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EDITOR: HAROLD A. SABBAGH SPRING 1988 (USPS 420-910)

PRESIDENT'S COMMENTS

I am very pleased to be elected President of the IEEE Oceanic Engineering Society. I have seen the society grow from the counsel on which I served from the late 1970's as a member representing the Automatic Control Society through its transition to a full-fledged society. Engineering applied to the ocean environment is one of the greatest challenges that any engineer could have the opportunity to face. I look forward to leading the society over the next two years, and I am particularly pleased with the staff with whom I will be able to work.

I am very pleased that Glen Williams has agreed to another term as Vice President of the East Coast, and that Lloyd Maudlin, who is co-located with me in San Diego, has agreed to serve as my replacement as Vice President of the West Coast. I am also pleased to announce that Roger Dwyer has agreed to act as Treasurer of the Society. I think it is of critical importance for us to get our hands around the financial health of the organization. I am also pleased that an old friend, Toby Raisbeck, who is currently our member for fellow nominations, has agreed to act as Secretary for the next two years. Of particular importance is the fact that we have been able to replace our retiring Journal Editor, Stanley Ehrlich, who has done an excellent job bringing us a first class society journal, with Fred Fisher of Scripps APL. Many of you have known Fred in the past, and I believe he is the right person to make a great journal even better. I am also pleased to be working with Harold Sabbagh, who is doing a fine job as Editor of this Newsletter.

I am calling on all of you to help me make the Oceanic Engineering Society and its chapters stronger in the next two years. I am particularly asking for the following specific things from each member:

1. Support your local chapter.
2. Make recommendations for fellow nominations from the IEEE Oceanic Engineering Society so that we are properly represented in such awards.
3. Attend the Oceans 88 Conference in Baltimore on October 31-November 2, 1988, as the highlight of your Oceans activities.
4. Submit papers or abstracts to the Oceans 88 Conference, volunteer to be a Session Chairman, or provide other support to the program organizers.
5. Ask if you can become involved in IEEE Oceans national activities. There are many exciting potential areas where volunteers are desperately needed. This will be addressed further in future newsletters.

Daniel L. Alspach, Ph.D.

IEEE OCEANIC ENGINEERING SOCIETY

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RESULTS OF THE ADCOM ELECTION BALLOT

As you know, a ballot for the election of nine IEEE Oceanic Engineering Society Administrative Committee members was issued on December 4, 1987. The ballots returned have been counted, and the following candidates have been elected for a three-year term ending December 31, 1990:

Arthur E. Bisson
Stanley L. Ehrlich
Ferial El-Hawary
William S. Hodgkiss, Jr.
Paul H. Kurtz
Lloyd Z. Maudlin
Mack D. O'Brien, Jr.
Daniel Steiger
Glen N. Williams

We wish the newly elected AdCom members success and thank the nominees for their willingness to serve and for permitting their names to be included on the ballot.

CALL FOR NOMINATIONS

OES DISTINGUISHED SERVICE AWARD

OES DISTINGUISHED TECHNICAL CONTRIBUTIONS AWARD

The OES Awards and Fellows Committee is requesting nominations for the two major Society awards: the OES Distinguished Service Award and the OES Distinguished Technical Contributions Award. The Distinguished Service Award is given to honor an individual IEEE member for outstanding contributions toward fostering the objectives of the Oceanic Engineering Society. The Distinguished Technical Contributions Award is given to honor an outstanding technical contribution to oceanic engineering in either the fundamental or applied areas. The recipient need not be restricted to being a Society or IEEE member. The award shall be for either a single major invention or scientific contribition or for a distinguished series of contributions over a long period of time.

Please submit your nominations with supporting materials no later than May 15, 1988 to:

Anthony I. Eller
OES Jr. Past President
SAIC
1710 Goodridge Dr.
McLean, VA 22102

OES MEMBERS ELECTED TO FELLOW GRADE ON 1 JANUARY 1988

Congratulations to the following OES members who were recently elected to Fellow grade:

NAME AND ADDRESS	CITATION
Dr. G. Clifford Carter 10 Winthrop Court Waterford, CT 06385	For contributions to the theory of coherence and time delay estimation.
Mr. Walter N. Dean 8060 Sacajawea Way Wilsonville, OR 97070	For leadership in the development and implementation of radio-navigation systems.
Dr. Chester S. Gardner 1904 Trout Valley Road Champaign, IL 61821	For contributions to laser ranging, altimetry, and optical remote sensing.
Professor Fumio Harashima Institute of Industrial Science University of Tokyo 7-22-1 Roppongi, Minato-ku Tokyo 106, Japan	For contributions to motion control systems and industrial electronics.
Dr. Keiji Kojima Sumitomo Electric Ind., Ltd. 1-3, Shimaya 1-chome Konohana-ku Osaka 554, Japan	For contributions to the development and application of extra-high-voltage power cables.

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JOE'S NEW EDITOR

Recently, Dan Alspach, OES President, appointed Dr. Frederick H. Fisher to succeed Stan Ehrlich as Editor of the Journal of Oceanic Engineering, beginning 1 January 1988. Dr. Fisher's photo and biography are given below. We wish him well in his new position.

Stan Ehrlich served a long and meritorious stint as Editor. Under his leadership the Journal became the outstanding organ that one expects of the IEEE.

Frederick Hendrick Fisher

Research Oceanographer
Deputy Director
Marine Physical Laboratory

Dr. Frederick H. Fisher, research oceanographer with the Marine Physical Laboratory (MPL) of the Scripps Institution of Oceanography, University of California, San Diego, received his B.S. degree in 1949 and his Ph.D. degree in 1957 from the University of Washington, Seattle. He was on a University Fellowship from 1949-54. In 1954-55 he was an assistant in physics at the University of California, Los Angeles. He was a midshipman at the U.S. Naval Academy from 1945 to 1947, and served in the U.S. Naval Reserve in 1945.

He became a graduate research physicist at Scripps' Marine Physical Laboratory in 1955, assistant research physicist in 1957, associate research physicist in 1962, and research oceanographer and lecturer in 1968. From 1957-58 he was also a research fellow in acoustics at Harvard University.

Since 1957, Dr. Fisher has been head of a research group; he became Associate Director of MPL in 1975 and Deputy Director in 1987. During 1963-64 he served as director of research for Havens Industries, San Diego, which was involved with desalination of sea water by reverse osmosis. During 1970-71, he was Professor and Chairman of the Physics Department at the University of Rhode Island. He was scientific officer and co-designer of the manned ocean buoy, FLIP, and was responsible for working out the "flipping" operation with 35-foot-long 1/10-scale models. He was scientist-in-charge of the sound propagation research which led to the need for the development of FLIP and has led numerous sea-going expeditions in submarines since 1959, and aboard FLIP since 1962. Since 1965 he has been principal investigator for National Science Foundation (NSF) grants devoted to high-pressure measurements related to the physical chemistry of sound absorption in sea water due to magnesium sulfate. His interest in the low frequency anomalous sound absorption in the ocean below 1 kHz led to the discovery of boric acid as the cause of the low frequency relaxation. He has also been principal investigator on various Office of Naval Research contracts related to measurements of sound propagation in the ocean.

Dr. Fisher was elected in 1976 to the Executive Council of the Acoustical Society of America; in addition, he was associate editor for the Journal of the Acoustical Society of America from 1969-1976, has served on the nominating committee for the Acoustical Society, as well as on its technical committees for Physical Acoustics, Underwater Acoustics and Engineering Acoustics. He was chairman of the Technical Committee for physical acoustics and a member of the Technical Council. He served as vice president in 1981-82 and president in 1983-84. In 1985 he was appointed to the governing board of the American Institute of Physics as one of the representatives of the Acoustical Society of America.

He is a Senior Member of the Institute of Electrical and Electronic Engineers and in 1988 became the Editor of the Journal of Oceanic Engineering published by the IEEE Oceanic Engineering Society.

He was a member of the ICES/UNESCO/SCOR/IAPO Joint Panel on Oceanographic Tables and Standards (SCOR Working Group 10), which is concerned with the physical and chemical properties of sea water. He also served as co-chairman of an Acoustical Society Symposium in 1967 on the Dynamics of Liquid Structures, sponsored jointly by NSF and the Acoustical Society. In 1975 he was chairman of a workshop/symposium on Coherence at the Navy Underwater Sound Laboratory, New London, sponsored by the Underwater Sound Advisory Group.

In 1975 he was elected Vice-Chairman of the Staff Council at the Scripps Institution of Oceanography. At Scripps he served on the Budget Committee (appointments and promotions) for various periods since 1966 and was Chairman during the 1975-76 academic year. He has served three times as Chairman of the Director's Space Advisory Committee. He has also served on various other committees

Continued on page 11.

(*Reprinted from OCEANS '87 PROCEEDINGS*)

A NOVEL APPROACH TO REAL-TIME WAVE PROCESSING

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One Bridge Street, Newton, MA 02158, USA

ABSTRACT

The hardware and software architecture of a system that performs real-time wave processing from pressure or acceleration or sea surface displacement is described.

On-board time and frequency domain data processing is accomplished by low-power microcomputers running software written in an interpretive high level language called VPL (Vector Processing Language). The unique feature of this firmware design approach is the ability of the user of the instrument to customize not only the calibration coefficients of the sensors, but also the signal processing algorithms. This ability to customize the system allows the same hardware to be used for a wide range of applications, including data compression for real-time transmission of representative data products, offshore civil engineering studies, etc.

A. INTRODUCTION

Real-time data presentation capabilities have been an important design goal for oceanographic instrumentation for some time. The need for real-time data presentation is especially acute for:

- assessing the severity of currently existing conditions; for providing proof of regulatory compliance; for modelling input for the accurate forecasting of future conditions;

- for verifying the proper functionality of the instrument; for assuring trouble free operation where continuous data sets are imperative; for updating continuously historical data bases of wave information;

- for compressing data to allow storage of reduced data sets of data products as opposed to entire data sets; for transmitting via telemetry links smaller amount of processed information instead of lengthy raw data sets.

This paper describes a unique, real-time wave processing system developed with primary design goals the low-power operation and the adaptability. A wide range of data acquisition and processing applications can be covered by adapting the operating firmware of the system in the lab or in the field. The architecture of the hardware consisting of modules for data acquisition, preprocessing, statistical wave processing, data storage, and power supply conditioning is described in Section B. Section C describes the hardware-independent, interpretive software package, called the Vector Processing Language (VPL), which allows extensive customization of the system. Typical algorithms used by the Wave Processing Station to process waves are given in Section D. A sample program written in VPL is presented in Section E, indicating the inherent simplicity to customize the system operation.

B. HARDWARE DESCRIPTION

The Wave Processing Station is typically packaged in a single 19" rack; a version in a 6" pressure housing is also available. The 19" rack version receives information from remote sensors including temperature, conductivity and pressure transducers. The standard sensors adaptable to this configuration include: the Model 2100-AS-002 Digiquartz Pressure Transducer from Paroscientific, Inc.; the Model SBE-4 conductivity meter from Sea-Bird Electronics, Inc.; and the Model YSI-44030 precision thermistor from Yellow Springs Instruments Co.

