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President's Message

I have two items to offer for your attention. First, as you may know, IEEE reserves have shrunk in the slumping markets, as have my reserves and those of many others. Second, I promised to report on our Strategic Planning Activities.

Thomas F. Wiener

IEEE Finances

First, let me review the high level financial situation of IEEE and discuss how that has affected the Oceanic Engineering Society. In 2000 the Oceanic Engineering Society provided US$96,000 to cover the operations of the IEEE. In 2001, preliminary figures show an additional loss of reserves of $13M or 6.2%. Because of some hard work and painful measures taken primarily by the IEEE staff, the Institute's operations were US$10.5 million favorable to budgeted figures, which were in deficit by UD$27.2 million. This leaves the Institute with a reduction in reserves of $29.7 million. Because the intellectual property generated by the Institute's Technical Societies is the Institute's primary source of revenue, for accounting purposes, the Institute carries much of its reserves in Society Accounts. With much of the reserves invested in the stock market, we find that this loss of reserves is distributed to the Technical Societies in proportion to their share of the reserves. In addition, the Institute has been budgeting the investment of its reserves heavily in information technology infrastructure and activity start-up. Among the results of these activities are IEEE Xplore, providing on-line access to our journals; and on-line membership renewal. As a result of these actions, each IEEE entity has experienced a proportional reduction in its reserves. Each Technical Society and Council provided 31.4% of its reserves to balance the Institute's budget. For the Oceanic Engineering Society, this meant a reduction of our reserves from US$860,700 to US$590,500. For reference, we ended 2000 with reserves of US$756,600. Thus, the gross surplus that our members and our friends generated was $104,100. I am not happy with this situation, and I am not alone. While I think using reserves for projects is the reason we accumulate reserves, I think we need to be careful in planning a draw down of reserves, especially in straitened times such as these. It appears to me that our Board of Directors was not as conservative as the situation required. I am disappointed not to see more discussion of this is-

sue in Institute-wide publications. This issue is of vital interest to all members of IEEE.

A second issue associated with this problem is the direct taxing of each Society's reserves. This sort of tax clearly discourages the accumulation of reserves, a behavior that is on the face of it undesirable. This issue has been discussed for over three years within the Technical Activities Board (TAB). As alternatives to distributing the TAB portion of the budget shortfall as a percentage of each Society's reserves, proposals have been made to apportion the bill by membership, by revenue, and by total expenditures. Neither one is favored by the larger societies. After much deliberation, we are slowly settling in on an approach called "Pay By The Drink". This distributes costs of operations based on the use of the services used. If you use a service, say editorial services, you pay the imputed cost of that service. If you use the service, you don't pay. This tends to discourage frivolously asking for services and running up a bill that, heretofore, you didn't have to pay. It

also leads the Institute staff to be sure that they are providing the best value services possible. Details of this plan are being worked out. Part of the problem is that arbitrary assignment of costs can easily occur. Further, in doing cost benefit analyses of two approaches, it is easy to miss some costs associated with the new approach. And, of course, in cost benefit analyses, it is regularly hard to quantify benefits, so we end up with a cost analysis. Watch this space. Be in touch with your Division Director (Dr. John Vig for Division IX, to which we belong) and your Regional Director. You can find their coordinates on the IEEE web (http://www.ieee.org/organizations/corporate/bod.html). Be active in letting your leadership know what you want.

Strategic Planning

AS I noted in the Fall Newsletter, your Administrative Committee conducted a Strategic Planning session last November. Out of that exercise came some ideas about the direction we should be taking the Society. These ideas have now been turned into named plans and we are working on turning the names into Action Plans. I will share the names with you here, and in my next column, I will report on the leaders of these efforts and the progress they are making.

Plans:

- Institutionalize Strategic Planning and Execution Process
- Develop a Data Base to support Strategic Planning and Execution Process, together with data gathering and analysis tools.
- Develop a comprehensive, coherent conference policy (in progress, René Garello, Chair)
- Prepare a Membership Development Plan
- Identify opportunities for strategic alliances
- Develop OES Operations Handbook
- Review and revise OES Constitutions, By-Laws, and Policies and Procedures Manual

If we are to improve our society, to make it a better servant of humanity, our profession and our members, we need you to contribute to this effort. You may do so by calling or writing me with your ideas, and you may participate in any of these activities. We need your help and support.

Thomas Freud Wiener, Sc.D.

STUDENT ACTIVITIES

At OCEANS '99, OES began a program to attract Student members to the Society through the initiation of the Student Poster Program. This program has continued and expanded over the years and has brought new members into the Society. We currently have two members of the Administrative Committee that joined OES as a result of their participation in the Student Poster Program. We are also seeing student posters from students whose faculty advisors have been past participants in the Student Poster Program. Each student that participates in the Student Poster Program is offered a free student membership in IEEE and OES. While the Student Poster Program is an excellent way to interest students in becoming members of IEEE and OES it has not produce enough student members at any given school for us to be able to form Student OES Chapters.

The questions is frequently raised as to why IEEE/OES does not have Student Chapters since other societies such as MTS, ASME, SNAME, and ASCE do. There are several reasons for this. There are no colleges or universities that provide an ocean or oceanic engineering major in their Electrical Engineering Departments. EE students that want to pursue degrees in the ocean engineering field must look to the Civil or Mechanical Engineering schools for these types of courses. Consequently we do not have a large pool of "oceanic" engineers in the Electrical Engineering Departments. Another factor is that most Ocean Engineering students are graduate students and are busy with academic activities and aren't that interested in going to society meetings. Where there is a large pool of ocean engineering students there is usually one organization that includes members from all of the different Societies, that meets for mutual interests. Perhaps the largest obstacle to forming student chapters is the IEEE organizational requirements. To establish a chapter we need a minimum of twelve IEEE members. In the case of a student chapter, we also need a faculty advisor that is an IEEE member AND we need a student

sparkplug that is interested in getting a chapter started and is willing to do the work necessary to form one. This does not mean that we should abandon the effort to form some type of student activity among ocean engineering students. Fortunately we can form Student Clubs. An OES Chapter can form a "Student Club". This is an excellent way of developing student interest in OES and providing a vehicle for expanding student membership. This requires a Chapter to develop an interest in working with students and have contacts with schools in their area. Again it requires a sparkplug on the campus that is willing to recruit students to join IEEE/OES and help to organize a "club". Four students and a faculty advisor are needed to establish a student club. OES will provide free student memberships and funds to promote and organize a student club. These clubs can continue to work with other societies on the campus to promote student activities.

The good news is that we now have an example of a Student Club! Following OCEANS 2001 in Honolulu, several students from MIT contacted the Boston Chapter and have recruited sufficient members to form the MIT Student Club! It is also likely that another club can be formed at the MIT WHOI campus. In addition we are also working to form a Boston Chapter sponsored student club at the University of Rhode Island. We also have the possibilty of establishing student clubs at Florida Atlantic University and Santa Clara University. Dr. Rick Driscoll, who was a student poster participant, is working to establish a Student Club at FAU through the Washington/Northern Virginia Chapter. Prof Jeff Ota is working at Santa Clara University to get a Student Club organized there. This Club would be sponsored by the San Diego Chapter. It should be pointed out that these three schools have been feeder schools for our Student Poster Program. It is our hope that these clubs would continue to support the Student Poster Program and would also develop projects that would retain student interest in OES and could be supported by OES. We will also be looking for new members from these Clubs.

While on campus student clubs are a focus of student activities for OES, these are not the sole focus of our student interest. OES is also active in supporting other programs that involve students. For the past several years we have been participants in the Human Powered Submarine programs. In 2001 we provide funding for the awards that were given to the winners at the Human Powered Submarine event held at the David Taylor Model Basin in June. This program was under the leadership of the Washington/Northern Virginia Chapter. We have also provided funding for similar programs in the San Diego area. We are encouraging Chapters to reach out in their local communities to assist in Science Fairs and similar activites in the local school systems. Our OES Chapters have been encouraged to develop programs that will excite members interest as well as be a benefit to school children in general.

