

# RELIABILITY SOCIETY

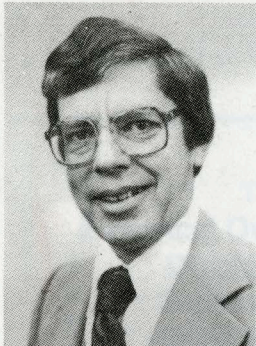
## NEWSLETTER



Editor: Anthony Coppola

Vol. 27, No. 2, April 1981 (USPS 460-000)

### President's Report



It is with a great deal of excitement and some trepidation that I take the helm of the Reliability Society. Excitement, because the Society is a dynamic organization, actively contributing to advancements in our profession. Trepidation, because the shoes I shall attempt to fill are several sizes too large. Under the able leadership of Thad Regulinski, the Society has gained stature and maturity.

Speaking for the Society in total and for myself personally, I wish to thank Thad for his tireless efforts in our behalf, his infinite contributions to the Society and the profession, and his motivational influence on all who had the privilege of working with him. We look forward to his continued active support of our Society.

In this "State of the Society" message, I am happy to report that we are extremely healthy. Under the previous administration, the Society has expanded the scope and accomplishments of its technical committees, sponsored highly successful technical conferences, grown in membership, established a new Chapter, and published superb transactions and newsletters. In short, all departments are functioning with efficiency and competence. It is my objective to continue this momentum with even further gains in the coming months. We must continue to grow in membership if we are to reach a high percentage of the practitioners of the reliability discipline, and

there are still several areas with sufficient members to organize and support a local chapter. We must strive to participate actively through our technical committees in any area where our discipline can contribute. This means the establishment and staffing of new committees, as appropriate. The Society must actively pursue adequate coverage of our discipline in technical papers and expanded sponsorship of appropriate conferences. We must continue to diligently strive for more papers on practical application of our technology in our conferences and in our transactions. I will attempt to furnish more detail on our objectives and accomplishments in subsequent newsletters.

The key to our current health has been the increased active participation by members of the Reliability Society. Your ADCOM can provide the adhesive to unite our operations, but the membership has provided the talent on our technical committees, the management of and attendance at our conferences, and the material for our publications. I thank the membership for this support and urge those of you who are not involved to become involved. Let your officers know of committees in which you are interested, topics you feel should be covered in conferences, conference management interests, or material you could provide for publications.

I thank the Society for the honor of serving as your president. I shall strive to conduct the affairs of the Society in a manner which serves the interests and desires of our membership.

*Carl M. Bird*  
President

Send Form 3579 to IEEE, 445 Hoes Lane, Piscataway, N.J. 08854

## The Editor's Corner



This is my first product as editor of the Newsletter. It's a fun job. Unfortunately, I currently have several fun jobs and my boss is getting suspicious of my priorities. So you will find in the help wanted section that I will relinquish the mantle to a worthy volunteer, if one can be found.

Until then, however, I will do my best to see that you get your newsletter on time and as crammed

full of interesting items as I can manage.

I invite you to take advantage of the neverending need for news to make the newsletter your forum for anything you think the R&M community should see. Want to announce a meeting, compliment or chew-out the Reliability Society ADCOM, offer

suggestions, pass along an observation or share a joke? Letters, notes, reproducible cartoons and photos all welcomed. Also any advice on what you would like to see in the Newsletter. Please note that our deadline for inputs is two months before publication so if you want to put something in a particular issue, allow for the lead time. Scheduled publication dates are the first of April, July, October, and January. Mail inputs to me, RADC/RBET, Griffiss AF NY 13441. Want to talk about it? Call me at (315)330-4726.

I consider this job a privilege and a pleasure, but also a significant responsibility. Whether my tenure as editor is short or long, my goal will always be to provide the maximum benefit to you. Your feedback will help keep me on track. Now you've heard from me; please let me hear from you.

*Anthony Coppola*

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## Chapter News

### Los Angeles Chapter

Los Angeles Chapter Reliability held a joint meeting with G-21 Components, Hybrids & Manufacturing Technology on Reliable High Speed Digital Packaging. Juliana Vidich of TRW's Electronic Systems Division described developments in packaging techniques to facilitate high speed digital processing, on Tuesday, October 14, 1980 at the Hacienda Hotel, 525 N. Sepulveda Blvd. in El Segundo.

Packaging digital logic circuitry for performance from 250MHz into the gigahertz range requires that special techniques be used in the areas of chip packages, circuit boards, connectors and thermal management. Minimization of impedance mismatch is essential to maintain signal quality. Controlled impedance transmission lines are necessary, and interconnecting elements such as wire bonds, chip carrier conductors, plated through holes, and printed circuit board connectors must be designed to create minimum disturbance to signal waveforms. This paper described developments of coplanar transmission lines, multilayer printed circuit board hybrid substrates, ceramic chip carriers, one-piece circuit board connectors, and direct attachment of chip carrier packages to circuit board heatsinks. Test data from developmental hardware reflecting high reliability of this design approach was included.

Juliana Vidich is a mechanical engineering graduate of Cal State, Northridge. She designed electronic packaging for

navigation and control systems at Teledyne Systems, and for the past two years has worked at TRW Defense Space Systems Group performing electronic packaging of digital systems. A substantial portion of this period has been devoted to the development of high speed digital packaging techniques. She is a member of the IEEE Computer Packaging Committee, the IEEE Components, Hybrids and Manufacturing Technology chapter and a member of the Society of Women Engineers.

### San Diego, California

You do not presently have an area Reliability Society Chapter even though you have a very significant number of members in the San Diego area. If any of you wish to join or form a chapter such as the Denver area did in 1980, please contact Hank Malec, Chapters Activities Chairman at the ITT-Advanced Technology Center, 1 Research Drive, Shelton, CT 06484 or call (203) 929-7341 Ext. 817.

### Wanted in Texas

Reliability Group members to join or form area chapters in the Dallas and Houston areas. You do not presently have an area Reliability Society Chapter even though you have highly regarded reliability specialists in the area. If you would like to help form a chapter, please contact Ray Wilson in Dallas (214) 247-9052.

## Announcements

### Third Annual Electrical Overstress/Electrostatic Discharge Symposium September 22-24 1981— Aladdin Hotel—Las Vegas

The symposium will be devoted to the understanding of fundamental phenomena and their application to design and production problems associated with transient electrical overstress in military, industrial, communications, consumer, and automotive electronics, especially intended for the dissemination of results related to EOS/ESD problems in the design, fabrication, testing, handling and assembly of microelectronic circuits.

For registration and general conference information contact:

Jim Beall  
Martin Marietta  
P.O. Box 197/M/S 0540  
Denver, CO 80201  
(303) 977-5508  
(303) 977-3838

Ernest D. Calbert  
Teledyne Ryan Aeronautical D/194  
2701 Harbor Drive  
San Diego, CA 92138  
(714) 291-7311 X 1126

1980 Proceedings are now available. Copies may be obtained through the Reliability Analysis Center, RADC/RBRAC, Griffiss AFB NY 13441. Request EOS-2. The price is \$24.00 per copy.

### Components Reliability Screening Seminar

A Saturday Seminar on Electronic Components Reliability Screening is scheduled to take place at the TRW Forum in Redondo Beach, California on April 25, 1981. It is sponsored jointly by the IEEE S7 Reliability and S21 Components, Hybrids and Manufacturing Techniques Society Chapters of the IEEE Los Angeles Council.

This seminar will feature results of burn-in and screening tests data collected by the Parts Screening Committee on over 30 million parts (mostly ICs) and also will include comparison of module burn-in and screening tests. Emphasis will be on comparative payoffs with different screening methods to aid in management decision on appropriate screening for each project.