Other water-level sensing elements, such as wave staffs measuring sea surface displacement by non-contact, strain gauge pressure transducers, and vertical accelerometers can be attached.

The primary output of the Wave Processing Station is a set of data products which include a complete spectral characterization of a wave time series. The data products are transmitted via RS-232 lines, or via modulated signals for telephone lines or via RF links. A 60 MB high-capacity recorder is used to record raw time-series wave data whenever specific threshold conditions are exceeded.

The Wave Processing Station is a distributed processing system with five microprocessors running simultaneously. The four modules within the Wave Processing Station (Figure 1) include:

1. The Wave Preprocessor Module (WPM)
2. The Wave Cruncher Module (WCM)
3. The High Capacity Recorder (HCR)
4. The Power Supply and Battery Backup Subsystem

1. The Wave Preprocessor Module (WPM) interfaces directly with the sensors and creates records of raw wave time-series information. The format of the WPM record is shown in Figure 2. The electronics of the WPM consist of an integrating A/D to digitize the resistance of the thermistor, a low-frequency counter to decode information received from the conductivity sensor, a high frequency counter to read the quartz pressure tranducer, and a single-board, low-power microcontroller. The microcontroller supervises operation of the data acquisition system, controlling the A/D converter and the frequency counters. The timing of the WPM is controlled by three software variables: sampling interval (T), burst interval (B), and number of data points per burst (N). Each triplet of (B,N,T) is called "the sampling scheme". Typical values of B, N, and T are:

B = { 1min, 20min, 30min, 1h, 2h, 3h, 4h, 6h, 8h, 12h, 24h }
N = { 64, 256, 512, 1024, 2048, 4096 }
T = { 0.25s, 0.5s, 1s, 4s, 8s }

The triplet (3h, 1024, 1s) is commonly used, for offshore engineering studies and designs; this triplet has been set as the WPM default. Other settings are made possible by programming the WPM accordingly.

2. The Wave Cruncher Module (WCM) receives raw data records from the WPM once every B units. The WCM performs extensive processing of the raw data and constructs two new data records: the Preprocessed Data Record and the Data Product Record. The first record is sent to the local recorder for archival; the second record (shown in Figure 3) is sent to the communication link via a modem or an RF transmitter.

Generation of the Preprocessed Data Record can be controlled by conditions of varying complexity. For example, a simple condition is to generate and archive data records when the significant wave height is more than three meters. An example of a more complex condition is to generate and archive data records when the energy in the frequency band between 0.05Hz and 0.1Hz is more 80% of the total wave energy, but to stop archiving when more than 100 records have been recorded.

The WCM can also create a hardware alarm signal based on conditions of similar complexity. This alarm signal can either be fed back to the Wave Preprocessor Module to change the sampling scheme, or used to control equipment external to the Wave Processing Station.

The electronics of the Wave Cruncher include a quad UART board, up to 512KB of low power static memory, support circuitry for controlling the front pannel status lights, and a low-power central processing unit.

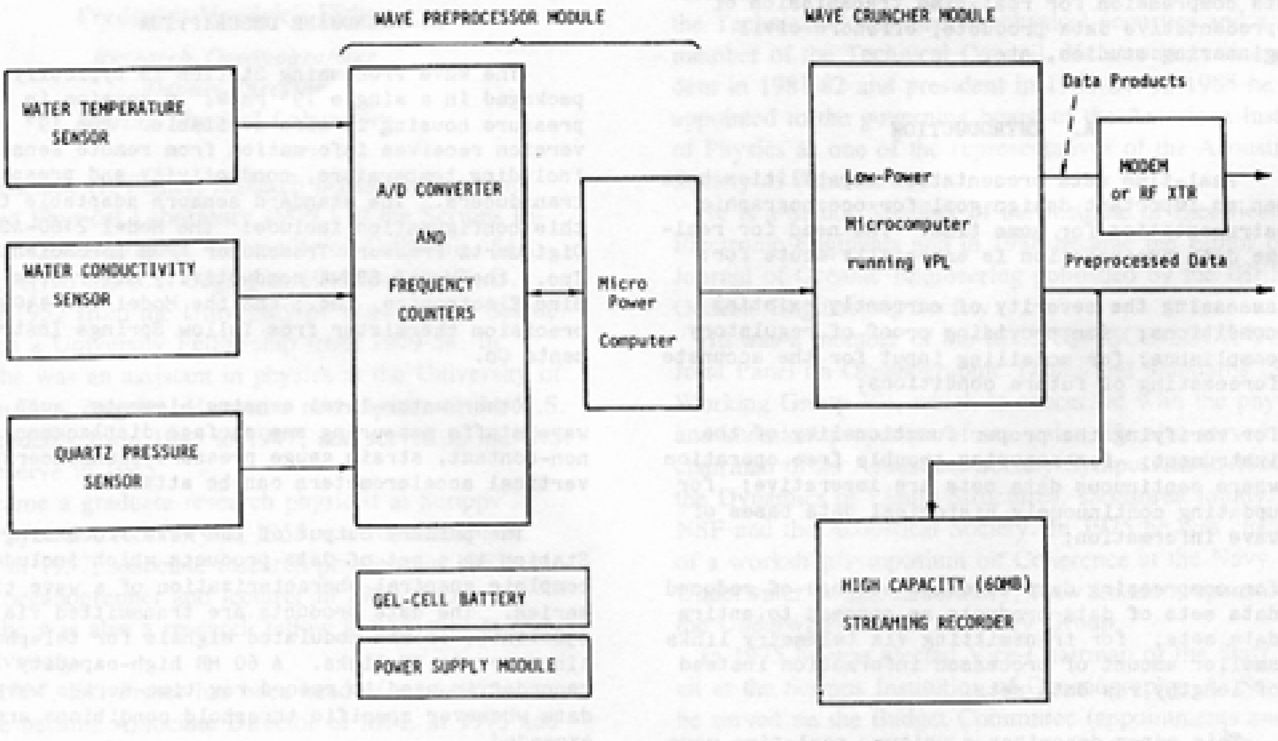

Figure 1: Block Diagram of the Wave Processing Station

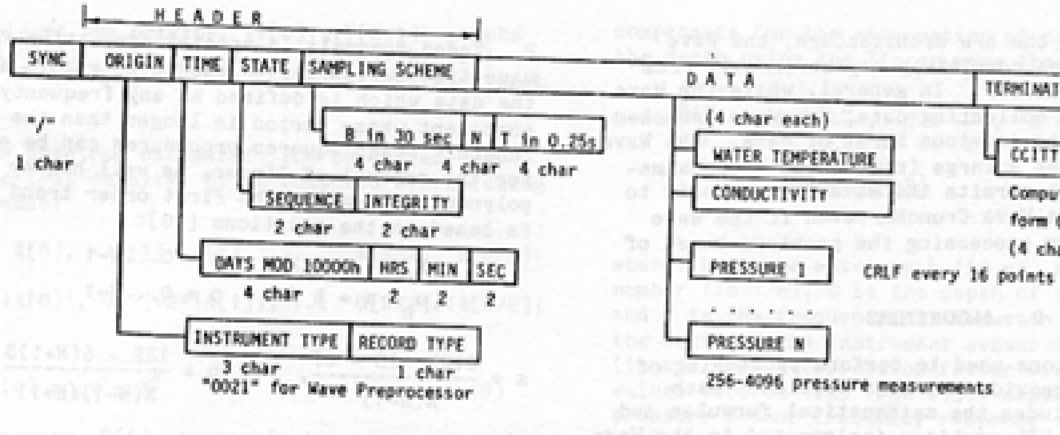

Figure 2: Wave Preprocessor Data Record Format

3. The High Capacity Recorder (HCR) receives Preprocessed Data Records from the Wave Cruncher and stores them on a 60MB quarter-inch tape using the QIC-24 industry standard format. The HCR module consists of a QIC-44 compatible streaming tape drive, a QIC-02 compatible formatter and a microcomputer/controller with 128KB cache buffer. Data are temporarily stored in the cache buffer; when the cache buffer becomes full, the tape drive is switched on and the data are dumped to tape in a streaming fashion. A more detailed description of the High Capacity Recorder can be found in [1].

4. The Power Supply and Battery Backup Subsystem provides the necessary power to all modules of the Wave Processing Station. High-efficiency switching regulators and micropower linear regulators are used to convert the internal 12v Gel-Cell battery voltage to the appropriate voltages needed by the other modules of the system. Normally, a charging circuit is used to maintain the battery fully charged; whenever the line power is lost, the battery provides sufficient back-up power for several days of operation.

For underwater deployments, the Gel-Cell can be replaced by an alkaline primary stack which can be enclosed in the same or adjacent housing to supply power to all modules for several months.

C. SOFTWARE DESCRIPTION

Most of the design effort has been concetrated on the Wave Cruncher firmware, an innovative, interpretive environment called the Vector Processing Language (VPL). This environment makes the Wave Processing Station completely programmable. Programming can be performed by the manufacturer, or by the end user.

A VPL program is functionally similar to a BASIC program, but uses C-language programming constructs. Highly structured programs, including vector operations can be written in a compact form. For example, if X and Y are vectors of 1024 points of floating point numbers, the statements:

```
Y = a * X + b;  Y -= mean( Y, 1024 )
```

perform a linear transformation of X onto Y, and then, the mean value of Y is subtracted inplace from all the elements of Y. Futher description of VPL can be found in [4] and [5]; the portion of the VPL code which performs the non-directional wave processing is included in Section 4.

Because VPL programs reside in an EEPROM, the user can change not system parameters, but also the program flow and the processing algorithms. From the user's point of view, the benefits in using VPL rather than fixed algorithms are:

1. Modification of the calibrating coefficients of sensors is simple.
2. Changes to conversion equations when the sensors are replaced by a different type are trivial.
3. Derivation of the algorithms for the final Data Product Record are more understandable.
4. Maintenance of the system documentation is simple and organized; a short VPL program can fully document a complete experiment.
5. Concentratation can be directed to the physical problem under study, away from the programming details.

Whenever a raw data record transmitted by the WPM is received by the Wave Cruncher Module, a VPL program is invoked and the following functions are executed:

1. Data are unpacked and converted to engineering units.
2. Time series parameters are computed.
3. Spectral analysis is performed.
4. Data products are transmitted as "Data Product Records".
5. Decisions are taken if it is necessary to create and archive a "Preprocessed Data Record"
6. Alarm conditions are examined and the Wave Preprocessor is alerted, if necessary.
7. The low-power consumption mode is entered upon completion of the previous tasks.

Because of the h/w architecture, the Wave Cruncher operates completely asynchronously from the Wave Preprocessor. In general, while the Wave Preprocessor is collecting data, the Wave Cruncher is processing the previous burst of data. The Wave Cruncher includes a large input queue (approximately 16KB) which permits the Wave Preprocessor to send data to the Wave Cruncher even if the Wave Cruncher is busy processing the previous burst of data.

