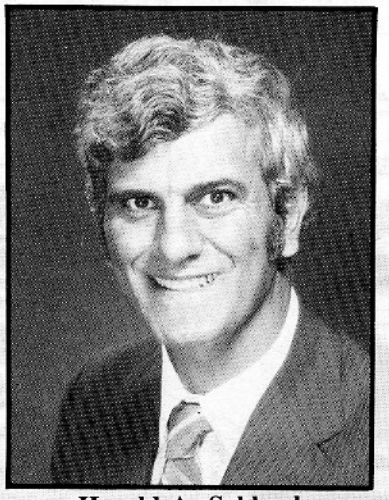
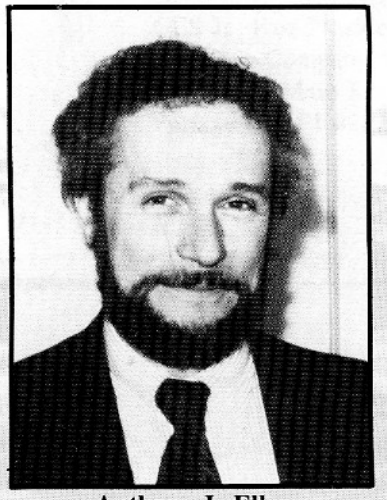
IEEE
OCEANIC ENGINEERING SOCIETY
NEWSLETTER

VOLUME XX NUMBER 2

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



Harold A. Sabbagh
Editor



Anthony I. Eller
President

EDITOR'S COMMENTS

Since its beginning, over ten years ago, this Newsletter has been distributed free of charge to all IEEE members who included oceanic engineering in their Technical Information Profiles (TIP). This has consistently been well over six thousand members, worldwide. In order to reduce costs and improve member services, however, we must now contemplate reducing the distribution of the Newletter to only those IEEE members who are also OES members.

Therefore, those of you who wish to continue receiving this Newsletter (and we hope that there are many), or who wish to continue an association with the Oceanic Engineering Society, should use the coupon "Now is the best time to join our society", which is included in the back of every issue of the Newsletter, to join our society.

The IEEE Oceanic Engineering Society is one of the world's outstanding technical societies dealing with electrical and electronics engineering in the oceanic environment. You should seriously consider joining us; we'd be glad to have you.

Harold A. Sabbagh
Editor

PRESIDENT'S COMMENTS

Opportunities for Technical Involvement

The Oceanic Engineering Society has about 2000 members, a level that has been held rather steadily since the Society was started three years ago. One might suppose that this many IEEE members have chosen to be members also of OES for the primary reason of receiving the Journal of Oceanic Engineering. The Journal is our strongest and possibly most widely known technical offering, but I would like to take the present opportunity to describe some other areas of technical activity in the Oceanic Engineering Society.

In addition to the Journal, we have an assortment of technical conferences sponsored or co-sponsored by OES. These include the annual OCEANS Conference, which has been co-sponsored with the Marine Technology Society since 1975. The next in the series, OCEANS '86, will be held in Washington, D.C., 22-25 September 1986. Of particular interest to IEEE-OES members, the OCEANS technical program usually includes sessions related to satellite remote sensing of the ocean, oceanic and Arctic instrumentation, navigation and communications, and underwater acoustics.

The Oceanic Engineering Society also is one of 11 joint sponsors of the annual Offshore Technology Conference held each year in Houston during the first week in May. At the 1986 OTC there were several sessions related to electrical engineering associated with the ocean, including "Offshore Instrumentation, Power and Fiber Application," "Seafloor Surveying and Mapping," "Satellite Applications" (primarily to communications, positioning and navigation), and "Cost Efficient Seismic Data Acquisition and Mapping."

A third form of technical conference activity, and possibly the most significant one for those members interested in ocean current measurement, is the series of working conferences on current measurement, sponsored by the OES Current Measurement Technology Committee. The third such conference was held in January 1986 at the Airlie Conference Center, Airlie, Virginia. It is a goal of the OES AdCom to promote similar focused workshop conferences by other OES Technology Committees.

Anthony I. Eller
President

IEEE OCEANIC ENGINEERING SOCIETY

President
ANTHONY I. ELLER
Code 130
NORDA Liaison Office
800 North Quincy St.
Arlington, VA 22217
(202) 696-4951

Jr. Past President
STANLEY G. CHAMBERLAIN
Raytheon Co.
Submarine Signal Division
Box 360
Portsmouth, RI 02871
(401) 847-8000 Ext. 4423

Sr. Past President
DONALD M. BOLLE
College of Eng. Phys. Sci.
Packard Labs #19
Lehigh University
Bethlehem, PA 18105
(215) 861-4025

Vice President, East Coast
GLENN N. WILLIAMS
Data Processing Center
Texas A&M University
College Station, TX 77843
(409) 845-5484, ext. 8419

Membership Development
DAVID E. WEISSMAN
Dept. of Eng. & Computer Sci.
123 Adams Hall
Hofstra Univ.
Hempstead, NY 11550
(516) 560-5546

Meetings
GLENN N. WILLIAMS (East)
LLOYD Z. MAUDLIN (West)

Vice President, West Coast
LLOYD Z. MAUDLIN
Group Vice President
Integrated Sys. Analysts, Inc.
5461 Toyon Rd.
San Diego, CA 92115
(619) 265-9292 (H)
(619) 422-7100 (O)

Chapters
ARTHUR S. WESTNEAT, JR.
Univ. of New Hampshire
P.O. Box 208
Durham, NH 03824
(603) 659-2195 (H)
(603) 749-6056 (O)

Constitution and Bylaws Committee
JOSEPH CZIKA

Treasurer
EDWARD W. EARLY
4919 N.E. 93rd St.
Seattle, WA 98115
(206) 543-9825

Awards and Fellows
DONALD M. BOLLE
College of Eng. Phys. Sci.
Packard Labs #19
Lehigh Univ.
Bethlehem, PA 18105
(215) 861-4025

