Reliability Society

NEWSLETTER

Vol. 53, No. 3, December 2007

President's Message

Dear Reliability Society Members,

As 2007 closes out, I have quite a bit of news to share with you. First and foremost, I would like to congratulate the newly elected ADCOM class of 2008. Our new members are Joseph A. Childs, Irving Engelson, Sam Keene, Carol Smidts, Todd Weatherford, and W. Eric Wong. The entire ADCOM looks forward to meeting these new members and working with them in their three year term.

The Reliability Society (RS) has improved on member benefits in 2008. The ADCOM has worked on this in 2007, and we are pleased to roll this out. Your annual renewal now includes an additional transactions, "IEEE Transactions on Dependable and Secure Computing" (TDSC)". This offering is based on an agreement with the IEEE Computer Society (CS) where we the RS have the opportunity to subscribe to a CS Transactions at their member price. In real dollars, this lowers the entrance cost for our members significantly. The Transactions has significant overlap with our field of interest, and as such the RS ADCOM worked to make this available to you, our RS members. Given that we have accomplished this, if you as members view additional publications from other IEEE Societies that you would be interested in receiving as an RS member, please make our 2008 Publications VP, Alan Street, aware of your interest (astreet@qualcomm.com). We will look into your request.

The ADCOM has voted to support a magazine adder for our membership. As I have previously discussed, the content area we will concentrate on are the reliability issues identified with "Trust". A focus team consisting of Jeff Voas, Bret Michael, Sam Keene, Christian Hansen, Dick Doyle, and myself are working the publication approach. We have reached a decision point that I am pleased to share. After considering all our options, we have determined partnering with an existing successful magazine that has excellent content is what we should pursue. We also were looking for a magazine where "Trust" is a natural extension to the magazines content. We have chosen to partner with the Computer Society, specifically with the magazine entitled *"IEEE Security and Privacy"* The partnership will include the addition of RS "Trust". The new title of this magazine will be *"IEEE Security and Privacy*, Building Dependability, Reliability, and Trust". The negotiations with the Computer Society are proceeding and we plan to ask for IEEE TAB approval in February 2008. In 2008, the RS membership will be given a no cost digital subscription to this magazine. Logistically this takes place through an e-mail security check. We have pulled all the RS 2007 member e-mail addresses from the IEEE database. If for some reason you do not receive a subscription confirmation by 3/01/2008, please send Alan Street an inquiry, (include an updated e-mail and your IEEE membership number), and we will resolve this. I hope that you are as energized as the ADCOM is over this exciting news, and that you will be contributing articles to this magazine. "Trust" has a very broad scope wherein everyone can have an influence.

Energizing or exposing engineering "graduates of the last decade" (GOLD) to industry and academic experts / mentors is a very important strategic goal of the Reliability Society. It is important for us as engineers at large to foster relationships with the upcoming generation, or if you will, our replacements. Below I describe a few of the GOLD activities (Student outreaches, Scholarships, and Women in Engineering) the Reliability Society has accomplished in 2007, and I solicit your inputs for ideas and additions and help for 2008.

In 2008, our VP of Membership will change hands from Scott Abrams to Jeff Clark (jclark@fcgnetworks.net).

Our September ADCOM was held at Stonybrook University on Long Island, NY. In conjunction with our business meeting, a very successful technical student outreach took place at the university. The outreach was led by Scott Abrams, 2007 VP of Membership, and an alumnus of the university. It is important to point out a student outreach is not simply having pizza and soda during lunch, it is an all day technically packed event where experts in their respective reliability fields delivering transaction polished platform papers to the students and faculty. Scott, as he learned by a trial of fire, took on an immense assignment as conference chairman, technical program chairman, logistics provider, and audio visual chair. We applaud Scott and thank him for his efforts that go beyond normal and approach superhuman.

In addition to having a successful technical program and meeting the students, the society learned quite a few interesting facts about Scott! - one of which is regarding the amount of hair he had in his younger college days versus today…

Scott (and his sister) during family visiting day at Stony Brook University (1979)

Scott welcoming everyone to the Stony Brook University Symposium

Following are the presentations that were given at Stony Brook University:

Session 1A

A Walk Through Obtaining a U.S. Patent by Dr. William R. Tonti, President IEEE Reliability Society and Manager CMOS Modeling and Release, IBM

The ingredients that are necessary and sufficient for granting a US patent are the intersection of new, useful, and non-obvious elements of enablement. This intersection is used by experts skilled in the art to examine the patent specification and it's claims. As an inventor you must describe why this application is not anticipated by the prior art. The analysis of the art when viewed as a unique element or in combination therein cannot read against the claims that arise as a result of the proposed invention.

This talk will analyze USPA 5,798,553 "Trench Isolated FET Devices, and the Method for their manufacture". The application describes a fundamental industry problem, and a proposed solution. A description of how this problem statement was introduced into the technical community through IEEE publication is also shown. Fundamental electrical engineering principles are used to both analyze and solve the problem. A semiconductor process solution using standard techniques is shown to satisfy the conditions of new, useful, and non-obvious, and leads to the claims this patent now protects.

