IEEE Reliability Group Newsletter

Editor: Alan Plait — July 1978 - Vol. XXV - Issue 3

EDITOR'S NOTES

This past April, I had the opportunity of attending a meeting of the Industry/Joint Services Automatic Test Project conference. Sponsored by five industry associations, it was attended by over 800 persons in industry and Government. If you still think of testing systems as oscillators, ohmmeters, and scopes, forget it! The field will have sales reportedly between 1 and 2 kilomegabucks for each of the next five years, as a conservative estimate. Testing of complex electronic systems has always been a problem and it was destined that computers would have to take over the job, although the man-machine interface is substantial. The field is not all that new, but much more concentrated effort in its expansion has occurred over the past few years. And a lot of Reliability types are entering into its technology. One of the bastions of reliability development, Rome Air Development Center, is now committed to a number of programs in automatic testing. The Navy has spent a considerable number of greenbacks for its VAST (Versatile Avionics System Test) program, which is ubiquitous in the Air fleet. Now, the Air Force is about to spend multi-millions on a program called Modular Automatic Test Equipment (MATE), which will cover a number of years and activities related to the development of many aspects of automatic testing. The successful bidder will be announced soon after the appearance of this NEWSLETTER. The Army's Automatic Test Support Systems Program (ATSS), is being handled in Fort Monmouth. Of course, not all the effort is concerned with electronics or avionic systms. The Nonelectronic, or Machinery, Testing boys are also in the act, and growing all the time.

In the latter days of March, the Joint Logistics Commanders, a "constellation of sixteen stars", consisting of the Commanding General of the Department of Army Readiness Command (DARCOM), the Chief (Admiral) of the Naval Material Command (NMC), and the Commanding Generals of the Air Force's Logistics and Systems Commands (AFLC and AFSC) chartered a JLC Panel on Automatic Testing. The Panel is just now developing a Study Plan that will define the tasks associated with automatic testing in the military and government services for at least the next six years; tasks that will be and are of major interest to industry.

As a relatively long-time practitioner in Reliability, it is ironic to be associated with a field that is (kind of) an outgrowth of the failures of reliability (I think that's a double pun). It was, and still is, true that the most reliable designs need the least field test and support. It was, and still is, true that reliability designed into the system is cheaper than changes made at any other time of the life cycle. It was, and still is, true that unless the manager who is responsible for project development funds is also responsible for field support funds, reliability will take a back seat to cost and schedule. In private conversations with friends in the reliability business, they often speculate whether anyone in the upper echelons of Government are listening. It is not clear that development and advances in automatic testing will be substantially affected even if significant progress is made in curing reliability management problems. The needs are great in both areas, AT and R. Sounds to me like another opportunity for good guys to get together.

Comment,
S'il vous
Alan Plait

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NEWSLETTER DEADLINE: SEPT. 1, 1978 FOR THE OCTOBER ISSUE

HELP WANTED

Reliability/Maintainability/Safety (R/M/S) Engineers (Military Electronics) – R/M/S program planning, predictions, allocations, modeling, hazards analysis, FMEA, LSA, MEA, LCCA, etc.; 2 years minimum experience; BSEE or equivalent; send resume to, or contact:

E.R. Carrubba, Manager
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GTE Sylvania ESG-ED
66 "B" Street
Needham, MA 02194
(617) 358-7667

Senior reliability/maintainability engineer. At least 5 years experience. Familiar with standards and specifications associated with military electronics. BS EE, Math or related field desirable. Small business, 300 employees. Washington, DC. No hardware. Position includes work in latest weapon system as well as billion dollar field. Contact Editor, Reliability Newsletter with resume and salary requirements. 2341 Jefferson Davis Highway, Suite 930 – Century Bldg., Arlington, VA 22202. Reference RIEN.

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ARITHME-TRICK?

Arithme-trick? New math? Not according to Mrs. Abdelkri Boujibar, director of the Museum of Morocco. She says that the figures 0 through 9, which we know today as Arabic numerals, were introduced more than a thousand years ago by a Moroccan genius whose work was the first to be called algebra. He shaped them so that each contained a different number of angles – the figure 1 with one angle, 2 with two angles, 3 with three angles, and so on. Zero, signifying *nothing* had no angles.

– Source unknown

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TREASURER'S REPORT ☆

Paul Gottfried

Financially, 1977 was another good year for G-R; a surplus of $9,000 (perhaps an all-time high) brought our reserves up to $43,000 as of the end of the year. This level of reserves is considered reasonable in view of the size of our annual budget and the (off-balance-sheet) advances we must make to the various symposia and conferences we sponsor or co-sponsor.

The reserves are high enough, however, to justify a substantial planned deficit in the 1979 budget, since 1978 is expected to be another year of surplus. The budget therefore contemplates:

- Continuation of the automatic distribution to all members of the proceedings of the Annual Reliability and Maintainability Symposium and the Reliability Physics Symposium;
- Continuation of the on-request (first come, first served) distribution of the proceedings of the Product Liability Prevention Conference;
- A further expansion of the Transactions from 404 pages in 1978 to 420 pages in 1979.

Beyond this, all that is needed to achieve a planned deficit is to let events take their course: income tends to remain stable, except for infrequent jumps such as the increase in nonmember subscription charges in 1976-77, while expenses follow inflation. Condensed figures for 1977 and 1979 are:

	INCOME		EXPENSES	
Category	1977 (Actual)	1979 (Budget)	1977 (Actual)	1979 (Budget)
Member Fee	$ 16,300	$ 16,300	$ 300	$ 500
Publications				
Transactions	62,900	63,300	52,700	64,800
Newsletter	–	–	5,500	6,000
Conference Pubs	6,500	6,500	21,500	24,000
Meetings	21,700	21,700	18,300	20,000
IEEE Technical	14,500	14,500	15,600	20,000
Awards	–	–	700	1,000
Other	5,000	12,100	3,300	4,700
TOTAL	$126,900	$134,400	$117,900	$141,000

As in previous reports, the condensed figures do an injustice to the Transactions inasmuch as some of the expenses should have been allocated to other publications; the Transactions then would show a surplus as well as exemplary cost control.

SPECIAL ISSUE DEVOTED TO SOFTWARE RELIABILITY ☆

The Editorial Board of the IEEE Transactions on Reliability is planning a special issue of invited papers on the subject of Computer Software Reliability. The basic objective is to provide a literary forum for the exchange of information among those involved with Software Systems/Reliability Engineering, Software Data Collection and Evaluation, Software Reliability and Maintainability Modeling, Life Cycle Costing, Software Development and allied fields of inquiry.
Invitation is extended to authors of previously unpublished papers dealing with software reliability in the following suggested or related areas:

1. Models for Prediction, Assessment and Measurement
2. Error Data Collection
3. Design Techniques for Reliable Software
4. Software Tools for Quality Control of Computer Programs
5. Test and Verification Methods
6. Configuration Management
7. Case Histories
8. Software Design Review
9. Maintainability, Availability and Other Quality Factors
10. Software Fault Tolerance
11. Computer Program Complexity
12. Standardization
13. Productivity/Reliability
14. Reliability of Hardware/Software Interface
15. Ultra Reliable Software
16. Failure Modes and Effects Analysis
17. Error Diagnostics
18. Software Reliability Management

In order to assist the Board in planning the special issue, cooperation of prospective authors is solicited with the following target dates:

14 July 1978	-Author's Letter of Commitment
18 August 1978	-An Abstract of 300-500 words and biographical sketch
1 December 1978	-Three copies of full text draft not to exceed 25 double-spaced typed manuscript pages to editor of special issue
1 Jan-Feb 1979	-Author-Referee Consultants

Letters of commitment containing a brief description of the essence of the paper, or requests for further information should be addressed to: *Myron Lipow*
27426 Fawnskin Drive
Rancho Palos Verdes, CA 90274

Is Reliability the Key to Reduced Support Costs?

A comparison of a two-level maintenance concept to the current three-level system showed that logistic support costs on avionics are driven by more than reliability considerations.

The need to reduce the support costs of avionics has been well documented. Considering the rather poor record of field reliability in avionics, it is not surprising that this parameter has been receiving the most attention. Data show that the field mean-time-between-failure rate is often only one-tenth of the specified MTBF.

This is ample cause for the avionics industry to take definitive action. Indeed, major strides toward this goal have been made in the design and manufacture of avionics. Furthermore, to ensure that field reliability meets expectations, financial rewards and penalties have been introduced in the form of guaranteed MTBFs and warranties. Still, one must ask: Are there other approaches to reducing support costs which can have an impact equal to or greater than that of reliability?

This question is classically addressed by examining the trade-offs among reliability, acquisition cost, and support cost (see Figure 1). The trade-off considers how much the Defense Department is willing to pay in acquisition cost to improve field reliability. This consideration is somewhat different from the question of support costs addressed above in that the abscissa of the curve is field MTBF, which presupposes that what one predicts for this parameter can indeed be achieved. Implicit in this theoretical "bath tub" curve is that there are significant potential benefits to be derived from buying more reliability and that there is an optimal region to minimize total cost.

Although much has been made of this particular trade-off in the literature and in the design of systems, the logistic support-cost element of life-cycle cost has received inadequate attention in terms of reducing its magnitude and consequential impact. However, because of some of the recent inroads made in improving reliability, logistic support costs must be attacked if total costs of ownership of weapon systems are to be reduced.

The advent of warranties and reliability guarantees represents one prong of the attack on logistic support costs. The contractor is penalized to the extent that he must supply additional spares and repair failures on the equipment so warranted. Thus, a maintenance concept which reduces logistic support costs also reduces the liability of contractors in a warranty or reliability-guarantee contract.

While its implementation requires applying new technology heretofore applied only to improving performance, the approach to reducing logistic support cost is relatively straightforward:

- Reduce the manpower required for support.
- Reduce the cost of spares.
- Reduce the amount of test equipment.

Using digital processing and control techniques to provide a fault-isolation capability inherent in the subsystem itself, the maintenance plan is to replace the lower-cost assemblies in the aircraft, eliminate intermediate-level maintenance altogether, and repair line-replaceable assemblies only at the depot level. Such an approach reveals that there are more potential savings in this area than are to be gained by reliability improvements, and that the financial consequences of unpredicted unreliability are reduced.

