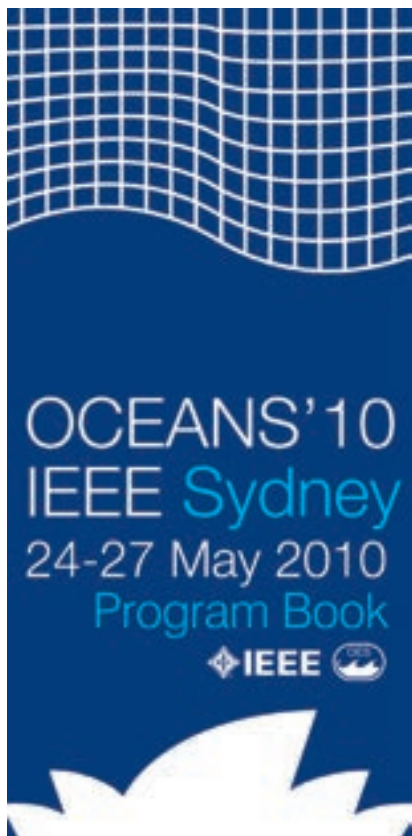
2008 Quebec City, Quebec



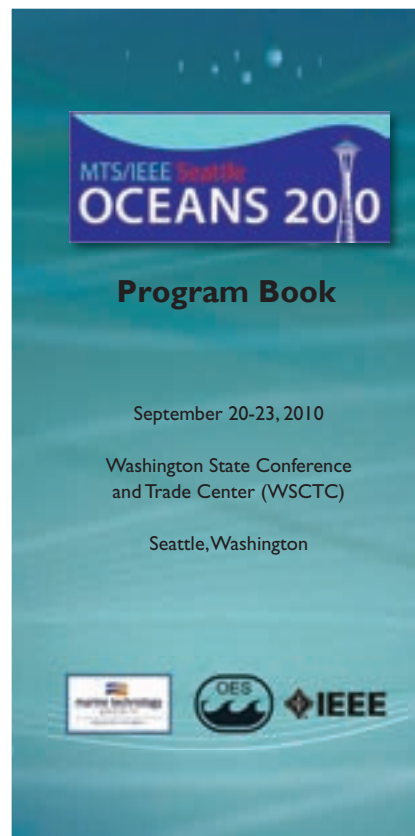
2009 Bremen, Germany



2009 Biloxi, Mississippi



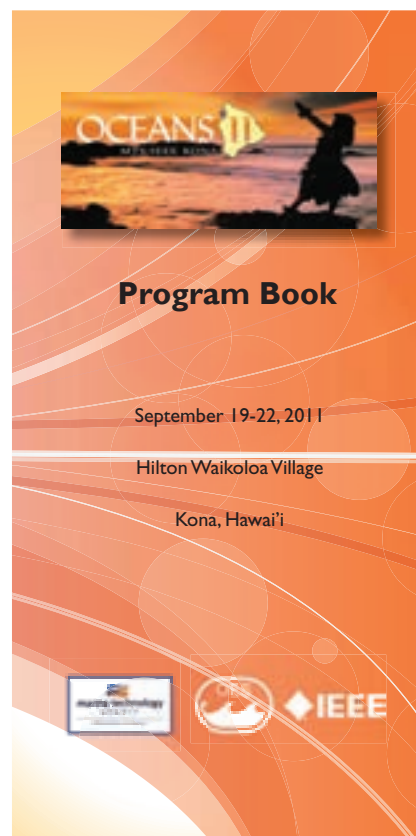
2010 Sydney, Australia



2010 Seattle, Washington



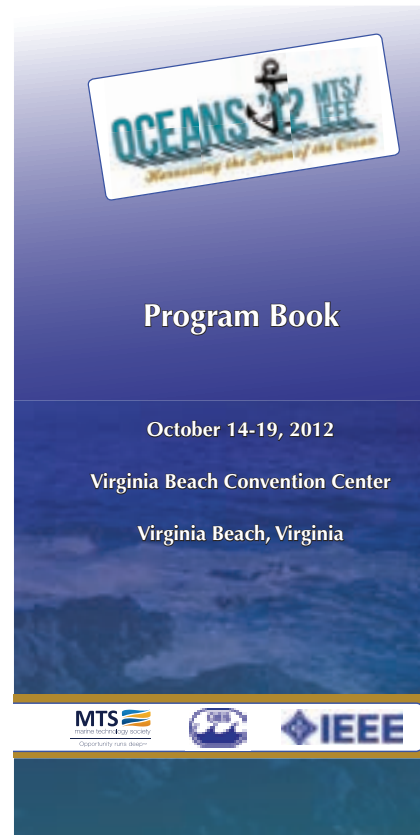
2011 Santander, Spain



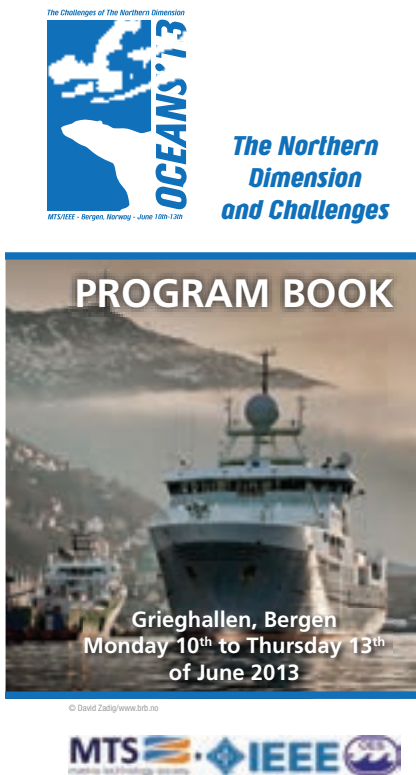
2011 Kona, Hawaii



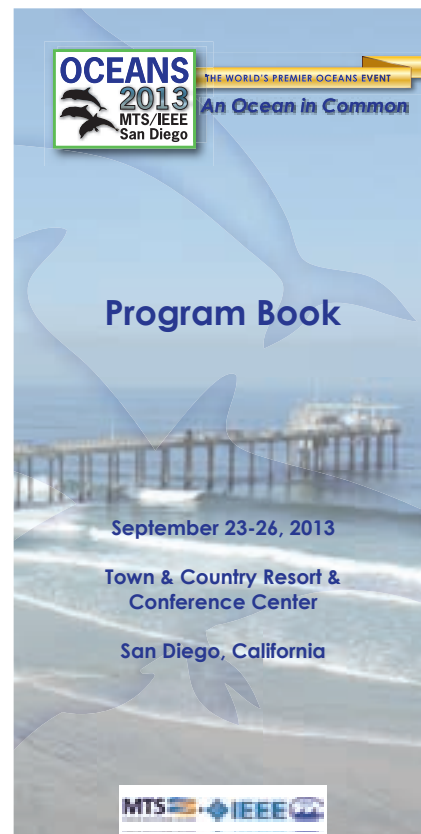
2012 Yeosu, Republic of Korea



2012 Virginia Beach, Virginia



2013 Bergen, Norway



2013 San Diego, California



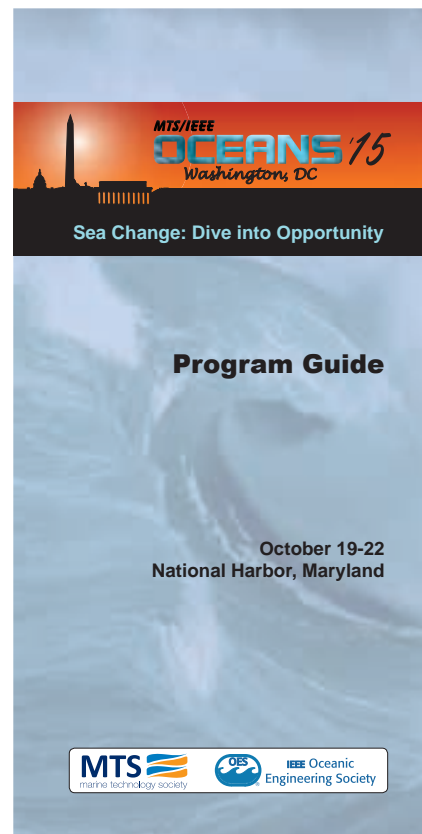
2014 Taipei, Taiwan



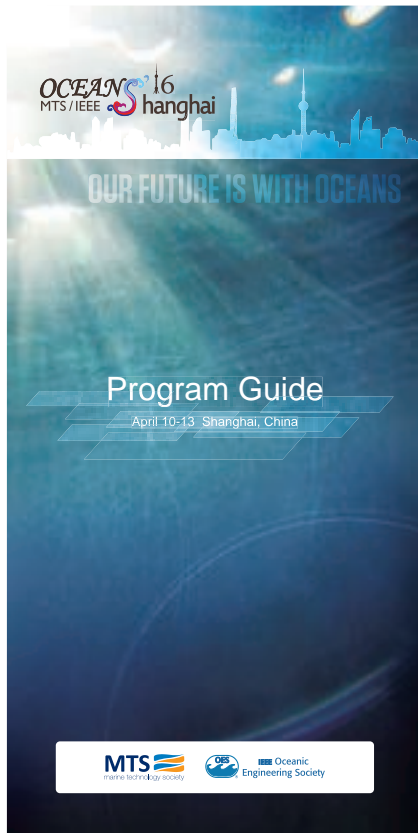
2014 St. John's, Newfoundland



2015 Genova, Italy



2015 Washington, D.C.



**2016 Shanghai, China**



**2016 Monterey, California**



**2017 Aberdeen, Scotland**



**2017 Anchorage, Alaska**

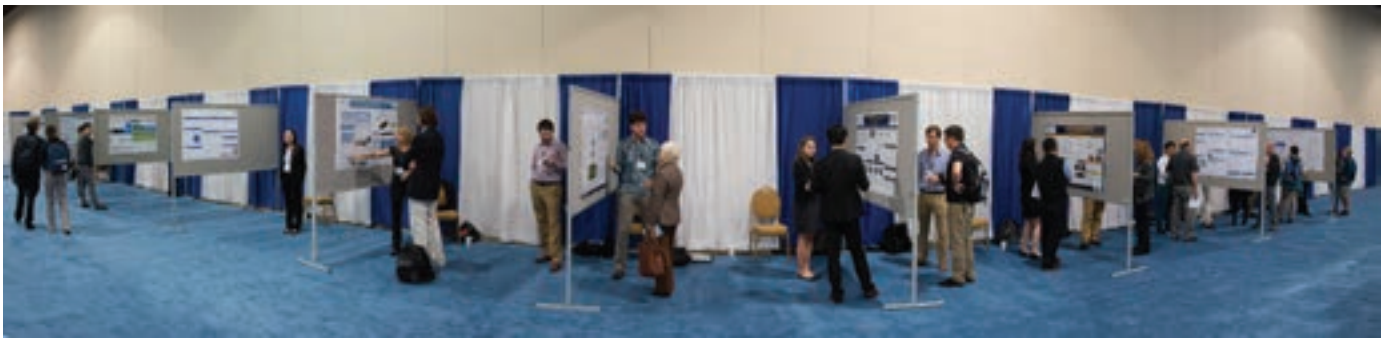
## OCEANS Student Posters

The 60th OCEANS conference also marks the 40th OCEANS Student Poster Competition. The OCEANS Student Poster Competition offers an opportunity for students to travel to an OCEANS conference to present their research, all expenses paid. During each competition 20–25 students (depending on available funding) are selected for this prestigious program. Students from colleges and universities around the world are eligible to compete.

During the paper abstract submission window for a conference, students can choose to submit an abstract to the Student Poster Competition. All abstracts are reviewed by a panel of volunteers to determine if the abstract is of high enough quality to be admitted to the pool

of accepted abstracts for the conference. Accepted abstracts are reviewed a second time by a set of reviewers dedicated to the student competition. Of the hundred or so student abstracts received each cycle, only about 20–25 are selected to present posters at the conference. Students whose abstract were not selected for the competition are encouraged to submit a regular paper to one of the technical sessions in the conference tracks.

The selected students prepare both a technical paper and a poster for the conference. They are expected to staff their posters during conference breaks and events. During this time, 3–5 judges from the societies will talk with the students and evaluate the posters. The judges then meet



*Student Posters at OCEANS '15 Washington D.C.*



*Student Poster Participants OCEANS '16 Monterey*



