

Reliability Society

NEWSLETTER

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Editor:
Bruce Bream

President's Report

The Reliability Society gained 464 new members in 1993. These new members represented 51 countries and nearly half (207/464 - 45%) came from outside the United States (Regions 1-6). Table 1 shows the new members in 1994.

So far this year (February 4, 1994) we have gained 82 new members and two additional countries.

The Reliability Society has 19 Technical Operations Committees:

- Advanced Reliability Techniques and Research and Development
- CAD, Concurrent Engineering and Expert Systems
- Computers, Information Systems and Telecommunications
- Emerging (New) Technologies
- Energy Systems Reliability and Energy Technology Assessments
- Health Care and Medical Reliability
- Human Performance Reliability
- International Reliability
- Inter-Society Technical Liaison and Quality Council
- Maintainability
- Mechanical Reliability
- Nuclear Reliability
- Quality Assurance Technology
- Software Reliability
- Speakers' Bureau
- Standards and Definitions
- Systems Screening
- Total Quality Management and Process Reliability
- Transportation

I encourage each of you to contact:

Richard L. Doyle
Doyle and Associates
5677 Soledad Road
La Jolla, CA 92037 USA
Tel: (619) 459-5604

Dick is our Vice President of Technical Operations and will be pleased to help you become more active in Reliability Society activities by joining one of our Technical Operations Committees. I believe you will gain more from your membership by participating in Society affairs.

(continued on page 3)

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Notice

ADCOM Nominations

The IEEE Reliability Society is seeking nominations for members to fill positions on the Advisory Committee. This body meets four times per year at locations throughout the US. One meeting is held in conjunction with the annual Reliability and Maintainability Symposium (RAMS). This is held in January. The second meeting is held with the International Reliability Physics Symposium (IRPS) in March or April. The other two meetings are held in the Summer and the Fall at various locations. Often these are on the East coast of the USA. The Adcom is the body from which Society officers are nominated. The ADCOM body sets policy for the society, helps support reliability symposia, reviews standards and specifications, disseminates technical information and otherwise administers society functions.

We would like you to consider putting your name into nomination or someone else you feel would be good. To do this you need to submit a petition to the society. That would be to:

Dr. Samuel Keene
3081 15th Street
Boulder, Colorado 80304
Questions: (303)673-5963

Your petition should show the nominee, 12 members who support that nomination, the address of each member, their IEEE number and grade, their signature and date. The 12 members should be above the student grade. Nominations should be received by June 15, 1994.

The nominations should have a resume or biography attached for publication with the election ballot. **WE LOOK FORWARD TO GETTING YOUR NOMINATION.**

Reliability Society Newsletter Inputs

All RS newsletter inputs should be sent to:
Mr. Bruce Bream
NASA Lewis Research Center, M.S. 501-4
21000 Brookpark Road
Cleveland, OH 44135
Tel: (216) 433-6532 Fax: (216) 433-5270
Email: scbream@lims02.lerc.nasa.gov

The schedule for submittals is:

Newsletter	Due Date
January	November 19
April	February 26
July	May 28
October	August 27

ADVERTISING RATES

All copy that contains graphics or special fonts must be camera-ready or delivered on computer disk and be received by the due dates indicated.

Ad Size	One Time	2-3	4+
Full Page	\$400	375	350
Half Page	\$300	280	260
Third Page (vertical)	\$240	225	210
Quarter Page	\$205	190	180
Eighth Page	\$120	110	100

Discounted per issue rates are shown for ads run in more than one issue.

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President's Report

(continued from page one)

Table 1. 1993 List - Newest Members of Reliability Society

Country	Members	Region
Argentina	5	9
Australia	5	10
Austria	2	8
Bahrain	1	8
Belgium	2	8
Brazil	1	9
Canada	28	7
Chile	1	9
China	1	10
Columbia	2	9
Costa Rica	1	9
Denmark	3	8
Egypt	2	8
England	4	8
Finland	1	8
France	9	8
Germany	7	8
Greece	2	8
Hong Kong	1	10
Hungary	2	8
Iceland	1	8
Ireland	1	8
India	11	10
Indonesia	5	10
Israel	4	8
Italy	10	8
Japan	13	10
Korea	11	10
Macedonia	1	8
Malaysia	1	10
Mexico	6	9
Netherlands	5	8
New Zealand	1	10
Norway	1	8
Oman	1	8
Philippines	1	10
Poland	1	8
Puerto Rico	1	9
Romania	1	8
Saudi Arabia	4	8
Singapore	12	10
Slovenia	1	8
Spain	7	8
Sweden	2	8
Switzerland	5	8
Taiwan	13	10
Thailand	1	10
Transvaal	1	8
Turkey	1	8
U.S.A.	257	1-6
Yugoslavia	1	8
TOTAL	464	

W. Thomas Weir
President, IEEE Reliability Society

Chapter Activities

Cleveland

The annual mid-year social was held at NASA LeRC, Guerin House. Old friends and new members got together for an evening of relaxation and a cold buffet. No speaker was used. Pool, ping pong and dancing were enjoyed by many.