Secretary
JOSEPH CZIKA
TASC
8301 Greensboro Dr.
Suite 1000
McLean, VA 22102
(703) 734-4100 (O)
(703) 938-0058 (H)

Nomination
DONALD M. BOLLE

IEEE Oceanic Engineering Society Newsletter is published quarterly by the Oceanic Engineering Society of the Institute of Electrical and Electronics Engineers, Inc. Headquarters: 345 East 47th Street, NY 10017. Sent automatically and without additional cost to each member of the Oceanic Engineering Society. Printed in U.S.A. Second-class postage paid at New York, NY and at additional mailing offices. Postmaster: Send address changes to IEEE OCEANIC ENGINEERING SOCIETY NEWSLETTER, IEEE, 445 Hoes Lane, Piscataway, NJ 08854.

CALL FOR NOMINATIONS

OES ADMINISTRATIVE COMMITTEE

It is time again to invite you to submit nominations for the OES Administrative Committee (ADCOM). There are currently 23 members serving on the ADCOM, with eight whose terms end on December 31, 1986. Those whose terms are ending this year are: Walter L. Bacon, Arthur B. Baggeroer, Donald M. Bolle, Stanley G. Chamberlain, Stanley L. Ehrlich, Anthony I. Eller, Robert Spindel and Arthur S. Westneat, Jr. It is possible to elect up to 30 members to the ADCOM.

We seek nominations of individuals willing to help us build a strong, dynamic Oceanic Engineering Society. They must be willing to attend the two ADCOM meetings each year, held during the OCEANS Conference in the Fall and the Offshore Technology Conference held each May in Houston. They must also be willing to work on projects between the meetings.

The Nominations Committee seeks volunteers as well as nominations. In each case, the individuals nominated must express a willingness to be considered by the Nominations Committee and to appear on the ballot. They must provide a brief two hundred word biography listing professional activities, current affiliations and participation in IEEE activities. We would expect to have no more than sixteen candidates for ADCOM positions placed on the ballot. Please submit nominations and supporting materials no later than August 15, 1986, to:

Stanley G. Chamberlain
OES Jr. Past President
Raytheon Company
1847 West Main Road
Portsmouth, RI 02871

IEEE BOARD OF DIRECTORS' RESOLUTION

ON SPACE SHUTTLE ACCIDENT

The following resolution on the Space Shuttle accident was approved unanimously by the IEEE Board of Directors at its meeting in San Jose, CA, on February 22, 1986:

> The Board of Directors of The Institute of Electrical and Electronics Engineers, Inc. expresses its profound sorrow at the recent tragic Space Shuttle accident which took the lives of seven brave astronauts. We feel a special loss and kinship to these dedicated pioneers, two of whom were electrical engineers.
>
> On behalf of our more than 270,000 members worldwide, we would like to express our heartfelt condolences to their families, friends and co-workers. We are all the poorer for their loss, but their dedication and sacrifice should inspire each of us to rededicate ourselves to the beneficial use of our science and technology for all mankind.
>
> They gave their lives in the quest to explore and make peaceful use of space. It is with resolve that we pledge ourselves to those continuing efforts necessary to make certain that we are worthy of their example and their dream.

RESEARCH PRIORITIES AND INITIATIVES

IMPROVED PROGRAMS AND COOPERATION BETWEEN FEDERAL AGENCIES ON AGENDA FOR U.S. SCIENTIFIC COMMUNITY

This statement is the work of a seven man committee chaired by Dr. John A. Knauss (Dean, School of Oceanography, University of Rhode Island) in his capacity as chairman, Marine Division, of the National Association of State Universities and Land-Grant Colleges (NASULGC). It was an outgrowth of hearings on the status of marine research held in 1984 by the House of Representatives Committee on Merchant Marine and Fisheries.

The other members of the committee and authors of the statement were: Dr. James Baker, president, Joint Oceanographic Institutions, Inc.; Dr. Donald Boesch, director, Louisiana Universities Marine Consortium; Dr. Robert Corell, director, University of New Hampshire/University of Maine Joint Sea Grant Program; Dr. Ross Heath, dean, College of Ocean and Fisheries Science, University of Washington; Dr. David Ross, director, Marine Policy and Ocean Management Program, Woods Hole Oceanographic Institution; and Dr. Jerry Schubel, director, Marine Sciences Research Center, State University of New York.

This statement was printed as a 32 page booklet by NASULGC. The following is an abridged adaptation. The NASULGC Marine Division is composed of more than 80 major marine research and education institutions in the U.S.

On July 13, 1984, President Ronald Reagan issued the following statement:

"The United States has long depended upon the ocean for food, transportation, national security, and recreation. Today, the ocean has become even more important to the people of our Nation — as a source of petroleum and minerals and an avenue for foreign trade. In addition, the ocean is a constant source of employment for hundreds of thousands of Americans each year.

"This Nation is the steward of the resources of the ocean. Americans have long cherished the freedom of the coastal regions which border our shores. The ocean is the link between the many countries with which we have shared the discoveries of modern technology in the development of oceanography.

"Our increased use of the ocean requires that we work to protect this resource effectively and efficiently. In order to do so, we must educate Americans concerning the role of the ocean in our lives and our responsibility to match increased uses of marine resources with vigilant efforts to preserve the ocean environment for the benefit of future generations."

Marine research has been characteristically broad and multifaceted, making the setting of a limited number of broadly acceptable priorities difficult. We believe, however, that a limited number of research areas can presently be designated as high priority based either on the opportunity for major scientific advances allowed by new technologies or on societal needs. We suggest that concerted initiatives or strengthened efforts are required in the five subject areas listed below.