and determine the winners of the competition. Three cash awards are given: 1st place for \$3,000, 2nd place for \$2,000, and 3rd place for \$1,000. All of the posters are published on the website, and the technical papers are included in the OCEANS proceedings. In addition, the technical paper submitted by the first place winner is published in *The Beacon*, the OES newsletter.

The Student Poster Competition was launched at OCEANS '89 to encourage the participation of students in the conference and the OES. Colonel (U.S Army ret.) Norman Miller recommended that the OES sponsor a "Student-Posters Competition" where graduate and undergraduate students would be invited to present posters describing their work. Miller later became a Vice President of OES and either ran or advised nearly every OCEANS student program from 1989 to just before his death in 2015.

The conference covers the students' registration and travel expenses. An initial grant of \$7,500 was provided



*Norman Miller*

to the OCEANS '89 organizing committee to fund the program. Sixteen abstracts were received and the students were invited to attend and present their posters. The posters were displayed where the conference attendees had ready access to them and the students were at their posters to explain them. The program proved highly successful and was continued at OCEANS '91 and subsequent OCEANS conferences. Support for the student-posters program has been incorporated into the Conference Guidelines, and as such is endorsed by both OES and MTS. The Of-

fice of Naval Research (ONR) and the Office of Naval Research Global (ONRG) have also financially supported the Student Poster Competition since inception. Colonel Miller's legacy lives on because the student poster competition is a valuable component of each MTS/IEEE OCEANS conference. The First Prize Award is named in his honor as the Norm Miller Award.



*Norman Miller with Student Poster Winners at OCEANS '10 Seattle*

# OCEANS Exhibition

The OCEANS exhibition is an integral part of the conference. Both the exhibitors and the attendees look forward to displays of new and advanced technology, often associated with the new ideas and results presented in the technical program. The exhibition program is mutually beneficial to exhibitors and attendees.

Significantly, the OCEANS exhibitors know their audience. A typical attendee is generally not a buyer, but rather a recommender. Generally, the goal of an OCEANS exhibitor is exposure to a technically savvy audience who will take the newly gained insight and information back to their employers for application to



The OCEANS '13 San Diego Exhibition Hall Entrance.