Session 2A

Ten Lessons from The University of Experience - Advice for Future and Existing Managers by Dr. Irving Engelson, IEEE Fellow, Past President of IEEE Engineering Management Society

All Engineers are affected by management. Some are managers and virtually all are being managed. University and college programs and courses are available to assist engineers with management knowledge. But there are areas of knowledge that come from experience that are not part of the normal educational course offerings. Dr. Engelson will present a set of principles based on his many years of management experience in industry, academe, and the not-for-profit sector. The principles are based on conventional wisdom that is seldom articulated. Engelson brings this experiential knowledge to life.

Session 3A

Lessons Learned on Five Large-Scale System Developments by Nathaniel Ozarin, Senior Engineering Consultant, The Omnicon Group This paper considers five categories of lessons learned on an equal number of large-scale projects. The lessons concern project difficulties caused by thinking that's stuck in the present, excessive faith in code re-use, failure to see the big picture, absence of independent failure analysis, and estimation processes driven by fear and ignorance. The first step for minimizing these difficulties is to recognize them. The next step, as a goal, is to encourage thinking that benefits the entire organization rather than the project.

Session 4A

Effective Time Management Techniques by Dr. Christian Hansen, Department Chair and Professor of Mathematics/Statistics, Department of Mathematics, Eastern Washington University

Time is a limited resource that must be managed wisely in order to perform the critical functions that rests upon each team player or leader. The implementation of effective time management techniques is a key factor in maintaining a productive environment. Likewise, poor time management can lead to reduced quality and reliability of products or services being rendered. The presentation will discuss methods and suggested practices for managing tasks and setting priorities to ensure that time is devoted proportionally to the tasks that are most critical for the success of a leader or team player's unit. Additional focus of the presentation is on preparing a "time budget" similar to a financial budget and on collecting data that compare actual time consumed to time budgeted.

Session 1B

A Process for Failure Mode and Effects Analysis (FMEA) of Computer Software

by Nathaniel Ozarin, Senior Engineering Consultant, The Omnicon Group Software FMEA is a means to determine whether any single failure in computer software can cause catastrophic system effects, and additionally identifies other possible consequences of unexpected software behavior. The procedure described was developed and used to analyze mission- and safety-critical software systems. The procedure includes using a structured approach to understanding the subject software, developing rules and tools for doing the analysis as a group effort with minimal data entry and human error, and generating a final report. Software FMEA is a kind

of implementation analysis that is an intrinsically tedious process but database tools make the process reasonably painless, highly accurate, and very thorough. The main focus here is on development and use of these database tools.

Session 2B

Juggling the Software Assurance Puzzle Pieces by Dr. Jeffery Voas, Director of Systems Assurance and Technical Fellow, SAIC

Software assurance is a puzzle. It is composed of very precise pieces that must fit together to demonstrate that the software serves its operational intent. Decades of research have been performed to tackle this problem, taking diverse approaches, and providing diverse results. This talk looks at the key research issues to be addressed, where the state of the practice is today, and what problems are so large that any complete solution is unlikely.

Session 3B

Developing World Class Products with "Design for Six Sigma"(DFSS) Tools by Dr. Samuel Keene, Six Sigma Master Black Belt, Keene and Associates

The Six Sigma process has been shown effective in identifying and eliminating product defects and eliminating waste, thereby improving process efficiency and product reliability. Six Sigma also goes the next step: to leverage the knowledge gained in resolving the defect to also improve the underlying development process. Hopefully, this proactive step not only improves the present product but keeps the problem from recurring in future products. Major companies, like Ford Motor Company, have published tractable savings in excess of 1B USD.

The six sigma processes has been beneficially extended to take the initiative in developing better designs in the first place, precluding problems rather than having to go back and correct them (six sigma focus). This is the Design-for-Six Sigma (DFSS) initiative. It focuses on getting correct requirements, communicating these effectively across the team, examining and managing the design and environment anomalies, and optimizing the design operating point. DFSS has been shown to deliver products with as few as 3-4 defects per million opportunities, such as seen on space shuttle software or commercial aircraft flights in the US.

This workshop teaches Six Sigma terminology and techniques that can be applied to software and product development. DFSS methodology will be discussed including ten key DFSS processes and tools that can be used to improve the development of systems and software.

Session 4B

Building Predictable Behavior into a System of Systems by Dr. J. Bret Michael, Professor of Computer Science, and Electrical and Computer Engineering, Naval Postgraduate School

Traditional systems engineering is based on the premise that engineers can build a complete system if provided a complete set of requirements, in addition to the assumption that operational concepts are completely known during requirements elicitation. The focus of traditional systems engineering is on engineering single systems with fixed boundaries, starting with hardware integration followed by addressing software. In this presentation we advocate a very different perspective on how to conduct systems engineering. Our perspective focuses on shaping the behavior of systems, whereas system behavior from a dependability perspective is left to the trade analyses in traditional systems engineering. We will discuss our perspective in the context of achieving predictable behavior in modern-day systems of systems.

Session 1C

Improvements in Antenna Reliability by Scott Tamashiro, Principal Systems Engineer, Raytheon Company, Space and Airborne Systems

As technology improved, the radar antenna reliability has improved. With fewer moving parts, higher reliability components, and reduction of single point failures, the number of times field personnel had to remove the antenna decreased, improving mean time between repair times and reducing downtime. But with these improvements, the techniques to calculate reliability have grown more complex. This short presentation will go over some of the reliability improvements of the radar antenna and generically describe the reliability modeling and calculations taking into account redundancy and degraded performance.

