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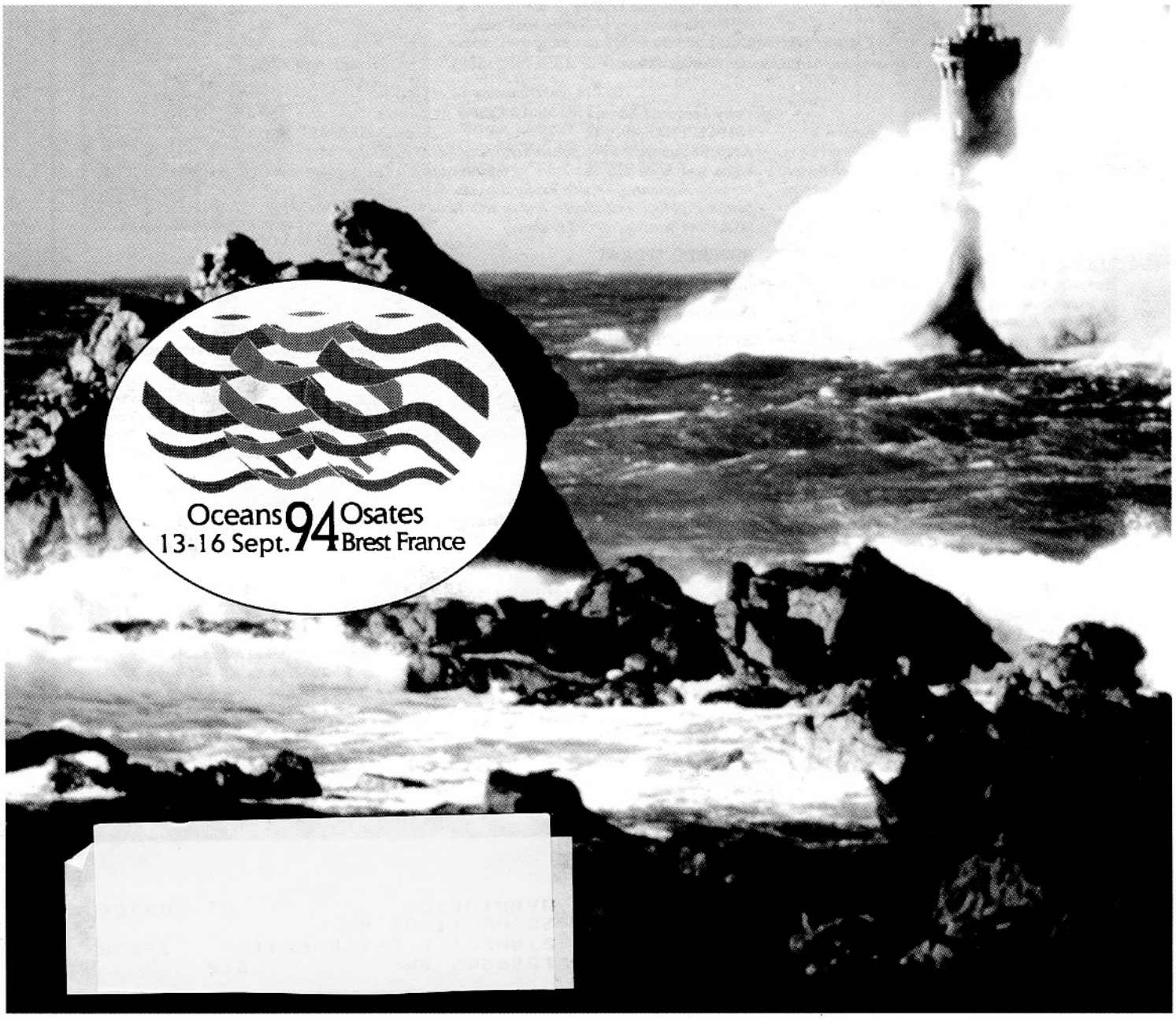

IEEE OCEANIC ENGINEERING SOCIETY

(Continued on back cover)

CHAPTER CHAIRMEN

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. $1.00 per member per year (included in Society fee) for 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

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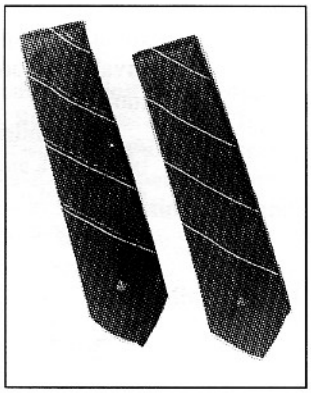

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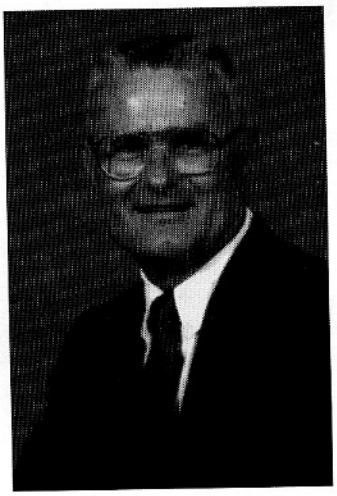
A Message to OES Members — Get Involved!



The OES is a very dynamic organization within the IEEE. It has remained so through the dedicated participation and service of its members, particularly those persons who have served the Society on the Administrative Committee (AdCom), various Technical Committees, Conference activities, as well as other volunteer assignments within the OES.

We are now seeking Society members who wish to serve on the AdCom during the next two terms, 1994-1996 and 1995-1997. The upside of such participation is manyfold, but for example, networking with a group of dedicated professionals, bringing your input to the table and giving a little something back to your profession. I personally have found the experiences most rewarding and the friendships invaluable, and I urge you to take advantage of the opportunity.

The nomination process is simple — nominate yourself or a friend (with their permission of course), and pass the information along to me at (409) 845-5484 or FAX (409) 847-9284, and I'll take it from there.

I hope to see you in Brest, France for Oceans '94 Osates.

Oceanic Engineering Society Awards

The OES presents two awards annually at the Oceans Conferences. These awards are the Service Award to the Society, and the Technical Achievement Award. I would like to take this opportunity to open the nominations for these awards to the body of the OES.

The Service Award has traditionally been presented to members of governing organizations in the Society, such as the AdCom. However, exceptions have been made in the past, in presentations to members of the IEEE staff. The recipient of this award should be a member of the IEEE.

The Technical Achievement Award is one given to any person who has contributed significantly to the field of electrotechnology in the ocean. Achievements must be technical in nature, and they must have been recognized as major advances by the oceans community. The recipient of this award is not limited to IEEE members.

The awards process in the OES is secret, and the nominees must not be aware of their nominations. The Society will notify the award winners at the appropriate time to allow their voluntary participation in the awards process.

I would welcome your nominations for either of these two awards. They are the highest forms of accolades given by the Society, and are held in high regard by the community. Please call me at (409) 845-5484 or fax me at (409) 847-9284 and we'll discuss the brief nomination package to be prepared to be submitted to the OES Awards Board.

Glen Williams

OCEANS 94 OSATES

Ocean engineering for today's technology and tomorrow's preservation

Oceans 94 Osates
13-16 Sept. 94 Brest France

IEEE OES see Communauté urbaine BREST

Parc de PENFELD, BREST, FRANCE
13 -16 September 1994

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Locating OCEANS 94 in France, for its first venue outside North America, is a major move in the long and successful series of OCEANS annual conferences. Sponsored by IEEE/OES, SEE (Société des Electriciens et des Electroniciens) & CUB (Communauté Urbaine de Brest) OCEANS 94 OSATES will increase international cooperation and expand our contributions to worldwide ocean monitoring programs.

The TECHNICAL PROGRAM will include 8 parallel sessions of over 300 technical papers with additional poster sessions, along the following topics:

1 - Underwater Acoustics
2 - Detection, Classification & Localization
3 - Boundary Effects & Propagation
4 - Matched Field Processing/Tomography
5 - Sonar Signal Processing
6 - Transducers & Arrays
7 - Ocean Monitoring Systems
8 - Water Currents
9 - Polar & Severe Environments
10 - Oceanographic Instrumentation
11 - Remote Sensing
12 - Metrology & Calibration
13 - Autonomous Benthic Stations
14 - Satellite Oceanography & Meteorology
15 - Signal & Information Processing
16 - Modeling, Simulation & Data Bases
17 - Neural Networks & Fuzzy Systems
18 - Knowledge-Based Expert Systems
19 - Geographical Information Systems
20 - Non-Acoustic Imaging
21 - Supercomputers
22 - Communication, Navigation &Control
23 - Autonomous Vehicles
24 - Satellite Navigation / GPS
25 - Underwater Telemetry & Communications
26 - Underwater Robotics
27 - Intelligent Control
28 - Power Sources

IEEE/OES is also sponsoring a special STUDENT POSTER SESSION for graduate and undergraduate students.

