IEEE

OCEANIC ENGINEERING SOCIETY

Newsletter

OES

VOLUME XXVIII

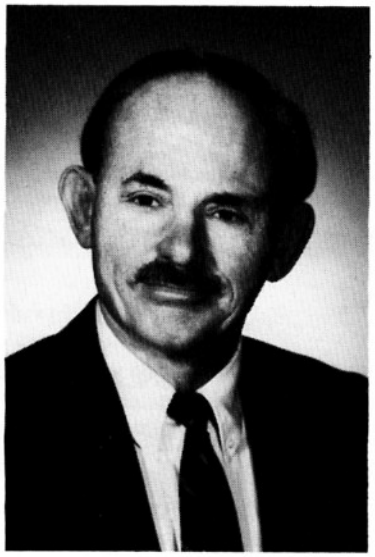
NUMBER 2

EDITOR: FREDERICK H. MALTZ

SUMMER 1993 (USPS 420-910)

(Continued on inside back cover)

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



Editor's Comments

In the last issue of the OES Newsletter, Spring of 1993, Stan Chamberlain, Technical Committee Coordinator, gave an overview of the function and scope of the eleven Oceanic Engineering Society Technology Committees. This was in response to the recommendation of our president, Glen Williams, to provide information to the membership on the activities of the OES Technology Committees. In subsequent issues of the newsletter I plan to include more information on the activities of individual OES Technology Committees. Thanks to Stan Chamberlain for his informative article, and I look forward to receiving inputs from individual chairpersons on the activities of their respective committees. Inputs are needed to expand the reporting of specific OES news and activities. My thanks also to the Seattle Chapter of the OES for their recent article. We are off to a good start.

Of special note from the December 1992 Technical Activities Board (TAB) Meeting:

> **Election of Society President Representatives to the TAB Administration Council.** The Society Presidents' Forum elected Mr. Harold L. Flescher, Dr. Gerald F. Harris, Prof. T.J. (Tzyn-Jong) Tarn, Dr. Glen N. Williams and Prof. Thomas G. Wilson, Sr. as the Society President Representatives to the TAB Administration Council for 1993.

Special thanks to Ann Scrupski, Newsletter Manager for the IEEE Magazines and Newsletter Department, for her continuing efforts in maintaining and improving the production quality of the OES Newsletter.

Frederick H. Maltz
OES Newsletter Editor

OCEANS '93

ENGINEERING IN HARMONY WITH THE OCEAN
18-21 October 1993

The Victoria Conference Centre, Victoria, Canada

CONFERENCE ANNOUNCEMENT

CONFERENCE COMMITTEE

General Chairman
Dr. James S. Collins
Royal Road Military College and University of Victoria
Ph: (604) 721-8684

Technical Program
Dr. Jon M. Preston
Defense Research Establishment Pacific
Ph: (604) 363-2897

Tutorials
Dr. Meyer Nahon
University of Victoria
Ph: (604) 721-6040

Publications
Dr. Dale J. Shpak
Royal Roads Military College and University of Victoria
Ph: (604) 363-4604

Exhibits
Ms. Terry Curran
Inst. of Ocean Sciences
Ph: (604) 363-6583

Publicity
Mr. G.D. (Joe) Young
A/D Computing Instruments Ltd.
Ph: (604) 592-9168

Local Arrangements
Dr. Rick Hudson
Applied Microsystems Ltd. and University of Victoria
Ph: (604) 721-6079

Finance
Dr. Christopher J. Damaren
Royal Roads Military College and University of Victoria
Ph: (604) 363-4572

Registration and Management Services
Mrs. Mary O'Rourke
University of Victoria
Ph: (604) 721-8470
Fax: (604) 721-8774
e-mail:
morourke@sol.uvic.ca

The theme for Oceans 93, *Engineering in Harmony with the Ocean*, emphasizes the benefits of technology which is tailored to the ocean environment. The Technical conference, Tutorials and Industrial Exhibitions are sponsored by the Oceanic Engineering Society of the Institute of Electrical and Electronics Engineers, Inc. and its Victoria Chapter. As always, the IEEE emphasis on high-technology content and high quality guides the development of the technical program.

UNDERWATER ACOUSTICS
- **Transducers and Arrays**
- **Source localization**
- **Matched Field Processing**
- **Boundary Effects & Propagation**
- **Air-Sea Acoustics**
- **Bottom Imaging & Detection**
- **Sonar Signal Processing**
- **Sonar Image Processing**
- **Bathymetry**
- **High-Bandwidth Communications**

REMOTE SENSING
- **Active Microwave Techniques**
- **Ocean & Ice Measurements**
- **Passive Microwave & Optical Sensing**
- **Satellite Oceanography & Meteorology**

INSTRUMENTATION AND MEASUREMENT TECHNIQUES
- **Ocean Environment**
- **Polar Environment**
- **Acoustic Thermometry**
- **Currents**

COMPUTING AND INFORMATION MANAGEMENT
- **Modelling & Simulation**
- **Knowledge-Based Systems**
- **Geographic Information Systems**

UNDERSEA VEHICLES
- **Positioning**
- **Obstacle Avoidance**
- **Robotics**
- **Stability and Imaging**
- **Power Sources**
- **Hardware/Software Architecture**

TECHNOLOGY ADVANCES
- **Power Sources**
- **Navigation**
- **Materials**
- **Non-Acoustic communications**

The Exhibit Program parallels the technical program. The exhibit hall, which is located conveniently in the main salons of the Victoria Conference Centre, will be the site of the opening reception and all breaks.

Representatives from companies, agencies or institutions are invited to participate in the Exhibit Program. The Victoria Conference Centre is adjacent to a completely protected harbour, so Exhibitors wishing to perform on-the-water demonstrations are encouraged to make their needs known to the Exhibits Chair.

The IEEE Oceanic Engineering Society is sponsoring Student Technical Poster Sessions.

For a copy of the Advance Program or further information, please contact:

OCEANS '93
University of Victoria
Conference Services, Division of Extension
P.O. Box 3030
Victoria, BC
V8W 3N6
Ph: (604) 721-8470 Fax: (604) 721-8774
E-mail: morourke@PostOffice.uvic.ca

(Reprinted from Oceans '92 Conference)

Advanced Computing Technology and Information Management for Oceanographic Applications

Robert F. Brammer
TASC
Reading, MA 01867

1. INTRODUCTION AND OBJECTIVES

As in many areas, oceanographic applications will become increasingly information-intensive during the 1990's, as computing technology continues to improve rapidly in its performance/cost ratio and as information management concepts become increasingly general. The objective of this paper is to provide a brief survey of some major developments in a few significant areas of advanced computing technology and information management with examples of how these developments will affect various oceanographic applications. The cited references supply further information.

The primary areas of information technology to be discussed in this paper are: data and information management, computing processor and architecture performance, communication networks, and software engineering. Brief mention is made of the areas of artificial intelligence, image computing, human computer interaction, and information technology standards.