Session 2C

Microelectromechanical Systems (MEMS) Reliability by Richard L. Doyle, P.E., Consultant

The intent of this tutorial is to provide:

- An overview of MEMS reliability engineering.
- A comparison of various mechanical reliability predictions and sources of data along with helpful methodology in using them.
- An understanding of important relationships with other reliability/design disciplines.

Session 3C

Focused Ion Beam Technology and Applications to Microelectronics by Marsha Abramo, Advisory Engineer, World Wide Analytical Services Laboratory, IBM Microelectronics, Systems and Technology Group

During the past two decades focused ion beam (FIB) systems have become indispensable tools in the arsenal of analytical techniques available to failure analysts and integrated circuit designers. FIB systems are similar to scanning electron microscopes (SEM) in that a charged particle beam is generated, raster scanned, and used for high resolution imaging. In addition, the use of massive Ga ions permits the FIB system to be used for both material removal (milling) and deposition, enabling applications such as precision cross sectioning and circuit modification. This presentation will review the fundamentals of FIB systems, describe a wide range of applications and discuss FIB techniques used for circuit modification and failure analysis. The reliability of FIB modified integrated circuits will also be discussed.

Session 4C

Challenges of Going Green - Early Problems with Lead-Free Solders in the Cell Phone Industry by Alan Street, Senior Staff Engineer/Manager of Failure Analysis, Qualcomm CDMA Technologies

During the introduction of Pb free solder in ball grid array (BGA) packages, reflow profiles were changed in the manufacturing of cell phone circuit boards to reflect the higher melting point of the SnAgCu alloys. Initial profiles maximized dwell time above 217 degrees C, which provided good solderability but poor impact strength. Analysis of the solder joints found that an unexpected CuNiSn over NiSn intermetallic compound formed under the higher time/temperature exposure, resulting in a brittle layer between the solder ball and the package metallization. A design of experiments optimized the solder flux and reflow profiles for successful manufacturing of Pb free handsets.

Session 5C

Safety and Reliability on the NASA Space Shuttle-A Look Back by Dr. Robert J. Loomis, Jr., Senior Manager for System Safety and Reliability, and Director of the Integration Division (Retired), NASA Kennedy Space Center, and Alfred Stevens, Director of the Safety Advocate's Office in Florida (Retired), United Space Alliance

The Space Shuttle system will be retired in 2010 after 29 years of service. During its service life the program suffered two catastrophic losses of vehicle and crew. Dr. Loomis and Mr. Stevens will provide an introduction to the Space Shuttle Program and the Kennedy Space Center, an overview of the Space Shuttle safety and reliability program as it was originally implemented and then changed in response to the accidents and insight from their experience in working in safety and reliability on the shuttle program for over 20 years at the Kennedy Space Center in Florida.

The RS typically target two to three of these outreaches a year, and it is important to point out another event took place earlier in the year at Eastern Washington University (Spokane Washington), and in this case Christian Hansen lead all the technical and logistical arrangements for the event. An earlier event took place in conjunction with the Robotics Society, and in this case the event was truly international, taking place in Italy. Marsha Abramo carried the ball for this outreach.

As a point of closure we plan to once again combine our business meetings with student outreaches in 2008, and we would consider hosting an event at a school, or in conjunction with a Chapter or company event. The point of contact is Marsha Abramo ,VP of meetings mabramo@us.ibm.com.

The IEEE Reliability Society is delighted to award $2000 scholarships to five students who are pursuing reliability-related academic and professional goals. Our honorees include:

Ms. Kellie Schneider, a Ph.D. student in Industrial Engineering at the University of Arkansas, is the initial recipient of the RS scholarship. Her credentials include research published in the IEEE Transactions on Reliability, both a moderator and a presenter at RAMS, publications in several other technical journals, selection as both the Best Undergraduate Researcher and the Best Graduate Student, a teaching assistant, and numerous other accolades.

Ms. Yanping Wu, a Ph.D. Industrial Engineering student at the National University of Singapore, pursuing a degree in Software Reliability. Ms Wu has completed a number of reliability-related courses, has in impressive publication list, and considerable experience in presenting papers and participating in IEEE conferences.

Mr. Jie Gu, a Ph.D. Mechanical Engineering student from the University of Maryland Center for Advanced Life Cycle Engineering, who demonstrated a broad reliability perspective, presented papers at several IEEE conferences.

Mr. Christopher Wilson, a Ph.D. Electrical Engineering student who has also presented at an IEEE conference, who is involved in IEEE student congress, and has exhibited real, applied reliability through his academic research project and his work in industry.

Mr. Lance Fiondella, a Computer Science and Engineering Ph.D. candidate at the University of Connecticut, who has several published papers in both software and hardware reliability whose dissertation research involves extending architecture-based software reliability modeled by discrete-time Markov chains.

These honorees share several common traits – outstanding references from faculty members with impressive credentials, exceptional academic achievement, and demonstrated interest in the IEEE and reliability related professional activities. Up to five $2000 scholarships will be awarded each year to students who have demonstrated achievement in their studies and have taken at least one course with reliability content.

Detailed requirements and applications for the scholarship are available here and on the Reliability Society website (http://www.ieee.org/portal/site/relsoc/) and through school financial aid offices.

The RS thanks Robert Loomis for his efforts in pulling this together and leading an evaluation team.

