IEEE

RELIABILITY GROUP NEWSLETTER

September 1977—Vol. XXII—Issue 4

Editor: Naomi J. McAfee

EDITOR'S NOTES

The July issue of the Newsletter stated that the American Society for Quality Control (ASQC) Board of Directors had voted to delete the ASQC membership requirement from its Certified REliability Engineer Program. The motion passed by ASQC's Board of Directors is:

> To recognize membership in an engineering society that is a member of the Engineers Joint Council, the Engineers' Council for Professional Development, or such similar engineering body, as being equivalent to ASQC membership for satisfying the membership requirements for ASQC Certification and Recertification. Additionally, membership in other societies that are recognized by ASQC as "affiliated societies" for this purpose, or acceptance by the Certification Committee that an individual has provided satisfactory evidence of professional qualifications for membership in a recognized society, even though not electing to become a member similarly will be deemed to satisfy this requirement; passing the regular examination for certification, and completion of the requirements for recertification when appropriate, plus such payments as are determined by the cognizant Board or Committees to cover the normal operating costs, plus additional expenses

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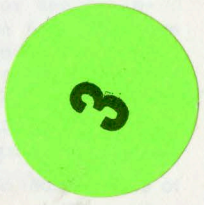
Material for the January issue must be in the Editor's hands by November 25, 1977.



accrued to the Society for administration and verification services will also be required.

IEEE is again facing an election for President, Executive Vice President, and Vice President. The candidates and their statements as to why they should be elected are contained within this issue. It is not important how you vote but that you vote. It is your institute, participate in the elective process.

WANTED: An editor for the IEEE-GR Newsletter. An editor has the opportunity of meeting many people (through the written word) and getting lots of information from a great number of sources. All this, and it doesn't take a lot of time. Applications should be sent to the current editor.

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CHAPTER NEWS

BALTIMORE

The Baltimore Chapter will hold its first meeting of the 1977-78 year, November 15, 1977 at the Beltway Inn. Mr. Paul Chelson, ARINC will discuss "Economic Incentives to a contractor to Provide Reliability Improvements Under RIW." Meetings have also been scheduled for February 21, 1978, March 21, 1978 and May 16, 1978.

CHICAGO

Four programs are scheduled for the 1977-1978 year. The first will occur on October 6th, 1977 with a morning (10:30 AM to 11:30 AM) tour of the Underwriters Laboratories, Northbrook, Illinois facility. The Heating, Air Conditioning and Refrigeration Department, the Hazardous Location Department and the Fire Department will be included in the tour, followed by an informal lunch.

The second annual Reliability Techniques Saturday Seminar will be presented on November 12, 1977. This year's program will include reliability basics and modeling, maintainability, cost effectiveness, derating, utility power reliability, and solar power reliability considerations. An $8.00 registration fee includes printed materials and refreshments.

In February, 1978, Mr. Thomas C. B. Ayres of ceLeuw, Cather and Company will present a meeting on Mechanical Reliability in the downtown Chicago area.

The fourth meeting is scheduled for April, 1978 with Mr. Hugh C. Edfors of GARD, Inc. organizing a panel session on the Reliability of Magnetic Bubble Memories.

The officers for the 1977-1978 year are:

Chairman:	Henry A. Malec GTE Automatic Electric Labs.
Vice-Chairman:	Raymond L. Schirmer ITT-Telecommunications
Secretary:	Paul E. Clawson KGA Engineering Company, Inc.
Treasurer:	Stanley W. Anderson Commonwealth Edison Co.
Membership Chairman:	Hugh C. Edfors GARD Inc.

NORTH JERSEY

"The Status and Future of Today's Engineer in Society" was the title of the seventh and last meeting for the North Jersey Section Reliability Chaper for the 1976-1977 year. The meeting was conducted as an informal, relaxed "cracker barrel" session with an attendance of approximately 20 engineers. The meeting was moderated by Mr. D. Bogush, Reliability Chapter Chairman 1976-1977.

The results of the meeting indicated that engineers do not feel that they are treated as professionals. Much concern and dissatisfaction was shown by the attendees in the areas of job security, salaries and pensions. The attendees concluded that an organization of engineers is needed to improve the status of engineers. Also, at this meeting the officers for the 1977-1978 year were elected.

The elected officers are as follows:

Chairman:	Rafael J. Hernandez
Vice-Chairman:	Peter J. Mulvey
Secretary:	Fred Mendez
Program Chairman:	Sergei Bogaenko
Member at Large:	Stanley M. Cherkasky
Member at Large:	Michael Y. Swaluk
Member at Large:	Sidmon E. Markowitz
Member at Large:	Richard Jacobs
Past Chapter Chairman & Membership Chairman:	Daniel Bogush

The North Jersey Section Reliability has generated its schedule for the first part of 1977-1978.

September:	Reliability & Quality in the RWG Industry
Sept. thru Dec:	Eight Week Reliability Course
October:	Government Contractor Relationship/ Joint Meeting with ASQC
November:	Scanning Electron Microscope Presentation
December:	Product Liability/Joint Meeting with Society of Women Engineers

The North Jersey Section Reliability Chapter in conjunction with the Educational Committee are sponsoring a course in "Reliability and Its Application". The fundamental methods and approaches will be developed and presented for basic reliability and design considerations and their applications. Statistical procedures, estimation techniques, reliability analyses for design improvement, data base implementation for effective reliability analysis and design, and failure analysis techniques and equipment for determining failure modes and mechanism. Techniques for improving system reliability, i.e.: redundancy, effective failure detection procedures, improved hardware design and software augmentation will also be presented.

The course will be taught by Charles Giardina, PhD. Dr. Giardina is Professor of Electrical Engineering, Mathematics, and Computer Science at Fairleigh Dickinson University. He is also Director of the Fort Monmouth Extension of the College of Science and Engineering. In addition, he has been associated with the Singer Company, Kearfott Division, for the past eight years. During that time, he has taught several courses related to Statistics, Reliability, and Operations Research in the Kearfott Continuing Education Center. The course will consist of eight sessions and will be given on Thursdays, at 7:00 P.M. at ITT Avionics Auditorium, 500 Washington Avenue, Nutley, New Jersey, 07110, beginning on October 13, 1977.

COURSE OUTLINE

Reliability and Its Applications

I. BASIC CONCEPTS AND DEFINITIONS
- Reliability
- Availability
- MTBF
- Failure Rate
- Reliability Distributions
  - Exponential
  - Gamma
  - Weibull

II. RELIABILITY STRUCTURES
- Series
- Parallel
- (m_jn) Systems
- Combinations
- Stand-By Systems

III. STATISTICAL PROCEDURES IN RELIABILITY
- Sampling
- Hypothesis Testing
  - Conventional
  - Non-Parametric
  - Sequential
- Inspection Diagrams
- Confidence Limits
- Estimation Nomenclature
  - Unbiasedness
  - Efficiency
  - Sufficiency
  - Consistency
- Estimation Techniques
  - Maximum Likelihood
  - Bayesian

IV. REDUNDANCY & APPLICATIONS - CASE STUDIES

V. RELIABILITY ANALYSIS FOR DESIGN
- Failure Mode and Effects Analysis (FMEA)
- Worst Case Circuit Analysis
- Prediction Analysis

VI. CONSIDERATIONS FOR RELIABILITY IN DESIGN
- MTBF or Failure Rate Objective
- Operating Life
- Storage Life
- Environmental Considerations

VII. FAILURE ANALYSIS TECHNIQUES AND FACILITIES TO DETERMINE FAILURE MODES & MECHANISMS

Questions about any of the above may be forwarded to:

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201-256-4000 X3651

WASHINGTON/NORTHERN VIRGINIA

The Chapter got off to a good start for the season when it held its first meeting on September 21, 1977. Mr. Fred Crum, a senior engineer with ARINC Research, spoke on the subject of reliability improvement warrenty and the feed back which has been received on this new form of contract in a talk entitled "TACAN RIW Field Experience and Contractor Activity"

The October meeting will feature, as speaker, Mr. Ken P. LaSala of the Naval Material Command (Mat-08E). His topic will be "Man-Machine Reliability--A Practical Engineering Tool". The meeting will be held at 8:00 p.m. October 19th, 1977 at the Ramada Inn, 8400 Wisconsin Ave., Bethesda, Md. Contact the IEEE Office at 737-4333 for 6 p.m. dinner reservation.

TOPIC SUMMARY

A life-cycle oriented approach to the prediction and evaluation of man-machine reliability will be discussed, including techniques for the allocation, prediction, and evaluation of achieved human reliability. The utility of the Human Reliability Prediction System is demonstrated by applying it to a man-machine system presently under development. The application described in this paper shows how to develop the necessary mission profiles and other data and how to use the specific human reliability prediction techniques. Typical problems identified by the techniques are illustrated with potential corrective actions. Other meetings are scheduled as follows:

16 Nov. 1977:	Reliability Analysis Applied to Mechanical and Structural Systems
Speaker:	Cal Dix, General Elec.
December:	No Meeting
11 Jan. 1978:	Reliability and Maintainability Influence on System Life Cycle Costs
Speaker:	William Wagner, Teledyne CAE
15 Feb. 1978	Unique Approach to Reliability in AEGIS System Design
Speaker:	Nick Lutz, Bird Associates

All meetings to be held at 8:00 p.m. at the Ramada Inn, 8400 Wisconsin Avenue, Bethesda, Maryland. Call IEEE Office at 737-4333 for 6:00 p.m. dinner reservations.