D. ALGORITHMS

The equations used to perform processing of the waves are provided in this section. Each subsection includes the mathematical formulas and the associated VPL routines implemented in the Wave Processing Station. A detailed example is given in the next section.

1. Pressure Computation: One of the following equations is used to convert the frequency readings of the quartz sensor to pressure, depending on the type of the transducer:

$$P_1 = A\cdot x - B\cdot x^2, \quad x = 1 - T_0 f \qquad (1)$$

$$P_2 = C\cdot(x - D\cdot x^2), \quad x = 1 - (T_0 f)^2 \qquad (2)$$

where, P_1, P_2 is the absolute pressure in P (Pascal); f is the frequency output of the quartz pressure sensor (in Hz); A, B, C, D, and To are calibration coeficients for a given sensor.

The VPL routines ToPrs1(PRSCOE1, f) and ToPrs2(PRSCOE2, f) use formulas (P1) and (P2) respectively, to compute the pressure for a given set of coefficients, (PRSCOE1 or PRSCOE2), and a given frequency, f.

2. Trend Removal: A special correction for the wave time series may be needed to remove a trend in the data which is defined as any frequency component whose period is longer than the record length. Least squares procedures can be employed for the removal of linear, as well higher order polynomial trends. The first order trend removal is based on the equations [10]:

$$y_n = x_n - u_n, \quad n = 0...N-1 \qquad (3)$$

$$u_n = a + b\,n \quad n = 0...N-1 \qquad (4)$$

$$a = \frac{2(2N+1)S - 6P}{N(N-1)}, \quad b = \frac{12P - 6(N+1)S}{N(N-1)(N+1)} \qquad (5)$$

$$S = \text{sum of all } x_n, \quad P = \text{sum of all } n x_n \qquad (6)$$

where, x is the original time series, y is the trend-free time series, and N is the number of points. The VPL routines, TREND0(V, N) and TREND1(V, N), can be used to remove the 0-th and the 1-st order trends respectively.

3. Frequency Domain Transformation: Pressure data are transformed to frequency domain using the equation

$$A_n = \sum_{i=0}^{N-1} a_n \exp(-j \frac{2\pi ni}{N}) \qquad (7)$$

where $a_n = x(t_n) = x(nT)$ for n=0...N-1

Modified versions of radix 2-4-8 FFT and IFFT [6] have been implemented in VPL, named FAST(V, N) and FSST(V, N). Both routines are efficient and perform in-place transforms with a minimum computation time and memory overhead.

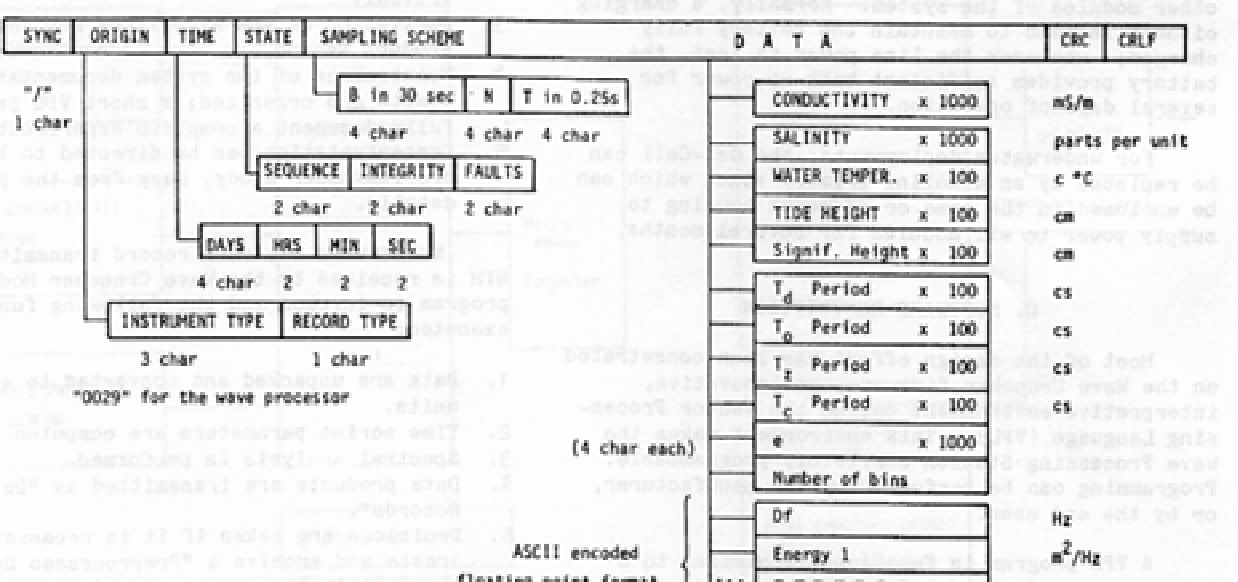

Figure 3: Wave Cruncher Output Data Product Record Format

FAST replaces the original {V[0]...V[N-1]} points by {R[0], X[0], R[1], X[1], ... R[N/2], X[N/2]} where R[.] and X[.] are the real and imaginary part of A[.]

4. Power spectrum estimate: The one-sided, raw-power spectral density, G, is computed by replacing the sequence:

R[0], X[0], R[1], X[1], ... R[N/2], X[N/2]

by

G[0]=|A[0]|, G[1]=2*|A[1]|, ... G[N/2]=|A[N/2]|

where

$$|A| = \sqrt{R^2 + X^2} \qquad (8)$$

In this manner, G[i] represents the energy density for the frequency band iF to (i+1)F where F = 1/NT. The total wave energy can be found by:

$$E = T\sum_{n=0}^{N-1} a_n^2 \qquad E = \sum_{n=0}^{N/2} \frac{T}{N} G_n^2 \qquad (9)$$

in time and frequency domain respectively. Power spectrum smoothing is done by averaging L power spectral estimates at a time. The resulting frequency resolution decreases to FL. It is known that, the smoothed spectral estimates are variables with roughly 2L degrees of freedom, and the normalized standard error is equal to sqrt(1/L) [10].

Example: For N=2048 points and T=0.5s, the power-spectrum frequency resolution is F=1/1024 Hz. To achieve a standard error of less 0.20, the number of bins, L, must be more than 25. Using L=25 points, the smoothed power spectrum has a resolution of 25/2048 = 0.0122 Hz, and consists of N/2L=40 (approximatly) power spectral constitutes. The last spectral estimate occurs at about 0.488 Hz.

5. Accelaration Spectrum: If vertical acceleration data (c(t)) are used to estimate the acceleration spectrum (C(jw)), the wave height (G(jw)) spectrum can be estimated by the following equations:

$$\frac{d}{dt}\left[\frac{d}{dt} h(t)\right] = c(t), \quad (j\omega)^2 H(j\omega) = C(j\omega) \qquad (10)$$

$$|G_i| = \frac{|C_i|}{(2 i F_L)^2}, \qquad F_L = \frac{L}{N \cdot T} \qquad (11)$$

In other words, after the acceleration spectral estimates (C_i) have been found, a simple division by the square of the index (i) can be used to derive the height power spectral estimates.

6. Depth Correction: The water pressure (P) is converted to surface elevation (E) using the hydraulic equation E = d g P (d=density of the water, g=gravitation acceleration). After the surface elevation smoothed-spectrum has been computed, each frequency band is corrected to compensate for the attenuation of pressure, due to the depth using the linear wave theory equations:

$$L = \frac{g \cdot T^2}{2\pi} \tanh \frac{2\pi D}{L}, \quad T = \frac{1}{f}, \quad k = \frac{2\pi}{L} \qquad (12)$$

$$H = E \cdot n \cdot \frac{\cosh k(k-z)}{\cosh kD} \qquad (13)$$

where, L is the wavelength (in m), k is the wave number (in 1/m), D is the depth of the water (in m) and f is the frequency of the waves (in Hz), z is the depth of the instrument sensor from the surface (in m), n is a correction factor with empirical values 1.00 to 1.35 (see [9]), depending on the pressure sensor frequency response characteristics.

The ratio H/E is called the Pressure Response Factor (PRF), and varies from 1.00 at very low frequencies or very shallow depths to an arbitrarily large number at high frequencies or in very deep water. Since this factor can cause amplification of noise at high frequencies where very little signal is present, a maximum PRF value is normally imposed on the calculations to avoid noise amplification. As a standard value we have chosen the maximum amplification to correspond to the point at which the wave is on the border between being considered a deep water wave (meaning no bottom influence due to the wave) and a "transitional" wave, where bottom influence begins to occur. The normally accepted value for this border is a depth equal to half the wavelength, which results in an attenuation (and subsequent PRF) of exp(π) or 23.14.

The wavelength equation (10) is solved iteratively using the algorithm:

$$k_{i+1} = k_i + (x_{i+1} - x_i)/s_i \qquad (14)$$

where:

x_i is the i-th estimate of $x(f) = \frac{(2\pi f)^2}{g}$ (15)

k_i and x_i must satisfy the equation

$$x_i = k_i \tanh k_i D \qquad (16)$$

and s_i is the derivative of x(k) at $k=k_i$

The associated VPL functions are: WavNum(PRSCOE, f) to compute the wave number (k) for a given frequency f, PRF(PRFCOE, f) to compute the pressure response factor for a given frequency f, and VPRF(PRFCOE, V, N, f, f_inc) which is the vector version of PRF(). The PRFCOE vector contains contants such as g, D, z etc., which are initialized before one of the PRF() routines is invoked.

7. Computation of Spectral Parameters: The n (n= 0,1,2,3 and 4) moments of the smoothed spectrum are computed using the formula:

$$M_i = \sum_{i=0}^{N/2} |A_i| * i^n \qquad (17)$$

Then, the mean period (T_0), the mean zero crossing period (T_z), the mean crest period (T_c), the spectral width parameter (e) are given by the equations:

$$T_0 = \frac{M_0}{M_1 F_L}, \quad T_z = \frac{M_0}{M_2 F_L}, \quad T_c = \frac{M_2}{M_4 F_L}, \quad F_L = \frac{L}{N \cdot T} \quad (18)$$

$$e = \sqrt{1 - \frac{M_2^2}{M_0 M_4}} \quad (19)$$

The significant wave height H_s is computed by:

$$H_s = 4\sqrt{\mathrm{var}\{ V \}} = 4\sqrt{M_0} \quad (20)$$

8. Water Temperature Computation: The resistance of the thermistor (R), and the water temperature (T) are computed by the A/D transfer function and the Steinhart and Hart equation respectively:

$$R = \frac{R_f}{2M + R_f/R_o} - R_1 \quad (21)$$

$$T = \frac{1}{A + B \cdot \ln R + C \cdot (\ln R)^3} - T_o \quad (22)$$

where, M is the fraction of full scale computed from the A/D measurement; R_f, R_o, R_1 are resistor values of the ratiometric circuit used to derive the resistance of the thermistor; T_o is the absolute temperature of zero degrees C (273.16 C); A, B, C are coefficients from the calibration sheets of the thermistor.