A reliability society member Lisa Edge (lfedge@us.ibm.com) herself a GOLD member is the RS Women In Engineering (WIE) representative. Lisa is working on ways to retain engineers, and has a lot to share within WIE and is contributing to the WIE charter. Clearly networking is a key goal, whether it be GOLD or WIE related and Lisa is pursuing ways to improve upon this. At all levels be it WIE, GOLD, and simply members networking can flourish at our conferences, our chapter, and our section meetings if we make it a priority and allow time for this. Lisa is working on this as a primary goal.

The Reliability Society instituted a new best student paper award at the 2007 International Reliability Physics Symposium. (www.irps.org) This award recognizes the best student paper as judged by the technical program chairs. It is in addition to the best overall conference paper, and it specifically targets student submissions. In of itself it is a GOLD activity, and it provides student researchers a unique opportunity. Jason P. Campell of Penn State University has won this award in 2007 f or the paper entitled "Location Structure and Density of States of NBTI-Induced Defects in Plasma-Nitrided pMOSFETs"

Conferences are in of themselves a very important part of the Reliability Society and we strive to deliver excellence in the conferences we technically and financially sponsor. The ADCOM voted to finance two new conferences in 2008. One is entitled "Secure System Integration and Reliability Improvement" (SSIRI), http://paris.utdallas.edu/ssiri08/main.html. SSIRI 2008 will focus on integrating tools and approaches for developing reliable, secure, and trustworthy systems. This will held in Yokohama Japan July 14-17, 2008 If you would like more details please contact Professor Shuichi Fukuda, the General Chair for SSIRI, (shufukuda@gmail.com). SSIRI will also feature tutorials on (1) design of trustworthy systems, (2) design for six sigma, and (3) assuring reliable structures or mechanisms. More tutorial information can be obtained from Sam Keene, SSIRI tutorial chair (s.keene@ieee.org).

A second conference is entitled Prognostics and Health management (PHM), and this investigates the built in reliability monitoring and corrective action for a system or a subsystem. This will be held in Denver Colorado October 6-9 2008. For more details regarding PHM 2008 please contact Dennis Hoffman, dennis.r.hoffman@lmco.com. I would like to note that PHM 2008 will have a GOLD competition wherein PHM will provide system reliability data so that teams can analyze and provide PHM actions. Three prizes at the conference will be awarded based on their respective novel approaches in fulfilling the challenge.

Irv Engelson our division director (the RS is one society in division VI) led a strategic planning session at the Stony Brook business meeting. Strengths, Weaknesses, Opportunities, and Threats or “SWOT” is the analysis the entire ADCOM participated in. Four subteam leads, lead the ADCOM and subsequently between August and now have refined the SWOT RS strategic areas into specific deliverables the VP’s will consider in 2008. We thank Irv for his time, and we also than the four team leads, Lou Gullo, Alfred Stevens, Scott Tamashiro, and Lon Chase for the many hours they have spent post ADCOM in their refinement. Here is a brief description of the top items:

1. Inter society networking: Develop collaborative projects. This item will be led by Sam Keene, The VP of Technical Operations, and will be co-owned by Jeff Clark, The VP of Membership and Marsha Abramo, the VP of meetings. Alfred Stevens is working on some co-operative ideas as we enter 2008.
2. Increase ownership percentage of existing publications and create new publications. This item reads directly on Trust, and as we finalize the details and roll this out in 2008 a team led by the VP of publications, Alan Street, will be working on this activity.
3. Recruit new members through an existing RS structure, and enhance communication to all existing RS members: This item is primarily owned by Membership, but it also relies upon publications. In 2008 look for enhancements/plans made to the RS society portal to improve communication and content to our members. If you have suggestions in this area please email Marsha Abramo.
4. Leverage our field of interest, and expand our offerings to members, and potential members who have specific interests. This item is owned by the VP of Technical Operations, and has many areas to investigate in 2008. The line item seeks to enhance conferences by bringing in experts to deliver invited talks, to expand our conference offerings based upon our broad field of interest, and also to strengthen our already existing communities such as but not limited to our Chapters.

In January 2008 at RAMS we will hold an all RS Chapters Congress. Jeff Clark has already contacted the chapter chairs and has solicited their respective support. Synergistic with (4) above Technical Operations will participate in the congress and look to help the chapters by describing and availing the resources contained within Technical Operations, and vice versa. If you have any interest in attending the congress please contact Jeff. This is an open meeting.

TAB: Technical Activities Board meeting Nov. 2007: Tab met in Boston. An annotated summary of what transpired is availble here.

Regards, and Happy New Year!

Bill Tonti

IEEE Reliability Society President

mailto:wtonti@US.IBM.COM

From the Editor

Welcome to the IEEE Reliability Society e-Newsletter. An issue will be published quarterly and published to the Reliability Society website.

We welcome your articles, comments or questions. All RS Newsletter inputs should be sent electronically to l.chase@ieee.org.

March	*Inputs due February*
June	*Inputs due May*
September	*Inputs due August*
December	*Inputs due November*

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Society News

Society Chapter Awards

Here are the 2006 IEEE Reliability Society Chapter Awards results:

1. Singapore (88 points) - $500
2. Boston (82 points) - $300
3. Twin Cities (73 points) - $200
4. Baltimore, Cleveland, Denver, Italy, Japan - $100 each

Cash awards will be issued as specified on the submission forms.

Congratulations and thank you for all your hard work!