Our January meeting was on NASA activities. Larry Ross, Center Director, took some time out of his busy schedule to bring us up to date on current events within the agency. The Red/Blue Team reports were discussed. Total quality efforts are being implemented. Many improvements were explained. Progress is being made on our Journey to Excellence. A timely, well received topic.

Our 5th meeting was on HDTV: Where we are; where we are going. This meeting was from The Learning Center Live Satellite Videoconference Seminars. Fourteen experts: Carey Carnona, et al talked about: HDTV and ATV Briefings, HDTV Standards and Regulations, Managing the ATV Standards, HDTV Appli-

cations, Electronic Cinema, From Past Production to the Future, Current Status of Projection Equipment, High Definition Production Equipment and Quality Considerations, HDTV and Film Interface. This meeting was very informative. Some could only get the notes.

RAMs '94 just about broke even. An earthquake and bad weather took their tolls. Hope we can do better next year. Our chapter will help RAMs '95 on the Publicity Committee.

Our community outreach project has made some progress. Six volunteers were obtained to staff the Program Committee. Dr. Pieter Cath will be Chairperson of this committee. A Call-for-ideas has been issued. This team can put together a nice one day workshop to build our "commandery" in Cleveland.

All-in-all here in Cleveland we are having fun serving as volunteers.

Sincerely,

Vincent Lalli

Chairperson, Cleveland Chapter

Dallas

The Dallas IEEE Reliability Society has had an outstanding 93/94 season. The average attendance at each meeting has been approximately twenty five (25) people and the speakers have been outstanding. A variety of topics related to device reliability, system reliability and defense and commercial electronics business have been presented and topics on power system reliability, software reliability and digital micromirror device reliability are upcoming. A brief listing of the topics and speakers that have contributed to our success is given below:

Month/Year	Topic	Speaker
Sep 93	Effects of Electrical Overstress and ESD in ICs	Dr. Charvaka Duvvury (TI)
Oct 93	Reliability and Customer Satisfaction in American Products	Jack Bedwell (Ford ELD)
Nov 93	Fighter Design from a Soviet Perspective	W.R. "Monty" Montgomery (Lockheed Ft. Worth)
Dec 93	"Inside the Beltway", A Current View From Our Nation's Capital	Tom Fagan (ITT Defense & Electronics)
Jan 94	IC Package Inspection With C Mode Acoustic Spectroscopy	Dr. Tom Moore (TI Central Research Labs)
Feb 94	Scanning Electron Microscope	Dr. Edward Cole Jr. (Sandia National Labs)
Mar 94	Electric Power System Reliability	Mark Carpenter (TU Electric)
Apr 94	Software Reliability Methodology in a Medical Device Environment	Mark Neal (Abbott Labs)
May 94	Digital Micromirror Device Reliability	Mike Douglass (TI)

Bill Grimes

Chairman, Dallas IEEE Reliability Society

Los Angeles

Our currently elected officers for 1994 are:

Chair	Dave Franklin
Vice-Chair	Winnfort Myles
Secretary	Myron Lipow
Treasurer	Winnfort Myles
PACE	Tyrone Jackson
Student	
Activities	Tyrone Jackson
Membership	Irv Doshay
Program	Loretta Arellano

Many chapter officers participated in RAMs where we were invited to be on the Host committee. This is the second time our chapter has been able to participate on the Host committee while RAMs has been in the Los Angeles area.

Two of our chapter officers, Dave Franklin and Winnfort Myles, were honored during 1994 Engineers Week at a luncheon where they were inducted into the College of Fellows of the Institute of Advancement for Engineering.

Meetings conducted this period include:

- August 93 — Andrew Shapiro of Hughes Electronics, gave us a presentation titled: Integrated Passive Components and Multi-Chip Modules (MCM). MCMs are claiming to be the packaging of the future.

- November 93 — Dr. John Carneghi of Hughes Aircraft, gave us a presentation on Avionics Design for Quality Assurance Systems. It was well attended especially by Hughes Aircraft employees.

We have scheduled a presentation on a Comparison of DoD vs. Commercial Software for March 94. We are also planning presentations on Electric Vehicles, Defense Conversion, Software Safety, and Quickring Controller.

Our Bulletin Board is very active with over 400 subscribed members. Membership is free. We offer meeting informa-

tion, Jobline, E-Mail, Video Tape Exchange information, Shareware and Demos. The phone is (818)768-7644, 300-2400 baud. Our Videotape Exchange program currently has over 150 videotapes available. The latest listing can be viewed and downloaded through the bulletin board.

Loretta Arellano
Los Angeles Chapter

Switzerland

During 1993, the Swiss Reliability Chapter organized, in cooperation with the Reliability Laboratory of the Swiss Federal Inst. of Technology (ETH), 6 meetings, one Industry-University Meeting, one international conference (EOBT 93), one national conference (Design Rules for Reliability) and two courses (Impurities in Silicon Wafers: Causes, Effects on Functionality, and Analysis; Reliability and Maintainability of Equipment and Systems).

Highlight of our activities has been the 4th European Conf. on Electron Beam Testing of Electronic Devices (EOBT 93). Beside the newest developments of the electron and optical beam techniques, which are nowadays quite standard in the industrial environment, it explored the capabilities of the most recent applications of the internal probing methods using Scanning Tunneling and Atomic Force Microscopes. EOBT 93 has been very successful with 114 participants from 14 countries, 33 full papers in 9 sessions, 17 poster papers, and 6 exhibitors.