INDIA ESTABLISHES RELIABILITY GROUP

On the initative of Dr. K.B. Misra, Senior Member, a Working Group on "Reliability Engineering in India" was constituted by the Department of Science & Technology, in August 1976 under the chairmanship of Maj. Gen. K. K. Mehta, Chief Controller of R & D, Ministry of Defense, New Delhi and Dr. K. B. Misra, Convener of this Group. Its members are derived from various public and private sector industries and Government Organizations, like Kirloskar, H.M.T., Electronics Commission, B.E.L., B.H.E.L., I.S.I., B.A.R.C., V.S. Space Centre, C.S.I.O. etc. The Working Group plans to study the extent of Reliability Engineering concepts in use at present, at the respective stages of design, development and production by various industries in India. The broader terms of reference of this Group are: to assess the currant status of Reliability Engineering, identify the gaps with techno-economic assessment and define the objectives and priorities of future action with programs expenditure and time schedules. The Working Group has already met twice and identified areas for immediate action. It is for the first time that such a concerted effort has been made involving industries and organizations for the above purpose. The work undertaken will have far-reaching consequences and promoting quality and reliability consciousness in this country while protecting consumers interests and ensure their satisfaction.

IEEE CANDIDATES FOR OFFICE

This year's board of directors' candidate for the presidency is Ivan A. Getting, president of Aerospace Corp. El Segundo, CA. Getting feels that the Institute should be responsive to the needs of its members and should work toward uniting its various constituencies.

Private consulant Irwin Feerst is once again a presidential petition candidate. Feerst encourages fellow engineers to recognize their duties to society and to the Institute.

Current IEEE vice president Carleton A. Bayless, of Pacific Telephone and Telegraph, Sacramento, CA, is being supported for reelection by the board. Bayless advocates increased communication between the Institute and the public.

C. Lester Hogan, vice chairman of the board of Fairchild Camera and Instrument Corp., is currently a petition candidate for vice president of the Institute. Hogan feels the Institute should strive for technical excellence, while exercising caution when entering into professional activities.

Each candidate was asked to evaluate what he has to offer the Institute and why he wants to be an executive officer.

IVAN GETTING: PRESIDENTIAL CHOICE, BOARD OF DIRECTORS

"I'm offering the Institute a substantial amount of experience as an EE and an adequate record in management in working out the environmental problems of the EE.

"When an individual is a member of society, he has an obligation to fulfill. I am a candidate for IEEE president because of the sense of obligation I have toward the Institute. In addition, I was asked to be president by the board of directors.

"I think that IEEE serves a very critical role and I think it's important that that role be preserved. The write-in presidential candidate holds views and advocates policies that will lead to fractionation. It is important that the Institute is united and continues to serve its members, including the publication of technical articles and continuing education for engineers."

IRWIN FEERST: INDEPENDENT CANDIDATE FOR PRESIDENT

"There are several reasons why I want to be president of the Institute, I've been an EE since 1949 and I'm determined to leave the profession in better shape than I found it.

"I'm offering the Institute the knowledge of the workings of the organization as I've seen it during the last 8 years and an appreciation of the problems of the working EE. I'm offering IEEE a chance to be governed, not by corporate executives, not by academics, but, rather, by a representative of the overwhelming majority of IEEE members who are practicing EEs.

"Whereas the Neanderthals want to return the Institute to a purely technical society, I think that the practicing EE requires a society which will address technical, educational and professional problems."

CARLETON BAYLESS: BOARD OF DIRECTORS CANDIDATE FOR EXECUTIVE VICE-PRESIDENT

"I am offering the membership of the Institute a tested and proven product of service and leadership. In the half year I have been executive vice president, I have significantly influenced the following areas: the additon of more applications-oriented articles to Institute publications; the initiation of studies for informaton retrieval of technical material; opening board of directors' meetings, with minutes made available to section, group and society leaders; improvements in member communications through the Institute's magazine, Spectrum, and other media; and refinements in the United States Activities Board (USAB) programs.

"I have experience at the corporate level and I feel that I have demonstrated that I can manage effectively with both the Institute's staff and volunteer leaders, as well as with the public. I believe I can finish a second year with additional significant accomplishments in the areas of membership communications; technical preeminence, standards, conferences and educational activities; members' professional needs and lifetime careers in engineering with adequate compensation; and sound financial planning for the Institute."

LESTER HOGAN: INDEPENDENT CANDIDATE,
EXECUTIVE VP

"I feel that we need a scientific scholarly society that is invovled in trying to seek and illuminate the truth in the engineering profession. This is not a position that is normally taken by lawyers and politicians, since they tend to become advocates of a cause. Once an individual becomes an advocate for a position, he tends to only illuminate those facts that prove the position that he has taken.

"As a professional society, we have to be very careful of the positons we take. As scientists, it is our job to illuminate all the facts. One could easily be led into a conflict of interests, which leads to a loss of integrity.

"I think the board of directors has recently supported positions which jeopardize the technical excellence of the Institute. In feeling this way, am I an old-fashioned reactionary? Or do the Institute members agree with me? Someone had to take this position.

"Being a candidate for executive vice president is not an emotional experience for me. I don't want to be president of the Institute. I don't want to be vice president, I don't want to be anything. I just want to find out how the membership feels on the matter of technical issues versus advocate issues."

AN ORGANIZATIONAL DILEMMA: WHERE TO PLACE RELIABILITY

By: Frank H. Squires, P.E.

The participants at the West Coast Reliability Symposium held in Los Agneles in February voted overwhelmingly in favor of making Reliability organizationally independent of Design Engineering and Quality Assurance.

I was scheduled to speak on the "Reliability - Quality Assurance Interface." When I looked closely at the assignement I realized that the word "interface" implied that Reliability and Quality Assurance were two different departments. In that case the problem was to comment on the overall efficiency of such an arrangement and on the probability of harmony (interdepartmental harmony being as difficult to maintain as international harmony at the U.N.)

Perhaps the word should have been "intraface" which would establish that Reliability and Quality Assurance were two sections with one chief. How then should they face up to one another for the good of the product? The latter is likely to suffer when embers of the technical staffs feel that they are not properly placed: that they have not been accorded appropriate organizational status.

I decided to put it to a vote. I defined reliability as the specific mathematical function of reliability analysis and prediction. The reliability analysis and prediction. The reliability analysts would accumulate failure rate data from all available sources. They would apply state-of-the-art predictive techniques and would indicate to the engineers which parts, components and subassemblies had failure rates especially detrimental to the whole product.

They would not do the reliability engineering. Both the initial design and changes made in response to the findings of the reliability analysts were defined as tasks of the design engineers.

They would not monitor the product for reliability characteristics during procurement and fabrication. This was defined as a task for quality assurance who should have the responsibility for monitoring all quality characteristics in the work areas. Incidentally, the production people, managers and workers are beginning to feel oppressively spied upon as technical staffers crowd the work areas monitoring quality, reliability and safety. Then, too, there are the time and motion study specialists, expeditors et al. This is a problem I'll return to another time.

With this narrow definition of reliability, I invited the participants to vote on their preference by marking E on an unsigned piece of paper if they felt that Reliability should be subordinate to the Chief Engineer; Q if Reliability should answer to the Quality Assurance Manager; and IND for independence. I emphasized that a vote for IND would mean organizational equality with Engineering and Quality Assurance, the Chief of Reliability having equal rank with the Chief Engineer and Quality Assurance Manager and equal direct access to the Chief Executive. The vote was:

Independent	31
Quality Assurance	17
Engineering	14
Undecided	6
	68

It's a particularly intersting score because most of the participants were members of West Coast ASQC sections. It might have been expected that they would favor the inclusion of Reliability with Quality Assurance. As a representative sample of the quality assurance and reliability community, the vote has significance for all of us.

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RELIABILITY TESTING FOR INDUSTRIAL USE

WALTER T. GREENWOOD, JR.
RELIABILITY, INC.

Introduction

The meaning of reliability varies greatly with its context. In an aerospace or military context, where system reliability requirements are frequently life-critical or mission-critical, reliability means certainty. Such certainty is achieved through design, testing, and conditioning of integrated circuits, components, and systems, as well as through system redundancy.

In the context of a $9.95 pocket calculator, reliability means something far different. What reliability there is in such applications is achieved through design-testing and conditioning having been ruled out by cost constraints. In most cases there is no warranty; a failed system is simply replaced.

Between these extremes is a large and burgeoning area of electronic system activity in which cost-effective reliability is of great importance. Such systems as tape and disk drives, microwave ovens, numerically controlled machine tools, and CRT terminals are typical. Here, reliability is generally a function of cost and profit; the amount of it that may be designed in, tested for, and provided by redundancy is a matter of plain old business economics. Reliability for such systems can be termed "economy-critical."* This article focuses on reliability testing for such systems-in particular, reliability testing of IC's destined for systems for industrial use.