Norman D. Miller
Vice President, Professional Activities

Upcoming Conferences and Meetings

Remote Sensing for Marine & Coastal Environments
7th International Conference
3-5 June 2002
Miami, Florida
email:nancy.wallman@veridian.com

OTC - Offshore Technology Conference
May 20-22, 2002
Houston, Texas
www.otcnet.org

IEEE Sensors 2002
June 12-14, 2002
Orlando, Florida
www.ieee.org/sensors

Subsea Controls & Data Acquisition Conference Paris Society for Underwater Technology
June 13-14,2002
email:jeansut@sstg.demon.co.uk

Undersea Defense Technology Conference & Exhibition
June 18-20
La Spezia, Italy
www.udtnet.com/europe

AUV 2002
Automonous Underwater Vehicles A Workshop on AUV Energy Systems
June 20 & 21, 2002
Southwest Research Institute
San Antonio, Texas
http://www.AUV2002.swri.org

Underwater Technology 2002
April 16-19, 2002
The New Sanno Hotel
Tokyo, Japan
http://underwater.iis.u-tokyo.ac.jp/ut02/

Oceans 2002 Conference & Exhibition
October 29-31, 2002
Mississippi Coast Coliseum & Convention Center
Biloxi, Mississippi
http://www.OCEANS2002.com

TECHNO-OCEAN 2002, 9th Techno-Ocean International Symposium and International Exhibition/Research Organizations Exhibition
November 20-22, 2002
Kobe International Exhibition Hall
Kobe Port Island, Japan
http://www.techno-ocean.com

Oceans 2003
September 22-26, 2003
San Diego, CA
http://www.oceans2003.org

Geoacoustic Inversion using Matched Field Processing

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Abstract—Geoacoustic inversion is a topic of much interest in the underwater acoustics community these days. It is also a very difficult subject. Shallow water geoacoustic properties include water - depth, sediment layer thicknesses, sediment sound-speed profiles, density profiles, and attenuations. It is not only difficult to explicitly "measure" some of these parameters directly, it is also impossible to survey any region extensively. Thus, inversion methods which are non-invasive and which can rapidly and efficiently estimate properties over a volume are very desirable. Over the past decade the effort to develop such schemes has grown, particularly those which are matched field processing (MFP) based, i.e., which compare measured acoustic data on an array with model predictions for such data and which are sensitive to and based on environmental inputs. This paper will review some of the history of MFP as applied to geoacoustic inversion as well as provide some details concerning recent efforts to develop a tomographic MFP geoacoustic inversion method.

I. Introduction

In situ sampling, e.g., cores, are not really a good way to go as a general rule since they are excessively time consuming, expensive, supply only very localized point samples, and still involve a fair amount of interpretation before they can be used in acoustic propagation predictions. It is well appreciated that efforts to remotely estimate bottom (geoacoustic) parameters via *acoustic sensing* are extremely complicated and frought with hazards. However, these rather new (within the past decade or so) acoustic methods offer a great deal of hope that fast, efficient, large scale, and accurate approaches may eventually be achieved.

This paper will discuss the development of geoacoustic inversion with particular mention of three workshops which have been held to either focus or lead into the issues. The paper will finish with details of a method (tomographic) of particular interest.

II. Some History

In the mid 70s a signal processing technique soon to be known as Matched Field Processing (MFP) was proposed using an array of receivers to locate a passive acoustic source traveling in an ocean environment (Hinich, '73; Bucker, '76). Efforts over the next decade or so to use MFP for localization were found to be sensitive to errors in environmental parameters (Bucker, '76; Klemm, '81; Porter et al. '87), i.e., to "mismatch" in such properties as sound-speed profiles, surface fluctuations, etc. These sensitivities were regarded as problematic for the determination of source range, azimuth, and depth.

The first work to suggest that MFP could be used to do *environmental inversions* was a presentation in 1987 (Tolstoy, '87) which examined the estimation of rms surface roughness via simulated data for a known source. Soon thereafter a paper appeared which applied MFP to Arctic reflectivity data for the estimation of the phase and amplitude of acoustic reflection coefficients (Livingston and Diachok, '89). In the early 90s two more applications of MFP to the estimation of environmental parameters were suggested: one for the tomographic estimation of deep ocean volume sound-speed profiles (Tolstoy et al., '91; Tolstoy, '92; Tolstoy, '94) and one for geoacoustic properties such as bathymetry (Dosso et al., '93).

Thus, the late 80s and early 90s saw the beginning use of MFP beyond localization and into environmental inversion. The early localization difficulties also led to a number of workshops designed to assess the progress and accuracy of MFP methods to such problems (there were a number of processors in use, see Tolstoy, '93). The workshop held at the Naval Research Laboratory (NRL), Washington DC, in 1993 was a particularly important effort because it transitioned investigations from localization *only* to localization *plus* environmental inversion. This workshop also established a number of key components for future workshops.

III. Workshop '93

The purpose of the Workshop of 1993 (organized by Porter and Tolstoy) was to assess the state of MFP for source localization including the effects of noise (both colored and white) and of environmental uncertainties. This workshop, unlike previous ones for MFP, prepared and offered some validated (mostly simulated) data which could be used by participants to test their methods. The solutions, i.e., the source ranges and depths as well as environmental properties, were known exactly (for all the simulated data) but not distributed to users until the meeting itself. A calibration case was provided to assure users that they were on track with regard to their models, e.g., that phases were not in conjugate form. A total of 5 cases were simulated (including the calibration case) which included 3 cases of environmental uncertainty: SSPMIS (allowing for sound-speed profile mismatch in the water), GENLMIS (general mismatch allowing for water and bottom sound-speed errors as well as bottom density and attenuation errors), and SLOPE (like GENLMIS plus bottom depth errors at the source and receiver corresponding to a bottom tilt).

Thus, this workshop provided:

- simulated data (validated);
- calibration case;
- solutions known but not provided beforehand;
- environmental uncertainly test cases.

Results from the workshop include comparisons of a variety of processors (including sector focusing, eigenvector methods, multiple constraint) with a general consensus that most methods worked quite well under high signal-to-noise levels and low environmental mismatches. Additionally, it became evident that the *best* performance occured when localization was combined with environmental inversion such as in

the approach presented using genetic algorithms (Gerstoft, '94). Details can be found in Porter and Tolstoy, '94 and in that issue of the Journal of Computational Acoustics (JCA). Data and test information are still available on the web site: oalib.saic.com/Other.

IV. Workshop '97

In 1997 the first MFP environmental inversion workshop (organized by Chapman and Tolstoy) took place in Vancouver, Canada. Here the purpose was to estimate geoacoustic parameters in shallow water scenarios assuming range-independent situations. Thus, there were no changes in bottom, surface, or ocean properties as a function of range. The effort emphasized not source localization (sometimes included as an unknown) but the more difficult problem (with much larger search spaces) of determining such bottom properties as water depth, sediment sound-speeds, thicknesses, densities, attenuations, and elasticity (when present). Noise was neglected. As before, however, simulated data were generated (by Brooke using the FFP model SAFARI), a calibration case was provided, test solutions were not known beforehand, and a number of uncertainty scenarios (growing increasingly more difficult) were considered. A new wrinkle included:

- the generation of many frequencies of simulated data ranging from 25 to 500 Hz allowing for broadband processing if desired.

As before, bottom properties were emphasized by a downward refracting ocean sound-speed profile overlying a sedimented bottom overlying a half-space. Search intervals were provided.

The workshop resulted in numerous search methods (including simulated annealing, genetic algorithms, neural nets), a variety of propagation models (such as normal modes, PEs, FFPs; see Jensen et al, '94 for model mathematics), and many cost functions being applied. It became evident that multi-frequencies were crucial to successful inversions for bottom properties and that numerous properties were naturally correlated where those relationships could be used to improve inversion efficiency. See Tolstoy et al, '98 and that issue of JCA for complete workshop details. Data and test information are still available on the web site: unix.uvic.ca/seos. The next workshop hoped to explore range-dependent and more generally complicated scenarios.

V. Workshop '01

Most recently there was a second MFP environmental inversion workshop (organized by Chin-Bing, Chapman, and King) held in Gulfport MS in May 2001. This workshop tackled some of the most difficult scenarios to date displaying range-dependence: a downslope, a shelf-break, and an intrusion (no bathymetric variation). As before, the data were generated (by Evans using both 2-way coupled normal mode and PE RAM models to guarantee valid, consistent data), a calibration case was given, solutions were not distributed beforehand, and numerous test cases were examined. This time, we found that only a few propagation models were used for the inversions since not many are appropriate for range variable situations.