Global Oceanic, Climatic Processes

New tools and theoretical insights will allow rapid progress in understanding the entire ocean as a system. This will result in important new understanding of the ocean environment and its productivity and world weather and climate. The driving technologies are the satellite missions planned during the next decade and improved supercomputer capabilities. These will allow the collection of huge amounts of data over large scales and the comprehensive analysis of these data.

Also related to these approaches are requirements for at-sea sampling and experimentation to provide ground truth and detailed verification. Basic science directions relevant to this theme are largely embodied under the Global Circulation, Climate and Productivity Initiative in the National Science Foundation (NSF) Advisory Committee long-range plan "Emergence of a Unified Ocean Science."

These studies will require cooperation of several federal agencies. NASA, NOAA and the Navy will be satellite operators with responsibilities for space technology, weather forecasting, and defense, respectively. The NSF is well poised to lead the advances in scientific understanding which will be required for effective use of these results. Funding must come primarily from the federal government, although it should also be noted that state and private institutions also contribute to the costs of oceanographic research.

As pointed out in the hearing, the basic science track record in open-ocean research is very good and it is reasonable to expect that the academic research community, given adequate support, will make excellent use of these new opportunities.

The benefits to society of this research are diverse and substantial. Most clearly, the research will allow longer term and more accurate predictions of weather and understanding of global climate variations. Such insight can help avoid tragic human consequences of natural disasters and plan ways in which the world's burgeoning population can deal with its resource needs in a changing climate.

Many other benefits, including technological spin-off, can not be fully imagined at this time.

Pathways and Fate of Materials in the Ocean

Coupled with the new understanding of the world ocean circulation discussed above comes the opportunity to make significant advances in understanding, in a fully quantitative way, the biogeochemical pathways and cycles in which the oceans figure so prominently. This involves measuring the fluxes of materials from the atmosphere to the ocean, from the continents to the ocean, and vertically within the ocean.

The nation's basic science agency, the National Science Foundation, will be expected to lead the way in these fundamental research objectives, although several applied research agencies have some responsibilities or interests in different facets of the problem.

The Department of Energy's oceanography program emphasizes fluxes of energy-related materials through the coastal ocean; DOE is also concerned with the fate of carbon dioxide derived from fossil fuels in the atmosphere and oceans. The National Oceanic and Atmospheric Administration has a role in terms of its interests in climate and, together with the Environmental Protection Agency, in ocean pollution. Many of the processes which must be studied bear even on the interests of the Navy (for example, as they relate to ocean acoustics and coastal dynamics) and the Department of the Interior (off-shore minerals and energy development).

The benefits of better understanding of fluxes of materials in the ocean include predictions of climatic and sea-level changes as a result of the buildup of carbon dioxide and other greenhouse gases. Also, such understanding would lead to safer controls of such potentially harmful substances as persistent synthetic organics, radioactive materials, and excessive biostimulants.

Coastal Ocean & Estuarine Processes

Coastal environments provide most of the exploitable marine resources and, at the same time, are the marine environments most susceptible to alteration by man. The record of developing penetrating insight into man's effects on the coastal zone, estuaries, and shelf environments has been less than we would wish.

As a consequence, there is an insufficient understanding of environmental processes which underlie the pervasive environmental changes which are now being recognized in estuaries and nearshore waters. Such changes include physical alterations of wetlands and shallow water environments, eutrophication and resultant oxygen depletion, and contamination by persistent, synthetic compounds.

In order to develop a level of understanding required for effective management, interdisciplinary and fundamental research on critical processes is needed. Little such research is presently being conducted for estuarine and coastal environments, but the effectivness of this approach has been demonstrated in open-ocean studies.

Responsibility for the needed research should be shared between governmental entities (both federal and more local) with management responsibilities and the private and governmental bodies which use the coastal environment for waste disposal or other purposes. Governmental coordination, both at the national and regional levels, is required to ensure the effective implementation of research plans.

Ocean Lithosphere & Mineral Resources

The exciting discoveries regarding plate tectonics made during the last 15 years will continue to drive exciting new research in the coming decades. Such research will focus on the mechanics of the plates themselves, spreading centers (where ocean floor crust is formed), and the interactions between oceanic and continental crusts.

Related to these processes is the desired assessment of the mineral resources of the ocean floor, in particular that under national jurisdiction within the Exclusive Economic Zone (EEZ).

This research will require federal support through the NSF (both Divisions of Ocean Sciences and Earth Sciences), USGS, NOAA, and the Navy. Private investment in research on economic mineral resources may also contribute, but this will likely be in the far term rather than the near term.

Biological Productivity and Living Resources

Opportunities exist for a significant improvement in understanding the bases of biological productivity in the sea and, thereby, the causes for its variations and ability to sustain living resources exploitable by man. In particular, new insight on food chains will allow better understanding of the production of higher consumers (secondary productivity). Also, improved knowledge of biological and environmental factors controlling recruitment in animal stocks will allow explanation and prediction of year-to-year variations in those stocks.

As opposed to other priorities in which quantum advances are expected as a result of new technologies (such as in Global Oceanic Process and Ocean Lithosphere studies), progress in understanding the underpinnings of living resource productivity is likely to be more gradual.

Federal sponsorship of research on this subject should be encouraged principally through NOAA (National Marine Fisheries Service and Sea Grant) and the NSF (the Recruitment Initiative of the NSF long-range plan).

Initiatives, Facilities, Equipment

From studies of the coastal zone to deep sea drilling to the sweeping new view of the ocean promised from satellites, oceanographers are looking forward to major new advances in understanding and predicting ocean processes.

Today in the United States the ocean sciences share two characteristics with the other field and laboratory sciences: preeminence in world science, and a deteriorating infrastructure. The former is being challenged by the latter. On the whole, our laboratory equipment is old, we are not up-to-date with computers, our research fleet will need replacement in a few years, and shipboard equipment and handling gear are not adequate for the major new programs that are being planned. Of all the field sciences, oceanography faces perhaps the most severe environmental constraints.