Included in the seminar presentations will be results of testing 12 competitive commercial 16K Dynamic RAM products periodically over 2400 hours of dynamic burn-in 125° C. Changes in performance parameters were evaluated and compared for devices that eventually failed versus those that did

Reliability Analysis Center  
RADC/RBRAC  
Griffiss AF, NY 13441  
(315) 330-4151

not fail. Results of Parameter Drift Analyses for Minuteman Semiconductors will also be presented for competitive high reliability MIL-SPEC devices. Device manufacturing data from long and short term burn-in and screening experience will be presented to reflect effectiveness of techniques, as well as expected test results. In addition to the data, information on newly developed evaluation techniques will be presented, along with preliminary results. Comparisons of device screening techniques that did not involve burn-in, such as voltage acceleration, and also comparison of burn-in versus hot rail screening results will be presented. Also, comparisons of module screening results will be presented from experience with various screening approaches.

Cost of the seminar is \$40 to non-IEEE members, including lunch and seminar book of presentation abstracts. \$10 credit

from that fee toward joining the IEEE and the Reliability Components Society may be designated by attendees.

Members of the IEEE, who are not Reliability or Components Society members are required to pay only \$35 and will be allowed to credit \$5.00 toward either of these societies if they wish to join at the time of the seminar. IEEE and Reliability or Components Society members are required to pay only \$30.

Space is limited at TRW to 250 attendees on an advance registration basis only. Those wishing to attend are encouraged to register early. You may register by sending your check to I. Doshay, TRW 88/1047, One Space Park, Redondo Beach, CA 90278. Checks should be made out to IEEE CRS Seminar. Please include your IEEE membership number or indicate your desire to join IEEE. The form below is provided for your convenience.

**Components Reliability Screening Seminar**

Saturday April 25, 1981

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

**Registration including abstracts**

Non-Member \$40—\$5 toward joining IEEE  \$5 toward \_\_\_\_\_ Society

IEEE Member \$35—\$5 toward joining \_\_\_\_\_ Society

IEEE and Society Member \$30

Make checks payable to IEEE CRS Seminar

## AdCom Vice-President Reports

### Technical Operations

26 January 1981

The goals of Technical Operations have been met.

- All committees are active and have tried to satisfy their intended objectives. The major problem is lack of support personnel.
- All committee charters have been completed and are available from the new Vice President.
- Committee chairmen have all reported to me on their activities, but have not always been able to attend AdCom meetings.
- A new committee was established this year—the Parts Screening Committee. Definition of activities and the charter need to be developed by the incoming chairman.

- Articles have regularly been submitted to the Newsletter, from which some responses have been obtained!
- Respectfully Submitted,

*Alan O. Plait*  
Vice President  
Technical Operations  
1980

### Publications

The January issue of the Newsletter was issued and in members hands by January 3, 1981. The cutoff date for information for the April Newsletter is January 26. Information should be sent to Tony Copolla by that date. Proper transfer of files to the incoming VP Publications has been effected.

The status of the Transactions is covered in Dr. Evans report (copy attached).

I want to thank all of those individuals who have worked so diligently to make this activity successful. Ralph Evans, Jim Victor, Dick Kowalski and John Rooney.

January 23, 1981

*Naomi McAfee*

### IEEE Transactions on Reliability

1. The Transactions are on schedule and on budget.
2. Our Special Papers Board continues to solicit practical papers, but with little result. All AdCom members ought to assist in this difficult task. The "From the Editors" columns have generated some response. That notice will be continued.
3. We continue to work with the compositor to find ways to cut costs without degrading appearance. We have not yet been informed by IEEE-HQ what the new cover will look like for 1982.
4. We are generating some "Special Sections" of the Transactions on topics which can not fill a complete Special Issue. The first such section is: "State of Reliability Effort on Indian Subcontinent" in the 1981 April issue.
5. Our page budget for this year (1981) is:  
472 text + 20 covers + 8 index = 500 total
6. We plan to list all past Editors of our Transactions in a forthcoming issue, if we can find out who they were. They all deserve a great deal of credit for our present success. If you know who any of the early ones were, please let me know.

—prepared 1981 January 5

*Ralph A. Evans, Ph.D., P.E.*  
Editor

### Membership

Membership as of November 1980 was 3082, compared to 2832 a year ago—up 8.8%. Final membership goal of 3250 by January 1981 appears achievable.

Subcommittee Reports are highlighted as follows:

1. *Membership—H. L. Wuerffel, Chairman*

Membership advertisements have appeared in *Electron Devices* (Oct. issue) and *Circuits and Systems* (Dec. issue).

Membership brochure has been printed (20,000). Disposition of brochures—4K, D. Troxel for mailing to IEEE members interested in Reliability—2K, H. Malec for distribution to Chapters—3K, R. Evans for inclusion in R&M Symposium Proceedings, and 11K, Membership Chairman.

A small sign soliciting society membership applicants has been constructed for use on a display table at the R&M Symposium calling attention to the brochure.

2. *Chapter Activities—H. Malec, Chairman*

Currently there are 19 Chapters active. There appears to be interest in forming a new chapter in the Dallas-Houston area.

Also an inquiry concerning chapter activity has been received from Taiwan.

Action was completed on the 1979-80 Chapter Awards. A supply of membership brochures were sent to each of the Chapters.

3. *Professional Development—O. D. Trapp, Chairman*

Limited progress made toward developing home study course on reliability. Material developed by V. Lalli still under consideration. In a communication from Dr. Shooman, he mentioned some material developed by his activity that might be considered for this purpose.

4. *Membership Analysis—D. Troxel, Chairman*

Action is underway to send a copy of the Reliability Society Membership Brochure to IEEE members who are not currently members of the Society, who have indicated an interest in reliability.

January 26, 1981

*B. Betterer*

### Meetings

January 26, 1981

The two major conferences sponsored by the Society during 1980 were highly successful and continued the Society's tradition of providing excellent opportunity for technical interchange. While not completely problem free from the conference management viewpoint, the primary objectives of providing a forum for dissemination of technical advances and publishing outstanding conference Proceedings were achieved by both the Reliability and Maintainability Symposium and the Reliability Physics Symposium. Copies of Proceedings from both were distributed as bonus publications to our members.

The Product Liability Prevention Conference was, unfortunately, not as successful. The interest in this Conference has been steadily declining and the Society support of the conference has been negligible. The AdCom took action to discontinue sponsorship of PLP. The future of the Conference is, as yet, unknown.

I would like to thank all members of the Reliability Society for the support extended to me during my two years tenure as Meetings Vice President and I hope I have contributed something of positive value.

Respectfully submitted,

*Carl M. Bird*

Vice President, Meetings

### Treasurer's Report

January 15, 1981

1. *1980 Financial Status.* The *October 31, 1980* financial report shows a surplus of \$32,800 bringing our reserves to \$85,600 as of that date. This surplus will be much smaller when the final 1980 financial report is received, since over 95% of the

expected income is included and only about 70% of the expected expenses are included in the October report. The final 1980 report should be available in about one month and will be reflected in my April, 1981 report. I have made an unofficial estimate of final 1980 income and expenses based on trends from prior year reports. My guess as to the final 1980 status is an expected final surplus of about \$6000, which would result in expected final reserves of \$58,800. This would be better than the \$600 surplus which is included in the official 1980 budget. Specific details relative to our cash position per the latest official reports are as follows:

Net worth January 1, 1980	\$52,800.
Net operating surplus, 10/31/80	32,800.
Net worth, 10/31/80	\$85,600.
Outstanding loans	4,400.
Cash balance, 10/31/80	\$81,100
Option 2 investment (14.0% interest)	\$35,000.
Option 1 investment (11.1% interest)	20,000.
Checking account	26,200.
Loans: 1980 PLP	\$ 300.
1981 ARMS	1,100.
1981 IRPS	3,000.