As for the First MFP environmental inversion workshop, it was apparent that multi frequencies were still critical to minimize sidelobes or false "solutions", and propagation model accuracy and efficiency were still extremely important (even a lack of energy conservation in an otherwise accurate PE model led to significant errors in parameter estimations). In addition, it was now evident that environmental assumptions were also critical (no bounds were provided on the search spaces nor was the "intrusion" described in detail beforehand. The search spaces for this workshop were even more enormous than ever, thereby approaching more realistic conditions. The details for this workshop will be published soon while data and test information are available on the web site: oalib.saic.com/Other.

VI. Tomographic Geoacoustic Inversion

One of the most promising approaches for large volume inversions is the MFP tomographic approach. This scheme was originally developed for deep ocean sound-speed profile estimates (Tolstoy et al., '91) and is based on MFP to optimize multiple source-receiver array (SR) paths through a volume. Originally the volume was expected to be 100-500 km by 100-500 km in area by 1000-5000 m in depth, i.e., very large. Mathematically a volume of interest is gridded into cells, e.g., x km by y km in area by z m (to the bottom) in depth, through which the acoustic SR energy passes. Keys to the success of the method are: (1) a means to optimize environmental properties assuming *range-independent* ("average") conditions between source and array (2) the implicit applicability of adiabatic propagation resulting in a linearization of the problem. Applying this method to a shallow water geoacoustic inversion problem changes the scales of the region (now smaller), the frequencies to be studied (now higher), and the number of unknown parameters per cell (now more). However, the final calculation remains a matrix inversion.

This tomographic method for geoacoustic inversion has been applied only to simulated Haro Strait "data" (Jaschke, '97; Tolstoy, '00; '01), and primarily for the estimation of water depths. It has been shown that performance can be enhanced by eliminating cells which are severely undersampled by the acoustic energy, e.g., cells having only a single SR path, resulting in rms accuracies of better than 0.23 m relative to water depths which range from 120 to 240 m. However, these high accuracies (better than 1 %) have assumed that the propagation could be *exactly* modeled by adiabatic normal modes.

Recently, efforts have begun to investigate the adiabatic assumption by first generating simulated "data" via an energy conserving PE for an SR path over the "true" linearly segmented topography through the region (a sample slice is shown in Fig. 1a). Then, at 25 Hz this field is "compared" via MFP (both linear and a high resolution Capon processor) to the field assuming a *constant* depth D between source and receiver (the depths at the source and receiver are true). That is, the modeled field (still using PE) is generated by assuming an "average" water depth between source and array (see Fig. 1c). Matrix inversion, as required by the method (Tolstoy, '01), should subsequently lead to the corresponding step topography as shown in Fig. 1b.

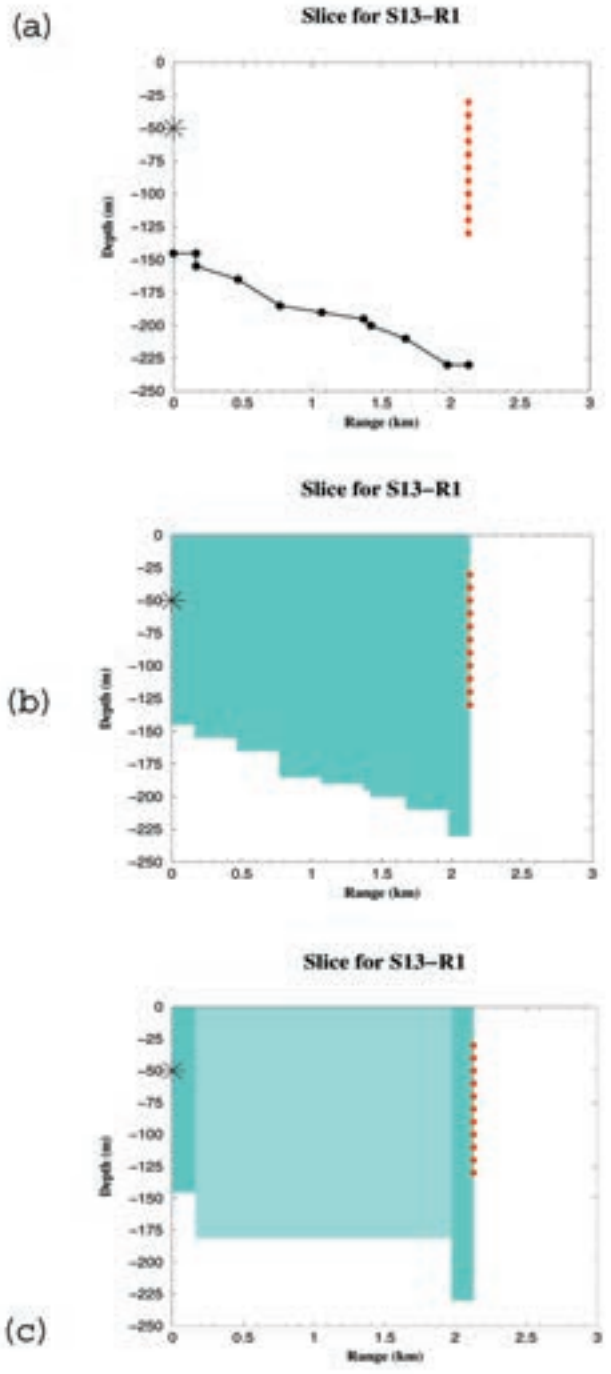

Fig. 1. The bathymetry of an SR slice for the simulated Haro Strait. (a) The "true" linearly segmented topography assumed for the generation of complex pressure. (b) The corresponding step topography desired by the final tomographic inversion procession. (c) The temporarily assumed topography where individual slices are inverted to estimate the "average" depth *D* along the SR path.

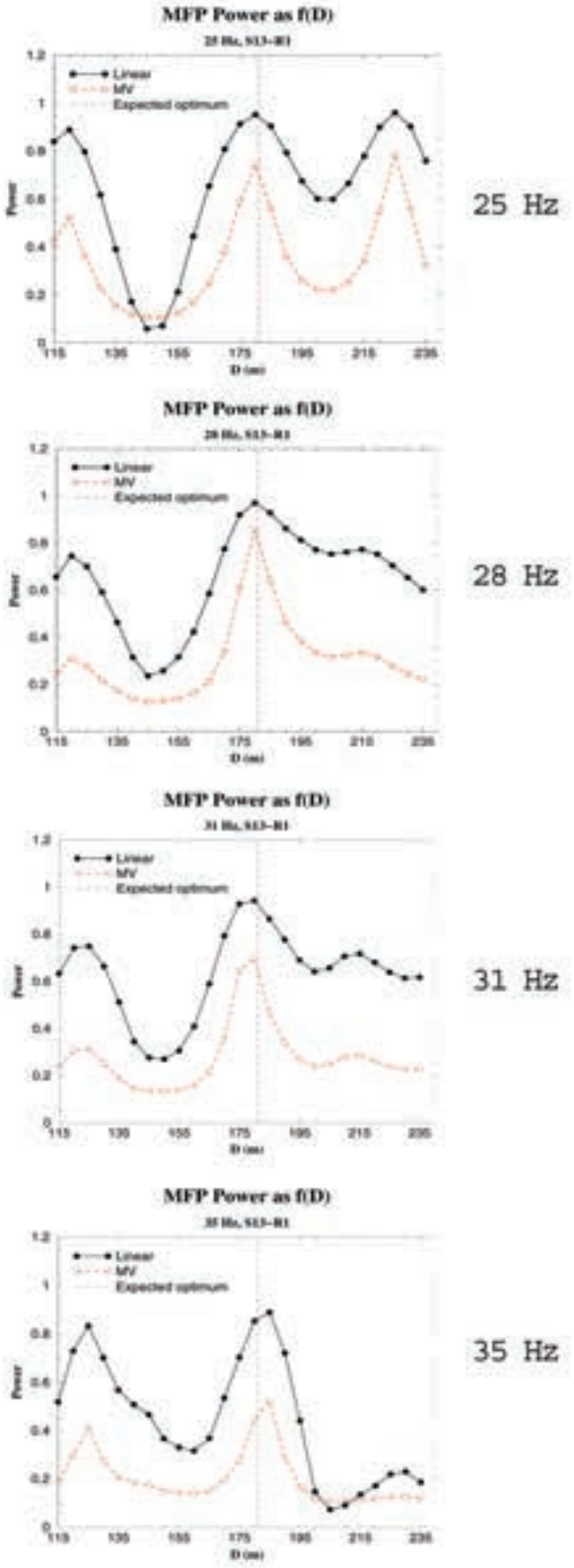

Fig. 2. MFP correlations at indicated frequencies 25 to 35 Hz between the simulated PE "data" (full linearized bathymetry as in Fig. 1a) and PE fields assuming constant "average" water depth *D* between source and array (depths are true at source and array; *D* as in Fig. 1c). The peaks should and do occur near $D = 181$m.