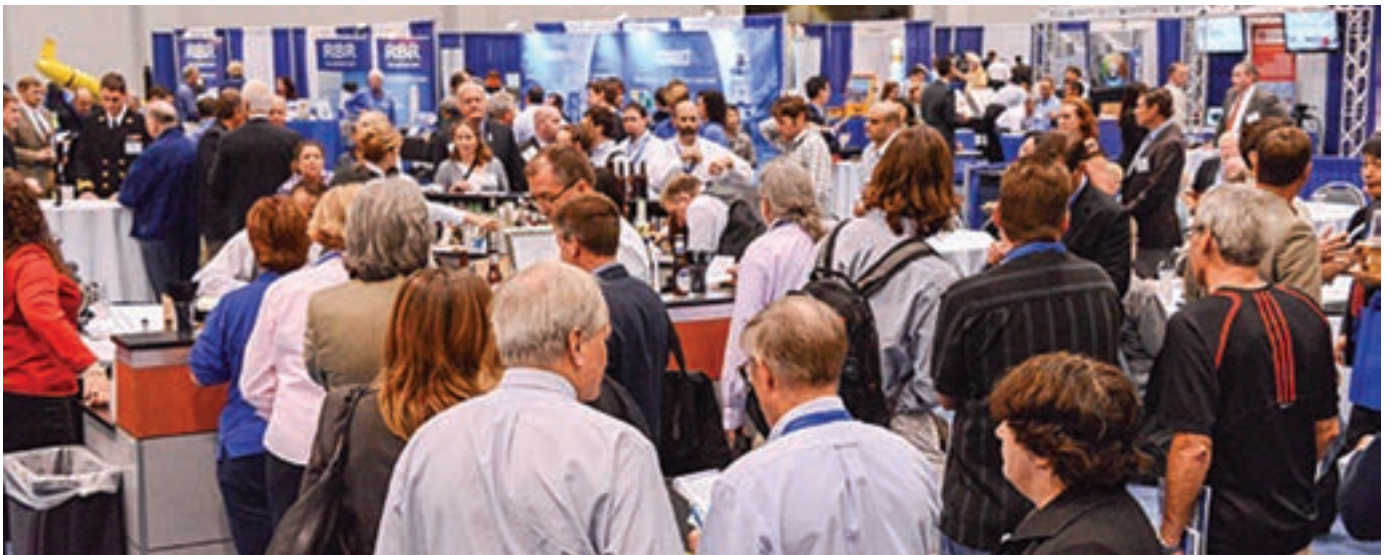
MTS Booth at OCEANS '14 St. John's



OES Booth at OCEANS '14 St. John's



*Exhibit Hall at OCEANS '14 St. John's*



*The Exhibitor's Reception is Always a Big Hit*



*Students Inspect New Technology at OCEANS '16 Shanghai*

future projects. It represents to the exhibitor a longer-range investment. That is true not only for industrial exhibitors but also for institutions and government organizations; they want to be recognized as meaningful contributors to the state of the art in ocean and marine technology.

The Exhibit Hall is a busy place. Technical paper presentations, award ceremonies, and special activities are arranged so that attendees have ample time to visit the exhibition.

The exhibition is particularly attractive to students. Often, it is their initial exposure to full up systems that employ new technology they have just learned about.

The exhibitor reception is always a big attraction and creates thousands of discussions about technology.

## OCEANS Attendees

**Benefits of OCEANS** What benefit does OCEANS have for the attendees? One key factor is the participation by government agencies and organizations that are there to notify the academic and commercial attendees, both in person and now via internet applications, of existing programs, funding and future needs. The academic community provides a significant number of attendees because the OCEANS is the perfect forum to have their research presented and published. Commercial attendees have the opportunity to (1) exhibit and sell their products, (2) interact with all attendees to determine what they should be developing and marketing, and (3) enhance the capabilities of their products with emerging technologies.



*Technical Session OCEANS '16 Monterey*

One of the overarching benefits of the OCEANS conferences is networking with fellow engineers and technologists. You can probably talk to any mid- or high-level attendee at the event and ask them how they got to where they are professionally, and most will answer “through networking” at conferences and events like OCEANS. And networking is not Facebook, LinkedIn, Tweeting, etc. Networking is meeting other attendees face-to-face, sitting down over a beverage or dinner and discussing



*Welcome Reception OCEANS '12 Yeosu*

common interests, emerging technology, possible job openings, etc. OCEANS conferences provide the opportunity to network, build a team, and interact with that team to climb the professional ladder. It works!

**Growth in Numbers** That OCEANS benefits the attendee, whether general attendee, author or exhibitor, is demonstrated by the growth of the attendance figures over the years. Participation in OCEANS conferences, by authors and exhibitors, has increased along with the Full Registrants and Exhibit attendees:

- From 70 papers in 1970 to over 500 at recent events
- Abstracts received now top over 700
- Conferences outside North America have about 20% fewer papers
- Exhibits have grown from 6 in 1971 to over 300 in 2003 in San Diego
- Exhibits average from 150–200 in North America and 50–100 in other countries
- Attendance from Asia has increased dramatically, especially from China
- Full registrations range from 700–1100 in North America, increasing to 2000–3000 when exhibit passes are included

The financial support of the conference is based largely on the registration fees charged to the attendants and the exhibitors’ booths; both are essential for a successful OCEANS, although they have been kept as low as possible and adjusted based on the economy. Exhibitors fees are also used to provide an Exhibitor’s Reception on the first night of the full event.

### **What Institutions Present Papers at OCEANS?**

Analysis of conference records shows a progression of institutional participants from Company and Military/Navy towards University/Research and Government Agencies and Consortia. As the number of authors has increased over the years, the task of determining the distribution between the four major affiliations of: Military/Navy; Government Agency or Consortium; University/Research Establishment; and Company has become more labor intensive, however, the trend continues to be reflected by the economy and government budgets. However, abstracts received during the last two years have reached record levels at well over 700, with student abstracts often exceeding 100.

**Where are the Authors From?** The distribution of participants, both as authors and attendees shows a continued dominance of the USA and also a recent strong increase in Chinese authors. Such increases are often related to the country that the OCEANS conference is being held in, which was apparent at OCEANS '16 Shanghai with nearly 500 Chinese abstracts submitted.

It is important to keep on top of the changes in the interests of participants in order to serve their needs, but the practical reality is that topic selection by the authors permits sending their abstracts to the appropriate reviewers, and this moving distribution of interest affects both authors and



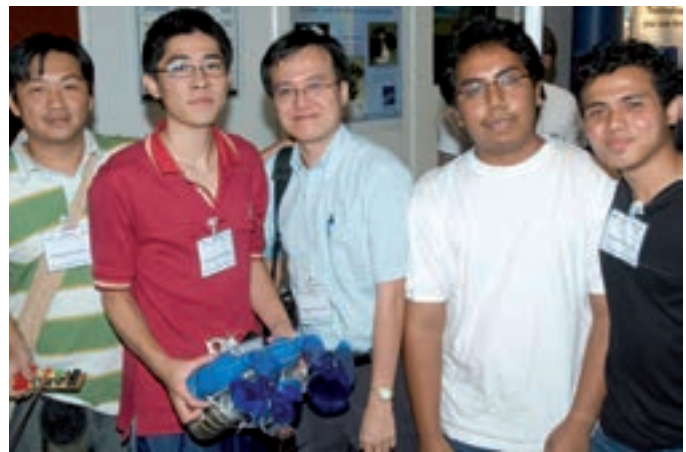
*Tutorial at OCEANS '16 Shanghai*

reviewers similarly, so it is self-correcting. Although there is a set list of technical areas for every OCEANS conference, inclusion of 6-8 technical tracks devoted to more geographical issues adds a local flavor.

