Reliability Society

N E W S L E T T E R http://www.ieee.org/society/rs

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C O N T E N T S

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Dave Franklin
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John Healy
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Bob Gauger

President's Message

Perspectives

December 31, 2000 brings to a close my two terms as your President. It has been an experience, which I have enjoyed thoroughly. In 2001, I become the Junior Past President with fewer duties but no less enthusiasm for the growth and health of the Reliability Society. As always, I will look forward with working with many of you.

Much of my enjoyment as President in 2000 has been due to the support of the excellent management team that we have had in place. In the Publications area, Bob Loomis, Way Kuo, and Dave Franklin have done marvelous jobs in maintaining and even enhancing both our Transactions and Newsletter. Sam Keene has done an excellent job in continuing our video tutorial program, also a part of Publications. In Technical Operations, Koichi Inoue, with the support of Christian Hansen and the technical operations chairs, has not only increased the technical activities, but also has produced our finest annual technical report. Jeff Voas has done an excellent job of coordinating our meetings and has made major contributions to our "globalization" efforts by arranging non-U.S. meetings and seminars. Jeff also has done an excellent job managing our conferences. I would like to give special recognition to Peggy Wallace, an associate of Jeff's. Peggy has given us substantial help with meetings throughout 2000. Our Membership team, headed by Marsha Abramo and Pat Hetherington and supported in the Chapters area by Loretta Arellano, has done a fine job in maintaining membership and elevating qualified members to Senior Member status. Dick Doyle deserves recognition for his work in proposing updates to our constitution and bylaws, as does Loretta for her work with elections and awards. I send congratulations to Loretta for her election as Division VI Director. It's good to have a Reliability Society person in the upper echelons of IEEE management. The other AdCom members also provided substantial support to the above-mentioned people and worked special projects. I appreciate their efforts greatly. Finally, I thank all of those who have worked as editors, meeting arrangers, and special representatives for their efforts in making 2000 a successful year.

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Editor's Column

Awards Awards Awards

Year 2000 brought many awards to the Reliability Society.

- At the January awards banquet, we saw Joanne Dugan and Jeff Voas share the Reliability Engineer of the Year award. Sam Keene walked away with the Education award and we awarded the Lifetime Achievement Award to R. Owen Holbrook.
- Chapter awards are usually held at the March meeting, but to coincide with the Millenium Medal awards, the chapter awards were given in July in Burlington VT. First place chapter award went to Boston (chairperson: Jim Fahy), 2nd place to Dallas (chairperson: Lon Chase) and 3rd place to Denver (chairperson: Sam Keene).
- IEEE awarded 3000 Millennium Medals in 2000, and 21 medals were received from Reliability Society members. The medals were awarded in July, at Burlington.

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Reliability Society Newsletter Inputs

All RS newsletter inputs should be sent to:

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Newsletter	Due Date
January	October 8
April	January 8
July	April 8
October	July 8

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President's Messsage

Continued from page 1

I would like to send congratulations to the new set of society officers:

Dennis Hoffman – President
Bob Loomis – Vice President for Publications
Koichi Inoue – Vice President for Technical Operations
Jeff Voas – Vice President for Meetings
Ann Campbell – Vice President for Membership

These all are excellent, experienced people who deserve your full support. Along with my congratulations to them, I also send them a challenge to maintain and expand the society and to increase society services to the members. In 2000, we took some steps to increase services, but there is more to be done. Lest the officers consider themselves unfairly challenged, I also challenge the society members to become more involved in society efforts to increase services to the overall membership. Nothing is more frustrating to an officer than to have a good idea and then not have the human resources to convert it to reality.

The above focuses primarily on the internal perspective. But there is the larger external IEEE perspective for the Reliability Society. The IEEE perspective has been a dynamic one in 2000 and promises to be even more dynamic in 2001. IEEE is in the process of updating its strategic plans. The Reliability Society will participate in developing the IEEE strategic plans and then in determining how it should implement those plans plus its own strategic initiatives. The financial aspects of the IEEE perspective also have been dynamic in 2000 and may be dynamic in 2001. Although proposals for a new IEEE financial model were defeated in 2000, new approaches to financial modeling are arising as part of the strategic planning process. How these new approaches to financial management affect the Reliability Society remains to be seen. Reliability Society members should expect a continuation in the "globalization" of IEEE, although the exact form of this seems unclear at this time. As most of us know already, the technology environment is changing rapidly in a great many areas. IEEE is adapting to the rapidly changing technological environment by creating new technology committees, councils, and publications. Major considerations in the strategic planning process are how to involve IEEE more rapidly in new technology evolution and how to disseminate new technology information more rapidly to the IEEE members.

From our own internal perspective and the external IEEE perspective, 2001 promises to have many stimulating activities. Be part of them!

Best regards,

Ken

Kenneth P. LaSala, Ph.D.
President,
IEEE Reliability Society
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Chapter Activities

Boston Chapter

The Boston Chapter is in the middle of another very active year.

The season began in September with a monthly meeting on "Software Reliability Estimations and Projections," given by David Dwyer of Sanders, a Lockheed Martin Company.

In October, we held a Fall Lecture Series on "Weibull Analysis of Reliability and Accelerated Stress Test Data." This three-evening event was presented by our technology experts, Joe Dzekevich of 3Com Corporation and Gene Bridgers of Sycamore Networks. Joe and Gene organized our last three lecture series, and we thank them for their continued support of the Chapter.

The November monthly meeting consisted of a "Tour of Integrity Design and Test Services" in Littleton, MA. Alex Porter of Entela, the parent company of Integrity, also discussed a variety of accelerated testing topics, including one of the latest developments in Environmental Stress Screening: Failure Mode Verification Testing.

Our annual Past Chairs Meeting was held in December. All previous Chapter Chairs were invited to attend, and each was introduced during this popular dinner meeting. Giora Kedem of Avici Systems gave a interesting talk on his experiences with "Printed Circuit Board Reliability."

The next three monthly meetings will cover different approaches to reliability prediction. In January, Joe Dzekevich of 3Com Corporation will discuss the "Relex" software tool. In February, David Tang of CTI-Cryogenics will review the new "PRISM" methodology, developed by the Reliability Analysis Center.

In March, Gene Bridgers of Sycamore Networks will present his own parts count approach and "Prediction Tool." Joe Dzekevich and Gene Bridgers will team together again in March to bring us a Spring Lecture Series on "Design of Experiments Featuring the Fusion One Tool."

The April monthly meeting will be hosted by Dana Crowe of M/A-Com in Lowell, MA, who will guide us on a "Tour of M/A-Com," focusing on their World Class Environmental Testing and Analytical Physics Laboratories.

Finally, our capstone event is the "38th Annual Spring Reliability Symposium," which will be held in May. This year's theme is "Reliability and Safety," and Dr. William Goble, author of the book "Control System Safety Evaluation and Reliability," will be the keynote speaker. John Rooney is serving as the Program Chair, and there is still time to submit papers to him for possible presentation at the Symposium.

For more information on Boston Chapter activities, please visit our web site at http://www.channel1.com/users/ieee/home.html.

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(ED/Reliability/CPMT Joint Chapter)

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Engineers of the Year

Joanne Bechta Dugan

Jeffrey M. Voas

Education Award

Sam Keene

Lifetime Achievement Award

R. Owen Holbrook

Chapter Awards

Tim Rost (Dallas)

Sam Keene (Denver)

Dick Kowalski (Baltimore)

1st place: Boston – chairperson: Jim Fahy
2nd place: Dallas – chairperson: Lon Chase
3rd place: Denver – chairperson: Sam Keene
4th place: Philadelphia – chairperson: Fulvio Oliveto
4th place: Baltimore – chairperson: Walter Willing

Millennium Medal Recipients

**Medal awarded through Section/Region*

Abramo	Arellano*	Campbell Ciappa	Doyle*	Dugan
Hoffman	Inoue	Keene	Kowalski	Kuo
LaSala	Loomis	Nitta	Rost	Tonti

IEEE Reliability Society AdCom Meeting

July 15, 2000 Burlington, Vermont

Those in attendance, Alan Street, Loretta Arellano, Bud Trapp, Bill Tonti, Koichi Inoue, Dick Kowalski, Robert Loomis, Ken LaSala, Bob Gauger, Jeff Voas, Dick Doyle, Way Kuo, Dennis Hoffman, John Healy, Marsha Abramo, Sam Keene, Ann Campbell, David Franklin, Shuichi Nitta, Tim Rost.

The meeting was called to order at 8:30AM. A quorum was present. The agenda was approved.

The minutes were approved. Past action items were reviewed and status updated.

President's Report:

Ken La Sala discussed the TAB Strategy Planning meeting. Meeting to be held in Irving, TX and Dennis Hoffman to attend if possible. IEEE is conducting an Industrial Relations Study – not sure where it is headed. Recommendations are open to RS for TAB positions if someone is interested. If you want to get involved in TAB and want one of these positions, please let Ken know.

Treasurer's Report:

Dick Kowalski gave his Treasurer's report. An additional investment (approved at the April AdCom meeting) was made on June 30 and acknowledgment was received from the IEEE. The potential IEEE overhead assessment to RS is being projected at $74.5K in 2000 and $123.4K in 2001. Dick reviewed new the budget from IEEE.

- Action: Koichi Inoue needs to review and make a recommendation at the Jan 2001 AdCom meeting on Council sponsorship. Basically, are we getting our money's worth?
- Motion: Motion made by Bud Trapp and seconded by David Franklin that this presented budget be accepted, as long as updated changes to IEEE are acceptable. Motion approved.

Meetings:

Jeff Voas gave the Meetings report. 1998 IRWS closed with a surplus to RS. Waiting on close outs from ISSRE'99, IRPS'99, IRWS'99, RAMS'00, and IRPS'00. Dick Kowalski is waiting for the reports. Suggestions for site of 2001 outside US meeting were Taiwan, Singapore, and Hong Kong.

- Action: Loretta is to get with LA Council to secure booth space for a RS display at WESCON / AUTOTESTCOM and to stay in touch with Jeff.
- AdCom approved technical sponsorship of the ASQ Six Sigma conference in Las Vegas

Membership:

- Action: Membership to review the IES membership program, Millennium for Success, material to see what that organization is doing to retain and capture members and possibly develop some ideals for RS.

Publications:

Bob Loomis opened the floor for his team to give their reports. Dr. Way Kuo stated that the 2000 issues of the Transactions are full. Delay in next issue is due to electronic input delays within IEEE. Now taking a month versus a few days before. Appointing Associate Editors for renewable 4-year terms. Ann Campbell reported that the TDMR was developing a web site for author interaction and that Bud Trapp, Bill Tonti, and Ann were on the TDMR Management Board. Tony Chan will lead the Accelerated Testing video development.

- Action / Suggestion: David Franklin asked Way to make available to him the authors of papers not detailed enough for the transactions as a source for possible publication in the Newsletter.
- Action: Bob Loomis to look into and make recommendation for TSM and RS involvement in TDMR.
- Action: Bob Loomis to pull the open-positions listings out of Discussion section and make a separate section for open-positions on RS web site.
- Action: Bob Loomis will have the IEEE expense report template added to web site.

