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NEWSLETTER

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EDITOR: HAROLD A. SABBAGH WINTER 1986 (USPS 420-910)

IEEE OCEANIC ENGINEERING SOCIETY

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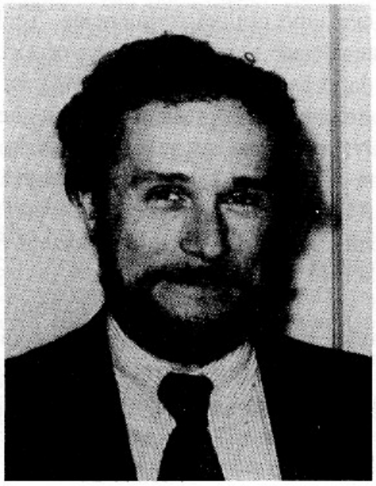
PRESIDENT'S MESSAGE



(The following is an edited version of the President's State of the Society report presented at the Administrative Committee meeting on September 24, 1986.

As we approach the conclusion of our fourth year as an IEEE society, our membership has stabilized at about 2000 members. Our journal, completing its eleventh year, our primary technical product, continues to grow and to attract articles from leaders in the field of oceanic engineering. Another area where technical solidification is becoming evident is the technology committees, several of which have played leading roles in organizing special focus conferences or special sessions at the annual OCEANS conferences.

A primary concern facing the Oceanic Engineering Society is the deficit budget projected for this and next year, brought on by the diminishing proceeds of the Offshore Technology Conference. Serious consideration must be given to the establishment of and adherence to realistic budgets for our journal, newsletter and various administrative costs that have been rising over the years.

A second concern, which can be turned into an interesting challenge, has to do with the Society conference profile. Plans are being developed to launch a new series of technology workshops or focused conferences. The issue is whether a new conference would erode attendance and contributions at the OCEANS conference. My own expectation is that the intended workshops, with proper planning, can draw from a now un-tapped portion of our membership, leaving the OCEANS conference unthreatened and at the same time helping to further solidify the technical cohesiveness of the membership. Anyone is welcome to contribute to this planning process for new conferences. Please send me a letter or give me a call with your ideas.

Anthony Eller
President
IEEE Oceanic Engineering Society

OES TECHNOLOGY COMMITTEES

Technical activities of the Oceanic Engineering Society are made possible in part through the existence of its Technology Committees. There are now eight such committees within OES. The Current Measurement Technology Committee is the oldest and most firmly established committee in OES, while the others, much newer, are in various stages of development. The present committees and their respective chairmen are listed below, followed by technical scope statements for those committees that have prepared one.

OES TECHNICAL COMMITTEE CHAIRMEN

1. Oceanographic Instrumentation and Data Acquisition

   Thomas M. Dauphinee
   Division of Physics
   National Research Council
   Ottawa, Ontario
   Canada, K1A OR6

2. Arctic Instrumentation

   Edward W. Early
   4919 N.E. 93rd Street
   Seattle, WA 98115

3. Underwater Acoustics

   Dan J. Ramsdale
   Naval Ocean Research and Development Activity
   Code 240
   NSTL, MS 39529-5004

4. Remote Sensing

   David E. Weissman
   Department of Engineering and Computer Sciences
   Hofstra University
   Hempstead, NY 11550

5. Marine Communication and Navigation

   John D. Illgen
   Kaman Sciences Corporation
   816 State Street
   Santa Barbara, CA 93101

6. Data Bases, Modeling and Simulation

   Glen N. Williams
   Data Processing Center
   Texas A&M University
   College Station, TX 77843

7. Autonomous Underwater Vehicles

Mack D. O'Brien, Jr.
Charles Stark Draper Laboratory
555 Technology Square
MS-5C
Cambridge, MA 02139

8. Current Measurement Technology

William E. Woodward
U.S. Department of Commerce
NOAA WSC-5
6010 Executive Boulevard
Rockville, MD 20852

SCOPE STATEMENTS OF THE OES TECHNOLOGY COMMITTEES

1. Current Measurement Technology Committee

The Current Measurement Technology Committee (CMTC) shall be a continuous forum within the marine community for addressing the issues and problems related to technology for measuring water currents. It shall also provide a focus for technical information exchange and promote cooperation and coordination among those in the marine community involved in current measurement including instrument manufacturers, and address the issue of standards for current measurement including laboratory and field standards, standard test methods and data recording standards.

2. Oceanographic Instrumentation and Data Acquisition Technology Committee

The technical interests of this committee include new developments in Oceanographic Instrumentation and Data Acquisition and their dissemination through workshops, conferences, publications etc; the solicitation and evaluation of papers related to Instrumentation and Data Acquisition; and the development, evaluation and acceptance of standards for oceanographic measurements and acquisition of data.

3. Arctic Instrumentation Technology Committee

The technical domain of the Arctic Instrumentation Technical Committee includes the development of instruments for sensing and measurements in polar regions. These measurements include, but are not limited to, in situ and remote sensing of ice, water and air temperatures; wind speed and direction; ice dynamics; ice and under-ice acoustics; water currents; and bottom topography.

4. Remote Sensing Technology Committee

The technical domain of this technical committee encompasses the technologies associated with the observation of geophysical quantities that describe the oceans, the air-sea interface, and its boundaries, which may include coastal regions, estuaries and ice. The medium of measurement is electromagnetic energy that may span all radio, microwave, and optical frequencies. Technologies of principal interest are the development of airborne, spaceborne or land-based sensors that transmit, collect and process the energy and information that they receive. Equally important is the interaction, reflection, and/or emission of energy from these geophysical bodies, as it affects communication links from sensor to further processing centers. In many important instances, the ocean surface or upper regions below the surface may be part of the channel of communication. The domain also includes theoretical interpretations and modeling, and their application to the needs of society: commercial, scientific, defense and educational.

5. Underwater Acoustics Technology Committee

The technical domain of the underwater acoustics committee comprises all aspects of applied acoustics in the ocean environment, including, for example: (1) the design of acoustics instrumentation (hydrophones, sound sources, transponders, recording systems); (2) the use of acoustics instrumentation (active and passive sonar systems) for such applications as acoustic telemetry, bottom mapping, underwater imaging, acoustic navigation, ocean measurements, target surveillance and tracking and position keeping; (3) the modeling and prediction of ocean acoustic parameters, such as multipath arrival structure, scattering, reverberation and noise, that influence system performance.

6. Marine Communications and Navigation Technology Committee

The technical areas of interest of the Marine Communications and Navigation Technology Committee are:

Marine Communications: Communications systems used between all possible combinations of marine platforms, shore based facilities, and intermediate relay facilities. Includes electromagnetic and acoustical systems of all wavelengths. Includes data and verbal communications.

Navigation systems: Systems which are used to derive present location and to provide the ability to move a platform to another relative or geographic location in the marine environment within a desired error budget. Includes electromagnetic positioning systems and electronic processing systems which use all sources of location or motion data. Also includes the interfaces to the user.