**OCEANS Tutorials** Tutorials, offered the day before the full technical program and exhibits open, provide a valuable service desired by participants and these have been tracked over the years. Like topics and reviewer expertise, tutorial topics are self-correcting with the demand stimulating the supply of tutors.

While the OCEANS conferences are to be a service to the OES and MTS and their members, they also are expected to serve the marine and oceanographic community as a whole. To continue to exist, they must cover their costs, and this revenue is provided by registrations of the members, and by booths sold in the Exhibit Center. A track of attendees and exhibits over the years would be helpful to steer OCEANS conferences to profitable venues, but these data are not readily available. Typical attendances have been 2000 in North America and 1000 outside North America.

Attendees of OCEANS conferences enjoy education by formal tutorials and presentations of papers in sessions.



*Possible Future Colleagues Often Meet at OCEANS for the First Time*

They also enjoy learning about products and services in the Exhibit Center. But some of the most valuable experiences at an OCEANS conference are interaction with newly introduced participants, some of whom will become future colleagues.

# OCEANS Honors Outstanding Achievements: OES

The OCEANS conference is an occasion to honor many people and organizations for their outstanding technical achievements, service to their sponsoring societies, leadership of the oceans and maritime communities, or financial support of the OCEANS conference series. OES bestows two distinguished awards: The Distinguished Technical Achievement Award (DTAA), given to a person for outstanding technical contributions to the oceans community, and the Distinguished Service Award (DSA), given to an OES member for service to the Society. Awardees are listed in the table below.

OES recently started an organizational award to a company or institution for significant support of OCEANS or other OES activities. These awardees are: 2014 Bluefin

Robotics, 2015 Kongsberg Maritime, 2016 Monterey Bay Research Institute. OES has a Presidential Award which acknowledges significant contributions to an ocean field or organization. The recent awardees are: 2014 Harumi Sigimatsu, 2015 Franz Hover, 2016 M. A. Atmanand. In addition, the OES has an Emeritus Award given to an OES member who has made a significant contribution to the society and who is no longer in the Society's governance structure; 2014 Glen Williams, Stan Chamberlain, and Norm Miller, 2015 Joseph Vadus and Claude Brancart, 2016 Fred Maltz.

IEEE Fellows are nominated by each society in the Institute. The following are IEEE Fellows having made major contributions to ocean science.

Year	Distinguished Technical Achievement Award		Distinguished Service Award
	Recipient	Citation	Recipient
2016	John Ehrenberg	Fisheries Acoustics	Harumi Sugimatsu
2015	Milica Stojanovic	Acoustic Communications	Elizabeth Creed
2014	Christian de Moustier	Acoustic Remote Sensing	Diane DiMassa
2013	Gwyn Griffiths	Doppler Current Profiling and AUVs	Robert T. Bannon
2012	Joseph Vadus	International Leadership in Oceanic Engineering	Robert C. Spindel
2011	Christopher James von Alt	AUV Applications to Oceanography	James T. Barbera
2010	Tamaki Ura	AUVs and Associated Sensors	Thomas Freud Wiener
2009	Robert T. Bannon	Submarine Cables	Christian de Moustier
2008	Thomas B. Sanford	Ocean Wave and Current Processes	Archie Todd Morrison III
2007	Donald E. Barrick	HF Radar Applications	Stephen M. Holt
2006	Fred Noel Spiess	Six Decades of Ocean Research	René Garello
2005	Douglas C. Webb	Ocean Instrumentation	Claude Brancart
2004	John P. Craven	Ocean Technology Innovations	William M. Carey
2003	Georges Bienvenu	High-resolution Sonar	Joseph Czika
2002	James Candy	Model-Based Processing	James Collins
2001	Werner R. Alpers	Ocean Remote Sensing	Claude Brancart
2000	Albert J. Williams III	Oceanic Instrumentation	Frederick H. Maltz
1999	William M. Carey	Shallow Water Acoustics	Pierre Sabathé
1998	Burton G. Hurdle	Oceanography and Acoustics	Norman D. Miller
1997	Newell Booth	High-resolution Matched-field Processing	Ferial El-Hawary
1996	Frederick H. Fisher	Ocean Acoustics	Glen Williams
1995	Mack O'Brien	AUV Technologies	David Weissman
1994	Edmund J. Sullivan	Model-Based Acoustic Array Processing	Daniel Alspach
1993	William J. Plant	Microwave Remote Sensing	Edward W. Early
1992	Arthur B. Baggeroer	Acoustic Array Processing	Gordon Raisbeck
1991	Henry Cox	Underwater R&D	Frederick H. Fisher
1990	Robert C. Spindel	Acoustic Tomography	Anthony I. Eller
1989	Victor C. Anderson	Acoustic Engineering	Eric Herz

1988	Chester M. McKinney	Acoustic Parameters	Harold A. Sabbagh
1987	James R. McFarlane	Underwater Vehicles	Stanley L. Ehrlich
1986	Robert J. Urick	Experimental Underwater Acoustics	Stanley G. Chamberlain
1985	William N. Nierenberg	Climate Analysis	Joseph R. Vadus
1984	John B. Hersey	Ocean Sediments	John C. Redmond
1983	Alan Berman	Applied Underwater Acoustics	Elmer P. Wheaton
1982	Ira Dyer	Acoustics Applications	Arthur S. Westneat
1981	No Award		Lloyd Z. Maudlin
1980	Neil Brown	Ocean Instrumentation	Donald M. Bolle
1979	David W. Hyde	Underwater Acoustics	Richard M. Emberson
1978	Richard K. Moore	Ocean Remote Sensing	Edward W. Early
1977	Howard A. Wilcox	Open-ocean Farming	Calvin T. Swift
1976	Werner Kroebel	Marine Measurements	Frank Snodgrass
1975	Robert Frosch	Acoustic Technologies	Arthur S. Westneat

<b>The IEEE Fellows Making an Ocean Science or Technology Contribution</b>		
2017	Andrea Caiti	For contributions to geo-acoustic inversion and autonomous underwater vehicles.
2017	K. Kyriakopoulos	For contributions to robot motion planning and control of multi-robot systems.
2017	Maurizio Migliaccio	For contributions to marine and maritime polarimetric synthetic aperture radar.
2016	Thor Fossen	For contributions to modelling and controlling of marine crafts.
2015	Kenneth Foote	For contributions to quantification of underwater sound scattering.
2015	Yahong Zheng	For contributions to channel modeling and equalization for wireless communications.
2014	John Leonard	For contributions to navigation and mapping for mobile robots and autonomous underwater vehicles.
2014	Shengli Zhou	For contributions to wireless and underwater acoustic communications.
2013	Glenn Zorpette	For contributions to professional communication in electrical and electronics technology.
2012	Malcolm Heron	For contributions to the application of radio science to oceanic and terrestrial remote sensing.
2012	S. Negahdaripour	For contributions to underwater computer vision.
2011	Louis Whitcomb	For contributions to the theory and application of robotics for intervention in extreme environments.
2011	D. Barrick	For development of high frequency radars and applications.
2011	Gaurav Sukhatme	For contributions to multi-robot systems.
2010	Norman Chapman	For contributions to geoaoustic characterization of ocean bottom environments.
2010	Milica Stojanovic	For contributions to underwater acoustic communications.
2010	John Vesecky	For contributions to marine remote sensing and technology.
2010	Andrew Singer	For contributions to signal processing techniques for digital communication.
2009	Rodney Coates	For contributions to underwater acoustics education.
2009	Jean-Pierre Hermand	For contributions to geoaoustic inversion techniques for adaptive signal processing in ocean acoustics.
2009	Junzo Kasahara	For contributions to submarine seismic technology.
2009	Kevin Fall	For contributions to Internet architectures and protocols in challenging environments.
2009	Ross Murch	For contributions to multiple antenna systems for wireless communications.
2008	David G. Long	For contributions to systems and applications of radar scatterometry and synthetic aperture radar in land and ice studies
2008	Peter Mikhalevsky	For contributions to ocean acoustics and tomography.
2008	Jay S. Pearlman	For leadership in space-based earth observing systems.
2008	Karen Panetta	For leadership in engineering education and curriculum development to attract, retain, and advance women in engineering.