The following activities are planned for 1994:

Conferences:

Oct. 20 - National Conf. on Reliability Aspects of the Surface Mount Technology (SMT) ETH room ETF E1

Courses:

March 2-3 - Failure Mechanisms and Failure Analysis of VLSI-ICs (M. Ciappa), ETH room ETZ E6

April 6-8 - Reliability and Maintainability of Equipment and Systems (Professor A. Birolini, in French), GESO, Geneva

Sep. 14-16 - Surface Analysis Methods for Microstructural Applications (P. Jacob), ETH room ETA F5

Oct. 18-19 - Quality and Reliability in Microelectronics and Microsystems (M.Ciappa ad P. Jacob), ETH room ETZ E7

Meetings:

Feb. 3 - Fault Tolerant Continuous Linear Processing Using a Recursive Kalman Corrector (Professor G.R. Redinbo, UC Davis)

March 14 - Statistical Methods in Reliability Theory (Professor I. Kovalenko, Ukrainian Academy of Sciences, Kiev), ETH room ETZ E6

May 9 - Distributed Fault Tolerance: Distinguishing Between Data and Control (Professor G.R. Redinbo, UC Davis)

May 16 - Reliability of Distributed Systems (Professor I.C. Bacivarof, Polytechnica Bucharest)

May 30 - Charge Loss in EPROMs with ONO Interpoly Dielectric (M. Herrmann, ETH Zurich)

June 20 - Software Quality and Reliability (Professor F. Popentiu, Polytechnica Bucharest)

July 24 - Point Processes in Reliability Theory (Dr. B. Gerlach, Humboldt Univ., Berlin)

The meetings take place at 5:15 pm at the ETH Zurich, room ETF C1. For further information please call Ms. Karin Ambuehl at +41 1 632-2743, fax: +41 1 251-2172, e-mail: birolini@nimbus.ethz.ch.

Alessandro Birolini
Chairman

Chapter Awards at RAMS

The reliability society presented its annual award to Mr. Ted W. Keller for his contributions to the reliable software for the U.S. Space Shuttle program. He is a Senior Technical Staff Member of the IBM Houston facility. He is also the Assurance manager for the Space Shuttle program. This program may be the only program in the world to qualify at a maturity status of 5 on the Software Engineering Institute maturity scale. It is judged to have six sigma quality. This has certainly been a world class software ef-

fort and it is with great delight that the reliability society presented this timely recognition.

The reliability society also recognized the fountain head of some of its best efforts. This is the three universities that have taken leadership positions in the field of reliability. These were:

- Dean Ernest T. Smerdon and the school of engineering and mines, University of Arizona for promoting to research and pedagogy in reliability engineering.

- Dean George E. Deiter and the college of Engineering, University of Maryland for contributions furthering the field of reliability engineering and reliability education.

- Dean J. Przemienicki and the school of engineering, Air Force Institute of Technology, in acknowledgment of academic leadership in pedagogy and research in Reliability engineering.

All award winners receive plaques. The annual award winner also receives an honorarium of \$500. The winners are determined by the awards committee which is always headed up by the past president. This year and next that will be Dr. Samuel Keene. Other members this year include: Dale Butler, Bob Jaquess, Bernie Bang, Al Plait, and Tom Fagan. Any nominations to be considered can be made to Sam Keene.

The 1993 Chapter awards were also announced at the AdCom meeting. While we have a number of very active chapters, only three can win the top honors. This year, the top Chapters and their awards were:

- First Place, Dallas, TX, \$500
- Second Place, Philadelphia, PA, \$300
- Third Place, Cleveland, OH, \$200

Our congratulations to Bill Grimes (Dallas), Fulvio Oliveto (Philadelphia), and Vince Lalli (Cleveland) for an outstanding job. We also encourage them to continue their excellent work.

Chapter awards are based on criteria that include such things as meetings, workshops, member participation in IEEE and outside activities, authorship/presentation of papers, etc. All chapters are eligible to compete; however, your activities must be documented and submitted to the evaluation committee. All submissions receive a minimum of \$100 and three lucky entrants will receive larger checks for their contributions to the Society and the Reliability profession. Consequently, the relatively small effort to fill out the paperwork and mail it in has a guaranteed reward that many of you have missed out on. A number of chapters known to be quite active slipped up this year and didn't send in their entries - we know you're out there - let's hear from you next time around and we will reward the effort.

Reliability Society AdCom Summary

The AdCom meeting was held January 24, 1994 at the Anaheim Marriott in Anaheim California. The next AdCom meeting is scheduled for April 11, 1994 at the Fairmont Hotel, San Jose, CA. AdCom meetings are open to any member. The July meeting will be held at IEEE Headquarters in Piscataway and the Fall meeting at the University of Maryland once again.

It was reported that turnaround time to publish Transaction articles is 15 months. This is primarily due to 9 months of review. Tom Weir agreed to appoint a committee headed by Hank Malec to evaluate existing review criteria and make a recommendation for improvement. The committee should report at the next meeting. Bob Schlentz recommended that un-refereed papers be put onto a Bulletin Board in order to utilize what information is available.