Jr. Past President's Report:

Loretta Arellano gave her report. Loretta identified the new AdCom candidates, identified the IEEE Millennium Award recipients, and identified the RS Chapter Award winners. The San Diego RS chapter became official. Washington DC chapter went inactive – anyone in that area interested in getting this chapter active again needs to contact Ken La Sala.

- Action: Dennis Hoffman to do members' attendance check for AdCom meetings.

Lunch Discussion

Improvement Ideals:

1. AdCom members and officers need to identify RS jobs that are available, with job descriptions and with time commitment estimates for pre-screening use.
2. New AdCom member mentoring / assigned to a VP.
3. Four meeting a year seem to be a good number – present schedule okay.
4. Welcome new AdCom members, first via a letter letting them know what to expect and to think about their AdCom involvement.
5. Need to develop a RS Purpose and Mission Statement for the letter.

Tech Ops Report:

Koichi Inoue provided the AdCom with a written status report that he distributed to the members. A Newsletter article was in the July issue covering Tech Ops Technical Committee Reorganization – Part 2. New Tech Ops chairs were appointed: Keith Janasak (R&M CAE), Clement Aladekugbe (Automotive Systems), and Hiroshi Yajima (Industrial Systems). Hank Wolf (Info Tech & Com) resigned as he is retiring – many thanks to Hank for many years of service. The Annual Tech Ops Report on Status of Rel Eng Technology 2001 will be developed for publication.

- Action: Ken LaSala took an action to call Dr. Roush and Mark Lively about their Tech Ops reports.
- Action: Tech Ops Chairs need to submit inputs for the Annual Tech Ops Report by 1 August 2000.
- Action: Koichi Inoue will send John Healy and David Franklin job descriptions for the Systems chair.
- Action: Jeff Voas and Marsha Abramo need to reconcile the IEEE and RS speakers lists.
- Action: Koichi Inoue to review Council involvement, along with travel and other liabilities, and make pro / con recommendation in Madrid if possible.
- AdCom approved covering part of the travel expense for Sam Keene to give his SW Reliability and Six Sigma Process Initiatives presentation and to promote the IEEE and the RS. for the Tokyo RS Chapter.
- Action: Koichi Inoue will contact Yvonne Lord on status of P1413 and send out status prior to October meeting.

Standards Status:

- *August 2:*

The Standards and Definitions Committee currently is involved in two standards projects. One, P1467, is addressing the planning aspects and assessment methodology for reliability growth programs. This standards document is intended to be a replacement for MIL-HDBK-189. New technologies are not a part of this project. The second project, P1413.1 under the sponsorship of IEEE Standards Board SCC37, concerns the selection and use of existing reliability prediction methodologies. There is no plan to develop new prediction models for specific technologies. To summarize, the current work of the Standards and Definitions Committee does not address new reliability technology. Perhaps future work by some of the technology-specific committees could be the subject of a standards document.

- *August 14, 2000:*

P1467 - This Working Group is currently upgrading their PAR for submittal to the Standards Board before the current PAR expires at the end of the year. The major upgrade is a change from a guide to a recommended practice. Dr. Paul Ellner, the Working Group Chair, reports that he expects to have the initial draft of the complete document ready for review by the entire working group before the end of the year.

P1413.1 - This project, sponsored by IEEE Standards Board SCC37, expects to have an initial draft ready for Working Group review in the mid-October time-frame. Minutes of meetings and teleconferences are posted on the web after they are approved: http://grouper,ieee.org/groups/reliability/wg1413/index.html. These minutes provide such information as meeting schedules, action item lists, document outlines and participation. This group has a goal of monthly interchange.

- *Oct 12, 2000 Update:*

The status above is current. P1467 is striving to meet a 27 October deadline for submittal of the revised PAR. The requirement for IEEE and SA memberships is the current barrier. The next P1413.1 meeting is scheduled for 16 and 17 October in Phoenix. I have made arrangements to attend. Draft 0 of the standards document is a planned outcome of that meeting. Meanwhile, P1468 - 70, which have been languishing for nearly 4 years, were successfully withdrawn at the 21 September Standards Board meeting.

Sr. Past President's Report:

Dick Doyle went over his changes to the By Laws with much discussion by the AdCom. Dick was given a feel for the items that were acceptable and what wasn't so he could continue with his revision process.

- AdCom approved allowing for AdCom business to be voted on between meetings. It would be taken by e-mail. Dick to incorporate in final draft.
- Action: Dick Kowalski to send Dick Doyle the latest copy of the RS Field of Interest statement.

New Business:

- AdCom approved setting aside seed money to sponsor a one day Critical Systems Safety Conference at the IEEE ECBS (Engineering Computer Based Systems) Conference in April 2001, with the seed money not to exceed $5K.

Meeting adjourned.

IEEE AdCom Meeting

October 21, 2000 Crowne Plaza Madrid City Center Hotel Madrid, Spain

Attendees:

Dennis Hoffman, John Healy, Luis Gandia, Bob Loomis, Bud Trapp, Ken La Sala, Bob Gauger, Jeffrey Voas, Dick Doyle, Marsha Abramo, Loretta Arellano, Koichi Inoue

Ken La Sala called the meeting to order a few minutes after 9:00 AM. Ken welcomed everyone to Spain and to the AdCom meeting. The agenda was approved. The meeting minutes from the last meeting were approved.

President's Report:

Ken La Sala provided his report. IEEE Strategic Planning — First meeting was held in Dallas. This meeting resulted in working groups being formed to work on mission statement, pro and cons, threats, electronic publishing, etc. A second meet-

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IEEE AdCom Meeting

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ing is planned for Saturday, Nov 18, that Ken plans to attend. Major items not presently covered are the IEEE organization and international membership. Planning sessions are planned and focused with too much headquarters involvement.

Ken did not attend the last Super Conductivity Council meeting. His attendance was excused by the Chair. The next Sensors Council will be held on Oct 28, 2000. Ken plans to attend. The council presently focuses on publications and conferences. The Council does not have technical committees. The council should focus on areas of sponsoring-society interest, but this is not their prime concern.

Action Item Review:

All of the Open action items were status'ed. Where action was completed, the action item was closed. The closed items are provided at the end of the minutes.

- Action — Koichi Inoue is to get with Yvonne Lord on distribution list for Standards Working Gro7ups to ensure that the AdCom members are listed.
- Action — Dennis Hoffman is to complete action to document member attendance for last 8 meetings by the Jan 2001 meeting.

Treasurer's Report:

Ken La Sala presented Dick Kowalski's report covering the RS budget. The 2000 budget should generate approximately a surplus, depending on actual income / expenses for the remainder of the year. Approximately 55 percent of the Society's assets are invested in long term investments, which is consistent with IEEE guidelines Ken asked VPs to start thinking about 2002 budget and to pass their information to the newly elected VPs. Note: The 2002 Budget is an agenda item for Jan 2001 meeting

Based on the Treasurer's recommendation to invest additional surplus funds in the long term IEEE investment account was approved.

Meetings VP Report:

Jeff Voas gave his meeting report, covering conference closeouts, conference budget approvals, and significant events. The 1999 IRPS closeout is in audit, 1999 IRW is open, and1999 ISSRE is closed. 2000 ISSRE shows a loss of $2K for our share. Budget received for 2001 IRPS. RS will be a technical sponsor again for the Testing Computer Software Conference (TCS2001) scheduled for June 2001.

- Action — Jeff Voas contact Bill Tonti concerning 1999 IRW close and take action for IRW to get closed faster. Jeff will also contact Val Monshaw concerning the whereabouts of the RAMS surplus check for approximately $4K.
- Action — Jeff voas will provide conference sponsorship notification at the Human Interface Technology Subcommittee meeting on Wednesday during RAMS.
- Action — Sam Keene and Jeff Voas will make a recommendation, with pros and cons, for the 2001 fall software safety conference.
- Action — Marsha Abramo is to provide Jeff Voas with information concerning 2001 Singapore Physical Analytical Conference.
- Technical sponsorship of TCS 2001 was approved.
- Action — Jeff Voas will send to Bob Loomis (or Webmaster) the latest list of RS conference sponsorship, by type of sponsorship, for posting on the web.

Membership VP Report:

Pat Hetherington resigned as VP Membership. Ken appointed Loretta Arellano to act as VP Membership until new officers are elected, the AdCom concurred.

Membership is declining about 5-6 percent per year. Our VP Membership needs to establish and execute an action plan to turn this decline around. Bob Gauger and Marsha volunteered to help the Membership VP. Marsha is our PACE Representative. The Northern Italy chapter is inactive.

AdCom approved funding of up to $3K for sending out a membership survey. John Healy volunteered to review and revise the Membership survey as necessary to increase the participation / return rate.

Publications VP Report:

Bob Loomis gave his Publication report. Bob presented a Publication database conversion plan that looks very plausible and AdCom concurred with his approach. Sam Keene's video report indicates that thirty video tapes, spread across 8 topics, have been sold in 2000 so far and that the AST video should be a winner.

- Action – With the strong support of AdCom Way Kuo will formalize the database conversion proposal (compatible with IEEE) present it at the Jan 2001 RAMS AdCom meeting.
- Action — Way Kuo needs to investigate how T-MDR is electronically interacting with authors as a possible ramp up for RS.
- Next Transactions (Sept) will be two months late. About 92 percent of the IEEE journals are late because of IEEE HQ electronic publication issues — switching to new editing / composition SW system, conversion to an all tagged format vs camera ready, and open org positions. Papers are available for our Transactions.
- Action — Bob Gauger to look into combining the business aspects (advertisements / revenue) of the Transactions with his work on the Newsletter, as RAE intends to stop doing the Transaction cover advertisements with the December issue.
- Action — Bob Gauger to investigate putting RS membership form in both our Transactions and Newsletter and the VP Membership to develop a suitable membership form for the Transactions and the Newsletter.
- Note: The sense of the AdCom is positive for Bob Loomis to spend $1.2K of Publication discretionary funds for getting web site up to date. Also Bob Loomis will contact Alan Street to determine his commitment to continue as RS Webmaster.
- Action — Sam Keene to work with IEEE Marketing to get a better focus (targeted audience publications) on

selling our videos. Report to AdCom at Jan 2001 meeting.

Tech Ops VP Report:

Koichi Inoue gave his report. Koichi has appointed two new chairs: John Healy for Information Technology & Communications Committee (replacing Hank Wolfe who retired) and as our representative to the IEEE National Committee on Communications & Information Policy (CCIP), and Dave Franklin for Aerospace & Defense Systems Committee. Koichi has chair openings for Consumer Electronic, Medical Systems, and Sensor Systems — any volunteers or recommendations. The Tech Ops Semiannual Report has been complied and sent to the Newsletter for publication. Koichi and Dick Doyle created group e-mail for Tech Ops. The Annual Tech Ops Report on the Status of Reliability Engineering Technology 2001 is in draft form for January 2001 Newsletter publication. The Annual Tech Ops Chair Meeting is planned for Sunday, Jan 21, prior to RAMS and directly after the AdCom meeting on Saturday.