TUTORIAL SESSIONS, sponsored by SEE, will cover topics selected from the Technical Program. They will take place on Monday 12 September from 9 a.m. to 5 p.m. at Faculté des Lettres, Bd Clémenceau, Brest.

A large BUSINESS EXHIBITION will be held in conjunction with the Conference, and a NAVAL EXHIBITION of Ocean Research Vessels will take place in Brest Harbor. Thousands of people working in Industry, Government and Academia in areas relating to Ocean Science and Technology will be attending OCEANS 94 OSATES in order to promote their activities and, through the TECHNOMER Business Convention, establish effective business links worldwide.

BREST is France's foremost site for oceanographic R&D and marine technology, employing more than 60% of French scientists, engineers and technicians in the field.

To receive the Advance Program in May or for further information, please contact:
OCEANS 94, Computer Science Department, Texas A&M University, College Station, TX77843, USA -
Fax.(409) 847-9284, e-mail: oceans94@cs.tamu.edu
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OCEANS 94 OSATES

Ocean engineering for today's technology and tomorrow's preservation

OCEANS 94 OSATES will be held 13-16 September 1994 in Brest, France. This is the first venue of the OCEANS Conference outside North America, and our goals are focused on quality while encompassing breadth of scope, including international programs dedicated to ocean modelling and monitoring.

OCEANS 94 OSATES, with 350+ papers in over 50 sessions, additional poster sessions and a special student poster competition, offers a complete coverage of all aspects of oceanic engineering. Together with an update of the state of the art, there will be many illustrations of applications to practical systems and operational results, as well as broad overviews of modem oceanography objectives and practices.

Also on the eve of the conference, tutorials covering several oceanic engineering topics will be presented. They will be followed by an open evening session on the conquest of the deep oceans.

The OCEANS conference will also be complemented by:

- the Autonomous Underwater Vehicles workshop,
- the Technomer business convention,
- a large business exhibition held in close conjunction with the conference,
- a naval exhibition of ocean research vessels in Brest harbor, and
- visits to research centers in the Brest area.

The program has been designed around tightly specialized sessions that deal with specific technologies or applications. The sessions are organized into seven generic groups in order to facilitate each delegate's personal planning:

Ocean Monitoring and Modeling

Satellite Sensors and Data for Oceanography

Underwater Robotics and Vehicles

Instrumentation Development and Deployment

Theoretical and Applied Information Analysis

Underwater Acoustics, Wave Propagation and Modeling

Applied Underwater Acoustics Systems

The presentations will be 15 minutes long, at 20-minute intervals, with up to nine parallel sessions. To minimize the frustration of wanting to hear papers in simultaneous sessions, every effort will be made to keep all papers synchronized.

Morning sessions start at 8:55. Coffee breaks, held in the exhibits area, will be timed to synchronize with the non-simultaneous endings of the parallel morning sessions. Extended length sessions will reconvene after lunch.

A special panel will also add to OCEANS 94 OSATES. "The Future of Ocean Science and the Needs for Year 2000 and Beyond" brings together top managers of ocean research and development from several countries. This will be an opportunity to check and extend the forecasts presented at the similar panel held during OCEANS '93.

The plenary session, following the opening session, will be based on the Global Oceans Observing System presented by Dr. Michel Glass, the Marine Science and Technology program of the European Union presented by Mr. Jean Boissonnas, and UUV's Today and Tomorrow presented by Mr. Charles Stuart.

A social program has also been arranged. It gives you the opportunity of more professional contacts and the chance to enjoy the French Celtic hospitality. A welcome cocktail hour for all the Conference participants will be held at the Brest City Hall on Tuesday, September 13 at 6:30 pm. The Official Dinner, co-presided by the Admiral and Maritime Prefect of the Atlantic Maritime Region and by the Mayor of Brest, will be held in a beautiful building overlooking the Brest roadstead, at the Centre d'Instruction Navale (CIN) (The French Naval Academy), Avenue de l'Ecole Navale, Brest, on Wednesday, September 14 at 8:30 pm.

For those wanting to explore the countryside, Brittany offers its rocky coasts and beautiful beaches, its traditional fishing harbors and the archeological and architectural treasures of five thousand years of civilization.

In OCEANS 94 OSATES,you will meet all the scientists and engineers, from Europe and America, working in Industry, Government or Academia in areas relating to Ocean Science and Technology.

We hope that you will be with us in Brest this September to participate in this unique event.

Travel Tips for OCEANS 94 OSATES Attendees from North America

Glen N. Williams

During the planning process for OCEANS 94 OSATES over the last two years, I have made several trips to Brest, France in my capacity as the Oceanic Engineering Society's representative on the Conference Steering Committee. The following Travel Tips are offered to those prospective attendees at the conference who may not have traveled in France recently, fully realizing that seasoned European travelers will certainly do their own thing. I think that the best Tip I could offer is to be flexible and appreciate the French experience.

If you check a world map, Brest is located on the westernmost tip of France, jutting quite far into the North Atlantic Ocean. You can get to Brest either by air or sea ferry from England, for those who will be stopping over in the UK. You can also get to Brest from Paris by train (4 hours) or bus or car (5 hours). My comments, however, will concentrate on traveling from North America to Paris to Brest, by air.

The IEEE Travel Service has been chosen as the official OCEANS 94 Conference North American travel agency and they can be contacted at 800-879-4333 (fax 908-981-0538); as for Addy Zeni. There are two major airports in Paris — Orly and Charles de Gaulle airports. However, to get to Brest from Paris, travelers must fly Air Inter, a subsidiary of Air France. Air Inter only flies out of Orly airport, hence the recommendation of an airline which flies from North America into Orly. If you choose to fly into Charles de Gaulle airport, please be aware that you will have to take the train (RER line B, change at Antony with direct access to ORLYVAL train: 1 hour), or the shuttle bus (45 minutes), to get to Orly to catch the Air Inter flight to Brest. Also, Orly airport has two terminals, Orly Sud (South) and Orly Ouest (West). North American carriers fly into Orly Sud, and Air Inter flies out of Orly Ouest. You will have to gather your luggage and go through Immigration and Customs at Orly Sud. Then you can take the unmanned, automatic ORLYVAL for the short 1/4 mile trip to Orly Ouest. Once you get to Orly Ouest, the Air Inter ticket counters are right on the first level, and all of the agents speak English.

When you get to Brest, you can take a taxi to your hotel or you can rent a car. Please note that CITER is offering a special discount for the participants to OCEANS 94 OSATES through Voyages en Bretagne. My suggestion is that, if you rent a car, buy the insurance, as most U.S. insurance coverage is not effective in Europe. Also, if you rent a car, reserve it well ahead of time from North America with a confirmed rate, which includes drop-off charges (if any), insurance (if any), and the French Value Added Tax, or VAT. (Rental cars are extremely expensive in Europe if you have to rent them on arrival.)

Hotels in France are graded on a star system, with one star being the cheapest and four stars the most elegant. I do not recommend staying in a one star hotel. Two star hotels are acceptable, albeit with smaller rooms and some rooms without private baths. Three star hotels are normally quite nice, but you must still specify a private bath if you so desire. There are no four star hotels in Brest. (I have stayed at both two and three star hotels in the city, and the old adage "You get what you pay for" is true. However, I have also stayed at some two star hotels in other parts of France which are as good or better than some three star facilities.) You will have to make your hotel reservations through the Voyages en Bretagne company whose contact information is:

V.E.B.
Alain Perrier
2, rue Branda
29200 Brest - France
Tel: (33) 98.44.41.00
Fax: (33) 98.43.22.95

Brest is an ocean-oriented industrial based city with a quite pleasant downtown area within walking distance of most major hotels. The countryside and the coastline of Bretagne, or Brittany, is very beautiful and I would suggest that you take advantage of the scenery and the Celtic hospitality as much as possible.

There are a number of points of interest inside Brittany, with wild and protected scenic areas, marvelous little churches of the 15th and 16th century, and old cities like Locronan, Quimper, etc. within less than an hour by car from Brest. Do not forget Ushant Island, a part of the Natural Regional Parc where you can go by ferry or by the local air company Finist'air.

For those who want to travel a bit in France, I would suggest the monastery Mont-Saint-Michel, and the Normandy coastline and beaches, just a bit northeast of Brest. (The beach area will possibly be crowded as this year celebrates the 50th anniversary of the Normandy Invasion.) Also there's the Loire valley with its chateaus a bit inland of Brest. And one of the many wine regions, Bordeaux, southeast of Brest. Mary and I have driven quite a bit in France, and driving is not a problem, although you do have to be careful, particularly on the French superhighways.