Background Data

To understand more fully the causes and implications of the reliability experience of the 1960s, Westinghouse examined data on a typical fire-control radar. A system designed and built in the '60s was chosen because it had been in the field for an extended period. While the reliability information on today's systems is considerably more complete, the observations based upon this radar's data were believed to be valid.

The maintenance concept for this equipment is a three-level system, as follows:

Level I (Organizational).

- After a failure is noted in the air, automated ground equipment is used to find the problem.
- The line-replaceable unit is removed from the aircraft and replaced with a spare.

Level II (Intermediate).

- At the base shop, the LRU is tested and the fault isolated down to the defective shop-replaceable unit.
- The SRU is replaced and the repaired LRU is sent to spares storage.

Level III (Depot).

- The SRU is shipped to depot for repair.

To examine the results of this process, Westinghouse analyzed over 70,000 maintenance actions (see Figure 2). Aside from discovering the nature of the failures experienced in the field, there were two major findings:

- Nearly 24 percent of all maintenance actions were "cannot duplicate."
- A significant number of parts returned for repair had incurred physical damage.

To minimize "cannot duplicate" or "no fault found" actions, it is best to locate the fault in the operating environment when the failure occurs. Obviously, the hardware should be designed to be less susceptible to damage. But a more significant action would be to reduce the amount of equipment handling required during the maintenance cycle.

If this same data is examined with respect to reliability, another insight is gained into the problem. Figure 3 shows the reliability achieved at seven different Air Force bases. At that point in time (October 1970), the average MTBF of all these systems in the Air Force inventory was 12 hours; the predicted MTBF was 26 hours; the specified MTBF was 18 hours; and Military-Standard-781 testing produced a 6-hour MTBF.

Why was there variation in MTBF on identical equipment at different Air Force bases? Possibly because there was a difference in the motivation and capability of maintenance personnel from location to location. The best reliability was obtained by Air Defense Command squadrons in Alaska. These units needed an operational radar for their daily missions because of the weather conditions and the real-world nature of air-defense command patrol (that is, looking for hostiles). The lowest reliability was obtained by Air Training Command squadrons in Florida.

Data in Figure 3 corroborate that the motivation of the maintenance crew has a major impact on the quality of the maintenance and, consequently, the MTBF. Were it not for the resultant impact on the total cost of doing business in the Air Force, this would not be a particularly startling

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Baltimore, MD

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Figure 1. Classic Cost-of-Ownership Curve

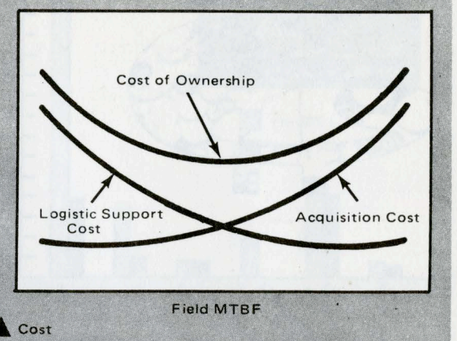


Figure 2. Distribution of Maintenance Actions (70,431 actions on 650 systems)

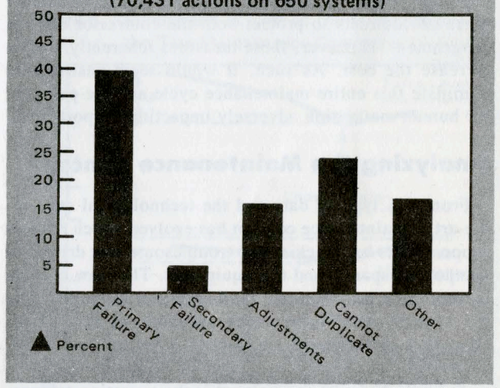
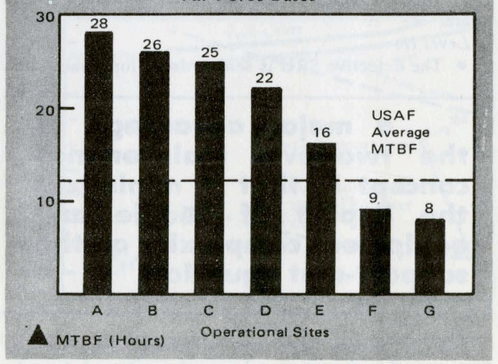
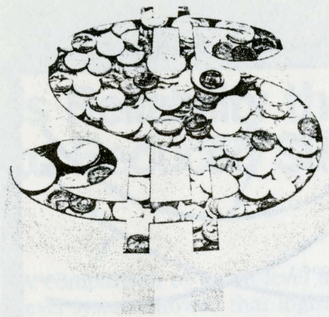


Figure 3. Variations in Reliability at Different Air Force Bases





conclusion. Further, because of how this affects a contractor whose equipment is under a reliability guarantee or warranty, elaborate measures are now being taken in these types of contracts to protect both the contractor and the government. However, these measures inherently tend to increase the cost. As such, it would seem desirable to eliminate this entire maintenance cycle and the potential for human motivation adversely impacting support costs.

Analyzing the Maintenance Concept

From this type of data and the technological state-of-the-art, a maintenance concept has evolved which reduces support costs by attacking the troublesome cost drivers of manpower, spares, and test equipment. This new concept incorporates an automatic fault-isolation capability into the system. The maintenance sequence of this design concept is as follows:

Level I.

- In-flight faults are isolated in the operating environment when they occur.
- These faults are isolated to a lower-level assembly (equivalent to an SRU).
- Upon return to base, the SRU is replaced with a spare.

Level II.

- The defective SRU is sent to depot for repair.

"... a major advantage of the two-level maintenance concept is that it minimizes the impact of people and equipment complexity on the support-cost equation."

There are several advantages to this approach. First and foremost, the amount of repair work conducted throughout the Air Force is substantially reduced, saving money in terms of manpower costs and the increasingly expensive flight-line and base test equipment. The replacement spare stocked at these bases is a much lower-cost assembly.

"The two-level maintenance concept makes possible a significant reduction in support costs; yet it offers other advantages, too."

And the isolation of a failure to a replaceable unit is done automatically by equipment design, as opposed to relying on the competence of the service technician. This also reduces equipment handling since there is no repair at the base.

The system used to evaluate this basic approach is the Electronically Agile Radar, which is being developed by Westinghouse for the Air Force. During the system's preliminary design phase, this maintenance approach was traded off against the existing three-level concept through use of the Air Force's logistic support-cost model. While analyses were conducted using the existing three-level approach, the proposed two-level concept was also evaluated by taking into account such factors as the cost of its implementation in terms of parts added to the system, its impact on reliability, and so forth. However, the system's performance capabilities remained constant.

Figure 4, which summarizes the logistic support costs for each maintenance approach, displays several salient factors. Because sparing is done at a lower-level assembly in the two-level concept, the cost of those spares is substantially reduced. When a fault occurs under a three-level concept, however, an entire LRU is removed and replaced. If an LRU is valued at $50,000, but only a $2,000 SRU is ultimately repaired, $48,000 worth of good parts are unnecessarily spared and replaced. Further, because the LRU has orders-of-magnitude more parts, its failure rate is higher by orders of magnitude. This requires more frequent replacement, which in turn demands more spares. But in a two-level concept, the fault is isolated to a lower-level assembly that costs only $2,000 to $4,000 and has a low failure rate.

Since the same faults occur regardless of the approach, the costs of first- and third-level maintenance remain the same. However, since no base maintenance is performed in a two-level concept, the only expense is a stores facility, which is considered a management cost under either system. With no base maintenance, the test equipment associated with this function is also eliminated.

The importance of test equipment in today's systems is much underrated. The complexity of test equipment is increasing at a rate which actually exceeds that of the hardware it is testing. This has resulted in extremely expensive test equipment; equally important, the test equipment itself has become a significant maintenance expense.

Moreover, the availability of the test equipment has become a major factor in base repair time.

"... the logistic support-cost element of life-cycle cost has received inadequate attention in terms of reducing its magnitude and consequential impact."

It is noteworthy that the findings of the earlier analysis on field data (that is, the high incidence of "cannot duplicate" and damaged equipment) are not accounted for in this modeling process. As such, a two-level concept which isolates the fault when it occurs and eliminates some handling of equipment should improve upon present experience in these two areas, further reducing support costs.

The Impact of Reliability

With two maintenance alternatives, the optimal reliability design point indicated in the "bath tub" curve can be examined. To do so, it is assumed that reliability can be improved by increasing acquisition cost. Most acquisition cost curves are drawn as continuous, although in fact there are practical limits on what can be purchased in parts reliability. When these limits are combined with the actual parts mix for a given system, the bounds on reliability and cost can be derived.

Figures 5 and 6 show the result of utilizing the available part types in four discrete mixes of increasing part quality; these produce variations in system reliability ranging from 70 hours to 105 hours. To examine reliability which is either less than or greater than these limits would require using parts that are not practical. For instance, the lower limit exclusively employs military-qualified parts.

"... a maintenance concept has evolved which reduces support costs by attacking the troublesome cost drivers of manpower, spares, and test equipment."

Assessing a still lower reliability would require the use of commercial-type parts, which is neither allowable nor practical for airborne avionics. At the other extreme, all the Mil-M38510 Class B parts that exist have been employed. Thus, to obtain higher reliability, Class A parts would have to be used, again not a practical alternative for avionics. Both of these extremes were examined and found to increase substantially the total cost of ownership.