(Since the hearing providing the basis for this report there has been considerable improvement in funding for facilities and equipment. The Fiscal Year 1987 budget request contains many items tagged for additional money. — Ed.)

Many of the instruments available to oceanographers are worn out or obsolete. A program of steady-state replacement of standard instrumentation is required.

Needs for seagoing equipment include navigation and data relay equipment for both ships and moored and drifting buoys, new sensors for measuring physical, chemical, and biological properties for periods of at least one year, instrument handling gear, and basic observational instruments used from ships, such as temperature and salinity devices and multi-channel seismic instruments. An estimate of costs to provide the necessary equipment is about $13 million.

Capital & Seagoing Facilities

The oceanographic community currently operates cooperatively three kinds of facilities: large research vessels, the submersible *Alvin*, and the new drilling ship for the Ocean Drilling Program. These will soon be joined by the oceanographic component of the Advanced Vector Computer at NCAR.

Other research facilities of importance that need basic support include multi-channel seismic facilities, long-term mooring facilities, and an increased capability to take long, high-quality, large diameter cores from the sea floor. These are all existing facilities that need increased support. Estimates of costs required are about $13 million, excluding ship replacement costs.

As new experimental techniques and scientific demands develop, we anticipate that new facilities will be required and old ones will be retired. Examples of such new facilities include a deep-diving submarine that could go to 6 km depth; a dynamically positioned oceanographic ship for physical, chemical, and biological studies; a permanent oceanographic station suitable for multiple and long-term work with heavy deployment capability, and large ecosystem tanks for study of higher trophic levels in marine systems. Advanced computers at individual institutions will also be required.

Personnel

Three major support groups can be identified as high priority: marine technicians, equipment operators, and post-doctoral fellows.

Our current levels of staffing and qualification are based on an era when instruments were simpler. As we have moved into the electronic age, the complexity of instruments and the data rates have increased by an order of magnitude. We need an adequate corps of qualified seagoing technicians if we are to continue to collect high quality data.

All fields of oceanography rely, to varying degree, on sophisticated shore instrumentation to attack key scientific questions. The reliable operation of such equipment requires skilled technical personnel and costs about 20% of the purchase price per year. We need on-going support for instrument operators to cover the predictable costs in order to enhance the quality and availability of the suite of major instruments in our institutions. Total costs for new support of research personnel are estimated to be about $10 million per year.

The global studies of the next decade will require the involvement of bright new oceanographers. Some of these can be found in the existing programs; some will have to be recruited from other science and engineering disciplines. Enhanced post-doctoral support to allow young oceanographers to become established and to provide a period for new recruits to learn the field is the only realistic mechanism to ensure the availability of the researchers who will see the new global studies of such topics as climate, ocean structure, and fisheries through to completion. The costs of an adequate program are estimated to be about $2 million per year.

Critical Programs

The U.S. commitment to excellence in science and technology, and to a scientific and technological base to our industrial and economic development, is founded in a working partnership between government, universities, and industry.

Several carefully planned and effective federally supported programs form the basis of the critical set of national priorities for maintaining our preeminence in the ocean sciences and technology, essential to maintaining our industrial and economic growth, and to enhancing our national security. These federal programs include basic ocean sciences and technology, marine resources assessment and development, and international ocean science and cooperation.

Basic support to the priority programs of the National Science Foundation, the Office of Naval Research (and other R&D programs of the Department of Defense), the National Aeronautics and Space Administration, and related agencies is essential in the following areas:

- Biological Oceanography and Marine Biology
- Chemical Oceanography and Marine Chemistry
- Marine Geology and Geophysics
- Physical Oceanography
- Ocean Engineering and Technology

The jurisdictional arrangements evolved in recent international declarations and negotiations have established the 200-mile Exclusive Economic Zone. The extensive marine resources contained therein are the essential natural resources for industrial and economic development of the oceans and coastal margins. The critical research and development programs that are conducted by our academic institutions and supported by NOAA, the USGS (and other R&D programs of the Department of the Interior), the Department of Energy, EPA, and more recently USDA, are essential to a coherent and coordinated program of industrial and economic development of the EEZ and of the coastal margin. Examples of essential research and development programs include:

- The National Sea Grant College Program
- The EEZ Assessment Programs of USGS and NOAA

- The Environmental Assessment Programs of NOAA, DOE and EPA
- The Fisheries and Aquaculture Development and Management Programs of NOAA and USDA
- The OCS Environmental Studies Program in DOI and related programs in other agencies

There are many important ocean science questions to be considered in the next 10-15 years. To study and answer many of them including their societal impacts, will generally require scientific access to most, if not all, parts of the ocean. This access will be a challenging task as many nations (to date, over 60) accept the general law of the sea conditions, which will lead to over 40 percent of the world's oceans coming under coastal state control for marine scientific research.

This "enclosed" region will include all coastal regions and nearly all continental margins and seas — a critical area of the ocean for research. Access to this area by U.S. ocean scientists will require them to meet certain specific regulations, including the participation of foreign scientists in the research programs. On the whole, the U.S. marine scientific community can probably meet this challenge; however, several actions by the federal government might be especially helpful:

- The United States should maintain its present positive position towards the concept that foreign states can control marine scientific research in their waters.
- In United States' relationships with foreign countries, we should recognize the potential and possibility of cooperative marine science activities.
- The federal government should assist U.S. scientists in the pursuit of foreign research opportunities, possibly through the establishment of an office to encourage and develop cooperative marine scientific endeavors with foreign countries.

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OF OCEANIC INTEREST

Chemical Energy Sustains Life at Ocean Depths

Marine researchers at the University of California, Santa Barbara have reported the first direct ocean measurements confirming that marine communities in extreme ocean depths rely on chemical rather than solar energy.