The matrix inversion is equivalent to assuming that adiabatic normal modes are appropriate (Tolstoy, '92). However, comparing transmission loss (TL) curves at 25 Hz (PE, coupled, and adiabatic normal modes using the full bathymetry) will clearly indicate that adiabaticity may not be very accurate. But all is not lost. If one attempts to find an "optimal" average

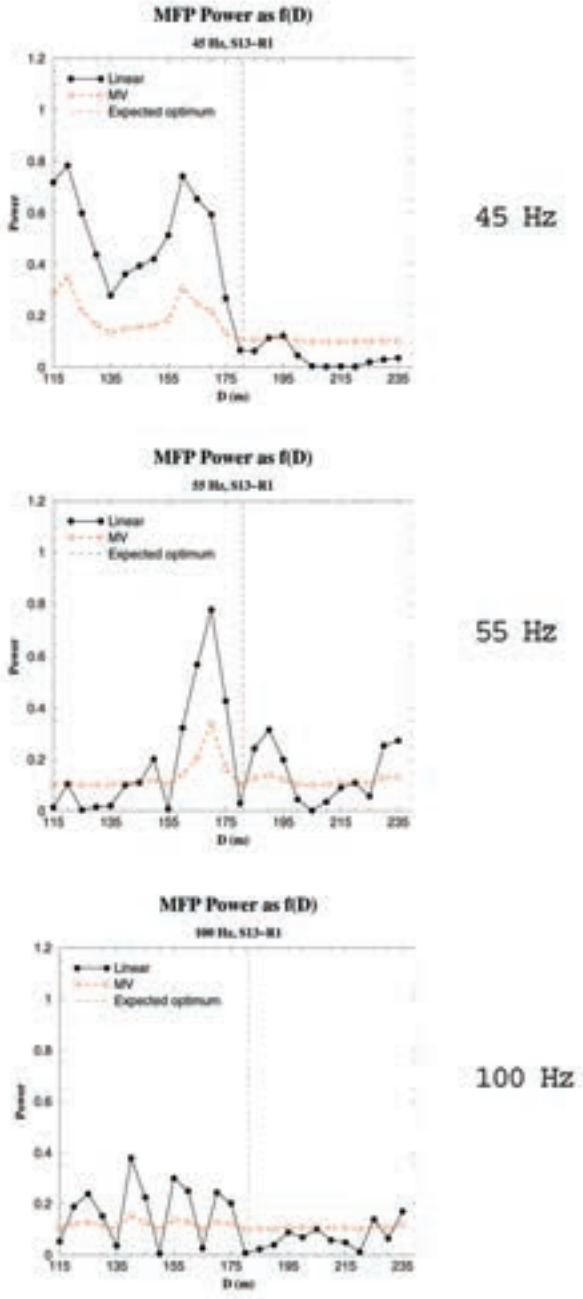

Fig. 3. MFP correlations at indicated frequencies 45, 55, and 100 Hz between the simulated PE "data" (full linearized bathymetry as in Fig. 1a) and PE fields assuming constant "average" water depth D between source and array (depths are true at source and array; D as in Fig. 1c). The peaks should ccur near $D = 181$m but clearly do not.

depth for this SR slice, then we find that while the MFP levels are not 1.00, as they would be for an exact match, they *do* still peak at the *correct* average depth D, as indicated by the dashed lines in Fig. 2 (optimal D) — at least for the lower frequencies 25-35 Hz. Thus, we may still be able to achieve excellent results at the lower frequencies after matrix inversion.

Unfortunately, as frequencies get higher, say 45 to 100 Hz, we find that this simple "average" D model for the path is not appropriate. In particular, MFP correlations to fit a path

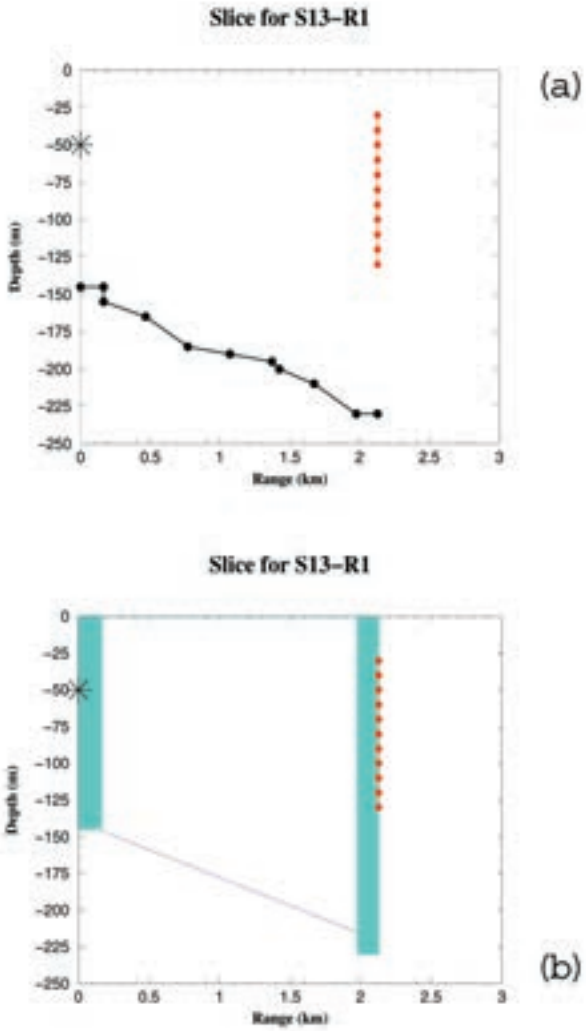

Fig. 4. (a) The "true" linearly segmented topography of the SR slice assumed for the generation of complex pressure. (b) The temporarily assumed topography where individual slices are inverted to estimate the "average" depth D and the "average" θ along the SR path.

with a simple "average" D do not yield a correct estimate for D as shown in Fig. 3. However, we find that by allowing for an "average" tilt θ to the bottom (as indicated in Fig. 4), this situation can be significantly improved. In particular, a tilt angle of 2.0° results in an MFP peak near $D = 181$m with values of 0.87 for the Linear processor (versus 0.06 with $\theta = 0.0$), and 0.48 for the MV processor (versus 0.10 with $\theta = 0.0$). Thus, at mid frequencies for each individual path it may be necessary to increase the parameter search from just a search for "average" D to a search for "average" D and "average" θ. However, the final matrix inversion will still only use only D to estimate the step topography.

VII. Conclusions

We conclude that MFP has now matured sufficiently that it has been successfully embedded in numerous geoacoustic methods, many results of which were presented at recent inversion workshops (Workshop '97 and '01). These methods began

after sensitivity studies in the late 70s and mid 80s which showed that there are environmental effects on source localization capabilities. Present MFP inversion methods can estimate roughness parameters, deep ocean sound-speeds, and bottom properties such as sediment thicknesses, sound-speed profiles, densities, and attenuations. One approach showing promise is the tomographic method which minimizes the search spaces for individual paths by seeking "average" properties, then combines path estimates of "average" properties into a simple matrix inversion to result in full, volume-wide estimates. All MFP geoacoustic inversion methods are presently concerned with broadband solutions to address non-uniqueness issues as well as with improved efficiency via parameter coupling and faster but more accurate propagation models. Additionally, methods are also attempting to provide confidence limits for their proposed environmental estimates. Finally, experimental testing can provide very useful insights and continues to challenge and improve all the inversion methods.