When you return to Paris from the west or the southwest, stop at Chartres (80 km SW of Paris) where there is one of the most magnificent cathedrals of Europe (12th century) with its famous stained glass windows.

Paris. If you have the opportunity, I would suggest a several day stopover in Paris. (From Orly airport, you can get into the city via taxi, or you can take the Orlybus (my suggestion) or ORLYVAL train (connection at Antony station with the RER B) to the major Paris Metro station Denfert-Rochereau. From Denfert, you can transfer to the appropriate train to your destination. The Orlybus stop is in front of the airport, and

there are train stations inside both Orly Sud and Orly Ouest. Note that there are several bus stops directly in front of Orly Sud, and you will have to read the signs, in English, as to which bus goes to Denfert.) Why go to Paris? The Lourve. The Eiffel Tower. Notre Dame, and the tiny little streets of the oldest part of Paris just nearby on the left bank. Arch de Triomphe. Saint Chapelle. Versailles. Museums. Restaurants. Enough said.

Traveling in France is not like Minneapolis, LA, Atlanta or New York, due mainly to the differences in culture and language. I'm certainly not an expert, but we've managed. I would be happy to help you with any questions you may have, if I can, or to put you in touch with my Travel Agent. Please call or fax me at:

Glen N. Williams
Phone (409) 845-0086
Fax (409) 847-9284

In an emergency in France, or if you need help in a particular situation, I will be staying at the Altea Hotel Continental (telephone 98.80.50.40, fax 98.43.17.47). Give me a call and we'll work the problem. During the day, I'll be at Parc Penfeld (telephone 98.47.88.00, fax 98.03.31.27) and will be available should questions arise.

Report from Underwater Acoustics Technology Committee

In the Spring 1993 issue of the IEEE Oceanic Engineering Society Newsletter (Volume XXVIII, Number 1), Stan Chamberlain, Technical Committees Coordinator, presented a very fine overview of the technical scope of the Oceanic Engineering Society. The review also included individual committee technical scope statements. The statement for underwater acoustics is repeated below:

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

To see that these topics are representative of current underwater research and development, one needs only to scan papers recently submitted to OCEANS conferences. For example, last week I received preliminary information on the OCEANS 94 OSATES Conference to be held in Brest, France, 13-16 September 1994. It is interesting to note that 120 underwater acoustics papers have been accepted for presentation and publication in the Proceedings. The papers, which come from both North American and non-North American authors, have been grouped in two broad categories: Underwater Acoustics Wave Propagation and Modelisation, and Applied Underwater Acoustics Systems. Together these groups account for 16 sessions adequately covering the topics mentioned in the statement above. In particular I would like to point out that there are special sessions on Biological Acoustics (mammal signal characteristics) and New Materials For Transducer Design. There is also a session on Environmental variability in Littoral Regions in the Ocean Monitoring and Modelisation category. This session covers both non-acoustic and acoustic shallow water issues and has application to commercial as well as military interests. It is also indicative of the military's growing concern with shallow water regions.

With the end of the cold war, there has been not only a switch from deep water to shallow water acoustics, but there has been increased activity in environmental acoustics. The use of underwater sound to carry out ocean surveys and bottom mapping with high resolution, monitor pollution levels, remotely determine oceanic and bottom parameters, etc., is reflected in our JOE and in the OCEANS Proceedings. This bodes well for the future of underwater acoustics. To those who have contributed, a sincere "well done" and "keep up the good work"!

Bob Farwell
Chairman
Underwater Acoustics Technology Committee

(Reprinted from Oceans '93 Conference Proceedings)

Statistics of Shallow Water, High-Frequency Acoustic Scattering and Propagation

Marcia A. Wilson, Robert W. Farwell, and Steve Stanic
Naval Research Laboratory, Code 7174
Stennis Space Center, MS 39529-5004

Abstract — During August 1991, the Naval Research Laboratory conducted high-frequency shallow water acoustic scattering experiments in the Gulf of Mexico near Panama City, Florida. The acoustic measurements included surface and bottom reverberation, surface and bottom forward scattering, and direct path propagation. The results reported here are confined to the direct and bottom forward reflected paths and include the statistical characteristics of three signals; namely, the direct, the bottom reflected, and the direct plus the bottom reflected. Representative envelopes will be presented that illustrate the complexity of the shallow water environment. Statistics, including the means, variances, and probability distributions for each signal, are presented to discern any differences that can be exploited in the detection process. The frequency range covered during the experiment was from 20 to 180 kHz. The supporting environmental measurements included sound speed profiles, currents, wave heights, and bottom samples.

INTRODUCTION

A need exists for high-frequency acoustic measurements to support the safe operation of ships in shallow water. An understanding of the variability and statistical properties of direct and boundary-reflected acoustic signals in the shallow water environment is essential to the U.S. Navy. Statistical properties of high-frequency acoustic bottom reverberation have been reported by Chotiros *et al.* [1]. They found that the fluctuations followed a Rayleigh probability density function (PDF) for a widebeam receiver, but, for narrower beams, the PDF fit a log normal model. Stanic and Kennedy found that the distributions were not only dependent on beam width but also on frequency, range, and grazing angle for both a shell-covered sand bottom [2] and a smooth sand bottom [3]. McDaniel [4] has developed a model that predicts the beam-width dependence reported by Chotiros *et al.*

This paper presents the results of the analysis of signals propagated along the direct path and forward scattered from the seafloor. Means, standard deviations, coefficients of variation, and probability distribution functions are presented as functions of frequency for the direct, direct plus the bottom reflected, and the bottom reflected signals.

This work was supported by the Office of Naval Technology, Program Element 0602435N and by Naval Research Laboratory High Frequency Bottom Scattering, Program Element 0601153N managed by NRL. The NRL contribution # is NRL/PP/7174- -93-0025.

EXPERIMENT

In August 1991, measurements of shallow water direct path propagation, bottom forward scatter, and bottom backscatter were made in the Gulf of Mexico 30 miles off the coast near Panama City, Florida. Two acoustic towers were carried on the deck of the HAWKE SEAL, an offshore oil field supply boat, to the site of the experiment, and lowered to the bottom. The water depth was 30 m and the range between the towers was 90 m. One tower was equipped for transmitting and receiving and the other for receiving only. Horizontal and vertical receiving arrays consisted of 16 hydrophones. Eight hydrophones were positioned along the horizontal array which was 7.6 m from the seafloor. The remaining 8 hydrophones were on the vertical array. Only data from Hydrophones 21, 22, and 24 on the horizontal array, and Hydrophones 25 and 27 on the vertical array have been analyzed for this paper. The positions and spacings of the hydrophones are given in Fig. 1. Two sources were used to generate signals between 20 and 180 kHz. Although they are located on the other tower, the backscatter tower, their positions are shown in Fig. 1. The center of the lower frequency source (20 to 90 kHz) was located about 15 cm below the horizontal array, and the center of the higher frequency source (90 to 180 kHz) was located adjacent to the other source about 10 cm below the horizontal array. For these measurements the maximum response axes of the sources were

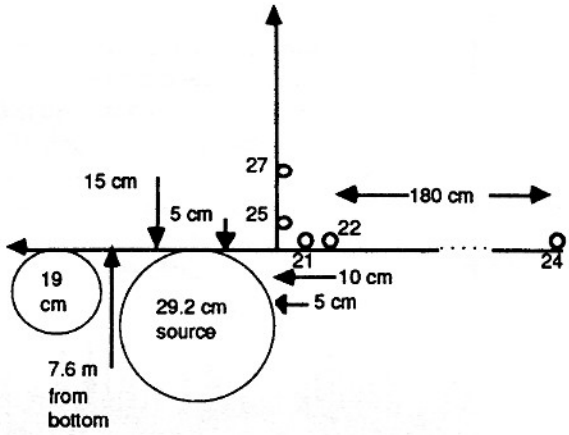

Fig. 1. Hydrophone and source positions. Numbers next to the open characters indicate positions of each hydrophone on the forward scatter tower used in this report. Arrows on the axes indicate the structures extend beyond that shown. Other lines with arrow indicate distance from the array axes and between Hydrophones 22 and 24. The source locations on the backscatter tower are shown here for convenience.

pointed at the arrays so the bottom was ensonified by off-axis portions of the main beam or by the side lobes. The signals used were 1.0-ms continuous wave pulses with a repetition rate of 1 sec.

A number of environmental parameters were measured in support of this experiment. These included sound speed profiles, currents, wave heights, and bottom sediments. The SANTA ROSA, a 33-m workboat assisted the HAWKE SEAL in diver operations, deployment of environmental sensors, deployment of anchors, and the collection of bathymetric data [5]. A representative sound speed profile is shown in Fig. 2. The two acoustic towers were deployed in an area characterized by sand ridges with an average RMS wave height of 0.5 cm.