Jeff Clark

Member, IEEE Reliability Society AdCom

Election Results - Society Officiers for 2008

- President: Bill Tonti
- VP Meetings:Marsha Abramo
- VP Tech Ops: Sam Keene
- VP Pubs: Alan Street
- VP Membership: Jeff Clark

Thanks to all that voted and/or ran in the election!

Society Recognition

Lou Gullo Recognized for Management and Development of Standards

Dr. Samuel Keene, VP Technical Operations

At the September IEEE Reliability Society ADCOM meeting, Lou Gullo was recognized and given an award for his contributions towards managing the development of 2 new IEEE standards. These standards are IEEE P1624 and IEEE P1633 which are sponsored by the Reliability Society. Lou recently accepted the position as Standards Chair for the Reliability Society Technical Operations in March 2007. Since starting in this role, Lou rapidly got involved and learned the Standards Chair position. He developed a solid working relationship with the IEEE Standards Association (IEEE-SA) Program Manager and the other members of the IEEE-SA. He established interfaces to the P1633 Working Group and Working Group Chair, Dr. Norman Schneidewind. Lou initiated ballot actions on behalf of the sponsor and the working group. He worked many long hours during personal time and weekends to contact ballot group members and working group members to work comment resolution. He edited the working draft to respond to comments from the ballot group members so their comments would be addressed to their satisfaction. Lou has taken the role of Standards Chair, to a new level with the initiative and level of effort to work the issues and drive the standards to publication following the process established by IEEE-SA. It is exciting to see the level of dedication that Lou has put forward and the current progress in the reliability technical standards area. Thanks Lou!

In Memory of:

The Reliability society recognizes the passing of C. Raymond Knight - A Reliability Icon. A eulogy to this important figure in the reliability community by Tom Fagan can be read here.

Also provided for reference is a 1999 interview of Ray Knight done by the IEEE History Center.

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Society Solicitations

Reliability Society Engineer of the Year Award for 2007

"The IEEE Reliability Society is soliciting nominations for its reliability Society engineer of the Year Award for 2007. This award aims to recognize key contributions to the reliability profession with the contribution occurring within the last few years. Nominees will be considered according to the following criteria:

Reliability Contributions

Reliability Technical Contributions

Reliability Management Contributions

Reliability Publications

Contributions to Reliability Education

Profession Service to IEEE

Reliability Society Service

Other IEEE Service Positions

An administrative superior of the nominee (e.g., department head, supervisor, or chapter chair) should make and submit the nomination. The nomination package should consist of a ½ page biography of the nominee plus up to a maximumof four pages of concise descriptions of accomplishments. For technical contributions, concisely describe why the contribution is unique. For managerial and educational contributions, concisely explain the obtained benefits. Please limit identified publications to only those in which the nominee was the sole or principal author. The accomplishments should be organized according to the above-described criteria. Send nominations to the Jr. Past President (j.voas@ieee.org) and copy the Senior Past President (dennis.r.hoffman@lmco.com)."

Reliability Society Lifetime Achievement Award

"The IEEE Reliability Society is soliciting nominations for its Reliability Society Lifetime Achievement Award for 2007. The IEEE Lifetime Achievement Award was created to recognize sustained outstanding contributions to the field of reliability engineering. Typically the contributions will span the career of the individual, usually in excess of 25 years. The contributions meriting this award must clearly be within the area of reliability engineering.

Nominations must be submitted by a peer or supervisor of the nominee. Self nominations or nominations from a member of the IEEE Reliability Society Nominations and Awards Committee will not be accepted. The nomination package should consist of a ½ page biography of the nominee plus up to 4 pages of concise descriptions of the nominee's lifetime accomplishments. Nominations may be submitted until mid-November of the year of award. Send nominations to the Jr. Past President (j.voas@ieee.org) and copy the Senior Past President (dennis.r.hoffman@lmco.com)."

Reliability Society Scholarships

Up to five $2000 scholarships will be awarded each year to students who have demonstrated achievement in their studies and have taken at least one course with reliability content. We encourage all interested students to apply.

"We are extremely pleased with this outreach effort, and hope that these scholarships encourage students to take an interest in Reliability Engineering and to understand that reliability is an overarching factor in whatever they may be studying and what they will do in their career. If you are a student, and have taken a course with reliability content which sparked an interest in reliability, I encourage you to apply for this scholarship" said Bill Tonti, the President of the IEEE Reliability Society.

Detailed requirements and applications for the scholarship are available here and on the Reliability Society website (http://www.ieee.org/portal/site/relsoc/) and through school financial aid offices.

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Chapter Activities

Boston

Dallas

Denver

Singapore

Twin Cities

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Technical Activities

Technical Committee Reports

The Reliability Society Annual Technical Report (ATR) for 2007 has been released. It is availaible for viewing in three parts. Part II can be viewed in with this link. Part I is available in the prior newsletter and III will be available in the next newsletter.