Command and Control systems: Systems which are used to direct the operations of platforms in the marine environment by echelons of operational, administrative or experimental control. This area would address the data, processing systems and operator interfaces.

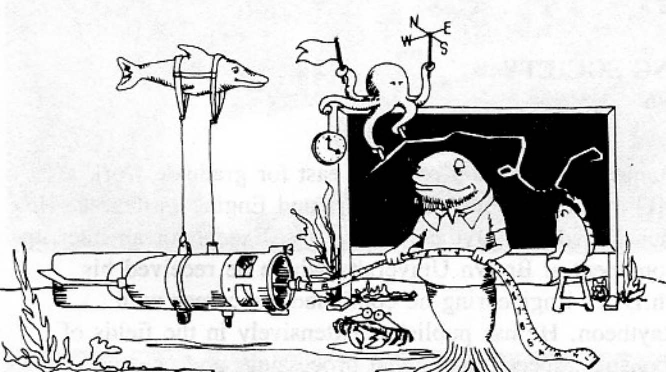
OCEANS '86

The OCEANS '86 meeting jointly sponsored by Oceanic Engineering Society and the Marine Technology Society had as its theme Science-Engineering-Adventure. The meeting was held September 23-25, 1986 at the Sheraton Washington Hotel in Washington, DC. There were approximately 850 registrants, 150 technical exhibitors, and 54 technical sessions dealing with essentially every conceivable aspect of ocean engineering technology. In addition to the regular technical sessions there were five tutorials and one workshop. The tutorials were Marine Archaeology and Marine Technology, Law for Marine Technology Managers: Government Technology Transfer, Global Positioning System, Export Licensing and Control, and Side Scan Sonar Record Interpretation. The workshop was entitled "Ocean Data Management to the Year 2000."

The conference also had a number of special events called "All Hands Sessions." These events consisted of the following:

- A program entitled "Sixty Years of Underwater Photography" at the National Geographic Society.
- A keynote address by Representative Claudine Schneider, U.S. House of Representatives, State of Rhode Island.
- A talk by Gary Jobson on "America's Cup Challenge — Who's Going to Win."
- A "State of the Society" address by OES President Tony Eller.
- A presentation entitled "The Titanic Revisited" by Robert Ballard of the Woods Hole Oceanographic Institute.
- An address by Mr. Marvyn Paisley, Deputy Secretary of the Navy for Research, Engineering and Systems.
- A "State of the Society Address" by the Marine Technology Society President.
- A talk by Mr. Curtis Mack, Deputy Administrative for NOAA.
- An address by Dr. Thomas Moore of the Council of Economic Advisors, representing the White House.

Of special interest was the presentation of the two OES Awards. The *Distinguished Technical Achievement Award* was given to *Robert J. Urick* in recognition of exceptional long-term contributions to the experimental study of underwater sound and related engineering principles, including the generation, propagation reception and processing of acoustic signals, ambient noise and other environmental effects, oceanography and geophysics, information and decision theory and fundamental concepts of physics; and for outstanding contributions to the working engineer through the publication of principles of underwater sound, including his text book which as become the generally recognized standard in the field. The *Distinguished Service Award* was given to *Dr. Stanley G. Chamberlain* in recognition of particular meritorious service to the Oceanic Engineering Society during the critical years of its formation. His dedication, vision, leadership and grace has ensured a sound foundation for future growth of the Society.



CURRENT MEASUREMENT TECHNOLOGY COMMITTEE NEWS AND INFORMATION

A primary objective of the Current Measurement Technology Committee (CMTC) of the Oceanic Engineering Society (OES) is to provide a focus for information exchange and promote cooperation and coordination among those in the marine community involved in current measurement. To this end, this column has been established as a regular feature of the *OES Newsletter* and everyone is encouraged to participate by submitting news items and information about active or planned current measurement efforts to Bill Woodward (301) 443-8444 or Jerry Appell (301) 443-8026 for publication in the column. This will be an effective forum only if everybody participates, so let's hear from you.

Our column in this Newsletter Issue is devoted to summarizing CMTC activities.

ELECTIONS

130 ballots were received by October 15, 1986 with the following nearly unanimous results:

WILLIAM E. WOODWARD, CHAIRMAN
GERALD F. APPELL, VICE CHAIRMAN
THOMAS N. MERO, SECRETARY/TREASURER

MEMBERSHIP ROSTER

The election ballots this year served an additional purpose of allowing us to assess the level of interest of the membership in remaining a part of CMTC. As stated on the ballot, those who did not vote by returning their ballot by October 15 were removed from the membership list. The net result was that our roster was trimmed from more than 300 to 130. Copies of this new roster are being mailed to each member.

BIBLIOGRAPHY

This project has been a low level effort for several years. Our goal is to produce a compendium that has the title, author(s) and abstracts where possible of virtually every relevant paper, journal article, internal report etc. prepared in the last 10 to 15 years pertaining to current measurement technology. The plan is to make this information available to the CMTC membership in personal computer floppy disc form along with a data base program which can be used to search and manipulate the information. To date a CMTC

Continued on page 10

DISTINGUISHED TECHNICAL ACHIEVEMENT AWARD

OCEANIC ENGINEERING SOCIETY
OCEANS 1986

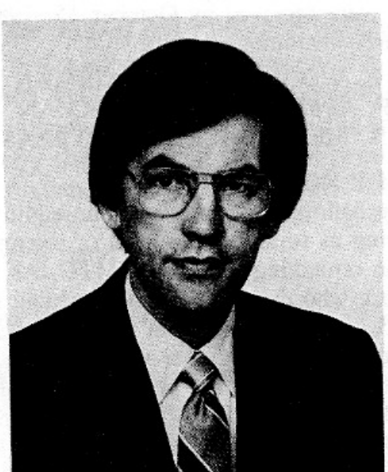
ROBERT J. URICK

This award is given in recognition of exceptional long-term contributions to the experimental study of underwater sound and related engineering principles, including the generation, propagation reception and processing of acoustic signals, ambient noise and other environmental effects, oceanography and geophysics, information and decision theory and fundamental concepts of physics; and for outstanding contributions to the working engineer through the publication of principles of underwater sound, including his text book which has become the generally recognized standard in the field.