Figure 4. Logistic Support Costs, Three-Level vs. Two-Level

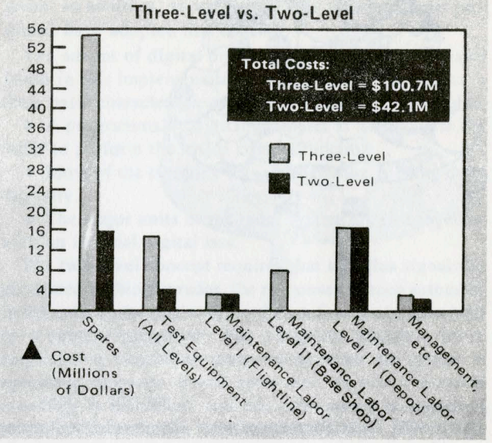


Figure 5. Comparison of Cost of Ownership Between the Two Maintenance Concepts

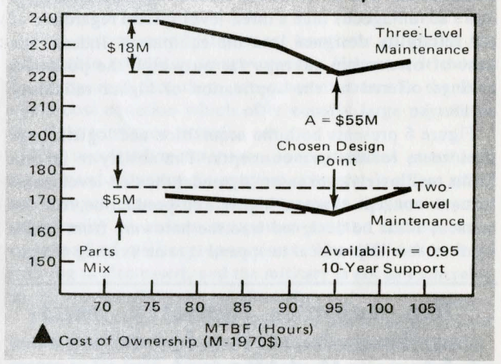
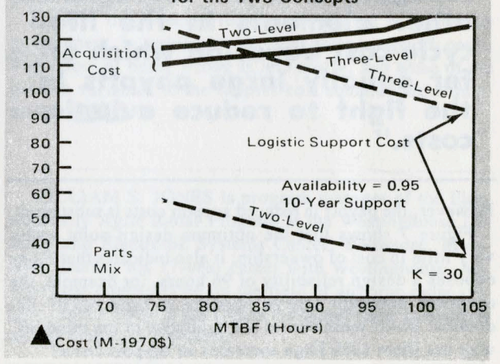
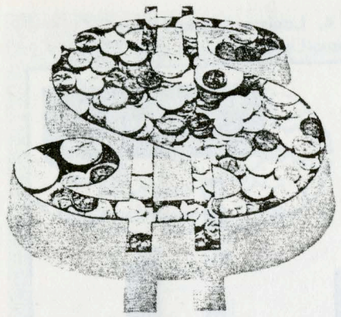


Figure 6. Acquisition and Logistics Support Costs for the Two Concepts





As a result, these alternatives were dismissed from further consideration.

Figure 5 shows a comparison of cost of ownership between the two maintenance concepts. These curves demonstrate that a two-level system of maintenance is more advantageous than a three-level system regardless of the reliability designed into the equipment. Indeed, the cost-of-ownership savings far outweigh the potential savings offered by the application of higher reliability alone.

Figure 6 presents both the acquisition and logistic support costs for the two concepts. The ability to isolate faults to a lower-level assembly under the two-level maintenance concept exacts a higher unit-production cost because it must be designed into the hardware from its inception; it is impractical to append it to an existing design.

"The avionics industry must continue to strive for achievable reliability improvements. However, it should be recognized that there are other elements in the life-cycle-cost equation which offer equally large payoffs in the fight to reduce avionics costs."

However, the payoff in reduced support costs is substantial.

Figure 7 shows that the optimum design point varies very little in cost of ownership; it also indicates that if one chooses a design reliability of 96 hours, for example, the optimum does not change position as field MTBF decreases. But if these curves are indicative of the trade-off, why are there such large increases in support costs?

Given a system designed for the optimum, one must first examine the variation in logistic support cost as a function of field MTBF. Figure 8 shows that this cost is not a linear function of MTBF and that the change in support cost for the existing three-level maintenance concept is dramatic as field MTBF degrades. The advantage of a two-level concept is indicated by the slopes of the curves.

"The need to reduce the support costs of avionics has been well documented. Considering the rather poor record of field reliability in avionics, it is not surprising that this parameter has been receiving the most attention."

The second factor affecting logistic support cost is the quality of maintenance. In the support-cost modeling process the quality of maintenance is evaluated according to the time it takes to repair equipment at the existing base shop (the second level in a three-level maintenance concept). Air Force experience shows that this time is getting longer every year. This is because of the increasing complexity of avionics and test equipment and the deteriorating skill levels being retained in the services.

Figure 9 displays the variation in logistic support cost as a function of the time required for base repair; it is apparent that a few days' change in the average value can have a major impact on this cost. Poorer reliability in the field naturally precipitates more repairs at a base shop, which creates additional delays in the cycle time. This combination of poorer reliability and poorer maintenance is regenerative, pushing support costs even higher.

Similarly, the reliability of test equipment has a significant impact on support costs. With the emphasis on more automated and general-purpose test equipment, equipment availability has been steadily decreasing. In normal support-cost analyses, the test equipment is always assumed to be available. But in actuality, as the test equipment grows in complexity, its reliability decreases and its maintenance becomes more difficult. The impact of these factors is shown in the base repair cycle time.

Thus, to retain a given availability despite poorer reliability and poorer quality maintenance, more spares must be purchased and more manpower expended. In an environment where more spares are not immediately available on demand, support costs are increasing while availability is decreasing.

Therefore, a major advantage of the two-level maintenance concept is that it minimizes the impact of people and equipment complexity on the support-cost equation.

Although the payoff of a two-level maintenance concept is obvious, it is equally obvious that its implementation is not a trivial matter. Westinghouse is presently implementing this approach in the Electronically Agile Radar program. In addition, several other Westinghouse radar programs have adopted this concept.

Figure 7. Effect of Field MTBF on the Optimum Design Point

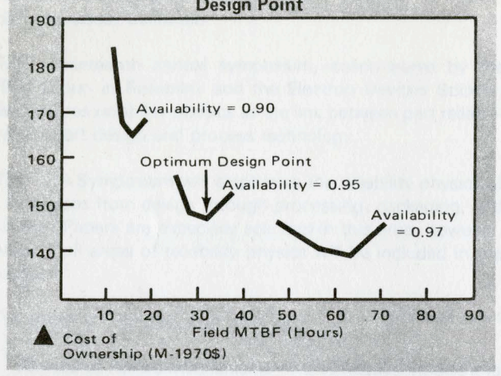


Figure 8. Effect of Field MTBF on Support Costs

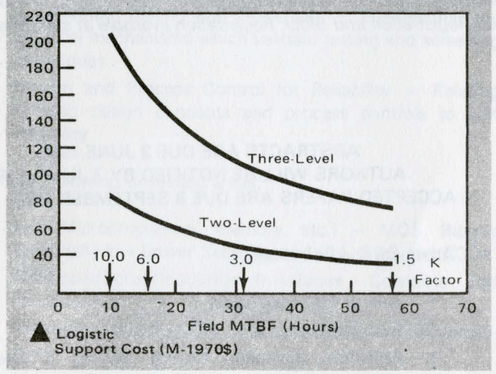
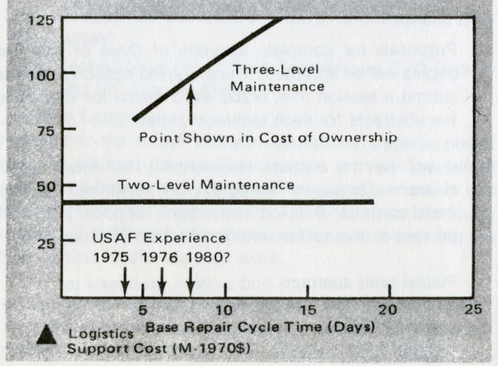


Figure 9. Effect of Repair Time on Support Costs



The two-level maintenance concept makes possible a significant reduction in support cost; yet it offers other advantages, too. For the government, it provides the opportunity to reduce manpower and the consequential overhead of military operations. The difficult task of training is also eased, and the military is not as vulnerable to the results of personnel turnover.

For industry, it offers an approach where the contractor has much greater control over the equipment's performance in the field, which minimizes the risks in warranties and reliability guarantees. And because the contractor has this control, the government can reasonably expect better performance.

Finally, this concept reduces the degree to which the government is vulnerable to unexpected support costs. The effect of being wrong is less costly, and some of the present variables in the support-cost equation are eliminated. DMJ

Conclusions

The avionics industry must continue to strive for achievable reliability improvements. However, it should be recognized that there are other elements in the life-cycle-cost equation which offer equally large payoffs in the fight to reduce avionics costs.

The advent of digital processing and control is a major factor in this implementation. Modern radar systems have three basic characteristics which make the concept feasible:

- A programmable digital computer is imbedded in the radar to perform the major control function.
- Most of the complex signal processing is being done digitally.
- The major units of the radar system are tied together with an internal digital bus.

The two-level concept requires that stimulus signals be generated within the radar; the responses of each assembly in the radar to these stimuli are then defined and transmitted to a central computer. The computer analyzes these responses to determine inaccuracies when the system is operating properly. Based upon this analysis, the failed assembly is identified, and this information is displayed or stored for action by a maintenance person. Obviously, the implementation of this automatic fault isolation is emerging as a technology in itself.

WILLIAM S. JONES is program manager of the Electronically Agile Radar Program at the Westinghouse Defense and Electronic Systems Center, Baltimore, Maryland. During his 17-year career with Westinghouse, Mr. Jones has concentrated on the field of airborne radar systems, specifically in the area of advanced radar technology and new system synthesis.

1978 IEEE INTERNATIONAL AUTOMATIC TESTING CONFERENCE
AUTOTESTCON

The annual IEEE meeting that is the only forum where users and designers meet to specifically discuss the technology and management of automatic testing.

NOVEMBER 28 — 30, 1978

HILTON MISSION BAY
San Diego, California

TECHNICAL PROGRAM

Three days of technical papers and panel sessions on automatic test systems.

REGISTRATION

IEEE/AIAA members $50.00, non-members $60.00. Registration includes admission to the technical sessions, exhibits, lunches, a copy of AUTOTESTCON '78 Record and tour admission. Advance Registration and Block Registration available at special rates.

CALL FOR PAPERS OR SESSIONS

ABSTRACTS ARE DUE 2 JUNE 1978
AUTHORS WILL BE NOTIFIED BY 7 JULY 1978
ACCEPTED PAPERS ARE DUE 8 SEPTEMBER 1978

Original technical papers are invited for presentation at the 1978 International Automatic Testing Conference. The theme of the conference is "What Today, Where Tomorrow." The conference will provide a forum to discuss the automatic testing technology and policies currently being developed and used today with emphasis on where the industry, customers and users see automatic testing systems in the future.

Suggested topics of interest:

- Automatic testing system Procurement Policies
- Application Program Development & Management
- Software tools for automatic test - such as automatic test program generators, configuration control tools, simulators, data banks, etc.
- Testability of prime equipment and automatic test system compatibility
- New applications for automatic test systems
- Modular, common and/or standardized automatic test systems
- Automatic test systems in the international market place
- Automatic test systems standards - hardware and software
- Advanced technology impact on automatic test systems
- Primacy of the user
- Automatic test systems life cost (LCC) and design to cost (DTC) impact/studies
- Field feedback on existing systems.

Abstracts should include:

- Title of proposed paper
- Authors name
- Affiliation, complete mailing address & telephone number
- Approximately 500 word summary of the material to be developed in the proposed paper stressing the conclusions and/or recommendations and their impact on automatic testing today and in the future.