Trends

No discussion of reliability testing of IC's can be intelligible without an appreciation of the trends in design and use of the devices themselves. Five or six years ago an MSI device had a transistor count in the neighborhood of 250, but today MOS/LSI devices are in the neighborhood of a 20,000-transistor count. And counts approaching 1 million are predicted. Not only is count increasing, but fundamental improvements in design are still being made. The semiconductor industry is today in much the same situation as the automobile industry prior to 1940: there are still breakthroughs such as the 16K and 64K RAM, 16-bit microprocessors, and CCD devices coming along. Fundamental changes-which will render devices even more useful-are by no means at an end.

The consequences of these trends are profound. As the capabilities of IC's increase, so do the capabilities of the systems that can be made from them. And as technology matures, the system cost per function decreases.

Almost at cross purposes is the intrinsic pervasiveness resulting from increased complexity of devices. As the IC manufacturers build more functions into a package, the transistor count (device complexity) increases. The designer is then able to produce a system with increased speed, capability, and performance. With the chip count the same or lower, equipment cost is reduced and the market for the equipment is implictly broadened. In such a situation, the importance of reliability can only increase. Implications of a component failure on the system become larger and affect a broader base of users.

Let us consider how one method of reliability assurance processing-burn-in-has kept pace with device development in its capability to eliminate IC's likely to fail early in their lifetimes.

*Such systems as anti-skid braking devices are considered to overlap life-critical and economy-critical.

Burn-in

Burn-in is the process of stressing IC's within their physical and electrical limits prior to installation and use in regular service. This operation is almost always performed under accelerated conditions-normally temperature-but in certain cases electrical. The purpose is to uncover those IC's which are likely to become early failures in completed equipment, remove them from the lot, and thereby improve reliability of the surviving lot and thus of the systems themselves. This approach to improving reliability is valid with components showing a decline in failure rate during early service life-those which historically conform to the front end of the classic bathtub curve (Figure 1).

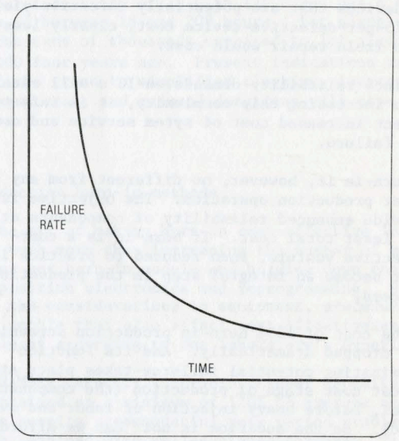

Figure 1. Classical pattern for early-life failures.

Extreme conditions of voltage, temperature, load, and frequency are used, either singly or in combination, to achieve the accelerated aging of components. With IC's, an arbitrary 2000 operating hours is generally accepted as the time at which most of the early life failures will have been exposed. The combination of extreme operating conditions involved in burn-in is an accepted means of compressing this aging into some shorter time period. Although thre is substantial discussion about the accelerating factors, 168 hours at 125 C is generally accepted as being equivalent to 2000 hours at normal operating conditions.

Obviously, since burn-in is a processing operation and not a testing operation, a post burn-in electrical test is required to reject those components which have failed outright or drafted out of specification.

When performed within the operational limits of the IC, there is little indication of degradation of the surviving lot population following burn-in The improvement in lot reliability following the removal of potential early failures obviously outweights the risk.

Failures resulting from defective system manufacturing or assembly techniques cannot, of course, be prevented by component burn-in. Burn-in of subassemblies and systems as performed by some system manufacturers can decrease such problems and will have an effect on component-related failures. The effect is limited, however, by "weakest link" constraints on the accelerating conditons-principally temperature. It also involves a high cost since the failure has been detected at a high skill level point in the production process.

Burn-in value

To be cost-effective, burn-in must return its cost as well as a profit by saving the cost of troubleshooting and field service. For example, a $0.15 investment per package to locate the 1% of devices that are potentially defective yields a $15-per-defective-device cost, clearly less than field repair would cost.

Since reliability demands on IC's will escalate with increasing chip complexity, it is safe to expect increased cost of sytem service and cost per failure.

Burn-in is, however, no different from any other production operation. The objective is to provide enhanced reliability of components at the least total cost. If burn-in is a cost-effective venture, then reduced to practice it must become an integral step in the production process.

The cost of 100% burn-in production screening has dropped dramatically. And its function-eliminating potential failures-takes place at the lowest cost stage of production (the component level, before heavy injection of labor and overhead). So the question is not "Can we afford burn-in?" but "Can we afford not to burn in, considering field maintenance and repair costs?"

In any case let us assume that burn-in is a viable form of screening potential early failures. What are the costs and the administrative problems of a production-line burn-in operation?

TTL cost history

Figure 2 presents eight years of cost history for burn-in of TTL IC's. The cost per unit for burn-in and subsequent test to identify devices that have failed or drifted out of specification has declined from a 1968 range of $3 to $5 to between $0.10 and $0.25 in 1976. The spreads in cost are due to variations in the volume of devices burned in, varying test specifications, package variations, and IC complexity. The steady decline in costs can be attributed to four principal causes:

INCREASED USE. Over the years, use of burn-in has increased about a thousandfold, and the average number of devices in the lots tested has increased two-hundredfold. Burn-in is like any other production process: it becomes more amenable to high-volume production methods, tooling, and economics as lot size and throughput increase.

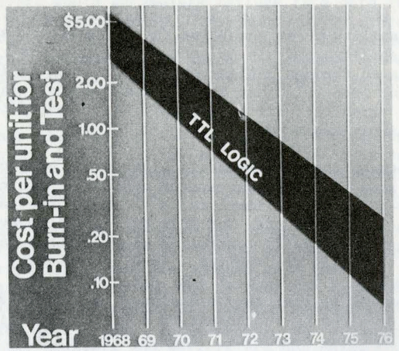

Figure 2. Cost history for burn-in of TTL IC's, 1968 through 1976.

INCREASED UNIFORMITY. Packages and processing specifications have become more uniform. The dual-in-line package is almost totally accepted, and MIL-STD-883 is widely accepted even among industrial users. The increase in uniformity translates to decreased short-run tooling and engineering costs and to amoritization over much larger volumes of similar material.

DESIGN MATURITY. The quantity of devices being burned in and tested and subsequently used in equipment that is in continuous production has increased. This is in many respects a function of the design maturity of a system. In the early design cycle, component reliability problems are overwhelmed and masked by design problems and design changes. It is only in maturity that component reliability problems become really visible.

SHIFT IN TECHNIQUE. In the last few years, burn-in durations have been shortened and temperatures raised, largely as a result of extensive work by Bell Telephone Laboratories.[1] Shortened durations increase burn-in equipment utilization and shop efficiency, thereby contributing to reduced cost.

ILLUSTRATION OF CHANGES. Some idea of the changes in burn-in practice may be gleaned from an illustration of the changes in hardware. The basic components required to perform IC burn-in are (1) the chamber (oven) with its attendant power supplies, clocks, and drive circuitry; (2) the burn-in sockets into which IC's are to be inserted; and (3) the electrical connections and components involved in programming particular sockets for the devices they must accept. (Sockets and associated connections and components make up a burn-in "position.")

A typical 1968 module had 24 device positions, cost about $25 per position, could be programmed for a new device type for about $5 per position, did dynamic burn-in with loaded outputs, and had a design life of about five years.

By comparison, a typical burn-in module in use today has 198 positions, costs about $1 per position, can be programmed for a new IC type at

a cost of $0.02 per position, performs static, unloaded burn-in, occupies about the same chamber volume as the earlier module shown in Figure 3, and has a design life of three years.

MOS/LSI burn-in

If we examine the trend in burn-in costs for 4K RAM MOS/KSU UC;s (Figure 3) and then compare TTL and MOS/LSI histories (Figure 4), we find that MOS/LSI follows the TTL history downtrend-with a displacement atrributable to the higher transistor count. Costs have dropped from the $1-$5 range in 1972 to their present $0.20-$1 range. The decline in cost shown in Figure 3 can be attributed to growth in lot size and throughput similar to that of TTL, reduced package sizes and pin counts, and a shift from device-by-device isolation for short circuit protection to group-by-group isolation.*

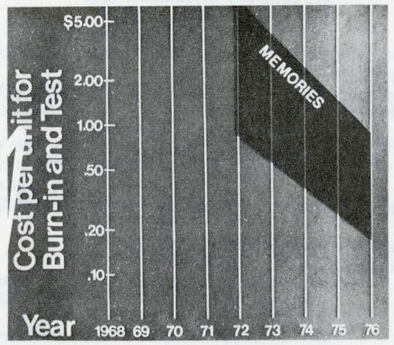

Figure 3. Burn-in cost trends for 4K MOS/LSI showing downtrend.