2. SELECTED ASPECTS OF ADVANCED COMPUTING TECHNOLOGY AND INFORMATION MANAGEMENT

A. Data and Information Management

Significant growth of data and observations relevant to oceanographic applications is anticipated during the 1990's. For example, NOAA's environmental information processing centers were receiving approximately 20 terabytes per year during 1990. This volume is anticipated to grow to approximately 200 terabytes per year by 2000 [1]. The raw data comes from a wide variety of platforms (e.g., satellites, aircrafts, ships, buoys, coastal stations) and sensor types (e.g., passive and active electro-optic and microwave systems, acoustic sonar systems, conventional environmental observations). Processing is performed at several National Data Centers. Other large volumes of ocean data are collected by the U.S. Navy, other U.S. and international government organizations, and a variety of commercial corporations.

Satellite observations are expected to dominate the data volumes by the end of this decade [2]. Currently, for example, NOAA's Polar Orbiting Satellites collect multispectral observations of the sea surface from the AVHRR sensor. These observations can be processed to provide estimates of sea surface temperature which are relevant for ocean weather and climate, ship routing, fisheries, and many other applications. A U.S. commercial ocean color sensor (imaging in eight visible and JR bands) is expected to be operational by the mid-90's which can be used to augment the AVHRR observations and to provide improved analysis of the ocean for the above applications. Satellite radar altimetry has been used in ocean applications since the mid 1970's [3], and a new joint U.S./French program (i.e., TOPEX) is expected to be operational within the next few years. Radar altimeter data can provide data relevant to ocean gravity, bathymetry, circulation, and climate [4]. The European ERS-1 with several ocean-related sensors (e.g., SAR altimeter) was launched in 1991, and some initial results are beginning to appear [5]. A final example is that of NASA's Earth Observing System (EOS) [2,6]. This system is expected to provide data from a variety of sensors with a volume of more than one terabyte per day by the end of this decade. Much of the EOS data will be relevant to several ocean applications. Shipboard and buoy observations are also significant, even though the data rates are significantly lower than that for satellites. For example, NOAA operates more than 40 coastal stations and 50 moored buoys to collect relevant data [1], and the Navy and DMA survey programs continue to collect data relevant to gravity, magnetics, bathymetry, and physical oceanography.

Managing this increasing variety and volume of data is representative of current challenges faced by the database research and development communities. Among the major data and information management challenges are the following:

- *Size and Upward Scaling of Databases* — For example the development of mass storage technology has lead to the design of hierarchial storage architectures. Information systems containing primary storage (i.e., main memory), secondary storage (i.e., disks), tertiary storage (e.g., digital cassette tape recorders) are now available with memory architectures in excess of 300 terabytes. larger scale systems with capacities up to 10,000 terabytes are now in development [7]. Competing approaches for new generations (by the late '90s) of mass storage devices with densities of gigabits/mm^3 and access times comparable to that of main memory include volume holograms and wafer-scale semiconductor arrays [8]. Systems this large require new concepts in database operations (e.g., system backups) and database access techniques (e.g., moving data from one level to another, accessing multivariable, multidimensional spatial/temporal datasets for GIS applications, and accessing data by content rather than by record header information) [9].
- *Data Types and Performance Issues* — Modern oceanographic databases must include diverse data types (e.g., acoustic signals, images, along track observations, point observations) as well as model parameter sets and knowl-

edge-bases (e.g., large rule sets for expert systems). Such systems are required to ingest real-time data streams from several sources while simultaneously processing requests for analysis and interactive presentation of results to multiple users. For certain applications, these requirements are feasible and commercially available today [10]. However, the sizes of today's databases, are very small compared, for example, to those contemplated for NASA's EOS Data and Information System [6].

B. Computing processor and Architecture Performance

Many oceanographic applications are extremely computing intensive. For example, global ocean circulation simulations with resolution barely sufficient to resolve eddy and other strong currents require approximately 3,000 processor hours on a gigaflop supercomputer to analyze a decade of circulation patterns. Such a global simulation will produce more than 250 gigabytes of processed output. Such simulations are being undertaken, for example, in the U. S. Global Change Research Program to analyze the effect of potential changes in global and regional climate [2,11]. Another class of examples requiring high performance computing architectures is that of acoustic transient detection and target tracking. Earlier approaches had been demonstrated in vector processors [12]. However, current multiresolution approaches seem well suited for massively parallel architectures [13].

New developments in computer processors and architectures appear able to such meet ocean-related modeling and analysis challenges. The speed of computing processors and architectures continues to increase at a rapid rate. For example, at the high end of the computing spectrum, the winner of the 1987 Gordon Bell competition for parallel algorithm performance demonstrated a 0.45 gigaflop rate. By 1990 the winner demonstrated a performance of 14 gigaflops [14].

Similar performance increases are expected at the personal computer end of the computing spectrum. For example, in 1991 a 50 Mhz 486 processor could demonstrate approximately 20 specmarks (i.e., a common benchmark performance measure). By 1995 microprocessors with clock rates at 400 Mhz are anticipated to deliver approximately 300 specmarks [14].

Specialized computing architectures relevant to oceanic applications are also in development. For example, lattice gas computers [15] are being designed for specialized applications in computational fluid dynamics which offer orders of magnitude performance improvement with respect to "conventional" supercomputers due to more parallelism and to increased use of fixed point operations. Another example is that of neural network architectures [16] which are used in systems for pattern recognition classification and control systems.

Most advances in performance are expected to come from the uses of parallel architectures. However, further advances in processor performance may result from applications of high temperature superconducting materials. Early results of DARPA-sponsored research suggest that the speeds of some electronic systems may be increased by as much as two orders of magnitude [17].

C. Communication Networks

The National Research and Education Network (NREN) [11] is expected to reach a bandwidth of approximately 3 gigabytes per second by the end of this decade. The NREN will link universities and other major research centers to provide communication bandwidth for distributed data management and visualization, and research relevant to the large data sets and processor speeds described above.

Other communication network developments relevant to ocean applications include global communications through satellites. The recent World Administrative Conference (i.e., WARC '92) [18] created new allocations for global satellite services, some of which affect maritime operations. By the end of the 1980's the INMARSAT system had more than 9,000 shipboard installations, and that number is anticipated to grow significantly during the next decade [19], despite contention for bandwidth allocations indicated at the above WARC '92.

The combination of GPS with various communication systems (terrestrial and satellite) offers the potential for many navigation-related services with significant ocean-related impact. For example, the U. S. Coast Guard has begun experiments with differential GPS signals transmitted through existing mid-frequency beacon facilities. If successful, this approach will be developed for (among other applications) meeting requirements in the Federal Radionavigation Plan for harbor and harbor-approach navigation in all important U.S. coastal areas [20].

Another communication network technology which is particularly relevant to oceanographic applications is that of underwater acoustic communication. The underwater channel is unusual because of the relatively rapid change in channel characteristics as compared to transmitted symbol rates [21]. This fact leads to a requirement for significantly more sophistication in communication signal processing than in many other channels. A variety of long range acoustic telemetry networks are being developed for such applications as ocean acoustic tomography, relevant to a variety of defense and environmental problems [22].