1975 — Robert Frosch	1981 — No Award
1976 — Werner Kroebel	1982 — Ira Dyer
1977 — Howard A. Wilcox	1983 — Alan Berman
1978 — Richard K. Moore	1984 — John B. Hersey
1979 — David W. Hyde	1985 — William A. Nierenberg
1980 — Neil Brown	

DISTINGUISHED SERVICE AWARD

OCEANIC ENGINEERING SOCIETY
OCEANS 1986

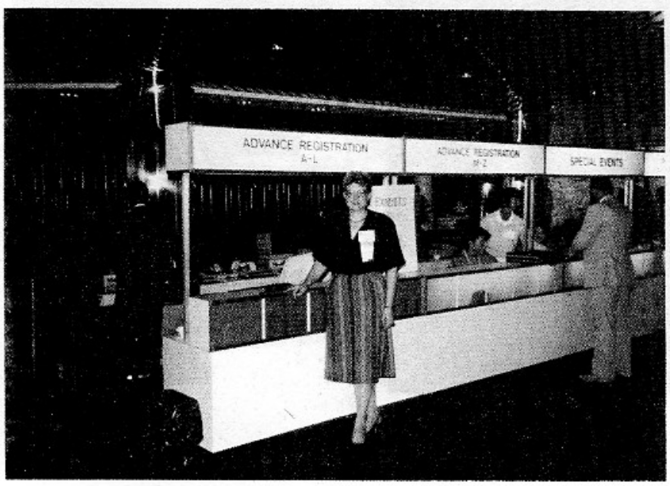


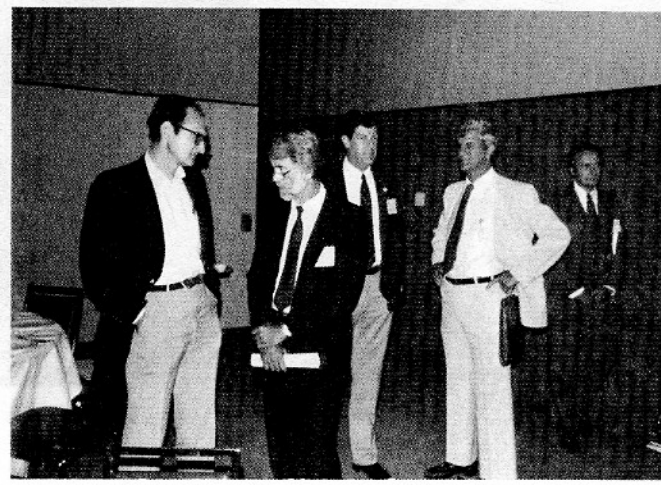
STANLEY G. CHAMBERLAIN

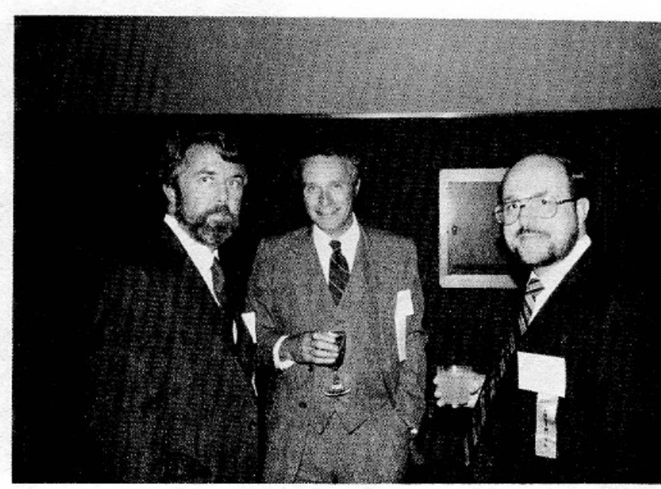
Given in recognition of particular meritorious service to the Oceanic Engineering Society during the critical years of its formation. His dedication, vision, leadership and grace has ensured a sound foundation for future growth of the Society. After receiving his B.S. degree in Physics from Wheaton College, Illinois, and playing on the NCAA (College Division) national basketball championship team, Stanley Chamberlain returned east for graduate work at MIT receiving both his Masters and Engineers degree. He then joined the Raytheon Company. Except for an interruption spent at Brown University where he received his Ph.D. in Engineering he continued his career with Raytheon. He has published extensively in the fields of acoustics, speech and signal processing, and oceanic engineering. He is currently manager of Systems Operational and Performance Analysis in the Systems Engineering Laboratory and is Junior Past-President of the IEEE Oceanic Engineering Society.

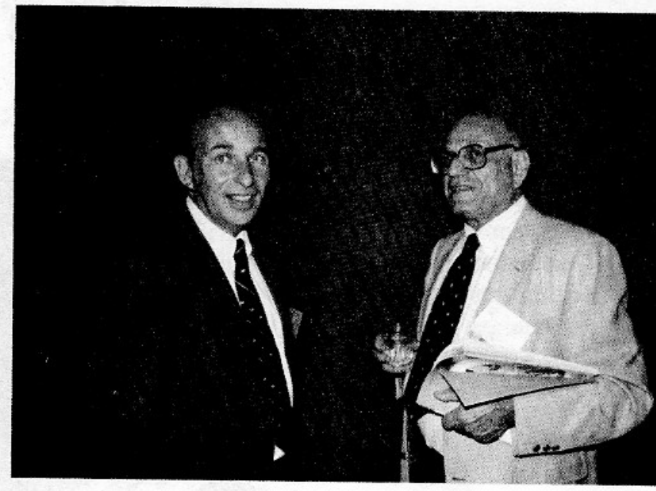
1975 — Arthur S. Westneat	1981 — Lloyd Z. Maudlin
1976 — Frank Snodgrass	1982 — Arthur S. Westneat
1977 — Calvin T. Swift	1983 — Elmer P. Wheaton
1978 — Edward W. Early	1984 — John C. Redmond
1979 — Richard M. Emberson	1985 — Joseph R. Vadus
1980 — Donald M. Bolle	

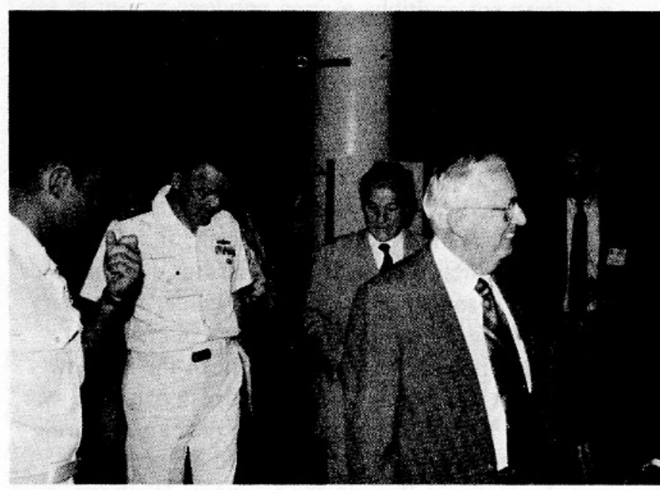
WASHINGTON WATCH: PICTURES OF OCEANS '86