AdCom granted permission for the Annual RE Technology Report to be reprinted, as in the past, within the RAC Journal and in the Journal of the Reliability Engineering Society of Japan. This reprint would be after it has appeared in the Newsletter.

- Action — Ops Manual needs to be reviewed by old and new Tech Ops VPs to assure job descriptions are covered and are adequate.

Jr. Past President's Report:

Loretta gave her report covering nominations, awards, and chapters. A nominating committee was established for identifying candidates for the AdCom member election. A committee was established to identify the new ExCom officers for election. Loretta missed the Newsletter for Annual Award nominations, so she recommended that she use a mail out. Plans are underway to begin the Chapter Awards process. Loretta recommended that the awards continue to be given at the July AdCom meeting banquet. Loretta recommended that we initiate our own Chapter Congress in conjunction with the July meeting.

- AdCom approved the mail out of Annual Awards candidate requests.

Sr. Past President's Report:

Dick Doyle gave his report. Dick provided copies of his recommended changes to the RS constitution and by-laws.

- Action — Jeff Voas to send voter module for web to Bob Loomis.
- Action — The AdCom members need to read the actual by-laws for wording, review Dick's recommended changes, and send comments to Dick Doyle, Loretta Arellano, and to Ken LaSala.
- Action — Dick Doyle and Loretta Arellano to revive pointer information for new members.

Old Business:

Ways to improve Reliability Engineering were discussed.

Ken La Sala adjourned the meeting a little before 4:00 PM

IEEE Reliability Society AdCom Agenda

January 20, 2001

8:00 New AdCom Member Breakfast

8:30 Call to Order - D. Hoffman

8:30-8:45 Agree to Agenda - D. Hoffman

8:45 9:00 Introduce new AdCom members and new officers - D. Hoffman

9:00-9:15 Minutes Approval - 2001 Secretary or Dennis Hoffman

9:15-9:45 President's Report - D. Hoffman

President's remarks

- Review of action items from last meeting
- Strategic Planning
- AdCom replacement selection

9:45-10:15 Treasurers Report - R. Kowalski

- Budget Report
- FY00 Budget
- FY01 Budget Planning

10:15-10:30 Break

10:30-11:00 Meetings - J. Voas

- Conference closeouts and budget approvals
- Significant events
- Fall 01 AdCom meeting - Hong Kong, Singapore, Taiwan? Or in association with
- First IEEE Workshop on Nanotechnology (IEEE-NANO 2001). Date: Oct. 28-29(30), 2001 Location: Outrigger Wailea Resort, Maui, Hawaii, USA
- Technical support for 2001 Nanotechnology Workshop?
- RS Support for AST Meeting
- RS support for High Assurance Systems Engineering conference

11:00-12:00 Publications - R. Loomis

- Transactions report - W. Kuo
- Newsletter report - D. Franklin
- Web site update - A. Street
- Evans Project Proposal & Progress - W. Kuo
- T-SM Review Report - M. Abramo
- T-MDR Report - A. Campbell
- Video Program Status - S. Keene
- SREWG website
  1. cover the website initial capital (or establishment) cost
  2. cover maintenance of the SREWG website (for 3 years from Nov 00 -
  3. Others???

12:00-1:00 Working Lunch (in meeting room)

continued on page 12

IEEE Reliability Society Adcom Agenda

Continued from page 11

12:15-12:45 Membership - Ann Campbell or John Healy

Membership Overview - Ann Campbell or John Healy

1:00-2:00 Special Presentation: IEEE Educational Activities - Dr. Peter Weisner IEEE/EA

2:00-2:30

- Technical Operations - K. Inoue
- Technical operations status and committee significant events
- Standards - Y. Lord, T. Brogan
- Council and liaison news - Sensors (LaSala), ITS (?), Nanotechnology (?), others?
- IEEE New Technologies Workshop (18-19 Jan 01) - attender

2:30-3:00 Junior Past President's Report - K. LaSala

- Nominations Committee Report - AdCom and Officer Election Results - L. Arellano
- Awards and Medals report - L. Arellano

3:00-3:15 Break

3:15-4:15 Senior Past President's Report - L. Arellano

- By-laws and constitution revision progress - R. Doyle
- Long-range planning - R. Doyle
- Updated field of interest progress progress - R. Doyle

4:15-4:30 Old Business

4:30-5:00 New Business

5:00 Adjourn

6:30 Banquet

International Standards

ISO 9001:2000, ISO 9004:2000 and ISO 9000:2000 Advance To FDIS Stage

At its meeting in Kyoto, Subcommittee (SC) 2, Quality Systems, of ISO Technical Committee 176, Quality Management and Quality Assurance, voted in plenary session to elevate the drafts of ISO 9001:2000, Quality management systems-Requirements, and ISO 9004:2000, Quality management systems-Guidelines for performance improvements, to the Final Draft International Standard (FDIS) stage. In addition,SC 1, Concepts and Terminology, voted to elevate ISO 9000:2000, Quality management systems-Fundamentals and vocabulary, to FDIS status.

The FDIS stage for an ISO standard involves a circulation to the P-members, for an up-or-down vote on approval of the FDIS for publication as an International Standard. Unlike earlier stages, members do not provide comments with their votes, since no further revisions are to be made.

The three FDISs will be edited over the coming weeks by the subcommittees in cooperation with the ISO Central Secretariat and are expected to be available for ballot by the P-members in early September. The target date for issuance of the revised standards remains mid-November.

2000 IRW FINAL REPORT

The final report of the 2000 Integrated International Reliability Workshop (IRW) marks the 19th year since this Workshop was started in 1982 as the Wafer Level Reliability Workshop. Since its inception, the workshop has focused on informal and close interaction of the attendees in a relaxed setting with minimum distractions. Judging by the record setting attendance this year, it remains a unique and effective venue for one-on-one interaction among reliability professionals to address the requirements of our ever-changing frontier in integrated circuits.

This year's program began with a challenging keynote on low voltage dielectric reliability co-authored by Dan DiMaria and Jim Stathis of IBM.

Keeping abreast of late breaking news, and in-depth reviews of specific subject areas is always of interest at IRW, and is executed through our renowned tutorial offerings. This year was no exception as we had three excellent tutorials on technology qualification, ultra thin-oxide reliability, and IC circuit fabrication and yield control. These tutorials were followed by 25 platform-presented technical presentations on: Designing in Reliability, Customer Product Reliability Requirements, Contributors to Failure, Reliability and Characterization Models, and Wafer Level Reliability.

New to the technical program this year are refereed posters. These enhance our already popular late afternoon open poster sessions. Many discussions arose on the reliability avenues appropriately coined "Device Road, Gate Oxide Alley, Electromigration Avenue, and Burn In Square". We plan to continue this successful venue next year, so don't forget to include a choice of "platform-presented" or "poster" paper on your 2001 submission.

Enhancing our technical program is always an IRW goal. This year we were pleased to show two IEEE instructional videos during our Wednesday afternoon break. They were: Oxide Wearout, Breakdown, and Reliability by Dr. David Dumin of Clemson University and MEMS Performance and Reliability by Paul McWhorter, Samuel L. Miller, and William M. Miller of Sandia National Laboratories.

Discussion groups (DG's), a popular participatory evening activity, complement the technical presentations as they offer a relaxed group focusing on one topical area. This year we discussed and debated Gate Oxide Reliability, Wafer Level Reliability Monitoring, Ultra-Thin Oxides, Electromigration, Negative-Bias-Temperature Instabilities, and Product Qualification/Burn-In. They were all led by knowledgeable and competent moderators.

The special interest groups (SIGs) provide opportunities to build synergy between individuals who wish to communicate and actively advance reliability physics for a particular topic. These efforts are unstructured and the level of involvement is left to each group. This year, SIGs met to discuss the following topics: Wafer Level Reliability, Process Qualification, Electromigration, Oxide Reliability and Non-Volatile Memory. We look forward to the papers that are always a SIG outcome. SIGs remain active throughout the year by communicating through our web site http://www.irps.org/irw.

This workshop is the product of a collective effort of volunteers representing the reliability physics community, including semiconductor manufacturers, equipment suppliers and customers, as well as government research labs and universities. Thanks to all of them for a job well done.

It is not too early to plan for next year's workshop: Please review the enclosed 2001 call for papers and plan to attend and contribute. Remember that the abstract deadline is July 6th, 2001.

In closing, I want to remind you of the "coin challenge" we had. I assume the activity went over well, … and yes, I have reimbursed Andreas $0.50; and I have two photos left! If someone can interpret the following phrase, then I have something for you next year. "The ELF had a FIT when ZOBI arrived".

Regards, and thanks to everyone for making IRW 2000 a success. I look forward to seeing you at next year's workshop.

William R. Tonti
General Chair
2000 IRW

ISSRE Report

I represented RS at ISSRE this year in San Jose. Our attendance was down, due in part to this meeting being held on the highest Jewish holiday of the year, Yom Kippur. It also overlaid Columbus Day, which could be a factor also. About 110 folks attended, whereas 140 would be desired. Last year, in Boca Rotan, 220 folks attended a record number.

Next year ISSRE will be held in Hong Kong 28 Nov - 1 December at noon. Michael Lyu, who now lives in HK will be the Chair. Michael had some photo clips of Hong Kong and the setting looked exciting. He has secured a hotel rate of $83 per night for a four star hotel. ISSRE would be delighted to have RS AdCom held at the same time. RS has been asked to be a financial participant in 2001 ISSRE. This is our recent history of participation. I agreed that we would continue our level of support. We are running a slight surplus on our ISSRE support and our position is very recognized at the Symposium Steering committee which I participate in at the conference.

RS was also asked to see if we could deliver some papers on combined software and hardware reliability. I propose we meet that challenge for 2001.

Regards,

Sam Keene

2000 IEEE Microelectronics Reliability and Qualification Workshop

The 3rd Annual IEEE Microelectronics Reliability and Qualification Workshop (MRQW), sponsored by the IEEE Reliability Society and the IEEE Components, Packaging, and Manufacturing Society, was held on Oct. 31st – Nov. 1st, 2000 at the Hilton in Glendale, CA. Organized by Founder and General Chair Dr. Sammy Kayali and Technical Program Chair Dr. John F. Conley, Jr., both of the NASA Jet Propulsion Lab (JPL), the workshop was a success. Over eighty people attended and participation was truly international, with authors and attendees representing eleven countries, twenty-three companies, fourteen universities, and thirteen government agencies.