Proposals for complete sessions of three or four technical papers will be accepted. The proposed session chairman must submit a session title, a 200 word theme for the session and the abstracts for each technical paper.

It will be the authors responsibility to obtain appropriate clearance for papers related to work performed under government contract. Detailed instructions for paper preparation will be sent to the author with notification of acceptance.

Please send abstracts and session proposals to:

R.G. Krukjian
Hughes Aircraft Co.
Bldg. 170C, MS-B
Culver City, CA 90230
(213) 648-2152

CALL FOR PAPERS

IEEE 1979 International Reliability Physics Symposium
April 24-26, 1979, San Francisco Airport Hilton,
San Francisco, California

This seventeenth annual symposium, cosponsored by the IEEE Group in Reliability and the Electron Devices Society, emphasizes reliability physics as the link between part reliability and part design and process technology.

The 1979 Symposium will emphasize the reliability physics of LSI devices from design through processing, packaging, and testing. Papers are especially solicited in this area; however, work in all areas of reliability physics will be included in the program.

The paper should deal with work on:

Physics of Failure Mechanisms — Quantitative models and mechanisms for component failure

Failure Analysis Techniques — Application to specific problems in failure analysis

Accelerated Testing and Screening — Emphasizing the physical mechanisms which validate testing and screening techniques

Design and Process Control for Reliability — Relating specific design concepts and process controls to part reliability

In the following or related areas:

LSI (Microprocessors, Memory, etc.) — MOS, Bipolar (especially low power Schottky and I^2L), SOS and CCDs

Semiconductor/Insulator Interfaces, Contacts and Metallization

Packaging, Bonding, Die Attach, Coatings and Encapsulation

Hybrids (Materials, Processes and Components)

Displays, Sensors, and Solar Cells

Microwave, Optoelectronic, and SAW Devices

GaAs Devices and Interface Effects on III-V Devices

New Devices (DMOS, VMOS, HMOS, and Magnetic Bubble Devices)

New Technologies (VLSI, Low Temperature CVD Deposition, and Dry Process Etching)

Passive Components

In addition to the normal verbal presentations, a special poster session is planned for significant papers on very specialized subjects and papers with a high mathematical content. In this session authors will display significant data, equations and a summary of their work on posters and be available during the entire session to discuss their work.

The deadline for submission of abstracts is October 22, 1978. Prospective authors are requested to notify the Program Chairman before September 15, 1978, of their intention to submit an abstract and the topics to be discussed. Authors must submit a 50 word descriptive abstract and a 300-500 word summary appropriate to describe a 20 minute paper or a poster presentation with 10 placards.

Both the abstract and summary must clearly state: (1) the purpose of the work, (2) how it advances the knowledge of reliability physics, and (3) the results of the investigation. The *50 word abstract,* suitable for publication in the advance program, should be typed on a separate sheet, and include the title of the talk, name and affiliation of the author(s), complete return address, and telephone number. The *300-500 word summary* must be submitted in a single-sided, double-spaced typewritten format suitable for immediate reproduction and review purposes. No photographs or drawings are permitted because of printing restrictions. The title, name and affiliation of authors, complete return address, and telephone number should appear on the first page, and the paper title and author's name on each subsequent page. Forward abstracts and summaries to:

Dr. John R. Edwards, Technical Program Chairman
1979 International Reliability Physics Symposium
American Microsystems, Inc.
3800 Homestead Road
Santa Clara, CA 95051
(408) 246-0330, Ext. 333 or 620

A limited number of late news papers reflecting important new developments will be considered on a space available basis. Please call the Technical Program Chairman to discuss the details of your late news paper as soon as you can.

Criteria used by the program committee to select papers for the symposium are:

The work must be new and previously unpublished.

Evidence of quantitative results and analytical models of studied phenomena must be given in the abstract.

The purpose and results of the work and how it advances the state of the art must be clearly described.

Authors of accepted papers will be required to submit their slides and paper manuscripts for review by their session chairman before March 1, 1979. Visual aid legibility is mandatory. Only 35mm slides will be permitted. Papers will not be approved for presentation if the slide quality is unacceptable. Final versions of manuscripts for all papers must be submitted at the symposium for inclusion in the Proceedings.

For general conference information contact:

Dr. Frank B. Micheletti, General Chairman
1979 International Reliability Physics Symposium
Rockwell International
Electronics Research Center
D/545, 002-HA27
3370 Miraloma Avenue
Anaheim, CA 92803
(714) 632-4380

ENGINEERING SOCIETIES BACK PENSION REFORM

Washington, D.C. – Spokesmen for the National Society of Professional Engineers (NSPE) and the American Society of Mechanical Engineers (ASME) have endorsed an IEEE proposal to allow employed engineers their own tax-sheltered retirement accounts. The endorsement came during February 16 testimony by all three engineering societies before a House Oversight Subcommittee of the Committee on Ways and Means looking into pension reform left undone by the 1974 Employee Retirement Income Security Act (ERISA).

The IEEE proposal, detailed for subcommittee members by Past IEEE President John J. Guarrera, consists of a draft bill for a combination Individual Retirement Account (IRA)/ Limited Employee Retirement Account (LERA) for employees currently excluded by law from holding such personal retirement plans if they are participants in a company plan. The bill was hammered out by IEEE's Pension Task Force, drafted by IEEE Special Counsel Frank Cummings and includes tables for computing company contributions, plus sample forms for amending IRS Form 5329. Both tables and forms were provided by George R. Buck Consulting Actuaries, Inc.

Although the IEEE bill had been presented to the Senate Subcommittee on Labor three months ago for inclusion in *published* testimony (see THE INSTITUTE, December, p. 1), this was the first time that IEEE was allowed to offer a Congressional Committee a verbal explanation of the concept. During testimony, Louis L. Guy, Jr., NSPE treasurer, Martha Frangiadakis, ASME legislative representative, and Michael Schoor, director of NSPE's Legislative and Government Affairs Department, praised the proposed IEEE legislation. "For engineers participating in an Individual Retirement Account," Mr. Guy stated, "immediate vesting is a fact." He called the IEEE plan a "sound approach to existing problems confronting employee engineers."

The IEEE proposal, according to Washington staffer Tom Suttle, is an attempt to address the problem of vesting in highly mobile professions such as engineering. It would allow an active participant in a company pension plan to make retirement contributions up to the regular IRA limit – currently $1500. Should the employee become 100 percent vested, an accounting would be made to ensure that the combination of the IRA and the employer-sponsored pension plan does not exceed the legal IRA limit. After vesting, the accrued tax would be averageable under the same rules that apply to lump-sum distributions from qualified plans. Even if the employee became completely vested, should the current value of a year's accrual be less than the IRA limit, the employee would continue to contribute the difference to an IRA/LERA account on a tax-deductible basis.

"Many of our members change employers again and again," pointed out IEEE's Guarrera during testimony, "forfeiting pension after pension – yet never qualifying for an IRA because they are almost always active participants in an employer-sponsored plan. Even those members who do manage to vest in an employer-sponsored plan frequently find themselves with accruals under the employer-sponsored plan of less than the value they could have had in an IRA."

In further testimony, Mr. Guarrera stated that the IRA/LERA would stand a better chance of passage than H.R. 10612, a LERA proposal that passed the House last year but died in the Senate. Unlike the earlier bill, he said, IEEE's concept is equitable to the Government because it will recoup the revenue loss occasioned by the deduction of the employee's excess contribution to the IRA or LERA. He also called the bill "more equitable to the employee" IRA contributions, he stated, "are determined by vesting along."

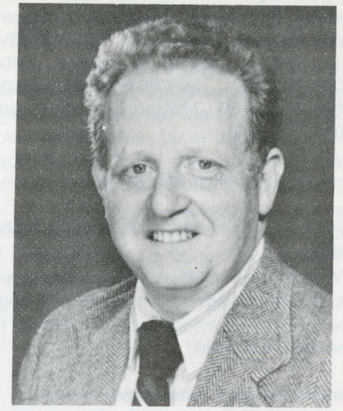
BIOGRAPHIES ★

THOMAS L. FAGAN CHAIRMAN – GEN'L MEMBERSHIP

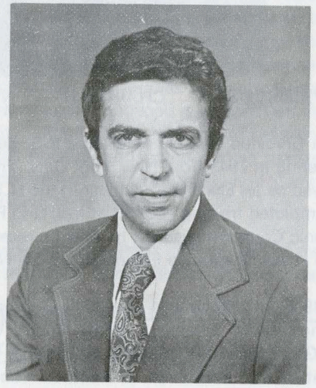
Mr. Fagan is Manager of Marketing, Advanced Military Space Programs at General Electric's Space Division in Valley Forge, PA. In previous assignments he has had extensive analytical experience in system effectiveness, reliability, and life cycle cost studies. He has managed System Safety on the AF-Manned Orbital Laboratory, development planning and scheduling for the LANDSAT program, and software development for classified military programs. His previous marketing assignments have included fluidics, ocean and environmental technology, and high energy lasers. He is currently heavily involved in survivability and communications technology as well as microwave imagery.

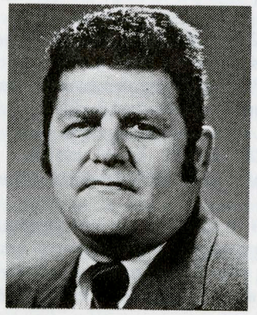
Mr. Fagan is a member of the evening faculty of the Philadelphia Community College (Adjunct Professor of Mathematics) and is a frequent contributor to the technical literature. He is a senior member of the IEEE and is currently Chairman Elect of the Philadelphia Section. He is also an Associate Fellow of AIAA, a senior member of ASQC, a member of SSS, and is currently a member of the Management Committee of the Annual R&M Symposium. He holds the A.B. in mathematics from Franklin and Marshall College and an M.S. in statistics from Villanova Univ. He is a Registered Professional Engineer in the State of CA.