2007	Colin Jones	For contributions to deep ocean exploration, search and recovery, and salvage.
2007	Naomi Ehrich Leonard	For contributions to the control of underwater vehicles.
2007	Tamaki Ura	For contributions to autonomous underwater vehicle technologies.
2007	William Jemison	For contributions to microwave photonics for radar and communications.
2007	Urbashi Mitra	For contributions to multiuser wideband digital communication systems.
2007	Michele Zorzi	For contributions in the area of energy efficient protocol design.
2006	Rene Garello	For contributions to signal processing applied to remote sensing of the ocean.
2006	Ellsworth Ledrew	For contributions to environmental remote sensing sciences.
2005	James F. Lynch	For contributions to sound transmission in shallow coastal waters for mapping bottom boundary layer characterizations.
2005	Albert J. Williams 3rd	For contributions to the development of instrumentation for measuring oceanic processes.
2005	Junku Yuh	For contributions to autonomous underwater robots.
2004	Julie Fouquet	For contributions to optical switch and light-emitting device technologies.
2004	Harold Kirkham	For leadership in the field of optical measurements for power systems
2003	Robert T. Bannon	For leadership in ocean engineering and the practical application of sensor technologies.
2003	Peter F. Worcester	For leadership in the development of acoustic techniques for observing the ocean, including ocean acoustic tomography.
2002	Hisaaki Maeda	For contributions to hydrodynamic theory on a floating structure in waves, to wave energy absorption theory and hydroelastic theory on a very large floating structure.
2001	Edmund Joseph Sullivan	For developments in model-based acoustic array signal processing.
2001	Joseph R. Vadus	For contributions to ocean technology, engineering, and research.
2000	Dale Louis Schuler	For contributions to the development of coherent multi-frequency microwave sensor and polarimetric SAR techniques for the remote sensing of geophysical parameters on both the ocean and the land.
1999	James Vincent Candy	For contributions to model-based ocean acoustic signal processing.
1999	Ferial M. El-Hawary	For contributions to the application of digital system concepts to underwater dynamic motion estimation and marine seismic methods.
1999	Said El-Sayed Ismail El-Khamy	For contributions to signaling techniques for propagation through natural media.
1999	Guillermo C. Gaunaud	For contributions to direct and inverse scattering interaction of acoustic, elastic and electromagnetic waves with matter.
1999	Sivaprasad Gogineni	For development of innovative research radars and radar studies of polar sea and glacial ice.
1999	Paolo Pampaloni	For contributions to and leadership in microwave remote sensing.
1999	Linwood Jones	For contributions to the development and application of active microwave remote sensing technology for satellite oceanography.
1998	Daniel Lee Alspach	For leadership in the theoretical development of non-linear estimation theory and its practical applications to multiple target data association and tracking problems in ocean surveillance.
1997	Susan Avery	For scientific and educational leadership and research in atmospheric science
1997	Akira Ohte	For contributions to and leadership in the development of a fully automatic temperature measurement.
1996	William Michael Carey	For international leadership in the modeling and analysis of acoustic signal fields and noise in the ocean.
1995	Glen N. Williams	For leadership in the development of a computer operated, highly reliable control system for autonomous underwater vehicles, and the development of computer science courses.
1994	Jose M. F. Moura	For contributions to nonlinear filtering and model-based signal processing.
1994	Arye Nehorai	For contributions to statistical signal processing and system identification.
1993	Irving Engelson	For management leadership of IEEE technical activities worldwide.
1993	Marti Hallikainen	For contributions to microwave remote sensing of forests, snow, and sea ice.
1992	Leif Bjorno	For contributions to ultrasound technology.
1992	Paolo Corona	For the development of continuous-mode stirred chambers, and their application in electromagnetic compatibility evaluations.
1991	Georges R. Biennu	For contributions to the theory and implementation of high-resolution methods in passive sonars.



1991	James L. Kirtley Jr.	For contributions to the theoretical understanding, development, and implementation of superconducting turbogenerators.
1991	Robert C. Spindel	For leadership in ocean engineering and the advancement of the technology for ocean acoustic tomography.
1991	David E. Weissman	For leadership in the development of radar techniques to measure ocean surface wave parameters and surface winds.
1990	Johann F. Bohme	For contributions to array signal processing.
1990	Robert B. Mcghee	For contributions to the theory and experimental study of mobile robots and legged locomotion.
1989	Arthur B. Baggeroer	For contributions to advanced array processing and underwater acoustics.
1989	Steven M. Kay	For contributions to the theory and application of parametric spectral estimation and detection.
1989	Venkatanarayana Ramachandran	For contributions to the theory of multivariable networks with applications to two-dimensional digital filters.
1988	G. Clifford Carter	For contributions to the theory of coherence and time delay estimation.
1988	Walter N. Dean	For leadership in the development and implementation of radio-navigation systems.
1987	Donald M. Bolle	For contributions to nonreciprocal components for microwave and millimeter-wave systems.
1987	Charles M. Knop	For development in high-gain, low-sidelobe, microwave reflector antennas for satellite communication earth stations and multiband terrestrial radio relay systems.
1985	Janis A. Bubenko	For contributions to energy systems through new concepts in power system analysis and modeling.
1985	William A. Von Winkle	For technical leadership in research and exploratory development in underwater acoustics, signal processing, sonar systems, and antisubmarine warfare.
1984	Wolfgang-Martin Boerner	For advancement in inverse methods in sensing systems and in high-resolution broadband Doppler radar polarimetry.
1984	Hitoshi Mochizuki	For contributions to maritime communications systems.
1983	Henry Cox	For technical leadership in underwater research and development.
1983	Eric Herz	For contributions to the development and management of information systems for testing aerospace vehicles and for valuable services to the Institute.
1983	Edward J. Powers Jr.	For contributions to the analysis of data relating to nonlinear phenomena in materials such as controlled thermonuclear plasmas.
1983	Calvin T. Swift	For contributions to the area of microwave remote sensing of the oceans.
1982	Richard La Rosa	For contributions to the development of electroacoustic signal processing devices.
1982	Donald W. Tufts	For contributions to digital communications and signal processing.
1981	George F. McClure	For contributions to mobile telephone communications systems engineering and the creation of new and more effective methods of spectrum utilization.
1979	Saul Aronow	For contributions to nuclear medical instrumentation and for innovative leadership in establishing clinical engineering in hospitals.
1979	Ira Dyer	For contributions to the science of acoustics and its applications and for distinguished academic leadership in advancing oceanic engineering and its applications.
1978	John Vinton Bouyoucos	For contributions to the field of hydrodynamic energy conversion devices.
1977	Morrel P. Bachynski	For contributions to the fields of electromagnetic waves and plasmas.
1976	Pier L. Bargellini	For contributions to satellite communications.
1974	Gerald G. Gould	For leadership in underwater systems development, and for contributions to the design of a major underwater tracking range.
1974	Harry L. Van Trees	For contributions to teaching and research in the detection, estimation and modulation theory area, and the design of military communications systems.
1969	Gordon Raisbeck	For contributions and leadership in research on communication theory, transmission line theory, and transistor circuits.
1968	Richard C. Honey	For his contributions to the fields of microwave antennas and laser applications.
1962	Herman V. Cottony	For contributions to antenna research and measurement.
1962	R. Wayne Masters	For contributions in the field of antennas and RF transmission systems. IRE
1962	Richard K. Moore	For contributions to electromagnetic propagation and engineering education. IRE
1959	David Middleton	For contributions to the theory of noise in electronic systems. IRE
1957	Laurence Batchelder	For contributions to the design and development of sonar equipment.