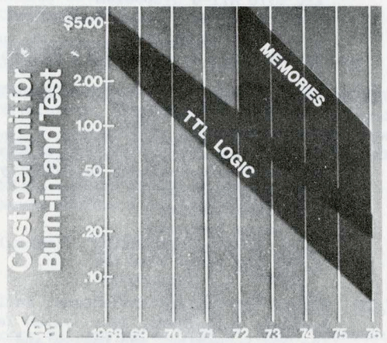

Figure 4. Similarity of burn-in cost downtrends for TTL and 4K RAM MOS/LSI.

*Short-circuit protection in TTL devices prevented one defective device from influencing burn-in effects on an entire group. Relatively low power levels are involved in MOS burn-in, eliminating need for device-by-device isolation.

Hardware comparisons show much the same improvement as was seen for TTL devices. The 1973 module had 30 positions costing approximately $10 per position. The module currently in use, has 135 positions costing approximately $2.75 per position in quantity.

Both of these modules are full dynamic and run a read/write cycle on all cells of the memory. Both are designed for operation at 130 C. Both have a design life of three years. The difference is a 4 to 1 decrease in position cost and a 4 to 1 increase in position density. That combination is obviously highly significant in lowering 4K RAM burn-in costs and making burn-in a viable production process.

Most 4K RAM burn-in today is dynamic, unloaded, and clocked in a manner which writes alternate 0's and 1's in all cells. It is performed in the temperature range of 70 C to 125 C and has a duration of between 18 and 208 hours. Lot sizes are in the tens of thousands compared to lot sizes of 100 four years ago. Present indications are that the trend to simplified clocking, increased temperatures, and reduced durations will continue.[2]

Production burn-in methods

The art of making burn-in cost-effective involves much more than increasing the number of positions per burn-in module and holding down the cost of position electronics and reprogramming. Here are the considerations in equipment, procedures, and people that also affect cost-effectiveness-at least according to one laboratory's experience.

CHAMBER CAPACITY. Burn-in chamber capacity is maintained at a minimum of 120% of average need. This permits accommodating peak period problems. When combined with well-designed chambers, it allows the flexibility for burn-in of devices requiring differentbiases or clocking conditions without purging the entire chamber from one lot to another.

MODULE CAPACITY. Module capacity (the inventory of burn-in positions) is normally maintained at 1½ times chamber capacity becuase the mix of devices to be burned in ever exactly matches the mix of available burn-in positions. New device types are constantly being added and familiar onces deleted as user's bills of materials change.

CHAMBER AND MODULE CHARACTER. General-purpose chambers designed for long life are combined with limited-life, dedicated-purpose modules. A general purpose chamber is flexible enough to accommodate changes in system design and new tyes of semiconductor technology. Dedicated-purpose modules are significantly less expensive than programmable modules and can be cost-justified in spite of the possibility of obsolescence in one or two years.

POSITION DENSITY. Every effort is concentrated on maximizing position density becuase of the ripple effect on operations. A lower socket density means more or larger modules, more chamber capacity, even more chambers, larger rooms, and more people.

BIAS TO FAILURE. All operations in the burn-in sequence are biased to resolve doubts in favor of rejecting good versus accepting defective devices. A wasted good IC cannot approach the cost of a field failure.

JOB SHOP ORGANIZATION. A burn-in operation works best as a job shop with each operation or work center set up on a first in, first out schedule. Scheduling may then be overridden by expediting on an exception basis.

Documentation of lot progress with lot travelers is essential when multiple lots are moving in parallel. Making maximum use of general-purpose chamber capacity minimizes peaks and valleys and out-of-mix conditions.

STAFFING AND MANAGEMENT. The use of a high percentage of workers with narrowly defined specialties requiring low skill levels is combined with supervision by a single experienced supervisor working through group leaders. Setups are made by a few, relatively highly skilled personnel. The burn-in process itself is essentially a manual one. Small variations in pin spacing exist from one device to the next. Packages vary from manufacturer to manufacturer. All make it extremely difficult to justify automated handling equipment. Even at a throughput of 2.5 million devices a month, we find automation of loading is not justifiable.

POST BURN-IN TEST. Post burn-in testing of IC's is often done using multiple shifts to maximize throughput, use of capital equipment, and line balancing, and to minimize elapsed time from burn-in to electrical test.

An important element in post burn-in testing involves the selection of computer-operated, general-purpose IC testers. These should be selected for ease and simplicity of programming, rather than on total equipment price. The cost of program preparation will, in the end, be two or more times initial equipment cost.

Summary

IC burn-in is cost-effective now as a means of eliminating devices which are likely to fail in service from production lots. As devices become more complex, systems more capable, and costs continue to drop, the costs of system failure in the field will continue to increase: 100% screening such as burn-in must be considered a production tool rather than an incoming inspection or QA operation. It is as essential as board assembly, flow solder, cleanup, or any other sequential production operation.

References

1. D.S. Peck and C.H. Zierdt, Jr., "The Reliability of Semiconductor Devices in the Bell System," Proceedings of the IEEE, Vol. 62, February 1974, pp. 260-273.

2. Gordon M. Johnson and Morton Stitch, "Microcircuit Accelerated Testing Reveals Life Limiting Failure Modes," (to be published in the Proceedings of the 1977 International Reliability Physics Symposium in the summer of 1977).*

* Proceedings title approximate.

Reprinted from: IEEE-Computer Magazine, July 1977.

CALL FOR PAPERS

ENERGY '78, Tulsa, OK, April 16-18, 1978.
(Abstracts due November 1, 1977)
Contact: Dr. R. Ramakumar
Technical Program Chairman
School of Electrical Engineering
202 Engineering South
Oklahoma State University
Stillwater, Oklahoma 74074
(405) 624-5170

28th ELECTRONICS COMPONENTS CONFERENCE, Anaheim, CA, April 24-26, 1978.
(Abstracts due with 10 copies October 28, 1977.)
Contact: H. Joseph Gisler, Jr.
General Electric Company
Bradley Park Plant
Lynchburg, Virginia 24502

INTERMAG CONFERENCE, FLORENCE, ITALY, May 9-12, 1978.
(Abstract due December 1, 1977)
Contact: David A. Thompson
IBM, Thomas J. Watson Research Center
P.O. Box 218
Yorktown Heights, New York 10598

1978 IEEE - MIT-S INTERNATIONAL MICROWAVE SYMPOSIUM, Ottawa, Canada, June 27-29, 1978.
(Abstracts due January 7, 1978)
Contact: Dr. Willem Steenart
TPC 1978 MTT-S Symposium
Electrical Engineering Department
University of Ottawa
Ottawa, Ontario - K1N 6N5 - Canada

1978 INTERNATIONAL RELIABILITY PHYSICS SYMPOSIUM, San Diego, CA., April 18-20, 1978.
(Abstracts due October 21, 1977)
Contact: G.T. Cheney, Technical Program Chairman 1978 International Reliability Physics Symposium
Bell Laboratories
555 Union Boulevard
Allentown, PA 18103
(215) 439-7628

TOPICS: Physics of Failure Mechanisms, Failure Analysis Techniques, Accelerated Testing and Screening, and Design and Process Control for Reliability

AREAS:
- Microprocessors, memory and other LSI-MOS, Bipolar (especially Low Power Schottky and I^2L), SOS and CCDs
- Semiconductor/Insulator Interfaces, Contacts and Metalization Systems (especially new materials)
- Packaing, Bonding, Die Attach, Coatings and Encapsulation
- Hybrids (Materials, Processes and Components)
- Displays, Sensors, Solar Cells
- Microwave, Optoelectronic, SAW Devices
- GaAs Devices, Interface Effects on III-V Devices
- New Devices, (DMOS, VMOS, Magnetic Bubble Devices)
- New Technologies, (VLSI, E-Beam and X-Ray Lithography, Ion Beam and Plasma Etching)
- Passive Components

SIXTEENTH ANNUAL SPRING RELIABILITY SEMINAR, Lynnfield, MA, April 27, 1978.
(Abstracts due November 30, 1977)
Contact: Mrs. Susan H. Eames,
Technical Program Chairwoman
c/o GT&E Sylvania
77 "A" Street
Needham Heights, MA 02194

WORKSHOPS & SHORT COURSES

FIFTH ANNUAL NATIONAL QUALITY CONTROL WORKSHOP FOR COMMERCIAL USERS OF INTEGRATED CIRCUITS, Durham, NC, October 27-28, 1977.
Contact: Dr. Ralph Evans
804 Vickers Avenue
Durham, NC 27701
(919) 688-2860

IEEE SHORT COURSES:

Microcomputer Design & Application,
Rome, N.Y., October 17-21, 1977

Osha Electrical,
Birmingham, AL, October 20-21, 1977

Transient Phenomena In Power Systems,
Charlotte, N.C., October 20-21, 1977

Microprocessors Seminar,
Jacksonville, Fla., October 21-22, 1977

Energy Conservation In Industry,
Birmingham, AL, Nov. 3-4, 1977

Microcomputer Design & Application,
Salt Lake City, UT., Nov. 7-11, 1977

Microcomputer Design & Application,
Novia Scotia, Can., Nov. 21-25, 1977

Contact: Lorraine Costiglia
445 Hoes Lane
Piscataway, N.J. 08854
(201) 984-0060, EXT. 175

GEORGE WASHINGTON UNIVERSITY SHORT COURSES:

Telecommunications Policy Problems,
Washington, D.C., November 7-11, 1977

Project Management,
Hampton, Va., December 12-14, 1977

Contact: Director, Continuing Engineering Education, George Washington University
Washington, D.C. 20052
(202) 676-6106

UNIVERSITY OF ARIZONA SHORT COURSES:

GIFTS Users Workshop,
Tucson, AZ, October 31-Nov. 4, 1977

Contact: Dr. Hussein A. Kamel
University of Arizona
Special Professional Education
College of Engineering
Tucson, AZ 85721
(602) 884-3054 or (602) 884-1755

THE 15th ANNUAL RELIABILITY ENGINEERING AND MANAGEMENT INSTITUTE,
Tucson, AZ, November 14-18, 1977

Contact: Dr. Dimitri Kececioglu, Director
Reliability Engineering and Management Institute
Aerospace & Mechanical Engineering Dept. Building No. 16
The University of Arizona
Tucson, Arizona 85721
(602) 884-2495 or 884-3901

POSITIONS AVAILABLE

RELIABILITY/MAINTAINABILITY SUPERVISOR ENG. (Sonar/Electronics) - to $26,000. Baltimore, Maryland area. BSEE or related BS. Exp. in RM defense electronics.