HENRY A. MALEC CHAIRMAN – CHAPTER ACTIVITIES



Henry A. Malec joined GTE Automatic Electric Laboratories in 1964 after having been with ITT-Communications System Division for 5 years. He received the BS degree in Electrical Engineering in 1961 and the BS degree in Mathematics in 1964 from the Illinois Institute of Technology. He is currently responsible for the System Reliability Activity in the Applied Research Section of the Systems Research Laboratory. Primarily engaged in systems reliability and system effectiveness studies, he also serves as a reliability consultant to the various systems design groups in the Laboratories and other GTE organizations. He has authored 9 papers on reliability, is a senior member of the IEEE, an instructor in the graduate Electrical Engineering Department of IIT (Illinois Institute of Technology), and is a registered Professional Engineer in the State of IL. Presently he is the Chapter Chairman of the IEEE Reliability Group – Chicago Section and the Chapter Activities Chairman on the IEEE Reliability ADCOM.





W. THOMAS WEIR, P.E., Ph.D. VP – MEMBERSHIP

Education:

BSEE – Drexel Univ.
MS (Physics) – Drexel Univ.
Ph.D. (System Engineering and Operations Research – Univ. of Pennsylvania

V.R. LALLI, M.S. 500-211
Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44145

CHAIRMAN – CLEVELAND CHAPTER

Vincent R. Lalli was born in Garfield Heights, OH on October 16, 1931. He received the B.S. and M.S. degree in Electrical Engineering from C.W.R.U. in 1953 and 1959, respectively. As a Research Assistant at Case and later at Picatinny Arsenal, he engaged in the development of electronic fuses and special devices. In 1956 he joined TRW, where he worked as design, lead and group engineer. In 1963 he joined NASA as an Aerospace Technologist, he is now responsible for Reliability Engineering in line with his recent work for the Product Assurance Directorate in design, analysis, and failure studies. He has taught courses in electrical engineering and statistics at various universities. He is a member of Sigma Xi, Eta Kappa Nu, is a Registered Professional Engineer in the State of Ohio, and a senior member of the IEEE (S'50, M'56, SM'65).

Teaching Experience:

Drexel Univ. (1956 – Present)
  Adjunct Associate Professor
  Evening College Physics Dept.
Drexel Univ. (1963 – Present)
  Adjunct Professor
  Graduate School of Engineering Management
General Electric Co. Courses
Radio Corporation of America Co. Courses
Developed and taught courses for
  Evaluation Associates, Inc.'s Military and
  Commercial Customers

Industrial Experience

IBM: Customer Engineer, 2 years
RCA: Component Engineer, 3 years
GE: Engineering and Management, 17 years
Reliability Engineer (1956 – 1961): Reliability, Availability, Maintainability, and Safety Analysis; FMEA; Design Review; Failure Analysis; Data Systems; Program Planning; Research; etc.

(continued)

Line and Program Management (1961 – 1973): Manager – Reliability Engineering Laboratory. Program Manager – Various Navy Programs [e.g., NOSP-64020-f-(FBM), NOSP 65052-t-(FBM), N00123-67-C-2572, N00030-68-C-0215, N00024-68-C-1324, N00030-69-C-0082, N00030-70-C-0036, N00030-71-C-0100, N00140-72-c-6075, N00030-72-C0066, N00030-73-C-0106]

Evaluation Associates, Inc., 5 years

President and Chairman of the Board of Directors (1973 – Present)

Dr. Weir has served as a consultant to major U.S. corporations and Federal agencies in the system engineering area.

Committee Activities:

American Standard Association (ASA)
Committee C-83 Task Force on Electromagnetic Relays

Electronic Industries Association (EIA)
Committee G41 on Reliability

Electronic Industries Association (EIA)
Committee G42 on Reliability

BuWeps Industry Material Reliability
Advisory Board (BIMRAB)

Naval Air Systems Effectiveness Advisory Board (NASEAB)

Institute of Electrical and Electronics Engineers (IEEE) Advisory Committee on Reliability (served as a member and as vice president)

Miscellaneous:

Dr. Weir has authored numerous technical presentations and publications. He has organized and chaired sessions of several International symposia. He directed the technical teams responsible for:

NAVWEPS OD 30668 Reliability Tables (1965)

NAVWEPS OD 29304 Guide Manual for Reliability Measurement Programs (1965)

NAVORD OD 29304A Reliability Evaluation Program Manual (1973)

NAVORD OD 42282 Integrated Test Program Manual (1973)

NAVORD OD 43251 Availability Evaluation Program Manual (1970)

Electronic Industries Association Standard on Reliability Quantification (EIA Reliability Engineering Bulletin No. 4 – 1969)

Electronic Industries Association Standard on Failure Mode and Effects Analysis (EIA Reliability Engineering Bulletin No. 9 – 1971)

Senior Member – IEEE

Member – ORSA

Member – Cherry Hill Junior Chamber of Commerce

Listed in Marquis Publication Who's Who in the East Trustee Corporate Pension Plan.

JOSEPH DRVOSTEP CHAIRMAN – NY-LI CHAPTER

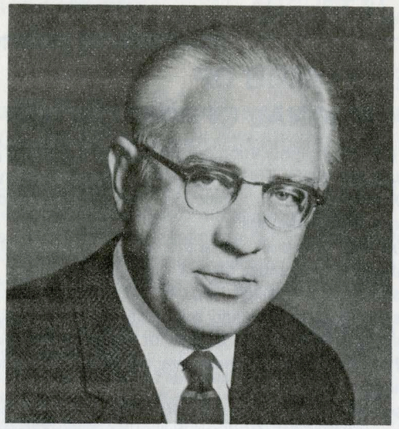
Joseph Drvostep (SM'54) received a B.S. degree in electrical engineering in 1943 from New York Univ. From 1944 to 1946 he served as an Electronics Officer in the U.S. Naval Reserve and completed training courses at M.I.T. in Radar, Sonar and Electronic Countermeasures. In 1949 he received the Masters degree in Administrative Engineering from New York Univ.

From 1946 to 1960 he was an electrical components engineer and engineering supervisor at the Sperry Gyroscope Company, Great Neck, NY. He was responsible for the selection, application and evaluation of electrical components for the B-58 bombing-navigation system, ALQ-27 countermeasures system, APN-150 and SPG-55 radar systems and the Sparrow missile.

From 1962 to 1965 he was an engineering dept. head at Sperry, responsible for the reliability, maintainability and quality of the Polaris navigation system, Loran, and the Mk. 12 & Mk. 14 Computers. His last assignment at Sperry (from 1965 to 1969) was a reliability and quality manager for the AN/SQQ-23 (PAIR) sonar system, which successfully demonstrated its reliability and maintainability requirements.

From 1969 to date, he has been a group leader and senior reliability engineer with the Grumman Aerospace Corporation, Bethpage, NY. He has been responsible for the reliability of advanced electronic sysstems in the A-6E and EA-6B aircraft.

He has actively participated in the NY Reliability Conference, the Electronic Components Conference, the Aerospace Industries Association and has been Chairman of several EIA Standards Committees. In addition to several years of service as an officer of the Metropolitan NY Chapters of the Parts and Reliability Groups, he was Chairman of the Administrative Committee of G-PHP. He has published papers on capacitors, transmission lines and reliability.



C.R. KNIGHT SENIOR PAST PRESIDENT

Experience: Mr. Knight, Executive Vice President-General Manager of ARINC Research Corp., has directed the activities of the company for more than 25 years, during which time the company has grown from six persons to approximately 280. Concerned originally with studies of electron-tube reliability, ARINC Research is now engaged in research on the reliability, maintainability, effectiveness, and cost of electronic and electromechanical systems and components; the logistics problems associated with such material; and communications systems consulting engineering.

Mr. Knight was chairman from 1956 to 1965 of the Electronic Industries Association Committee on Effectiveness Measurement, Reporting, and Evaluation Techniques. A Fellow of the Institute of Electrical and Electronics Engineers (IEEE), he is a past chairman of the Group on Reliability, Washington Chapter and has served on the editorial board of the IEEE Proceedings; he has been chairman since 1961 of the Foreign and Special Guests Committee for the Annual Symposium on Reliability. As Technical Director of Task Group II of the Air Force Weapons System Effectiveness Industry Advisory Committee (WSEIAC), he was responsible for the technical recommendations of effectiveness-measurement and prediction methods submitted by that Group. He is a recent past President of the National Advisory Committee – Reliability Group of the IEEE and was the 1976 recipient of the Group's Annual Reliability Award. He holds several patents and is the author or co-author of many technical papers on reliability and related subjects.

Two of Mr. Knight's monographs, Electronic Reliability: A Discussion of Some Basic Theoretical Concepts and a Review of Progress Since World War II, and Terms of Interest in the Study of Reliability – both written in collaboration with Dr. E.R. Jervis and Dr. G.R. Herd and published in 1955 – laid the theoretical groundwork for ARINC Research Corp. reliability analysis methods.

Before joining ARINC Research Corporation in 1951, Mr. Knight was Manager of Electronic Tube Advanced Development for General Electric Co. He is a licensed engineer in the District of Columbia and Maryland. He was elected to Tau Beta Pi, Sigma Pi Sigma, and Phi Kappa Phi, honorary scholastic fraternities.

Education: B.S., electrical engineering, Univ. of Utah; M.S., physics, The George Washington Univ.

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(continued)

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IEEE Continuing Education programs have expanded greatly in the past few years. This edition of our catalog now includes over 100 courses for your selection. Referenced are both live and home-study offerings.

Let us help you over those pre-course financial "jitters." This catalog also provides several plans that will assist you in successfully bringing these "topical" and functional education courses to the engineers and scientists in your organization. Our courses are designed to give or enhance the technical edge that they need to meet the demands of a changing technology.

Please remember that the co-sponsored programs require a full five months to satisfy all the pre-course arrangements. On the other hand, our "in-house" courses can be scheduled with a lead-time of only 30 to 60 days.

If you desire a copy of the catalog or need additional assistance on any of the programs, we invite you to write Mr. Vincent J. Giardina at IEEE Service Center, 445 Hoes Lane, Piscataway, New Jersey 08854. Or, you can call him at (201) 981-0060, Exts. 174-175.

2ND INTERNATIONAL SEMINAR ON: STRUCTURAL RELIABILITY OF MECHANICAL COMPONENTS AND SUBASSEMBLIES OF NUCLEAR POWER PLANTS

International Congress Center, Berlin, Berlin (West), Germany
August 20-21, 1979
to be held in conjunction with the
5th International Conference on
STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY

Seminar Co-Organizers:

Dr. Jack R. Benjamin
President, Engineering Decision
Analysis Company (EDAC), Inc.
480 California Avenue, Suite 301
Palo Alto, Calif. 94306, U.S.A.