2. *1981 Budget.* The latest official 1981 budget shows a projected deficit of \$5,100. This includes an increase in budgeted transactions costs of \$14,000 based upon our planned budget of 500 pages for the coming year, a budgeted membership fee increase of \$1,000 based on 2749 members, and a budgeted subscription income increase of about \$2,000 instead of the \$7,000 previously budgeted. If my projected 1980 estimate and the preliminary 1981 budget both prove to be correct, our reserves would be cut to \$53,700.

3. *Miscellaneous*—The following were noteworthy income and expense items for 1980:

1980 ARMS Surplus	\$ 113.68
1979 IRPS Surplus	3,560.16
1980 IRPS Surplus	5,733.64
1980 ARMS Proceedings	\$10,607.26
1980 IRPS Proceedings	8,789.16
1980 PLP Proceedings	500.00
Congressional Fellows Fund	2,500.00
Denver Meeting	474.69

Respectfully Submitted,  
**Irwin A. Feigenbaum**  
 Treasurer

## AdCom Committee Reports

### Summary of Software Reliability Committee (SRC) Activity—1980

During 1980 the primary emphasis of SRC activity was in establishing meaningful definitions that are acceptable to both software and systems practitioners, as well as the community of reliability mathematicians. Also, establishing a firm foundation of software fault experience together with data on the impact of such faults on system reliability was an ancillary objective.

After preparation and review of the field of interest statement for the charter in July, the first meeting of the SRC was held at Minnowbrook in August. Principal results of that meeting was an agreement on preliminary definitions and on the primary difference between hardware and software. That difference is that software (logic) does not experience a change-in-state with respect to time or any related environment. A corollary is that the implementation of software logic in hardware memory and/or resultant functions may result in failure of the software (due to its erosion in memory locations). Similarly, hardware or system failures may result due to erroneous logic design or unexpected/undefined interface of the software with its environment (principally data or operator inputs).

Coordination of SRC tasks were effected with the EIA Reliability Committee G-41, with DACs, with IEEE Computer Society and with persons and subcommittees related thereto or have otherwise expressed interest. The second SRC meeting was held with the G-41 EIA committee on 10 October. In

addition to the working paper on software reliability by Dr. Regulinski, another such paper was generated by the IEC, and was graciously sent to me recently by an IEC member. It is suggested that the IEC be made aware of SRC activity and kept informed of our progress. That paper, together with a current SRC membership list, is included below.

In the area of symposia participation, Myron Lipow presented a tutorial on Software Reliability at the R&M Symposium. Mr. Lipow also chaired a panel session at the National Computer Conference where SRC members debated controversial aspects of software reliability with noted software practitioners.

I. Doshay  
 Chairman, SRC

### Software Reliability, Availability and Maintainability (RAM) Definitions

*Software Reliability* - the probability that the required software will perform the intended logical operations for the prescribed mission(s) and period(s) in the specified data/environment, without failure.

*Software Failure* - the inability, due to a fault in the software, to

perform an intended logical operation in the presence of the specified data/environment.

*Software Reliability Prediction Model* - mathematical model that could include appropriate parameters such as code complexity, branching numerics, structured/modular format utilization, execution rate, timing restrictions, and data complexity, predictability and variability, as may be verified by test data.

*Compatible Hardware/Software Prediction Models* - suitable interpretation of hardware and software mathematical relationships for combined computation so as to make feasible prediction of the System Reliability.

*Software Maintainability* - the probability that the software can be retained in or restored to a specified status in a prescribed period compatible with mission requirements.

*Software Corrective Modification* - the necessary corrections of the logic/code that will preclude repetition of a prior experienced software failure when processing a data set associated with that failure.

*Software Preventive Modification* - the periodic updating of the software to preclude system failure when processing potential data sets.

*Software Maintainability Model* - a mathematical model that may be derived from prior experience in correcting software faults that predicts frequency of faults of various categories, and may include:

- Suitable parameters to accommodate results of timeline analysis of software corrective and preventive maintenance.
- Determination of mean-time-to-restore (MTTR) as well as maximum restore time for the 95th percentile of the timeline data.
- Determination of optimum performance of software corrective and preventive modification tasks, including frequency and duration.

### System Hardware/Software Effectiveness Definitions

*System Effectiveness* - the measure of the degree to which the hardware and software achieve the mission requirements in the operational environment as evidenced is system availability, dependability and capability.

*System Dependability* - the probability that the hardware and software will perform successfully during one or more required sequences of a mission, given the hardware and software status at the start of the mission (availability).

*System Capability* - the probability that the hardware and software can achieve the required mission objectives given the operational conditions, including data environment, during the mission.

*System Availability* - the probability (or proportion of operational time) that the hardware and software is in the required operable and committable state when the mission is required with a specified data/environment.

*System Effectiveness Model* - a mathematical model encompassing both hardware and software for a prior prediction, a pre-operational test evaluation or an operational demonstration of the deliverable system effectiveness.

- The model should encompass the foregoing defined parameters and include a practical means of computation and analysis.
- Implementation of the model is generally demonstrated with data from other programs or data assumed from requirements, prior to application in the current program.

### 1980 IEEE Mechanical Reliability Committee Report

During 1980 the Mechanical Failures Prevention Group (MFPG) held two symposiums and completed plans for a Spring 1981 meeting. The first symposium addressed "Failure Prevention in Ground Transportation Systems" and was held at the National Bureau of Standards, Gaithersburg, Maryland, from 22-24 April 1980.

The objective of this symposium was to bring together experts concerned with failures in ground transportation systems with the intention of discussing significant failure prevention methods and flaw detection techniques. The conference was organized in sessions addressing: Rail Vehicles and Structures, Highway and Road Bridges, Pipeline Transportation Systems and Motor Carrier Activities.

The Rail Vehicles and Structures Session covered:

- Component reliability of railroad freight car trucks
- Mechanical behavior and potential failure mechanisms of railroad locomotive pads
- Fracture of steel plate materials under abrasive service conditions in railroad tank cars
- Fracture analysis of cast steel components in rail vehicles
- Requirements for on-board failure detection systems for rail vehicles
- Detection of defects and prevention of rail fracture
- Automated NDE for detection of braking abnormalities on trains

The Highway and Road Bridges Session covered:

- Failure analysis of highway bridges
- Failure analysis of rapid transit bridges
- Bridge welding and fracture control
- Theory and design of instrumentation for bridge investigations

The Pipeline Transportation Systems Session covered:

- Ductile fracture analysis of pipelines
- NDE - defect sizing in pipeline welds
- Development of welding consumables for arctic pipelines
- Analysis of pipeline failure data

The Motor Carrier Activities Session covered:

- Regulation, legislation and teamsters: an equation for highway safety
- Stress systems related to fracture of ductile and brittle materials
- Perspectives on diagnostic systems
- Investigation of defects in motor carrier activities

The second symposium was on Detection, Diagnosis, and Prognosis (DD&P): Contribution to the Energy Challenge, at Santa Monica, California from 7-9 October 1980. The DD&P Technical committee of MFPG organizes a technical program approximately every two years to address the prevention of mechanical failures by means of DD&P techniques and equipment. The purpose of this symposium was to address this problem and aid communications between those involved with the reduction of mechanical failures in the various energy fields.