PRINCIPAL/SR. RELIABILITY ENG. Naval (Ship's Systems) - to $30,000. Southern California area. BSME/EE or related BS. Exp. in RMA (electronic & non-electronic shipbaord equip.)

Replies kept confidential. EOE fee pd. agcy. Send resumes first to D. Jones, Tech-Prof Empl. 3111 St. Paul St., Balto., Md. 21218. Established in 1967. Phone: 301-243-1545.

INSIDE IEEE

IEEE Good Government Group Formed

A number of prominent members of the Institute of Electrical and Electronics Engineers (IEEE) have announced the formation of the IEEE Good Government Group, or IEEE/GGG.

The activities of the IEEE/GGG are solely concerned with identifying and endorseing the best available candidates for IEEE President, Vice-President and Director. The group will not be involved with candidates at the Society or Section levels. No member of IEEE/GGG will be a candidate for Institute-wide offices.

A Steering Committee consisting of C.C. Cutler, Paul E. Gray, William R. Hewlett, John Pierce, M.E. Van Valenburg, and F. Karl Willenbrock will coordinate IEEE/GGG activities. Dean Willenbrock of the School of Engineering and Applied Science at Southern Methodist University is Secretary of the Committee.

The present members of the Group are on the attached list. Organizational affiliations are given for identification purposes only.

GRANTS AVAILABLE

ENGINEERING RESEARCH INITIATION GRANTS, Sponsored By The Engineering Foundation with The Cooperation Of Its Founder Societies: American Society of Civil Engineers American Institute of Mining, Metallurgical and Petroleum Engineers, The American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers, American Institute of Chemical Engineers.

The ENGINEERING FOUNDATION announces the availability of Engineering Research Initiation Grants during 1978-1979 in fields represented by its FOUNDER SOCIETIES.

The program is directed toward young full time engineering Faculty members who are without research support.

A grant of $10,000 will be awarded on a competitive basis to a member of each of the FOUNDER SOCIETIES for a proposed research project in a field of mutual interest to his FOUNDER SOCIETY and to the ENGINEERING FOUNDATION.

It is expected that the investigator will devote at least one-fourth time during one academic year as part of his normal academic assignment and full time (2-3 months) during the summer following the academic year to the proposed research on the campus of his institution.

ELIGIBILITY

One proposal may be submitted per department on behalf of an individual who:

1. holds a full-time regular academic appointment on the engineering teaching faculty of an institution of higher education.
2. a). was awarded the Doctor's degree not longer than two academic years prior to the submission of the proposal.

   or

   b). has gained several years of industrial or post-doctoral experience and is within his first two years as a full time member of the faculty.

STATEMENT BY DEPARTMENT HEAD

The proposal must contain a signed statement by the Department Head indicating: investigator's eligibility, and where applicable, the name of the institution who conferred the Doctor's degree, date and title of the dissertation; the normal full time teaching load of the applicant during the current year at the present institution; and that anticipated during the grant duration; endorsement by the Department Head.

STATEMENT OF ENGINEERING RELEVANCE

The proposal must contain a short specific statement of the relevance of the proposed research to engineering.

Projects directed toward innovative engineering approaches to the solution of major national problems or toward the development of new engineering principles, applications and techniques are encouraged.

EVALUATION AND SELECTION OF PROPOSALS

Proposals should be sent directly to the Executive Officer of his professional society. A panel organized by his professional society will evaluate and select meritorious proposals. They will be submitted (in rank order) to the Projects Committee of the ENGINEERING FOUNDATION who will make the final selection of a proposal in the technical field of each of the FOUNDER SOCIETIES for submission to the Board of the ENGINEERING FOUNDATION for final approval.

DEADLINE

All proposals being submitted to the FOUNDER SOCIETIES must be postmarked by December 1, 1977.

Selected proposals by the FOUNDER SOCIETIES to the Projects Committee of the ENGINEERING FOUNDATON must be postmarked by April 1, 1978.

ANNOUNCEMENT OF GRANTS

Grantees will be notified by a grant letter from the Secretary of the ENGINEERING FOUNDATION on or about June 1, 1978, with copies to their FOUNDER SOCIETIES. Grants will be effective as of September 1, 1978.

REPORTS AND PUBLICATIONS

A semi-annual progress report and a final report are required and shall be submitted to the ENGINEERING FOUNDATION by each grantee.

Continuing payment of supporting funds will be contingent upon satisfactory progress as evidenced by the progress reports.

It is the policy of the ENGINEERING FOUNDATION that results of all investigations shall be available to the engineering profession and to the public. If the results of an ENGINEERING FOUNDATION supported project are not otherwise published, the ENGINEERING FOUNDATION reserves the right to publish the material giving due credit to those who conducted the work.

Appropriate recognition of the ENGINEERING FOUNDATION and the cooperating FOUNDER SOCIETY must be prominently displayed on the title page of any publications resulting from projects supported by the ENGINEERING FOUNDATION.

INSTRUCTIONS FOR PREPARING A PROPOSAL

The formal proposal shall include the following information. Fifteen copies are needed.

The Cover Sheet

The first page of the proposal shall include the title of the project; name of principal investigator, title, institution and location; name of person financially responsible for administering project funds.

Statements

The Department Head's statement should be on page 2. The engineering relevance statement should be on page 3.

Abstract of Proposed Research

The fourth page of the proposal should contain an abstract of the proposed research. It should be limited to approximately 250 words and be of a style suitable for direct insertion into a technical journal.

Proposed Budget

The proposed budget should be on page 5. The funds provided may be used to defray such costs as support of the investigator's salary, expendable supplies, some travel, publication costs, and computer time. The ENGINEERING FOUNDATION reserves the right to make adjustments in budget categories.

Budgets will be prepared on the above basis and may not exceed $10,000. Indirect costs will not be covered by the grant. Although these grants are nonrenewable, the recipients are eligible to apply for continued support under the ENGINEERING FOUNDATION's regular Grant Policy.

Biographical Sketch

Following the proposed budget, a biographical sketch of the principal investigator should be presented including a listing of publications.

Description of Proposed Research

The next section should contain the research proposal in sufficient detail to allow evaluation of its engineering merit, including statement of the problem and its significance, approach to execution of the project, and timing of project work. Names of two or three recognized authorities in the field should be provided.

Dissertation Abstract (where applicable)

As the last page, the proposal should contain an abstract of the investigator's doctoral dissertation.

MAIL PROPOSALS TO:

Dr. Eugene Zwoyer, Executive Director
American Society of Civil Engineers
United Engineering Center
345 East 47th Street
New York, New York 10017

Mr. Joe B. Alford, Executive Director
American Institute of Mining, Metallurgical and Petroleum Engineers
United Engineering Center
345 East 47th Street
New York, New York 10017

Dr. Rogers B. Finch, Executive Director
The American Society of Mechanical Engineers
United Engineering Center
345 East 47th Street
New York, New York 10017

Dr. Richard Emberson, Acting General Manager
Institute of Electrical and Electronics Engs.
United Engineering Center
345 East 47th Street
New York, New York 10017

Dr. F.J. Van Antwerpen, Executive Director
American Institute of Chemical Engineers
United Engineering Center
345 East 47th Street
New York, New York 10017

IEEE MEMBERS' PROFESSIONAL NEEDS - POSITION PAPER

In recognition of the importance of engineering for maintaining and improving the quality of life for the peoples of the world, in recognition of the great investment of time, effort and finances of individuals in developing and maintaining their engineering competence, and in recognition of the dedicated and responsible effort to apply that competence, the IEEE shall actively and demonstrably pursue courses of action to meet the following needs of engineering professionals.

1. A lifetime engineering career with adequate compensation;
2. Adequate public support for engineering in solving society's problems;
3. Enhancement of the qualifications for entering and practicing the profession of engineering.
4. A positive incentive system for significant new contributions;
5. A work environment that provides a positive incentive and the opportunity to maintain technical proficiency;
6. Peer recognition for the complete spectrum of professional contributions;
7. Enhancement of the continued technical preeminence of IEEE.