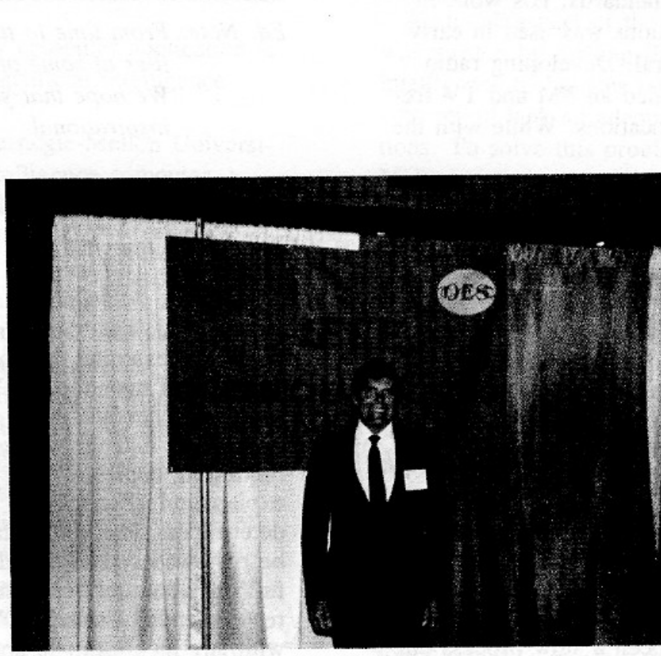






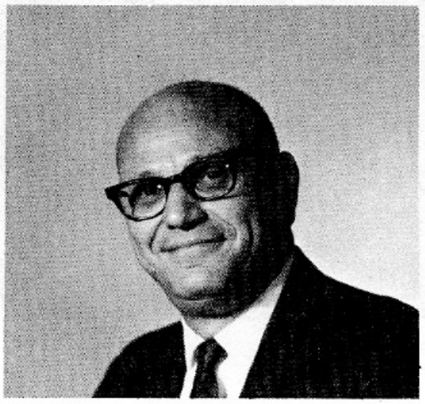





OES

PROFILE: MORRIS SCHULKIN

(Life Fellow, IEEE)



Dr. Schulkin is internationally recognized for his work in underwater sound propagation, acoustic oceanography, sonar performance evaluation, and prediction. He has written extensively on acoustic range prediction and sonar systems performance. He originated the statistical range prediction techniques in current use in the Fleet, initiating the statistical signal excess concept and developing the associated statistical figure-of-merit concept. In addition to his pioneering efforts in underwater acoustics and undersea warfare, he has also had a distinguished career in military electronics. During World War II, he was in charge of miniature tube reliability and quality control for the newly developed rocket and bomb proximity fuzes. After the war, the atmospheric radio refractometer was developed during Dr. Schulkin's tenure as Head of the Radiometeorology Section at the National Bureau of Standards. His work in atmospheric radio refraction corrections was used in early rocket experiments at Cape Canaveral. Developing radio propagation analyses, he recommended an FM and TV frequency utilization plan for FCC allocations. While with the Naval Research Laboratory Radio Astronomy Group, he was the first person to observe a solar flare at a wavelength of 3 cm.

Dr. Schulkin has been Chairman of the Caribbean Committee of the Undersea Warfare Research and Development Planning Council. He was Chairman of the Program Review Group at NUSC, as well as the Associate Director for Science, Engineering and Acoustics at NAVOCEANO. As Consultant on Acoustics for the Maury Center for Ocean Science, he was heavily instrumental in defining the Navy Interim Model for Sound Propagation, as well as preparing the Acoustics Section of the Long Range Plan for Ocean Science. Dr. Schulkin was the first Director of Performance Analysis for the ASW Systems Project Office, and specialized in Surface Ship Weapons Systems. He was an Associate Member of the Underwater Sound Advisory Group to the Chief of Naval Research, and has been on the Committee on Underwater Acoustics of the Acoustical Society of America since 1974. He is a Fellow of the Acoustical Society as well as Fellow of the Institute of Electrical and Electronics Engineers. He has taught several courses in Ocean Acoustics, Ocean Engineering, and Physical Oceanography at The Catholic University of America. He has organized and conducted workshops in Ocean Acoustic Remote Sensing for NOAA and Shallow Water Acoustics for ONR. He has been awarded the Navy Civilian Service Medal. He has also been designated Senior Fellow of the Applied Physics Laboratory of the University of Washington. Dr. Schulkin is now President and Consultant of Oceans Acoustics, Inc.

Ed. Note: From time to time we will print professional profiles of some of our distinguished OES members. We hope that you'll find these interesting and inspirational.

Current Measurements continued from page 5

subcommittee led by Jill Morrison has collected, categorized and assembled more than 700 citations. We will shortly enter into a small contract for construction of the database, entry of the material and production of copies for CMTC members. Estimated completion date for this effort is May 1987.

STANDARDS

The initial objective of this effort was to determine what role (if any) standards should play relative to current measurement technology. This has been a slow process due to the controversial nature of the topic. At our CMTC Meeting No. 7 at OCEANS '86 a consensus was developed to accelerate the "standards" effort by initiating a specific project to examine the possibility of developing a common or standard manufacturer's current meter specification sheet. A letter will soon go out to current meter specification sheet. A letter will soon go out to all manufacturers requesting copies of their specification sheets as well as an explanation of terms and how the specifications were determined. The accumulated set of specification sheets will be reviewed and analyzed by a CMTC subcommittee with full manufacturer representation. They will then produce a recommended "standard" sheet for review, discussion and with any luck ultimate approval by all manufacturers.

For further information contact: Bill Woodward, 301-443-8056.

OF OCEANIC INTEREST

Reprinted with permission from recent issues of Sea Technology

Artificial Intelligence Provides Aid for Drilling

Computer Technology Brings Diagnostic Assistance to Marketplace

Emerging into the marketplace after nearly 30 years of research in university laboratories, the computer technology known as artificial intelligence is providing valuable help to the drilling industry.

Developed in response to a variety of needs, the incorporation of this new computer technology supplies technical advice to personnel on drilling rigs and allows them to apply accumulated technical expertise to drilling problems 24 hours a day throughout the year.

Artificial intelligence is a discipline which allows computers to think and reason as humans. One area of study within the discipline is expert systems, in which a knowledge base is built through interviews with people who have become experts in a certain field. The information collected is programmed into a rule base of a general if-then-else format.

Artificial intelligence is different from data processing. Data processing is the manipulation of numbers and data, and is sometimes referred to as ''number crunching.'' Artificial intelligence has no logical step-wise program, only a collection of information in a rule base, and any rule can be called upon at any time during the execution. This is non-routine and a non-repetitive function. At any stage of the rule base execution, the reasoning behind any decision can be explained. The ability to use all information and arrive at previously unknown results with a reason explained distinguishes artificial intelligence from data processing.

One company employing this new computer application is NL Baroid. Baroid's version of an artificial intelligence system is called the Mudman.™

Developed in cooperation with Carnegie-Mellon University, Mudman is the first artificial intelligence computer system to be placed in general use in the drilling industry and one of the first in any industry that will be available commercially.

Artificial intelligence systems like Mudman are expected to help substantially decrease the risk of oilfield drilling problems such as kicks, lost circulation and stuck pipe, especially on deep and complex wells. This system also provides networking, report generation, drilling data calculations and data base capabilities at the well site.