The small size of the workshop encouraged extensive interaction among participants, detailed technical discussions, and excellent question and answer sessions during and after the presentations. The final technical program consisted of twenty-eight oral, five invited, and nine poster presentations. The keynote address was delivered by Dr. Leon Alkalai (Director of JPL's Center for Integrated Space Microsystems) and was entitled, "NASA's Deep Space Exploration: From Astronomical Units to Angstroms." Other invited speakers included Dr. Eric Vogel of NIST who gave an excellent presentation entitled, "Issues in High-k Gate Dielectrics for Future MOS Devices," Prof. Carl Thompson of MIT, "Circuit-Level and Layout-Specific Interconnect Reliability Assessments," Dr. Phil Canfield of Conexant, "Yield and Reliability Challenges in the Migration from DARPA GaAs Pilot Line to High Volume GaAs HBT Process Line," and Prof. Allesandro Paccagnella of the Universita di Padova who gave an informative presentation on "Radiation Effects in Ultra-thin MOS Gate Oxides."

Local Arrangements Chair, Dr. Joanne Wellman (JPL), coordinated the meeting facilities and activities, including continental breakfasts, two lunches, and an evening reception. Communications Chair, Peter Schrock (JPL) coordinated the paper submission process and the A/V part of the program. The Workshop Proceedings was prepared Mr. Schrock (JPL), Yvette Berumen (JPL), and Dr. Leif Sheik (JPL). Exhibits / Publicity Chair, Jim Weiler (JPL) organized the Industrial Exhibition, four companies exhibited. The Workshop webpage was maintained by Manuel Gallegos.

The MRQ workshop focuses on the latest results as well as work in progress in all areas of microelectronics device reliability and qualification methodologies. More information can be found at http://parts.jpl.nasa.gov/workshop/home.htm.

Dr. John F. Conley, Jr.
Technical Program Chair,
MRQW 2000
NASA JPL
California Institute of Technology
Pasadena, CA 91109
john.f.conley@jpl.nasa.gov

Meeting Notice

FPL'2001

Call for Papers
Call for Tutorials
Call for Exhibitors, Industrial Papers
27 - 29 August 2001
Belfast, Northern Ireland

FPL 2001: 11th International Conference on Field Programmable Logic and Applications

Conference theme: Technology, tools and applications with a particular emphasis on DSP, networking and Telecommunications

Paper deadline: 9 March 2001, Notification of Acceptance: 14 May 2001

The proceedings will be published by Springer Verlag - within the LNCS series (Lecture Notes on Computer Science). See: http://link.springer.de/series/lncs/

General Chair: Roger Woods, Queen's University of Belfast, r.woods@qub.ac.uk. Program Chair: Gordon Brebner, University of Edinburgh, g.brebner@ed.ac.uk

For further details, see the conference web page on: http://www.ee.qub.ac.uk/dsp/fpl2001

Authors are invited to submit PDF of their paper (10 pages maximum) by March 9, 2001 via E-mail to fpl2001@qub.ac.uk. For guidelines, see Web site http://www.springer.de/comp/lncs/authors.html

Cut the Cord: Introduction to Wireless Now Available from IEEE

Piscataway, NJ. 27 November 2000. *Introduction to Wireless and Personal Communications,* an IEEE self-study course, is now available from the IEEE. At the COMDEX 2000 held in Las Vegas, Nevada, L.M. Ericsson Telephone Co. President Kurt Hellström said in a keynote presentation, "We believe that the mobile Internet will soon be bigger than the fixed Internet. It will happen for the same reasons the cords of the telephone were cut. It appeals to a basic human need for freedom and convenience."

Don't be left behind in the wireless transformation. Get the fundamentals from this self-study course.

Dr. Vijay K. Garg has designed this course to provide basic understanding of wireless and personal communications. It includes an overview of the basics of telecommunication systems and traffic engineering; an introduction to cellular/PCS systems, radio propagation; and the fundamentals of radio technology. The course focuses on information processing in wireless communications and explores the fundamentals of wireless mobile communications.

After completing this course, you will be able to:

- demonstrate an understanding of the basics of teletraffic engineering,
- examine information processing in a wireless system (speech coding, channel coding, interleaving, modulation, etc),
- recognize components of a cellular / BCS system,
- develop propagation models and estimate path loss,
- discuss antenna systems and link budget,
- describe 2G North American and European cellular systems.

The course package comes with a study guide, final exam, and the best-selling Prentice-Hall book by Dr. Garg and Joseph E. Wilkes, *Wireless & Personal Communications Systems.* Upon successful completion of the exam, students are eligible to receive eight (8) IEEE Continuing Education Units (CEUs).

Vijay K. Garg is a Distinguished Member of the Technical Staff at Lucent Technologies, Inc. His professional responsibilities include design of GSM-based systems, evaluation of the performance and capacity of mobile switching centers, and specification of operations system requirements for wireless networks.

To order use code HL5758-TCU, IEEE member price: $350.00; list price: $450.00. IEEE Customer Service Department, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331, USA; e-mail: customer-service@ieee.org; phone: +1 800 678 4333 (USA and Canada), +1 732 981 0060 (worldwide); Web: http://shop.ieee.org/store.

For a complete listing of educational products see www.ieee.org/organizations/eab/cathome.htm.

JPL Open House

May 19 - 20, 2001

Every year, JPL hosts its two-day Open House and invites the public to come explore the facility. This popular, free event provides a golden opportunity for the public to visit the Laboratory and learn all about our latest projects. For more information, visit http://www.jpl.nasa.gov/openhouse.

Jim Weiler

5th WSES/IEEE World MULTICONFERENCE ON Circuits, Systems, Communications & Computers (CSCC 2001)

JULY 8-15, 2001

Location: Rethymnon, CRETE (GREECE)
http://www.softlab.ntua.gr/~mastor/cscc01.htm
cscc@worldses.org
Jointly with the 3rd MCP and 3rd MCME
Technical Co-Sponsorship by IEEE Signal Processing Society

RELEX 2-page spread
pick up from Oct. p14

RELEX 2-page spread
pick up from Oct. p15

The IEEE & New Jersey Institute of Technology Announce Partnership

Piscataway, NJ. 5 December 2000. IEEE and the New Jersey Institute of Technology's (NJIT) Division of Continuing Professional Education have announced a partnership designed to promote and encourage continuing education and professional development among IEEE members.

IEEE members who enroll in NJIT distance learning courses via the IEEE web site at http://www.ieee.org /eab/PDI/NJITcourses/index.htm will receive a 10% discount off the price of tuition. The NJIT enrollment site joins the IEEE Professional Development Institute (IEEE PDI), gateway website to life-long learning.

NJIT has been recognized by The National Science Foundation as a leader in the development of engineering education for the 21st century. It provides the flexibility that IEEE members need, offering distance learning as well as traditional site instruction. The IEEE member discount is applicable only to the distance learning programs. For more specific information on NJIT's current array of graduate, undergraduate, and certificate-bearing courses and degrees, visit their website at www.njit.edu/DL/.

"The IEEE is dedicated to providing its members access to high-quality education programs designed to promote their technical vitality and advance their careers," said Lyle Feisel, Vice President of the IEEE Educational Activities Board. "We are happy that NJIT has joined the IEEE PDI roster and encourage all interested IEEE members to explore NJIT's well respected academic programs and courses."

"We are delighted to be able to offer our courses to IEEE members at this special rate," said Dr. Gale Tenen Spak, Associate Vice-President of Continuing and Distance Education at NJIT. "The breadth of courses available from NJIT allows engineers to acquire the skills needed to shift to fields with better employment prospects, to enter newly emerging cross-discipline fields, or to explore ones that match their maturing interests."

About NJIT

New Jersey Institute of Technology has long been a leader in the use of varied delivery options for reaching the distance learning student. Capitalizing on almost 20 years of experience in delivery of distance learning courses and its in-house technical expertise, computing prowess, and television and multimedia studios, NJIT holds a continually growing inventory of internally-produced distance learning courses that number over 150 and employs two major methodologies to bring engineering, computer science, management, mathematics, chemistry, physics, and other technical subject to student's homes, to professional's desktops, and to the classroom of college students as well as K-12 students. Their commitment to and support of distance learning education had contributed to their receiving recognition from Yahoo! Internet Life for three years in a row as America's Most Wired Public University.

For more information see http://cpe.njit.edu.

For more information, please contact

For NJIT: Shelly Zimmerman, Director of Development and Marketing, Division of Continuing Professional Education. E-mail: zimmerman@njit.edu.

For IEEE: Alan Trembly, Manager, Business Development, a.trembly@ieee.org

The IEEE & United States Open University Announce Partnership

PISCATAWAY, NJ. 27 November 2000 IEEE and United States Open University (USOU) today announced a partnership designed to promote and encourage continuing education and professional development among IEEE members.

IEEE members who enroll in USOU distance learning courses and degree programs via the IEEE web site at www.ieee.org/pdi/open will receive a 10% discount off the price of tuition. The USOU enrollment site joins the IEEE Professional Development Institute (IEEE PDI), gateway website to life-long learning.

USOU, a new, non-profit university, has been established to meet the needs of students whose schedules and commitments prevent them from attending a traditional campus. Dedicated to reducing the barriers to education it combines convenience and flexibility with faculty support and multimedia course materials. To find out more about USOU, see http://www.open.edu. Spring 2001 registration is now under way.

"The IEEE is dedicated to providing its members access to high quality-education programs designed to promote their technical vitality and advance their careers," said Lyle Feisel, Vice President of the IEEE Educational Activities Board. "We are happy that USOU has joined the IEEE PDI roster and encourage all interested IEEE members to explore USOU's programs and courses."

"For busy working professionals, USOU offers the opportunity to continue your education without having to meet the demands of a fixed classroom schedule," said Dr Richard Jarvis, Chancellor of USOU. "With single courses that can help enhance work skills to professional degree programs, we are delighted to join the IEEE PDI roster and look forward to meeting the needs of IEEE members."

About USOU

United States Open University is the sister institution of The Open University, chartered over 30 years ago in the United Kingdom. Recognized as the world's leader in part-time education and training for working adults, The Open University has become a model for distance learning programs throughout the work. For more information see http://www.open.edu.

For more information, please contact:

For USOU: Josephine Feldman, Deputy to the Chancellor for External Relations, j.a.feldman@open.edu

For IEEE: Alan Trembly, EAB Manager, Business Development, a.trembly@ieee.org

39th Annual International Reliability Physics Symposium

Plan to attend the 39th IRPS at the Wyndham Palace Resort in Orlando, Florida, April 30- May 3, 2001 !

The IRPS promotes the reliability and performance of integrated circuits and microelectronic assemblies through an improved understanding of failure mechanisms in the user's environment. This year's symposium will also stress product reliability as well as high speed and MEMs devices.