NOTE: The Board of Directors voted to adopt the above position on December 4-5, 1976. Subsequently, Need 3 was slightly revised, as stated above, and is to be processed by the United States Activities Board and the IEEE Board of Directors during their next regularly scheduled meetings.

IEEE POLICY STATEMENT
7.3 - Registration of Engineers (USAB)*

The Board of Directors of IEEE recognizes the need to safeguard the quality of the practice of engineering in order to protect the health, safety and welfare of the public. In the implementation of such policy, the IEEE is motivated also to protect the professional reputation of competent and responsible practitioners against the injury to that reputation occasioned by unprofessional practice. In furtherance of this policy, the IEEE:

A. Offers advice and assistance to boards of engineering examiners and similar agencies;

*Approved by the IEEE Board of Directors at its meeting on February 19-20, 1977.

B. Approves the concept of uniform laws to aid in improving the quality of competence reflected in the attainment of a license to practice as being in the public interest;

C. Recommends that in the requirements for the practice of engineering there shall be a minimum of restrictions of a legal nature in the functioning of qualified engineers;

D. Recommends that, upon request, committees of IEEE members cooperate with appropriate agencies in the development of sound registration examinations which will adequately protect the public interest;

E. Recommends that the State laws uniformly reserve the title of Engineer, or Engineer, to licensed practitioners; (= Electrical, Electronics, etc.)

F. Recommends that all practitioners responsible for their activities, or the activities of their subordinates, be licensed to practice. Signature to any work performed, or to show approval/acceptance of a subprofessional's activitis is one example to indicate responsibility;

G. Recommends that the industrial exemption, as it applies to practitioners responsible for their activities, be eliminated in all State laws and that current practitioners be permitted to "grandfather" into licensure on the basis of application.

In addition to the above, the following actions are recommended:

H. Each IEEE Section cooperate with State boards of engineering registration or other appropriate State agencies in the dissemination of educational information concerning registration.

I. IEEE Sections consider sponsoring or cooperating with other groups in conducting education refresher courses as preparation for registration examinations.

J. IEEE Student Branches devote some time to the subject of professional development with special emphasis on the purpose of registration from the standpoint of protection of the public interest, the standards required for such protection, attainment of higher quality professional performance, and the procedure in applying for registration.

DUES, SERVICES TO REMAIN AT PRESENT LEVEL FOR 1978

The good news coming out of the July 14-15 meeting of the IEEE Board of Directors in Minneapolis is that there will be no dues increase in 1978. Moreover, the Board plans to maintain the present level of services to the Institute's membership-despite the likelihood of a 1978 deficit amounting to as much as $200,000.

Among other actions at last month's meeting, the Board eased requirements for petiton candidates for Regional and Divisional Directorships, rejected the concept of a President-Elect, and formed a committee to implement Bylaw 112.1, Expulsion, Suspension or Censure of a Member. IEEE's Code of Ethics also came up for discussion, with debate centering around proposals for "putting teeth" into the Code. Another controversial topic was U.S. Activities Board Chairman John J. Guarrera's proposal to establish an IEEE political action fund-supported and administered by IEEE members who are U.S. citizens-to contribute to the campaign funds of Representatives and Senators who had taken positions in line with IEEE policy. However, in the face of concern expressed by Directors who wished legal guidance prior to a vote, Mr. Guarrera withdrew his proposal pending the winter meeting of the Board in San Diego.

Reader questions and/or views concerning these important issues should be directed to The Institute, which this month carries further details of the recent Board meeting.

IEEE POSITIONS ON ENERGY

The IEEE has issued three position papers on energy, which were prepared by the Energy Committee. The papers were approved for release by the IEEE Executive Committee at its April 17 meeting of the full Board. Several additional position papers are being developed by the Energy Committee.

Taken as a whole, this group of position papers will afford a rather comprehensive coverage of the current energy situation in the United States as it pertains to electrical engineering. The three energy papers now issued--covering the areas of electricity in the U.S. energy economy, energy conservation, and solar energy. For more information, contact Ralph C.Clark, Secretary of the Energy Committee.

USAB NEWS

A political action fund, USAB plans to start, for which monies would be raised from voluntary member contributions, has been approved by the Executive Committee. A fund-raising program to solicit membership contributions to the new fund will be launched in early summer. Anticipated contributions have already been earmarked by USAB for use on the Democratic and Republican campaign committees, in accordance with the proportions of representatives from the parties in Congress.

The political action fund was created in response to a survey conducted this January in which sampled members responded positively to the question: "If the IEEE were to establish a political action fund, would you contribute?" Typical activities the fund will make possible are allowing the IEEE to participate in the major functions and gatherings of the two parties, and allowing the Institute to provide nonpartisan support of Congressmen responsive to engineering issues.

USAB urges IEEE members to write to their Senators or Representatives to express their opinions on various pieces of legislation and to provide background information to aid Congress in formulating important national policies. Members have asked for assistance in writing to Congressmen, so USAB has prepared a short guide entitled "How to Write Your Congressman."

Employer cooperation in career maintenance and development is the subject of a letter USAB has sent to all Section Chairmen requesting that all U.S. Sections implement the Board-of-Directors-approved policy that "all IEEE activities involving employer-employee relationships should solicit the views and cooperation of employers of engineers as well as of employees." One method suggested for implementing this policy would be for each Section to establish an "Employer Advisory Committee" consisting of representatives of local employers of engineers. The complete text of the USAB letter will appear in the September issue of The Institute.

***

Reminder: Call the USAB information line (202-785-2180) for news updates.

THE LONG RANGE PLANNING COMMITTEE

The Long Range Planning Committee (LRPC), chaired this year by former IEEE Executive Vice President Robert Cotellessa, has changed its focus since the issuance of its 1973-75 LRPC report (see Spectrum, June). Although one of the committee's charges for this year is to publicize the report and commentary on it, it is also taking on specific areas within which concrete improvements can be executed.

This year, the committee's main charge has been to prepare the Institute for activation of the President-Elect system. Robert Cotellessa explained how this system would work: At the moment, the Institute elects independently an Executive Vice President and a President, with no succession arrangement. A plan is under study to have the elected Executive Vice President become the next year's President automatically. In other words, the candidate would be elected to serve for a two-year term: one year as Executive Vice President, one year as President.

At present, the committee is rewriting applicable portions of the IEEE Constitution and Bylaws, particularly Article 12, Section 1 to allow for instituting the President-Elect system. The proposed constitutional amendments will be publicized in Spectrum this September if they are given initial approval by the Board of Directors in July; then, if all goes smoothly they will be put to a member vote in September 1978. Among the advantages of this system are continuity in the office of the Presidency and an ample planning period for the new administration. However, the plan may also carry drawbacks, and the LRPC and the Board are interested in soliciting general membership response to the idea. If the plan is instituted, the first President-Elect chosen under it would serve his or her term in 1980.

The committee is comprised of 13 members and four consultants. It has operated on an extremely modest budget since the LRPC report was issued; however, it benefits from the full cooperation of other IEEE officers and committees.

THE MAN WHO KEEPS IEEE's BOOKS

Charged with implementing the financial policies of the Institute, Controller Thomas Barlett's areas of responsibility are divided geographically between IEEE's Piscataway offices and New York Headquarters. Of Tom's three main units, the general accounting in Piscataway, close to the computer; the budget area is in New York, within earshot of the Staff Directors. The general accounting area, reporting to Accounting Manager Ed Rosenberg, is responsible for the maintenance of the Institute's general accounting records as well as those of the Groups and Societies, preparation of financial reports, of the payroll, and of all the payables. The financial area, which reports to Finance Manager Mike Sosa, is concerned with the processing of all cash receipts, review of the Institute's Investment Fund performance, handling of short-term investments, preparation of tax returns, and monitoring all contracts involving the Institute. The budget area reports to the new Staff Budget Coordinator, Carol Scragg, who reviews and monitors the operations of the budget and assists the Staff Directors in preparing their detailed budgets.

Tom Bartlett himself is an old-timer who doesn't look the part. He has been with the Institute since 1946, when he joined the staff fresh out of high school and before he earned his B.B.A. degree in the evening from Pace College. IEEE Controller since 1975, he works closely with the Institute's Treasurer, who plays an extremely active and formative role in the fiscal process.

Tom is now assembling the 1978 budget plans, which he anticipates will result in an operating deficit. But deficit financing cannot continue indefinitely, as he sees it, and, ultimately, a dues increase or some new source of income will be needed. Tom does not agree with the approach that would call for cutbacks in technical services to members or a reduction in the dissemination of technical information to the scientific community. "After all," he says, "that's why we're in business."

PUBLICATION NEWS

In-house composition will be possible now that the Publications Department and Spectrum have ordered Compugraphic Editwriter 7500 photocomposers. This machine includes a sophisticated keyboard, a display terminal, and a minicomputer for output. The keyboard allows complete control over input, proofing and correcting, formatting, and work management, as well as over the final output. The display terminal continuously monitors operational functions, and serves as a guide to accurate composition. The editing screen allows the operator to work on up to 6000 characters at a time.