D. Software Engineering

Productivity in software development, management, and maintenance is widely recognized as a problem of national and international importance [23]. It is currently a competitive issue for many industries and may actually become a key international competitive dimension by the end of this decade [24]. A variety of "silver bullets" have been proposed to improve the productivity of the software life cycle from requirements analysis and system design to life-cycle maintenance. However, none of these has been demonstrated to deliver performance increases at anywhere near the levels of the above hardware changes. The Software Engineering Institute at Carnegie Mellon University has been a leader in attempting to define software engineering practices and to introduce a repeatable manageable methodology into software engineering [25]. Current "object-oriented" analysis, design, and programming technologies are widely anticipated to provide some productivity enhancement. These are particularly

relevant to the above oceanographic applications because of the diversity of relevant data types and because of the need for large-scale software developments in real-time applications (e.g., environmental analysis and forecasting, autonomous underwater vehicles, etc.).

E. Other Topics

Other areas of advanced computing technology and information management which should be mentioned at least briefly are:

- *Artificial Intelligence* — Artificial intelligence was a significant research area in computer science during the 1980's, and this will continue (possibly at a lower funding level) during the 1990's [26]. Applications in many oceanographic programs were attempted with varying degrees of success. One important area is that of autonomous underwater vehicles [27]. Much work has been devoted to intelligent control algorithms for these vehicles in applications such as environmental data collection and national defense [28].
- *Image Computing* — During the late 80's, a new discipline of image computing was created which includes the previously diverse areas of image processing, image communications, image data management, and computer graphics [29]. Several of these areas are important in oceanographic applications. For example, image processing and computer vision technologies are important in some of the above autonomous vehicle control systems. Image generating synthetic aperture sonars [30] are also becoming available for underwater object detection and mapping applications.
- Human-Computer Interaction — During the past several years the area of human-computer interaction has received increased attention [31]. Information system design has shifted from a "developer-centered" philosophy to a "user-centered" philosophy. Many "state-of-the-art" information systems are now designed with 50-75% of their lines of code being involved with the system interface. A new discipline has evolved from the combination of computer science, experimental psychology, and various domain experts to create systems that are much more effective in their operational characteristics than in previous generations. Much research is now being performed, for example, in displays of multidimensional data sets which are highly relevant to oceanographic systems [32]. New systems for ocean and environmental data management and Navy sonar acoustic signal processing systems reflect some of these current concepts. New interaction technologies from data gloves, 3D displays, and force-feedback sensors to full virtual reality environments are now used in research programs [33] and applications can be anticipated in ocean-related systems during this decade.
- *Information Technology Standards* — In recent years there has been a proliferation of proposed and accepted information technology standards in many of the above areas. Organizations such as NIST, ANSI, IEEE, ISO and many others are developing and promoting many aspects of "open systems" standards [e.g., 34]. The IEEE electrical and communications standards (e.g., RS232) continue to be important, but standards for data formats (e.g., DoD CALS), processor chips, (e.g., 80x86) operating systems (e.g., POSIX), network standards (e.g., TCP/IP), graphics standards (e.g., X-Windows), programming methodologies (e.g., SEI Levels), and many other areas are now being developed. Software safety standards are also receiving increasing attention [35]. These are all very important areas, but there is a long way to go to achieve the level of standardization and integration required for the large-scale information system developments anticipated for the end of this decade.

3. CONCLUDING REMARKS

This brief survey has attempted to describe some of the most significant areas of information technology development and a few of its potential applications to various ocean-related challenges. While it is obvious that there was a significant explosion in information technology development during the 1980's, particularly in computing hardware, it is also clear from current research programs that this development has really just begun. Accordingly, the nature of computing technology and important oceanographic applications can be expected to change, not only quantitatively, but qualitatively during the next decade as entirely new methods of applying information technology become feasible. For example, the widespread use of extremely powerful portable computers [36] promotes many new applications in navigation, acoustic signal processing, environmental data utilization, and many other areas. It has been just a little more than a decade since the IBM PC, the Apple Macintosh, and the first Apollo and Sun engineering workstations were first introduced. Massively parallel and portable computers, high definition displays, and mass storage systems appeared during the 1980's. The next decade should see widespread developments in the above and several other areas of information technology [e.g.,37], that have the potential for significant impacts in many ocean-related problems.

REFERENCES

[1] J.J. Carey, J.R. Vadus, "Ocean Space Utilization: A NOAA Perspective," *Oceans 91 Proceedings*, Vol. 1, pp.15-23, October 1-3, 1991.

[2] "Our Changing Planet: The FY 1993 U.S. Global Change Research Program," A Report by the Committee on Earth and Environmental Sciences, A Supplement to the U.S. President's Fiscal Year 1993 Budget.

[3] R.V. Sailor, M.L. Driscoll, "Comparison of Noise Models and Resolution Capabilities for Satellite Radar Altimeters," *Oceans '92 Conference*, October 1992.

[4] "The Future of Spaceborne Altimetry: Oceans and Climate Change — A Long-Term Strategy," C.J. Koblinsky, P. Gaspar, G. Lagerloef, Eds., Washington, D.C., Joint Oceanographic Institutions Inc., March 1992.

[5] C. Dionisio, C. Zelli, L. Borgarelli, R.V. Sailor, M.L. Driscoll, and J.V. White, "Preliminary Noise Models for ERS-1 Satellite Altimeter Data," 1992 Spring Meeting Program, *American Geophysical Union Spring Meeting*, Montreal, Canada, p. 133, May 14, 1992.

[6] J. Dozier, "Looking ahead to EOS: The Earth Observing Systems," *Computers in Physics*, Vol. 4, No. 2, May/June 1990, pp. 248-259.

[7] W. Myers, Ed., "Supercomputing '91 Summary", *Computer*, pp. 87-90, January 1992.

[8] R. Zech, "Volume Hologram Optical Memories, Optics and Photonics, Vol. 3, No. 8, August 1992, pp. 16-25.

[9] A. Silberschatz, M. Stonebraker, J. Ullman, "Database Systems: Achievements and Opportunities," *Communications of the ACM*, Vol. 34, No. 10, pp. 111-120, October 1991.

[10] Real-Time Weather and Other Ocean-Related Information Services are available from the WSI Corp. in Billerica MA.

[11] "Grand Challenges 1993: High Performance Computing and Communications," A Report by the Committee on Physical, Mathematical, and Engineering Sciences Federal Coordinating Council for Science, Engineering, and Technology, A Supplement to the President's Fiscal Year 1993 Budget.

[12] J.V. White, J.D. Goldstein, and R.F. Brammer, "Model-Based Target Tracking", *International Symposium on Science and Engineering on Cray Supercomputers*, October 1988.

[13] B. Broder, D.A. Whitney, "Multiresolution Modeling for the Analysis of Acoustic Transients," *Oceans '92*, October 1992.

[14] G. Bell, "Ultracomputers: A Teraflop Before Its Time," *Communications of the ACM*, Vol. 35, No. 8, pp. 26-47, August 1992.

[15] A. Despain, C.E. Max, G. Doolen and B. Hasslacher, "Prospects for a Lattice-Gas Computer," *Lattice Gas Methods for Partial Differential Equations*, G. Doolen, (Ed.), Addison-Wesley Publishing Co., 1990, pp. 211-218.