A system like Mudman is designed to serve as a technical partner in the field and will be especially valuable on remote offshore locations where it is difficult for the engineer to gain informational support from the home office. A Mudman system can make comprehensive technical information immediately available at any drilling location worldwide.

A typical exchange using the system involves the representative telling Mudman the physical characteristics of the fluid in use and any changes that are detected, and then describing the problem being encountered or the characteristics of the new fluid that are desired. The computer and the representative engage in a series of questions and answers about the specific mud application or drilling problem, and the system then recommends solutions and explains the basis for the recommendations. The computer may also ask questions for clarification and then recommend the appropriate actions. Recommendations may include such things as changing the weight or viscosity of the fluid in use or applying certain additives for particular downhole problems.

The entire exchange between human and computer takes place in standard English through a user-friendly, menu-driven program.

Artificial intelligence systems such as Mudman make the human mud technologist more effective by freeing him from many routine tasks such as generating API reports, keeping track of inventory and recapping drilling fluids activities upon completion of the well.

The core of the Mudman artificial intelligence system, in particular, is a Digital Equipment Corp. VAX 11/780™ super mini-computer, a highly sophisticated machine particularly adapted to engineering usage that is used in American military systems. This main unit is located at NL Baroid headquarters in Houston.

A unique aspect of the Mudman is the program which was written by drilling fluids engineers trained in artificial intelligence techniques rather than computer programmers who might lack an adequate knowledge of drilling applications. To solve this problem, NL Baroid enlisted Carnegie-Mellon to train several mud engineers in artificial intelligence programming. Baroid then trained Carnegie-Mellon scientists in the basics of drilling fluids. The two groups then worked together for more than four years to develop the program.

''We believe that the Mudman system will help to usher in a new age in the oil industry,'' said William H. Welch, president of NL Baroid. ''Most of the readily available petroleum reserves have been tapped. If we are to continue meeting the world's long-term demand for energy, the industry must increasingly turn to new technologies that will improve on tried and true practices of the past.''

Utilizing such features as the incorporation of a sophisticated simulation capability to determine the effect of drilling fluids or combinations of applications prior to any action being taken on a well, systems such as Mudman will surely assist the oil industry in the cost effective location and retrieval of oil in a period when it is so crucial.

Ocean Wave Energy Conversion

Inexpensive Energy Source Yields Significant Results Through Simple Methods

By Dr. Michael E. McCormick
NAVFAC Professor and Director Ocean Engineering

Pneumatic ocean wave energy conversion has been in existence since the early twentieth century. Prior to 1920 an inventor in France built a pneumatic system in the side of a sea cliff and, according to Palme (1920), received all of his electricity from the system. The fan used in the Bouchaux-Praceique wave energy converter, as it is called, consisted of pieces of leather used as runner blades. The leather blades changed their profiles as the wave-induced air flow changed direction.

In pneumatic wave energy conversion, internal water motions are excited by the external water wave. Depending on the volume of water in the "capture chamber", resonance with the external wave may occur. That is, the natural frequency of the rising and falling internal water column may equal or be close to the frequency of the external wave. When this resonance phenomenon occurs large motions of the water column also occur. The amplitudes of these motions can be several tims that of the alternately inhaling and exhausting air above the water through the turbine. This excites the turbo-generating system and, hence, produces electricity.

Much has happened in the wave energy conversion area since the first system was built. In 1965 Yoshio Masuda patented the ocean wave electric generator which was used to power navigation aids by pneumatic wave energy conversion. The U.S. Coast Guard used one of Masuda's buoys.

In 1971, the Coast Guard requested that I analyze the Masuda buoy to determine its optimum efficiency. Results showed that both the reliability and efficiency of the system could be improved if the un-directional turbine could be replaced by a bi-directional turbine. Note: Over 1,300 of the Masuda turbo-generators have been sold for more than $8,000 each. These systems deliver up to 20 watts of electrical power.

At the invitation of the Japanese government, the International Energy Agency (IEA) sponsored a full-scale wave energy conversion project which begain in 1978. The project involved pneumatic wave energy conversion systems placed on the ship-shaped platform called "Kaimei" which was moored in the Sea of Japan. Ten turbines, each converting an average of 125 kW of wave energy to electrical energy were to be palced on Kaimei.

The turbo-generating systems were of three types. One British turbine and several Japanese turbines were uni-directional. A second British turbine was a bi-directional Wells turbine. This system is now commercially available from Munster Simms Engineering Limited in Bangor, Northern Ireland. The turbine submitted (late for the first Kaimei deployment) by the United States was the bi-directional McCormick turbine.

That turbine consists of two counter-rotating runners wi a set of two guide vanes.

The second deployment of the Kaimei is now underway in the Sea of Japan. During this deployment, the McCormick turbine shares the bow position with the Wells turbine. The differences in the turbines are the following: First, the diameter of the Wells turbine is approximately two meters, while that of the McCormick turbine is one meter. Second, the operational speed of the Wells turbine is greater than 1,400 rpm, while that of the McCormick turbine is approximately 700 rpm.

The most practical configuration of the pneumatic wave energy conversion system is on a stationary platform with fixed capture chamber. One concept of such a system wa suggested by engineers of the applied Physics Laboratory of the Johns Hopkins University. A system of this size would deliver up to one mega-Watt of electrical power — the power depending on the width of the system. This power could be used to produce either a-c or d-c electric ty, depending on the need. The cost of this electricity has been estimated by Norwegian engineers working in the field to be between two and five cents (US) per kW-hr. Since island communities pay up to 20 cents (US) per kV hr for imported fuel, wave energy conversion could be very attractive.

Several countries are now entering the market with fix pneumatic wave energy conversion systems. The most notable are Japan, Great Britain, and Norway. The rush enter the market is because of the more than 100,000 island communities that must have energy imported at co siderable cost. In the United States there are a few companies making efforts to commercialize other types of systems, namely contouring rafts, movable bulkheads, ar heaving bodies. All three of these systems were rejected the British after extensive studies. No one, to date, has a tempted to commercialize the pneumatic system in the United States.

The Market

As previously stated, there are over 100,000 inhabited islands that require imported energy. The cost of this energy, depending on the location, is up to 20 cents (US per kW-hr. It has been estimated that wave supplied elec tricity, using pneumatic systems, will vary from two to cents (US) per kW-hr. In addition to direct use of electr ty, energy-intensive products can also be produced by w energy conversion. One such product is fresh water whi costs between $20 and $60 (US) per 1,000 gallons, dep ing on the amount of rainfall available.