The photo unit provides unrestricted mixing of a wide range of sizes and faces from the tape library. The font capacity is 96 fonts on-line: two film masters of four faces each, in 12 sizes. There are 118 characters per font.

Delivery of the machines is expected in about four months, and they will be used initially to set Spectrum articles, Standards, newsletters, and nonmathematical Transactions material. Over a period of time, more difficult composition will be attempted, with the goal of setting math perhaps a year away.

The new U.S. copyright law, which takes effect next January, requires publishers officially to

obtain written transfers of rights from authors or their employers in order to copyright their works. Such copyright transfer is necessary in order for journal publishers, such as IEEE, to continue to function effectively. It will provide a single source to whom individuals, libraries, and other publishers can turn for reprint or republication permission and for dealing with such requests on behalf of IEEE's 12,000 authors per year. Policies and procedures will be developed by midsummer to make transfer of rights as simple as possible for editors and authors to execute and to provide maximum privileges for authors. Since the new procedures will require educating authors and their employers, all hands are alerted to the need for full cooperation during the transition. For further information, contact Woody Gannett.

Spectrum was named a finalist in the 1977 National Magazine Awards for its special issue, "What Went Wrong?," focusing on technological failure and its lessons. Spectrum was one of 24 magazines selected as finalists in a field of nearly 500 entries, and is the first electrical/electronics magazine in the history of the National Magazine Awards to be named to this distinction. Other finalists included Business Week, Scientific American, Newsweek, Esquire, The New Yorker, and Harper's.

Three new books are being issued by IEEE Press: "Electrical Noise: Fundamentals and Sources," edited by Madhu S. Gupta; "Microprocessors; Fundamentals and Applications," edited by Wen C. Lin; and "Computer Methods in Image Analysis," edited by J.K. Aggarwal, R.O. Duda, and A. Rosenfeld. The 368-page book, "Electrical Noise: Fundamentals and Sources," contains 22 reprinted papers concerned with all aspects of fluctuation noise and is priced at $13.45 for the paperbound member edition, $26.95 for the clothbound (discounted to $20.00 for IEEE members). "Microprocessors: Fundamentals and Applications," a 344-page volume sponsored by the IEEE Computer Society, contains 43 reprinted papers and is priced at $9.95 for the paperbound member edition, $19.95 for the clothbound ($14.95 for IEEE members). "Computer Methods in Image Analysis," a collection of 31 papers in 472 pages, focuses on digital image analysis--the use of computer to extract useful information by the IEEE Computer Society, and is priced at $14.95 paperbound, $29.95 clothbound ($22.45 for IEEE members). All three volumes can be ordered postpaid from the IEEE Service Center, 445 Hoes Lane, Piscataway, N.J. 08854.

STUDENT NEWS

Calling all hams: a new edition of the directory of IEEE Student Hams will be published this month. Names, addresses, and call letters of individual student hams and Branch stations are sought. Contact Judy Rundle, Manager, Student Services, at Headquarters.

IEEE T-shirts are now available. These new, colorful T-shirts, perfect for campus or beach, in sizes small to extra large, are only $3.75 in individual orders; $3.25 each for orders of ten or more. Interested? Contact Bob Asdal.

"Career and Life Planning for Students," a pamphlet by John Picarelli which originally appeared as a series of articles in the "IEEE Student Newsletter," is planned for publication this summer. Advance copies will be included in each Student Branch's fall promotional package, due on campus in August.

PUBLIC RESPONSE TO U.S. ENERGY INQUIRY

by E.W. Morris, Editor,
Power Engineering Society Newsletter

The Summary of Public Participation resulting from the March 3, 1977 request of Dr. James R. Schlesigner has been published, and is available from the Superintendent of Documents, Washington, D.C. 20402. It covers, in addition to 28,000 written replies, the results of ten regional "Town Meetings" attended by 2,600 persons, and of twenty-one small conferences of various groups/organizations held by the Energy Policy and Planning Office in the Executive Office of the President.

An attempt was made to include a broad representation of business and other interests in the twenty-one small conferences, from consumer groups and environmentalists to those industries which must provide the energy generation and utilization equipment.

A review of the Summary Report indicates the written replies could be categorized as being received from:

- Those who know there is a worldwide energy crisis and have strong feelings on methods of how to improve and correct.
- Those who realize there is an energy crisis, but who do not know what should be done to correct.
- Those uninformed who do not know the facts about future energy requirements.
- Environmentalists who feel that increased rate of energy use is not essential.
- Critics who are averse to some of the positive steps that need to be taken immediately.

Several positions were strongly evident from the public and inudstry replies.

- Conservation in the use of energy was emphatically supported by the public, the users, and manufacturers.
- Industrial leaders and businessmen supported voluntary conservation. The public supported enforced conservation.
- The public replies indicated a lack of knowledge in energy questions, and there was strong support for more "Town Meetings" and public discussions before civic groups.
- There was support for use of more coal, with solar energy as a second major choice.
- Transportation was selected by the majority as the industry where greatest energy savings could be effected. This was followed in order by homes, industry and business.
- Nuclear energy received the least support from the citizens and the environmentalists. This is an indication of the composition of the 28,000 individual replies, as compared to the strong vote favoring nuclear energy in seven states in 1976.
- Many individuals supported the idea of having citizens committees participate in power plant siting.

Many believe that energy problems have been brought about by Federal regulations which have prevented growth and development of facilities. All industry groups pointed to the need for substantial capital investments and for the long term stability in government policies which would permit those investments to be made.

Establishing a reserve stockpile of petroleum sufficient for 3 to 6 months use was urged by the majority of those who replied to that question.

Environmentalists urged that the greatest energy potential lies in the non-nuclear area (sources) and reminded the Energy Staff of President Carter's pledge to make use of nuclear power "a last resort."

In times of high energy need, respondents agree that new energy sources are a more important consideration than environmental quality. A California man wrote, "A middle ground must be found that will allow us to mine coal, dig out shale, site nuclear plants, tap geothermal energy, and do all those other necessary things to provide energy - and still keep a semblance of order in the environment. Under no circumstances should concern for the environment be the only pacing factor."

Quoting directly from the report on the National Energy Plan, "Overall, those who rank energy sources for development gave highest priority to coal. Solar energy was uniformly supported in all regions. There were, however, wide regional variances for nuclear energy. A disporportionately large number of letters favoring nuclear energy were mailed from several zip codes, indicating a group effort. When the numbers were normalized, coal remained first but solar energy became second choice and nuclear third."

The climax to this study can well be summarized by the reply from a man in Visalia (San Joaquin Valley) California: "To protect the democratic process will require continuous and effective participation at all levels, from the grassroots to the federal agencies...Responsible citizens participation can only be achieved if responsible citizens are selected for commissions and committees to work with government officials." Further - a man in West Harford, Connecticut stated: "Society is entitled to decide on the risks it will or will not accept - but this requires the judgement of an informed society, not an inflamed society. But the final responsibility and accountability for decisions rests with the elected or appointed officials having technical jurisdiction."

As this NEWSLETTER goes to press, it is difficult to find any positive aspects in the President's energy policy. He has adopted the Ford Foundation's recommendation for continued installation of nuclear fission reactors "under stricter safeguards." The Administration program, however, defers indefinitely "commerical reprocessing and recycling of plutonium fuel, and construction of the Clinch River breeder reactor demonstration project."

REPRINTED FROM POWER ENGINEERING SOCIETY NEWSLETTER, AUGUST 1977.

MANNERS MAKETH THE MANSERVANT

While waiting at dinner never be picking your nose, or scratching your head or any other part of your body, neither blow your nose in the room; if you have a cold and cannot help doing it, do it on the outside of the door; but do not sound your nose like a trumpet, that all the house may hear when you blow it. Still it is better to blow your nose when it requires, than to be picking it and snuffling rudely...which is a filthy trick. Do not yawn or gage, or even sneeze...that is, if you can avoid it. And as to hawking and spitting, the name of such a thing is enough to forbid it without a command.

When you are standing behind a person do not put your hands on the back of the chair, as it is very improper, though I have seen some not only do so, but even beat a kind of tune upon it with their fingers. Such conduct in a domestic servent is unthinkable. Have your face and hands well washed, your finger nails cut short and quite clean underneath, as it is a disgusting thing to see black dirt under the nails.

When you are intrusted with the wine, neither make away with it, nor let your mind hanker after it, but endeavour to fulfil your trust with uprightness. When you have finished serving the wine, and other liquors, see that they are returned to their proper places; do not let them stand to tempt others.

Never make a noise or talk loud in the house. Keep from singing, bawling and whistling; this may do in the country to frighten the birds in the field, but not for a gentleman's house.

When you hear a knock at the streetdoor and go to open it, always throw it wide open, but not so as to drive the key or the handle through the wall, which some have done, to the great disfiguring of it, but which will be avoided by holding the handle firm in your hand, by taking the handle firm in your hand, by which means you will be able to stop the door the moment you please, before!

Never allow any licentious conversation, it is wicked;nor suffer the men-servants to be twisting and turning the words of female servants to some filthy meaning, as it is too often done in gentlemen's service. Instances have been known where the females have been fearful to open their mouths to speak before the men-servants, on account of their putting some obscene and offensive meaning to every word they have spoken; this is true black-guardism...