Mike Pecht reported that the industry version of MIL-STD-785 equivalent project is not a substitute for 785, but rather a new document that will address the same items. The first draft will be available prior to the next AdCom meeting and it was recommended that Mike Cushing give a presentation on its status at the next meeting.

Dr. Bob Kahrman, IEEE Education Committee, gave us a presentation on IEEE Satellite Videoconferences. It was proposed and agreed that we produce one on Software Reliability. IEEE has ran 7 courses to date.

Dick Doyle reported that a listing of Distinguished Lecturers has been published.

There are presently 3400 active members as of the end of 1993 including students.

The International RAMQ Conference was canceled.

New Reliability Society AdCom Members-At-Large were elected to a three year term ending in December 1996. The current AdCom members are shown below:

To 31 Dec 96	To 31 Dec 95	To 31 Dec 94
Dale Butler	J. Adams	Loretta Arellano
Joseph Gruessing	Gary Kushner	Henry Hartt *
Marvin Roush	Vincent Lalli	Dev Raheja
Dennis Hoffman	Henry Malec	Richard Kowalski
Richard Doyle	Michael Pecht	J. Thomas
Thad Regulinski	Alan Plait	W. Weir *

Note: * indicates second term - ineligible for reelection

Loretta Arellano
Secretary, Reliability Society

Free Proceedings

Your Reliability Society has a large number (over 300) of surplus copies of the 1992 IRPS and the 1993 RAMS proceedings on hand. We also have a small number (less than 30) of 1992 RAMS Proceedings.

Reliability Society members who did not get a copy of any of these and want one, may request a copy by writing the following address. Requests should identify the proceedings desired and confirm that the requester is a member of the Reliability Society. Requests will be filled only so long as supplies last. We have only the proceedings listed. Send to: Anthony Coppola, IITRI, 201 Mill Street, Rome, NY 13440-6916.

The Reliability Society will also honor requests by Academic Institutions for multiple copies of any of these proceedings for educational purposes, so long as supplies last. (e.g. We would be happy to provide a copy of a proceedings for every member of a class on reliability, if we have enough.) Individual Reliability Society member requests will have priority.

IEEE-USA Electronic Mail Services

IEEE United States Activities (IEEE-USA) is continuing to expand its distribution of information by electronic mail. Three new electronic "autoresponse" files have been established with Internet and Comppmail addresses to provide information on subjects of interest to IEEE's U.S. members. Several files already exist with such subjects as pensions, employment assistance, and lobbying. The new autoresponse files provide information on IEEE-USA Congressional Fellowships, Washington Internships For Students of Engineering (WISE), and Student Professional Awareness Conferences (S-PACs).

In response to messages sent to these addresses, the corresponding IEEE-USA text file is sent automatically by e-mail. Information on IEEE-USA's Congressional Fellowship program, including qualifications, application procedures, and a listing of past Fellows is available at info.ieeeusa.congfel@ieee.org (Internet) or info.ieeeusa.congfel (Comppmail). For WISE program infor-

mation and application procedures, the address is info.ieeeusa.wise@ieee.org (Internet) or info.ieeeusa.wise (Comppmail). To learn about S-PACs and how they're organized, contact info.ieee.spac@iee.org (Internet).

To use electronic autoresponse files, just send an e-mail message to the address indicated. No subject line or text message is necessary. Your message will trigger the autoresponse mechanism, which will return an e-mail file containing the requested information to your electronic address.

These autoresponse files are just a few of the many information files being developed by IEEE as a member service. For a complete listing of current files and their addresses, send your e-mail request to info.info@ieee.org (Internet) or info.info (Comppmail).

For more information contact:
Scott Grayson
Tel: (202)785-0017
Email: s.grayson@ieee.org

Wanted! A Few Good People to Serve on the RAMS Management Committee

A few energetic volunteers are needed to fill openings on the management committee of the Reliability Symposium. It's a great group of people, its educational and it can be career enhancing.

The management of the symposium is accomplished by sponsor member volunteers, with the concurrence and support of their corporate, government or academic employers. The Advisory Board, which is composed primarily of senior corporate and military management individuals, provides guidance on management of the symposium.

This is an opportunity to work with other professionals in the reliability (and associated) fields and meet senior management from both military and corporate sectors that are concerned with the analytic and practical techniques necessary to improve the reliability/competitiveness of our products.

If you can secure the necessary support to attend 3 or 4 one day meetings a year, attend the symposium in January each year, are a member of IEEE Reliability Society and are interested in further details on how to join this select group on the management committee, please contact: V. R. Monshaw, 1768 Lark Lane, Cherry Hill, NJ 08003, (609)428-2342.