Acknowledgments

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Alexandra Tolstoy holds B.A. and M.A. degrees in Mathematics from GWU and a Ph.D. in Applied Mathematics from UMD. She has been an independent scientist since 1999 (ATolstoy Sciences), previously with IPD, Inc. (11/94-10/99) and the Naval Research Laboratory, Wash. DC (5/80-10/94). Earlier work involved seismic and low frequency radio wave propagation. Recent work has involved environmental inverse problems using Matched Field Processing (MFP). She is the author of the monograph MFP for Underwater Acoustics (World Scientific, 1993) and developed an ocean acoustic MFP tomography technique for which she holds two patents. Dr. Tolstoy is a Senior member of IEEE and a Fellow of the ASA. She is also an editor for the J. Computat. Acoust.

[Editor's Note: This article is the latest in the series of Technology Overview Papers contributed with the cooperation of the IEEE Oceanic Engineering Society Technology Committee Chairs.]

Soundings by John Irza

Welcome to the latest installment of "Soundings", a column that reports on a broad spectrum of news items from the mainstream media as they relate to Ocean Engineering technologies. The purpose of this column is to inform the ocean engineering community of our industry's visibility in the media and how the general public perceives our efforts.

Scientists Examining Civil War Sub Crew's Remains

Scientists continue to study the remains of the crew from the recently excavated Civil War-era submarine Confederate submarine H.L. Hunley.

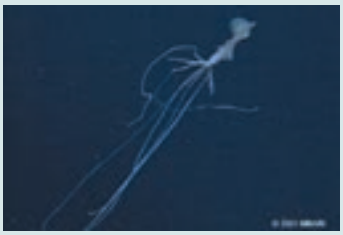
One surprise is the height of the crew. The captain, Lt. George Dixon, was 6-feet tall and the thers were also much taller than the scientists had expected. Additional forensics about the men revealed that they ranged in age from 18 or 20 to their early 40s, were all white, and suffered back problems and torn rotator cuffs from cranking the sub's propeller.

The Hunley, a 43-foot sub built to break through a Union blockade of Charleston Harbor, disappeared on Feb. 17, 1864 shortly after sinking the USS Housatonic in the world's first successful submarine attack. It was lost until 1995, when a dive team paid for by adventure novelist Clive Cussler discovered it four miles off Sullivan's Island, South Carolina.

For more information visit the Friends of the Hunley web site at http://www.hunley.org

MBARI ROV Images New Squid Species

The Monterey Bay Aquarium Research Institute (MBARI) used remotely operated vehicle Tiburon to record observations of an unknown species of squid during dives off the coast of Oahu in May 2001. Seven other submersible sightings of apparently related individuals have been reported at similar depths in the Gulf of Mexico, Atlantic, and Indian Oceans. MBARI scientists estimate that the individual seen by Tiburon was between four and five meters in length. More information is available at MBARI's site: http://www.mbari.org/news/news_releases/2001/dec21_clague/dec21_clague.html



Squid hanging.

Squid close-up.

Squid swimming.

Ocean Bottom As Energizer Bunny

Recent work by UMass-Amherst and NRL researchers show that it is possible to make a battery from marine sediments. This is not your father's seawater battery (to paraphrase a familiar marketing slogan). They have found that energy in the form of electricity can be harvested from marine sediments by placing a graphite electrode (the anode) in the anoxic zone and connecting it to a graphite cathode in the overlying aerobic water.

The researchers have shown that microorganisms of the family Geobacteraceae can "conserve energy to support their growth by oxidizing organic compounds with an electrode serving as the sole electron acceptor. Their finding not only provides a method for extracting energy from organic matter, but also suggests a strategy for promoting the bioremediation of organic contaminants in subsurface environments." Inquiries for further information should be directed to Derek Lovley at dlovley@microbio.umass.edu

Micro AUV's Team Towards a Common Goal

Nekton Research, in conjunction with Duke University under funding from the US Defense Advanced Research Projects Agency (DARPA), has developed the first of an anticipated family of micro-miniature autonomous underwater vehicles (MicroAUVs) that can operate individually or in collaborating swarms to perform a wide variety tasks.

The MicroHunter line of vehicles are small enough to be hand-launched or air-dropped and have a range of tens of kilometers. The simplest versions feature patent pending control technology that allows for the maneuverability of conventional torpedo-shaped AUV with only a single moving part. Versions under development and testing include acoustic modem links to allow for semi-autonomous control and data uploading.

For more information: http://www.nektonresearch.com/ MicroHunters.htm

If you see an article (whether in print or in electronic form) that you would like to see mentioned in this column, please let me know by email, fax, phone, or regular mail. Email contributions can be sent to a special address: Soundings@Sygnus.Com. Information for phone, fax, and regular correspondence can be found in the back of newsletter where I am listed in the AdCom section.

Minutes of the IEEE Oceanic Engineering Society (OES)

Administrative Committee (AdCom) Meeting Held In Honolulu, Hawaii (5 November 2001)

The formal agenda to be addressed was presented to each of the attendees by Dr. Thomas Wiener, the IEEE OES President.

The IEEE OES AdCom meeting commenced on 5 November 2001 at 8:00 AM at the Hilton Hawaiian Village Hotel in Honolulu, Hawaii. The meeting began with a call to order and an official welcome from Dr. Wiener. A formal roll call was then conducted by Stephen Holt (Secretary). The attendees were:

Dr. Thomas Wiener (President)	Steve Holt	Jim Lynch
Joe Vadus	Hissaki Maeda	Fred Maltz
Norm Miller	Ken Ferer	Sandy Williams
Jim Barbera	Joe Czika	Kevin Hardy
Glen Williams	Dan Alspatch	Dr. Hisaaki Maeda
Rene Garello	Ken Foote	Dr. Hiroshi Ohba
Robert Bannon	Feriel El-Hawary	Mr. Masato Chijiya
Pam Hurst	Jerry Boatman	Dr. Toshitsugu Sakou
Pam Hurst	Jerry Carroll	Mr. Hiro Nakahara
Claude Brancart	Robert Wernli	Dr. Tamaki Ura
Todd Morrison	John Irza	Ms. Harumi Sugimatsu
Stan Chamberlain	John Wilshire	

The meeting continued with a discussion from Claude Brancart about the costs incurred for the Oceans 2000 conference that was held in Providence, RI. It was agreed that Tom Wiener will send Claude a copy of the Oceans 2000 audit report for his review. This issue became the basis for action item AI-Hono-AdCom-01-1 at the meeting.

There was general discussion between several AdCom members that we still did not know if we are having two conferences in 2004 and whether one would be in North America and one would be abroad.

Pam Hurst summarized what we would all need to do for our formal Strategic Planning Activities session later that day.

Jim Barbera (OES Treasurer) expressed his concerns about exceeding the budget. He stated that you canít have four meetings a year with this many people without seriously impacting the budget.

Steve Holt began a review of several specific open action items from earlier AdCom and ExCom meetings. Their latest status is detailed below.

AI-Wash-ExCom-01-1: Oceans'98 is still open.

AI-Albu-ExCom-01-3, 4, 5 are still open. Steve Holt will call Jim Lynch for a status.

AI-Prov-AdCom-00-5 and 6: Closed.

AI-Prov-AdCom-00-7: Open. An issue remains with the Oceans 2004 Conference: Will the MTS go 50% with the OES for costs? New date: 6 May 2002.

AI-Prov-AdCom-00-9 and 10: Closed.

Claude Brancart wanted to know about recommendations to bring the History Project to fruition. A new action item, AI-Hono-AdCom-01-2, was created to address this issue.

Dr. Tom Wiener gave a presentation on the future direction for the AdCom. There were four issues discussed: (1) energizing the AdCom, (2) conference management, (3) membership, chapters, and student chapters, and (4) expected achievements.