Started in the early 1960's by the military and aerospace community, the IRPS's sponsorship moved to the IEEE in 1967, when its scope expanded to commercial integrated circuits. As the premier symposium for reliability, the IRPS provides an open and professional forum dedicated to progress in the areas of:

- Reliability implications of integrated circuit scaling
- Failure and degradation mechanisms of microelectronic devices
- Correlation of reliability with the properties of electronic materials
- Reliability optimization by circuit design, modeling, and simulation

Highlights of the Symposium in 2001:

- **Technical Program:** keynote presentation, a new panel discussion, and high-quality, carefully selected and peer-reviewed technical presentations.
- **Tutorials and Workshops:** a highly diverse collection of cutting-edge and debatable topics, which represent one of the major elements of the technical program for most attendees.
- **Equipment Demonstrations**: as always, a technically oriented forum allowing attendees to try-out new equipment hands-on.
- **Social and Networking Events:** Incredible networking opportunities for all participants, including a Tuesday reception and a Wednesday awards luncheon.

For further information, please contact:

Anthony S. Oates, 2001 IRPS General Chair, Lucent Technologies, 9333 South John Young Parkway, Orlando, FL 32819, USA. E-mail: AOATES@LUCENT.COM

Edward I. Cole Jr., 2001 IRPS Publicity Chair, Sandia National Laboratories, 1515 Eubank SE, MS 1081, Albuquerque, NM 87185-1081, USA, E-mail: COLEEI@SANDIA.GOV

Or visit the **IRPS web page** at: www.irps.org, which includes the latest on IRPS 2000 and information (proceedings, CDROMs, video tapes) from past symposia.

We look forward to welcoming you at the 2001 IRPS!

A NEW CD-ROM TUTORIAL COVERING THE LATEST AST TECHNIQUES...

Accelerated Stress Testing

Presented by T. Paul Parker, Lucent Technologies; H. Anthony Chan, AT&T Labs;
Charles Felkins, Storage Technology; Anthony Oates, Lucent Technologies;
Technically edited by Samuel Keene, Seagate Technology

Accelerated Stress Testing, AST, is a mandate today to meet time-to-market and product quality needs. AST has been shown to ferret out problems that would otherwise plague the customer in the field. One study demonstrated that AST was able to reduce PWB failures by almost two orders of magnitude compared to a control sample. AST uncovers problems before they are shipped to the customer, thereby rapidly maturing the product and demonstrating diligence protecting the customer. Today's market place demands and rewards such diligence.

Topics covered include:

- AST cycle time reduction and product robustness improvement
- Stress Testing HALT and HASS samples
- Tests and testing equipment needed
- AST set up considerations and economic payoffs
- Stress variables most effective for AST and stress levels to be used
- Component and systems to be burned in
- Important Lessons learned from AST experts
- Role of stress testing in contract manufacturing
- How to get development engineering's buy-in for AST
- Failure modes in ICss equipment required, general processes, success stories

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Technical Magazine Section

THE STATUS OF RELIABILITY ENGINEERING TECHNOLOGY 2001
A Report to the IEEE Reliability Society

Compiled by Christian K. Hansen, Ph.D.
Chair, Reliability Methodology Committee
E-Mail: c.k.hansen@ieee.org

Introduction

This report is compiled annually for the IEEE Reliability Society. Its purpose is to discuss current issues in reliability and related fields, and to identify possible trends for the future. The report is based on input submitted by technical committees of the society, by statements obtained from experts in the field, from the current technical literature, and from information published on the World Wide Web. The topics are chosen based on their significance, but are also limited by the type of input received. The editor welcomes additional comments or discussion of issues of concern or importance to today's active reliability engineers. Input may be submitted at any time to Christian K. Hansen at the following address c.k.hansen@ieee.org.

ISO 9000

The next generation of ISO 9000 series standards, the year 2000 revision, was released during fall 2000, representing a major revision of the 1994 edition. The most radical change involves the merging of the ISO 9001, 9002, 9003 into one single document. Critics of the 1994 edition have raised concerns about the existing documents being too cumbersome, calling for changes to the 2000 editions aimed at making the standards more user-friendly. The ISO 9000 family now comprises only three documents, 9000: Fundamentals and Vocabulary, 9001: Requirements and 9004: Guidelines for Performance Improvements.

Parallel to the developments of the generic ISO 9000 family, specific developments of three industry-specific derivatives have taken place. QS 9000, the quality standard for the automotive industry developed by the US "big-three", Ford, GM and Chrysler (now Daimler-Chrysler) is expected to be adapted into the international standard TS 16949, which harmonizes the requirements of QS 9000 with the standards of the European auto-makers VDA 6.1 (Germany) and EAQF (France) AVSQ (Italy). The globalization of the auto industry has intensified the demand for more uniform standards.

AS 9000, the aerospace industry derivative of ISO 9000 is anticipated to be replaced by AS9100 and EN 9100 (an identical European version). The AS9100/EN9100 documents are now available in final draft, and add a significant number of additional items to AS9000 (e.g. related to configuration management). The new document has the support of Boeing and some of the major European aerospace companies.

TL 9000, the quality standard for the telecommunications industry, is the latest of the three industry specific standards. The newly released standard is based of the 1994 edition of ISO 9001. The QuEst forum, a partnership of Telecommunications suppliers which developed the first edition of the standard, is currently working on a revision that will reflect the 2000 edition of ISO 9001.

Current information about the status of ISO 9000 and related standards are available from the ISO web site http://www.iso.ch/.

Human Interface Technology

During recent years, the IEEE-RS Human Interface Technology Committee has played an active role in promoting the study and education of the very important field of reliability that deals with human interfaces. Contributor Ken LaSala reports that recent research in this area has focused on especially air traffic control environments and other control situations. A topic that has become popular recently has been "situation awareness," i.e. how to make a human adequately aware of the surrounding situation.

The Human Factors Research Laboratory, School of Naval Architecture and Ocean Engineering, Shanghai Jiao Tong University, China recently completed research work on the design of human computer interface (HCI) of the control system in the Cheng Dao oil field, contributor Yi Hong reports. The design was guided by the consideration of human reliability, especially with respect to information transition and past experience. The project fully considered human cognitive character in such facets as task distribution, structure design, and information display methods. It has been reported that this approach not only decreases the overall failure probability, but also reduces the workload on the operator. This study makes a first step into the research of the quantitative analysis of HCI information, some new views are proposed on the introduction of information entropy into the quantitative analysis of the operating complexity of HCI. The laboratory is performing research work on the human reliability-oriented design of ship navigation control rooms. To support the research work on this project, the laboratory is building a multitask simulation test console, Hong reports.

Some elements of Human Interface Technology have been published in the form of ISO13407: Human-Centered Design Processes for Interactive Systems, a new standard enacted on June 1, 1999 centered around the following key content ar-

eas: Human-centered Processes, Design Processes, Interactive Systems (which must be computerized). According to contributor Takehesa Kohda, the motivation for this standard is that technology-centered design has been shown to be insufficient to address modern, complex human-machine systems. For example, humans have caused severe accidents in advanced human-machine systems such as airplanes and nuclear plants. The principles of Human-Centered Design are: (1) Active participation of users, (2) Appropriate task allocation between users and technology, (3) Repetition of design process by feedback, and (4) Design based on multi-domain disciplines. Human-centered design activities are composed of: (1) the understanding and the specification of the context of use, (2) the specification of the user and the organizational requirements, (3) the production of design solutions, and (4) the evaluation of the design against the requirements. These activities should continue until the design satisfies the requirements. The use of ISO13497, according to Kohda, should improve the safety and reliability of human-interface technology.

As in past years, the U.S. Federal Aviation Administration (FAA) continues to have a strong program in human factors, Dr. LaSala reports. The ultimate objective is improving human-machine interfaces and, consequently, operator reliability. The principal FAA program is the ACT-530 Operations Concept Research Program, which examines longer-term issues and concepts that relate to human performance in the National Airspace System. This program develops measurement tools and methods that are being used to evaluate new procedures and hardware as the system evolves towards the 21st Century. This program also examines organizational concepts that maximize employee productivity, improve training concepts and methods, reduces stressful work environments, and minimize errors. This program conducts basic research in air traffic control and airway facilities domains, see http://www.tc.faa.gov/act-500/hfl/opsconcept.htm for more information. Described below are several important facets of the program.

- *Controller Visual Scanning.* Controller visual scanning is a potential source of human error. The Research Development & Human Factors Laboratory uses state-of-the-art eye-tracking equipment to evaluate controller scanning behavior and the impact of new displays on controller scanning behavior.
- *Controller Performance and Workload Measurement.* Researchers designed a new performance rating form for over-the-shoulder observational evaluations. Form designers assessed reliability and validity against objective system measures in real-time simulations.
- *Human Factors Design Guide*. The program produced a comprehensive set of human factors guidelines for AF applications. The AF Human Factors Design Guide provides an exhaustive compilation of human factor design practices and principles integral to the procurement, design, development, and testing of FAA systems, facilities, and equipment. It primarily focuses on FAA ground systems, such as those that are managed by AF, but it has general applicability.
- *Auditory Alarms.* The program is conducting an auditory symbology study to review alerting and status sounds now used in AF equipment. Over 80 alarms have been digitally recorded and analyzed for their sound characteristics. Further research is underway to evaluate the urgency of the alarms, develop samples of new alarm sounds, and create human factors recommendations for the use of alarms in FAA systems.
- *Symbology*. The FAA is conducting several studies on symbols and icons representing AF facilities and equipment. The goal is to develop a standard set of visual symbols and color codes that will be used on new displays. Human factors recommendations will be developed for the use of sound in new systems.
- *Voice Technology*. There are several projects using voice recognition and production technologies in the AF environment. AF specialists recently viewed demonstrations of a voice-controlled oscilloscope, electronic mail, and a weather program. A study evaluation used a voice-controlled laptop computer that guided a technician through a maintenance procedure using synthesized voice. Laboratory personnel are evaluating further applications of voice technology in different environments.

The U.S. National Aeronautics & Space Administration (NASA) Human Factors Research and Technology Division continues its active research and development program. Provided below is a sample of the division's recent accomplishments (ref: http://olias.arc.nasa.gov/reports/index.html.)

- *Making Human-Machine System Simulation a Practical Engineering Technique*. NASA has constructed a framework for modeling human operators (APEX) that combines a set of human cognitive and motor resources with a flexible planning system for action selection. This architecture addresses three main challenges. First, it must be able to predict design-relevant aspects of human performance such as design-induced operator error. Second, it should be usable in typically complex and dynamic environments such as air traffic control and flight deck operation, not just in controlled laboratory-like environments. Third, applying the framework to a new design problem must not require excessive time or expertise.
- *Air Traffic Controller Performance in Simulated Free Flight.* The NASA Ames Cognition Laboratory has undertaken a series of experiments to determine empirically whether controller situation awareness is hindered by the loss of traffic constraints under free flight. The results show that the time to find conflicts is strongly affected by traffic load, by conflict geometry, and time to conflict. The study showed that performance deteriorated as the number of planes increased, but there was little or no impact of the presence or absence of restrictions. NASA found some evidence that removing altitude restrictions has a modest negative impact on performance, but removing route restrictions consistently failed to produce any significant impact on performance. Free flight showed no significant performance decrements, whether or not the system used a symbology that showed the direction of aircraft track.
- *Detecting and Correcting Errors in Flight*. A simulator study was conducted to gain a fuller understanding of

factors that contribute to monitoring and challenging errors. This study examined two potential causal factors: (a) level of risk in a developing situation and (b) degree of "face threat" involved in challenging an error. This study has identified situations that might occur during real flights and pose a threat to safety if not corrected. Based on this information, training programs can develop intervention skills, especially in first officers, that are most effective in producing corrective actions, thus enhancing flight safety.