Notice that computation of R depends on the A/D converter circuit topology and is h/w dependent. The VPL routines used to perform the above calcualtions are TempDef(TMPCOE) to define the h/w specifics, ToResis(TMPCOE, M) to compute R from M, and ToTemp (TMPCOE, R) to compute T from R.

9. Salinity Computation: Since salinity (S) is a function of the conductivity, temperature and pressure of the water, the conductivity (C) has to be computed by first using hardware dependant sensor equations. For example, for the Sea Bird SBE-4 sensor:

$$C_1 = (a_1 f^m + b_1 f^2 + c_1 + d_1 T)/10 \quad (23)$$

$$C_2 = \frac{f^2}{(a_2 - b_2 f^n)^2 + c_2 T - d_2} \quad (24)$$

where C_1, C_2 are conductivities in S/m (Siemens per meter); f is the frequency (in Hz), output from the conductivity sensor; T is the water temperature in degrees C; a_1, b_1, c_1, d_1, m, a_2 b_2, c_2, d_2, n, are calibration coefficients calculted for the individual conductivity sensor by the manufacturer.

Finally, salinity is computed using the equations described in [7]. The associated VPL routines for conductivity and salinity computations are: ToCnd1(COECND1, f, T), ToCnd2(COECND2, f, T) and ToSal (COESAL, T, P, R). The coefficients vectors COECND1, COECND2 and COESAL appearing in the above functions are initialized to default calibration parameters. A simple equate of the form COECND1[0] = <new_value> can be used to alter the default value.

E. AN EXAMPLE

The segment of the VPL program to perform the complete spectral analysis of the wave time series is given below. It is assumed that:

V[.] is a vector containing NPNTS of pressure measurements

NPNTS is the number of pressure points (typically 1024 or 2048)

(The initial line numbers are for reference only; not needed by VPL)

```
(1)    RMEAN = mean(V,N); RSTDEV = stdev(V,N)
(2)    RMIN  = Vmin(V,N); RMAX   =  Vmax(V,N)
(3)    V -= ATMPRS;    V /= WDENS * GRAV
(4)    TIDES = trend1( V, NPNTS )
(5)    RVAR  = var ( V, PNTS )
(6)    wdtap( V, NPNTS, 0.4 )
(7)    fast ( V, NPNTS ); power( V, NPNTS )
(8)    V *= RVAR / (Vsum( V, NPNTS )/NPNTS)
(9)    NBINS = smooth( V, NPNTS, PPERB )
(10)   FRQ   = PPERB/(NPNTS*PERIOD)
(11)   VPRF2( PRFCOE, V, NBINS, FRQ )
(12)   moments( NM, V, NBINS )
```

Lines 1 and 2 find the mean value, the standard deviation, the minimum and the maximum of the time series wave pressure data. Line 3 consists of two "in-place" vector operations. The first line subtracts the atmospheric pressure from all the pressure data, while the second computes the water height time series. Lines 4 and 5 remove the linear trend of the time series and compute the tide water level and the variance of the wave heights. Line 6 is used to window the data (tapered window at 40%). Line 7 performs an in place real FFT transform and computes the raw power-spectrum. Line 8 compensates the pressure raw spectrum for the windowing operation. Line 9 smooths the spectrum by avearging PPERB raw spectral lines to one. Line 11 applies the pressure response factor to frequency components. Finally, line 11, computes the moments and the mean (statistical) periods of the waves (To, Tc, Tz etc).

From this example it is apparent that VPL is a very powerful interactive programming language. Twelve lines of VPL program can replace hundrends of lines of FORTRAN code.

CONCLUSION

A new, real-time wave processing system has been developed in response to the need for more sophisticated presentation of wave data products. Key features of this system include a low-power wave data "Cruncher", which allows battery-powered operation for long periods of time, and a hardware-independent interpretive software package which can be customized to accomplish a wide variety of data acquisition and processing tasks.

The Wave Processing Station is currently being enhanced with directional wave processing. Using the existing hardware as a starting point, the system will acquire data from a 2-axis current sensor as well as the standard sea surface elevation data. The enhanced VPL program will perform the necessary auto- and cross-correlations in real time to allow calculation of directional spectral estimates according to the method set forth in [2]. This inherent enhancement capability underscores the adaptability of the wave processor hardware and software to a growing number of real-time oceanographic data acquisition tasks.

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JOE'S NEW EDITOR continued from page 4.

including Marine Operations, Specialist Review Panel, Personnel Appeals, Chancellor's Marine Sciences Physical Planning Committee, Aquarium Museum Committee and the Physical Oceanography Building Advisory Committee. He was also president of the Scripps Alumni Association for three years.

He is an Adjunct Lecturer in the Electrical Engineering and Computer Sciences Department and has been a Lecturer in the Department of Oceanography, teaching Special Topics Courses in Electrolyte Solutions and Marine Corrosion. He supervised a Ph.D. thesis by LTCDR V. P. Simmons on the boric acid low frequency acoustic relaxation in the ocean and a Ph.D. thesis by C. C. Hsu on the effect of pressure on chemical sound absorption and ion-pairing in the ocean. He has over sixty journal publications and three patents as well as numerous abstracts and other reports.

He was elected to Sigma Xi and Pi Mu Epsilon honoraries. He is a Fellow of the Acoustical Society of America, a Senior Member of the IEEE and a member of the American Physical Society,the American Chemical Society, the American Association for the Advancement of Science, American Geophysical Union, Sigma Pi Sigma, U.S. Naval Institute, Marine Technology Society, and the American Defense Preparedness Association. He served on a panel of the Naval Research Advisory Committee (NRAC) for Environmental Science in 1984. In 1986 he served as a Review Panel member for the Office of Naval Technology Postdoctoral Fellowship Program. He was Co-Chairman of a Low Frequency Passive Acoustics Workshop in 1986, and a Stable Platform Workshop in 1987, both jointly sponsored by the Marine Physical Laboratory and the Office of Naval Research.

REVIEW & FORECAST: SMALL BUSINESS INNOVATION RESEARCH EQUALS OCEANIC COMMUNITY OPPORTUNITY

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In response to *Sea Technology's* request for a summary of NOAA's Small Business Innovation Research (SBIR) Program, this review summarizes that program from the NOAA perspective to help small businesses better understand the opportunities available. The program is beginning to pay off for NOAA and the oceanic-atmospheric community.

Three new technology developments will soon be available to the community as a result of the program: a high-accuracy ship positioning system, a portable water vapor radiometer, and a method for holding lobsters for long periods. These have been funded since 1985. Other SBIR-sponsored developments are in the pipeline.

TAU Corporation of Los Gatos, California, has developed a positioning system for ships that provides 5-meter accuracy using the Global Positioning System (GPS) in a differential mode. The Standard Positioning Service (SPS) portion of GPS will only "guarantee" 100-meter accuracy. This system will provide many advantages over the shore-based radio positioning systems that NOAA and others presently use for hydrographic surveys. The technology is also being explored by the U.S. Coast Guard to enhance harbor navigation.

Ophir Corporation of Lakewood, Colorado, has developed the first small, portable, precision microwave water vapor radiometer. The system measures sky brightness temperature to an accuracy of 0.5ºC from which total precipitable water and water-induced refractive errors are derived. Presently available systems are too large, costly, and cumbersome for many uses.

Applications for the system include corrections to GPS and radio-astronomy measurements, weather monitoring, and atmospheric research.

Aquatic Systems Inc., of San Diego, California, has developed commercially viable technology for holding wild-caught lobsters up to 200 days under controlled, cold-water conditions. This allows holding lobsters caught in the warm summer months until winter — when much higher market prices prevail — and could result in the effective increase of the lobster harvest, through reduction in mortality, of at least 10-15%.

The SBIR program began in 1982 with the enactment of the Small Business Innovation Development Act. It was reauthorized in 1986 to run until September 30, 1993. The act requires that federal agencies with extramural R&D budgets in excess of $100 million establish SBIR programs. Funding is provided by a 1.25% assessment of a participating agency's extramural R&D budget. Each of the 11 participating agencies issues an annual solicitation for proposals, listing areas in which R&D is desired. (For information on the solicitations of all the agencies, small businesses can request the "SBIR Pre-Solicitation Announcement" from the Office of Innovation, Research and Technology; SBA; 1441 L St. NW, Room 500; Washington, DC 20416.)

The SBIR is a three-phase program. Phase 1 is to demonstrate feasibility. Phase 2 is to develop the product or service, perhaps completing a prototype. The final Phase 3 is for the commercialization of the results of Phase 2 and requires the use of private or non-SBIR federal funding. Thus, the SBIR program provides an opportunity for small business firms to use federal funds for innovative, high-risk R&D with commercial potential that will also meet government needs to cover the gap between the idea and the point where venture capital and other financing generally becomes available.

The Department of Commerce SBIR program is only a small part of the total SBIR program. It obligated $1.5 million in FY 87 out of the approximately $400 million for all agencies. It has awarded $2.6 million since inception out of the about $1.0 billion for all agencies in the first five years. About 92% of these DOC funds come from NOAA. Commerce awards break down into the following topical areas: Atmosphere and hydrology (24%), ocean science and engineering (32%), aquaculture (10%), fisheries technology (11%), mapping and charting (9%), data and information systems (10%), and other (4%).

To get an adequate spread of coverage, DOC limits Phase 1 contracts to $30,000 and a six-month period of performance; Phase 2 contracts to $200,000 and 24 months, although the legislation allows $50,000 and $500,000 limits, respectively.

The Commerce SBIR program is very competitive. Since inception, it has funded 32 Phase 1 proposals out of 449 proposals received from 346 companies. Nine Phase 2 contracts have been funded from 18 completed Phase 1 contracts. NOAA expects to fund about a dozen Phase 1 and five or six Phase 2 proposals each year. Fourteen Phase 1s and six Phase 2s were awarded in FY 87. NOAA has found the opportunities so good that two extra Phase 1 contracts have been funded from program resources outside the regular SBIR budget.

The DOC SBIR program is very structured. The solicitation is released on October 15 of each year and closes on January 15 the following year. Each Phase 1 proposal that passes both an administrative and a technical screening is given at least two independent evaluations, which provide both a numerical score and written comments. The scores are used to determine a competitive range, which has included approximately 25% of the proposals submitted. Selection from among those in the competitive range is done at a selection meeting in which organizational priority and program balance are considered. Phase 1 contracts are normally awarded by mid-June.

Phase 2 proposals are submitted at the conclusion of Phase 1, normally in February the year following the Phase 1 contract award. The review and evaluation process is much more detailed than that of Phase 1 and three independent reviews are required, at least one of which is external to DOC. All Phase 2 proposals are individually ranked at Selection Committee meetings and the selections made from a consolidated committee ranking. Potential for Phase 3 funding and commercialization are explicit considerations.