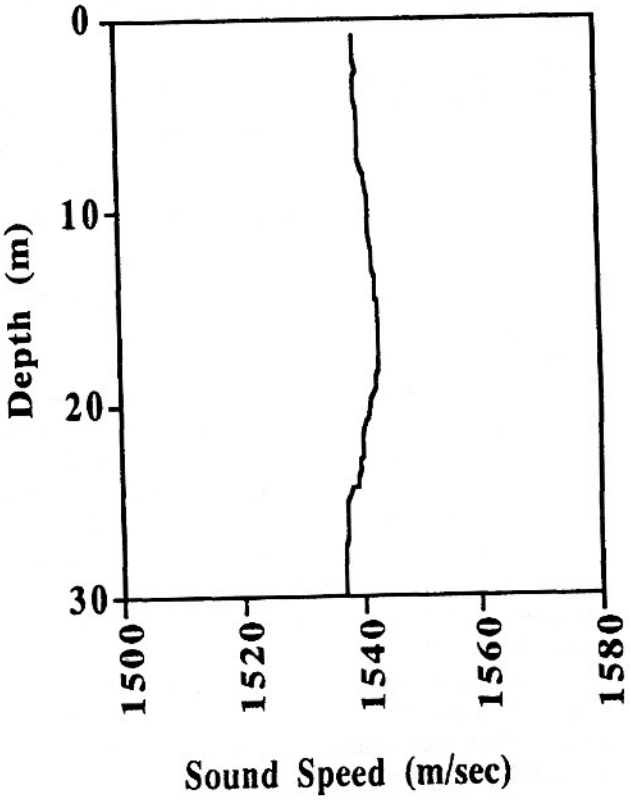

Fig. 2. Sound speed profile from the Panama City 1991 Experiment.

ACOUSTIC DATA ANALYSIS

The output from each of the hydrophones was fed through a computer controlled variable gain amplifier, band shifted to 5 kHz, low pass filtered, and sampled at 20 kHz. The envelope derived from the time series has one sample every 0.1 millisecond. A typical example of this data is shown in Fig. 3. A total of 100 milliseconds of data was collected from each hydrophone. The data contain signals from the direct and bottom reflected paths, as well as surface reflected paths. This paper addresses the relative amplitude fluctuations for the direct and bottom bounce paths. Because of the geometry, their arrival times are separated by 0.9 ms as shown in Fig 4. For this reason only short, 1-ms pulses are considered. The frequencies included in this report are 25, 40, 60, and 90 kHz from

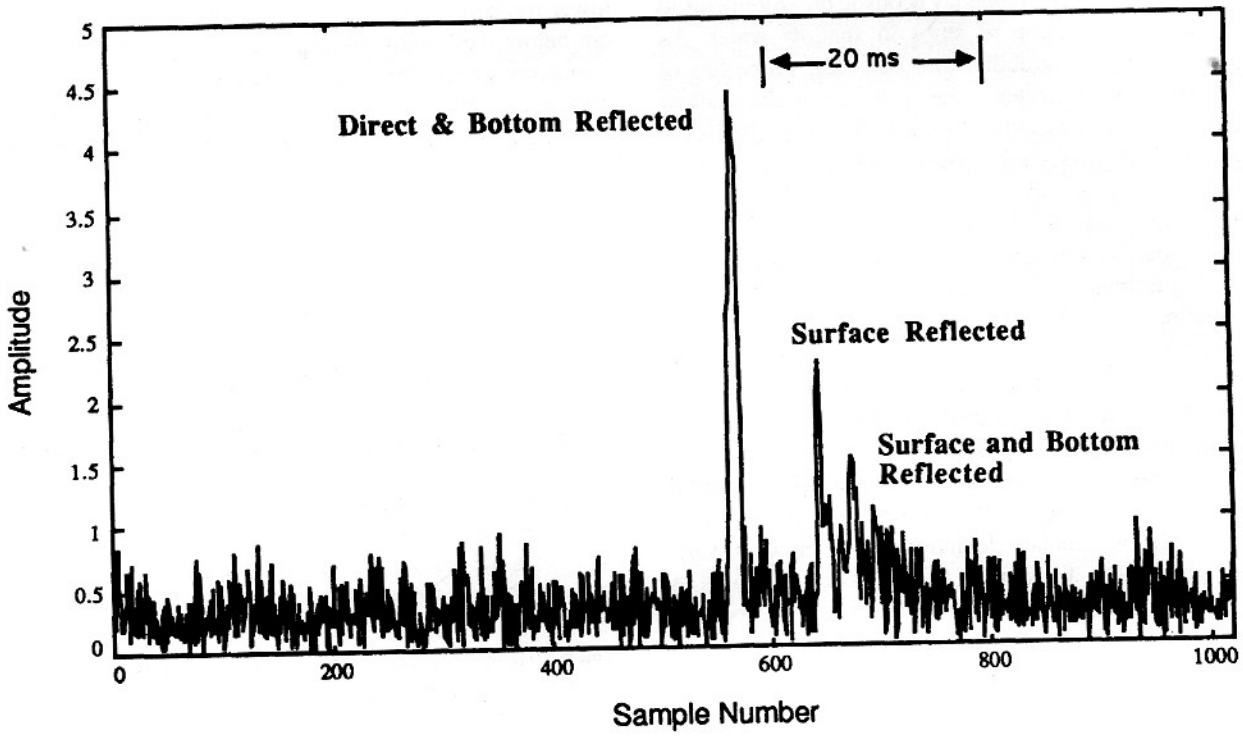

Fig. 3. Envelope of representative received signal indicating paths of main arrivals.

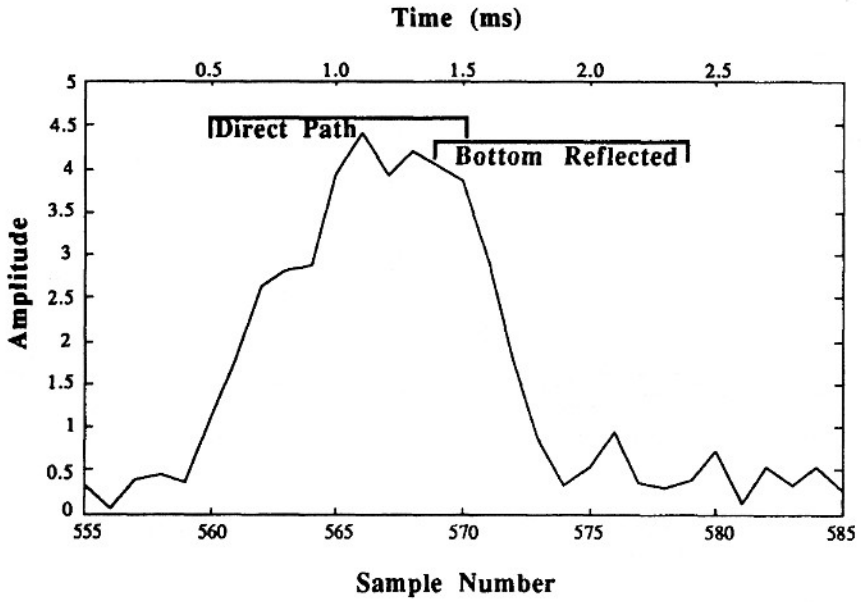

Fig. 4. Expanded view of the direct and bottom reflected arrivals from Figure 3 showing the overlapping portion.

the low frequency transducer, and 90, 130, 150, and 180 kHz from the high frequency source. Table 1 shows the source beamwidths. For each of these configurations a 100-pulse data set was collected and analyzed.

Eight representative examples of time series envelopes for selected individual signals are shown in Fig. 5. They are characterized by fluctuations in amplitude that appear greater for a given pulse at different hydrophones than for different pulses for the same hydrophone. These trends are maintained for 100-pulse averages. Since the towers are stationary, the fluctuations observed must be due to multipath effects in the water column, or interference between the direct, bottom reflected, or subbottom scattered paths.

Each of the 100 pulses for each frequency starts at the same time relative to the time when the signal is transmitted (about sample number 560). Samples 562, 570, and 576 were chosen as representative of the direct, mixed, and bottom paths, respectively. Means, standard deviations, and coefficients of variation were calculated for these representative samples. The frequency dependence at Hydrophone 21 is shown in Fig. 6

Table 1 Beamwidths at Source Frequencies

Frequency (kHz)	Source (cm)	-3dB Beamwidth (deg)
25	29.2	12.5
40	29.2	8.7
60	29.2	5.8
90	29.2	3.5
90	19	5.4
130	19	3.7
150	19	3.2
180	19	2.7

and Fig. 7. At 90 kHz mean values for the smaller source are larger than for the larger source for the direct and mixed paths. Because the error bars overlap, this may not be significant. Figure 8 shows the differences between hydrophones at the same frequency and time for direct and bottom reflected paths. Results for several hydrophones are given at 25 kHz to show the spatial variability of these statistics.