Dr. Joe Vadus presented the introductory remarks of his work as IEEE OES Vice President for Technical Activities. Documents related to his efforts are included in Attachment B. It includes a letter from Joe to Dr. Hiroshi Ohba celebrating the 30th anniversary of the Japan Marine Science and Technology Center (JAMSTEC). Dr. Ohba is the Chairman of JAMSTEC. A response letter from Dr. Ohba to Joe is also included.

Joe introduced Dr. John Wiltshire who was the Executive Co-Chair of Oceans 2001. John stated that there was an early concern about the number abstracts coming in for Oceans 2001. There were a few at first, then many later. Many were accepted, but some were rejected. Due to reaction to September 11, attendance was estimated to have dropped from 2000 to 1500.

Joe Vadus then introduced Jerry Boatman to give a presentation on the Oceans 2002 Conference which will be held at the Stennis Space Center, Mississippi from October 28-31, 2002. He addressed such issues as facilities, hotel arrangements, and contracts.

Joe Vadus then introduced Bob Wernli to give a presentation on the Oceans 2003 Conference which will be held in San Diego, California from 22-26 September, 2003. These documents consist of a presentation given at Oceans 2001 to the Marine Technology Society (MTS) Executive Committee by Kevin Hardy on this conference, the proposed contract between the Scripps Institution of Oceanography and the Town and Country Resort and Convention Center to the MTS (via Ms. Judith Krauthammer), and the Group Sales Contract with the Town and Country Resort and Convention Center.

Joe Vadus introduced Dr. H. Ohba, Dr. T. Sakou, and Mr. H. Nakahara who each gave a short presentation on the Techno-Oceans 2002 Conference which will be held in Kobe, Japan from 20-22 November 2002, as well as the Oceans/Techno-Oceans 2004 Conference which will be held in Kobe, Japan from 9-12 November 2004. In addition, a report was given by Professor H. Maeda on the Underwater Technology (UT) 2002 Conference to be held in Tokyo, Japan from 16-19 April 2002 and the IEEE Post Underwater Technology (UT) 2002 Workshop to be held at the National Taiwan University in Taipei, Taiwan several days later from 22-23 April 2002.

Claude Brancart gave a presentation on the Offshore Technology Conference (OTC), which will be held in Houston, Texas from 6-9 May 2002, as well as the Autonomous Underwater Vehicles (AUV) 2002 Workshop which will be held from 20-21 June 2002 in San Antonio, Texas. AUV 2002 will be a workshop mainly on AUV energy systems.

Bob Bannon gave a presentation on the proposed Submarine Cable Technology Conference to be held hopefully between April to June 2002.

Dr. Stan Chamberlain gave a presentation where he discussed his activities as the OES Technology Committees Coordinator. His report is included in Attachment H. Documents in this attachment include the final report on the IEEE OES Technology Committees, an addendum which is entitled Proposed Structure and Responsibilities for a Permanent Oceans Conference Technical Program Committee (TPC), and the latest list of the IEEE OES Technology Committee Chairs.

There was a motion from Stan to reappoint eleven of the twelve members of the OES Technical Committee. This motion was seconded and after a vote was approved unanimously. It became new motion Mot-Hono-AdCom-01-1.

Jim Barbera proposed a motion for the OES to support the Consortium on Oceanographic Research and Education (CORE) for the National Ocean Sciences Bowl (http://www.coreocean.org/Dev2Go.web?anchor=nosb_home_page) for $5,400. This motion was seconded by Dan Alspatch and approved by unanimous vote. Jim agreed to continue to interface with those involved with this effort as the Interim Committee Chair. This became new motion Mot-Hono-AdCom-01-2.

Dr. Joe Czika wanted a motion to approve $90,000, over a period of one year, to produce an Internet-based Grade 5 and Grade 11 educational project. Joe Czika and Joe Vadus will produce a hard copy version of what the website will look like, for $25,000, in six months' time. Tom will appoint a committee to examine the feasibility of this effort. This motion was seconded by Claude Brancart and approved by unanimous vote. This became new motion Mot-Hono-AdCom-01-3.

Jim Barbera wanted a motion to support the International Submarine Races for an annual expenditure of $5,000. This would be a Washington Chapter project. For the year 2003, we will also supply $5,000 for a similar project through the San Diego Chapter. This motion was seconded and approved by a unanimous vote. This became new motion Mot-Hono-AdCom-01-4.

A motion was made for Norm Miller to continue as Vice-President of Professional Activities. He was elected to continue in this office because the AdCom members voted to waive his term limitation under the OES Constitution. This motion was proposed by Tom Wiener and Glen Williams, and then seconded by Claude Brancart. This motion was voted on and then approved unanimously. This new motion became Mot-Hono-AdCom-01-5.

Col. Norm Miller gave a presentation on his Student Chapter and Chapter/Membership activities. Among his issues he raised were:

There is a critical mass of members is needed to have a chapter

There is a need to expand the Boston Chapter outside of Boston. Its expansion has to do with working in other areas such as Providence, RI to build up a basis for additional Chapters in the New England area. He proposed a "Chapter of the Year" award be given at an AdCom meeting each year based on the results of their annual reports. Tom didnít want this to be raised at this time and asked Norm to form a committee to look into it and then report back at the next AdCom meeting. Norm has since contacted Joe Czika and Pam Hurst to assist in defining the award criteria. Norm has also contacted the MTS and has their procedure for doing this. There is a need to bring in more students to be in the chapters.

Jim Collins gave a report on membership makeup. He stated that we had 1550 members. Membership was good up to 1992, then has steadily decreased.

Todd Morrison gave a report on his activities in establishing a new IEEE OES web site. The main points of his discussion were:

A Request For Proposal (RFP) was extended to eight potential bidders to develop and maintain the site. We had about $10,000 in costs projected over two years to do this.

We had responses back from four of the eight developers. Three of these developers were reasonable, one was completely off in their bidding estimates. The firm Veraprise Corporation (of Winchester, VA) was selected to develop and maintain the web site.

Veraprise was said, at the time of the AdCom meeting, to be awaiting a formal contract (and thus funds) from the OES to begin development of the site. Todd stated that ideas from the AdCom members were urgently needed by him on how the site should be constructed as well as what information should be contained in it. A meeting was to be set up with Veraprise in the future to get started in a structured way. Note that since the AdCom meeting, this meeting occurred between Tom Wiener and Todd Morrison at Verapriseís headquarters.

A motion was proposed by Todd to proceed with the web site development. This motion was seconded and voted on whereby it was approved unanimously. This new motion became Mot-Hono-AdCom-01-6.

Dr. Glen Williams gave a presentation on the details behind the development of the IEEE OES CDSet Project and its costs. It was noted that they were being sold here at the Oceans 2001 Conference. There were discussions about selling these CDSets at the Registration desk at Oceans 2001. Jim Barbera had worries about this with J. Spargo selling them. It is unknown at this point how often the OES will update the CDSets. A complete description of all of Glenís work on developing the CDSets can be found in the earlier IEEE OES ExCom Meeting Report for September 2001 which was held in Washington, DC (pp. 3-4).

Dr. Jim Lynch gave a presentation on his activities as the Journal of Oceanic Engineering (JOE) Editor. Jim was nominated for a Presidential Appointment to continue for another term as JOE Editor for another three years. This motion was approved by the AdCom members by a unanimous vote. This new motion became Mot-Hono-AdCom-01-7.

Fred Maltz gave a presentation on his activities as the Newsletter Editor. Fred discussed issues such as costs for producing and distributing the newsletter. Fred also called for volunteers to partake in book reviews for the IEEE OES.

Dr. Rene Garello discussed issues related to his Committee on Conference Policy (CoCoPo) activities.

Jim Barbera discussed several financial issues related to his activities as Treasurer. He stated that financial issues related to

UT 2000 are closed. Also, Oceans 2000 is still being audited and should be finished by the end of November 2001. The IEEE lost some funds on their conferences because the stock market dived.

The OES Strategic Planning Activity began with a review of its purpose and all procedures to be followed in conducting it by Pam Hurst and Bob Bannon. All AdCom members participated in the process whereby three separate teams were formed, each with its own team leader, to solicit and capture ideas. The team leaders were John Irza (Blue Team), Dr. Ferial El-Hawary (Red Team) and Ken Ferer (Green Team).