A unique aspect of the Commerce SBIR program is the relationship between the Contracting Officers Technical Representative (COTR) and the contractor. From the day of assignment as COTR, he or she becomes the contractor's advocate in the competition for Phase 2. The COTR not only works closely with the contractors during Phase 1 to see that the technical objectives are met, but also presents his contractor's Phase 2 proposals to the Selection Committee and advocates its selection.

NOAA participates in two other (besides SBIR) explicit technology development and transfer programs to help business: the Stevenson-Wydler Technology Transfer Act and the Marine Electronics Agenda Program.

Under Stevenson-Wydler, information on new NOAA technologies is disseminated through the NTIS. The Electronics Agenda is a program being developed through a grant to the Massachusetts Centers of Excellence Corporation to lay out a program for revitalizing the commercial marine electronics industry in the United States. It will stress taking advantage of government R&D.

As to the future, I expect the Department of Commerce SBIR budget to decrease only slightly during these times of budget exigencies. Since the SBIR budget is a fixed 1.25% of total extramural R&D expenditures, it will not be cut more than other programs. We look forward to continuing to receive and fund many good proposals.

OF OCEANIC INTEREST

Reprinted with permission from past issues of SEA TECHNOLOGY.

French Take Lead in Race to Recover *Titanic* Artifacts.

The French ocean science agency IFREMER (Institute for Research & Exploration of the Sea) began survey and salvage operations of the sunken luxury liner *H.M.S. Titanic* on July 25. On site are the IFREMER research ship *Nadir* acting as support for the deep-diving *Nautile* submersible, a three-person vehicle capable of reaching 6000-meter depths. *Titanic's* wreckage lies in only 4000 meters some 725 kilometers southeast of Newfoundland. The 18.5-ton submersible is carrying a small ROV named Robin — much like Jason Jr., which acted as the eyes for Woods Hole Oceanographic Institution's *Alvin* during the July 1986 photographic expedition led by WHOI's Dr. Robert D. Ballard. The *Titanic* was first discovered by Ballard during a joint IFREMER/WHOI expedition in September 1985. IFREMER has already recovered some dinner plates from *Titanic's* debris field while weathering severe criticism for "grave robbing and desecration" from both sides of the Atlantic.

Sonar Exploration Expedition Will Scan Scotland's Loch Ness Next Month.

Called "Operation Deepscan," a 20-boat flotilla will sweep the 23-mile length of Loch Ness with powerful sonar and underwater television equipment on October 9-11. Sponsored by the Loch Ness Exhibition Centre (Drunmadrochit, Scotland), Lowrance Electronics (Tulsa, Oklahoma), Swiftech Ltd. (Wallingford, U.K.), and Caley Cruisers (Inverness, Scotland), the attempt will be "the largest scientific expedition ever undertaken on the mysterious lake," according to project field leader Adrian Shine. "Not just another hunt for 'Nessie'," he said, "there are four scientific objectives for the search." Included are (1) study of an as-yet-unidentified fish recently discovered on the bottom in 700-foot depths; (2) mapping of the Loch's deepest waters — more than 720 feet — with Lowrance X-16 chart recorders where large sonar "contacts" were made in 1982 and 1984; (3) study of the fish distribution of the Loch's char, trout, and salmon; and (4) study of temperature changes and thermoclines where unusual thermal patterns have been recorded earlier on sonar.

Gulf of Mexico Sealife Communities Thriving on Natural Oil Seeps.

To the aesthetic among us, tar balls, slimy gunk, and oil slicks sound like an environment to avoid. Yet dense communities of mussels, clams, and tube worms in the Gulf seem to be thriving on what they consider a perpetual feast. The finding was announced recently by Texas A&M University scientists who told of newly identified colonies at several underwater sites where natural seepage of petroleum occurs. "Instead of hindering the population of organisms on the sea floor, it appears that the oil seepage actually enhances it," said Dr. Mahlon C. Kennicutt II of the university's Geochemical & Environmental Research Group. He added that natural seepages of petroleum is extensive enough in the Gulf that any "additional inputs from drilling may not be a problem." Kennicutt and his colleagues used submersibles to trace the movement of petroleum from deep within oil reservoirs in the sea floor. They reported seeing large mounds of oil coming out of the sea bottom on the continental shelf off the Louisiana coast as well as evidence of seepage even on the water's surface.

State-Sized Iceberg Breaks from Antarctica Coast.

An iceberg, now called B-9, twice the size of Rhode Island and measuring some 2450 square miles broke away from the Ross ice shelf recently and is drifting westward in the Ross Sea, according to the National Science Foundation. "The size of the iceberg in human terms is staggering," reported Guy G. Guthridge, manager of NSF's Polar Information Program. "If you could somehow transport it to California and melt it, [the iceberg] would supply all the water needs of Los Angeles for the next 675 years." The iceberg — approximately 98 miles long, 25 miles wide, and with an estimated average thickness of 750 feet — contains the historic Bay of Whales, a niche in the Ross ice shelf used as a starting point by American explorers during early antarctic expeditions. Nearby are several "Little America" camps originally constructed by RAdm. Richard E. Byrd. Navy aerographer's mate Terry R. Cooke, who is stationed at McMurdo Station and who was among the first to detect and record the birth of B-9, commented that "the major significance....besides the historical aspects, is that it will alter all our maps of the continent."

ELECTRICAL PERSONALITIES

Reprinted from
Instrumentation and Measurement Society Newsletter

BENJAMIN FRANKLIN
(1706-1790)

Everybody who writes about Benjamin Franklin has his own Franklin. And little wonder. Franklin was a success at everything he tried, and what he tried was legion: printing, publishing, science, insurance, advertising, government, diplomacy, soapmaking, stove-making, education, music, and — yes — gallantry.

When the 250th anniversary of Franklin's birth was celebrated in 1956, the most popular image of him was the dynamic, aggressive seeker after fame and fortune. In the outpouring of homage that year, the old seer (for some reason, Franklin is almost always pictured as he was in his 70s and not as the slimmer, more athletic writer of almanacs) was quoted on every subject that the agile brains of Madison Avenue admen could twist into applicability. As the "Patron Saint of Advertising", Franklin was hailed for introducing pippin apples to England and starting the "trend that made this country the world's largest producer of apples." It was almost to be expected that someone would come up with "You can follow B. Franklin's creed of sensible spending and systematic saving with S & H Green Stamps." Yet nothing was more amazing than the tribute of a member of the Philadelphia Club of Advertising Women: "Benjamin Franklin — We, The Women of the World, Salute You in 1956! YOU WERE RIGHT ABOUT WOMEN!" They cannot have read Poor Richard's advice: "Keep your eyes wide open before marriage; half shut afterwards."

The most common shape in which the protean figure of Franklin appears in our day is as the penny-saving, early-to-bed almanacs Franklin began issuing in the 1730s. The most famous edition was in 1758, for which he strung together many of the already printed moral tags in an essay originally called Father Abraham's Speech; it was later and more popularly titled The Way to Wealth.

As is generally recognized now, the famous Autobiography, written and emended between 1771 and 1790, was intended to exemplify "strongly the effects of prudent and imprudent conduct in the commencement of a life of business." Hence, as Clark points out, one must be wary of omissions in the aborted self-history — and not only because it concludes with Franklin's arrival in England in 1857 and so treats not at all his subsequent career as an American revolutionary and international diplomat.

Yet even in describing his nonbusiness achievements — which are skimped in Clark's biography — some interpreters present a limited view, painting Franklin only as a proponent of voluntarism. Franklin had a flexibility that defies categories, and like the elephant's child, he had insatiable curiosity. Franklin personified the importance of what Arnold Toynbee calls challenge and response; and, if he was clever and sometimes sly in responding, he was never mean or vicious. A great believer in self-help, he nevertheless did not hesitate to ask the proprietor of Pennsylvania for a gift for the library he founded. Franklin persuaded the Philadelphians to form the first volunteer militia company only after he failed to get money for it from the Pennsylvania Assembly. And the Pennsylvania Hospital was an example of a government subsidy, its building made possible by a grant from the Assembly matching that from private subscribers. It is a paradox that the "Apostle of Thrift" first entered the field of propaganda to urge the inflationary issuance of paper money.

Although The Way to Wealth is sometimes subtitled "The Art of Making Money Plenty", Franklin himself was satisfied with a comfortable income and never sought to accumulate a fortune. In 1748, still in his 40s, he retired from the printing business, retaining an interest in the firm of Franklin and Hall that let him live in what a sociologist would call upper-middle-class style. It was then that he devoted himself to his experiments with electricity, which made him the best-known American in the world. Most people who realize that Franklin didn't "invent" electricity only know that he flew a kite in a thunderstorm, drew down electrical sparks from the sky, and invented the lightning rod. Franklin did do those things, but his main contribution to science was his definition of electricity as a single flow consisting of a positive and a negative charge. He also was the first to use the word "battery" to describe a container of electrical charges. There were, of course, other experiments that he and his Philadelphia friends made. He wrote about them in a series of letters published as Experiments and Observations on Electricity in 1751 after having been communicated into the prestigious Royal Society in London. Historian Daniel J. Boorstin in the atomic age could call it "more like a book of kitchen recipes or instructions for parlor magic than like a treatise on physics." Yet in the mid-18th century Franklin's clearly expressed accounts of experiments carried out and judgments made won him honorary degrees at Oxford and St. Andrews and recognition by scientists in England and Europe.

During the years from 1758 to 1762 and from 1764 to 1775, his fame and his great social charm gained him far more friends than his antagonistic missions created enemies. He was first sent abroad by the Pennsylvania Assembly in an attempt to wrest control of Pennsylvania from the Penn family and make it a Crown Colony; later, after the Stamp Act, he struggled hard to present the colonials' point of view to an increasingly hostile British government. In November 1757 he wrote his wife, Deborah: "I make no doubt but reports will be spread by my enemies to my disadvantage, but let none of them trouble you." Such reports were spread early and late, but Franklin weathered them with resiliency. His popularity was not lessened by the fact that both missions failed; Pennsylvania never became a royal province, and the British colonies, of course, had to fight to obtain for themselves the rights they had sought from Parliament.

Had Franklin not been both tough and a consummate master of political maneuvering, he would have been forced from public life by his misjudging the temper of the Americans when the Stamp Act was promulgated in 1756. He saw the tax as inevitable, as at worst a burden that frugality and industry could go a long way to lighten. He went so far as to recommend certain men for the posts of stamp collectors. Made aware of the real and strong feeling against the law by letters from Philadelphia — Deborah was even threatened by an angry mob blaming him — he swiftly and effectively became the Stamp Act's most active opponent. His appearance in Parliament in support of the repeal was a triumph of his ability to state a case clearly and succinctly.

Like his mentor James Logan before him, Franklin started out as an imperial Englishman; he looked for the expansion and domination over the American continent of the British peoples, of whom he considered himself one. It took a great deal of frustration to turn this empire builder into a revolutionary; but eventually, by repeated rebuffs and an insulting confrontation before the Privy Council, the ministers of George III managed to convince Franklin that there was no willingness to compromise or grant the colonies an objective hearing of their complaints.