The symposium consisted of five technical sessions as follows:

#### *Energy Management Session*

- Smithsonian Air and Space Museum DD&P
- Energy Management System
- Statistical Analysis of Core Barrel Motion Orbits
- Marine Performance Monitoring System for FF 1052 Class Steam Plant
- Surveillance of PWRP Water Control Feed Valves

#### *Techniques for Detection Session*

- Oil Debris Detection Progress
- Advanced Radioactive Engine Wear Analysis
- Shipboard Measurements of Water/Oil Concentration Using Clamp-On Ultrasonic Sensors
- Oxygen Sensor for Automobile Combustion Control
- DD&P of Gas Turbine Engine Health with the Use of Fiberscopes

#### *Better Availability Session*

- Integrated On-Board DD&P System for Military Application
- Progress with Pielstick Engine Diagnostics and Experimental Results
- An Energy Conservation Concept for Operating Machinery
- On-Board Gas Turbine Mack Truck
- Marine Ball/Roller Bearing Monitoring by Shock Pulse Monitoring

#### *Diagnostic and Prognostic Techniques Session*

- Conservation: Loss Prevention and Risk Management
- Recent Experiences with Steam Turbine Disc Cracking
- A Doppler Technique for Detecting and Locating Excessively Vibrating Blade in a Running Turbine
- IMACS TM Cost Saving Estimator, a Trade-Off Analysis for a Built-in Monitoring System
- Operating Experience with Advanced Computer Based Surveillance System
- Mechanical and Aerothermal Diagnostics for Turbo Machinery

#### *Opportunities for DD&P in the Energy Field Session*

- Data Acquisition and Analysis in the DOE/NASA Wind Energy Program
- Periodic Vibration Monitoring in the Synthane Coal Gasification Pilot Plant
- A Computerized Broken Blade Monitor for a Nuclear Fuel Bundle Shearing Machine
- Tidal Hydroelectric Power
- DD&P in Geothermal Energy

The Spring 1981 meeting of the MFPG on Innovation for Maintenance Technology Improvements will be held at NBS, Gaithersburg, Maryland on 21, 22, and 23 April 1981. The meeting will emphasize innovation for maintenance engineering technology improvements and address such issues of national scope as:

- New Approaches to Effective Maintenance Engineering
- Prevention of Equipment and Vehicle Deterioration
- Increased Service Life
- Improvements in Material Durability
- Research for Improved Maintenance Engineering
- Improved Processes for Maintenance Applications

The major goal of the meeting is to provide descriptions and demonstrations of new technology for maintenance engineering applications to obtain improvements in safety, readiness, productivity, and cost savings. Equipment areas include transportation, manufacturing, communications, plant, and military vehicles.

### **Solar Energy Device Reliability Report**

January 5, 1981

The Solar Energy Device Reliability Committee was established at the April 24, 1980 meeting of the Reliability Society Administrative Committee. A Charter for the Committee has been prepared defining the field of interest and objectives.

The following people have agreed to serve on the committee:

Steven E. Forman  
Energy Systems Engineering  
Massachusetts Institute of Technology

Frank J. Mollura  
Systems Engineering Section  
Rome Air Force Development Center

I. Arnold Lesk  
Motorola, Inc.

Gerald T. Noel  
Solar Energy Materials & Systems  
Battelle Memorial Institute

An attempt to arrange a special session at the IEEE Photovoltaic Specialist Conference in May, 1981 was unsuccessful as the conference organization was too far advanced when this committee was established. It is anticipated that

special sessions focused on reliability will be featured at the 16th Photovoltaic Specialist Meeting.

Submitted by:

**John D. Meakin**  
Chairman  
Solar Energy Device Reliability

### **Human Performance Reliability Report**

Activities over the period have centered on two interest areas: (1) development of a tutorial on human performance reliability, and (2) monitoring of human performance reliability developments relative to the design of nuclear power plants. The activities in each of these areas are summarized below.

#### *Tutorial on Human Performance Reliability*

Because of the increased focus on human performance reliability and because methods for predicting human performance reliability have not been made generally available, a two day tutorial relative to this topic was planned. The tutorial was planned for administration in the Washington, D.C. area with a fee of \$295. The fee would be reduced to \$250 for IEEE Reliability Society members. Permission to proceed with the planning/implementation of the tutorial was requested and we are advised that a concrete answer will be on hand shortly after the first of the year. If approval is received, the tutorial will take place either in June or October, 1981. The faculty for the tutorial is tentatively A. Siegel (Applied Psychological Services), J. Jenkins (Nuclear Research Council), K. LaSala (Naval Sea Systems Command), and D. Raheja (Booz, Allen, & Hamilton). One or two additional faculty members will be sought. Authorization to spend up to \$500 for documented costs relative to the tutorial was also requested. These funds would be returned from the income from the tutorial and all profits would be turned over to the Society.

#### *Monitoring of Nuclear Energy Developments*

A number of meetings have been held by the IEEE Standards Office Working Group 5.5 relative to the human factors in nuclear energy plants. Some of these meetings have been attended by A. Siegel. The position taken has been that the Human Performance Reliability Committee will continue to cooperate with Working Group 5.5 and will be pleased to review, from the point of view of our concern, any reports or documents which emerge from the efforts of Working Group 5.5.

The following persons have been added to our Committee:

Mr. James Jenkins, NRC  
Mr. Dev Raheja, Booz, Allen, and Hamilton

29 December 1980  
*Arthur I. Siegel*

### **International Reliability Committee**

1. International meeting of IEC Technical Committee No. 56 on Reliability and Maintainability will be held in Tel Aviv, Israel, March 23-27, 1981.

2. In preparation for above meeting, the USA Technical Advisory Committee, chaired by Dr. Lee Weaver, will meet on January 27, during RAMS, in Philadelphia. Principal topics for the Tel Aviv agenda include the following:

- Definitions - updating
- Reliability Testing - including design of test cycles and preferred test conditions.
- Maintainability - including design studies and maintainability verification.
- Failure modes and effects analysis.

3. Future work proposals include preparation of an international standard on software reliability. The USA is taking a negative position on this proposal.

4. The USA has submitted a recommendation to expand the scope of IEC TC 56 to include quality assurance.

5. The US National Committee met in Clearwater, Florida on January 23, where the agenda included progress of the certification program for electronic components.

Respectfully submitted,

*M. P. Smith*

### **Summary of NSRS Activities in 1980**

The Nuclear Systems Reliability and Safety Committee has been involved in two major activities during 1980.

1. We received IEEE standards project authorizations for a document dealing with qualitative common cause failure analysis, designated Project 831. The title of the document is "Guide for Qualitative Common Cause Failure Analysis of Engineered Systems." We are currently collating comments from our first committee ballot and other segments of IEEE.

2. A Working Group on Risk Evaluations of Radioactive Waste Management has been formed. Dr. T. H. Smith of EG&C Idaho, Inc. is chairman of the Working Group.

The role of the Working Group is to (1) act as a third-party reviewer of selected criteria, standards, and major studies related to risk evaluations of radioactive waste management, and (2) recommend acceptable approaches, procedures, and data bases for these risk evaluations. These recommendations will be for consideration by regulatory bodies and other groups funding such risk studies.

Sincerely

*David P. Wagner*  
Secretary  
NSRS Committee

### **Chapter Activities Report**

#### *Chapter Activities - Awards*

Ten of the eighteen eligible Chapters replied to the Chapter Awards Program. The award certificates for the 1st, 2nd and 3rd

places were presented at the RAMS Award Luncheon on January 27, 1981.