In the March 7 issue of *Science*, the scientists describe an extensive series of measurements of sulfur and oxygen concentrations in the waters of a marine community at a deep-sea hydrothermal vent. These measurements, the first chemical analyses performed in "real time" in the deep ocean, clearly support the supposition that the creatures in this lightless realm rely on the sulfur and oxygen in the mineral-rich hydrothermal water for the energy required to sustain life.

Until 1977 sunlight was considered the sole energy source for virtually all higher life forms on Earth. But then exploration of the deep-sea floor off the Galapagos revealed a series of luxuriant oases of marine life in the Stygian blackness more than 250 meters beneath the waves where none should have existed. Unusual communities of giant and showy tube worms, mussels, clams and crabs clustered around hydrothermal vents, areas where hot, mineral-rich waters bubble up from the sea floor.

Since the initial discovery, similar chemically powered organisms have been found in a sewage outfall off Los Angeles, natural gas seeps in the Gulf of Mexico, submarine springs in the waters off Florida, in the Santa Barbara Channel and other similarly non-exotic settings. The ecology of these peculiar colonies, however, have remained shrouded in mystery.

VIMS Scientists Discover Sea Turtle's Winter Home

Dr. John A. Musick and Richard Byles, research scientists at the Virginia Institute of Marine Science of The College of William and Mary, Gloucester Point, have been studying the movements and behavior of sea turtles in the Chesapeake Bay for several years.

Many facts have been uncovered by VIMS scientists regarding turtles in the Bay, especially the loggerhead and Atlantic Ridley, but an answer to the question "Where do turtles spend the winter?" had gone unanswered until recently when a loggerhead sea turtle, tagged with a special radio transmitter, which can be tracked by satellite, was found spending the winter at the western edge of the Gulf Stream off Virginia. Musick and Byles, have been tracking the turtle since its release off Oregon Inlet, North Carolina in November 1985.

"The satellite-traced turtle's behavior took us completely by surprise," Musick said. "We thought it would hang out at the edge of the continental shelf in the warm Gulf Stream water south of Cape Hatteras. Instead it migrated along the coast, close inshore as far as Cape Lookout, then migrated east to the Gulf Stream and rode the currents north to an area east of Chincoteague in several thousand feet of water," Musick said. "The turtle then headed south again in warm continental slope water. We are anxious to see what the turtle does this spring as the water warms up inshore," he added.

Byles' satellite tracking experiments were begun in 1985 to try to determine where Virginia's sea turtles spend the winter.

It was once thought that turtles appearing in the bay were merely strays, but research has proven that turtles come to these productive waters every spring to feed and grow. "Sea turtles spend the summer in Chesapeake Bay by the thousands because of the abundance of food and small numbers of turtle predators," Musick said.

When the first cold northeast storms arrive in late September or October, the turtles migrate out of the bay and to the south because they cannot survive cold winter temperatures. Byles has been able to trace these southward migrating turtles by boat and airplane as far as Cape Hatteras but from there the turtles move too far offshore to be followed. VIMS researchers plan to track several more turtles by satellite in 1986.

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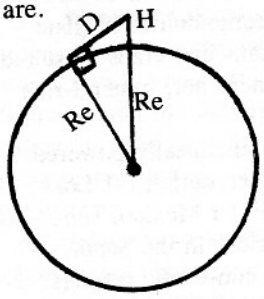
'TIS A PUZZLEMENT

LAST QUARTER'S PUZZLE

As Far As The Eye Can See

Last quarter's puzzle was to determine how far you can see from a boat in open water. Two of the possible answers listed (4000 and 8000 yards) could be correct, depending upon how big a boat you have and how tall you are.



H = height of eye above sea level (ft)

Re = radius of Earth ($\sim 2.09 \times 10^7$ ft)

D = distance to horizon (ft)

1. Pythagoras Theorem:
   $Re^2 + D^2 = (Re+H)^2 = Re^2 + 2HRe + H^2$

2. $H << Re$ so H^2 is negligible. Also subtract Re^2 from both sides which leaves:
   $D^2 = 2HRe$ or $D = \sqrt{2Re}\sqrt{H}$ or $D \cong 6450\sqrt{H}$ ft
   or $D \cong 2150\sqrt{H}$ yds
   (H is still in ft)

   so D = 4000 yds for H $\cong$ 4 ft and
   & D = 8000 yds for H $\cong$ 16 ft

THIS QUARTER'S PUZZLE

Who Turned Out The Lights?

This quarter's puzzle is to determine the intensity of sunlight with respect to time during a total eclipse of the sun. One useful piece of information is the fact that when total eclipse occurs the moon just covers the sun.

Puzzlement Editor: Dave Hollinberger
1607 Mahan Avenue
Bremerton, WA 98310

ELECTRICAL PERSONALITIES

MICHAEL FARADAY
(1791-1867)

Two steps advanced electrical science to the status of a major social force. The first was the invention by Alessandro Volta of a chemical source of electricity, the voltaic cell, and the second the discovery of electro-magnetic induction by Faraday. Volta's battery provided early electricians with means for electrically decomposing elements, producing an electric arc, and more important, it led to the construction of the electromagnet which, in turn, opened the way to the full expansion of the electrical age.

The early investigators asked themselves why powerful magnets could be produced by the flow of an electric current in a wire, yet electricity could not be produced from a magnetic circuit. The problem set off experiments in the first third of the 1800s. It remained for Michael Faraday to resolve this problem and thereby to transform the fabric of society into an ever-growing, integrated network.

Of most humble origin, and with no formal education, Faraday began work at the Royal Institution in London as a laboratory assistant to Humphry Davy, an outstanding chemist and electrical experimenter of the time. Thru Davy, Faraday met the important scientists of England and the Continent including Ampere, Count Rumford, and Volta. At the Royal Institution Faraday lived and experimented in chemistry and in electricity. A series of lectures and demonstrations before distinguished audiences, including royalty, brought the work of these experimenters before the rapidly expanding world of science.