It was decided that two action items and seven motions were generated from this meeting.

The meeting was adjourned at 5:00 p.m.

Who's Who in the OES

Kenneth G. Foote received his B.S. in Electrical Engineering from the George Washington University in 1968, his Ph.D. in Physics from Brown University in 1973.

Ken worked at Raytheon Company, Submarine Signal Division, 1968-74, thus experiencing the transition from analog to digital electronics in sonar control and signal processing. He then spent a year at Loughborough University of Technology working in Roy Griffith's Department of Electronic and Electrical Engineering, followed by 24 years at the University of Bergen and Institute of Marine Research in Bergen, Norway. During this time, he began developing and applying acoustical methods and instruments to the quantification of marine biological resources, including especially the stock of Norwegian spring-spawning herring. Conducting the first sea trials of new echo sounders and other instruments and gear and methods became something of a specialty. Sabbaticals were spent at Brown University, Department of Physics, and Ecole des Mines de Paris in Fontainebleau, the second to study geostatistics.

In the austral summer 1987-88, Ken participated in an expedition to South Georgia to determine the target strength of Antarctic krill. This experience led to work on other euphausiids, as well as other zooplankton.

The lure of other applications of underwater sound, and indeed other remote sensing tools and platforms, led to an appointment as Senior Scientist at the Woods Hole Oceanographic Institution in 1999.

A distinguished oceanographer in Bergen once told Ken that acoustical methods were not very good for use in abundance estimation of fish stocks, but that there was nothing better! He also said that his father, who fished, owed his wealth to observing the scratchings of a pen on a strip chart recorder. The colleague continued to explain how older fishers had been able to judge the size of a school of fish from the impulses felt on a weighted string deployed over the side of a boat. That sonar was a superior tool was never doubted, but the example served as a spur to many engineers, scientists, and technicians to refine acoustical methods for application to marine organisms.

As chair of the OES Technology Committee on Underwater Acoustics, Ken is keen to encourage the development of acoustical technology for both physical and biological applications. Converting one-of-a-kind research tools to commercial scientific devices is a particular interest.

Visit the OES online:

http://ewh.ieee.org/soc/oes/oes.html

OTC 2002 - DEEP INTO THE FUTURE

RICHARDSON, TX, U.S.A. (12 February 2002). The latest technologies and innovations in the industry bring worldwide participants to explore "Deep Into the Future" of the offshore industry at the most important oil and gas event of the year - the 34th Offshore Technology Conference (OTC).

The four-day event, 6-9 May 2002, will bring more than 45,000 oil and gas industry professionals to the city of Houston. OTC 2002: Deep Into the Future signifies the journey that the industry has made over the past decade, and at the same time, the forward progression of technology, the management of people, and work efficiency.

"After this year's recent tragedies and economic downturn, the strength and tradition extended by OTC will become even more important", said Charlie Richards, OTC 2002 Chairman. "The gathering of worldwide companies and professionals at OTC will again prove to be the crux of the newest leading technologies and innovations."

OTC 2002 promises to deliver four days of the latest technologies in the global offshore industry. The more than 365,000 net square feet of exhibit space will tout state-of-the-art technology available to the industry. Running concurrently with the exhibition are technical sessions that detail new practices available to engineers in the offshore field.

Attendees can expect more than 49 technical sessions that include 285 technical papers. Other presentations include eight Topical Luncheons and two General Sessions, "What is the Future Model for Offshore Project Execution?" and "Offshore Gas Development: A Critical Factor in Global Energy Markets", featuring some of the most notable names in the industry. Three Industry Breakfasts are scheduled for Tuesday through Thursday.

On Tuesday, attendees will gather in the ballroom for the annual OTC Awards Luncheon. This yearís luncheon recognizes Bruce G. Collipp, Shell Oil Company and ExxonMobil Development Company's Hoover Diana Project.

Founded in 1969, the Offshore Technology Conference is the world's foremost event for the development of offshore resources in the fields of drilling, exploration, production and environmental protection. OTC is held annually in May at Reliant Center at Reliant Park in Houston. For more information, visit the OTC 2002 Web site at www.OTCnet.org.

Dr. Henry Cox of Orincon Corp. Elected to the National Academy of Engineering

"I am pleased to announce that our own Dr. Henry (Harry) Cox has been elected to the National Academy of Engineering. This is a well deserved great honor. It also speaks very well for all of us to have our CTO a member of such a prestigious organization.

Congratulations Harry"

Daniel L. Alspach
Orincon Corp. 9363 Town Center Drive
San Diego, CA 92121

Dr. Henry Cox was the recipient of the IEEE/OES Distinguished Technical Achievement Award at the Oceans 1991 Conference. The award recognized Henry "Harry" Cox's record of technical innovation in the field of ocean engineering, particularly in signal processing, acoustics, and sonar. Over his 30 year career, Dr. Cox has written more than 50 technical papers and presentations in the fields of active and passive sonar, sound propagation, ambient noise, and signal processing. He has served on a number of national advisory panels, including the SECNAV Advisory Panel on Undersea Surveillance, the Naval Research Advisory Committee Panel on the Soviet Submarine Threat, and the Panel on ASW Applications of Artificial Intelligence. Dr. Cox also served as a consultant to OSD and DARPA on ASW matters.

Dr. Cox received his B.S. in Physics from The College of the Holy Cross and his Sc.D. in Electrical Engineering from Massachusetts Institute of Technology. He gained much of his ocean engineering experience during a 25 year career in the Navy, where during his work for the Office of the Assistant Secretary of Defense, he developed the "Cox" model of sonobuoy field performance. Later, working for DARPA, he applied advanced technologies to undersea warfare problems. After retiring from the Navy in 198l, Dr. Cox spent l0 years as Divisional Vice President at BBN Systems and Technologies, where his groundbreaking research led to new robust beamforming software algorithms that control random error sensitivity. Currently, his position is Chief Scientist and Corporate Vice President for ORINCON Corporation.

Among Dr. Cox's numerous awards are the Gold Medal from the American Society of Naval Engineers, the David Taylor Award for Scientific Achievement, and a presidential citation and award for cost reduction as a result of signal processing innovation. Dr. Cox is a Fellow of the Institute of Electrical and Electronic Engineers and of the Acoustical Society of America and an honorary member of the American Society of Naval Engineers.

Reprinted from the Winter 1992 issue of the *IEEE Oceanic Engineering Society Newsletter*.

NEWS ITEMS

SCRIPPS SCIENTISTS DISCOVER 50-YEAR WARMING TREND IN SOUTHERN OCEAN

San Diego, California — An armada of autonomous marine robots deployed in the 1990s has helped produce new evidence that the Southern Ocean is warming faster than the rest of the world's oceans. Professor Sarah Gille of Scripps Institution of Oceanography at the University of California, San Diego, has uncovered a warming trend over the last 50 years through a comprehensive comparison of temperature points throughout the Antarctic Ocean. Gille discussed these results at the 2002 Ocean Sciences meeting of the American Geophysical Union last Wednesday, February 13. The study will be published in the current edition of the journal Science.

The Southern Ocean, the body of water surrounding Antarctica, has long been known by ocean voyagers as a harsh seagoing destination. However, it plays a key role in global climate conditions. With no continental barriers, the Southern Ocean serves as a conveyor belt, transmitting climatic signals between the Pacific, Atlantic, and Indian oceans. "It's a very climatically sensitive region," said Gille, an assistant professor at Scripps. "We can think of it as a canary in a coal mine for telling us what may happen to the global climate. What's happening in the Southern Ocean can give us a picture of what could be exchanged into all of the ocean basins and into the latitudes where people live." Gille's study uses information collected during the World Ocean Circulation Experiment (WOCE). In the 1990s, WOCE researchers deployed a series of Autonomous Lagrangian Circulation Explorer (ALACE) floats, instruments originated by Scripps Professor Russ Davis that sink to a predetermined depth and follow ocean currents for 10 to 25 days. They then rise to the surface to relay their position and temperature information via satellite (Davis has since developed a new generation of floats called Sounding Oceanographic Lagrangian Observers or SOLOs). More at http://scrippsnews.ucsd.edu/.