Congratulations to the Washington/Northern Virginia Chapter for their second win in a row for the 1st place Chapter of the Chapter of the Year Award. The Chapter will receive a maximum of \$500 for expenses for a guest speaker meeting. Owen Holbrook received an award certificate and a personal gift as the Chapter Chairman during the award period.

Congratulations to the Boston Chapter for their second place finish. The chapter received a check for \$150. Gene Carrubba accepted the award certificate and gift for Mark Snyder who was unable to attend.

The third place award of \$100 went to the Philadelphia Chapter. Fulvio Oliveto received his certificate and gift and previously welcomed us to the City of Philadelphia which hosted the RAMS.

The remaining seven entries were sent \$45 in stamps on January 12, 1981 along with letters of congratulations. They were: Baltimore, Chicago, Cleveland, Los Angeles, New York/Long Island, Mohawk Valley, North Jersey.

In total, the Chapter Awards Program distributed \$1,065 to the Chapters.

*H. Malec*

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## Welcome to New Members

The names and addresses of new members, from November 1980 through December 1980, are listed below. For USA members, they are listed by alphabetical order of their state. For members outside the USA, they are listed by alphabetical order of their country's English name.

<b>ALABAMA</b>	Sheldon V. Jennings 512A Ave. F Redondo Beach, CA 90277	Joel M. Schoen ITT Telecom 1 Research Dr. Shelton, CT 06484	Colin B. Willmott 917 Saybrook Ln. Buffalo Grove, IL 60090	Arthur W. John Data General Corp. 15 Turnpike Rd. Westborough, MA 01581
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Suchai Thanawastein 201 Elm St. #11 Auburn, AL 36830	S. N. Lehr 6669 W. 80th Pl. Los Angeles, CA 90045	<b>COLORADO</b>	<b>IOWA</b>	Donald A. Miller 20 Pearl St. Lexington, MA 02173
Raymond C. Watson Jr. Southeastern Inst. of Tech. P.O. Box 1485 Huntsville, AL 35807	Fred L. Leverenz Jr. 5 Palo Alto Sq. Suite 200 Palo, Alto, CA 94304	T. S. Basso SERI 1617 Cole Blvd. Golden, CO 80401	Mark J. Heindselman Gov. Rd. P.O. Box 11 Marshalltown, IA 50158	E. R. Sanchez 21 Morrison Ave. Wakefield, MA 01880
<b>ARIZONA</b>	Joe W. Menke 14983 Shast Ln. Morgan Hill, CA 95037	James R. Beall 3422 W. Berry Dr. Littleton, CO 80123	<b>KANSAS</b>	Nils R. Sandell Jr. 3 New England Executive Pk. Burlington, MA 01803
George M. Goodrich 1821 E. Elm St. Tucson, AZ 85719	Jerry W. Miller 1990 Byers Dr. Menlo Park, CA 94025	<b>FLORIDA</b>	L. Darlene Fearey 2334 Gentry Wichita, KS 67220	Richard P. Stone 12 Stanley St. Natick, MA 01760
Jennings D. Neylon Product Eng. Burr Brown P.O. Box 11400 Tucson, AZ 85734	John R. Murdock 2421 W. 230 Pl. Torrance, CA 90501	W. J. Brangan Jr. 10620 NW 39th St. Coral Springs, FL 33065	<b>MARYLAND</b>	Gregory DeSantis 6320 Golden Hook Columbia, MD 21044
Cindy A. Sutton IBM 63S/060-2 Tucson, AZ 85744	Louis G. Rayes 156 Carling Ct. San Jose, CA 95111	David J. Girard 805 N. Thornton Ave. Orlando, FL 32803	Paul F. Condon, Jr. 600 Clayborn Ave. Takoma Park, MD 20012	Glenn Denomme 563 Coachman Dr. Apt. 4 Troy, MI 48084
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Melvyn D. Ashcraft Litton Systems 5500 Canoga Ave. Woodland Hills, CA 91364	Carey C. Tate 7337 Independence Ave. Apt 27 Canoga Park, CA 91303	Guy N. McNico 1985 Hunterfield Rd. Maitland, FL 32751	J. P. McHugh Camelot Apts Arthur Ct. Apt. 571 Bldg. E-1 Salisbury, MD 21801	Russell L. Jacobs 1931 Parmenter Apt. 201 Royal Oak, MI 48073
John J. Barnes 4628 Ariel Ave. Fremont, CA 94536	Victor A. Vanlint 1032 Skylark Dr. LaJolla, CA 92037	Alfred E. Weston III 112 15th St. Belleair Beach, FL 33535	Stephen R. Meyer 7895 Apt. I Tall Pines Ct. Glen Burnie, MD 21061	Timothy W. Kaufmann 33112 Trafalgar Apt. 8 Westland, MI 48185
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Mikhail Draekin 1936 Parrott Dr. San Mateo, CA 94402	Loyd A. Wright 8767 Navajo Rd. Apt. 8 San Diego, CA 92119	<b>ILLINOIS</b>	James G. Concanon 10 Stevens St. Methon, MA 01844	Stephen A. Zayac 1610 Christian Hills Dr. Rochester, MI 48063
Juanito F. Evalle 650 Davenport Dr. San Jose, CA 95127	Henry C. Wong 3326 Garden Ave. Los Angeles, CA 90039	Kenneth R. Audino 900 Third Ave. Des Plaines, IL 60016	Kevin C. Daly 555 Tech Sq. Cambridge, MA 02139	Stephen A. Zayac 1610 Christian Hills Dr. Rochester, MI 48063
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	A. W. Schneider 610 Belmont Ave. Addison, IL 60101	Weston O. Ison 509 Sportsmans Rd. Orange, CT 06477	David W. Jackson United Engrs & Constructors 100 Summer St. Boston, MA 02110	Stephen A. Zayac 1610 Christian Hills Dr. Rochester, MI 48063
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Engineering, which also contains an article by Rolls-Royce and Associates on the Reliability of a Nuclear Reactor Rod Control System. The latter includes the statement "The complexity of the risk assessment model dictated that a computerized assessment was preferable," and reference to a program labeled SMOAKIT.

Automated reliability analysis is the topic of a paper "Reliability Analysis Computer Programs" by Melvin T. Chambers, presented at the IEEE Engineering Management Conference. The paper describes several NASA, DoD and Department of Energy Reliability Analysis Programs. Mr. Chambers also provided for this report a listing of areas in which advances were made in 1980. These are:

- Application of graph theoretic methods of network reliability analyses
- Application of Fourier series to Bayesian techniques
- Application of Boolean/Switching algebra to the reliability analysis of complex networks
- The continued development and availability of computer programs for performing system reliability predictions
- The continued development of computer programs for performing exhaustive tie-set and cut-set enumerations for complex systems
- The application of data management systems to searching and sorting FMEA and other tabular analyses to fulfill unanticipated ad hoc report requests.

Many of the programs mentioned above require failure rate estimates as an input. These estimates themselves can be obtained as computer products. Many companies have automated the procedures for performing reliability predictions in accordance with MIL-HDBK-217. In addition, Defense Contractors can obtain access to a government owned prediction program (RADC-ORACLE) and at least one program (PREDICTOR) is available commercially.

RADC-ORACLE is resident on the Rome Air Development Center (RADC) computer. By agreement with RADC, DoD agencies can obtain authorization to access the program from terminals at their own facilities through communication links such as the ARPA computer network. They can also provide access to their contractor as government furnished property for use on DoD contracts. All three services and at least three contractors are now using RADC-ORACLE. The program also provides a system reliability modelling routine to accommodate redundancy.