Dr.-Ing. Gerhart I. Schueller
Institut f. Bauingenieurwesen III
Technische Universitat Muchen
Arcisstrasse 21
D-8000 Munchen 2

Mr. F. Joel Witt
Westinghouse Electric Corporation
Power Systems Company, PWR Systems Division
Box 355, Pittsburgh, Pennsylvania 15230, U.S.A.

Although the integrity and safety of many mechanical components and subassemblies of nuclear power plants are demonstrated by the appropriate design code, such codes seldom provide guidance as to "how safe" the structure is. By combining the technologies of solid mechanics and probabilistic structural reliability methods, engineers are finding many and varied opportunities to demonstrate margins in terms of probabilities of failure.

Present and still very preliminary plans envisage organization of the Seminar in four half-day sessions with the scope of the Seminar being:

I. **State of the Art - Theory and Applications**
Failure modes and criticality analysis, failure criteria, multi-mode failure, interference theory, Monte Carlo procedures, data analyses, modeling, confidence intervals.

II. **Nuclear Plants - Applications, Limitations, Needs**
Probabilistic simulation modeling, design rules and codification, specification reliability, component reliability, system reliability.

III. **Future of Structural Reliability Methodology in Reactor Power Plant Technology**

IV. **Summary Session - Consensus, Plans and Projections**
This session will seek to summarize the presentations and discussions and develop consensus opinion on the present and future potentials of structural reliability technology for nuclear power applications.

The first three sessions will be opened by introductory lectures followed by short presentations of panelists. Audience participation is encouraged and short individual presentations may be prearranged. To achieve a workshop atmosphere attendance will be limited to 80 persons. The conference language will be English.

All inquiries and correspondence pertaining to this Seminar should be directly addressed to one of the Seminar Co-Organizers, with copies to the other ones.

Product Liability Prevention Conference — AUGUST 21, 22 & 23

This year's PLP Conference will give you more of what the HIGH COST of Product Liability is all about.

THE SPEAKERS ARE AS VARIED AS THE SUBJECTS TO BE COVERED
- Discussion on Congressional Legislative Relief
- The Small Business Senate Committee Plans on Product Liability
- European Status of Product Liability
- Product Liability Defense Procedure and Methods

THERE WILL BE, 4 FREE, EVENING WORKSHOPS ON
- Prediction Systems
- Good Manufacturing Practices
- Economics of Design Review in Product Liability
- Personnel Loss Control and Safety Training

THERE WILL BE A MAJOR PANEL DISCUSSION INVOLVING
- The Insurance Industry
- The Association of Trial Lawyers of America
- Special committee for Work Place Reform
- National Product Liability Council
- Review of Congressional Action

This year's PLP Conference will be held at Holiday Inn, University City, 36th and Chestnut Streets Philadelphia, PA.

For more information on how to beat the HIGH COST of Product Liability, contact Richard M. Jacobs, or Luke J. Daidone of Product Liability Prevention Conference, 23 Rumson Road, Livingston, NJ 07039. Proceedings of the PLP-77 East are still available. Copies can be obtained from Richard M. Jacobs at the above address.

1978 IEEE STANDARDS CATALOG NOW AVAILABLE

The 1978 edition of the IEEE Standards Catalog is now in print. Copies are available free of charge. The new 32 page catalog lists each of the over 300 electrical and electronics standards publications under one or more of the 167 subject headings. The catalog also provides a handy numerical sequence listing of every standard. The many American National Standards published by IEEE are included in the catalog in their categories as well as in a separate numerical listing.

Standards developed within the IEEE cover test methods, practices for electrical installations, units, definitions, graphic symbols, and applications methods. The 1978 catalog lists important new and newly revised publications, including: the 1977 edition of the National Electrical Safety Code, The IEEE Standard Dictionary of Electrical and Electronics Terms, IEEE Std 500-1977, the IEEE Nuclear Reliability Data Manual, and the just published National Electrical Safety Code Interpretations, 1961-1977.

Engineers in such widely varied fields as antenna design, communications, power generation and distribution, microwave measurement, industrial applications, electromagnetic compatibility, and rotating machinery will find many authoritative documents that have received recognition both nationally and throughout the world.

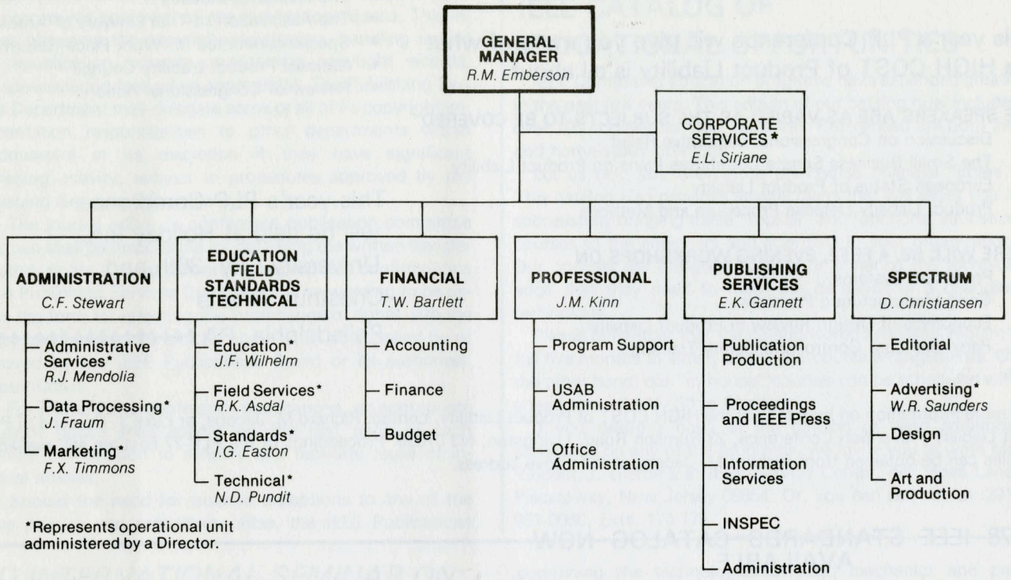
Single copies of the 1978 IEEE Standards Catalog may be obtained free from the IEEE Standards Office, 345 East 47th Street, New York, NY 10017.

We regret to inform you that the Chairman of the Board of the American Society for Quality Control, Orde R. Weaver, died on April 24, following surgery on April 21. The news is doubly tragic in that Mrs. Weaver collapsed on April 22 and died the following day. Funeral services for both Mr. and Mrs. Weaver were conducted in Bartlesville, Oklahoma on April 27 with many relatives, friends, and associates from ASQC and from Phillips Petroleum Company present.

For those who might wish to write a note of sympathy to a family member, I suggest that such be addressed to Mr. Weaver's daughter, Jayne. Her address is:

Miss Jayne Weaver
8602 Buckingham Lane No. 10
Kansas City, Missouri 64138

IEEE Functional Chart



*Represents operational unit administered by a Director.

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TRANSACTIONS REQUEST

Practical papers are still in high demand by the IEEE Transactions on Reliability. Articles on "Real World" experience, lessons learned or practical solutions to reliability and maintainability (R&M) problems are desired to make the Transactions more useful to the practicing engineer. If you have an interesting bit of R&M information, please share it with your colleagues and earn yourself some prestige as a Transactions author. Instructions to authors are printed inside the back cover of every issue of the Transactions. Your manuscript will be welcomed by the Transaction Editor:

Ralph A. Evans, Ph.D.
804 Vickers Ave.
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For more information or advice please contact the Special Papers Chairman:

Anthony Coppola
RADC (RBRT)
Griffiss AFB, NY 13441

Reliability and Maintainability Technical Reports produced by the Rome Air Development Center are available from the Defense Documentation Center (DDC) and the National Technical Information Services (NTIS). A bibliography of the latest RADC reports may be obtained without charge by request to:

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Griffiss AFB, NY 13441

1979 IEEE POWER ENGINEERING SOCIETY
WINTER POWER MEETING
February 4-9, 1979

CALL FOR PAPERS

The 1979 Winter Meeting of the IEEE Power Engineering Society will be held February 4-9, 1979, at the Statler Hilton Hotel in New York City. The Winter Meeting is a general meeting which covers the entire field of Power and its many areas of technical interest. Authors who have important information to contribute are invited to submit papers for presentation and discussion at the meeting.

Prospective authors should immediately request an author's kit from the PES Special Activities Office at IEEE Headquarters, 345 East 47th Street, New York, NY 10017. The kit includes Declaration of Intent forms, a Publication Guide outlining the current requirements, and a supply of model paper on which the manuscript is to be typed. Completed Declaration of Intent forms should be returned immediately so that preliminary plans may be made to include the paper in the technical program.

There are a number of mandatory requirements regarding the preparation of manuscripts which must be met if the paper is to be accepted. These are discussed in the Publication Guide. Authors are urged to study the guide carefully, to be sure their paper conforms with the instructions.

September 1, 1978 is the deadline date for the receipt of the original manuscript at IEEE Headquarters, if it is to be considered for the 1979 Winter Meeting. Papers submitted should be within the scope of interest of the Power Engineering Society, technically sound, contribute to existing knowledge, or reveal new knowledge.

Papers will be reviewed by an appropriate Technical Committee and if accepted, included in the meeting program. Preprints will be made of all papers accepted. Following presentation, papers will be published either infull along with their discussions and closure or in abstract form in Power Apparatus and Systems. Abstracted papers and their discussions will also be available in separate bound volumes. To be published in full, a paper must be of unquestionably high quality and in the judgement of the reviewers make a definite contribution to the technical knowledge. All accepted papers along with discussions and closures will be indexed and available on request in the future. Rising publication costs make it mandatory that preparation and publication policies be rigidly enforced.