He returned to Philadelphia in time to be elected to the Second Continental Congress. He was the elder statesman, the man who had more experience in the world of transatlantic politics than any other American. He spoke little at the Congress, but his fellow delegates entrusted him with many responsibilities — he was after all the sage Dr. Franklin. He was to help write the Declaration of Independence; more than 70 years old, he was sent in the spring of 1776 to try to persuade the Canadians to join the revolutionary cause.

Then, when it became vital to obtain European support, it was the celebrated Dr. Franklin who was sent to France to secure both financial and military aid. Franklin in France had the amazing impact of an American who was a combination of Rousseau's innocent — he wore Quaker gray and a coonskin hat — and a delightful man of the world, who charmed the court and the people, the erudites and the ladies. In his long life as a political personage, nowhere did Franklin so completely succeed as he did in Paris. He got the needed financial help; he got a treaty of alliance; he made warm friends, men and women; he hammered out an advantageous peace treaty with the English. He came home finally respected by the Englishmen and unreservedly adored by the French. And then in 1787, just three years before his death, speaking but seldom, he was able to convince the conflicting factions at the Constitutional Convention that compromise was better then disagreement.

All this and much more is treated in Ronald Clark's biography. It is a workman-like job, condensing into just over 400 pages of serviceable prose the irrepressible Benjamin Franklin. The work is advertised as making use of recent scholarship to create a "fascinating and enlightening reinterpretation", the first complete life of Franklin since Carl Van Doren's classic 1938 biography. But the new material and the reinterpretation do not seem to be significant. In a somewhat pretentious bibliography at the end, some major studies of Franklin published since 1938 are omitted. A comparison of the text with Van Doren's, period by period and subject by subject, leads one to say of Clark vis-a-vis Van Doren, what Jefferson said of Franklin upon coming to France as the new minister: that he succeeded his predecessor but did not replace him.

The great idea that Franklin offers to our age is himself. And that, too, is the side of American civilization that most needs dissemination throughout the world. Franklin writing on small-pox inoculation, making bifocal lenses, perfecting and playing the curious musical instrument called the Armonica, amusing himself and a large circle of friends with the witty bagatelles he printed on his own little press at Passy, observing the pioneer ballon ascensions, passing judgment on Mesmer's animal magnetism, negotiating international loans and treaties and printing, buying, selling and reading books — it was this Franklin whom a Frenchman dubbed the first civilized American. It is this Franklin that we should honor, a civilized man, a cultured man, one of the last men on earth to whom no field of knowledge was alien.

'TIS A PUZZLEMENT

Last Quarter's Puzzle

Happy Happy Birthday Birthday: Last quarter's puzzle was to determine how many people need to be at a party for there to be more than a fifty percent chance of at least two people having the same birthday.

This is the same as finding the number of people, N, such that the probability of no people having the same birthday is less than fifty percent.

The probability of any given pair of people not having the same birthday is 364/365, and from a group of N people there are $N(N-1)/2$ unique pairs that can be formed.

The probability that no one in a group of N people will have the same birthday is then:

$$\left(\frac{364}{365}\right)^{N(N-1)/2} < 0.50$$

Solving for N, we get:

$$\frac{N(N-1)}{2} > \frac{\log(0.50)}{\log\left(\frac{364}{365}\right)} = 252.65,$$

or

$$N > 22.98.$$

So, in any group of 23, or more, people there is a better than even chance of there being identical birthdays.

Rick Smith of Cornelius, OR correctly answered this puzzle.

This Quarter's Puzzle

Word Equations: This quarter's puzzles are a set of word equations that produce a word or phrase.

As an example:

Q: A judge's introduction produces a sticky situation.

A: ADHERES

* "Hear, ye; Hear, ye"

* Hear + Hear = ADD HEARS, or ADHERES=a sticky situation.

The following three questions constitute this quarter's puzzle. Because this is a rather subtle puzzle, we are printing the answers immediately below the questions. Don't peek!

Q1: (Errol Flynn's secondary pastime) - S = A native discourse on German beermaking and blackberries.

Q2: (The founder of the Jewish Mamas and Papas) + (Opposite of a Parisienne Christmas + Cleopatra's end) = A quick way into heaven or out of the sea.

Q3: I stopped watching football during the strike = Something good for football, but bad for the economy.

A1: WORDPLAY

* Errol Flynn's secondary, or dual (duel), pastime was SWORDPLAY
* Subtracting an S gives WORDPLAY
* Translating this into German gives WORTSPIEL
* WORT is the mixture of grain used to make beer, and SPIEL is a speech or discourse.

A2: JACOB'S LADDER

* JACOB was the father of the twelve patriarchs ("The Papas"), and made the soup (perhaps the predecessor of chicken soup) that enticed Esau to give up his inheritance.
* A Parisienne Christmas is NOEL (NO L), so the opposite is L.
* Cleopatra's end was due to an ADDER (well, actually an asp, but that doesn't spell anything)
* Together, these form JACOB'S LADDER, which was Jacob's dream of a ladder extending into heaven, or a rope ladder on the side of a ship that extends into the water.

A3: INFLATION

* That I stopped watching football during the strike means, in other words,
* I NO SEE NFL ACTION
* or I, NO "C", NFL ACTION
* or I NFL ACTION - C = INFLATION

Let's all use our Jacob's ladders to stay dry until next quarter.

Dave Hollinberger
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TECHNOLOGY TRANSFER — KEY TO STARTING YOUR OWN HIGH TECHNOLOGY BUSINESS

Hyman Olken

The nature of high technology industry is such that it affords great opportunity for starting and building your own business. To do that you need a good high technology spin-off from the Government's huge R&D programs.

In any one of the many national laboratories valuable high technology products are cropping up as a byproduct of their research programs.

For example, in the program on fusion power research at the Lawrence Livermore National Laboratory in Livermore, California, a huge number of advances in laser technology are coming out in that program. The question is, how do you find which one of those technology advances will provide the foundation for a new high technology business? And then, when you have found it, how do you build a successful business based on it?

Fortunately, both these things can be done systematically and easily. To begin with, you search for a commercially valuable technology spin-off in the literature in which they are described. This is the technical literature known as Conference Proceedings. All the National Laboratories write research reports on the work they do every time they fulfill a research contract for the government. These reports are available in the agency which collects them — the National Technical Information Service.

But most of the reports you will find in that collection are on the theoretical results desired from that program. The technology often developed to effect that research program are only occasionally described in those reports. But the technology needed to obtain those research results are very often written up in the reports which the national laboratories present at the conferences held by particular technology groups — the electronics engineering groups, the optical engineering groups, the vacuum technology groups, etc. It is at these technology conferences that the national laboratories show off the technology they have developed. Usually, the new technology developments are written up so the laboratories compete with one another in their technology achievements. So, if you will get the Proceedings of these technology conferences, in which their technology advances are reported, you will get a gold mine of valuable new technology.

The trick in studying these Proceedings is to pick a particular technology development that is small, simple, and easy to manufacture. For example, in the Proceedings of the American Vacuum Society Conferences, you will often find a lead-in to the vacuum chamber, a vacuum gauge, or other small device that has good user-benefit features that make it commercially promising, and that can be easily manufactured in a small shop.

Having thus found a product that can be easily produced and easily sold, you next proceed to build a business based on it by this systematic procedure. First, you write up a new product description article and send it out to many technical magazines that deal with such products. You print up a number of these new product description articles and send them out broadcast to the many magazines in the field in which this product is used. If done right, you can get this new product article published in magazines with a total circulation of a million or more. How this can be done and done successfully is explained in detail in Chapter IV of my book, *The High-Tech Industry Manual*.

After the new product campaign has generated a great deal of publicity on the existence of your product, you find customers that are using it in different areas of technology. For example, for a vacuum gauge, you would find users of the gauge in micro-electronics manufacturing plants, in vacuum coating plants, etc. You then get permission from the user to write up an article on how the product is used in his plant and what user benefits are derived from it. Then you broadcast copies of this article to industrial magazines whose readers are interested in this device and its application to their needs.

This procedure is also detailed in my book, *The High-Tech Industry Manual*. Examples are shown there of articles covering the use of one product in many different industrial fields. After these two publicity programs — the new product release and the application articles have achieved publication in magazines that reach thousands of readers — you will have built up a good market for that one product. Then you search the Conference Proceedings for others and build up good markets for them. By this process, in a year or two, you can have a successful high technology business. Good illustrations of these are presented in my book, *The High-Tech Industry Manual*.

In short, a new high technology business can be built up easily and systematically. All you have to do is to take advantage of:

1. The huge amount of valuable new technology produced in our government national laboratories, and

2. The vast amount of technical trade literature that exists in the U.S.

PCS PUBLISHES INDEPENDENT LEARNING PROGRAM

Marshall Kremers

Reprinted from IEEE Transactions on Professional Communication, Vol. PC 30, No. 4, December 1987

Communication Techniques for Engineers, Scientists, and Computer Specialists — Prepared by Ron S. Blicq et al. [an Independent Learning Program (ILP), published by the Educational Activities Board of IEEE, January 1987.

"Working alone on an Independent Learning Program can prove to be a lonely experience; it can also take a long time." That's how Ron Blicq, the principal author of this learning guide, acknowledges what anyone who has ever attempted an independent learning course must surely think about the prospects for actually finishing. This time, however, it will be different; this learning guide was prepared with your loneliness in mind. Stopping just short of making a house call, black bags in hand, Blicq and his associates have gone to a great deal of trouble to give their students a mindset that will make them want to keep going, in spite of all the usual distractions and demands on their time. This is both a comprehensive course in professional communication skills and a carefully thought out independent learning guide.

DESIGN OF THE PROGRAM

The Independent Learning Program (ILP) is a multimedia set of materials: a videotape containing five lessons (featuring Ron Blicq), an audiotape with four lessons (featuring Tim Higgins), a study guide, a workbook, an answer book, and a textbook. Thus there are resource materials and working materials, all of which blend together to make up the total "self-paced environment." [The textbook is Ron S. Blicq, *Technically—Write!* (3rd ed.), New York: Prentice-Hall, 1986.]

The central tool is not the textbook but rather the study guide, which serves as the instructor does in a lecture course. It tells the student what to do, in what sequence, and when a piece of work is finished. Within this guide there are 12 learning modules and a final exam; each module is divided into 10 to 20 steps or tasks. To work through a module, the student moves among the materials, reading the textbook, viewing the videotape, listening to the audiotape, composing in the workbook, and checking responses against models in the answer book. The titles for the modules are as follows:

1. Introduction to the Course
2. Guidelines to Organizing Your Writing
3. Writing Technical and Business Correspondence
4. Writing Short Informal Reports
5. Writing Descriptions and Instructions
6. Writing Semiformal Reports
7. Preparing Illustrations and Longer Reports
8. Writing Formal Reports
9. Writing Research Reports and Technical Papers
10. Communicating Orally: Informal Communication
11. Communicating Orally: Formal Communication
12. Communicating as a Job Applicant
13. Final Examination

The final exam comprises 100 multiple-choice questions and is "open book"; that is, the student is encouraged to refer back to all the learning and resource materials while working through the questions. An added feature — at the student's option, the IEEE Continuing Education Department will score the answer sheet and, if the grade is passing, award the student an IEEE Certificate of Achievement and 8 Continuing Education Achievement Units (CEAUs).