Access to RADC-ORACLE is limited to DoD agencies and their contractors for use on DoD programs only. Other agencies who do not wish to develop their own reliability prediction programs can lease one called PREDICTOR from Management Sciences, Inc. (MSI) Albuquerque NM. MSI offers a series of programs. The Reliability PREDICTOR, as the name implies, provides reliability analysis capabilities. There is also a parts list PREDICTOR, a block diagram evaluation PREDICTOR, a maintainability predictor (per MIL-HDBK-472), a failure modes and effects PREDICTOR (per MIL-STD-1629A), a PREDICTOR catalog program, a report analysis program and a fault tree analysis program (per MIL-STD-882A) called

RESULTS. The programs are designed to be compatible in that, for example, failure rates derived by the reliability PREDICTOR can be used as inputs to the other programs. MSI reports that the service is currently used by over 100 firms including some government agencies.

As the preceding discussion implies, there are significant advantages to interfacing computer programs. An ambitious example of this is the Integrated Thermal Avionics Design (ITAD) Program of the Air Force's Wright Aeronautical Laboratories (AFWAL). ITAD is an interactive computer aided design program intended to help create optimum avionic designs using a set of programs for analyzing routeability, reliability, thermal and electrical stresses and other considerations. Design options and comparisons of features are displayed on color graphics terminals for the designers selection. The program began in 1979 and will be completed in 1983.

Computer Aided Design will also be a feature of the DoD Very High Speed Integrated Circuits (VHSIC) Programs. The program calls for development of chips containing 30,000 gates each by 1983 and 100,000 or more gates each by 1986. Besides Computer Aided Design, fully automated testing is planned. In addition, the relatively great availability of low cost circuitry will be taken advantage of by creating on chip built-in-test and automated reconfiguration capabilities using on chip redundancy. These features will not be merely convenient. They will be an absolute necessity.

Even today, the complexity of devices makes testing a significant problem. As stated by Mr. Charles Windisch of RADC:

Microprocessors, despite revolutionizing digital design and providing many new benefits, have brought along a host of their own problems. The most notable of these is in the testing and reliability proving area. One hundred percent testing is a practical impossibility, hence, alternative approaches must be looked into. One such approach being investigated on contract by Rensselaer Polytechnic Institute is weak point testing. Short programs are written which exercise the different functional parts of the microprocessor. Then, these programs are run while the device is subjected to elevated temperatures or higher than normal supply voltages. The resulting data is analyzed for errors and then traced back to uncover weak points in the design.

The RADC Reliability Branch is also using automation to keep track of the changes in the dynamic microcircuit and semiconductor technologies. They have created two programs: Microcircuit Reliability Analysis Program (MRAP) and Semiconductor Reliability Analysis Program (SRAP).

The programs compare an inputted parts list to a data base and, for each part, lists whether or not: a military specification is available, a QPL source exists, an alternate military specified part is recommended, the device is recommended for new designs, there is standardization activity planned. Besides its use by RADC personnel in evaluating proposed program parts lists, the programs are used to generate listings to aid designers in selecting parts. One listing provides a functional description, specification status and QPL status for each device by specification and shash sheet designator. It also provides a recommended substitute if a particular device is not recommended for use in new designs. A second listing provides cross references to the data by commercial or generic part number. A

third listing cross references the military specification/shash sheet designator and generic number by DESC drawing numbers. About 200 copies of these listings have been provided by RADC to interested users to aid their part selection. The listings are updated by RADC as required by changes in the MRAP and SRAP data bases.

A final example of R&M computer software is a program for optimizing burn-in procedures originally published in 1978 in RADC-TR-78-55 "Electronic Equipment Screening and Debugging Techniques." The program has been used by the Navy to design a screening program for the MK-47 torpedo and by various industrial firms, one of whom estimated that its use could result in a cost avoidance of \$900,000 a month. Screening remain an area of high interest, with the Institute of Environmental Sciences leading a team to develop a recommended standard, and RADC continuing to fund research to provide inputs to such a standard. A survey of the current burn-in knowledge was done by RADC in 1980 and will be published in 1981 as an RADC Technical Report entitled "Burn-in; Which Environmental Stress Screens Should be Used?" Among other findings, the report questions the adequacy of ten thermal cycles cited as sufficient in previous documents including NAVMAT P-9492 "Navy Manufacturing Screening Program," the only government screening standard now available.

In another form of software, that of published documents, the major news is the release of DoD directive 5000.40 "Reliability and Maintainability" on July 8, 1980. The directive provides DoD standard R&M terms and mandates R&M accounting using terms related to operational effectiveness and ownership costs.

These terms were anticipated by the Air Force and already implemented in AFR 80-5 and AFSC Supplement 1, both released in 1979.

MIL-HDBK-217C "Reliability Prediction of Electronic Equipment," Notice 1 was published May 1980 with major changes in the monolithic integrated circuit and microwave solid state device models. In December 1980, proposed MIL-HDBK-217D was released for coordination review, in accordance with the preparing activities' (RADC), policy of annual revisions to the handbook. The proposed revision will add CCD, Bubble Memory and GAAS FET models and change the environmental factors, except for avionics environmental factors which will be changed in the 1982 revision.

MIL-STD-785B "Reliability Program for System and Equipment Development and Production" was published 15 Sept. 1980 by the Air Force Avionic Systems Division providing reliability program elements in a form amenable to tailoring for specific procurements.

In printing and perhaps available by the time this report is issued, is MIL-HDBK-189 "Reliability Growth Management" prepared by the US Army Communications Research and Development Command.

In coordination by the Navy is a revision to MIL-HDBK-472 "Maintainability Prediction" adding a new prediction technique developed by RADC. The proposed change will be the first since publication of the handbook in 1966.

Also in coordination is MIL-STD-471, "Maintainability Demonstration" providing, among other things, a means for measuring testability requirements.

Still in preparation are changes to MIL-STD-470 "Maintainability Program" and a proposed new standard on evaluating human performance impacts on Reliability and Maintainability.

The IEEE Reliability Society Nuclear Systems Reliability and Safety Committee is preparing a "Guide for Qualitative Common Cause Failure Analysis of Engineered Systems". This is one of the two major activities report by Mr. David P. Wagner, Committee Secretary. The other was the formation of a Working Group on Safety Evaluation of Radioactive Waste Management headed by Dr. T. H. Smith of EG&G, Idaho, Inc. Mr. Wagner reports the role of the working group will be to:

- (1) seek areas of commonality among safety evaluations of radioactive waste, wherein common guidelines, assumptions or methods can be recommended as standard practice;
- (2) present the recommendations to decision-making bodies such as regulatory agencies; and
- (3) serve as a peer review body to provide comments on proposed regulations and on major studies.

Dr. Lee A. Weaver, Technical Advisor to Technical Committee 56 of the International Electrotechnical Commission reports the committee is currently developing and publishing 2 major documents.

IEC publication 605 is a standard that gives procedures for equipment reliability compliance and determination testing. The expected publish date of the eleven parts which comprise the standard are given below:

- Part 1: General Requirements - Published 1978
- Part 2: Guidance for the Design of Test Cycles for Equipment Reliability Testing - 1981.
- Part 3: Preferred Test Conditions for Equipment Reliability Testing, 1981
- Part 4: Procedures for Determining Point Estimates and Confidence Limits from Equipment Reliability Determination Tests, 1981.
- Part 5: Compliance Test Plans for Success Ratio, 1981.
- Part 6: Tests for the Validity of a Constant Failure Rate Assumption, 1981.
- Part 7: Compliance Test Plans for Failure Rate and Mean Time Between Failures Assuming Constant Failure Rate, published 1978.
- Part 8: Tests for the Validity of a Non-constant Failure Rate Assumption, 1983.
- Part 9: Compliance Test Plans Assuming Weibull Distribution of Times to Failure, 1983.
- Part 10: Compliance Test Plans Assuming Normal Distribution of Times to Failure, 1983.
- Part 11: Flow Chart Describing Preparations for an Execution of Reliability Tests, 1981.