Faraday's electrical experiments began to receive attention in 1821 when he demonstrated electromagnetic rotation, in which the flow of electric current caused a magnet to revolve around a wire carrying current or a wire carrying current to revolve around a fixed magnet. The motions continued as long as the current continued to flow. He then succeeded in causing a delicately balanced wire carrying current to move as a result of being in the earth's magnetic field alone. For ten years thereafter, Faraday concerned himself with the problem of converting magnetic force into some form of electrical force. He studied intensely what other experimenters had accomplished and, in particular, the phenomenon of electrostatic induction. Four times in these ten years Faraday had applied himself to the specific investigation of magno-electric generation, with no results.

In the summer of 1831 he began a fifth attempt at solving the problem. He took a soft iron ring about six inches in diameter and wound a coil of copper wire on one side of the ring and a second coil on the other side. He next placed a magnetic needle a short distance from the ring and connected it to the first coil; a battery was connected to the second coil. At the instant of connection the magnetic needle moved and came to rest; when the connection was broken the motion was repeated in the opposite direction. He checked the true magnetic nature of the current produced by substituting a copper ring for the iron one and observed little motion. Faraday then wound a coil of 220 feet of wire into a solenoid and connected its end to a galvanometer. When he plunged a cylindrical bar magnet into the coil, the needle moved; when he pulled it out, it moved in the opposite direction. He therefore concluded that it was the relative motion of magnet and coil that was inducing the generation of electric current.

Following the cue established by the momentary generation of an electrical impulse from a magnetic source, on October 28, 1831 Faraday completed the assembly of an electric machine consisting of the great magnet of the Royal Society between the poles of which he had erected a copper disc 12 inches in diameter on an axle terminating in a crank. From the disc two collector strips were carried; one rode on the axle, the other on the rim of the disc, and these strips were led to a galvanometer. The axle and disc rim where the strips made contact were treated with amalgam. When Faraday revolved the disc by means of an attached handle the galvanometer showed a deflection; when he reversed the rotation the deflection was in the opposite direction. Faraday visualized his disc ''cutting'' magnetic lines flowing from pole to pole of the great magnet. These lines he could demonstrate by sprinkling iron filings in the path between pole and pole. When he replaced the disc by a wire that he moved across the magnetic field, the same results followed. He devoted ten days of intensive experimentation to check the nature of the electricity so produced and finally, at the end of November, announced his most important discovery before the Royal Society. Electricity had finally been produced from magnetism. This discovery was formulated into a paper for publication under the title 'Experimental Researches in Electricity' and was the first of a series of 29 that continued on thru 1852, announcing the many contributions of Faraday to the science he helped establish.

After Faraday's major contribution there came the discovery of self-induced currents, polarity in diamagnetic bodies, lines and fields of magnetic force and the use of induced current as a measure of field intensity. In the work of his earlier interest, chemistry, he evolved the law of electro-chemical decomposition, electro-chemical conduction, analysis of generation in the voltaic pile and the general theory of electrolysis. With his discoveries Faraday contributed a parallel vocabulary of new electrical and magnetic terms that have become the language of the

science. His work carried him into a study of dielectrics and the determination of "specific inductive capacity." It was no easy step between the invention of the electric generator by the process of induction (which constitutes the practical form of the electric generators of today) and its practical use in industry. Devices to use this electricity had still to be invented. The electric light, the electric motor, metallurgical, thermal or chemical use of electricity, these and similar devices awaited the inventive genius of later electricians. Other than its application to telegraphy it was not until 1860 that current from an electric generator was applied to lighthouse illumination thereby providing the first bulk use of the new force.

Following the announcement of his discovery of the means for generating electricity by electromagnetic induction, in a paper read before the Royal Society on November 24, 1831, and in a letter to his friend Richard Phillips written from Brighton on November 25th, the recognition of the importance of the discovery by scientists was immediate. Over a hundred academic and scientific honors were conferred upon Faraday, including only one which he actively sought, membership in the Royal Society. Sponsored by Phillips, Faraday at the age of 32 became a Fellow of the Royal Society in January 1824. In the 54 fruitful years he spent as experimenter and lecturer at the Royal Institution, Faraday had published 158 papers in chemistry and electricity. The most important of these was the series 'Experimental Researches in Electricity' which continued to appear for a period of over 20 years. In January 1832 the first of these papers was published and in that year Oxford conferred an honorary doctorate on Faraday. A grateful International Electrical Congress, meeting in Paris in 1891, voted to term the electrical unit of capacitance the 'farad' in honor of one who had contributed so much to electrical science.

Reprinted from Instrumentation and Measurement Society Newsletter, July/August 1985.

MISCELLANY

(Reprinted from *Instrumentation and Measurement Society Newsletter,* October/November, 1985)

KILROY'S MOTTO

"Kilroy was here," World War II's most enduring graffito, was first penned by a shipyard worker who was just trying to prove he was doing his job, says the widow of James J. Kilroy, who died in 1962.

Margaret Kilroy, 81, said her husband came up with the idea for the phrase after his superiors questioned his work as a rate-setter at the Fore River Shipyard in Quincy during the war.

"Jim didn't like that," Mrs. Kilroy said. So, he printed "Kilroy was here" on the ships he inspected. With his name all over the ships there would be no more questions about his work."

Soldiers everywhere were familiar with the words, finding them anywhere there was space to print. And endless speculation about Kilroy ensued.

The name Kilroy tugged at the imaginations of millions, both in and out of uniform, binding members of the armed forces with those at home. Next to "I love you," the second most important three words of the war may have been "Kilroy was here."

By the end of the war 40 years ago, the words, together with the caricature of a large-nosed, bald-headed man peering over a fence, had found their way onto the walls of buildings, inside ships and submarines, and on tanks, planes and trucks.