[16] B.L. Yoon, "Neural Networks Still Looking Good," *Aerospace America*, pp. 48-50, October 1991.

[17] R.W. Ralston, et al, "Cooperating on Superconductivity," *IEEE Spectrum*, Vol. 29, No. 8, August 1992, pp. 50-55.

[18] L.A. Taylor, "WARC-92, Green Light for New Satellite Systems," Via Satellite, pp. 32-34, May 1992.

[19] S.J. Campanella, J.V. Evans, T. Muratani, P. Bartholome, "Satellite Communications Systems and Technology, Circa 2000," *Proc. of the IEEE, Special Issue on Satellite Communications*, pp. 1039-1056, July 1990.

[20] D. Pietrazewski, in "Directions '92," *GPS World*, Vol. 2, No. 10, November/December 1991, pp. 22-28.

[21] J.A. Catipovic, "Performance Limitations in Underwater Acoustic Telemetry," *IEEE Journal of Oceanic Engineering*, Vol. 15, No. 3, pp. 205-216, July 1990.

[22] R.C. Spindel, P.F. Worcester, "Ocean Acoustic Tomography Programs: Accomplishments and Plans," *Oceans '90*, September 1990, pp. 1-10.

[23] "Keeping The U.S. Computer Industry Competitive," A Colloquium Report by The Computer Science and Telecommunications Board, National Academy Press, 1992.

[24] E. Yourdon, *Decline & Fall of the American Programmer*, Yourdon Press, 1992.

[25] G. Forte, R.J. Norman, "A Self-Assessment by the Software Engineering Community," *Communications of the ACM*, Vol. 35, No. 4, pp.28-32, April 1992.

[26] D. Kirsh, " Foundations of AI: The Big Issues," *Foundations of Artificial Intelligence*, pp. 3-30, The MIT Press, 1992.

[27] *Special Issue on Autonomous Underwater Vehicle Technology, IEEE Journal of Oceanic Engineering*, D.R. Blidberg, D.R. Yoerger, Eds., Vol. 15, No. 3, July 1990.

[28] D.P. Glasson, "An Autonomous Control logic Concept for the Autonomous Undersea Vehicle," *AIAA Guidance, Navigation and Control Conference*, (AIAA 92-4542), August 10-12, 1992.

[29] R.F. Brammer, Unified Image Computing Based on Fractals and Chaos Model Techniques," *Optical Engineering*, Vol. 28, No. 7, pp. 726-734, July 1989.

[30] *Special Issue on Acoustic Synthetic Aperture Processing IEEE Journal of Oceanic Engineering*, E.J. Sullivan, W.M. Carey, S. Stergiopoulos, Eds., Vol. 17, No. 1, January 1992.

[31] J. Grudin, "The Computer Reaches Out: The Historical Continuity of Interface Design," *Empowering People*, CHI 90 Conference Proceedings, Special Issue of the SIGCHI Bulletin, pp. 261-268, April 1990.

[32] F.M. Marchak, D.D. Zulager, "The Effectiveness of Dynamic Graphics in Revealing Structure in Multivariate Data," *Behavior Research Methods, Instruments, & Computers*, 1992, 24 (2) pp. 253- 257.

[33] A. Marcus, A. Van Dam, "User-Interface Developments for the Nineties," *IEEE Computer*, Vol. 24, No. 9, September 1991, pp. 49-57.

[34] D.R. Kuhn, "IEEE's POSIX," *IEEE Spectrum*, Vol. 28, No. 12, December 1991, pp. 36-39.

[35] D.R. Wallace, D.R. Kuhn, and L.M. Ippolito, "An Analysis of Selected Software Safety Standards," *IEEE AES Magazine*, Vol. 7, No. 8, pp. 3-14, August 1992.

[36] L. Press, "Personal Computing: Dynabook Revisited — Portable Computers Past, Present and Future", *Communications of the ACM*, Vol. 35, No. 3, pp. 25-32, March 1992.

[37] J. Piel, (Ed.), "Special Issue — Communications, Computers, and Networks," *Scientific American*, Vol. 265, No. 3, September 1991.

IEEE-USE Releases New Position Statements on Technology Commercialization, Defense Conversion

WASHINGTON, May 5 — The twin specters of increasingly-aggressive international competition and the downsizing of the U.S. defense technology industry have conspired to threaten American competitiveness in a host of key manufacturing industries. IEEE United States Activities (IEEE-USA) has responded with new position statements on technology commercialization and defense conversion. They call on the federal government to implement a coherent technology policy that enables private industries to turn technology into applications creating wealth and jobs.

TECHNOLOGY COMMERCIALIZATION

"Regaining Strength in Technology Commercialization" outlines federal policies and programs needed to direct engineering R&D toward the efficient production of innovative civilian products and to encourage U.S. industry to commercialize the results of R&D effectively. As developed by the IEEE-USA Engineering R&D Policy Committee, several goals are posited: to strengthen the structure of technical activities within the U.S. Department of Commerce providing a coordinated federal technology commercialization program; to encourage industry investment in longer-range strategic and high-quality manufacturing undertakings; to maximize the utilization of government and academic technology resources; and to strengthen the U.S. technology infrastructure.

A series of recommendations details the central role of the Commerce Department in managing technology policy. Building on the present Technology Administration, IEEE-USA recommends that a National Civilian Technology Agency (NCTA) be established within Commerce. The NCTA would support effective pre-commercial technology by maximizing effectiveness of existing activities such as the Manufacturing Technology Center, National Institute of Standards and Technology activities and the Strategic Partnership Initiatives. According to IEEE-USA, the Technology Administration should also coordinate technology commercialization ventures among the other government agencies, and create a technology extension program and comprehensive directory of government and university technical experts facilitating utilization of government technology resources in the private sector.

The position statement also includes recommendations to expand coverage of the Cooperative Research Act of 1984; to facilitate government executives' access to industry advice; to ensure a supply of long-term or "patient" capital; and to support professional education for technological commercialization.

DEFENSE CONVERSION

"Defense Conversion," developed by the IEEE-USA Defense R&D Policy Committee, urges enactment of a comprehensive national strategy to minimize the detrimental impacts of defense cuts and commercialize continuing U.S. investment in defense R&D. The strategy aims at building a strong national industrial base and economic capability suited to new security challenges.

Central to the IEEE-USA plan is integration of the defense and civilian industrial bases to serve post-cold war economic and national security requirements, which requires updating defense needs while building a commercially-competitive sector for developing multiple-use technologies. The plan also provides for the removal of barriers to and institution of incentives for defense industry diversification and conversion; mitigation of the impact of defense budget cuts on affected individuals and communities; and expansion of federal support for civilian technology development and commercialization, including establishment of domestic technology transfer as a Defense Department mission.

Copies of "Regaining Strength in Technology Commercialization" and "Defense Conversion" can be obtained by calling IEEE-USE in Washington at 202-785-0017.

IEEE-USA Backs Pension Portability Legislation

WASHINGTON, May 5 — A bill to increase the adequacy and efficiency of the private pension system was introduced in the House of Representatives on April 28 by Rep. Sam M. Gibbons (D-Fla.). The Pension Portability Improvement Act (H.R. 1874) would reduce pension vesting requirements, guarantee the portability of earned pension benefits, and encourage the preservation of pension assets for use in retirement.