The second IEC publication is a guide on maintainability which is being developed in seven parts. The expected publish dates are as follows:

- Part 1: Introduction to Maintainability 56 (General Office) 68, 1981.



- Part 2: Maintainability Requirements in Specification 56 (Central Office) 69, 1981.
- Part 3: Maintainability Program 56 (Central Office) 70, 1981.
- Part 4: Test and Diagnostic Procedures, 1984.
- Part 5: Maintainability Design Studies, 1983.
- Part 6: Maintainability Verification, 1983.
- Part 7: Collection Analysis and Presentation of Data Related to Maintainability, 1983.

Documentation relating to testability made some significant advances in 1980. The Industry/Joint Services Automatic Test Project issued its final report in June 1980 presenting a comprehensive survey of the field and detailed recommendations. The task team involved over 800 representatives of all services, DoD, the Aerospace Industries Association (AIA), Electronics Industries Associates (EIA), National Security Industrial Association (NSIA), Shipbuilders Council of America (SC/A), American Electronics Association (AEA), and countless industrial concerns. Copies of the report may be requested from Tom Burley Jr., NSIA, 1015 15th Street, N.W. (Suite 5901) Washington DC 20005.

Also on Testability, the Rome Air Development Center completed publication of a series of technical reports designed to provide the foundations for a Testability Engineering Discipline. The reports cover the specification and demonstration of testability figures of merit, testability design guides and testability-cost trade offs. These reports are listed, with other RADC reports on R&M, in a bibliography entitled "Reliability and Maintainability Reports of the Rome Air Development Center 1975 - 1980, available in December 1980. The listing covers reports on device reliability, system/equipment reliability and maintainability (including testability) and software reliability. Copies may be requested from: RADC/RBET (A. Coppola), Griffiss AFB NY 13440. Not included in this listing, however, is a report "Bayesian Reliability Demonstration Made Practical" now in printing for release as a RADC Technical Report in 1981. It is intended to spur the use of Bayesian Test techniques by providing a simple, practical and believable approach.

A new International Journal "Reliability Engineering" published its first issue in 1980. It is edited by F. R. Farmer and published by Applied Sciences Publications Ltd, Ripple Road, Barking, Essex, England IG11OSA.

Also published in 1980 was a text "Reliability and Maintainability of Electronic Systems" edited by J. E. Arsenault and J. A. Roberts, published by Computer Science Press, Inc., 9125 Fall River Lane, Potomac MD 20854.

Finally, the reliability of software itself has been a topic of considerable interest. The remainder of this paper presents a report by Mr. Alan Sukert who was responsible for the RADC Software Reliability Program until his departure in December 1980. (Editors Note - See also the report of the ADCOM Committee on Software Reliability in this issue).

During 1980 the RADC program in software reliability achieved significant results. First, two software reliability model development efforts were completed. The initial good results of experimental validation efforts for these two models indicates a strong potential for their use as a basis for a

standardized set of software reliability estimation techniques. The first model, developed by IBM, uses binomial and Poisson distributions for the time to detect software faults which incorporate the important assumptions of a non-constant error detection rate and a non-trivial probability of error generation during error correction. The second model, developed by Syracuse University, assumes a non-homogeneous Poisson process for the cumulative number of software faults detected as a function of time. These two models, in addition to several others such as the Jelinski-Moranda and Shooman Exponential, are now being rigorously validated against software error data being collected during the validation and integration testing of a large on-going Air Force command and control software development project.

In addition to these two software reliability modeling efforts, additional software reliability research is ongoing. The above two models, plus several other newly formulated software reliability models, are being extended to incorporate differing assumptions about the software fault detection process as more about this process becomes understood. The initial development of a framework to specify combined hardware/software reliability models and related figures of merit, which can be used to specify system reliability, is underway. This framework will be extended over the next two years to incorporate system reliability considerations as they pertain to fault tolerant and distributive systems. Efforts are underway by Dr. Amrit Goel of Syracuse University and others to provide a more statistical basis, based on optimization with respect to software cost, reliability, and other related criteria, for formulating software testing strategies, for making software acceptance decisions, and for determining software maintenance policies. These optimization techniques are also being applied to develop a software/hardware reliability tradeoff capability throughout the software life cycle based on the establishment of reliability and cost criteria. Investigations into the theoretical understanding of both software and programming language complexity are providing important new measures to predict these complexities, and through which a priori the achievable reliability of a software system before actual coding begins can be determined. Although the above investigations and research are ongoing, some significant results are now becoming available from experimental application of these techniques to small ongoing software development projects.

The most significant results in 1980 in software reliability standardization have been the development of two draft handbooks. The first deals with procedures for specifying and measuring overall software quality throughout the software life cycle, including maintenance. Part of this software quality measurement handbook involves the formulation of quantifiable measures, called metrics, and their associated data requirements which will permit the specification of software reliability goals in RFPs. This software quality measurement technology is currently being applied to the Army RPV project, and initial results of this application have been very encouraging. The second handbook, due for completion in December 1980, will provide guidance and procedures for performing software reliability assessments on a software

development. This guidance will include discussions on available software modeling technology, the necessary data for model input, and how the various model outputs can be used to perform any required software reliability assessment. Both of these handbooks will form the basis for the development of standardized software reliability prediction and estimation procedures, which will take the form of appropriate MIL-HDBKs and MIL-STDs. It is expected that by the end of CY81 the first such draft MIL-HDBK on software reliability and quality assessment will be completed.

The next few years should see an increased emphasis on system reliability models using the current model frameworks as guides. New software reliability techniques, specifically oriented to distributed system technology, will be investigated. Critical experimental validation of current software reliability

models will be completed, resulting in a better understanding of model applicability and the preparation of complete model usage guidelines. Finally, the standardization of software reliability techniques, including not only the software modeling and quality measurement technologies but additional proposed techniques such as software FMEA, will become firmly established, and will result in software reliability equivalents for the various hardware reliability standards such as MIL-STD-781.

Submitted by

*Anthony Coppola*

Chairman,

Advanced Reliability Technology Committee,  
IEEE Reliability Society

## Reliability Program Standard Revised

The basic standard for military reliability programs, MIL-STD-785, has been revised. The "B" version of this document is dated September 15, 1980, and is the first change to the document since March 1969. Government and industry users of the document will find significant changes in both format and content of the standard. Some of the significant changes are:

- The document is intentionally structured to discourage indiscriminate blanket applications. Tailoring is forced by requiring that specific tasks be selected and, for those tasks identified, that certain essential information relative to implementation of the task be provided by the procuring activity.
- Many of the tasks solicit facts and recommendations from the contractors on the need for, and scope of, the work to be done rather than requiring that a specific task be done a specific way. The selected tasks can be tailored to meet specific and peculiar program needs.
- Appendix A to the document, "Application Guidance for Implementation of Reliability Program Requirements," is 31 pages of rationale and guidance for the selection of tasks to fit the needs of any reliability program. This appendix is to be used

to tailor reliability requirements in the most cost effective manner that meets established program objectives.