Means for the direct path range from 1.8 to 3.2 on the relative amplitude scale used. Corresponding standard deviations are between 0.36 and 0.57 and coefficients of variation are from 12 to 32%. The means for the portion of the data containing both direct and bottom bounce returns range from 1.2 to 3.5. Most of the standard deviations are a little higher but in the same range as for the direct path. Data representing only the bottom bounce path have mean values of 0.29 to 0.85. Standard deviations are between 0.13 and 0.49. Since the coefficient of variation is the standard deviation divided by the mean, lower mean values result in higher coefficients of variation that varied from 33 to 80% over the frequency range.

Histograms like those in Fig. 9 at 150 kHz show the distributions of the amplitudes for the three parts of the signal. A Rician probability density distribution for the mean and variance of the data is also shown [6]. A relatively simple way of testing the randomness of a process is to use the randomness factor, T, which is calculated using the equation: $T = v/(m^2 + v)$ where v is the variance and M is the mean. Rician distributions with low T values are essentially Gaussian. Those with T values approaching 1.0 are Rayleigh [7]. Table 2 shows the T values derived from the statistics. Direct signals are Gaussian with the highest T value being 0.09. Bottom reflected signals are much more random, but with a randomness factor less than 0.4.

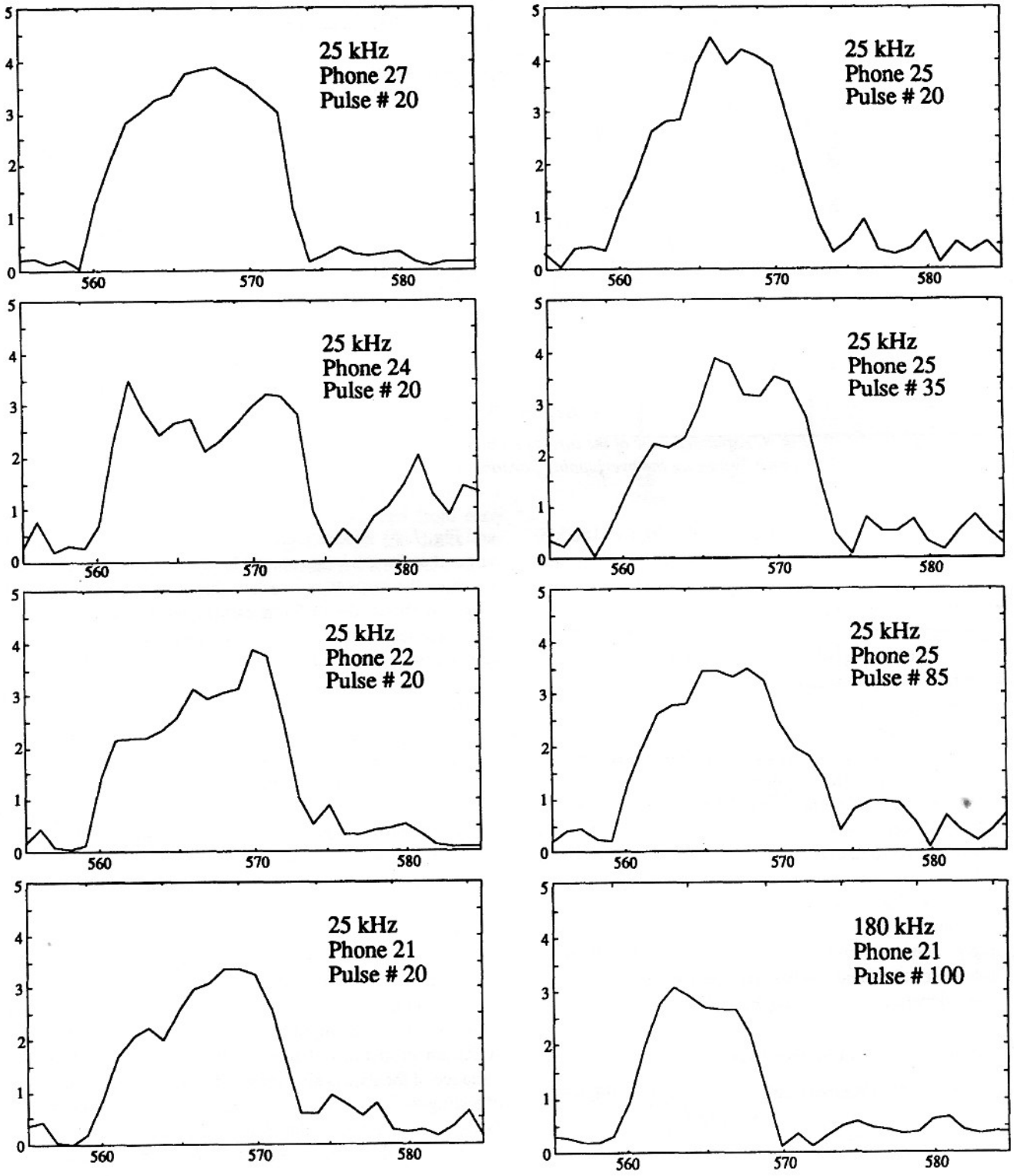

Fig. 5. Examples of variability in the time series plots with time, array position (hydrophone number) and frequency. The vertical axis is in relative amplitude units and the horizontal axis is time in sample number after the start of the data file for each pulse, with 0.1 ms time between samples, as in Fig. 4. Examples at the same frequency and pulse number were taken simultaneously at different phones. The three examples for hydrophone 25 were taken a few minutes apart at the same location.

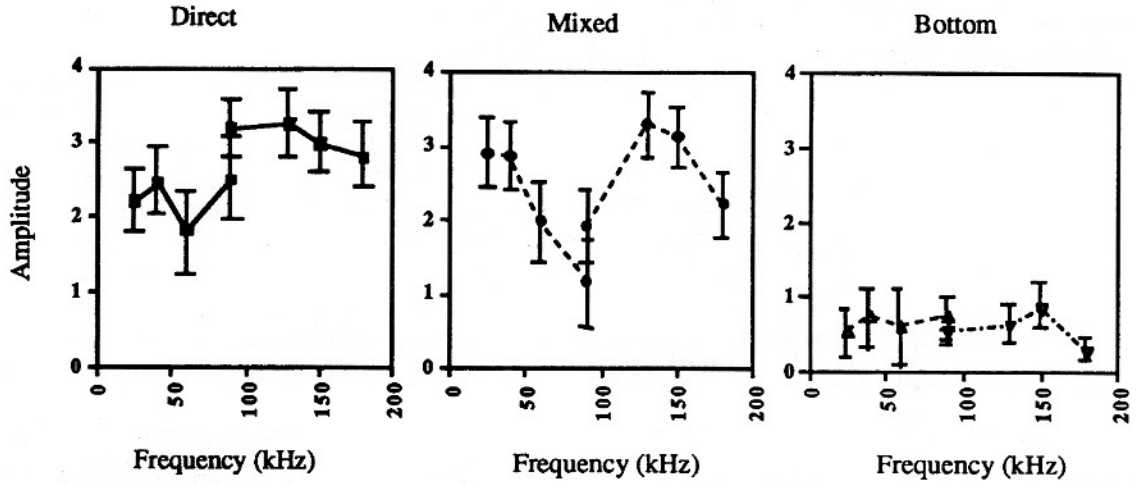

Fig. 6. Frequency dependence of mean and standard deviation (shown by error bars) from 100 CW pulses received at Hydrophone 21. There are two sets of data at 90 kHz because both sources were used at that frequency.

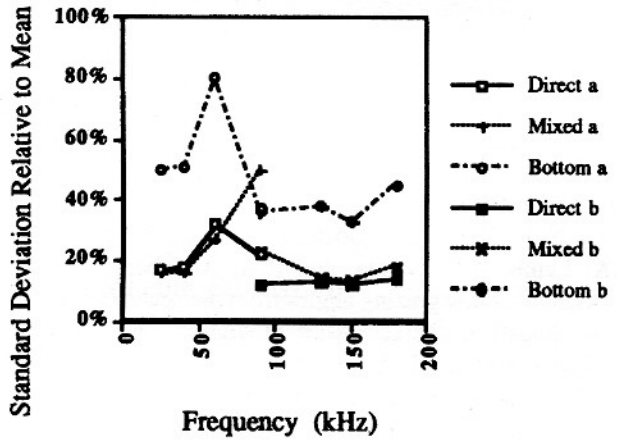

Fig. 7. Coefficients of variation for Hydrophone 21: a) 29.2-cm source, and b) 19-cm source.