The United States Activities unit of The Institute of Electrical and Electronics Engineers, Inc. (IEEE-USA) has endorsed HR 1874, according to IEEE-USA Pensions Committee Chair Mary-Ann M. Boyce, because "the bill would improve pension portability for American workers and protect their benefits during job changes." IEEE-USA backed similar legislation considered by the House and Senate in 1991-92.

The bill was referred jointly to the Committees on Education and Labor and Ways and Means. A copy of H.R. 1874 can be obtained from IEEE-USA in Washington at 202-785-0017.

IEEE-USA Challenges Federal Plan to Facilitate Hiring of Non-U.S. Engineers

WASHINGTON, June 2 — The Institute of Electrical and Electronics Engineers U.S. Activities unit (IEEE-USA) has opposed U.S. Department of Labor (DoL) plans to change rules governing permanent employment of foreign nationals in occupations deemed to be experiencing labor shortages. The department's list of shortage occupations includes computer systems analysts and computer software engineers in seven states.

Under current rules, employers' applications for foreign workers' "green cards" are evaluated by state certifying officers on a case-by-case basis to ensure that foreign admissions do not adversely affect U.S. workers. Employers must first attempt to recruit American candidates for the position and then certify that no qualified domestic applicant can be found. The proposed new policy, designed to implement a Labor Market Information Pilot Program mandated by the Immigration Act of 1990, would allow employers to recruit foreign applicants with advanced qualifications in designated shortage occupations without going through the normal certification process.

In a response to DoL's call for comments on the rule change, Charles K. Alexander, Jr., IEEE vice president of professional activities and chairman of the Institute's United States Activities Board, wrote: "IEEE-USA's most serious concern about the proposed rule and the published list of possible shortage occupations is based on recent substantial increases in unemployment among engineers and scientists in the United States." Dr. Alexander added: "Unemployment among engineers as reported by the Bureau of Labor Statistics (BLS) has increased steadily, from 1.2 percent in 1990 to 2.4 percent in 1991 and 3.8 percent in 1992." For electrical engineers, he said that unemployment has been increasing "at an alarming rate," rising from 1.8 percent in 1990 to 3.5 percent in 1992.

Dr. Alexander charged that DoL has ignored a fundamental dynamic in engineering labor markets: while some localities are experiencing spot shortages of very highly specialized workers, others are experiencing spot surpluses in the same specialties. "In spite of the specific congressional instruction to identify surplus as well as shortage occupations, DoL has elected to include only shortage occupational classifications in the Labor Market Information Pilot Program."

According to Dr. Alexander, the result is a rule that will worsen the already-bleak employment outlook for engineers throughout the United States. He cited as evidence recent data from the Immigration and Naturalization Service and BLS suggesting that domestic unemployment problems are being exacerbated by recent dramatic increases of foreign workers' admissions following the 1990 Immigration Act.

IEEE-USA has called on DoL to reassess the validity and reliability of its research findings, using mostly pre-1990 data, as well as to make a deliberate effort to involve representatives of employers, professional organizations and job seekers in the evaluation process. Dr. Alexander emphasized: "Failure to conduct such an evaluation will give additional credence to an unfortunate perception among many U.S. IEEE members that the nation's immigration laws are being misused by some employers to take unfair advantage of foreign engineers and engineering students who wish to enter or remain in the United States. As a result, employment opportunities, wage and working conditions for all engineers in the United States are being adversely affected."

Copies of the comments can be obtained from IEEE-USA by calling 202-785-0017.

IEEE USA HOT LINES

IEEE-USA Office, 1828 L Street, N.W., Suite 1202, Washington, DC 20036-5104, USA (202) 785-0017
IEEE-USA telephone hotline recording: (202) 785-2180
James A. Watson, Editor—Georgia C. Stelluto, Associate Editor

Beware . . . New Tax Rules Affect 401(k) Funds

Planning a job change in 1993? Be aware that new tax rules will affect your 401(k) funds distribution. Under the new rules, if you change jobs or retire and take a lump sum distribution, instead of leaving the funds with your old employer or doing a trustee-to-trustee transfer into a new Individual Retirement Account or new 401(k), 20 percent of your funds will be withheld.

Why the new rule? The Government's official word is that the new taxes collected will be used to extend jobless benefits and that discouraging spending will ensure that an individual's pension is protected. The unofficial word is that this rule may be an easy way to raise taxes. Many people will not even be aware of the rule change. If job changes are involuntary, workers may overlook the new rule while trying to deal with lay-offs or forced retirements. The rule could lead to more people losing pensions instead of saving them.

Many employers are establishing procedures to handle trustee-to-trustee transfers. If you are changing jobs or retiring, consult a financial adviser about the best way to handle your 401(k) funds.

Tort Reform Needed to Help Boost U.S. Economy

Citing critical insurance problems, frivolous lawsuits, and excessive jury awards, IEEE-USA is urging Federal and state lawmakers to enact significant tort reform legislation. In a recently approved position statement, IEEE-USA said that if such legislation is not enacted, the entire economy of our nation will be affected.

Engineers are seriously affected by these concerns, especially those in private practice, due to excessive costs and inability to obtain adequate liability insurance. These problems are threatening to reduce engineers' ability to provide services needed to help sustain the nation's economic growth. Not only are insurance premiums increasing significantly each year, but also such important services as the cleanup of hazardous waste and the removal of asbestos are being excluded from any coverage.

IEEE-USA believes that our nation's legal system should provide prompt, just, and full compensation to injured victims at a reasonable cost. In order to have such a legal system, IEEE-USA recommends eliminating joint and several liability, so that defendants pay damages only in proportion to their responsibilities. In addition, comparative negligence should be revised, so that plaintiffs cannot receive awards if they are more responsible for their injuries than the defendants. IEEE-USA recommends returning to a rational—not arbitrary—basis for distribution of punitive damages.

USAB Chairman Promotes U.S. Competitiveness

USAB Chairman Charles K. Alexander recently wrote a letter to the U.S. Department of Commerce (DOC) endorsing DOC's investigation into the national security implications of U.S. dependence on foreign imports of integrated circuit (semiconductors) ceramic packages. The investigation is being conducted in accordance with Section 232 of the ***Trade Expansion Act of 1962***.

Alexander urged efforts to promote the competitiveness of the U.S. ceramic packaging industry. "Ceramic packaged semiconductors are incorporated in almost every U.S. defense system employing modern electronics and play a critical role in ensuring our national security," he said. Further, Alexander expressed IEEE-USA's belief that national security in the technological age requires the maintenance of strong, competitive domestic capabilities to meet U.S. defense needs in the event foreign supplies are disrupted.

USAB Approves Position Statements

IEEE's United States Activities Board recently approved these position statements. Copies are available from the IEEE-USA Office in Washington, D.C.