Mrs. Kilroy, who lives in this suburb 30 miles south of Boston, said her husband was hired by the Quincy shipyard at the age of 39, two days before the Japanese bombing of Pearl Harbor on Dec. 7, 1941.

From that time on, he printed "Kilroy was here" to attest to his presence and attention to duty. Mrs. Kilroy said her husband took a dim view of any cheating on the work involved in shipbuilding.

What began as a simple statement found its way onto the overheads and bulkheads of a number of ships, including the USS Massachusetts, and the Lexington, both built in Quincy.

Only in 1946 did Kilroy make an effort to identify himself as "the real Kilroy," his widow said.

He won a nationwide contest sponsored by the American Transit Authority that sought to explain the legend's origin.

EXPLORING THE MYSTERY BEHIND YOUR CREDIT RATING

As a credit cardholder, you know you have an established credit rating. But the concept and purpose behind your credit rating may remain somewhat of a mystery.

A credit rating is basically an evaluation of your qualifications to receive credit and is based largely upon your past record of meeting credit payments. The moment your first credit application was approved — whether it was for your VISA or MasterCard or a short-term loan — you began your credit history.

Storer of Information: The Credit Bureau

Whenever a lender or creditor wishes to check a credit rating of a potential borrower, he/she will contact a credit bureau. A credit bureau stores information regarding the financial histories of many individuals.

In most cases, this data is gathered every time a consumer applies for and receives a loan or credit card or requests credit from people who have provided credit previously.

There are over 2,500 national and local credit bureaus across the country who process millions of reports each year. Most are tied to a nationwide network of computers that can provide information on anyone that has ever applied for credit. Even when you move to another state, your credit rating will follow you wherever you go!

Determining How You Rate

Please note that a credit bureau does not rate you as a good or bad credit risk. This decision is made by the lender or creditor. The bureau simply acts as a clearinghouse of financial information.

When a lender asks for your credit history, a credit report will be issued. This report includes all your relative and public financial information for the past seven years. (If you have declared personal bankruptcy, however, that fact may be reported for 10 years.)

Exactly what is in this report? It includes your name, address, birthdate, Social Security number, dependents and whether you rent or own your home. Also included is your place of employment, salary, length of employment and previous jobs.

Most, if not all, of your creditors are listed along with a special code next to each. The type of codes used varies with each bureau. The code may be a number which ranges from 0-9, depending upon your rate of payment. For example, a number 1 shows that you pay your bills within 30 days. A number 2 indicates that you are a slower payer, but usually make your payments within 60 days. The highest number — 9 — may indicate that the credit source needed to turn to a collection agency to retrieve payment or has simply taken the loan as a loss.

Once the lender or creditor has received the report, it is up to him/her to evaluate the information for creditworthiness. Each institution has its own method of judging this; however, most refer to the three Cs: capacity, character, and collateral.

Capacity refers to your ability to take on further debt. *Character* examines how well you have handled credit in the past. *Collateral* refers to the number of financial sources you have to draw upon to pay all outstanding debts.

Why Is A Good Credit Rating So Important?

Your credit rating is one of the most significant aspects of your financial life because it plays a role in almost everything you do. From buying a car or requesting a loan to applying for a mortgage, your credit rating may be the determining factor in whether your request is accepted or denied.

Although each lender or creditor makes the ultimate decision, the quality of your rating is entirely controlled by you. Good or bad, it is based on records of how you have paid past bills and obligations.

Credit and credit ratings are important in today's society. Don't risk losing the privilege of credit use and don't jeopardize your credit rating by overextending yourself. Wise credit use will help put you in a secure financial position.

ON THE LIGHTER SIDE —
OTHER NECESSARY NAUTICAL TERMS

AHEAD — The nautical term of "ajohn."

ASTERN — Without humor, i.e., "The Captain told no jokes. He was astern captain."

AMIDSHIPS — This condition exists when you are completely surrounded by boats.

ANCHOR — What you display when you find you're completely surrounded by boats.

BERTH — The day on which you were born.

BUNK — Phony sea story.

BUOY — A buoy is the floating device you always smash into when trying to avoid the submerged obstacle the buoy is there to warn you about.

CHANNEL MARKER — Tells you which station you're tuned into on your tv set.

DINGHY — The sound of a ship's bell, i.e., "dinghy-dinghy, dinghy-dinghy."

DISPLACEMENT — Accidental loss, i.e., when you dock your boat and later you can't find it again.

DOCK — Nickname for a medical man.

EDDY — Nelson's last name.

HEAVE-HO — What you do when you get seasick and you've eaten too much ho.

HITCH — The thing to look for when a millionaire invites you aboard, especially if you're of the opposite sex.

KEEL — What your spouse does when you confess you've bought a boat.

LAUNCH — The meat eaten aboard a boat at about noontime.

MOOR — Number of people needed for a boat party, like "the moor, the merrier."

OAR — When you have a choice, like "this — oar that."

PORTHOLE — A hole in the left side of a boat — or is it the right side?

QUARTERDECK — The floor on a cheap boat, which cost about 25 cents to install.

SHOAL — Worn by female sailors on chilly nights.

TIDE — A commercial detergent.

SUPERSTRUCTURE — A structure that's a lot better than the one on your boat.

WAKE — What friends attend when you've been careless with your boat.

ANNOUNCEMENTS AND CALL FOR PAPERS

SPECIAL ISSUE ON MANNED AND UNMANNED UNDERWATER VEHICLES

Reprinted from ***IEEE Journal of Oceanic Engineering***
Vol. 11, No. 3, 1986 July

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CALL FOR PAPERS

SPECIAL ISSUE OF THE

JOURNAL OF OCEANIC ENGINEERING

ON

APPLICATIONS OF OCEAN REMOTE SENSING TO COMMERCE AND ENVIRONMENTAL MONITORING

Papers are invited that present new approaches to the analysis and utilization of satellite and airborne data for the economic and social benefits of major industries that are operated in or interacted with the ocean, individual nations and the global community. These should include state-of-the-art methods of dealing with the present and future satellite sensors and data systems, and their interfaces with the user communities.