In summary, therefore, the market seems quite attract

The McCormick Turbine

Over the past eight years many tests have been conducted on the McCormick Wave Energy Conversion Turbine in the United States. At the U.S. Naval Academy, wave tank tests (in a 117-meter long wave tank) have been performed on turbo-generating systems having 0.25-meter and 0.50-meter turbines, the latter being a half-scale of the turbine now on Kaimei in the Sea of Japan. Wave power was converted into electrical power by the 0.25-meter turbo-generator at an efficiency of 36%. This value of efficiency is rather remarkable since the maximum theoretical efficiency for the capture chamber configuration used is 50%. For a capture chamber the maximum theoretical efficiency is 100%. Thus, the 0.25-meter turbo-generator would be at least 72% if used with this configuration. Actually, because of "small-scale" losses, the efficiencies of larger turbo-generating systems would be even greater.

The minimum desired wave power line intensity is 10kW per meter of wave crest. That is, for each meter width of wave at the capture chamber, 10 kW are available. For a 10-meter wide system operating at 72% efficiency, therefore, 72 kW of electricity would be supplied by the system in a minimum wave resource condition. Each U.S. citizen requires approximately 1kW (peak) for his or her existence. The 10-meter wide system, then, would supply 72 citizens with electricity under the minimum sea state condition.

The McCormick Wave Energy Conversion Turbine is rather simple in design. Four bevel gears are required to couple the impulse turbine runners for an in-line system. Through either a gear system or a pump system, the low rotational speed of the turbine is increased for the high-speed generators. All the components, including the guide vanes, are off-the-shelf items. Hence, the cost of the system is minimal.

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Michael E. McCormick began his professional career in 1958 as a hydrodynamicist at the David Taylor Model Basin. His teaching career began in 1961 when he joined the mechanical engineering faculty of Swarthmore College, where he returned in 1976 as Visiting Scholar of Engineering. He has also taught at Trinity College (Hartford), Catholic University and the U.S. Naval Academy, where he is now NAVFAC Professor and Director of Ocean Engineering. Prof. McCormick holds doctorates in mechanical engineering from Catholic University and civil engineering from Trinity College in Dublin, Ireland. He is author of two books and over 70 papers and reports. In addition, he is the editor of two book series and co-editor of the journal Ocean Engineering.

New Brushless Electric Motors Powered *Alvin* in *Titanic* Survey

Preparations for the Woods Hole Oceanographic Institution-sponsored survey of the *R.MS. Titanic* included updating the propulsion system of one of the key players — the deep-diving submersible *Alvin.* Moog Inc., Electric Motion Controls Division (East Aurora, New York), assisted in the submersible's overhaul, yielding a "considerably more responsive" *Alvin* that "handles now more like a sports car," according to Ralph Hollis, chief pilot for the Woods Hole submersible.

Six of the motors installed were used to replace *Alvin's* outdated propulsion system. Each one was connected directly to a high-speed, 24-centimeter-diameter propeller. Three motor/thruster combinations provided steering and vertical motion while the remainder propel *Alvin* horizontally. Installation of the horizontal drives enables three 24-centimeter propellers to replace a single 122-centimeter propeller that had been driven by a hydraulic system.

Two additional brushless motors power the submersible's salt water ballast pump and a hydraulic pump. The latter in turn powers all the hydraulic controls, including one of *Alvin's* manipulator arms.

OTC to Leave Traditional Meeting Dates, Combine with World Petroleum Congress

In a surprising move, the Offshore Technology Conference's board of directors approved plans to change OTC 87's dates to April 27-30 — "to coincide with the World Petroleum Congress which will be held in Houston from April 26 through May 1." The Congress — held every four years — will take place in the city's Albert Thomas Convention Center and Jones Hall while OTC remains at its traditional Astrohall and Astroarena locations. The move also eliminates the Astrodome for exhibit space because of schedule conflicts that week with the city's professional baseball team. Brown & Root's James E. Dailey, chairman of OTC's board, explained that moving OTC will "maximize the opportunity. . .to take advantage of both events. The WPC — which has not been held in the U.S. since 1959 — covers a full range of issues from exploration anc production through refining, transportation, marketing, an government policies. The 1983 Congress in London drew 2500 attendees. Officials at OTC aren't talking much abou expectations for 1987 attendance at the oil industry's premier show, but some expect the same as last year, abc 27,000.

ELECTRICAL PERSONALITIES

JAMES CLERK MAXWELL (1831-1879)

This genial Scotsman can be considered as the oak whose roots gathered up the electrical knowledge of his predecessors and contemporaries and passed them on to the many branches of the physical sciences of today. He was the product of the universities of Edinburgh and of Cambridge (Trinity), the school of Newton and Darwin.

Maxwell's interest in the physical sciences was at first general and included special studies in the behavior of gases, the interchange of forms of energy, and of optics. From 1860, when he was awarded the Rumford Medal by the Royal Society for his studies in light, to 1866 when he resigned his academic work to retire to his estate at Glenlair in Scotland, Maxwell experimented and wrote on these varied physical topics. The swing towards a primary interest in electricity and magnetism became definite when the British Association Committee endeavored to determine a set of electrical standards in 1862. It was under Maxwell's direction that experiments began to fulfill this requirement. The vague theory which Faraday had noted in 1832 in which he compared the diffusion of magnetic forces from a magnetic pole to ripples on water, to sound or to the vibrations of light, Maxwell clarified in firm mathematical demonstrations in his 'Dynamical Theory of the Electrodynamic Field', published in 1865. In this paper Maxwell treated the transmission of electric and magnetic forces through a medium in mathematical terms and concluded with the electromagnetic theory of light. The same approach was followed in the preparation of Maxwell's most important publication, his classic 'Treatise on Electricity and Magnetism' that appeared in 1873 in two quarto volumes.

Although regarded as unnecessarily complex by his con temporaries, the mathematical treatment in defining electrical and magnetic relationships, the increasing complexit of electrical usage, and the training of electricians and physicists in subsequent generations has prompted them tc refer to Maxwell for a clear understanding of these basic relationships. His contact with Faraday at the Royal Instit tion where Maxwell lectured in 1861 made him admire nc only Faraday the man but also Faraday the experimenter. Maxwell was engaged, in particular, by Faraday's concep of the nature of the space or field existing around a magnetized or electrified body (so remarkably revealed by iron filings). Maxwell thereupon decided to study this fiel and to give its properties mathematical expression. He realized then, as we do increasingly today, that there was more knowledge concerning the laws relating to matter, motion, and energy than grasp an understanding of that which seemed to pervade everything and yet was resolved to nothing.

He realized that "the work of mathematicians is of two kinds, one is counting, the other is thinking," and he regarded thinking as a nobler though more expensive occupation than counting. He wished to represent the physica universe not in directionless symbols, denoting mere quantities, but in dynamic vector terms in which one could think about a material system in a relative position of its parts. The mind had to shift from a three co-ordinate system to a point of space having magnitude and direction Thus, the phenomena of static electricity, electromagnetic attraction, electrical induction, and diamagnetism were viewed as the products of actions that proceed in an excite body and its surrounding field. Applying his equations to the propagation of a magnetic disturbance through a nonconducting field, he concluded that the velocity of propagation "is so nearly that of light, that it seems we have strong reason to conclude that light itself — including radiant heat, and other radiations if any — is an electromagnetic disturbance in the form of waves propagated through their electromagnetic field according to electromagnetic laws;" and "Light consists in transverse undulations in the same medium which is the cause of electric and magnetic phenomena." In these terms, the concept of the electromagnetic field coupled with Ohm's law as a basic principle, he established the electromagnetic theory of light, and deduced therefrom the common operating laws of electricity and magnetism. Then light, electricity, and magnetism became extensions of the same operation.