J. Miller
Technical Program Chairman
1979 IEEE PES Winter Meeting

FIFTH ANNUAL NATIONAL CONFERENCE ON NUCLEAR POWER
October 16-19, 1978

AT THE HYATT REGENCY, KNOXVILLE, TENNESSEE

HOW TO WORKSHOP IV—THEME: COST EFFECTIVE QUALITY ASSURANCE

AMERICAN SOCIETY FOR QUALITY CONTROL

Sponsored by: THE EDUCATION AND PROGRAMS COMMITTEE OF THE NUCLEAR DIVISION

SCHEDULE

Sunday, the 15th
5:00 - 9:00 PM REGISTRATION
7:00 - 10:00 PM RECEPTION

Monday, the 16th
7:00 - AM REGISTRATION
8:30 - 11:30 AM
- Welcome Address
- Keynote Address
- Executive Panel

1:00 - 5:30 PM
- Technical Sessions
- Poster Session
- Exhibits

Tuesday, the 17th
8:30 AM - 5:00 PM
- Technical Sessions
- Poster Session
- Exhibits
- Tours

Wednesday, the 18th
8:30 AM - 3:30 PM
- Technical Sessions
- Look-Ahead Panel
- Exhibits

Thursday, the 19th
8:30 AM -
- Tour of Oak Ridge National Laboratory and American Museum of Atomic Energy

TECHNICAL SESSIONS

*A. *How to Implement a Cost Effective QA Program in Design and Procurement*
1. Design for reliability, availability, and maintainability
2. Plant availability improvement
3. Value analysis in procurement

*B. *How to Implement a Cost Effective QA Program in Manufacturing*
1. Quality cost collection
2. Quality performance indicators and measurement
3. Techniques for quality improvement

*C. *How to Implement a Cost Effective QA Program in Construction*
1. Productivity improvement
2. Quality trend analysis
3. Quality activity scheduling
4. Construction quality cost

(continued)

*D. *How to Implement a Cost Effective QA Program in Operations*
1. Outage planning
2. Safety review
3. In-service inspection

* These sessions will be presented twice

*E. *Education/Training*
1. Training techniques
2. Auditor training
3. Motivation

*F. *Quality Cost (Tutorial)*
Developing and implementing an effective quality cost program

*G. *International Experiences*
Canada, Europe, Japan

CONFERENCE THEME:

COST EFFECTIVE QUALITY ASSURANCE

All quality assurance programs should be cost effective, but it is sometimes difficult to demonstrate this cost effectiveness.

The Fifth Annual Conference will take a look at how cost effective QA programs are being used in the nuclear industry.

In the nuclear industry NRC regulations require the establishment and execution of a formal Quality Assurance Program which will provide adequate confidence that a structure, system or component will perform satisfactorily in service. Using creativeness and common sense there is no reason why such a QA Program cannot be made meaningful and cost effective, contributing to: reducing costs, and improving schedules, reliability, and availability.

A cost effective QA Program is "prevention oriented" whereas a "correction oriented" QA Program relying on a "go" – "no-go" gage at the end of the line will not be cost effective if there is an uneconomic rejection rate.

The prevention oriented program is one where front end planning is applied to all activities and where management provides direction to line and quality assurance personnel who jointly develop and execute the program.

We will be hearing from utilities, architect-engineers, constructors, and manufacturers. There will also be an international session where speakers from England, Canada, Sweden, and Germany will describe some of their cost effective practices.

Joseph P. Knight
Conference Chairman

CONFERENCE COMMITTEE

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615-483-8611, ext. 35093

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Stan Duhan, Chairman

KNOXVILLE NOW!

Knoxville, the home of TVA's engineering and construction organizations, is only a short distance from Oak Ridge – The Nuclear Energy Capital of the World. Also, Knoxville is the gateway to the Great Smoky Mountains National Park and is surrounded by five of the "Great Lakes of the South." Recreational and vacation facilities are just a few minutes drive from Knoxville. Relax, stay awhile, and enjoy seeing the wonders of some of the oldest and most beautiful mountains on earth. Visit TVA's Watts Bar Nuclear Power Plant, the Oak Ridge National Laboratory, and the American Museum of Atomic Energy. Bring your family and enjoy a vacation in the Smoky Mountains. See the fall colors of the leaves in the mountains at the peak of their splendor.

Your conference hotel will be the Hyatt Regency, high above Knoxville, overlooking the Tennessee River. It has a 9-story atrium lobby that will be bustling with exhibitors displaying the latest in equipment and services available to the nuclear power industry. You will find it busy as a city square where you can meet with your professional associates and internationally known Nuclear Power Quality Assurance Specialists. Bring your spouse and family. The Hyatt Regency is providing special family rates for the conference. Facilities include free parking, swimming pool, playground, gift shops, and beauty shop, plus superb dining and cocktail facilities.

(continued)

On Sunday evening there will be a reception with light buffet, cocktails, and entertainment. During the sessions, breakfasts, coffee breaks, and luncheons will be provided to those attending the conference. Tours of Knoxville attractions will be conducted for spouses and conference attendees as described in the brochure. For the evenings, the conference committee is securing special group rates for the Knoxville Dinner Theatre, tours, and other activities. A special activities desk will be in the conference registration area to help you fully enjoy your stay in Knoxville.

ACTIVITIES PLANNED

The committee has planned activities for both you and your spouse.

- Sunday – A reception with a light buffet, cocktails, and musical entertainment
- Monday – A trip to Knoxville's professional dinner theatre where you will enjoy a great meal and light hearted entertainment
- Tuesday – A conducted tour to TVA's Watts Bar Nuclear Plant plus dinner at a country restaurant. The American Museum of Atomic Energy in Oak Ridge will also be available on this day.
- Thursday – A conducted tour of Oak Ridge National Laboratory and the American Museum of Atomic Energy

SPOUSES PROGRAM

Bring your husband/wife to Knoxville, Tennessee

A complete program of activities is being planned while your spouse is attending the conference.

- One complimentary breakfast with your spouse on the first day of the conference
- Two complimentary get-to-gether continental breakfasts
- Trip to the Greak Smoky Mountains and Gatlinburg, Tennessee – a resort town known for its many unique shops. Plan to do your holiday shopping while there
- Conducted tour of Knoxville's many places of interest with lunch at a fine local restaurant
- Optional programs for Wednesday:
  - Trip to the Southern Highland Craft Fair
  - Walking tour of the historical sites of Knoxville
  - Visit to the University of Tennessee

ADVANCE REGISTRATION
ASQC FIFTH ANNUAL NATIONAL CONFERENCE
ON NUCLEAR POWER
OCTOBER 15 - 19, 1978
Knoxville, Tennessee

*Registration fee includes:
Coffee breaks, Three (3) breakfasts, three (3) luncheons & proceedings
Complimentary Spouses' Program

*Advance Registration $120.00
*Registration at Conference $135.00

Mail this form with payment to:

Mr. M. W. Alexander
Tennessee Valley Authority
401 United Bank Building
709 Chesnut Street
Chattanooga, TN 37401

*Advance registrations and requests for refunds on advance registrations must be received by September 21, 1978. No confirmation of registration unless requested.

Name _____
Title _____
Company _____
Street _____
City _____
State & Zip _____
Phone Number (____) _____

Member of ASQC?* YES ☐ NO ☐
Member of Nuclear Division YES ☐ NO ☐
Spouse will attend YES ☐ NO ☐

*Membership in the ASQC is not required to attend.

I am interested in participating in the following late afternoon and evening activities for which there will be a separate charge (amount to be determined):

Monday – Dinner theatre (Great food & entertainment) YES ☐ NO ☐
Tuesday – Conducted tour of TVA's Watts Bar Nuclear Plant and dinner YES ☐ NO ☐
or Tour of The American Museum of Atomic Energy YES ☐ NO ☐
Thursday – Conducted Tour of Oak Ridge National Laboratory and the American Museum of Atomic Energy YES ☐ NO ☐

For an advance registration form of Spouse's Program, please contact:

Mrs. Hinda Duhan
Spouses Program
9612 Cotesworth Rd.
Knoxville, TN 37922

RELIABILITY GROUP IEEE (Joint meeting with Baltimore Reliability Group and Washington ASQC).

Date: 19 April 1978

Subject: Quality/Reliability Interface

Speaker: Naomi J. McAfee, Westinghouse Electric Corp.

Place: Goddard Space Flight Center, Recreation Center, Greenbelt, MD.

The reliability/quality interface presents a difficult organizational problem to corporations and other organizations. Ms. McAfee discussed the advantages/disadvantages of various methods of interfacing these two disciplines and showed how these organizations can be set up to operate with maximum coordination and communication interchange. The view from both organizations was examined to show how the interface effects operations.

CHAPTER ACTIVITIES

Our chapter program this year was as follows:

Sept. 20, 1977 – "The Facts About Nuclear Power", a presentation by Mr. Robert H. Gauger, Supervisor of Reliability Services, Holmes & Narver Inc., Oradell, NJ.

Nov. 15, 1977 – "The Hazards of Off-Shore Oil Exploration", presented by Mr. Dan Patton, Chief of the Division of Environmental Assessment, Bureau of Land Management, NYC.

Feb. 22, 1978 – "A Reliability Program for Licensed Manufacture", by Mr. Harold von Hasseln, Quality Assurance Manager of the Sperry Gyroscope Division, Great Neck, NY

Apr. 20, 1978 – A Tour of Underwriters Laboratories Inc., Melville, NY and an overview of UL services to industry.

May 18, 1978 – A Tour of Pan American World Airways facilities at John F. Kennedy Airport, NYC.