# OCEANS Honors Outstanding Achievements: MTS

## Compass Distinguished Achievement

For significant contributions to the art and science of oceanography and marine technology Open to all working in the field.

Year	Awardee
2016	Dr. Kathryn Sullivan
2015	Drew Michel
2014	Bjorn Jalving
2013	Dennis “Mike” Egan
2012	Robert Winokur
2011	Bruce Gilman
2010	Julius Rockwell, Capt. (Ret.)
2009	Calvin A. Gongwer
2008	Dr. James R. McFarlane
2007	Dr. Andrew M. Clark, P.E.
2006	Martin Klein
2005	Howard Shatto
2004	Adm. Conrad C. Lautenbacher, Jr. (Ret)
2003	James Cairns
2002	Norman B. Estabrook
2001	Adm. James D. Watkins (Ret)
2000	David Himmelfarb
1999	RAdm. J. Bradford Mooney, Jr. (Ret)
1998	Dr. Robert W. Corell
1997	Dr. Sylvia A. Earle
1996	Dr. Don Walsh
1995	Dr. Edward A. Frieman
1994	Dr. John Norton Moore
1993	Dr. Ned A. Ostenso
1992	Dr. William McFarlane/Dr. Florence McAlary
1991	Dr. Walter H. Munk
1990	Joseph R. Vadus
1989	Dr. W. Stanley Wilson
1988	Dr. Robert M. White
1987	Dr. Robert B. Abel
1986	James R. McCullough
1985	Phillip Eisenberg
1984	Dr. Jerome Namias
1983	Hon. Lowell P. Weicker, Jr.
1982	Jack W. Boller (Ret.)
1981	Dr. Athelstan F. Spilhaus
1980	Dr. Robert Cohen
1979	Carl H. Savit
1978	David H. Wallace
1977	Dr. Robert D. Ballard
1976	William Q. Wick
1975	Dr. William A. Nierenberg
1974	Dr. Kenneth O. Emery
1973	Dr. Warren S. Wooster
1972	Butler King Couper
1971	Dr. Fred N. Spiess
1970	Willard Bascom
1969	Allyn C. Vine
1968	James M. Snodgrass
1967	Dr. Roger Revelle
1966	Dr. Henry B. Bigelow

## Compass International Award

For outstanding contributions to the advancement of the science and art of oceanography and marine technology; open to any individual, company, or organization from any country or territory outside the United States working in the field.

Year	Awardee
2016	Dr. Lian Lian
2015	Nautilus Marine Service GmbH
2014	Kongsberg Maritime Embien
2013	Oceans Branch- Department of Innovation, Business and Rural Development, Government of Newfoundland and Labrador, NL
2012	EDT Offshore Ltd.
2011	CONTROS Systems and Solutions
2010	Simon Allen, CSIRO Marine Research
2009	Dughal J. Lindsay, Ph.D.
2008	International Submarine Engineering
2007	TSS (International) Ltd.
2006	None
2005	Dr. Ferial El-Hawary
2004	Dr. Noriyuki Nasu
2003	Manned Submersibles Laboratory, Russian Academy of Sciences
2002	Jean Jarry 2001 Dr. Hiroshi Ohba
2000	Dr. Hisaaki Maeda
1999	Dr. Toshitsugu Sakou
1998	Mr. Don E. Lennard
1997	Mr. Joseph Seiler
1996	Mr. Dominique Girard
1995	Dr. Vladimir E. Zuev
1994	Dr. Seizo Motora
1993	Alberto G. Lonardi
1992	Frederico de Strobel
1991	Cliff Tyner, Canada
1990	Ascensio C. Lara, Argentina
1988	Dr. Arvid Pardo, Malta
1987	Dr. Noboru Hamada
1989	IFREMÉR, France
1986	Claude Riffaud
1985	Society for Underwater Technology, UK
1984	Japan Marine Science Technology Ctr.
1983	Dr. A. R. Bayoumi, Egypt Adm. Yohay Ben Nun, Israel
1982	COMEX, S.A., France
1981	Dr. Jacques Piccard, Switzerland
1980	Dr. Kenji Okamura, Japan
1989	IFREMÉR, France
1988	Dr. Arvid Pardo, Malta
1987	Dr. Noboru Hamada
1986	Claude Riffaud
1985	Society for Underwater Technology, UK
1984	Japan Marine Science Technology Ctr.
1983	Dr. A. R. Bayoumi, Egypt Adm. Yohay Ben Nun, Israel
1982	COMEX, S.A., France
1981	Dr. Jacques Piccard, Switzerland
1980	Dr. Kenji Okamura, Japan

## Compass Industrial Award

Presented to a firm for outstanding contributions to the advancement of the science and engineering of oceanography and marine technology; open to any legally operated industrial firm working in the field (not government and non-profit organizations).

Year	Awardee
2016	Teledyne Marine
2015	Vencore Services & Solutions
2014	RBR, LTD
2013	Shell
2012	Sonardyne International
2011	Oceaneering International
2010	Schilling Robotics
2009	VideoRay
2008	Samson Rope Technologies
2007	None
2006	Phoenix International
2005	Makai Ocean Engineering, Inc.
2004	Mitsubishi Heavy Industries, Ltd.
2003	RD Instruments
2002	Sonsub, Inc.
2001	Oceaneering Technologies Inc.
2000	Ocean Design
1999	Sound Ocean Systems, Inc.
1998	Service Argos, Inc.
1997	Dynacon, Inc.
1996	Vector Cable Company
1995	D.G. O'Brien, Inc.
1994	Whitehill Manufacturing Corporation
1993	Williamson & Associates
1992	Klein Associates
1991	Western Instrument Corporation
1990	John E. Chance & Associates, Inc.
1989	Eastport International, Inc.
1988	Deep Ocean Engineering, Inc.
1987	General Instrument Corporation
1986	Inter. Underwater Contractors, Inc.
1985	Ocean Systems Group, Sperry Corp.
1984	Intern. Submarine Engineering, Ltd.
1983	Jet Propulsion Laboratory
1982	Harbor Branch Foundation, Inc.
1981	Raytheon Ocean Systems, Company/Submarine Signal Division
1980	Vetco, Inc.
1979	Shell Oil Company
1978	Lockheed Ocean Systems Organization
1977	Deepsea Ventures, Inc.
1976	United States Steel Corporation
1975	DomSea Farms, Inc.
1974	Western Geophysical Company
1973	Industrial Nickel Company
1972	Hydronautics, Inc.
1971	Perry Oceanographic, Inc.
1970	Humble Oil and Refining Co.
1969	Varian Associates
1968	Sippican Company
1967	Reynolds Metal Company
1966	HyTech Marine Products. Bisset

## Lockheed Martin Award for Ocean Science and Engineering

For outstanding accomplishments in marine science, engineering or technology; open to all working in the field.