VOICES OF INNOVATION TO PROMOTE ENGINEERING AWARENESS

The American Association of Engineering Societies, of which the IEEE is a founding member, is sponsoring *Voices of Innovation*, a daily radio series of 2-minute radio spots featuring engineers talking about their innovations, careers and work. Each day the program will tell how engineering contributes to the overall well-being of society.

Voices of Innovation allows engineers to tell their own stories and speak with personal passion about their professions and how engineering affects everyday life. A pre-launch demo CD has been produced featuring engineers talking about artificial hands, earthquake engineering and the world's fastest plane.

Voices of Innovation is slated to begin on 1 April 2002 and run through 31 March 2003. It is made possible by a generous grant from the United Engineering Foundation and is being produced by Jim Metzner, the radio personality behind the widely successful program Pulse of the Planet. Several major-market radio stations have expressed interest in carrying the series.

For more information and to submit your story idea, go to <http://www.voicesofinnovation.org>. You may also contact David Gately - AAES director, communications and public awareness - telephone + 1 202 296 2297; "MailTo:dgately@aaes.org".

The AAES is a multidisciplinary organization dedicated to advancing the knowledge, understanding, and practice of engineering in the public interest. Its members represent the mainstream of U.S. engineering -affecting over 1 million engineers in industry, government and education. For more information, go to <http://www.aaes.org>.

WHITE SHARKS SAID TO MIGRATE ACROSS THE PACIFIC

Pacific Grove, California — The largest and most powerful predator in the sea, the great white shark, has been tracked by satellite and found to travel across vast stretches of open ocean. Researchers studying white sharks along the California coast have long believed that they spend most of their lives close to shore, pursuing seals and sea lions. But a newly published study by six California scientists from three institutions has documented the migrations of six sharks, including a male tagged along the Central California coast, who swam thousands of miles to the warm waters off Hawaii. The study, "Expanded Ecological Niche for White Sharks," appears in the January 3 issue of the journal Nature.

To monitor long-distance migrations, the researchers attached pop-up satellite archival tags to the backs of six adult white sharks near seal rookeries in California between 1999 and 2000. The electronic tags recorded data every two minutes on water depth, temperature, and light. "The migrations and environmental preferences of white sharks have remained elusive," observed Barbara Block, the Charles and Elizabeth Prothro Professor of Biological Sciences at Stanford's Hopkins Marine Station here. "Until this study," said Block, "white sharks had only been tracked for a few days around seal colonies. With the advent of new electronic tagging technology, we can now track their movement, depth, and temperature preferences over many weeks and months."

Block and Andre Boustany of the Tuna Research & Conservation Center – a joint project of Stanford University and the Monterey Bay Aquarium – were joined in the research by Peter Pyle and Scot Anderson of the Point Reyes Bird Observatory in Stinson Beach, California, as well as biologists Burney Le Boeuf and Scott Davis of the Institute of Marine Sciences at the University of California/Santa Cruz. "I was shocked by the results," said Le Boeuf. "Going into this, what we expected was that white sharks were just coastal animals that breed in Southern California, then migrate a few hundred miles north to feed on seals. But it turns out they've got a life at sea, and when they're in the open ocean, they're diving very deep at times."

"Light-level data allow you to calculate when sunrise and sunset occurs," said Point Reyes biologist Pyle, who has been has been studying white sharks for 15 years. "From the light data, we can calculate the longitude and latitude of the fish." Each tag was programmed to detach from the animal on a specific date, then pop up to the surface where the data were transmitted via the Argos satellite system to computers at Hopkins Marine Station. A marine hunter, the white shark (Carcharodon carcharias) is the world's largest predatory fish, reaching 21 feet in length and weighing up to 4,800 pounds. The six sharks tagged during the study, four males and two females, ranged in size from 11 to 15 feet. All six were tagged in the fall: four near Southeast Farallon Island, a national wildlife refuge about 30 miles west of San Francisco, and two near Año Nuevo Island about 55 miles to the south. The sharks are easy to tag because they are attracted to the numerous elephant seals that congregate on these islands.

OCEAN DRILLING REVEALS CLUES ABOUT WARMER EARTH

Washington, D.C. — Scientists using cores from far below the ocean floor are uncovering details about the warmest period on earth in the past 65 million years. During the warm Eocene period (34 to 55 million years ago), the first recognizable mammals appeared in North America, palm trees were found in the Rocky Mountain region, and alligators were found as far north as the arctic. The Eocene time period and its associated oceanographic and climatic regime appears to have begun very quickly, with a warming on the scale and rate of modern global warming, and ended almost as abruptly. A recent research expedition aimed to find out how and why this warm climate period began, maintained itself, and ended. Scientists found the transition from the Eocene to the modern world occurred abruptly, with major ocean circulation changes.

The Ocean Drilling Program drillship JOIDES Resolution left Honolulu, Hawaii, in late October with 28 scientists from eight nations gathered to focus on understanding the Eocene. Led by co-chiefs Mitch Lyle, from Boise State University, and Paul Wilson, from the U.K.'s Southampton Oceanography Centre, the shipboard scientists analyzed drill cores from eight sites near the Eocene equator. Because the drift of the earth's plates moves north in the Pacific, the area studied was north of the modern equator, about half way between Hawaii and Mexico. From these sites, scientists recovered cores that contain continuous records from this warm period that were not previously available. Results of the on-board studies reveal a very different equatorial oceanographic world in the Eocene. Co-Chief Lyle remarked," The Eocene isn't subtle, it sort of hits you in the face." Today, wind systems from the northern and southern hemispheres come together and stir the ocean near the equator such that deep, nutrient-rich waters come to the surface and support a thriving and diverse community of plankton. Fossil remains of these plankton provide the primary geological record of equatorial processes.

The Ocean Drilling Program is an international partnership of scientists and research institutions organized to study the evolution and structure of the earth. C. Nigrini, a scientist participating the expedition, remarked, "The opportunity to work with an international team, all coming together to work on a single grand problem, is always a thrill." Although the cruise ended in December, these scientists will continue to study the cores to make additional scientific discoveries. ODP is funded principally by the National Science Foundation, with substantial contributions from its international partners. The Joint Oceanographic Institutions (Washington, D.C.) manages the program. Texas A&M University (College Station, Texas) is responsible for science operations, and Lamont-Doherty earth Observatory of Columbia University (Palisades, New York) is responsible for logging services. More at http://www.joi-odp.org/.

IEEE XPLORE ENHANCED

IEEE Xplore Release 1.3 has been launched with several enhancements. Among them are:

- *New This Week - lists four weeks of the newest content.
- *E-mail Alerts - sends a notification when a journal or magazine title
- of interest becomes available.
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U.S. OFFICE OF NAVAL RESEARCH SEEKS $l6 MILLION IN RESEARCH PROPOSALS

Arlington, Virginia — The U.S. National Oceanographic Partnership Program is soliciting research proposals. Point of contact is Brian Glance, ONR code 252, at +1 (703) 696-2596. According to a broad area announcement, NOPP has available up to $16 million in funding, subject to "appropriation and final approval by the National Ocean Research Leadership Council. Team efforts among academia, industry, and government participants are required (at least two of the three). Cost sharing or proposals augmenting ongoing partnership efforts are very strongly encouraged."

The central focus of the partnership program is an integrated and sustained ocean observation system achieved by a federation of many elements to support a wide range of users. The following topic areas form the basis of the NOPP investment portfolio: operational/routine observations (including pilots, testbeds, etc.), research "observatories" (long-term experiments and data series, etc.), observational technique development (sensors and platforms), "commons" for ocean information (hubs and nodes, etc.), and outreach/education. These investment areas are more fully described at http://www.nopp.org/NOPPfunds.html where examples of ongoing NOPP efforts are also listed by these areas.


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The OES Digital Archives

The Oceanic Engineering Society digital archive is here! Developed as a service to the OES members, this project was initiated in November 1999 and completed in August 2001. The archive is accompanied by the AstaWare Search Engine, and all documents, almost 9600 papers and articles, are full text searchable. The CD set is PC-compatible under Windows 95, 98, NT and 2000; Mac-compatible under Macintosh 9.0 and above (a bit squeamish on OS X); and UNIX-compatible on a variety of platforms.

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