Society Technical Activity Organization

"Technical operations" is now called "technical activities" to align with the naming used by the IEEE technical advisory board. "Technical activities" is obviously the technical arm of the IEEE Reliability Society. Its charge is to:

- Help incubate new conferences
- Foster ways to get more technical information to our members through:
  - Annual Technical Report that comes out each January
  - Enable a content rich web site that will provide IEEE RS organizational data, technical reports and data, and tools.? These capabilities are under development.?
  - Publicize state of the art work in the IEEE Transactions, Spectrum magazine, our web site, and discussion groups.
  - Enhance the RS promotional flyer with technical activities content.
  - Build templates, guides and resources to guide and mentor new members of the society and profession
  - Interface with other technical societies and collaborate on joint ventures to gain synergy
  - Deliver technical information through: classes, tutorials, DVD's, and online collaboration (meetings)

Technical Activities organization:

Sam Keene VP Technical Activities

Tech Ops Deputy	Dennis Hoffman
Tech Ops Japan	Shuichi Fukuda
Tech Ops Europe	Enrico Zio
Tech Ops Taiwan	Shiuhpyng Shieh
Tech Ops Communications	Lon Chase

Technical Pillar leads:

Jim McLinn	System of Systems Development and Performance
Robert Stoddard	Software Development and Performance
Lou Gullo	System/Subsystem Development and Performance
Aaron Dermarderosian	System Foundation Development and Performance

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IEEE P1624 Standard for Organizational Reliability Capability Goes Through Initial Ballot

By Diganta Das, Ph.D. University of Maryland

Globalization has made electronics development and manufacturing dependent upon a worldwide supply chain of contractors and vendors. This supply chain ranges from electronic part suppliers, part assemblers, board suppliers, electronic manufacturing services, and assorted outsourced services that support various facets of design and manufacturing. Original Equipment Manufacturers (OEMs) and system integrators need to assess reliability risks early in the product realization process and cannot afford to wait until they receive and test their products to determine if these products are reliable. This document is a standard for assessing, in a consistent manner, the capability of an organization to deliver a reliable product, which is defined as organizational reliability capability.• Organizational reliability capability is the measure of the effectiveness of an organization•s reliability program, practices, or activities in meeting the customer•s requirements for product reliability. Reliability capability is determined by assessing key reliability practices and associated metrics. This standard will be usable by all organizations that design, manufacture or procure electrical/electronics components or products.• The purpose for assessing the reliability capability of an organization is to facilitate improvement of the practices by the organization that impact product reliability.
A reliability capability assessment can be used for:

- Specifying or planning reliability practices if product development is implemented internally.
- Evaluating reliability practices to determine the extent to which a supplier is capable of providing a product that meets the reliability requirements/needs.
- Improving reliability practices if the current reliability practices have been evaluated and improvement is desired or required.

The standard will provide a set of key practices that should be present in an organization involved with development of a reliable product. The key practices will encompass all aspects of operation within an organization from a product reliability perspective. The standard will provide methods to assess the maturity of the organization on these key practices to determine its reliability capability level of an organization. The assessment can also help an organization in selecting process improvement strategies by determining the current maturity levels of their reliability practices and identifying the most critical areas for reliability capability improvement.
This standard, which was written by a working group with wide participation from industry and academia, has successfully completed initial ballot review by a ballot group of 106 members. After being submitted for ballot in August 2007, the balloting process resulted in a 78% response rate with 87% affirmative votes.• The ballot group has been very helpful and has provided many constructive comments.• The working group will address the comments and resubmit the draft for recirculation balloting in November 2007.

Structure of the Working Group:

Michael Pecht, PhD, Chair, CALCE, University of Maryland, College Park
Diganta Das, PhD, Vice Chair, CALCE, University of Maryland, College Park
Jerry Cartwright, Secretary, Celestica
Michael H. Azarian, Ph.D., Technical Editor, CALCE, University of Maryland, College Park

Alan Wood, Ph.D., Associate Technical Editor, Sun Microsystems
Lou Gullo, Sponsor-Standards Board Liaison, Raytheon

Six Sigma Collaborative Tools
Dr. Samuel Keene, FIEEE

Six sigma is a fact-based decision making process. One component of that is the *collaborative tool set* underlying six sigma.►► These are tools that are used to capture the state of a process.► For example, this author has successfully facilitated and mediated a volatile process problem that spanned several locations in the USA and Asia. This involved product specifications and documentation.► These documents originated in a California laboratory and then were sent to a Colorado laboratory to add additional details.► Then their final product was sent to the Asian manufacturing location to build product.► Too many problems were arising and each location did not want to be found as the 'guilty party" for those problems.► In the six sigma mode, the operational data was just collected and organized using a six sigma tool called RASCI to properly depict the operation, and the distributed responsibilities across the several physical locations.► **RASCI** is an abbreviation for:

► **R**► = ►**Responsible** - owns the problem / project

► **A**► =► to whom "R" is **Accountable** - who must sign off (**Approve**) on work before it is effective

► **S**► =► can be **Supportive** - can provide resources or can play a supporting role in implementation

► **C**► =► to be **Consulted** - has information and/or capability necessary to complete the work

► **I**► =► to be **Informed** - must be notified of results, but need not be consulted

RASCI charted the level of responsibility at each step in the development process step.► Emotion and defensiveness melted.► The working group was able to properly focus and resolve the problem without undue anxiety. In fact, this process, with its high involvement, was fun for the participants.► The problems and process improvement opportunities became apparent to all participants as the RASCI tool was used.► Defensiveness went away and much was accomplished and good feelings prevailed.►

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Sam: -)

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Memorable thoughts that can apply to Six Sigma, Lean and Project Management

Sam Keene ◆ September 2007

"If you want to build a ship, don't drum up people together to collect wood and don't assign them tasks and work, but rather teach them to long for the sea."
◆◆◆ ◆ Antoine de Saint-Exupery

I want to know God◆s equation (for a given process)
◆◆◆ ◆ Bill Diamond, IBM DOE Statistician retired and mentor to many in Six Sigma.