COMPETENCY-BASED LEARNING

This is a practical communication course, equivalent to what one would take in college to meet a requirement in business and/or technical writing, and designed specifically to meet the immediate concerns of engineering, science, and computer specialists. The learning modules are divided into three categories: correspondence, report writing, and speech.

Yet since it is also an independent learning guide, a lot of attention is given to the matter of self-pacing. As the student, you are never left very long to wonder how the work is going. At regular intervals, the study guide will ask you to pause so it can show you how your work compares to the models in the answer book. A typical sequence would work this way: you look over the list of objectives for the particular module, then go right to work on a variety of carefully integrated activities. For example, for the module ''Guidelines for Organizing Your Writing,'' you read a brief introductory/overview passage in the study guide, read some more introductory material in the textbook, view a segment of the videotape (which is a kind of demonstration/lecture by Blicq), pause to review the *pyramid* method of writing, read a model answer in the answer book, go back and read some more in the textbook, and finally write in the workbook. You are encouraged to move ahead rapidly but only when you have clearly mastered the concepts for each module.

SELF-PACING

To establish a positive attitude toward self-pacing at the outset, Tim Higgins (on the audiotape) tells the student to ponder three key questions:

- How many hours can you commit each week to this program?
- What specific time periods during the week can you give to this program?
- Are you willing to plot your working times as firm dates by actually entering them onto a chart (included in the first module)?

The average time for completing the course is 80 hours, so to complete the course in 10 weeks, you would have to find 8 hours during a week. In effect, Higgins asks, are you willing to give up part of your Saturday mornings for 10 to 13 weeks? Or a fishing trip now and then? At the start of each module there is an estimated time for completion (for example, the ''Guidelines for Organizing'' module should take about 5 hours), which says something about the investment required.

Higgins' questions are fair, because they imply that, if you don't have a lot of motivation, you probably would be wasting your time attempting this course. At the same time, the answers tell you that there is a sound program here, not a superficial review of principles.

A COMPLETE LEARNING EXPERIENCE

This course is clearly aimed at professionals who recognize that their career path is linked to their ability to read, write, and speak effectively. It seems to be an alternative to the standard technical writing course offered at most colleges and required at most technological colleges. Obviously, there are advantages to taking courses in a standard classroom, not the least of which is the higher chance of completion. Recognizing this, the authors seem to be saying, ''In this approach we have done the best we can to give you the advantages of the classroom (hence the audio- and videotape features) but with the clear advantages as well of independent learning.'' They say, in effect, don't try to carry this burden alone:

- Practice the skills at work (which full-time students can't very well do).
- If you can, find others at work who are taking the course and share your experience with them.
- Don't try to ''cheat'' by jumping around in the program to find what might serve a short-term purpose; follow the program all the way through to get the total picture.

The exercises have been carefully integrated, making this a valuable reprise for those who are already experienced communicators, and a complete learning experience for those who need to build a really sound base for their communication skills.

Editor's note: The Independent Learning Program *Communication Techniques for Engineers, Scientists, and Computer Specialists* can be ordered — Order No. HL0405-1 — from the IEEE Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331. It is priced at $439.00 ($329.00 for IEEE members), plus $15.00 for shipping and handling. There are additional charges for overseas shipments. You may include a check payable to the IEEE with your order, or charge the Program to your MasterCard, Visa, American Express, or Diners Club account. Please indicate the videotape format you require.

The rejection slip used by Oxford University press:

Dear Sir:

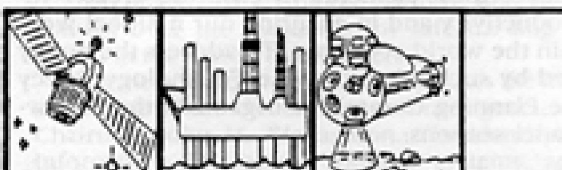
The Delegates of the Press have considered your suggestion that they should publish ______, and they desire me to reply to you, conveying their thanks for the suggestion you have been so good as to make to them, and their regret that they do not find themselves able to accept it.

SHORT FORM NEWS RELEASE — PACON 88

The third Pacific Congress on Marine Science and Technology (PACON 88) will be held May 16-20, 1988 in Honolulu, Hawaii. This international and interdisciplinary meeting is designed to provide scientists, academicians, resource planners, policy analysts, administrators and engineers with an opportunity to discuss the economic, legal, resource, technological and sociocultural dimensions of marine resource development and management in the Pacific Basin. Special attention will be paid to the impact of marine technology on the quality of life in this region.

Sessions are planned on ocean energy, marine mining, marine transportation, technology of fish finding, maritime economics, mariculture technology, marine biotechnology, marine recreation, ocean robotics, remote sensing, ocean acoustic systems, EEZ mapping, software technology, ocean engineering applications in the Pacific, tsunamis, marine applications of the global positioning system and sea level variability. Research and industrial exhibits will be on display.

Registration information is available from: PACON 88, c/o Sea Grant, University of Hawaii, 1000 Pope Rd., Honolulu Hawaii, 96822 (telephone 808-948-6163 or 948-7338). Authors wishing to present papers at the conference should submit abstracts of approximately 400 words to the above address by July 30, 1987. Completed papers are due by November 30, 1987 and will be published in a conference proceedings volume. PACON is being organized by the Hawaii section of the Marine Technology Society, with the assistance of over 40 other societies and organizations representing governmental, industry and education interests in the U.S., Japan, Taiwan, and Canada.



PACIFIC CONGRESS ON MARINE SCIENCE & TECHNOLOGY

PACON 88

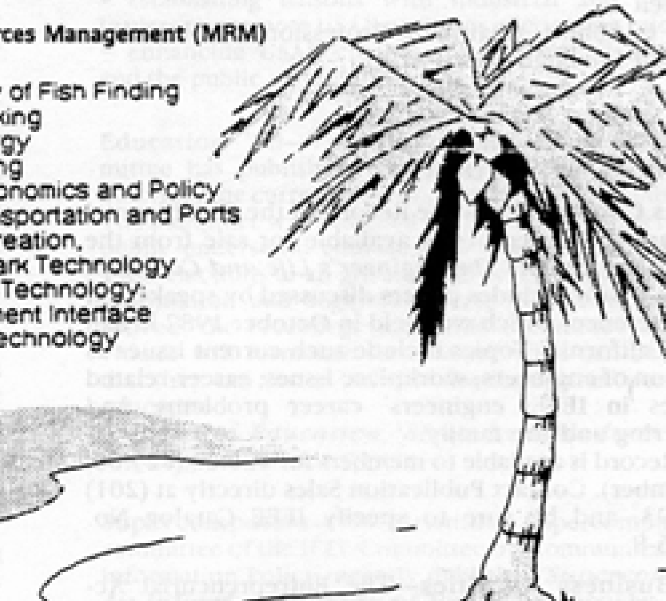
HONOLULU, HAWAII - MAY 16-20, 1988

Ocean Sciences & Technology (OST)

- Undersea Vehicles and Ocean Robotics
- Remote Sensing and Oceanographic Satellites
- Marine Applications of Global Positioning
- Ocean Acoustic Systems
- Ocean Engineering Applications in the Pacific
- Tsunami
- Pacific Ocean Sea Level Variability
- EEZ Mapping
- Software Technology

Marine Resources Management (MRM)

- Technology of Fish Finding and Tracking
- Ocean Energy
- Marine Mining
- Maritime Economics and Policy
- Marine Transportation and Ports
- Marine Recreation, Marine Park Technology
- Mariculture Technology: Management Interface
- Marine Biotechnology



For Information:
PACON 88
c/o Sea Grant College Program
University of Hawaii
1000 Pope Road
Honolulu, Hawaii 96822

MARINE TECHNOLOGY SOCIETY
HAWAII SECTION

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USAB HOT LINES is designed to provide IEEE Sections and Societies up-to-date information on the United States Activities Board and professional activities. Contents can be used in their entirety or excerpted as you see fit. We invite your comments on format, content, and lead time.

IEEE Washington Office, 1111 19th Street, N.W., Suite 608, Washington, DC 20036, USA, (202) 785-0017

Vol. 3, No. 5 John J. Kelleher, Editor—Catherine S. McGowan, Associate Editor January 1988

USAB Officers—The following IEEE members have been appointed to serve one- or two-year terms on the United States Activities Board:

Edward C. Bertnolli, Chairman
Victor G. Zourides, Director, Region 1
Joseph M. DeSalvo, Director, Region 2
Vernon B. Powers, Director, Region 3
James E. Holte, Director, Region 4
Mary Alys Lillard, Director, Region 5
Richard L. Doyle, Director, Region 6
Richard S. Nichols, Director, Division II
Thomas H. Grim, Director, Division VI
H. Troy Nagle, Director, Division VIII
Gerald W. Gordon, Chairman, Member Activities Council
Edward J. Doyle, Chairman, Government Activities Council
Harb S. Hayre, Chairman, Career Activities Council
William R. Tackaberry, Chairman, Technology Activities Council
George F. Abbott, Chairman, Professional Activities Council for Engineers (PACE)
Peter A.E. Rusche, Member at Large
Eric E. Sumner, Member at Large
William W. Middleton, Controller
Leo C. Fanning, Staff Director

Careers Conference—The Record of the fifth biennial IEEE Careers Conference is available for sale from the IEEE Service Center. *The Engineer's Life and Career in Today's World* includes papers discussed by speakers at the Conference, which was held in October 1987 in San Diego, California. Topics include such current issues as utilization of engineers; workplace issues; career-related activities in IEEE; engineers' career problems; and engineering and the family.

The Record is available to members for $20.00 ($25.00, nonmember). Contact Publication Sales directly at (201) 981-1393, and be sure to specify IEEE Catalog No. UH0176-8.

Small-Business Facilities—The Entrepreneurial Activities Task Force has produced an information Source Sheet on "Small-Business Incubators." The Source Sheet describes how small-business incubator facilities meet the needs of new, small businesses during the critical, early stages of development. It includes information on who sponsors the incubators, where the facilities typically are located, types of businesses using the facilities, and advantages of the small-business incubator approach to new-business start-up. It also includes a list of resources for obtaining further information.

Copies of this Source Sheet are available from the IEEE Washington Office.

Technology Policy—The 1988 IEEE U.S. Technology Policy Conference will be held in Washington, D.C. on March 29 and will carry the theme "Manufacturing Technology and the U.S. Engineer." This year's conference will focus specifically on policy issues related to manufacturing and competitiveness.