- **Human Exposure to Radio Frequency Fields from Portable and Mobile Telephones and Other Communication Devices**—Recognizing public concern about the safety of exposure to radio frequency (RF) energy, IEEE and such organizations as the American National Standards Institute, the National Council on Radiation Protection and Measurements, and the International Radiation Protection Association, have published guidelines outlining safe limits for human exposure to RF fields. Based on present knowledge, prolonged exposure to RF fields from portable and mobile telephone devices at or below the recommended levels is not hazardous to human health, according to IEEE-USA and its Committee on Man and Radiation.
- **Engineering Manpower Policy in the United States**—Recognizing that members of the engineering community operate within an increasingly complex national economy, IEEE-USA believes that business and government can and must do more to prevent major fluctuations in the demand for scientific, engineering, and technical resources. Further, IEEE-USA believes that decision-makers must improve the utilization and productivity of these resources and support the improvement of engineering education programs, in order to produce and maintain competent engineers.
- **Energy Efficiency**—IEEE-USA concludes that energy efficiency must form an integral component of a comprehensive national energy policy designed to ensure a reliable, economical, and environmentally sound energy supply. Further, IEEE-USA recommends that the Government and the energy-consuming public give a high priority to promoting aggressive research, development, commercialization, and use of efficient energy conversion technologies.

IEEE USA HOT LINES

IEEE-USA Office, 1828 L Street, N.W., Suite 1202, Washington, DC 20036-5104, USA (202) 785-0017
IEEE-USA telephone hotline recording: (202) 785-2180
James A. Watson, Editor—Georgia C. Stelluto, Associate Editor

CCIP Hosts Information Exchange

IEEE-USA's Committee on Communications and Information Policy (CCIP) is hosting an information exchange on ***"Telecommunications as Part of the National Information Infrastructure,"*** May 4 and 5, in Arlington, Virginia. The purpose of the exchange is to take a first step toward developing a superior national information infrastructure in the United States.

Fundamental to achieving this goal is establishing a national telecommunications policy that fosters effective application of evolving technologies, incentives for investment, and responsiveness to users. The exchange will bring together representatives of industry, government, universities, associations, and other organizations to share their views.

CCIP Chairman Will Stackhouse will open the exchange, and Arno Penzias, AT&T Bell Laboratories' Vice President of Research, will deliver the keynote address. Contact the IEEE-USA Office in Washington, D.C. for more information.

IEEE-USA Calls for Policy Changes to Boost Technology Commercialization

In a recently approved position statement, ***Regaining Strength in Technology Commercialization***, IEEE-USA recommended that the Department of Commerce (DOC) be strengthened to provide coordinated support for technological competitiveness encompassing all elements of engineering research and development. IEEE-USA also called for increased funding of the Advanced Technology Program within the DOC'sTechnology Administration (TA) and advised that TA be designated as the Federal Government's lead agency for coordinating support of technology commercialization ventures.

Federal Government policies and programs are needed that support and facilitate engineering R&D directed toward the efficient production of innovative civilian products and services, according to the statement. IEEE-USA also recommended that DOC encourage and facilitate U.S. industry investment in long-range strategic R&D and high-quality manufacturing; maximize use of technology resources in U.S. Government laboratories and research universities; and strengthen the U.S. technology infrastructure.

USAB Approves Position Statements

IEEE's United States Activities Board recently approved these position statements. Copies are available from the IEEE-USA Office in Washington, D.C.

- **Section 1706 of the Tax Reform Act of 1986—** This legal provision deprives a specific segment of the nation's scientific, engineering, and technical work force of entitled rights under prior law that continues to apply to taxpayers in other professions and occupations. Section 1706 made outmoded common law the exclusive test of whether workers providing services to technical firms are classified as employees or as independent contractors for the payment of Federal income, Social Security, and unemployment taxes. IEEE-USA recommends that Section 1706 be repealed or amended to ensure that the nation's tax laws apply fairly and equitably to all professions and occupations.

- **Individual Retirement Arrangements (IRAs)—** IEEE-USA supports the expansion of eligibility to make tax-favored contributions to IRAs because of their proven effectiveness as a stimulus to personal savings for retirement and the accumulation of capital needed for productive investment in the nation's economy. While also supporting policies designed to encourage preservation of tax-favored IRA contributions, IEEE-USA recognizes that taxpayers need some flexibility in terms of access to their retirement savings.

- **Service Contracts and Engineering Compensation —**Recognizing that a predictable and essential link exists between employee compensation and work performance and that competitive wages and benefits are in the best interests of both the providers and recipients of engineering services, IEEE-USA continues to oppose administrative policies adversely affecting compensation of IEEE members employed by service contractors. IEEE-USA urges employers of engineers and other professionals to provide such employees with salary and other benefits commensurate with the services they provide.

Engineers Have the Future on Their Minds

From February 14 through 20 the nation paid tribute to engineers, the people who turn ideas into reality. National Engineers Week (NEW) is a celebration of engineers' technological achievements and their constant improvement of our quality of life.

Without engineers, the things Americans take for granted, such as space travel, personal computers, heart pacemakers, electric power, bridges, and even the daily newspaper would not exist. Yet for all of the many contributions engineers have made to our modern world, most people have little knowledge about who they are or what they do.

IEEE President and Chair of NEW '93 Martha Sloan said that "our future depends on the minds and hands of engineers." In 1993, NEW was jointly sponsored by 18 engineering societies and 10 major corporations, with IEEE as the lead society.

IEEE USA HOT LINES

IEEE-USA Office, 1828 L Street, N.W., Suite 1202, Washington, DC 20036-5104, USA (202) 785-0017
IEEE-USA telephone hotline recording: (202) 785-2180
James A. Watson, Editor—Georgia C. Stelluto, Associate Editor

PEER II Contract Canceled

IEEE-USA's Employment Assistance Committee (EAC) Chairman John E. Martin announced that EAC's contract with Success Systems, Inc., to operate the Professional Engineering Employment Registry (PEER II) will not be renewed.

"Both EAC and Success Systems worked hard to make PEER II a success, because it held out so much hope for our members," Martin said. However, he pointed out that the company has never been able to deliver what was promised in the PEER II brochure. The Committee felt that the product could not be improved sufficiently to satisfy IEEE's member-users.

Success Systems will continue to honor existing subscriptions to the service. Current subscribers will still be able to contact the company for additional diskettes of job listings, and their resumes will continue to be included in a data base searched by employers.

At this time, EAC has no plans to replace the employment registry, but the committee will provide members with a list of several existing commercial registries and data bases. IEEE-USA will continue to sponsor employment workshops, job fairs, local job banks, videotape libraries, local consulting networks, and other forms of employment assistance.

IEEE Leads National Engineers Week 1993 Activities

IEEE's lead sponsorship of National Engineers Week (NEW) 1993 culminated in a series of high-profile events held in Washington, D.C., during the week of February 14-20. On Wednesday, February 17, the first NEW Future City Competition national finals were held at the U.S. Department of Energy (DOE). Martha Sloan, IEEE President and 1993 NEW Chairman, presided over a ceremony and press conference following the competition.