Year	Awardee
2016	Tyler Schilling
2015	Fritz Stahr
2014	Francis Rowe
2013	Liesl Hotaling
2012	Franz Hover
2011	Howard Shatto
2010	Chuck Richards
2009	Dana Yoerger, Ph.D.
2008	Mark R. Patterson
2007	John A. Orcutt
2006	Joseph R. Vadus
2005	James Cairnes, Ph.D.
2004	James G. Bellingham, Ph.D.
2003	Dr. Andrew Clark
2002	Bruce Robison
2001	Frank Debritz
2000	Carey Ingram
1999	D. Richard Blidberg
1998	Dr. Robert D. Ballard
1997	Drew Michel
1996	Craig Mullen
1995	Ivar Aanderaa
1994	John A. Pritzlaff
1993	Jack B. Harmon
1992	John H. Clotworthy
1991	John E. Flipse
1990	Andreas B. Rechnitzer
1989	Ocean Systems Engineering, Inc.
1988	James G. Wenzel
1987	Allyn C. Vine
1986	Willard F. Searle, Jr.
1985	Fred Noel Spiess
1984	Howard S. Talkington
1983	Francis P. Shepard
1982	John P. Craven
1981	André Galerne
1980	Phillip Eisenberg
1979	Dr. Alfred A.H. Keil
1978	Prof. Harold E. Edgerton
1977	Prof. Ben C. Gerwick, Jr.
1976	Dr. Thomas G. Lang
1975	Prof. John Isaacs
1974	Capt. Joseph P. Kelly
1973	Dr. William S. Richardson
1972	Dr. Christian J. Lambertsen
1971	Dr. Lauren M. Donaldson
1970	Johannes A. Kylstra
1969	Walter H. Munk

## Ocean News and Technology Young Professional Award

Presented to an individual 35 years old or younger who is an MTS member in good standing has shown leadership in MTS and who works in a professional capacity in management, engineering or research and development in a marine technology field.

2016	Jeremy Stuhr
2015	Arnold Hechanova
2014	Michael Lombardi
2013	Ryan Morton
2012	Jeremy Childress
2011	Jacob Sobin Evan Zimmerman
2010	Stephen Faley Marcel Montrose

## MTS Fellows

The grade of MTS Fellow was established in 1966. A Fellow is someone who has made outstanding contributions to the advancement of the Society's objectives and who has distinguished accomplishments and experience in his or her professional fields. A number up to 5 percent of the overall membership may be designated as Fellows.

Year	Awardee
2016	Thomas Curtin
2015	None awarded
2014	Karen Kohanowich, Will Kohnen
2013	Suman Muddusetti
2012	Charles Royce
2011	Benton Baugh, Peter Fougere, Brock Rosenthal
2010	Diann Karin Lynn, Julius Rockwell
2009	John Bomba, Calvin Gongwer, Sandeep Khurana, Craig McLean
2008	Dietmar Deter, Mark Olsson, Daniel Schwartz, Richard Spinrad
2007	Landry Bernard, Daniel White, Herbert Ripley
2006	William Friedl, Alex Malahoff
2005	John Schiltz, Amos Bussmann
2004	William Venezia
2003	Jerry Boatman, William Phoel, Terry Thompson
2002	Andrew Clark, Patrick Fell
2001	Thomas Coughlin, Lorenz Maggaard, Hiroyuki Nakahara, Toshitsugu Sakou, Catherine Woody
2000	Richard Bloomquist, Jerry Carroll
1999	Norm Estabrook, Will Forman, Bruce Gilman, Frank Hughes, George Maul, Robert Randall

1998	None Awarded
1997	Martin Finerty, Drew Michel, John Wiltshire, Robert Winokur
1996	Craig MacDonald, Charles A. Richards, Douglas Stroud
1995	Sam Kelly, Howard Shatto
1994	Phillip Gibson
1993	J. Bradford Mooney
1992	Charles Bookman, Robert Haring, Nelson Ross
1991	Kevin Hardy, Robert Spindel
1990	William Milwee, Eugene Russin, Robert Swan
1989	Ronald Greer
1988	None Awarded
1987	Michael Champ, Wayne Ingram, Colin Jones, Muneendra Kumar
1986	Edward Clausner, Michael McCormick, Clifford McLain, Kenji Okamura*
1985	Michael J. Cruickshank, Ferial El-Hawary, Fred N. Spiess
1984	Howard Talkington, Robert Wernli
1983	Jack Jaeger, Ned A. Ostenso, William Rainnie
1982	Jack Harmon, Maxwell McKnight, John Moore, Morris Ransone James Wenzel
1981	Steven Anastasion, Charles Bishop, Frank Busby, Donald Keach, Harley Nygren, Andreas Rechnitzer, Joseph Vadam
1980	Robert B. Abel*, John C. Calhoun, Jr., John P. Craven, Phillip Eisenberg*, Paul M. Fye*, Gilbert L. Maton, James Wakelin*, Don Walsh Elmer P. Wheaton*
1979	Carl H. Savit
1978	David H. Wallace
1977	Dr. Robert D. Ballard
1976	William Q. Wick
1975	Dr. William A. Nierenberg
1974	Dr. Kenneth O. Emery
1973	Dr. Warren S. Wooster
1972	Butler King Couper
1971	Dr. Fred N. Spiess
1970	Willard Bascom
1969	Allyn C. Vine
1968	James M. Snodgrass
1967	Dr. Roger Revelle
1966	Dr. Henry B. Bigelow



*OCEANS '16 Shanghai: (L-R) OES president René Garelo presents an OES certificate of appreciation to Wen Xu, Chair of the Technical Program; Lian Lian, General Chair of the conference receives an MTS certificate of appreciation for the Local Organizing Committee from MTS Vice President Andrew Clark.*



*Lockheed-Martin Ocean Science and Technology Award Recipients Robert Ballard ('98) and Andrew Clark ('03) on National Geographic Expedition, of the RMS Lusitania off the Irish Coast, 1993. Photo by Jerry Neely.*

# OCEANS Looks Ahead

The future is wet. The waters are sometimes murky but in this case crystal clear. OCEANS will continue to build on its strong international presence, maintain its standing as the premier conference for ocean-related research and technology, and grow its global impact. The technical content delivered during OCEANS is unrivaled in the community, and OES and MTS are committed to expanding the influence of this great work by growing the number of attendees and exhibits and fostering enhanced discussion and the exchange of ideas. Digital technologies and social media will continue to be exploited to increase the interaction of the attendees by stimulating dialog and debate before, during, and after the conference. The recent town hall discussions have been standing room only and this practice will continue (with larger rooms) to focus on the most pressing and current topics in the industry. These electronic innovations will also create more positive experiences for attendees by putting timely information at their fingertips at all times. OCEANS will continue to serve as the premier event to develop in-person business relationships and partnerships between research scientists, practicing engineers, and world-class exhibitors. The achievements of the next generation of engineers will continue to be showcased by our highly competitive student programs. OCEANS is and will continue to be the best place for networking in the marine industry.