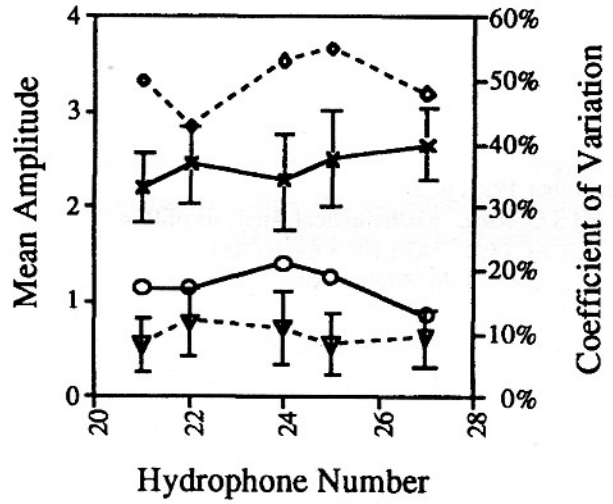

Fig. 8. Spatial variability of direct and bottom signal statistics at 25 kHz: x Mean of direct path data with standard deviation shown by error bars, o Coefficient of variation for direct path, ∇ Mean of bottom path data with standard deviation, ◊ bottom path coefficient of variation.

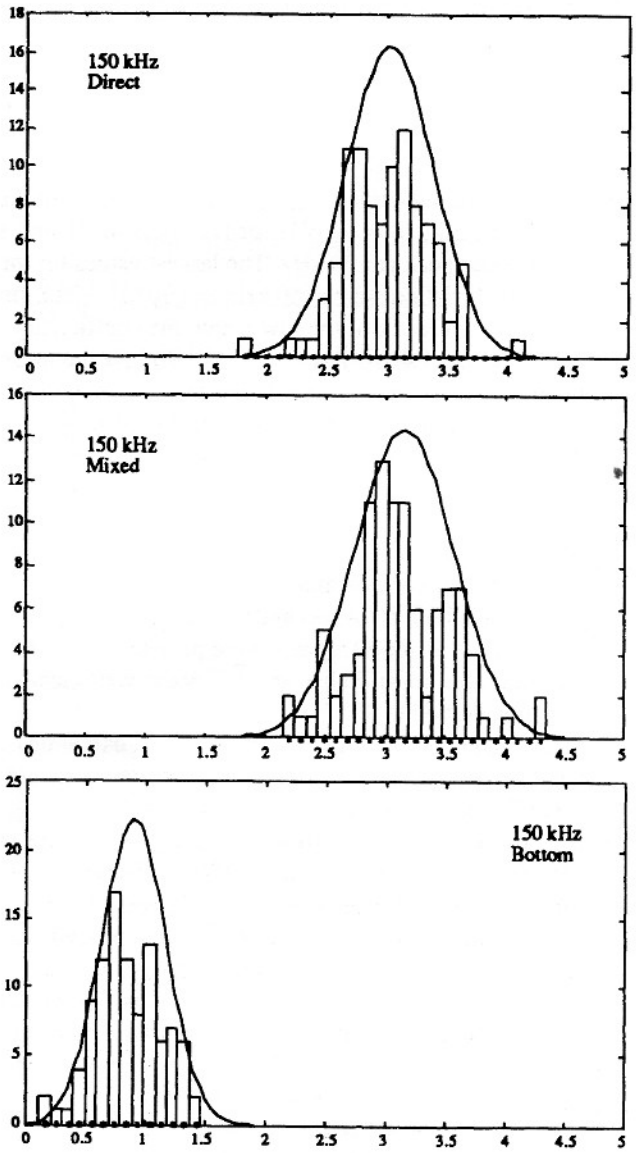

Fig. 9. Histogram of data distribution overlaid with the scaled Rician probability distribution calculated from the data statistics.

Table 2 Randomness Factor T

Frequency (kHz)	Hydrophone	Direct	Mixed	Bottom
25	21	.03	.03	.20
	22	.03	.05	.15
	24	.04	.05	.22
	25	.04	.02	.23
	27	.02	.01	.18
40	21	.03	.02	.20
60	21	.09	.07	.38
90	21	.04	.20	.12
90	21	.01	.05	.12
130	21	.02	.02	.13
150	21	.01	.02	.09
180	21	.02	.03	.18

CONCLUSIONS

Based on the analysis of data from five of the sixteen hydrophones, the following tentative conclusions can be drawn.

- The direct and mixed signal portions of the pulse contain relatively constant components of the signal as indicated by high mean values, low coefficients of variation, and low T values.
- For the direct path there is a dip in the mean value of the relative amplitude at 60 kHz for Hydrophone 21 and a slight broad peak at 130 kHz. The largest values for the standard deviation were at 60 kHz and 90 kHz (29.2 cm source). As a result of the low mean, the coefficient of variation peaks sharply at 60 kHz. At 90 kHz the mean for the 29.2 cm source was lower than for the 19-cm source resulting in a higher coefficient of variation for the larger source. It is speculated that phenomena occurring at 60 kHz are due to the microthermal variations in the water column causing path length differences on the order of 2.5 cm.
- Similar results were obtained for the mixed region of the pulse where both the direct and bottom-reflected (lower levels than the direct) signals were present, except that the minimum mean value and the peak coefficient of variation shifted to 90 kHz.
- The sound speed data are not refined enough to indicate whether changes in the thermal microstructure are sufficient to explain the shift from 60 to 90 kHz.
- For the bottom-only portion of the signal, the mean values were much lower due to off-axis ensonification. They did not exhibit any pronounced frequency dependence, however, the coefficient of variation peaked very sharply at 60 kHz. The bottom-only path is characterized by low means, high coefficients of variation, and higher T values indicative of more Rayleigh-like processes (randomness). The fluctuations must have been introduced within the water column, either by the thermal microstructure affecting the sound speed and the ensonified area, or by currents. These would account for random fluctuations in the direct path measurements as well.
- Larger variations were observed from hydrophone-to-hydrophone than from pulse-to-pulse for the same hydrophone. This indicates that interference effects from path length differences among the direct, bottom-reflected, and refracted paths through the bottom sediment are larger than those caused by fluctuations in the water column.
- For the data analyzed the direct and mixed paths follow a Gaussian distributions, while the bottom path is more Rayleigh.
- The sharp peaks in the coefficient of variation at 60 kHz and the different means and coefficients at 90 kHz for the two transducers will be investigated in experiments conducted in 1993.

ACKNOWLEDGMENTS

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Chapter Activities

Joe Czika, OES President, has appointed me chapter coordinator. I have now looked into our chapter situation and find it lacking to say the least. New Orleans, Galveston Bay, and New England Chapters are without leaders and apparently have been for some time. Some other chapters are having one or no meetings per year. We obviously need to correct this.

The OES ADCOM voted a $3000 chapter fund for 1994 with an $800 maximum per chapter. These funds are for the use of chapters to reestablish themselves, to bring in speakers or for chapter promotions in general. (A free feed — pizza maybe — or travel, room and food for a speaker are legitimate expenses for instance). I have notified the present chapter chairs of this action and have asked them to let me know of their needs. I encourage the OES members to support the chairs, volunteer where needed and especially to attend meetings when they are held. Who knows, your next job may come out of making acquaintances at the meeting in addition to learning something which may help in your present-work as well as broadening your horizon.

Look over the chapter listing on the inside cover of this Newsletter and see who leads your chapter and give them a call. If there is no leader, maybe you could volunteer or help to find someone. Please call me if I can help in any way.

Ed Early
202-525-2578

Washington/No. VA Chapter

The Washington/No.Va chapter schedules a meeting once a quarter to present to the members in the area, or anyone else for that matter, open discussions on topics that are of interest to the oceanic engineering community. We have found that a lunch time meeting is appropriate for our chapter. In past meetings we have had presentations on various subjects from the status of the program to a discussion by the JOE editor with respect to the procedures and criteria for submitting papers for publication as well as the goals of the publication. So far this year we have had presentations on the two subjects described in the following paragraphs.

In March, Tim Krout of NRL made a presentation on a telemetry system that NRL uses to assist in the collection of acoustic data at sea and real time transmission for immediate processing.

The presentation described the satellite vertical line array system used during the TESPEX experiment that successfully demonstrated real-time delivery of acoustic data. The system was discussed in two sections, the in-water system and the shore-based system. The in-water system consists of a vertical line array, data acquisition unit, Bumble Bee Buoy, array electronics and a satellite buoy communication system and was primarily responsible for the digitization, formatting and transmission of the acoustic signals from the experiment site to the satellite. The shore-based system consisting of the satellite electronics, array decoder electronics, and a quality assurance workstation was responsible for receiving the telemetry from the satellite. It was then decoded, initial data processing performed, and the signal distributed to scientists for post-processing. TESPEX II plans were discussed along with limitations of the current system. A lively discussion was generated when the prime power system was described in that it included a motor generator set in the buoy.