Also, a significant study of human performance in software development has taken place at the University of Maryland, where researcher Carol Smidts has developed a stochastic model which relate human errors committed during software development and debugging activities to the software failure intensity function. Other areas that seem relatively untouched by human interface research include information technology systems and processes and biomedical technologies, especially computer-assisted surgery. Information technology is becoming extensively pervasive, is evolving rapidly, and is affecting both basic business operations and specific operational tasks. Systematic consideration of participating humans generally is lacking in the development of information technology systems. Dr. LaSala views these areas as excellent opportunities for future research.

Software Reliability

Y2K After Thoughts

The Year 2000 problem (Y2K) is undoubtedly the most commonly known example of a software reliability problem. The last several editions of this report contained discussions on this subject quoting various estimates for the impacts and financial costs of fixing the bug. In a post-mortem analysis, one may note that the impact of Y2K was less than forecasted, however, this should be viewed as an underestimate of the effectiveness of the Information Technology (IT) staff and programmers working to fix the problem, rather than an underestimate of the seriousness of the problem itself. The estimated cost of fixing Y2K worldwide has been reported to exceed 100B USD. Hopefully, IT people have learned from this traumatic experience. Y2K has also sensitized the general public to the greater potential impact of software failures.

Critical Areas of Deployment and Problem Sources

Y2K is just one example of how software intertwines and envelops our lives. Software is an integral part of our cars, our appliances, our homes and our stores. Contributor Sam Keene has been involved in all aspects of software reliability over several decades, and has made many significant contributions to the research in this area. According to Dr. Keene, we now have an Information Technology layer that surrounds our life and which we depend upon. Internet use is pervasive and growing. The Internet related companies have rocketed in value over the past several years. Alaska, Colorado, Maryland, Utah and New Hampshire have between 41% and 52% of their population on-line. When the Internet works, it multiplies our effectiveness. But when it fails, we are left hapless.

Our offices, businesses and personal lives depend upon computer communications. We feel stranded when that service is not available, even for short periods. The most notorious outage may be the 18-hour outage experienced by AOL users in August 1996 [1]. This resulted from an undetected operator error occurring during a software upgrade. The cause of failure was initially thought to be solely due to the upgrade. This confounding of events misled the analysts tracking the problem. Thus 18 hours were required to isolate and correct the problem.

More importantly, many of our common services depend upon computer controllers and communications. This includes power distribution, telephone, water supply, sewage disposal, financial transactions, as well as web communications. Shocks to these services disrupt our way of life in our global economy. We are dependent on these services being up and functioning. Dr. Keene has identified the following list of critical and intertwining IT services that envelop our lives, either directly or indirectly:

- Nuclear power
- Medical equipment and devices
- Traffic control (air, train, drive-by-wire automobiles, traffic control lights)
- Environmental impact areas (e.g., smoke stack filtration)
- Business enterprise (paperless systems)
- Financial systems
- Common services (water, sewer, communications)
- Missile and weapons systems
- Remote systems (space, undersea, polar cap, mountain top)
- Transportation (autos, planes, subways, elevators, etc.)

As sources of several significant software problems, Dr. Keene has identified the following list:

Software exception code

The main line code usually does its job. Breakdowns typically occur when the software exception code does not properly handle abnormal input or environmental conditions—or when an interface doesn't respond in the anticipated or desired manner. The infamous "Malfunction 54" of the Therac 25 radiation therapy machine fried some patients because the software controls did not successfully interlock the high-energy operating system mode. This allowed patients to be exposed to potentially lethal radiation levels.

- *System Management problems.*

The major cause of software or system problems lies in System Management problems. These are requirement deficiencies or interface defects. The Martian probe failed in the fall of 1999 [2]. This failure was due to system management problems. There was a breakdown in communications between the propulsion engineers and the navigation scientists, at a critical point in the design cycle. The newspaper headlines publicized another program communication problem. NASA and its contractor had unconsciously commingled metric and British dimensional units. The resulting tower of Babel situation helped misguide the $125 million dollar space probe.

System Management problems are truly communication problems. In the experience of Dr. Keene, for the most part, today's hardware is reliable and capable. Almost all significant system problems are traceable to a communications breakdown or too limited design perspective on the programmer or designer's part.

- *Small changes can have grave consequence.*

There is significant error proneness in making small code changes[3]:

Defect rate:	1 line	50%
	5 lines	75%
	20 lines	35%

The defects here are any code change that results in anomalous code behavior, i.e., changes causing the code to fail. Often, small changes are not given enough respect. They are not sufficiently analyzed or tested.

For example, signaling systems at DSC Communications Corporation (Plano, Texas) were at the heart of an unusual cluster of phone outages over a two-month period of time. These disruptions followed a minor software modification. The Wall Street Journal reported, "Three tiny bits of information in a huge program that ran several million lines were set incorrectly, omitting algorithms – computation procedures – that would have stopped the communication system from becoming congested with messages. Engineers decided that because the change was minor, the massive program would not have to undergo the rigorous 13 week (regression) test that most software is put through before it is shipped to the customer" [4,5]. That was a mistake.

The Ariane 4 code worked fine, but it did not scale up satisfactorily to Ariane 5. Ariane 5 design changes were not properly handled by the original code. This is an example of using Commercial Off-The-Shelf code (COTS). Reusing COTS code is an increasingly popular way to reduce development cost and time. The code does not have to be reinvented, but it needs to be fully analyzed and tested for its new application, paying particular attention to any changes in the hardware or the system from its predecessor application.

Software reliability, especially the system management problem, is the long pole in the tent for developing new systems. It impacts development time, cost and system reliability.

Proactive System Reliability Initiatives

Understanding the nature of software reliability problems can greatly reduce the impact and extent of those problems. Dr. Keene identifies the following general areas of Proactive Reliability Initiatives:

- Maintaining strong and systematic focus on requirement development, validation, and traceability with particular emphasis on System Management aspects.
- Planning backup and contingent capabilities for critical failure events.
- Studying "near misses" to further understand how to prevent or mitigate failures, just like we do today in aircraft near misses.
- Institutionalizing a "lessons learned" database and using it to mitigate potential failures during the design process.
- Performing potential failure modes and effects analyses (FMEA) to harden systems against abnormal conditions.
- Performing root cause failure analysis to trace problems down to the underlying cause.
- Leveraging discovered failures using the Defect Prevention Process, as it is labeled by IBM [6].
- Studying and profiling the most significant failures.
- Understanding the constructs that allowed the failure to happen.
- Developing more effective testing techniques to cover the extensive number of program paths covering the possible input conditions.
- Thinking defensively by examining how the code handles inappropriate inputs, and designing to mitigate these conditions.
- Performing fault injection into systems, as part of system development, in order to speed the maturity of the software diagnostic and fault handling capability.
- Building in diagnostic capability. Systems' vulnerability is an evidence of omissions in designs and implementations.
- Designing in opportunistic times to restart, and refresh the software during its deployment.

Future Challenges

The biggest development challenge, according to Dr. Keene, may well be improving our test capability to deal with the burgeoning amount of high function code (object oriented) that is being developed. Testing such code, with its explosive number of operating paths, is a great challenge. Because of this, safety critical code will probably be developed using more formal methods or clean-room processes. This development method tests and assures the contingent path conditions as the code is developed. The code and the checking and exception handling are developed simultaneously.

Where the world is most weak is not in the random failure modes but in the possibility of an organized attack directed at nations' (or companies') economic, environmental or enterprise systems. It is conceivable that a well-organized attack could defeat the redundancies. This means that the potential threat of terror must also be considered in the development of 21st century systems.

Mission critical systems will demand broader attention be paid to all system aspects. The notion of reliability, or more to the point, the definition of failure will expand. Precluding failures will include managing system security, robustness, safety, data privacy, fault mitigation and recovery. The greater reach of software and systems, into the critical areas of our lives, will demand more internal "mistake proofing" and hardening against adverse external factors. System users will increasingly demand their systems behave better (less damaging and easier to recover) under failure conditions. How gracefully critical systems fail will be as important as how much functionality they provide. This will be an exciting challenge for those people like Dr. Keene who will help carry out and facilitate this role.

Mechanical Reliability

Mechanical reliability engineering is becoming increasingly important, particularly as it relates to the development of Micro-components, according to contributor Dick Doyle. Both Micro-Mechanical and Micro-Electromechanical Systems (MEMS) are being developed for diverse applications. This new use of micro-products requires high reliability, while just the opposite is being observed. Actually, many of these new products are not providing the desired or expected reliability, Doyle reports. This makes it necessary to implement Reliability-by-Design for these new items.

The purpose of a Micro-Mechanical Reliability analysis is to provide a realistic estimate of the reliability of a very small

part. This estimate may be used as a basis for reliability improvements through design changes or to predict if the desired reliability of the system has been achieved. It is difficult to establish a good estimate of reliability without an organized and proper approach. This requires all of the techniques available in classical reliability analysis including: determining the loads, performing mechanical stress analysis, determining failure modes, and recommending design changes.

As the analysis progresses, one should reevaluate reliability goals and modify the Micro-Mechanical design to ensure that these goals are met. If the product can not be modified, then the prediction provides the best estimate of the expected life and reliability of the Micro-Mechanical system.

Examples of micro devices include: Transducers, sensors, springs, bearings, gears, sieves, magnetic devices and motors. The predicted reliability values shall be calculated for all major components in the system. The individual part failure rate is determined using classical mechanical reliability predictions. If test results are available, this provides the best reliability estimate and a mechanical stress analysis will provide appropriate parametric tradeoffs. The component reliability values are combined using series or parallel redundancy depending on the design. This will provide the predicted reliability values for the Micro-Mechanical system.

Environmental conditions are critical for Micro-Mechanical devices. This includes such influences as moisture, temperature, thermal stresses, mechanical shock and vibration. For vibration, it may be necessary to provide a strong support, including a three point (or more) mounting. It may be that HALT testing provides the highest loads. If failures continue to occur, changing the design may be a solution. Or it may be necessary to obtain higher strength materials.

Micro parts will be found in a growing number of applications, Doyle predicts. Some examples of areas/industries with present applications of micro devices include:

- *Medical Field.*

Implants for administering medicine. Sensing nerve signals. Measuring and monitoring body functions. Electrical and optical probes. Micro-Sieves are used for screening DNA from blood samples.

- *Automotive Industry.*

Micro-G sensors are used in determining when to actuate air bags. Magnetic, chemical, electrical, thermal, and other sensors are used to measure the performance of the engine and to adjust operating conditions to best meet the requirements of the drive.