Technological competitiveness, which in the past has been measured predominantly in terms of end-product, has begun to depend more on sophisticated manufacturing processes and increases in industrial productivity. Advances in engineering and manufacturing technology have become critical elements in ensuring greater industrial productivity and in ensuring our national well-being within the world economy. To address the policy issues raised by such advances, the Technology Policy Conference Planning Committee organized the following four panel sessions:

- Overview: The Role of Manufacturing in Competitiveness
- New Technology in Manufacturing
- Education to Enhance Manufacturing Technology
- Effects of Government Regulations on Competitiveness

Technology Policy Conferences are conducted primarily for Members of Congress and their staffs, and for IEEE leaders within the IEEE Executive Committee and United States Activities Board. However, a limited number of outside attendees will be welcome, and a *Conference Record* will be produced after the conference for all those interested. For more information, contact the IEEE Washington Office.

1987 Award Recipients—USAB recently announced the recipients of its achievement awards for 1987:

- Engineering Professionalism: Stephen H. Unger
- Citation of Honor: Sidney Fernbach, Gerald W. Gordon, F. Karl Willenbrock, and James A. Watson
- Regional-Divisional Professional Leadership: John P. Densler (Region 1); Beth A. Cooper (Region 2); Kenneth L. Schlager (Region 4); Dan Michaels (Region 5); Robert T. Bronder (Region 6); and William D. Lang (Division VII)
- Professional Achievement: David B. Cousins, Donald W. Cramer, Irving J. Gabelman, John J. Kelleher, Robert E. Ludlum, Lois K. Moore, Charles R. Wright, and Arvid G. Larson

Winners will be presented with their awards at upcoming USAB or PACE meetings. Nominations for 1988 awards will be accepted until March 15. Nomination forms are available from the IEEE Washington Office.

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Vol. 3, No. 6 Joseph A. Edminister, Editor—Catherine S. McGowan, Associate Editor February 1988

Computer Security—The Committee on Communications and Information Policy has endorsed President Reagan's January signing of H.R. 145, *The Computer Security Act of 1987*. CCIP developed a position statement on computer security and testified several times on H.R. 145, which reverses President Reagan's 1984 National Security Decision Directive 145. NSDD 145 gave control of the protection of both classified and "sensitive but unclassified" information that is stored in Federal and private computer systems to the Department of Defense and the National Security Agency. H.R. 145 will restore civilian control by giving the National Bureau of Standards control over the standards for safeguarding information stored in the nation's computers.

"The new law quite properly separates the different goals and needs of the civilian and defense agencies," said CCIP Chairman John M. Richardson. "In identifying sensitive information in (their) computer systems, agency heads should exercise extreme restraint and should make the designation according to publicly disclosed criteria, specific to the nature of the information in relation to the agency mission and the national interest.

"The result should be an interpretation of sensitive but unclassified information that is not as broadly encompassing as that implied by NSDD 145," he continued. "This should foster the unabridged dissemination of unclassified scientific and technical information that is crucial for the continued advancement of U.S. industry."

Background information on this computer security issue is available from the IEEE Washington Office.

Congressional Fellows—IEEE's three 1987–88 Congressional Fellows have chosen their assignments on Capitol Hill. Dr. George C. Sponsler III is serving on the legislative staff of Sen. Paul Simon (D-Illinois), studying issues and developing policy positions on the superconducting super collider, the strategic defense initiative, a unified energy policy, civilian space policy, supercomputers and acid rain.

Dr. James E. Gover selected a congressional assignment on the personal staff of Sen. Pete V. Domenici (R-New Mexico). He has broad responsibility for technology issues and has already participated in activities involving semiconductors, competitiveness, and waste management.

Clark E. Johnson is serving on the personal staff of Rep. George Brown (D-California). Mr. Johnson is working on competitiveness issues and on R&D funding as it relates to the House Science, Space and Technology Committee.

Applications will be accepted until March 31 for IEEE's 1988–89 Congressional Fellowships. For more information or for an application package, contact the IEEE Washington Office.

Professional Activities Goals—Edward C. Bertnolli, IEEE Vice President of Professional Activities and Chairman of USAB, recently submitted various goals for accomplishment by USAB in 1988. These goals include:

- meeting the professional needs of U.S. members;
- providing support to USAB positions that enhance U.S. competitiveness;
- seeking means to motivate employers and members to pursue continuing education for engineers throughout their careers;
- evaluating USAB's Committees and Task Forces to ensure their timely response to targets of opportunity on both professional concerns and technology policy issues.
- establishing liaisons with industrial and educational leaders to promote USAB positions of common interest; and
- enhancing USAB communications with U.S. members and the public.

Education '88—The IEEE Precollege Education Committee has published ***Education '88***, a pamphlet that describes the current state of education in the United States. The pamphlet was designed to help IEEE members and the public understand education as a significant issue in the 1988 elections at all government levels. In presenting this information and suggesting ways education can be improved, the Precollege Education Committee hopes individuals will formulate ideas about what can be done, so that they can better evaluate the candidates' positions on education.

Copies of ***Education '88*** are available from the IEEE Washington Office.

Supercomputers—The Scientific Supercomputer Subcommittee of the IEEE Committee on Communications and Information Policy recently published ***Supercomputing: An Informal Glossary of Terms.*** The booklet lists both common and uncommon terms used in the supercomputing industry. It's intended to help both novices and experts communicate better and to provide a foundation for developing more definitions.

Copies of the booklet are available from the IEEE Washington Office.

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Vol. 3, No. 4 John J. Kelleher, Editor—Catherine S. McGowan, Associate Editor December 1987

Section 1706—Efforts to repeal or to impose a moratorium on the enforcement of Section 1706 of the Tax Reform Act of 1986 have been complicated recently by Congressional-White House budget negotiations. Currently, both the House Ways and Means Committee and the Senate Finance Committee have completed work on their versions of a $12 billion budget reconciliation-deficit reduction proposal.

Among the differences between the House and Senate versions of this legislation are the provisions affecting Section 1706. The House Ways and Means Committee decided not to include either the repeal or moratorium provisions in its budget reduction proposal. The Senate Finance Committee, on the other hand, voted to accept an amendment by Sen. Daniel P. Moynihan (D-New York) that calls for repeal of Section 1706 *for income tax purposes only*, effective January 1, 1988. The amendment would also impose a 10 percent income tax withholding requirement on technical services personnel who stand to benefit from the Section's repeal.

Senator Moynihan offered his amendment "solely to ensure that Section 1706 can be considered when members of the House and Senate Committees meet to work out the differences between the two reconciliation bills." He expressed his dissatisfaction with Internal Revenue Service guidance on Section 1706 and said that a legislative solution will be necessary to ensure the proper treatment of independent contractors in the technical services field.

Your communication with Senators and Congressmen is still essential. It's important that you contact members of Congress who are likely to serve on the budget reconciliation/deficit reduction conference committee. Names of probable House and Senate Committee Conferees, as well as addresses, telephone numbers and other information, are available from the IEEE Washington Office.

New USAB Positions—At its November meeting in Orlando, Florida, the United States Activities approved the following USAB Position Statements:

- Engineering Manpower Policy (replaces 1982 IEEE Position Paper on same subject)
- IRA Incentives For Persons Who Are Covered But Not Vested in Employer-Sponsored Pension Plans
- Regulation of Reversions From Overfunded Defined Benefit Pension Plans
- Tort Reform

Copies of these and other positions are available from the IEEE Washington Office.

DoD Rule on Information Dissemination—The Office of the U.S. Secretary of Defense has issued a final rule on the policy for considering national security in disseminating DoD-sponsored scientific and technical information at meetings. The ruling gives guidance for both meetings conducted by the U.S. government and those conducted by private organizations.

The rule states in part that it is DoD policy to:

- Encourage presentation of scientific and technical information generated by or for DoD at technical meetings consistent with U.S. laws and national security requirements;
- Allow the publication and presentation of unclassified, contracted research results;
- Release information at meetings in a manner consistent with statutory and regulatory requirements for protecting the information. Such requirements include, but are not limited to, protection of classified, unclassified export-controlled, proprietary, privacy, and foreign government-provided information;
- Provide timely review of DoD employee and contractor papers intended for presentation; and
- Assist DoD contractors and others in determining the sensitivity of or the applicability of export controls to technical data proposed for public disclosure.

The entire policy, as well as the procedures and regulations set forth by DoD's rule, are available in the *Federal Register* (Vol. 52, No. 210, October 30, 1987, pp. 41707-41710).

Careers—The USAB Career Maintenance and Development Committee has introduced the first in a series of career workshop videotapes as part of a new IEEE Career management Program. This two-hour workshop, "Career Conflicts," is designed to be presented in local Sections. It can stand alone or can be presented in conjunction with other Section activities.

Illustrative vignettes make up the taped portion of the Career Conflicts workshop, which stresses the need for individuals to take charge of and manage their careers. It focuses on the need for "life balance," the personal resolution of conflicts between work-related career needs and personal and family needs outside work.

This workshop module includes: a VHS videotape, which provides background on career management and presents challenges faced in achieving "life balance"; recorded panel discussions, which highlight the issues; a facilitator's manual which guides discussion; and a participant's workbook, which provides ongoing reference to the program, self-assessment activities and suggestions for personal activity after the workshop. For more information on the program, or to obtain a preview tape, contact the IEEE Washington Office.

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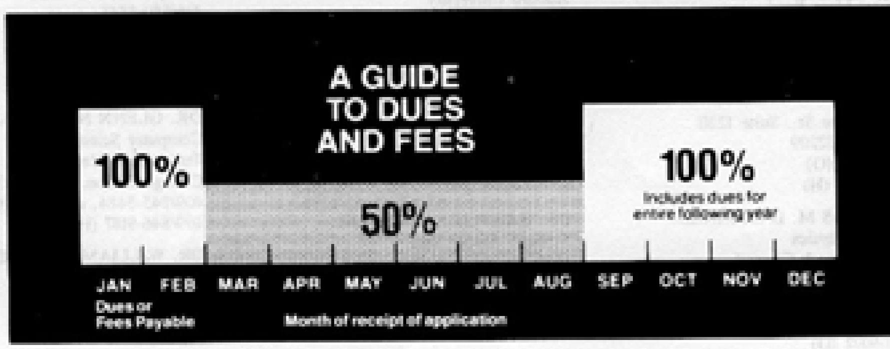
Please take this opportunity, now, to broaden your outlook, open your mind to new concepts, new techniques, new fields of interest. There will be no better time. Return the Membership Application form below. *(Students should contact their IEEE counselor or write for a Student Membership brochure.)*



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Please check appropriate box(es) below:

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☐ 100% ☐ 50%

Society fee: $6.00 (Includes *Journal of Oceanic Engineering*) ☐ $ ______

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Date of birth ______ Month ______ Day ______ Year ______ ☐ Male ☐ Female

Were you ever a member of IEEE? ☐ Yes ☐ No If Yes, please furnish (if known): ______ Grade ______ Membership No.

EDUCATION (Highest level completed):

Name of educational institution ______

Course ______ Degree received ______ Date ______

ENDORSEMENT (Signature of one IEEE member, who knows you professionally.) ______

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