The second presentation was given by Clyde Nishimura a geophysicist from NRL. He discussed a project he is working on related to the monitoring of whales and earthquakes using SOSUS. About 18 months ago a scientific was initiated using the SOSUS arrays to study large cetaceans, whales, and low magnitude earthquakes in the ocean. Clyde had samples of the low frequency vocalizations from four species of whales. He also displayed the time series associated with them. The primary characteristic of the recorded vocalizations is their repetitive nature. However, they also display subtle variations that may not necessarily be random. The people that worked on the project over two seasons have conjectured that they have in fact tracked the same whale during two separate periods almost a year apart. They feel that the vocalization was uniquely similar. The earthquake monitoring was straight forward as the impetus for the original arrays was seismic in nature.

The chapter's officers include Jim Barbera, Chairman, Phil Rost, Vice Chairman, Paul Etter Treasurer and Basil Decina, Secretary. We would like to request the members in the chapter to indicate to one of the officers topics that are of interest so that we can invite speakers that are appropriate. We would also encourage the younger members to become more proactive in the society as a member said "remember member begins with me". If you would like to contact Jim Barbera, my email address is oes.mem@ieee.org.

Jim Barbera
Chairman
Washington/No. VA Chapter

Federal Officials Stress Reforms In Intellectual Property Policy

WASHINGTON, May 31 — Top federal officials outlined Clinton administration reforms for intellectual property policy, which they said would enhance U.S. competitiveness, at a May 20 symposium sponsored by the United States Activities division of The Institute of Electrical and Electronics Engineers Inc. (IEEE-USA).

Bruce A. Lehman, assistant secretary of commerce and commissioner of the U.S. Patent and Trademark Office (PTO), said his goal is to make the patent process "an inventor's paradise, not a lawyer's paradise." According to Lehman, new legal obstacles have emerged deterring innovation, even as reforms have been instituted over the last 15 years making intellectual property more valuable. He said the PTO has responded in the following ways:

- redefining performance guidelines for patent examiners that emphasize the quality of patents issued, not just the quantity;
- issuing legal guidance so that examiners know what to expect from the law and the courts; and
- shifting resources to the examining corps, now 1800 strong.

Anne K. Bingaman, assistant attorney general, Antitrust Division, U.S. Department of Justice, lauded the new interagency cooperation on intellectual property issues achieved through the National Economic Council's intellectual property task force. Bingaman also asserted that "antitrust is a bad word today, but it is a great word for the American economy." Citing two examples of successful actions by her division, she stated that antitrust would remain a critical function in federal efforts to guarantee a free, open and dynamic U.S. economy.

Joseph S. Papovich, deputy assistant U.S. trade representative for intellectual property, described the intellectual property ramifications of the General Agreement on Tariffs and Trade (GATT). Papovich cited the activities of his office to hasten implementation, through bilateral negotiation, of fair practices in advance of GATT's timetables. The Trade-Related Intellectual Property Section has significantly reduced incidents of intellectual property piracy in many foreign nations, he said.

A second panel of speakers addressed efforts to advance government and industry cooperation in commercializing technology. Lionel S. Johns, associate director for technology and space, White House Office of Science and Technology Policy, described how the National Science and Technology Council promotes interagency cooperation and improvements in technology transfer policy.

The remainder of the panel consisted of Jon Paugh, director, Office of Technology Commercialization, U.S. Department of Commerce Joseph Allen, director of training and economic development, Federal Technology Transfer Center; and Beverly Berger, Washington, D.C., representative, Federal Laboratory Consortium.

Clinton 1995 Budget Shows Move Toward Dual-Use, Civilian Technologies

WASHINGTON, May 31— President Clinton's Fiscal Year 1995 budget request demonstrates the continued shift in federal investment in electrotechnology from military toward civilian R&D, according to a budget analysis released today by the United States Activities division of The Institute of Electrical and Electronics Engineers Inc. (IEEE-USA). Titled "Electrotechnology-Related Research in the FY 1995 Budget," the document contains statistics taken from Clinton's budget proposal, and do not reflect subsequent congressional action.

The FY 1995 R&D budget authority request constitutes the Clinton administration's first opportunity to present its own comprehensive blueprint of federal research priorities. Although Clinton's FY 1995 R&D proposal of $73 billion is down slightly from the FY 1994 request of $75.4 billion, agencies that support research on civilian and dual-use technologies with commercial applications fare relatively well.

For example, the administration seeks substantial authorizations for several civilian-use electrotechnology areas: $1.27 billion for the National Information Infrastructure (NII), including $1.15 billion for high-performance computing and communications; $2 billion for manufacturing R&D, with an emphasis on intelligent control and sensor technologies and flexible computer-integrated manufacturing; $978 million for energy conservation and efficiency R&D, coupled with $390 million for solar and renewable energy R&D; $289 million for intelligent vehicle/highway systems; and $100 million for National Telecommunications and Information Administration pilot projects related to the NII.

According to the administration's estimates, the civilian share of R&D will remain at the 1994 level of 47 percent, which is up from the FY 1993 share of 43 percent. However, increased funding of dual-use technologies in the Department of Defense adds to the proportion of R&D which is deemed commercially relevant. The administration is seeking a four percent increase, to $2.66 billion, for the Advanced Research Projects Agency, a center for dual-use technology development in the Defense Department.

The IEEE is the world's largest technical professional society, with an international membership of some 320,000 electrical and electronics engineers and computer scientists. IEEE-USA promotes the professional careers and technology policy interests of IEEE members in the United States.

IEEE-USA Introduces New Career Maintenance Services

WASHINGTON, June 15— With engineering unemployment near an all-time high, the United States Activities division of The Institute of Electrical and Electronics Engineers Inc. (IEEE-USA) has introduced a series of new career maintenance services for U.S. members: a job referral agency, an alliance of consultants' networks, and a special services discount.

IEEE-USA has contracted with JOB BANK USA to offer an inexpensive job referral service that provides a state-of-the-art, computerized resume data base with a large, national client base of employers. To join, an IEEE member submits a one-page enrollment form and up to two current resumes, creating an individual electronic career record. When JOB BANK USA receives employment openings, its computer identifies qualified applicants, who are

then informed of available positions. If applicants are interested in the openings, their resumes are forwarded directly to the employers.

The service includes maintenance of the personalized career record for one year, a quarterly newsletter, a toll-free telephone number for updates to the record, and unlimited referrals to JOB BANK USA clients. For information and costs, members can call 800-296-1872 and indicate IEEE affiliation.

Further, a newly-formed Alliance of IEEE Consultants' Networks (AICN) will coordinate the development of IEEE's rapidly growing local consultants' networks. Networks serve their primarily self-employed members with speakers, newsletters, membership directories and client referral services. At the national level, AICN will establish a data base of IEEE consultant-members, develop tutorials, publish a newsletter, and produce standards and guidelines for legal documents related to self-employment. Interested members can contact AICN through IEEE-USA at 202-785-0017 to request a copy of "How to Start A Local Consultants' Network," the list of local networks, and the membership list of AICN's national coordinating committee.

In addition, all IEEE members are now eligible for a 10-percent discount on most services at Kinko's, including computer rental, resume creation, typesetting, fax and printing. The newly-expanded discount was originally negotiated by IEEE-USA's Employment Assistance Committee for unemployed members. To receive the discount, members must show their IEEE membership cards. Members can telephone 800-743-COPY for Kinko's locations.

National Engineers Week 1995 Will Highlight Engineering In Everyday Life

WASHINGTON, June 15 — The National Engineers Week Committee has announced that next year's celebration will emphasize the engineering of everyday life. The 45th annual National Engineers Week, scheduled for February 19-25, 1995, will feature a variety of national and local programs designed to increase public appreciation of the engineering profession by highlighting engineers' contributions to American life. Through its United States Activities division, The Institute of Electrical and Electronics Engineers Inc. joins 16 other engineering societies and several major corporations as sponsors.

National Engineers Week 1995 is chaired by the American Institute of Chemical Engineers (AIChE). Leslie G. McCraw, chairman and CEO of Fluor Daniel Inc., will serve as honorary chairman. The theme for the week is "Engineers: Turning Ideas into Reality," while the Discover "E" classroom program will inspire students to "Discover Engineering Every Day."

Discover "E" involves many thousands of engineer volunteers who motivate students to pursue math and science studies. Other national programs for the week include: technology fairs in shopping malls, science centers and local libraries; and the third annual Future City Competition, with engineers helping teams of middle-school students design cities of the 21st century.