Tilden Middle School of Rockville, Maryland, was awarded first prize by DOE Secretary Hazel R. O'Leary. The school's computer design and scale model of a 21st century city that is energy efficient, environmentally sound, cost-effective, and people-oriented was judged best of almost 200 entries at the regional and national levels. The competition received wide TV, radio and newspaper coverage, including ABC Evening News footage of Sloan and the winning team at a White House meeting with President Clinton.

After meeting with their respective Members of Congress on Capitol Hill, finalists in the Future City Competition demonstrated their projects at a National Engineers Week Evening Gala at INTELSAT. This unique event brought together adults and children to celebrate the profession's present and future. Participants were treated to the "Marsville" project, a walk-through model of a human habitat on Mars created by local grade-school students. "Dr. Fad," the inventive PBS children's show personality, provided lively entertainment, and Sloan presided over a program that included presenting the Engineering Foundation's National Engineering Journalism Award to *The New York Times'* Jay Romano, and remarks by Kenneth T. Derr, Chairman of Chevron Corporation and Honorary Chairman of NEW 1993.

Sloan concluded her National Engineers Week itinerary by leading a teach-in at Ludlow Taylor School in Washington, D.C. Her spirited presentation to the inner-city fifth- and sixth-graders dramatized the importance of engineering in fundamental aspects of American life. Sloan and Derr led more than 30,000 engineers this year in educating almost three million students and adults about the engineering profession through NEW '93's Discover"E" program.

Also during the week, the profession was spotlighted in the nation's most influential print media. An IEEE-produced ad appeared in *The Washington Post* and *The New York Times*. In addition, Rep. George Brown (D-California) read a statement honoring the engineering profession into the *Congressional Record*.

Washington Office Undergoes Staff Reorganization

IEEE-USA Staff Director W. Thomas Suttle recently announced the promotions of Chris J. Brantley and Scott D. Grayson to managerial positions.

As Manager of Government Activities, Brantley oversees IEEE-USA's Government Activities Council, and is also responsible for managing the U.S. competitiveness effort. He holds a J.D. and a Masters in Law and International Affairs from The American University, a B.A. in Political Science from Mercer University, and is currently on the adjunct faculty of American's Washington College of Law.

Grayson has been promoted to Manager of Career Activities. He supervises IEEE-USA's Career Activities Council, as well as managing pension reform efforts. Grayson holds an M.A. in politics and international economics from New York University's Center for Latin American and Caribbean Studies, and a B.A. from the University of Wisconsin.

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.

IEEE USA HOT LINES

IEEE-USA Office, 1828 L Street, N.W., Suite 1202, Washington, DC 20036-5104, USA (202) 785-0017
IEEE-USA telephone hotline recording: (202) 785-2180
James A. Watson, Editor—Georgia C. Stelluto, Associate Editor

IEEE-USA's Legislative Initiative Highlights Competitiveness and Pension Reform

IEEE's United States Activities Board launched a Legislative Initiative, a concentration of volunteer, staff, and budgetary resources, to promote two issues of vital concern to U.S. members—enhancing U.S. competitiveness and achieving pension portability. Begun in 1989, this effort continues today with a renewed focus on competitiveness and pension reform. As an election year, 1992 offered special opportunities.

The Campaign '92 Initiative—In 1992, IEEE-USA promoted jobs, economic growth, and competitiveness as election-year issues to raise public awareness of the role technology plays in promoting competitiveness. Presidential candidates George Bush and Bill Clinton responded to IEEE President Merrill W. Buckley's challenge to answer 10 questions outlining their plans for improving U.S. technological competitiveness. Their responses were highlighted in *The Institute* and *Professional Perspective*.

Enhancing U.S. Competitiveness—IEEE-USA's Competitiveness Committee pursued several special initiatives in 1992, including sponsoring a Competitiveness Fellow on the staff of Senator William V. Roth (R-Delaware) and two Technology Fellows to support the programs of the new Technology Administration in the U.S. Department of Commerce. With support from the National Center for Manufacturing Sciences, the Committee also developed draft legislation for introduction in Congress that would provide Government guarantees and low-cost loans for manufacturing production facilities in the United States. The Committee will renew its efforts in 1993 and join with the Technology Policy Council to promote passage of the ***National Competitiveness Act***, H.R. 820 and S.4.

Promoting Pension Reform—IEEE-USA's Pensions Committee is pursuing changes in pension law to expand pension coverage and savings options, reduce vesting requirements, and improve pension portability. Member participation in letter-writing campaigns and Capitol Hill visits helped the Committee secure introduction of the ***Pension Coverage and Portability Improvement Act*** and the ***Pension Reform Act*** in the 102nd Congress.

The Committee has crafted new legislation that focuses narrowly on pension portability and vesting, to broaden the base of political support for reform. Committee members are also seeking Congressional sponsors, lining up public support, and giving testimonies supporting full restoration of Individual Retirement Accounts to help advance the retirement security interests of IEEE's U.S. members.

Technology Policy Council Hosts Capitol Hill Briefings

IEEE-USA's Technology Policy Council hosted key Congressional policymakers at an electrotechnology policy issues briefing on Capitol Hill. Designed to introduce IEEE-USA volunteers and staff to new Members of Congress and their staffs, the event will inaugurate a new series of monthly Congressional seminars on technology policy issues.

The briefing featured three presentations. IEEE-USA Technology Policy Council (TPC) Chairman Joseph D. Bronzino stressed the need for a bioengineering emphasis at the National Institutes of Health. TPC Co-Vice Chairman J. Mark Pullen proposed a stronger role for the Department of Commerce in establishing U.S. technology policy, and Co-Vice Chairman Robert S. Powers discussed telecommunications as part of the national information infrastructure.

Future briefings will continue to spotlight IEEE-USA as a knowledgeable and ready resource for policymakers seeking assistance in the technological components of policy issues.

The Pen Is Mightier Than the Scope Probe

IEEE-USA's Intellectual Property Committee (IPC) hears from engineers trapped in such bizarre situations as being forced to work without pay or to finish a patent application long after leaving employment. One employer tried to claim a patent obtained before the inventor went to work for the company. IPC members have written articles, generated testimony for the U.S. Senate, visited Members of Congress and various Federal agencies, and spoken before groups about intellectual property issues.

Every committee within IEEE-USA's Career Activities Council is involved with the needs of practicing engineers. The committees include Pensions, Ethics, Licensure and Registration, Manpower, Career Maintenance and Development, and Anti-Discrimination, as well as Intellectual Property. They are not legal defense funds, nor can they dispense legal advice or negotiate with your employer. However, the committees can offer information, and they inquire into the dark recesses of our profession, which is often sufficient to initiate change.

Few things calibrate the duties of IPC members better than a horror story from an engineer. Members of Congress will listen politely to philosophical positions, but real examples of people being hurt impel them to action. In other words, you need to educate us to empower them.

Tell us about the lumps and bumps in your professional path. Write or call the IEEE-USA Office in Washington D.C., and the staff will guide you to the appropriate committee for help.

Protect Your Retirement: Support Portable Pensions

The IEEE's United States Activities unit, IEEE-USA, is backing Federal legislation to increase the adequacy and efficiency of the private pension system. H.R. 1874, *The Pension Portability Improvement Act,* would:

- **Reduce vesting requirements** from five to three years.
- **Improve pension portability** by permitting vested employees to transfer earned benefits from one retirement savings plan to another.
- **Preserve pension assets** through direct transfers of vested benefits to individual retirement accounts (IRAs) or other portable pension plans.