New 1994 IEEE Reliability Society Members

- | | |
|--|--|
| Mr. Ogunjebi T. Ayodele
Sacramento CA | Mr. Wai-Leung Chung
Kowloon HONG KONG |
| Mr. Mohammad H. Awedh
Jeddah SAUDI ARABIA | Mr. Kazue Kato
Kodaira Tokyo JAPAN |
| Mr. Ivan Moscoso-Duran
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Andover MA |
| Mr. Ting-Kai Hwang
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| Mr. Hung-Pin Chen
Hsin-Chu TAIWAN | Mr. George Shirilla
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| Mr. Frank P. Jufano
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| Mr. Harold A. Brassert
Pittsburgh PA | Mr. Subhash R. Nariani
San Jose CA |
| Mr. Daniel J. Pearson
Hayward CA | Mr. Richard LaRiuee
Quebec CANADA |
| Mr. Alfred J. Clinton
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| Mr. Richard K. Stobart
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| Mr. Erik Hollnagel
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| Mr. Manbulbul Hassan
Upton NY | Ms. Maria R. Macapobre
Laguna PHILIPPINES |
| Mr. Alexander Manta
Penzberg GERMANY | Mr. Yeon-Suk Lee
Kunsan KOREA |
| Mr. Arcenio Torres
Santa Fe de Bogota COLOMBIA | Mr. James L. Montgomery
Hurst TX |
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Shizuoka-Pref JAPAN |
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Brookline MA | Mr. F. Takacs
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Edmond OK | Mr. Claude Thibeault
Quebec CANADA |
| Mr. So Y. Youn
San Jose CA | Mr. Charles G. Mink
Colorado Springs CO |
| Mr. M. V. Taneja
Milpitas CA | Mr. Mark W. Michael
Cedar Park TX |
| Mr. Roland Ekinge
Comerio Varese ITALY | |

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1-800-678-IEEE

Electronic Bulletin Boards

Los Angeles Chapter
(818) 768-7644 300-2400 Baud (8N1)
Free Membership — (400+ members)
Meeting information, Jobline, Email,
Video Tape Exchange
Information, Shareware and Demos

Statistics Bulletin Board System
(316) 265-3036 1200-2400 Baud (8N1)
Free Membership
Statistics, Reliability

Computer Aided Logistics System (CALS)
(703) 321-8020 300-9600 baud 8N1
The CALS BBS is reached through this number to the National Technical Information Service (NTIS) BBS. Membership is free.

Defense Electronics Supply Center (DESC) Engineering Standardization Bulletin Board System
Latest information on many standard military electronic part drawings under the control of DESC
DESC-RBBS:
(513) 296-6046 300-2400 baud, 8N1
(513) 296-8875 9600 baud, 8N1,
V.32/V.42
Sysop: Cindy Prich, (513) 296-6347

JPL/NASA Radiation Effects Data Bank
Test data on Single Event Effects and total-dose for electronic parts
BBS: (818) 393-4156, 1200 baud, 8N1
(818) 306-6920, 1200 baud, 8N1
Sysop: Keith Martin, (818) 354-0319
After logon hit return and type RADATA in response username, no password required.

DOD Field Failure Return Program (FFRP) Reliability Bulletin Board
This Bulletin Board provides information concerning the DOD FFRP program as well as providing a vehicle for both commercial and government users to exchange ideas and information on component and system problems.

1200 baud or less
8 Data bits, no parity, 1 stop bit
(315) 339-7120, Access
(315) 339-7043, Questions

NEW RELIABILITY SOCIETY FELLOWS

We are pleased to announce the following Reliability Society members that are newly elected IEEE Fellows (as of 1 January 1994):

Dr. Yalcin Ayasli

Hittite Microwave Corporation
Woburn, MA

For contributions to the design and development of wide band gallium arsenide (GaAs) monolithic microwave integrated circuits (MMIC's).

Dr. Charles C. Huang

Anadigics Inc.
Warren, NJ

For engineering contribution and technical leadership in the development of high-volume GaAs MMIC's for commercial applications.

Prof. Hermann Kopetz

Inst. fur Tech. Informatik
Wien, Austria

For contributions to the field of fault-tolerant real-time local-area distributed systems.

Dr. John H. Lau

Palo Alto, CA

For advancement of electronic packaging with special contributions to soldering science and fatigue studies.

IEEE 1994 Standards Catalog

The 1994 Standards Catalog has just been released. It provides you with a complete listing of all active IEEE Standards publications available from IEEE, along with the ordering information you need to place an order. To receive your FREE copy of the Catalog, call (908)562-3824. If you prefer, send a fax to (908)562-1571. IEEE standards can be ordered by phone at (800)678-IEEE (US & Canada), or (908)981-1393 (Outside US & Canada).

The Status of the Reliability Technology January 1994

In past surveys of trends in the Reliability (and Maintainability) technology, it has been predicted (by Kam Wong in 1982) that statistical analysis would yield prominence to the detection of defects, which would in-turn be replaced by emphasis on defect prevention. Other sources (Coppola, circa 1985) saw a change in the R&M engineer's mission from traditional R&M duties to the creation of R&M packages for computer aided design (CAD). The Total Quality Management (TQM) movement (starting with NBC's 1981 Special "If Japan Can, Why Can't We) called for preventing defects in lieu of finding them, improving processes in preference to testing to cull out poor product and for teamwork between suppliers and customers instead of the traditional adversarial relationship. All these ideas are evident in the current R&M technology.