Maxwell investigated the kinetic energy that might possibly be possessed by an electric circuit when in rapid motion. In 1861 he constructed an apparatus to determine its value. The apparatus consisted of a central electromagnet capable of being rotated about its horizontal axis between pivots, and a ring which revolves about a vertical axis. There was independent neutralization of the earth's field, and the pivots were used as conductors to energize the coil. Any possible angular movement of the coil towards the vertical was observed during the rotation of the ring. Maxwell operated the device and concluded that if a magnet contains matter in rapid motion, the angular momentum of such rotation would be very small compared with any measureable quantities. He also constructed a dynamical model to demonstrate the equations of electric currents, as in the case of two inductive circuits.

In 1871 Maxwell was appointed the first professor in the newly founded chair of Experimental Physics at Cambridge, and he devoted himself to the task of establishing the Cavendish Laboratory, a fountainhead of physical knowledge where Ohm's law for metallic conductors was verified. It was therefore fitting that shortly thereafter Maxwell should also edit the electrical research of Henry Cavendish (1731-1810), the earliest of quantitative electricians.

At Cambridge, the birthplace of nuclear physics, experiments were made important to the electromagnetic theory, establishing that the unit of charge in electromagnetic units bears a ratio to the unit of charge in electrostatic units that is numerically and dimensionally equal to the speed of light. Maxwell predicted that light exerted mechanical pressure, and this prompted Crookes to devise the radiometer to demonstrate this phase of energy conversion.

The existence of electromagnetic waves had been indicated by Maxwell's equations. It was 15 years later that Heinrich Hertz of Karlsruhe demonstrated the existence of such electromagnetic waves in the space about a discharging Leyden jar. Later Hertz expended the experiments by using induction coils joined to metallic sheets and balls. The spaced second conductor having a small gap in its circumference showed that oscillatory discharges took place between the metal sheets in the form of sparks appearing in the gap of the secondary detector. Hertz calculated the value of the velocity of propagation in the air and found it, as Maxwell had predicted, to be the order of that of light. This evolved into signalling through space and has expanded into modern radio communication.

In 1860 the Royal Society presented the Rumford Medal to Maxwell for his research in light and in the following year he presented his first lecture at the Royal Institution under the sponsorship of Faraday, whom Maxwell admired more than anyone else among his colleagues. Maxwell delivered the inaugural lecture at the Cavendish Laboratory in 1871, but actual research did not commence there for another three years. He sponsored popularization of difficult scientific subjects and contributed his own 'Matter and Motion' as an example of such a simple and lucid presentation. He wrote delightful humorous poetry, often poking fun at his colleagues. He was especially honored to receive, in 1878, a doctorate and the Volta Medal from the University of Pavia, the school where Volta taught. The void left by the early death of Maxwell at the age of 48 is still felt as efforts to understand the physical world move on towards the paths outlined by this consummate interpreter.

Reprinted from *Instrumentation and Measurement Society Newsletter, Jan/May 1986*

'TIS A PUZZLEMENT

Last Quarter's Puzzle: Who's All Wet?

Last quarter's puzzle was to figure out if you stay drier running or walking in the rain. Mr. Norm Dillman of Loveland, CO correctly answered the question. You do stay drier by running, but there is an amount of rain that has to land on you no matter how fast you move. Mr. Dillman also pointed out that there is an alternative solution for areas of the country outside the Pacific Northwest: wait until the rain stops!

This problem can be best approached by modeling your body as a block and ignoring your head for simplicity (I know, it would be more accurate for me to model my head as a block and ignore my body–all the girls do–I just don't get no respect!). The height of the block is H (50 in.), the thickness T (10 in.) and the width W (18 in.).

The next step is to stop the rain (nice trick if you can do it–the Seattle Chamber of Commerce would pay you big bucks) by changing frames of reference to that of the rain. It would appear then that the rain was hanging motionless in the air while your body had an upward velocity of V_{rain}, the speed of the rain (another neat trick that the Air Force and Otis Elevator would be interested in). The horizontal length that you have to travel is L, the density of the now motionless rain is D and the horizontal velocity of your body is V. Now that we have symbols for everything let's see what trouble we can get into.

Figure 1 shows a sketch of this problem.

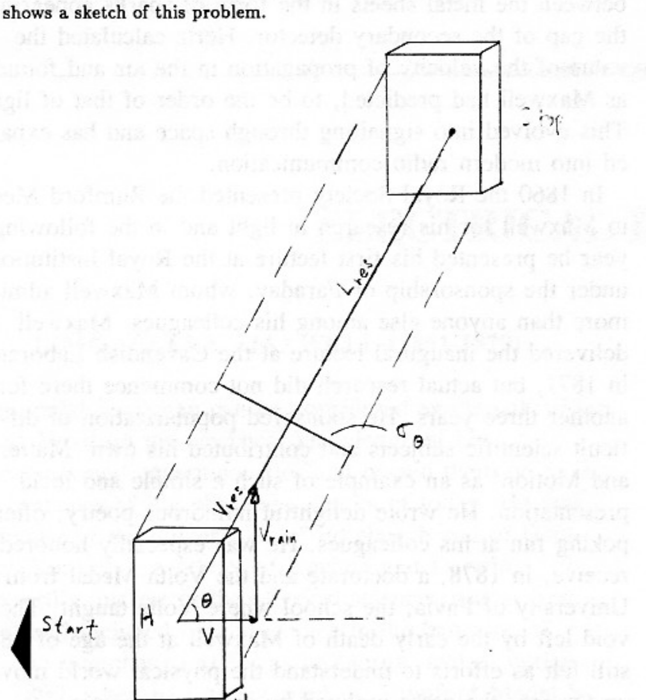


Figure 1.

From the new frame of reference it would appear that your body travels along the path of length, L_{res}, sweeping up the rain in its way. L_{res} is the vector sum of L and the vertical distance travelled. V_{res} is the velocity along this path and is the vector sum of V and V_{rain}. σ_θ is the cross-sectional area of the block, as viewed along the apparent path, and θ is the angle between the apparent path and the horizontal.