WHAT YOU CAN DO

U.S. IEEE members can help by writing to their Representatives in Washington. Urge them to enact portability improvement legislation during the current Congress. Tell them how important it is to reduce vesting requirements, guarantee transferability of pension benefits, and promote pension preservation.

Additional information on the legislation and how you can communicate your support to lawmakers is available from IEEE-USA's Vin O'Neill (v.oneill@ieee.org).

IEEE United States Activities
1828 L Street, N.W., Suite 1202
Washington, D.C. 20036-5104
(202) 785-0017 (Voice)
(202) 785-0835 (Fax)

Elected Administrative Committee

DANIEL L. ALSPACH
ORINCON Corp.
9363 Towne Center Drive
San Diego, CA 92121
(619) 455-5530

STANLEY G. CHAMBERLAIN
Raytheon Co.
Submarine Signal Division
1847 West Main Rd.
Portsmouth, RI 02871-1087
(401) 847-8000, ext. 4423

JOSEPH CZIKA
TASC
1101 Wilson Blvd., Suite 1500
Arlington, VA 22209
Tel (703) 558-7400
FAX (703) 524-6666

RUI J.P. deFIGUEIREDO
IERF Bldg., Rm. 208b
Universityy of California
Irvine, CA 92717
Tel (714)-856-7043
FAX (714)-856-4152

SHELDON BALK
Lockheed Missiles & Space Co.
0/90-20 Bldg. 201
3251 Hanover St.
Palo Alto, CA 94304
(415) 424-2180

DAVID E. WEISSMAN
Hofstra University
Dept. of Engineering
Hempstead, N.Y. 11550
(516) 560-5546

ROGER DWYER
43 South Cobblers Ct.
Niantic, CT 06357
(203) 440-4511

EDWARD W. EARLY
4919 N.E. 93rd St.
Seattle, WA 98115
(206) 525-2578

FERIAL EL-HAWARY
Tech. Univ. of Nova Scotia
P.O. Box 1000
Halifax, NS, Canada B3J 2X4
(902) 429-7541

ROBERT W. FARWELL
Code 240
Naval Oceanogr. & Atmos. Res. Ctr.
Stennis Space Center, MS 39529
(601) 688-5230

GORDON RAISBECK
40 Deering St.
Portland, ME 04101
(207) 773-6243

CHRISTIAN DE MOUSTIER
Masrine Physical Lab.
Scripps Instit. of Ocean.
La Jolla, CA 92093
(619) 534-6322

NORMAN D. MILLER
West Sound Associates
2644 NW Esplanade
Seattle, WA 98117
(206) 373-9838

CHARLES E. STUART
DARPA
1400 Wilson Blvd.
Arlington, VA 22209
(202) 841-7200

MICHAEL SEROTTA
General Dynamics
Two Corporate Place
Middletown, RI 02840
(401) 848-8531

ROBERT C. SPINDEL
Applied Physics Laboratory
University of Washington
1013 N.E. 40th Street
Seattle, WA 98105
(206) 543-1310

FRED AMINZADEH
Unocal-Science & Tech. Div.
Brea, CA 92621
(714) 528-7201

Ex-Officio

Jr. Past President
DANIEL L. ALSPACH

Sr. Past President
ANTHONY I. ELLER
SAIC
1710 Goodridge Dr.
P.O. Box 1303
McLean, VA 22102
(703)734-5880

Membership Development
FERIAL EL-HAWARY

Nominations
DANIEL L. ALSPACH

Chapters
LLOYD Z. MAUDLIN

Publicity
J. DAVID IRWIN

Journal Editor
FREDERICK H. FISHER

Constitution and Bylaws Committee
JOSEPH CZIKA

Standards
FREDERICK H. MALTZ

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

Awards and Fellows
DANIEL L. ALSPACH

Fellows Evaluation
W.A. VON WINKLE

Publications Review Board
GLEN N. WILLIAMS

Newsletter Editor
FREDERICK H. MALTZ

Associate Editors

ARTHUR B. BAGGEROER
Dept. Ocean Eng. — Rm. 5-204
Mass. Inst. Technology
Cambridge, MA 02139
(617) 253-4336

RICHARD STERN
Applied Research Lab.
Penn State Univ.
P.O. Box 30
State College, PA 16804
(814) 865-6344

TAKENOBU KAJIKAWA
Ocean Energy Sect.
Electrotechnical Lab.
1-1-4 Umezono
Sakura-Mura, Niihari-Gun
Ibaraki, 305, Japan
(0298) 54-5397

D. RICHARD BLIDBERG
Marine Systems Eng. Lab.
Univ. of New Hampshire
Marine Program Building
Durham, NH 03824-3525
(603) 862-4600

JOHN E. EHRENBERG
Boeing Aerospace & Electronics Co.
P.O. Box 3999
MS 82-22
Seattle, WA 98124-2499
(206) 773-0325

JOHN D. PENROSE
Centre for Marine Science & Tech.
Curtin University
Kent St., Bentley, W. Australia 6102
Australia
61 9 351 7380

WILLIAM J. PLANT
Woods Hole Oceanographic Inst.
Woods Hole, MA 02543
(617) 548-1400, ext. 2725

ADRIAN K. FUNG
Elec. Eng. Dept.
Univ. of Texas at Arlington
Box 19016
Arlington, TX 76019
(817) 273-2671

GIORGIO TACCONI
University of Genoa
Dept. Eng., Biophy. & Elec. (DIBE)
Via all' Opera Pia 11a
16145 Genoa, Italy
39 (0) 10 31 18 11
39 (0) 10 31 18 11

CHRISTOPHER VON ALT
Dept. of Ocean Engineering
Woods Hole Oceanographic Instit.
Woods Hole, MA 02543
(508) 548-1400, ext. 2290

MALCOLM L. HERON
Physics Dept.
James Cook University
Townsville, Queensland 4811
Australia
61 77 81 4117

CHRISTIAN DE MOUSTIER

ROBERT W. FARWELL

ROBERT C. SPINDEL

Technical Committee Chairmen

Underwater Acoustics Technology, ROBERT W. FARWELL
Artic Instrumentation, EDWARD W. EARLY
Autonomous Unmanned Underwater Vehicle Technology, DANIEL STEIGER
Current Measurement Technology, GERALD F. APPELL
Marine Communication and Navigation Technology, JAMES ATKINSON
Modeling, Simulation, and Data Base Technology, GEORGE DWORSKI
Oceanographic Instrumentation and Data Acquisition Technology, OREST I. DIACHOK
Remote Sensors Technology, DAVID E. WEISSMAN
Technical Committees Coordinator, STANLEY G. CHAMBERLAIN
OCEANS '92 General Chairman, DR. CRAIG E. DORMAN, *(Newport R.I.)*
TECHNICAL CHAIRMAN, Thomas Mottl
OCEANS '93 General Chairman, DR. JAMES COLLINS, *(Victoria, BC, Canada)*