Abstain, at all times, from reading blasphemous and licentious books, as they are to the mind

what poison is to the body. The profane and wicked do not enjoy this present world. They desire to enjoy it but they do not succeed, for they seek their hapiness where it is not to be found.

1797 Manual found in an English pub.

REPRINTED FROM ENGINEERING MANAGEMENT SOCIETY NEWSLETTER JANUARY/FEBRUARY 1977

WARM-UP IS IMPORTANT FOR THE HEART

Sudden death in adults is not at all uncommon and usually occurs in individuals with coronary artery disease. Although a majority of the deaths occur while the individuals are relatively sedentary, some occur during or immediately after strenuous exercise. In contrast with adults, children have little cardiovascular disease and fewer incidents of sudden death. During the past few years several individuals have experienced sudden death from myocardial infraction following participation in sprint races. A young girl from Florida died after running a relay race during recess. A teenage boy from California died after running a wind sprint in football practice. Autopsy reports on both of these young people showed no vascular obstruction which would limit oxygen delivery to the heart. Three men participating in Senior Swim Meets died after racing in the 50 yd. dash. Most athletes feel that stretching and warm-up exercises are important to prevent muscle and tendon injuries but what effect does warm-up or the lack of it have on the heart?

An initial study (1) was conducted in our laboratory on 44 subjects ranging in age from 21 to 52 years. The subjects were all healthy, asymptomatic individuals without any signs of coronary artery disease as determined by a near-maximal eletrocardiographic stress test. Their physical fitness levels encompassed a wide range. Two were competive marathon runners, several participated in regular jogging programs and some were sedentary except for the activity involved in their occupation. The subjects reported to the laboratory in the morning and were connected to the electrocardiographic leads. After several minutes rest the men were asked to run on the treadmill at 9 mph, 30% grade for 10 sec without any prior warm-up. Thirty (68%) of the men had abnormal electrocardiographic changes immediately after the run. When 2 min of easy jogging-in-place preceded the sudden strenuous exercise the abnormal electrocardiographic changes were eliminated or reduced in severity in most all cases. The abnormal electrocardiographic changes were not related to age or state of physical condition which suggests that warm-up is important for everyone. In addition to the laboratory experiments telemetry data obtained during a 440 yd. dash without prior warm-up showed ischemia during the initial part of the run.

In a second study (2) arterial blood pressure was measured in 10 subjects. When sudden, strenuous exercise was performed without prior warm-up arterial blood pressure showed an abnormal increase. This abnormal increase in blood pressure greatly increased the oxygen demands on the hearts and again produced abnormal electrocardiographic changes. The subjects were then given a 15-20 min warm-up followed by a 15-20 min rest prior to the sudden exercise. This warm-up eliminated or reduced the severity of the abnormal electrocardiographic changes in all cases.

The results of these two studies suggest that the adaptation of coronary blood flow to a rapid increase in cardiac work is not instantaneous and periods of ischemia (inadequate oxygen supply) may occur in hearts without apparent vascular obstruction. Adequate warm-up (more than 2 min of easy jogging) can be effective in reducing the ischemia. These findings provide a physiological basis for performing warm-up prior to sudden, strenous activity. Although warm-up is suggested for everyone, it is most important for individuals who have a reduced oxygen supply to the heart due to vascular obstruction or anemia. Similarly, individuals who have excessive demands on their hearts due to hypertension, aortic stenosis, etc. should not perform sudden exercise without adequate warm-up.

1. Barnard, R.J., G.W. Gardner, N.V. Diaco, R.N. MacAlpin, and A.A. Kattus. Cardiovascular response to sudden strenuous exercise-heart rate, blood pressure and ECG. J. Appl. Physical.34:833-837,1973.

2. Barnard, R.J., R.N. MacAlpin. A.A. Kattus, and G.D. Buckberg, Ischemic response to sudden strenous exercise in health men. Circ. 48:936-842, 1973.

COURTESY OF CARDIOMETRICS, INC. OF NEW YORK

THE EXECUTIVE

"An executive has practically nothing to do except decide what is to be done; to tell someone to do it; to listen to reasons why it should not be done; or should be done by someone else, or done in a different way; to follow up to see if the thing has been done; to discover that it has not; to ask why; to listen to excuses from the persons who should have done it; to follow up to see if the work has been done properly at last, only to discover that it was done incorrectly; to point out how it should have been done; to conclude that as long as the work has been done to let it stay as it is; to wonder if there is not time to get rid of a person who cannot do a thing right, but also to reflect that he probably has a wife and 10 children, and that anyway someone else would be just as bad if not worse; to consider how much simpler and better the work would have been done if one had done it himself in the first place; to reflect sadly that one could have done it right in 20 minutes and that, as things turned out, one has had to spend two days to find out why it has taken three weeks for someone else to do the work the wrong way."

ANONOMYOUS

CONFERENCE CALENDAR

Oct. 2-4	Industry Applications Society Annual Meeting L.A. Marriot L.A., CA
Oct. 5-7	ESMO-77 (Live Line Maintenance Procedures & Practices) Montreal, Quebec, Canada
Oct. 5-7	Micro-10 (Microprogramming) Ramada Inn, Niagara Falls
Oct. 6-8	Very Large Data Base Confernce (VLDB) 3rd Tokyo, Japan
Oct. 10-14	Information Theory Int'l Symposium Cornell Univ. Itaca, NY
Oct. 17-19	OCEAN "77 L.A. Bonaventure L.A. CA 90071
Oct. 19-21	Nuclear Science-Nuclear Power Systems Symposia Sheraton-Palace S.F., CA
Oct. 24-26	Frontiers of Education U. of Illinois Champaign, Urbana, Ill.
Oct. 25-27	Machine Tools Industry Technical Conference Mariot Inn Cleveland, OH
Oct. 25-27	Semiconductor Test Symposium Hyatt House Cherry Hill, NJ
Oct. 25-28	Engineering Problems of Fusion Research Hyatt Regency Knoxville, TN
Oct. 25-28	Radar International-RADAR 77 IEE, London England
Oct. 26-28	Ul-rasonics Symposium Dell Webb's Town House Phoenix, Arizona
Oct. 31-Nov. 1	Joint Engineering Mgmt. Conference (25th) Stouffer's Inn Cincinnati, OH
Oct. 31-Nov. 2	Foundations of Computer Science (18th) Marriot Inn Providence, RI
Nov. 2-4	Automatic Support Systems for Advanced Maintainability (AUTOTESTCON) Dunfey's Hyannis on Cape Cod, Mass.
Nov. 5-9	Engineering in Medicine and Biology Conf. (30th) Hilton L.A. CA
Nov. 8-10	Mechanical Engineering in Radar Sheraton Nat'l Washington, DC
Nov. 8-10	MIDCON O'Hare Conv. Ctr. Hyatt Regency Chicago, Ill.
Nov. 8-11	COMPSAC '77 (Computer Software & App. Conf.) Sheraton-O'Hare Chicago, Ill.
Nov. 8-11	Magnetism & Magnetic Material Conf. Raddison Hotel Minneapolis, MI.
Dec. 1-3	Semi-Conductor Interface Specialist Conf. Carillon Hotel Miami Beach, Fla.
Dec. 5-6	Chicago Fall Conference on Consumer Electronics Ramada-O'Hare Inn Des Plains, Ill.
Dec. 5-7	Int'l Electron Devices Meeting Hilton Washington, DC.
Dec. 5-7	National Telecommunicatins Conf. Marriott Hotel L.A., CA
Dec. 5-7	1977 Winter Simulation Conference National Bureau of Standards Gaithersburg, MD
Dec. 7-9	Decision & Control, Adaptive Processes Fairmont New Orleans, LA
Dec. 15	Computer Networks, T&A Nat'l Bureau of Standards Gaithersburg, MD
1978	
Jan. 16-18	Integrated & Guided Wave Optics Salt Lake City, Utah
Jan. 24-26	Reliability & Maintainability Biltmore L.A., CA
Jan. 29-Feb. 3	Power Engineering Society Winter Meeting Statler Hilton New York, NY
Feb. 7-9	Laser and Electro-Optical Systems II Town & Country Hotel San Diego, CA

Feb. 13-15	Aerospace & Electronic Systems Winter Convention (WINCON) L.A., CA
Feb. 15-17	Int'l Solid State Circuits Conference Hilton S.F., CA
Feb. 28- Mar. 2	Compcon Spring S.F., CA
Mar. 1-3	Control of Power Systems Lincoln Plaza Hotel Okla. City, OK
Mar. 15-17	Simulation Symposium (11th) Tampa, FL
Mar. 20-24	Subscriber Loops & Services Int'l Symposium (ISSLS '78) Georgia Tech/Sheritan-Biltmore Atlanta, GA
Mar. 21-23	Industrial Applications of Microprocessors Sheraton Phil., PA
Mar. 22-24	Vechicular Technology Conference Regency Denver, CO
Mar. 23-24	New England Bio-Engineering Conf. College of Engineering, Univ. of Rhode Island