The structure and foundation of OCEANS will stay the same. The conference will continue to feature impressive keynote speakers who are recognized globally, and to offer unique technological content and tutorials. Additionally, in the future there will be greater emphasis to highlight the latest developments in instrumentation and technology with a larger exhibit and more opportunities to see equipment in action and discuss capabilities with knowledgeable exhibit staff. Both loyal and new exhibitors will continue to be inspired to bring innovative products. We also anticipate growth in the technical program while maintaining the existing high standards that enable some papers to be expanded into full journal articles.

Moving forward, OCEANS will partner more closely with local chapters of both OES and MTS, securing the bond between the Societies and the commitment to stay the best in

the business. The conference will continue to travel the globe to give as many engineers from universities, companies, and government organizations from around the world the opportunity to attend this flagship event. Join us as OCEANS looks ahead. The future is wet, very very wet.



Photo From MBARI

**OCEANS CONFERENCES**  
**Past Conference Locations**

**United States**  
 San Francisco, CA  
 Los Angeles, CA  
 San Diego, CA  
 Honolulu, HI  
 Seattle, WA  
 Biloxi, MS  
 Boston, MA  
 Newport, RI  
 Kona, Hawaii  
 Providence, RI  
 Washington, DC  
 Hampton Roads, VA  
 Fort Lauderdale, FL

**Canada**  
 Halifax, NS  
 Victoria, BC  
 Vancouver, BC  
 Quebec City, QC  
 St. John's, Newfoundland

**Europe**  
 Brest, France  
 Bremen, Germany  
 Aberdeen, Scotland  
 Santander, Spain  
 Bergen, Norway  
 Genoa, Italy

**Asia-Pacific**  
 Singapore  
 Kobe, Japan  
 Yeosu, Korea  
 Sydney, Australia  
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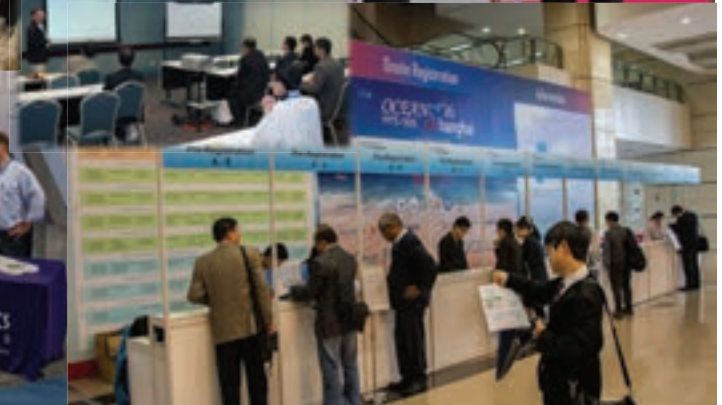
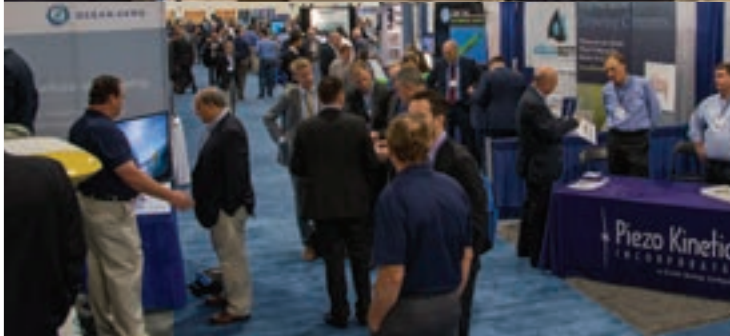
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**Sites Under Consideration**

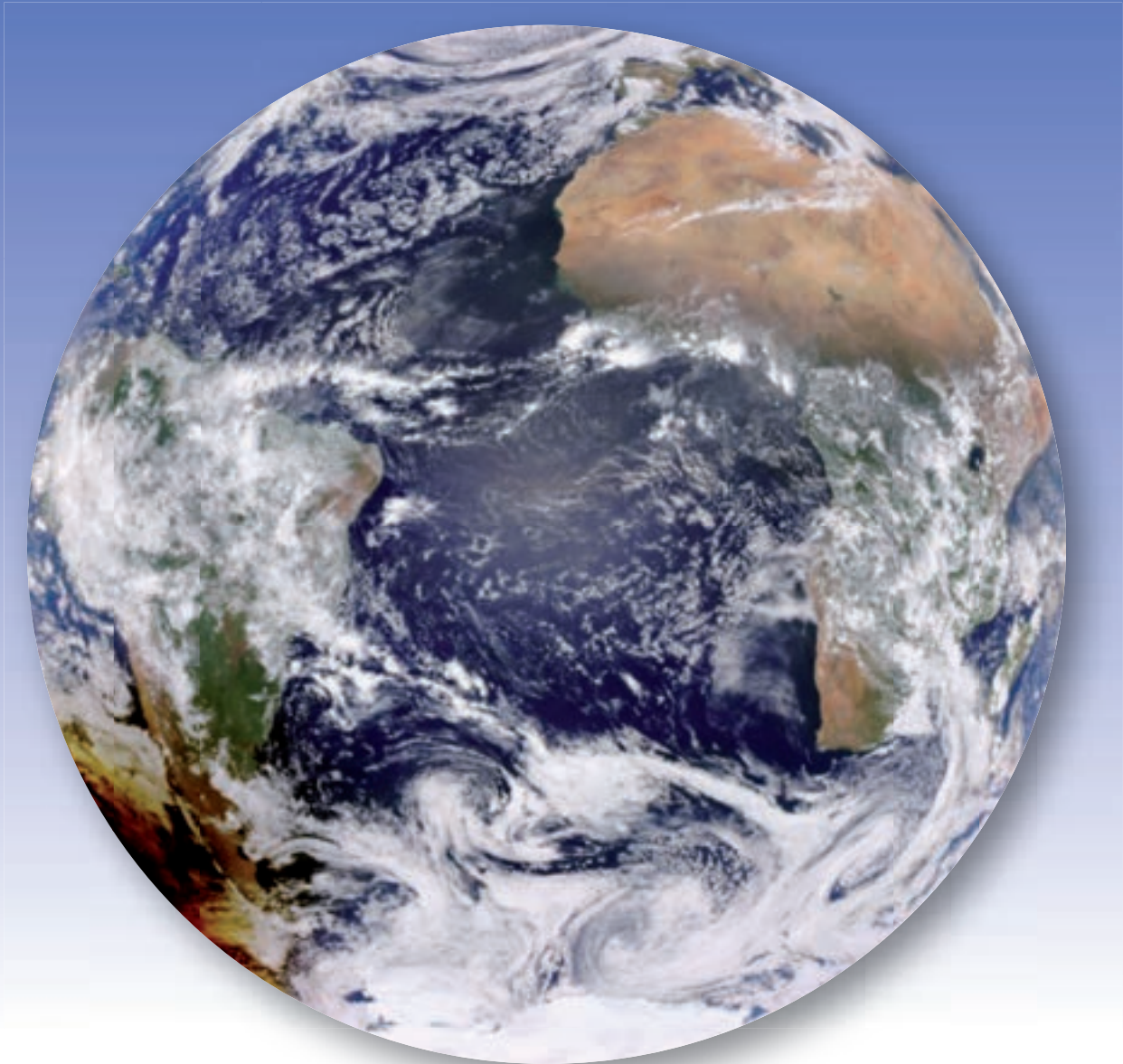
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