"Nature does nothing uselessly."
◆◆◆ ◆ Aristotle

As we mature, we need to learn to see simplicity in the complex things and complexity in the simple things.

◆Nature goes her own way, and all that to us seems an exception is really according to order.◆
◆◆◆ - Goethe

◆Pollution is nothing but the resources we are not harvesting.◆ We allow them to disperse because we◆ve been ignorant of their value.◆
◆◆◆ - Buckminster Fuller

◆Quality is never an accident; it is always the result of high intention, sincere effort, intelligent direction and skillful execution; it represents the wise choice of many alternatives, the cumulative experience of many masters of craftsmanship. Quality also marks the search for an ideal after necessity has been satisfied and mere usefulness achieved.◆
◆◆◆ - Willa A. Foster

◆When Six Sigma initiatives cease to be an irritant and become our common quest, in that moment the organization will be exponentially transformed with power.◆
◆◆◆ -◆ Sam

All decisions are made on insufficient evidence

You◆ll never have all the information you need to make a decision.◆ If you did, it would be a foregone conclusion, not a decision.◆
◆◆◆ - David Mahoney

◆◆When you are looking for an excuse, any excuse will do.◆
◆◆◆ - As a Man Thinketh

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C. Raymond Knight\uf\uf -\uf\uf A Reliability Icon

The Reliability Community recently lost a valued early pioneer in the field of Reliability and the Assurance Sciences.\uf\uf Ray Knight passed away on September 19, 2007, at the age of 89. \uf\uf Ray was born on September 25, 1918, in Salt Lake City, Utah, son of a Mormon Pioneer Family.

Ray\uf\uf s entire career was spent with ARINC, Inc. a company who for decades was at the forefront of all phases of Reliability Engineering and did seminal research in such areas as Step Stress Testing, Accelerated Life Testing, Failure Mode & Effects Analyses, and a list of areas too long to include here.

Ray retired from ARINC in 1979 as Executive Vice President\uf\uf He then served as Historian on the Management Committee of the RAMS Symposium for 19 years from 1980 to 1999.\uf\uf Ray was on the RAMS Management Committee from it\uf\uf s inception in 1954 until 1999, a total of 45 years.\uf\uf In Ray\uf\uf s early career from 1951 to 1958, he was the Director of the Tube Reliability Project at Aeronautical Radio Inc (ARINC).\uf\uf In 1958, Ray became Vice President and General Manager of ARINC.\uf\uf From 1940 until 1951, Ray was engaged in electron tube application and advanced development with the General Electric Company\uf\uf s Corporate Research & Development Center in Schenectady, NY.\uf\uf

Ray received his Bachelor of Engineering Degree from the University of Utah and a Masters Degree in Physics from George Washington University.\uf\uf He was a Life Fellow of IEEE and President of the Reliability Society in 1972-1973.\uf\uf Ray received the Reliability Society Annual Award for Excellence in 1975. \uf\uf He was a Registered Professional Engineer in the State of Maryland.\uf\uf

Ray will be missed by all who knew and worked with him over the years.\uf\uf Anyone wishing to make a donation in Ray\uf\uf s memory can do so through the University of Maryland College Park Foundation, specifying the C Raymond Knight Scholarship and mailed to the attention of Radka Nebesky, Clark School of Engineering, University of Maryland, 3214 Kim Engineering Building, College Park MD 20742.

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C. RAYMOND KNIGHT

An Interview Conducted by

David Morton

IEEE History Center

January 17, 1999

Interview # 352

For the

IEEE History Center
The Institute of Electrical and Electronics Engineers, Inc.

and

Rutgers, The State University of New Jersey

Interview: Raymond Knight
Interviewer: David Morton
Date: 17 January 1999
Place: Washington D.C.

Morton: Why don't we start. If you could tell me where and when you were born, a little bit about your childhood and early education.

Knight: You want to go back that far?

Morton: Maybe to childhood, including a little bit about how you got interested in engineering or technical things; then, how you became an engineer.

Knight: That goes back a long ways. I was born September 25, 1918, in Salt Lake City. As a kid in high school I became interested in physics, chemistry, and math. I was quite good at math, particularly in junior high and high school. I started taking mechanical drawing and things of that nature. I was very interested in that. I also started playing with crystal set radios back in those days.

Morton: Those are crystal receivers?

Knight: I built crystal sets myself, then graduated from that into building a regular tube operated receiver, a short-wave receiver. I eventually got licensed in amateur radio and built a transmitter; I built both my own receiver and transmitter. I also got my license as a radio-telephone first-class operator while I was still in high school. Then I went to college. While in high school I decided that I wanted to go to college to become a physicist. As a matter of fact, I enrolled in the University of Utah. Of course, times were kind of tough then. It was in the Depression years. I struggled in many ways to try to get enough money to make it through and went into washing dishes in university restaurants.

Morton: Why did you go into physics instead of electrical engineering?