- *Space Applications.*

Many specialized applications are required in operating satellites in space; for use in Television transmission, Weather measurement, determining Ocean and Atmospheric conditions, and sensors for deep space.

- *Aircraft Industry*

The development of personal entertainment centers for each passenger and the necessity for more automation in the cockpit requires many advanced micro devices.

New CAD/CAE Technologies

Technologies are available now that can greatly enhance the health status knowledge of a complex system. Reported by contributor Dennis Hoffmann, Prognostics & Health Management (PHM) is the term used to describe this technology. PHM is described by Hoffmann as the "next generation" approach to system maintenance and health management, and a comprehensive approach for detecting and isolating failures as well as predicting remaining useful life for critical components. PHM is a hierarchical distribution of data collection and information management elements, both on-board and off-board a system, that make maximum use of conventional failure symptom-detecting techniques combined with advanced software modeling to achieve excellent failure detection and isolation with zero false alarms. PHM also collects and processes performance information on critical components to enable prediction of remaining useful life for those components. The information processed and managed on-board a complex system enhances the operator's knowledge of remaining capabilities in the event of malfunction and, at the same time, triggers Autonomic Logistics processes by relaying failure information to the home base. Autonomic Logistics is the concept of automating previously labor-intensive activities such as maintenance, spares, and transportation management. The use of on-board processing resources, coupled with an Autonomic Logistics system, provides operational and support cost savings over legacy systems while providing superb system management capabilities. Hoffmann gives several examples of applications as described below.

Both Boeing and Lockheed Martin's proposals for the next generation fighter aircraft, the Joint Strike Fighter, include PHM capabilities integrated within their designs. PHM as a function touches every element of the aircraft in some way. The PHM development approach is to design for excellent diagnostics, supplement the diagnostics with reasoning to enhance failure detection and isolation, and selectively acquire performance data for equipment to predict remaining life.

Cummins Engine Co. Inc. has unveiled a new engine, that is a product of a totally integrated approach to engine design calculated to improve everything from manufacturing to maintenance. The engine has an electronic controller that is a full-function computer that delivers diagnostic, prognostic, and reporting capabilities. Service technicians can diagnose performance problems as well as calculate how long to stretch maintenance intervals safely. The controller compares data received to what a "normal" reading would be and if it notes anything out of the ordinary, it stores that information. Customers can literally see how the engine is being operated and plan for maintenance when it's least disruptive, thus reducing unscheduled downtime. Capabilities include advanced prognostics and diagnostics, with industry-standard data-links for uploading and downloading of use information and reconfiguring parameters. It provides a "window" where real-time engine performance data (such as fuel consumption, idle time, fault codes, and maintenance reminders) can be viewed.

Another technology enhancement described by Dennis Hoffmann is a method called REBAM® that is available from Bently Nevada Corporation. This method allows vibration measurements taken directly at a bearing outer ring. This direct measurement greatly enhances bearing vibration data. The REBAM® system provides a simpler and more direct method for

determining rolling element bearing condition with the added capability to also monitor the machine's condition.

Device and Product Design

Process optimization techniques are employed in the design of present state of the art bulk silicon DRAM technology, contributor Bill Tonti reports. Numerous issues influence a MOSFETs in-line process and field reliability. Assuring a stable IC design is a great challenge, and has many concerns with today's small feature size. Some of these are investigated using present DRAM technology.

Inclusion of process tolerances and lifetime shifts during the design of a DRAM transfer device greatly influences the MOSFETs performance and reliability operating point. Given an appropriate relationship for each occurrence a statistical design methodology insures product stability. The device off-current (Iso) and on-current (Ion) trade-off are the primary design goals of a given technology. Simple scaling (i.e., $I_{on} \propto (T_{ox} / L)V_t, I_{so} \propto Ae^{-v_t/B}$)) shows L and T_{ox} can be used to improve drive current. If nothing else is done, then V_t and subsequently I_{so} suffers. Well doping may be increased to compensate for the reduction in T_{ox} and L. This adjustment could lead to a large increase in base V_t tolerance, source to substrate sensitivity, and substrate hot carrier problems if not implemented in a manner, which minimizes these adverse effects. There exists an optimum doping profile which satisfies the above conditions, Dr. Tonti reports. Today's state-of-the-art isolation technology is box shaped, and commonly implemented as a trench filled with SiO2. This isolation tends to have a parasitic parallel device gated at the isolation edges. In some cases I_{so} may be defined by the number of edges in a design rather than the total device width. Edge degradation therefore becomes a mechanism to be investigated in this type of isolation technology. Wafer-level burn-in and module-level burn-in test methodologies are important early life screens used to improve the overall yield by replacing circuit reliability failures with known good spare elements.

Contributor Wayne Ellis reports on the issue of *Functional Reliability* addressed in the realm of high performance DRAM product design and development. Insights into defects, their distribution and activation energies have been applied to the design methodologies for today's advanced DRAM products. These methods seek to reduce product sensitivities to the most common defect species, such as use of redundant elements for the DRAM array and use of relaxed design ground rules for the support circuits where the concept of a redundant element is more problematic in it's implementation, Dr. Ellis explains. However, the concern for the support circuits is moderated by at least two complimentary effects. The first is that the density of defects falls off as x^{-3} as defect size increases above the minimum printable dimension of the lithographic tools in the fabricator. The second effect is the increasing amount of defect induced leakage current needed to disrupt operation of the more robust support circuits.

Functional reliability issues relate to such electrical issues as noises in the chip power/gnd grid, precision timing circuits and delay stability in the presence of process parametric variations. Another aspect is how device scaling and the required reduction of internal operating voltages is affected by the external operating/interface voltages defined by international standards bodies such as JEDEC. This dictates that the internal operating voltages and resulting device design point must be developed with consideration of external voltage and the electrical impedance characteristics of product package and the on-chip voltage regulation system and power grid.

New IEC Standards on System Safety

Historical disasters such as the poisoning at Bhopal, India and the destruction of nuclear reactors at Three Mile Island and Chernobyl have indicated the need for a more thorough assessment of the safety of process control plants. Contributors John Peter Rooney and Yoshinobu Sato report independently on the significance of the update of two international standards related to Safety Management. IEC 61511 *Functional Safety: Safety Instrumented Systems (SISs) for the Process Industrial Sector* and IEC 61508 *Functional Safety-Safety Related Systems* are being developed by the task force of IEC/TC65/65A to deal with the intensified need for safety in process control. Historically, ISA S84.01, *Applications of Safety Instrumented Systems for the Process Industries* pre-dates IEC 61508 by a few months. Both ISA 84.01 and IEC 61508 are similar in requiring the quantitative assessment of Safety Integrity Levels (SILs) for Safety Instrumented Systems (SIS). IEC 61508 has four different SILs, while ISA S84.01 covers the various operations in only three SILs.

Both standards are largely devoted to the calculation of SIL numbers for the designs of Safety Instrumented Systems, the shut down systems for plants that can be dangerous. The demand for safety in process control by the fifteen member nations of the European Union appears to be the chief reason that these standards are receiving so much attention at this time.

The chief purpose of both standards is a quantitative assessment of the risk inherent in an industrial process, emphasizing the safety shut down systems. Industrial processes range from the large refineries that convert or "crack" crude oil into petroleum products used to heat our houses and run our automobiles, to food processing plants which convert tomatoes to the ketchup we use on millions of hamburgers.

Both revised standards are expected to be issued by fall 2000 for committee draft voting (CDV). Contributor Yoshinobu Sato estimates that the standards could be approved as international standards by the end of 2001.

In the reliability and safety engineering, electronics and computer-based approaches are becoming more common every year, and are more commonly being applied to critical systems including automated transportation and lifelines, according to Sato. He reports that the current trend in safety is leaving the classical approaches of component-related way of thinking and is moving toward the modern approach by means of systems safety integrity in context of the full lifecycle of the system. Thus, both of the international standards mentioned above have dual frameworks of safety integrity levels (SILs) and of functional safety assessment. The former is required to be given to SRSs, whereas the latter to be carried

out by independent assessors over all phases of safety lifecycle.

The IEC 61508/61511 standards do not give any written instructions for certifying the SILs and/or assessors. However, it is self-evident that both of them must have some kind of qualifications by third-sector bodies. As the matter of fact, TUV Product Service has already begun to certify the SILs of components of SRSs like programmable logic controllers (PLCs) and smart transmitters. But their business does not cover the SILs of entire SRSs yet. A new certification program called *Certified Safety Engineer* has been initiated by TUV to work where functional safety assessors (engineers) are qualified.

In the UK, *CASS Scheme Limited* offers 5 types of assessment covering 16 phases of the safety lifecycle. Here, certification bodies allow only registered CASS assessors to conduct functional safety assessment. These individuals are supposed to be industrial experts who are required to attend a 5-day training course, examination and interview. This system draws heavily on the competency study document, which was recently published by IEE/BCS.

In the USA, *Factory Mutual* (FM) is also certifying components of SRSs (SISs) in compliance with IEC 61508. Both FM and TUV have an agreement to work jointly for certification. In Japan, a few companies have begun preparing the business both in certifying SILs and in offering hazard & risk analyses related to functional safety assessment. Thus, it is expected that reliability- and system safety engineering will be more tightly connected in the 21st century.

John P. Rooney reports on standards demanding more detailed Failure Modes and Effects Analyses (FMEAs), and on the suggested use of Markov methods to model the operation of the safety related system. Further, there is renewed emphasis on more accurate reliability predictions, since it is generally the predicted failure rate that is divided among the modes deemed dangerous by the FMEA. The approach in IEC 61508 evolved from the requirements of FMEAs from the venerable MIL-STD-1629A: *Procedures for Performing a Failure Mode And Effect Analysis for Shipboard Equipment.* The new millennium safety requirements necessitate a method called Failure Modes and Effects, Diagnostic Analysis, FMEDA. The FMEDA requires the identification of four device failure modes:

- Failed Safe Detected
- Failed Safe Undetected
- Failed Dangerous Detected
- Failed Dangerous Undetected.

Logically, the goal is to eliminate or minimize the number of failure modes, which are Dangerous and Undetected by the overall system. Rooney reports that, in recent work on designs for safety related systems, he, as a reliability practitioner, encountered some concrete problems in the implementation of the standards. Included in this experience has been the usual and mundane task of scheduling and running FMEAs when the entire staff is overworked and facing an unreasonable (to them) completion deadline. There has, however, also been an unusual (for engineers) misunderstanding of the difference between the accuracy and precision inherent in reliability predictions. Far too often, the number of figures beyond the decimal point, the precision, has confused the report recipient who was truly concerned with the accuracy of the prediction. When informed that a predicted MTBF of ten years may be as high as 30 years, actual, in the field, those seeking extremely accurate values for the probability of an event were abashed. In addition, when applying failure modes to complex integrated circuits, some analysts were taken aback by the lack of knowledge of how those postage stamp sized ICs can fail. The major conclusion is that these two new standards represent a fresh opportunity for reliability practitioners, worldwide.