Planning kits for National Engineers Week 1995 contain everything needed for individuals, Sections or companies to participate in the week's activities, and will be available in October. For free kits, contact National Engineers Week, P.O. Box 1270, Evans City, PA 16033, 412-772-0950. For more information on National Engineers Week, call National Engineers Week Headquarters at 703-684-2852, or IEEE Public Relations in Washington at 202-785-0017.

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IEEE ExCom Visits Washington

IEEE's Executive Committee (ExCom) recently visited Washington, D.C., for a series of high-profile meetings and events. ExCom members met with past and present IEEE-USA Congressional Fellows and attended an Industry Relations Luncheon featuring speaker Gregory Simon, chief domestic policy advisor to Vice President Al Gore, and Craig Fields, outgoing CEO of the Microelectronics and Computer Technology Corporation.

ExCom members visited with key Executive Branch officials at the National Science Foundation, the National Institute of Standards and Technology, the Environmental Protection Agency, and several other Government agencies and met with Members of Congress to discuss pension and health care issues. In addition, IEEE President H. Troy Nagle met with local press to discuss health care and technology issues.

HCEPC Cosponsors Technology and Health Care Conference

IEEE-USA's Health Care Engineering Policy Committee (HCEPC) joined with the International Society for Optical Engineering (SPIE) in sponsoring a major conference on "The Role of Technology in the Cost of Health Care" on April 27-29, 1994, in Arlington, Virginia. The conference coincided with Congressional deliberations on legislative proposals for reform of the national health care system and emphasized participation by Congressional and Executive Branch staff.

Intended to highlight the role that technology plays in the delivery of cost-effective health care in the United States, the program focused on four major policy issues: the role of technology in the cost of health care; the use of technology to control and quantify health care costs, the impact of governmental regulation on health care technology, and the potential for modelling the health care decision-making process.

More than 50 speakers representing the medical and engineering profession, industry, academia, and government took part in four plenary sessions and fourteen break-out sessions that constituted the program. Topics included panel discussions on the need for outcomes research; the role of information systems in controlling costs; risk and public safety-cost vs. benefit; introduction of new technology into the health care system; and new medical missions for the National Laboratories.

USAB Approves Position Statements

IEEE's United States Activities Board (USAB) recently approved these position statements. Copies are available from the IEEE-USA Office in Washington, D.C. To receive a complete list of position statements by electronic mail, write to **info.ieeeusa.pos @ieee.org** (Internet) or **info.ieeeusa.pos** (Compmail). A copy of the listing will be automatically returned by electronic mail to your originating address.

• ***Alien Engineers, Foreign Students and Our National Engineering Resource***—IEEE-USA's Manpower Committee (MC) is concerned that hiring foreign nationals reduces engineering salaries by increasing the supply of engineers. Urging employers to consider the pressing need for maintaining our national engineering resources, IEEE-USA further recommends closer monitoring of foreign labor certifications, with flexible ceilings on the admission of foreign nationals as U.S. residents based on fluctuating national employment conditions and unemployment levels.

• ***Interpretation of Engineering Supply and Demand Surveys***—MC asserts that engineering supply and demand surveys are often subject to significant errors and misinterpretations due to erroneous assumptions, flawed research methodologies, and simplistic analyses. The committee recommends that factors such as market forces, compensation, and international economics be taken into consideration when interpreting engineering supply and demand surveys. In addition, MC advises analyzing underlying assumptions and definitions, data collection, and analysis techniques to determine the merit of survey results.

• ***Integration of Social Security Benefits and Private Pension Benefits***—IEEE-USA's Pensions Committee opposes integrating pension and Social Security benefits, because the original intent of combining these benefits to expand private pension plan coverage of U.S. workers has failed. Integration also results in a relative loss of private pension benefits to lower paid employees, with a relative gain to highly paid employees.

Counsil Hosts NII Symposium

IEEE-USA's Technology Policy Council (TPC) will host a National Information Infrastructure (NII) symposium, June 29-30, in McLean, Virginia, on "NII: What Will It Be, How Will It Be Used?" The symposium will examine issues surrounding NII's implementation and prospective user benefits.

TPC will inform participants of NII's industry benefits, explain opportunities and obstacles, and clarify the concept of universal service. Speakers from academia, industry, and Government are scheduled to share their perspectives on NII's critical role in the nation's technological future. Speakers include Representative Rick Boucher (D-Virginia), member of the House Science, Space, and Technology Committee, and Dr. Michael Nelson, senior policy analyst, White House Office of Science and Technology Policy. Contact the IEEE-USA Office inWashington, D.C., for more information.

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Health Care Committee Outlines Role of Technology
IEEE-USA's Health Care Engineering Policy Committee (HCEPC) recently sent Congress its newly approved position statement on the role of technology in health care reform and an agenda for its cosponsored symposium on the topic. USAB Chairman Charles K. Alexander introduced the position statement and invited Congress to participate in the symposium.

HCEPC asserts that improved, cost-effective technology must be developed through engineering and medical profession collaboration. For technology to aid in cost containment and improved individual health and health services, it must be assessed in actual clinical situations through outcome-based research, with information systems and required patient-care standards to support efficient electronic exchange of medical information.

Committee Questions Telecommunications Proposal
United States Activities Board Chairman Charles K. Alexander recently wrote to President Clinton and Vice President Gore expressing IEEE-USA's Committee on Communications and Information Policy's (CCIP) concern over the FBI's Digital Telephony and Communications Privacy Improvement proposal. CCIP believes this proposed legislation could pose a significant barrier to technological progress and the global competitiveness of U.S. industry.

Because of the proposal's vague requirements, telecommunications developers will be reluctant to introduce and develop new technology, putting the United States at a competitive disadvantage. Due to privacy concerns, U.S. equipment manufacturers will not be able to market their products or compete on the basis of cost or functionality. In addition, the legislation would severely undermine the development of the National Information Infrastructure, providing an unnecessary competitive edge to global economic competitors.

IEEE-USA finds the proposal intrusive and unrealistic. By working with law enforcement agencies, the telecommunications industry has made significant progress in identifying the technical requirements for legal wiretapping. Once these privacy requirements are agreed upon, the legislation estimates a three-year time period for network modification, imposing a three-year limit on cost reimbursement. IEEE-USA surmises a five-year time frame would be required to make the necessary system changes.

Manpower Committee Responds to DOL
On behalf of IEEE-USA's Manpower Committee, USAB Chairman Charles K. Alexander recently responded to the Department of Labor's (DOL) review of employment-based immigration laws. Alexander commended DOL's efforts to ensure that admission of foreign nationals does not adversely affect the employment opportunities, wages, or working conditions of U.S. workers.

IEEE-USA supports proposed DOL regulations calling for restrictive policies and standards for visa program administration and enforcement. Further, Alexander urged that employers be required to notify affected professional societies and labor unions if they plan to hire foreign nationals. Procedures for making prevailing wage determinations must also be simplified and standardized.

Engineering Employment Guides Available
As part of its employment assistance efforts for members, IEEE-USA has reprinted both editions of its popular two-volume *Employment Guide for Engineers and Scientists*. Subtitled "A Practical Job Hunter's Manual," the Guide covers all aspects of finding or changing employment.

One edition is written specifically for engineers and scientists who have employment experience. Containing information on salaries and solid advice on conducting a job search, this edition also provides assistance in writing resumes, working with employment services, networking with colleagues and friends, interviewing, evaluating the compensation package, coping with job loss, and knowing your legal rights in the employment process.

An alternate edition is written for students and contains basic information about how to conduct a job search. Special features include a list of the 50 most-asked questions during a job interview. The companion volume to both editions is a *Directory of Employers of Engineers*. Listing hundreds of companies by state, the *Directory* includes telephone numbers and contact persons.

IEEE-USA provides complimentary copies of the *Guide* to unemployed U.S. members above student grade. Put your request in writing, including your member number, and mail it to the IEEE-USA Office in Washington, D.C. These publications are also sold through IEEE's Service Center at a cost of $14.95 to members and $19.95 to non-members, plus tax and shipping, for either edition. To order, call (800) 678-IEEE and request IEEE Catalog No. UH0186-7 for the experienced engineer edition or UH0188-3 for the student edition.

Further information about IEEE-USA, engineering career and technology policy issues, and copies of testimony, IEEE-USA Position Statements, and complimentary publications are available from the IEEE-USA Office. Write or phone IEEE-USA, 1828 L Street, N.W., Suite 1202, Washington, DC 20036-5104; (202) 785-0017 (office); (202) 785-0835 (fax); ieeeusa@ieee.org (electronic mail via Internet).

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8. Design / development engineer
9. Software engineer
10. Basic research
11. Computer scientist
12. Scientist / physicist / mathematician
13. Marketing, sales and purchasing
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56	57	58	59	60	61	62	63

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E	Z	1	9	4		
68	69	70	71	72	73	74