- Increased emphasis has been placed on reliability engineering tasks and tests. The thrust is toward prevention, detection, and correction of design deficiencies, and workmanship defects. Reliability accounting tasks have been retained, and expanded to serve the needs of acquisition, operation and support management.
- A sharp distinction has been established between basic reliability and mission reliability. Measures of basic reliability include all item life units (not just mission time) and all failures within the item (not just mission-critical failures of the item itself).
- New tasks include: Electronic Parts/Circuits Tolerance Analysis, Sneak Circuit Analysis, Environmental Stress Screening, Reliability Development/Growth Test Program, and Failure Review Board.

Copies of MIL-STD-785B should be available after December 1, 1980 from: Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

## Help Wanted

Apply to A. Coppola RADC/RBET, Griffiss AFB NY 13441 unless otherwise noted.

**COMMUNICATOR:** To be editor of this newsletter. Duties will be to gather information, and provide in legible form to IEEE Headquarters by establishing due dates for printing. Plentiful supply of Reliability Society stationary provided for soliciting Chapter Chairman and ADCOM members for news.

**AGITATOR:** To obtain more practical papers for the IEEE Transactions on Reliability. Title of Special Papers Chairman, elegant letterhead provided. Duties will be to bug all potential contributors until Ralph Evans is buried in practical papers. Types of papers desired are:

1. Case histories.

2. Reliability techniques which were actually found to be useful on a job, and those which were not useful or were too expensive.

3. How you set realistic R&M requirements for a system or equipment.

4. What kinds of reliability testing were actually cost-effective.

5. Use of reliability data from the field instead of from special reliability tests. Comparison of field data with reliability tests.

6. Comments on the worth of standards such as the many international or US military standards on reliability.

7. Ideas, from experience, on the major obstacles to setting and achieving worthwhile reliability requirements in commercial, military or other fields.

8. Where to find information. For example, a list of trade and professional journals of value to electronics reliability and quality control practitioners.

9. Information summaries. For example, annotated lists of computer programs for analyzing electronic circuits or for generating fault trees; tell what the programs do, how big a computer they need, and where they are available.

**CONTRIBUTORS—All Types:**

1. Practical Papers: See wish list above. Send submissions or ideas directly to Ralph A. Evans, Editor, IEEE Transactions on

Reliability, 804 Vickers Ave, Durham NC 27701.

2. Newsletter Items: Any item of interest to the R&M Community welcome. Also comments, kudos, and criticisms. By-lines provided or omitted as desired.

3. Humor: The Transactions provides a few laughs along with all those equations in a series called "Landmarks in R&M Engineering". If the Transactions can be funny, so can the Newsletter. All contributions welcomed (keep it clean and, preferably, topical). Will by-line or publish anonymously as desired.

## Reliability Society Album

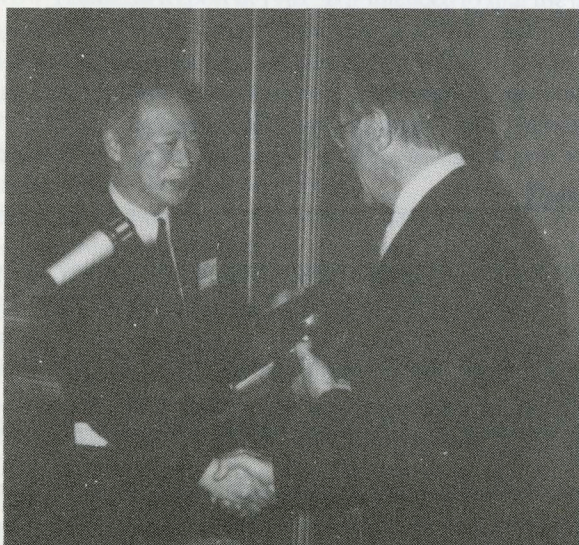
The Society honored three pioneers in Reliability at the Awards Banquet held January 27, 1981 in the Philadelphia Marriott Hotel.



Dr. Benjamin Epstein (left) receives his award from Dr. Regulinski, Society President, for laying basic foundations of the statistical theory of Life Testing and for development of its mathematical models.



Mr. Clifford M. Ryerson is recognized for the development of the method and rational underlying the practice of failure rate predictions.



Dr. John H. K. Kao (left) is honored for originating the Weibull Probability Paper for the Development of the Graph analytic method of reliability analysis.



Dr. Regulinski toasts his successor, Mr. Carl M. Bird, who was installed as Society President at the Awards Luncheon.

These photos were taken for the Newsletter by H. C. Jones. Your contributions welcome. Chapter chairman—please send some pictures of your activities.

# CALL FOR PAPERS

## 1982 ANNUAL RELIABILITY AND MAINTAINABILITY SYMPOSIUM

January 26, 27, 28, 1982

Biltmore Hotel

Los Angeles, CA

### THEME: Increasing Productivity— Assurance Technologies' Contributions

The topic of Productivity continues to be a major concern to all elements of our society. The need for more effective and efficient operations in industrial, commercial, and government activities clearly implies the requirement for more reliable and maintainable systems.

The 1981 Symposium addressed the *role* of the Assurance Technologies in improving Productivity. At the 1982 Symposium in Los Angeles, we shall concentrate on the *contributions* made to increase Productivity.

The Program Committee, therefore, solicits *results-oriented* papers that describe how improved Productivity is being achieved through the effective application of new and existing R&M and related techniques.

### PAPER SUBMISSION REQUIREMENTS

If you wish to present a paper, now is the time to contact us. It is requested that you observe the following:

- Submit the title, author(s) and a Summary of not more than 1000 words.
- Structure the Summary into the following 3 sections:
  - (1) Problems or Questions Addressed
  - (2) Work Performed on (1)
  - (3) Results and/or Conclusions Reached
- Paper Title not to exceed 50 letters and spaces
- Submit brief biographical sketch of the author(s)
- Submit as soon as possible—but May 1, 1981 is the deadline

Please note that initial screening for candidate papers is based solely on these summaries. If a Summary does not *clearly* indicate the paper's value (i.e. the 3 sections itemized above), it will generally receive no further consideration. It is essential, therefore, that your initial submission be *carefully prepared*.

All papers must be new and must not have been presented at a national meeting prior to the Symposium. Papers presented at local meetings are acceptable. Authors must indi-

cate the status of any previous or planned presentation/publication of the subject material covered in their submittal. All submittals become the property of the Symposium and cannot be returned.

*TEN COPIES* of the title, summary and biographies should be sent to:

H. C. Jones  
RAMS Program Chairman  
Westinghouse, MS 3608  
P.O. Box 1521  
Baltimore, MD. 21203

Authors will be notified of Program Committee decisions by June 30, 1981. Full text drafts will be required by August 1, 1981 for review. Comments from this review will be returned to the authors by September 15. Final papers must be submitted not later than October 15, 1981 and must be accompanied by the author's signed release for publication in the Symposium Proceedings. These dates do *not* have slack, and authors should fully recognize the responsibility of their commitment to this schedule when the initial submittal is made.

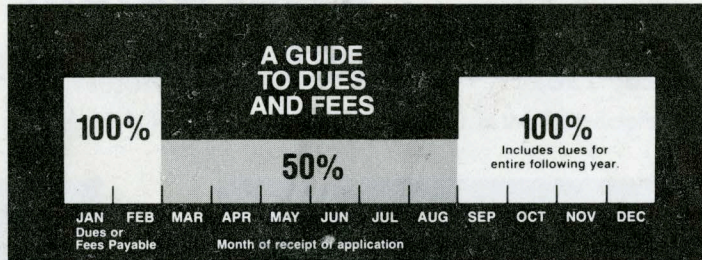
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