Joseph Drvostep
Chairman, NY-LI Chapter
Reliability Group

CONFERENCE SCHEDULE

1978	CONFERENCE	LOCATION	INFORMATION CONTACT	PUBLICATION PLANS
July 30-Aug. 4	INT'L CONFERENCE ON INDUSTRIAL APPLICATIONS OF MAGNETIC SEPARATION *Sponsors: MAG* *Exhibits: Yes* *Est. Attendees: 125*	Franklin Pierce College Rindge, NH	Prof. U.A. Liu Dept. of Chemical Engr. Auburn University Auburn, AL 36830 (205) 826-4827	Record OOP OPTION 1 SUB-OPTION 1D
Aug. 20-25	INTERSOCIETY ENERGY CONVERSION ENGR. CONFERENCE *Sponsors: ED, AES*	Town and Country Hotel San Diego, CA	George P. Townsend Hamilton Standard Div. United Technologies Corp. Windsor Locks, CT 06096 (203) 623-8723	Record OOP OPTION 1 SUB-OPTION 1D,C
Aug. 22-25	INT'L CONFERENCE ON PARALLEL PROCESSING *Sponsors: C, Wayne State University* *Est. Attendees: 150*	Shanty Creek Lodge Bellaire, MI	Prof. T.Y. Feng Dept. of Elect. & Comp. Engr. Wayne State University Detroit, MI 48202 (313) 577-4850	Record 78CH1321-9 C OOP OPTION 1 SUB-OPTION 1E
Sept. 5-7	INT'L OPTICAL COMPUTING CONFERENCE *Sponsors: C* *Est. Attendees: 95*	Imperial College London, England	S. Horvitz Box 274 Waterford, CT 06385 (203) 442-0771	Digest 78CH1305-2 C OOP OPTION 1 SUB-OPTION 1E
Sept. 5-8	COMPCON FALL *Sponsors: C*	Washington, DC	Harry Hayman Computer Society P.O. Box 639 Silver Spring, MD 20901 (301) 439-7007	Record OOP OPTION 1 SUB-OPTION 1E
Sept. 6-8	OCEANS '78 *Sponsors: OEC, MTS* *Exhibits: Yes*	Sheraton Park Hotel Washington, DC	Myra Binns Marine Tech. Society 1730 "M" Street NW. Washington, DC 20036 (202) 659-3251	Record 78CH1351-6 OEC OOP OPTION 1 SUB-OPTION 1C
Sept. 10-13	JOINT POWER GENERATION TECHNICAL CONFERENCE *Sponsors: PE, ASME, ASCE* *Exhibits: No*	Sheraton Hotel Dallas TX	Max. H. Tanner, Jr. Dallas Power & Light Col 1506 Commerce Street Dallas, TX 75201 (214) 747-4011	Record 78CH1329-2 PWR OOP OPTION 1 SUB-OPTION 1F
Sept. 11-13	PETROLEUM & CHEMICAL INDUSTRY TECHNICAL CONFERENCE *Sponsors: IA* *Exhibits: No* *Est. Attendees: 500*	Camelot Inn Tulsa, Oklahoma	Tom Shaw Phillips Petroleum Co. 6 Al Phillips Bldg. Bartlesville, OK 74004 (918) 661-4516	Record 78CH1322-7 IA OOP OPTION 1 SUB-OPTION 1B
Sept. 12-14	WESTERN ELECTRIC SHOW & CONVENTION (WESCON) *Sponsors: Los Angeles & San Francisco Councils* *Exhibits: Yes*	Los Angeles Convention Center Los Angeles, CA	W.C. Weber, Jr. 999 N. Sepulveda Blvd. El Sugundo, CA 90245 (213) 772-2965	Record - WESCON

(continued)

1978	CONFERENCE	LOCATION	INFORMATION CONTACT	PUBLICATION PLANS
Sept. 12-14	AUTOMATIC SUPPORT SYSTEMS FOR ADVANCED MAINTAINABILITY (AUTOTESTCON) *Sponsors: AES, San Diego Section* *Exhibits: Yes* *Est. Attendees: 400*	San Diego, CA	Bob Aguais General Dynamics Electronics Division Mail Stop 7-98 P.O. Box 81127 San Diego, CA 92138 (714) 279-7301 ext. 3975	Record OOP OPTION 1 SUB-OPTION 1C
Sept. 13-15	INT'L CONFERENCE ON VERY LARGE DATA BASES *Sponsors: C*	Federal Republic of Germany Berlin-Germany	Anthony Wasserman U.S. Conf. Chairman Medical Information Sci. Room A-16 University of California San Francisco, CA 94145 (415) 666-2951	Record OOP OPTION 1 SUB-OPTION 1E
Sept. 18-21	CYCLOTRON CONF. *Sponsors: NPS*	Indiana University Bloomington, IN	R.F. Pollock Cyclotron Facility Indiana University Bloomington, IN 47401	Record OOP OPTION 1 SUB-OPTION 1B
Sept. 21-23	INTERACTIVE TECHNIQUES IN COMPUTER AIDED DESIGN *Sponsors: C, ACM* *Exhibits: Yes* *Est. Attendees: 500*	Palazzo dei Congressi Fiera di Bologna Italy	Dr. Bertram Herzog Computer Ctr. Unviersity of Colorado Boulder, CO 80303 (303) 492-6501	Record 78CH1289-8 C OOP OPTION 1 SUB-OPTION 1E
Sept. 24-27	ELECTRONIC AND AEROSPACE SYSTEMS CONVENTION (EASCON) *Sponsors: AES, Washington Section* *Exhibits: No*	Sheraton Int'l Hotel Arlington, VA	At-Your Service, Inc. c/o Bette English 821 15th Street NW. Washington, DC 20005	Record 78CH1352-4 AES OOP OPTION 1 SUB-OPTION 1C
Sept. 25-27	"CONVERGENCE '78" *Sponsors: VT* *Exhibits: No* *Est. Attendees: 1000*	Hyatt Regency Hotel Dearborn, MI	J.M. Leahy MICRO-SWITCH Division Honeywell, Inc. 17515 West Nine Mile Rd. Southfield, MI 48075	Record 78CH1343-3 VT OOP OPTION 1 SUB-OPTION 1B
Sept. 25-27	ULTRASONICS SYMP. *Sponsors: SU* *Exhibits: No*	Cherry Hill Hyatt House Philadelphia, PA	F.S. Welsh Bell Telephone Labs. 555 Union Blvd. Allentown, PA 18103 (215) 439-7978	Record 78CH1344-1 SU OOP OPTION 1 SUB-OPTION 1D
Oct. 1-5	INDUSTRY APPLICATION SOCIETY ANNUAL MEETING *Sponsors: IA, Toronto Section* *Exhibits: No* *Est. Attendees: 900*	Royal York Hotel Toronto, Ontario Canada	W. Harry Prevey 4141 Yonge Street Willowdale, Ont., Canada M2P 1N6	Record 78CH1346-6 IA OOP OPTION 1 SUB-OPTION 1B
Oct. 16-17	JOINT ENGINEERING MANAGEMENT CONF. *Sponsors: EM*	Regency Hotel Denver, CO	Henry Backman Hazeltine Corp. Greenlawn, NY 11740	Record 78CH1359-9 EM OOP OPTION 1
Oct. 16-19	FOUNDATIONS OF COMPUTER SCIENCE *Sponsors: C, ACM-SIGACT, Michigan U.* *Est. Attendees: 110*	Ann Arbor, MI	J.W. Carlyle 4532 Boelter Hall School of Engr. UCLA Los Angeles, CA 90024 (213) 825-6830	Record OOP OPTION 1 SUB-OPTION 1E

(continued)

1978	CONFERENCE	LOCATION	INFORMATION CONTACT	PUBLICATION
Oct. 18-20	JOINT AUTOMATIC CONTROL CONFERENCE *Sponsors: CS*	Civic Center Philadelphia, PA	Dr. Harlan J. Perlis New Jersey Inst. of Tech. 323 High Street Newark, NJ 07102 (201) 645-5492	Record OOP OPTION 1 SUB-OPTION 1A
Oct. 18-20	CANADIAN COMMUNICATIONS AND POWER CONFERENCE *Sponsors: Canadian Region, Montreal Section* *Exhibits: Yes*	Queen Elizabeth Hotel Montreal, P.Q. Canada	Jean Jacques Archambault CP/PO 757 SUCC. "C" Montreal, Quebec H2L 4L6 (514) 285-1711	Record OOP OPTION 1 SUB-OPTION 1H
Oct. 18-20	NUCLEAR SCIENCE SYMP. *Sponsors: NPS* *Exhibits: Yes*	Shoreham Americana Washington, DC	J.H. Trainor Code 663 Goddard Space Flight Ctr. Greenbelt, MD 20771	Nuclear Science Trans. Vo. NS-26 No. 1, February '79
Oct. 18-20	NUCLEAR POWER SYSTEMS SYMPOSIUM *Sponsors: NPS* *Exhibits: Yes*	Shoreham Americana Washington, DC	E.A. Corte General Atomic Co. P.O. Box 81608 San Diego, CA 92138	Nuclear Science Trans. Vol. NS-26 No. 1, February '79
Oct. 21-25	ENGINEERING IN MEDICINE AND BIOLOGY *Sponsors: EMB* *Exhibits: Yes*	Marriott Hotel Atlanta, GA	Walter L. Bloom, MD Georgia Institute of Tech. Atlanta, GA 30302	Record OOP OPTION 1 SUB-OPTION 1F
Oct. 23-25	DIGITAL SATELLITE COMMUNICATIONS *Sponsors: REG. 7* *Exhibits: Yes* *Est. Attendees: 400*	Hotel Reine Elizabeth Montreal, Canada	Marcel Perras Teleglobe Canada 680 Sherbrooke Street W. Montreal, Quebec H3A 2S4 (514) 281-7976	Record 78CH1326-8 REG. 7 OOP OPTION 1 SUB-OPTION 1H
Oct. 23-25	FRONTIERS IN EDUCATION *Sponsors: Ed*	Dutch Inn Lake Buena Vista, FL	E.R. Chenette Dept. of Elect. Engr. University of Florida Gainesville, FL 32611	Record OOP OPTION 1 SUB-OPTION 1F
Oct. 24-26	BIENNIAL DISPLAY RESEARCH CONFERENCE *Sponsors: ED, SID* *Exhibits: No* *Est. Attendees: 300*	Cherry Hill Inn Cherry Hill, NJ	G. Slottow Dept. of Elect. Engr. University of Illinois Urbana, IL (217) 333-6500	Record 78CH1323-5 ED OOP OPTION 1 SUB-OPTION 1D
Oct. 25-27	COMPUTER ARITHMETIC *Sponsors: C* *Est. Attendees: 100*	Miramar Hotel Santa Monica, CA	Prof. Milos D. Ercegovac 3732 BH, UCLA Computer Science Dept. University of Calif. Los Angeles, CA 90024 (213) 825-2660	Record OOP OPTION 1 SUB-OPTION 1E
Oct. 25-27	INTELEC (INT'L TELEPHONE ENERGY CONF) *Sponsors: COMM* *Est. Attendees: 500*	*Sheraton Park* *Washington, DC*	J.J. Suozzi Bell Laboratories Room 5D-178 Whippany, NJ 07981	Record *78CH1353-2 COMM* OOP OPTION 1 SUB-OPTION 1C
Oct. 30-Nov. 1	SEMICONDUCTOR LASER CONFERENCE *Sponsors: QEA* *Exhibits: No* *Est. Attendees: 120*	Sheraton at Fisherman's Wharf San Francsico, CA	T.L. Paoli Bell Laboratories 600 Mountain Ave. Murray Hill, NJ 07974 (201) 582-2903	Record OOP OPTION 1 SUB-OPTION 1D