In addition, the R&M discipline has always reflected the transcendent themes of the times. The declining DoD budget has supported development of methods to "do more with less" and encouraged teamwork with DoD suppliers. The national emphasis on (total) quality improvement led to policies on concurrent engineering, and the need for increased competitiveness in international markets led to a demand for dual-use technology. These added to pressure for change to traditional approaches, for example to reduce requirements for conformance to military standards, and to encourage conformance to ISO 9000, the international quality standard. The continuing development of computer aided design (CAD), computer aided manufacturing (CAM) and the integration of the two, threatens that R&M efforts not integrated into the automated process will be irrelevant.

Inside the discipline, the search for more effectiveness has led to new approaches, debates on the utility of traditional tools, and disparagement of "bureaucratic" approaches including ISO 9000.

The epitome of current trends is the replacement of the Qualified Products List (QPL) by the Qualified Manufacturers List (QML) for DoD procurements of integrated circuits for new systems. QML permits the use of best commercial practice, makes it possible to use one process for commercial and military products, permits a single DoD/Industry validation, and calls for constant improvement of the production processes. The QPL system, which required the certification of individual products to government imposed criteria, is now used only for support of systems acquired before QML implementation. Current plans are to expand the QML program to include GaAs, Hybrids, multi-chip modules and chip-on-board devices. MIL-I-38535, "General specification for Integrated Circuits (Microcircuits) Manufacturing," the QML guiding document, will become a national dual-use standard in an effort supported by the Air-Force Industry Reliability without Hermeticity (RwoH) program and the Tri-service/NASA Reliability Technology to Achieve Insertion of Advance Packaging (RELTECH) program, and using inputs from MIL-H-38534 "General Specification for Hybrid Microcircuits," the Microelectronics Computer Technology Corporation (MCC) RwoH test plan, the Hughes Chip-On-Board General specification, the MCC/SEMATECH Known Good die program, the Rome Laboratory Known Good Device program, and ISO-9000. An Industry Coordinating Working Group will review and evaluate the proposed specification.

The QML program has many elements in common with the Total Quality Management (TQM) movement. It is interesting to note that the principles of TQM are being widely adopted, even as the title "TQM" seems to be going out of favor. Articles have appeared questioning the effectiveness of TQM in specified applications, and have been answered by other articles citing success stories and sug-

gesting that the TQM name has been tarnished by half-hearted applications, and by too many consultants jumping on the TQM bandwagon in name only. Nevertheless, TQM initiatives continue under new titles such as CI (constant improvement) or TQL (Total Quality Leadership) and others including no title at all. TQM students may notice hospitals, car dealers, department stores and others trying to obtain the "voice of the customer," empowering employees and improving processes, without fanfare or labels. While the Malcolm Baldrige national quality award has taken some flak in the press, a number of regional awards have been established based on the Baldrige criteria, such as New York State's Excelsior award. TQM books, of various utility, are flooding the market.

The emphasis on constant improvement has reinforced the philosophy that there is no limit to the reliability achievable so long as effort continues. This, and other factors, has led to a deemphasis on reliability predictions and reliability qualification tests in favor of design analysis and reliability growth testing. However, predictions still have a place (for example, in logistics planning) and reliability qualification testing may be useful in small lot buys of new designs. Buyers will still consider qualification testing essential where the traditional adversarial relationship between supplier and customer has not been replaced by a more cooperative relationship.

The current needs of the reliability and maintainability discipline include the development of a "quality culture" in which all parties involved work together to produce a quality product. This is one of the tenets of TQM and one of the points in the teachings of W. Edward Deming, the recently deceased quality leader. Creating this culture is hampered by autocratic tradition and existing bureaucracy. For example, the Federal acquisition regulations (FAR's) governing U.S. Government purchases discourage teamwork between suppliers and customers. The FAR's rely on demonstrated compliance to government standards as the means of assuring quality. Ironically, it is increasingly believed in government agencies that private industry has a better handle on quality than the government and the adoption of commercial practices is fre-

quently proposed. Even more ironic is that commercial reliability programs are often based on military standards, without the formal proofs of compliance.

A current requirement for suppliers of designated products for Europe is compliance to ISO 9000, the international quality standard. ISO 9000 has been hailed by some as the means for establishing a universal quality culture and condemned by others as counterproductive. ISO 9000 usage requires a "third party" to certify that a supplier's quality system is compliant to stated general standards. The intent of this certification is to remove the need for the customer to audit the supplier. A problem for American Suppliers is that there is no guarantee that the customer will accept certification by an American third party. The American National Standards Institute and the American Society for Quality Control have established a Registrar Accreditation Board (RAB) to examine and certify the competence of third party auditors. It is intended that RAB accreditation will be accepted by European customers, but this arrangement is not yet established. As a result, while ISO 9000 is intended to encourage free trade, there are some fears that it may become a trade barrier. It should also be noted that ISO 9000 provides for certification of a quality system, not of the quality of products produced under that system. Hence, to insure competitiveness it may be necessary to qualify to ISO 9000, but it is not sufficient. Philip Crosby, the author of "Quality is Free" commented that a company certified to ISO 9000 tends to stop trying to improve. Such a company may become worse off for its efforts. It should also be noted that Japan did not need ISO 9000 to become the world's quality leader. Their success came because the Japanese suppliers used quality as a selling point, and therefore did not need to be forced to comply with a quality standard imposed by the customer (a quality culture existed). However, it must also be noted that Japanese companies are adopting ISO 9000 as a competitive necessity, and in some cases have used ISO 9000 certification in lieu of customer audits.