Industrial Systems Reliability

In the industrial field, as a result of globalization and deregulation, companies have faced strong competitions, contributor Hiroshi Yajima reports. The problem of how to manage an entire plant system reliably and efficiently in order to decrease the total cost of ownership has become more daunting. Yajima identifies several approaches to cope with this problem:

- *Establishing a telecommunication line between the maintenance center and the plant, and applying the following technologies for highly reliable operation*

  1) Remote monitoring technology employing defact open standard exchange of monitoring and control data in use of object oriented software technology and intranet on the Web.

  2) Remote maintenance technology.

  3) Information sharing technology between operator in main control room and engineer and manager in work office or business office that enable engineers in remote office access and control instrumentation system.

  4) On-site information collection system that accurately gathers on-site image and acoustic information of the plant on demand.
- *Expanding remaining life of equipment and control system in plant, by introducing precautionary measures and diagnosis methods that integrate the operation history data used to monitor trends of process parameters, and assessing the remaining life of equipment and control systems with high reliability.* Achieving these technologies involves storing of operation data, also, information integration systems of heterogeneous data bases that consist of a variety of data sources such as electric device database, document database, plant operation database and failure/accident database.

In these systems, simple model prediction control systems and operation support systems with a knowledge sharing function for abnormal state have been employed to cope with failures at start up and shut down or at frequent changes of products at plant, Yajima reports. Attention to reliability in Japan has been focused on risk management instead of conventional prevention method of plant accidents. This is partially because confidence for preventive technology has been lost at recent big accidents and partially because the demand for higher reliability has been quite strong in Japan. So, companies have been forced to prepare for a variety of accidents and troubles. On the other hand, many technologies have been developed in use of operation data and trouble history data. More stock and utilization of these data and organization management method for plant accidents should be studied.

IEEE Reliability Publications

The IEEE Reliability Society sponsors several publications in the reliabil-

ity and related disciplines, including the *IEEE Transactions of Reliability, IEEE Transactions on Semiconductor Manufacturing*, and the refereed proceedings from the Annual Reliability and Maintainability Symposium and the Annual Reliability Physics Symposium. These publications are available to members of the Society as part of their membership dues. Members of the society are also entitled to discounted registration fee for participation in these reliability symposia.

Dr. Way Kuo, IEEE Fellow and Editor of the IEEE Transactions on Reliability (IEEE-R) reports on many new challenges that this journal is facing. Dr. Kuo suggests that although some reliability topics have arrived at a state of maturity, many new topics are now emerging which will demand sophisticated future research. One thing is certain: the ubiquitous presence of high-tech industry means that reliability problems will not only continue to exist as usual but are likely to require even more complex solutions.

The first issue of the journal appeared in 1950, and its frequency of publication is presently 4 issues per year. Statistics on the volume of subscribers etc. are as shown in table 1.

Year	1998	1997	1996
Member subscribers	2,592	2,620	2,657
Student subscribers	138	117	120
Non-member subscribers	619	652	689
Pages printed/budgeted	480	536	692
Average pages/issue	120	134	172
Issues per year	4	4	4
Papers submitted	201	195	189
Accept/Reject ratio	35% / 65%	41% / 59%	47% / 53%
No. of disputed papers	4	3	4
Time to publication (months)	22	20	20
Paper backlog (issues)	0	½	1

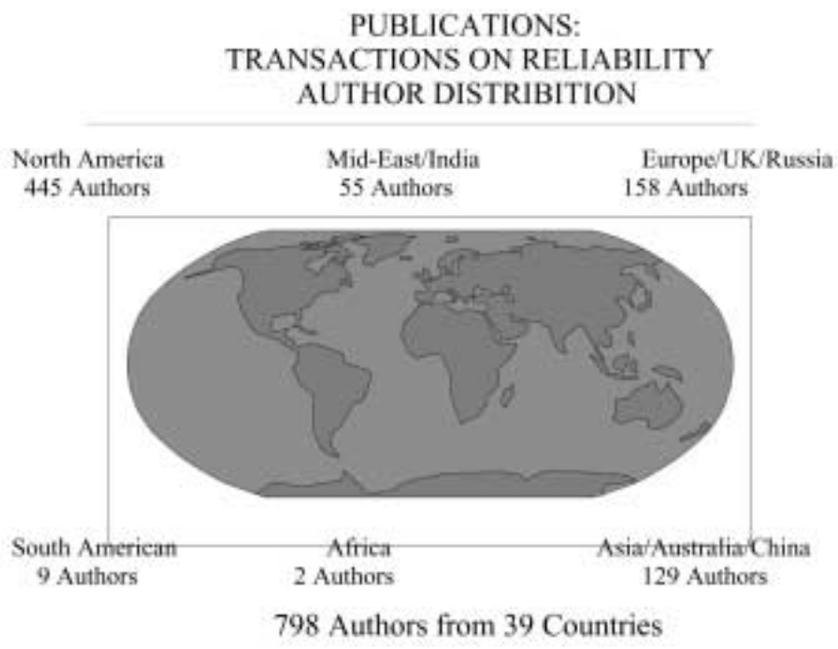
Table 1.

Papers for IEEE-R have been sought that address problems/solutions on reliability and maintainability (R&M) design, statistical inference, software R&M, hardware R&M, human reliability, and R&M performance measures in the life-cycle products or processes. Although theoretical papers are welcome, application papers have been strongly encouraged. The journal publishes papers in the following areas and formats:

1. Reliability-and-maintainability (R&M) aspects of, and solutions for, emerging technologies.
2. R&M techniques for engineering and product-design applications to emerging technologies
3. Proposed agenda for the future of R&M research.
4. Critical evaluations of current R&M research and development, including recommendations for changing the emphases in the field.
5. Reports on current R&M research results.
6. Unique R&M case studies.
7. Perspectives on R&M studies that one believes should be aired.
8. Papers on new developments and findings in areas of interest to the Society.
9. Tutorial articles, correspondence, opinion items, literature review, and other practical papers.

Occasionally, special issues/sections are devoted to a single topic of timely interest. Dr. Kuo also reports that, in the past three years, the contributing authors have come from a large number of countries as depicted in the chart below (contributed by Dennis Hoffman). In recent issues, fewer papers were published on topics of data analysis and more emphasis were placed on topics related to software and networks.

The journal is anxiously and continually looking for papers on real case studies of modern subjects.



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Editor's Message

continued from page 2

Editor's Note

Please Participate, I have received only one response to date.

I would appreciate your opinions on two questions.

1. Should reliability engineers be certified?
2. Should companies certify their reliability engineering processes to maturity levels as is done with software?

Please email your opinions to me at D.L.Franklin@ieee.org. Regular mail is also acceptable, address below.

Thanks
Dave Franklin

Millennium Medal History

- Not since the 1984 IEEE Centennial Medal has the IEEE given an Institute-wide award to honor such a select and special group of members.
- The Third Millennium Medals will honor 3,000 outstanding members
- World-renown sculptor Gladys Gunzer created the Millennium medals. Her work includes the 1984 IEEE Centennial Medal and the 1980 Winter Olympics Medallions.
- The design includes a world map symbolizing the global nature of the IEEE and the words "In celebration of the Third Millennium".

Congratulations to all award and medal winners of 2000.

Loretta Arellano
Awards Chair, 2000

Dear Dr. Ken LaSala and all AdCom:

Thank you very much for dispatching Dr. Sam Keene to Tokyo Chapter as an IEEE Reliability Society Distinguished Lecturer. During his stay in Japan from Nov. 20 to Nov. 26, Dr. Keene kindly gave us two Special Talks, the one in Tokyo and the other in Kyoto. Both Special Talks were greatly successful.

On Nov. 22, Dr. Keene gave us in Tokyo the first Special Talk on "Six Sigma and Quality Development", which attracted 107 attendants, mostly from industries. On Nov. 24, he gave us in Kyoto University the second Special Talk on "Software Reliability", which attracted 20 attendants, mostly from the University and some from industries. Details will be reported in the Newletter by the Tokyo Chapter Chair soon.

We would like to express our heartiest thanks to Dr. Sam Keene, Dr. Ken LaSala and all AdCom, who made it possible and also made it great success.

Best regards,

Dr. Koichi Inoue
VP TechOps
Junior Past Chair,
Tokyo Chapter

IEEE Sensors Journal

New for 2001!

The **IEEE Sensors Journal**, a print and electronic journal to be published bimonthly beginning in June 2001, will be a fully-refereed publication with an online peer review system and electronic submission of papers. **IEEE Sensors Journal** covers the theory, design, fabrication and application of devices for sensing and transducing physical, chemical, and biological phenomena. With an emphasis on the application of sensors and focusing on the electronics and physics aspects of sensors and integrated sensor-actuators, **IEEE Sensors Journal** will cover the numerous sensor technologies spanned by the IEEE as well as emerging sensor technologies.

Publish in a Journal You Can Afford!

Professor Vladimir Lumelsky of the University of Wisconsin, who is currently on sabbatical at the National Science Foundation, was recently named Editor-in-Chief of **IEEE Sensors Journal**. "With 37 review paper commitments for the inaugural issue by the top names in the sensor field, we are well on our way toward our goal of publishing a journal of the highest quality," said John Vig, President of the IEEE Sensors Council. "We want to provide a place where the best authors can publish in a journal they and their libraries can afford. It is imperative that the major players in this evolving technology create a forum for an affordable information exchange. And it's important that the papers be rapidly peer-reviewed and available online," said Vig.

Endorsed by SPARC

SPARC (the Scholarly Publishing and Academic Resources Coalition) has announced its collaboration with IEEE to produce the **IEEE Sensors Journal**. "IEEE is a high-quality non-profit publisher that's well prepared to bring a low cost alternative to market," said Rick Johnson, SPARC Enterprise Director. "Moreover, they have an impressive record of publishing economical, high-impact journals. Their average institutional subscription price is about half that of all engineering titles."

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Also New for 2001!

IEEE Transactions on Device and Materials Reliability

This new publication will provide in-depth analysis of the measurement and understanding of the reliability of electronic materials and devices at each phase, from concept through research and development and into manufacturing scale-up. Available solely online, the scope of this publication includes the reliability of Devices, Materials, Processes, Interfaces, Integrated Microsystems, Transistors, Integrated Circuits, and Thin Film Transistor Applications.

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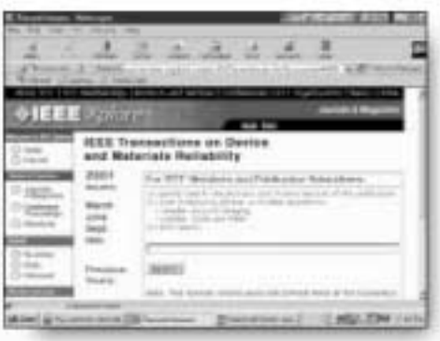

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Three copies of the papers (maximum 15 double-spaced pages) should be submitted by March 1, 2001, to Program Chair:

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