GUEST EDITOR

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ISSUE MONTH: 1987 JULY

SUBMISSION DEADLINE:

1986 OCTOBER 15

Prospective authors should prepare their manuscripts in the manner prescribed on the back cover of the IEEE Journal of Oceanic Engineering and submit them at any time up to the deadline to the Guest Editor.

JOURNAL OF OCEANIC ENGINEERING

CALL FOR PAPERS

SPECIAL ISSUE ON *SCATTERING* (THEORY AND EXPERIMENT)

A special issue of the IEEE Journal of Oceanic Engineering, scheduled for publication in April 1987, will be devoted to theoretical and/or experimental studies of the interaction of acoustic and electromagnetic waves with single or multiple scatters or materials, with a view toward applications for sensors, transducers, and radiation — absorbing substances. Topics of special interest may include, but are not limited to, the following:

DIRECT CLASSICAL SCATTERING

1) Low and high-frequency methods
2) Resonance frequencies and hybrid methods
3) Target-scattering within wave-guides
4) Rough surface scattering (sonar/radar)
5) Variational methods
6) Numerical and matrix methods
7) Porous and composite media
8) Radar/sonar cross-section reduction

CLASSICAL INVERSE SCATTERING

9) Exact/approximate methods
10) Computational methods/algorithms
11) Remote sensing/tomography
12) Classification and identification
13) Inhomogenuous layered media
14) Non-Linear evolution eqs. & solitons
15) Target imaging/spectral analysis
16) Target characteristics

All the above pertain to acoustic or electromagnetic waves in theoretical or experimental cases. Prospective authors should prepare their manuscripts in accordance with the "Information for Authors" published in the back cover of any recent issue of the IEEE Journal of Oceanic Engineering and forward the completed text by the firm deadline of July 15, 1986 to:

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Naval Surface Weapons Center
White Oak, Code R-43
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XIXth General Assembly
International Union of Geodesy and Geophysics
August 9 - 22, 1987 Vancouver, Canada

XIX^{e} Assemblée générale
Union Géodésique et Géophysique Internationale
9-22 août, 1987 Vancouver, Canada

ANNOUNCEMENT

The IXth General Assembly of the International Union of Geodesy and Geophysics (IUGG) will be held at the University of British Columbia, Vancouver B.C., Canada on August 9-22, 1987.

In addition to Union and interdisciplinary symposia the Assembly will include meetings sponsored by IUGG member association which are: Geodesy; Seismology and Physics of the Earth's Interior; Volcanology and Chemistry of the Earth's Interior; Geomagnetism and Aeronomy; Meteorology and Atmospheric Physics; Hydrological Sciences; Physical Sciences of the Oceans.

Details regarding the Assembly and the Call for Papers can be obtained by contacting the Secretariat c/o VENUE WEST LTD., #801 — 750 Jervis Street, Vancouver, B.C., Canada, V6E 2A9. Telephone: (604) 681-5226, Telex 04-352848 VCR.

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URSI — Commission F

Microwave Signatures in Remote Sensing

An International Symposium on Microwave Signatures in Remote Sensing will be arranged in Göteborg, Sweden, 19-22 January 1987. It is sponsored by URSI Commission F, Swedish National Committee of URSI, Swedish Board for Space Activities, Swedish Defence Research Institute and Chalmers University of Technology.

Key topics: Radar backscatter, microwave emission — oceans, ice, land

Interpretation of data from active and passive microwave earth sensing systems

Further information: Address as below.

Titles of proposed papers are expected by May 1, 1986, and abstracts are requested by August 1, 1986 to:

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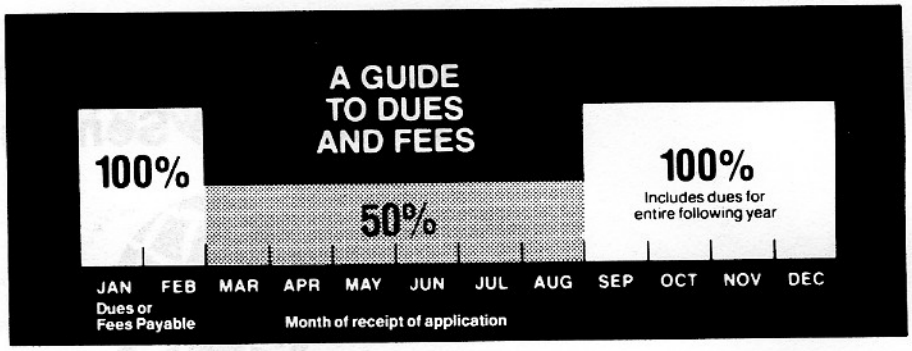

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Monterey Park, CA 91754
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Dept. of Ocean Engineering
Room 5-326
Mass. Inst. Technology
Cambridge, MA 02139
617/253-4336

DONALD M. BOLLE*
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Code 02
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601/688-4205

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Alameda, CA 94501
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STANLEY G. CHAMBERLAIN*
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Box 360
Portsmouth, RI 02871
401/847-8000, ext. 4423

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703/734-4100 (O)
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Rice University
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Houston, TX 77251
713/527-8101, ext. 3569
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Auburn, AL 36849
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617/548-1400, ext. 2283

JOSEPH R. VADUS
U.S. Dept. Commerce
NOAA Office of Ocean. Eng.
6001 Executive Blvd.
Rockville, MD 20852
301/443-3778

DAVID E. WEISSMAN
Dept. of Eng. & Computer Sci.
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Hofstra University
Hempstead, NY 11550
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