A dominant technology trend is the advance of computer aided design (CAD). Some designs would not be possible without CAD, and the time required

for manual design procedures is increasingly a liability in today's hotly competitive environment. The ease of modifying a proposed design on CAD and the power of the computer for analysis are assets for designing in reliability. On the negative side is the need for reliability analysis packages able to interact with the CAD programs. The current situation, in both hardware and software reliability, is that "islands of automation" exist which do not interact with each other.

Needed, therefore, is the integration of reliability engineering tools with each other and with CAD packages. The IEEE Reliability Society has been addressing the issue in an annual workshop on computer aided engineering which in January 1994 became an adjunct to the Annual Reliability and Maintainability Symposium. The Army Armament Research Development and Engineering Center and the Air Force Armstrong Laboratory have a joint program called RAMCAD (Reliability and Maintainability Computer Aided Design) to develop a prototype integrated capability and to apply artificial intelligence as a design aid. Rome Laboratory is also establishing a framework for integrating reliability, maintainability, testability and manufacturing into a designer's computer, and developing specialized packages such as one to analyze the susceptibility of a circuit under design to electromigration.

Related needs are the design of user-friendly reliability packages, and the development of a hardware description language for analog and hybrid circuits. VHDL (the VHSIC Hardware Description Language) has done much to enhance the exchange of automated information between designers of digital circuits; an extension of VHDL to other types of circuits is still to come, but is under development at Rome Laboratory.

Another need to make reliability analysis an effective part of CAD is an understanding of the failure mechanisms in new technology such as GaAs, multi-chip packages and 3-D packaging. Powerful tools such as finite element analysis can determine temperature and stress values within a design, but the connection between stress and failure must be established and quantified.

The cost of software and the dependency of modern systems on it make soft-

ware reliability a critical issue. Software maintainability, meaning the ability to make changes without introducing errors, is also important. Yet too many programs are still produced more as artistic creations than as engineered products. Invocation of MIL-Std-2167A, the software development standard, has not alleviated the problem; one software specialist called the standard "at best neutral" to software reliability.

However, a trend to designing-in software reliability does exist. The error-reducing methods of M.E. Fagan are in wide use. More developers are automatically collecting and routinely using software metrics. Computer Aided Software Engineering (CASE) tools are being developed to aid in improving software quality. Here again, islands of automation exist which do not work together. A joint service program called I-CASE (Integrated Computer Aided Software Engineering) is being pursued to bridge the gaps.

Also, a Software Quality Framework has been developed by Rome Laboratory. It was adapted by Japanese software producers who reported that it enabled them to increase software reliability and simultaneously lower costs. The framework is being applied to a variety of programs by a consortium of Rome Laboratory, Grumman, SoHar, TRW, CTA, Frontier Engineering and Hughes. Members of the consortium will exchange data to evaluate and refine the techniques included in the framework.

Concerning maintainability, Air Force analysis of operations in Desert Storm found there was too long a "logistics tail" in the combat zone and resurfaced the need for two level maintenance (flight line and depot) with no intermediate shop. Current efforts to meet this need include the Integrated Maintenance Information System (IMIS) program by Armstrong Laboratory to (among other things) demonstrate a portable maintenance aid which can obtain needed diagnostic information by radio links. IMIS technology is being developed with the aid of the Air Force F-16 and F-22 Program offices, the Navy David Taylor Research Center and the Navy Ocean Surveillance Center. The portable main-

tenance aid was tested on Navy F/A-18 flight control system failures and proved superior to the standard paper manuals. Also pertinent is a Rome Laboratory program to develop design tools to create an integrated chip to system diagnostics capability built into the product.

A popular development of Rome Laboratory has been the Time Stress Measurement Device (TSMD). Originally designed as a self-contained unit to measure temperature, temperature cycling shock, vibration, and the presence of moisture in an equipment bay, a second generation TSMD was designed as a hybrid microcircuit which could be integrated into a printed circuit board. TSMDs are currently flying in 40 B-1 aircraft. A third generation TSMD is now in development which will add the capability to measure the electromagnetic environment. One potential user is the FAA.

Though widely used for parts testing, accelerated testing has not yet been prac-

tical on the equipment level. A Rome laboratory study suggests that the empirical methods used in the Statistical Design of Experiments could be employed to determine acceleration factors for equipment.

Finally, papers on Fuzzy Logic are starting to appear in the reliability literature. The 1994 Annual Reliability and Maintainability Symposium includes a session on its applications to reliability and maintainability. The importance of this trend is not yet apparent. However, most of the authors seem to be affiliated with academic institutions, and it is possible that the esoteric papers on redundancy modeling so common in the literature will in the future be replaced with esoteric papers on fuzzy logic analysis.