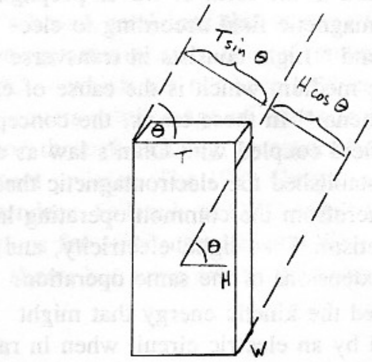
The amount of rain falling on your body would be equal to the volume swept out by the body times the density of the rain:

$$Rain = (\sigma_\theta \times L_{res})D. \qquad (1)$$

The next step is to find expressions for σ_θ and L_{res}. First L_{res}:

$$L_{res} = \frac{L}{\cos\theta}. \qquad (2)$$

Next σ_θ: The total cross-sectional area is equal to the sum of the cross-sections of the and front of the block:



As shown in this figure, the cross-section of the top is $WT\sin\theta$ and the cross-sectic the bottom is $WH\cos\theta$, so:

$$\sigma\theta = W(T\sin\theta + H\cos\theta).$$

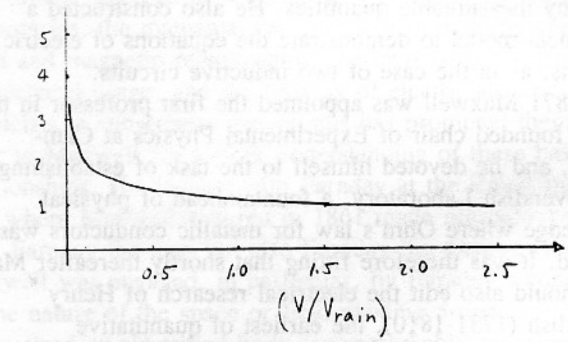
Substituting (2) and (3) into (1) yields:

$$Rain = W(T\sin\theta + H\cos\theta)(\frac{L}{\cos\theta})D.$$

Since H = 50 in. and T = 10 in., T = 0.2 H. Also, $\tan\theta = \frac{V}{V_{rain}}$. Substituting these (4) yields:

$$Rain = WHLD(1 + \frac{0.2}{\frac{V}{V_{rain}}}),$$

which has the graph:



The above graph shows that the faster you go, the drier you stay, but there minimum amount of rain that has to hit you. This is the amount of rain which at given instance is in the air directly between you and your destination, and is equ $WHLD$.

This Quarter's Puzzle: Pool Shark

This quarter's puzzle is to determine how a pool cueball behaves when struck cuestick. Does it slide first, then start rolling, or does it roll only? Assume tha cuestick is horizontal and its force acts through the center of the cueball.

Dave Hollinberger
1607 Mahan
Bremerton, WA 98310

CORRESPONDENCE

374 East Street
Hingham, MA 02043
October 2, 1986

Mr. Harold A. Sabbagh, Editor
Oceanic Engineering Society Newsletter
345 East 47th Street
New York, NY 10017

Dear Harold:

Enjoyed the definitions of nautical terms in the Summer 1986 issue. How about a few additional ones, as follows:

BOW — A greeting in Tokyo

BUOY — (second definition) Opposite of a girl

KETCH — What you do with fish

LIGHTER — How you start a fire

LIGHTHOUSE — A house that doesn't weigh much

OAR — (second definition) A lady of the evening in Liverpool

SEXTANT — Your uncle's wild wife

THWART — Getting one up on the other guy

YAWL — You (pl) in Savannah.

Sincerely yours,

Larry

Laurence B. Stein, Jr., PE

October 7, 1986

Dear Hal,

You asked for appropriate data related to those Life Members in the IEEE who are also members of the OES. I know of three such: myself, Ed Early, and Morris Shulkin.

There is a rule in the IEEE, stating that if the sum of your age plus the number of years that you have been a member exceeds 100, and that if you have attained the age of 65, then you become a Life Member with membership fees excused.

I became an Associate Member of the IRE while a student at Purdue University, in 1941, years before there was an IEEE. That was 45 years ago, so when I reached the glorious age of 65 this summer, my total sum of age and membership reached 110 years, a full 10 years more than the minimum. I have received a nice letter from the Institute, naming me a Life Senior Member, plus a bill with all appropriate charges excused. I am delighted to have survived the hazards of all those years so well, and feel very pleased to have had the privilege of being an IEEE member. I have tried hard over this time to give back to the Institute in service as much value as I have received from them, but the IEEE is way ahead of me. It has been a great experience to have been a member.

For you young squirts out there, keep working to make the IEEE better, and don't forget to give assignments to people like Ed Early, Morris Shulkin, and myself. Age 65 is like 45 used to be when we started, in terms of one's drive and potential, and while most of us like that "no dues" stuff, we don't want to be out of the action in the Institute or the Society.

With best wishes,

Art

Arthur Westneat

ANNOUNCEMENTS AND CALL FOR PAPERS

Name:	XXIInd General Assembly of the International Union of Radio Science
Date:	August 24-September 2, 1987
Place:	Tel Aviv, Israel

For further information, please apply to:

URSI Secretariat
P.O. Box 50006
61500 Tel Aviv
Israel

Dr. Victor C. Anderson (left), research physicist at Scripps Institution of Oceanography/UCSD, is presented the NSIA's Admiral Charles B. Martell Technical Excellence Award by Dr. Edward A. Frieman, Scripps director. The award was given for Dr. Anderson's outstanding achievements in scientific research and the development of the DIMUS system. Dr. Anderson was the technical program chairman for OCEANS '85 in San Diego.

IEEE

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

Announces the 15th Annual Competition for

1987-1988

Congressional Fellowships

A CONGRESSIONAL INTERNSHIP FOR MEMBERS OF IEEE

PROGRAM: Electrical and Electronics Engineers and Allied Scientists are competitively selected to serve a one-year term on the personal staff of individual Senators or Representatives or on the professional staff of Congressional Committees. The program includes an orientation session with other Science-Engineering Fellows sponsored by the American Association for the Advancement of Science (AAAS).

PURPOSE: To make practical contributions to more effective use of scientific and technical knowledge in government, to educate the scientific communities regarding the public policy process, and to broaden the perspective of both the scientific and governmental communities regarding the value of such science-government interaction.

CRITERIA: Fellows shall be selected based on technical competence, on ability to serve in a public environment and on evidence of service to the Institute and the profession. Specifically *excluded* as selection criteria shall be age, sex, creed, race, ethnic background, and partisan political affiliations. However, the Fellow must be a U.S. citizen at the time of selection and must have been in the IEEE at Member grade or higher for at least four years. Additional criteria may be established by the selection committee.

AWARDS: IEEE plans to award two Congressional Fellowships for the 1987-1988 term. Additional funding sources may permit expansion of awards.

APPLICATION: Further information and application forms can be obtained by calling W. Thomas Suttle (202) 785-0017 at the IEEE Washington, D.C. Office or by writing:

Secretary, Congressional Fellows Program
The Institute of Electrical and Electronics Engineers, Inc.
1111 Nineteenth St., N.W.
Suite 608
Washington, D.C. 20036

Applications must be postmarked no later than March 31, 1987 to be eligible for consideration.