Anthony Coppola
Chairman, Advanced Technology
Committee
IEEE Reliability Society

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Reliability Program Standard Survey

The IEEE Reliability Society is developing a Standard Reliability Program for product development. Results of this survey will be used in the development of the new standard. Please take a moment to fill out the survey and mail to:

DIR, USAMSAA
ATTN: AMXSY-RP (T. Stadterman)
Aberdeen Proving Ground, MD 21005-5071

1. Which of the following categories describes your organization? (Circle all appropriate)

- a) Computers industry
- b) Communications industry
- c) Aircraft industry
- d) Automotive industry
- e) Consumer electronics
- f) Defense industry
- g) Other (please specify) _____

2. What position do you manage or perform?

- a) Reliability Engineer
- b) Research and development
- c) Design Engineer
- d) Production, manufacturing, process engineering
- e) Quality control/assurance, production testing
- f) Other (please specify) _____

3. My organization operates as a: (Circle all appropriate)

- a) Product designer
- b) Product manufacturer
- d) Customer/contract office for product design
- e) Customer/contract office for product manufacture

4. What is the size of your organization?

- a) small (1-100)
- b) medium (100-1000)
- c) large (>1000)

For questions 5-7, please note the letter(s) of the appropriate standards. If another standard applies, please specify.

- a) MIL-STD-785
- b) ARMP-1
- c) IEC-300
- d) Internal standard
- e) No reliability program standard

5. Which of the above standards do you use? _____

6. Which of the above standards are you contractually obligated to use? _____

7. Which of the answers in question 6 would you use if not contractually required? _____

For questions 8-10, please note the appropriate letter(s) of the following tasks.

- a) Reliability program plan
- b) Control of subcontractors and suppliers
- c) Program reviews
- d) FRACAS
- e) Failure review board
- f) Reliability modeling
- g) Reliability allocation
- h) Reliability prediction
- i) FMECA
- j) Environmental stress screening
- k) Reliability development/growth test
- l) Acceptance tests

8. Which of the above tasks do you perform? _____

9. Which of the above tasks do you believe are important? _____

10. Which of the above tasks do you believe should be included in the IEEE Reliability Program Standard? _____

11. Which of the following would you like to see in a reliability program standard? (circle all appropriate)

- a) More processed based approach/less task oriented
- b) More science based/engineering approach
- c) A process in which root causes of failures are eliminated before product is built and tested
- d) More statistical tests and predictions
- e) More tasks

12. Please provide any other comments on MIL-STD-785, or any other reliability program standard you use, to help us develop the IEEE Reliability Program Standard.

OPTIONAL INFORMATION

Name _____

Organization _____

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ence on Fault-Tolerant Computing Systems" was organized (from 1982 up to 1991) by the German Technical Interest Group "Fault-Tolerant Computing Systems". The other series, known as the "International Conference on Fault-Tolerant Systems and Diagnostics", was annually organized (from 1975 up to 1990) by Universities and academic research institutions in the former Czechoslovakia, Poland, Bulgaria and the former GDR. EDCC will be organized every two or three years in different European countries.

For more information contact: Dr. David Powell, LAAS-CNRS, 7 Avenue du Colonel Roche, 31077 Toulouse, France, Tel: +(33) 61 33 62 87, Fax: +(33) 61 33 64 11, E-mail: David.Powell@laas.fr

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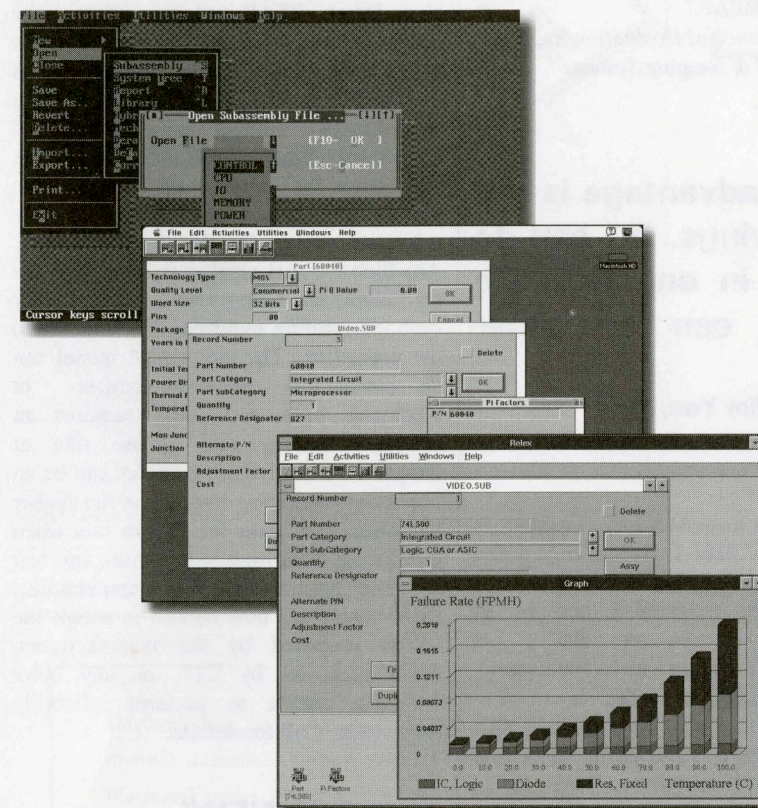
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Volume 2, Number 2

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