Knight: Well, I was quite interested in theoretical side of things. Physics appealed to me very much that way. Turns out that later my sister married one of the professors in the Physics Department at the university. He was somewhat older than I, and he told me, after I had finished two years in preliminary physics, that unless I could see my way to go on to my Ph.D. in physics I would do better to go into engineering. Since I couldn't earn my keep until I got a Ph.D. in physics, I changed over after about two years. It took an extra year to make it, but it turns out that I did enjoy engineering, of course. Though electronics wasn't even a word in those days, radio was. But universities didn't have much in the way of radio. I did that on the side with a three-tube radio that I built myself and a one-tube transmitter, and learned to operate it. I worked all continents as a radio amateur; almost completely with what in amateur parlance is called C. W. (Morse code). As I got on in college there just wasn't time for amateur radio. But in my junior year, the end of my junior year, I got a job, fortunately, because of my license (radio first class). I got a job as a radio operator at the station KSL in Salt Lake City, a 50 kw station.

Morton: Was it a commercial or university station?

Knight: No that wasn't a university station. That was one of the big major stations in Salt Lake. I earned my way through senior year at school. So that was a Godsend. Well that is why I was interested in the technical things of engineering. I guess I was always somewhat of a frustrated physicist because 20 years later, after I was living in Washington, I went to the George Washington

University and got my master's degree in physics, making up a lot of physics work. I enjoyed that. I still do. As a matter fact, I was reading Stephen Hawkings' *The History of Time* just before coming up here.

Morton: When and from where did you graduate?

Knight: In 1940 from the University of Utah. While I was still in school I was offered a job in the student engineering program at GE and instructed to report in June or July following my graduation. In June of 1940, I entered GE at Pittsfield, Mass. Though I had said that I was interested in radio, I was assigned to the power transformer test program. Despite the detour, I enjoyed it, except for climbing into the top of a power transformer that was about two stories high after it had been taken off a heat test and still had hot oil fumes inside. But anyway, you're able to gather that from there I rotated through other test assignments for a year and ended up in the radio transmitter division of GE in Schenectady. I was there for three months. I started there testing a Navy 50 kw transmitter. Again, this was a CW transmitter (keyed as opposed to voice modulated), that was being constructed for war efforts. I mean pre-war efforts. This was in early 1941. Then, I was offered, even before I was off the test program, a job in the tube division of the electronics department in Schenectady. The company was not in the large-scale receiving tube business at that time, but was in the some of the special things like ultra-high frequency tubes. I don't know if you are familiar with any of that, Magnetrons and Lighthouse tubes for some of the WW II efforts such as Radar. I mean in the C-band, that is, 3,000-megahertz area. I worked in this field as a tube application engineer for most of the war years.

Morton: By applications you mean? What kind of engineering?

Knight: Tube application engineering. I worked closely with people over at the Radiation Lab at MIT and Division 15 of the NDRC at Harvard. At Harvard they were working on electronic warfare under Dr. Terman (of Stanford University). I worked with them applying lighthouse tubes in some rather exotic tricks to receive enemy radar signals and play them back with a planned delay to give incorrect range information.

Morton: Just pursue that from an employee's view. How did they do that? What was the technology for recording that stuff? Or was it just a straight delay?

Knight: Just a straight delay. Just a delay line.

Morton: Oh, I see.

Knight: When the war was over, I got involved in the ordinary receiving tube market. GE at the end of the war bought out Kenrad. That was before your day.

Morton: Now I'm a historian.

Knight: You are involved in history. So that was 1945. I was made manager for Application Engineering for all the tubes that GE made at that time, including the Kenrad line. I had a group of about five engineers that were responsible for tube Application Engineering with our major customers. It was as a part of that work that I got interested in the possibilities for uses of tubes other than in home radios. I felt that the real future in electronics wasn't in home radios. It was in industrial applications, basically. If they were going to be used in industrial applications, they had to be a hell of a lot more reliable than they had been. So, I made a survey in the late '40s, between '45 and '47 I guess it was, of various

industrial users. Everybody wanted more reliability, but nobody was willing to pay a dime for it. Typical commercial! Until finally I contacted (and this was in 1948) Aeronautical Radio Incorporated, which was owned by the airlines and was then writing specifications for new airline communication and navigation equipment. This was shortly after the war while the airlines were still using military avionic equipment and experiencing serious reliability problems with it, problems they hoped to correct, at least in the new equipment they were preparing to buy. They were very interested in getting more reliable tubes and were willing to pay more for them. We would analyze the failures and attempt to design improved types. This program resulted, largely, from experience with prior attempts to use so called "more reliable tubes," such as the Navy's post war ruggedized tubes usually called "W" types. This airline program proved to be far more successful than any of the previous attempts based on popular assumptions of what the problems were - not really knowing, not really analyzing. So much of the reliability area at that time was work generated by way of buzzwords. And there are still too many buzzwords in it.

Morton: What were examples of some of the typical problems tubes were having?

Knight: Well it was commonly thought, particularly in the military, that lack of vibration and shock resistance was the problem. So they ruggedized! We found in the airlines that shock and vibration were really not a large part of the problem. There were some vibration problems, but we found there were design ways to solve them without making them so you could hit the damn things with a hammer. We also found that there were horrible misapplications in the range of

applied heater voltages. For example, a typical tube was rated for operation at a heater voltage of 6.3 percent volts plus or minus 10 percent. They were being applied in series - parallel strings operating from 20 to 28 volt supplies. There was just no real consideration for operating things within the limits specified by the manufacturer. So we made definite recommendations in regard to application as well as to the structure of the tubes involved. We found that certain kinds of heater designs, for example, were far more reliable in these applications than others. Specifically, spiral wound heaters as opposed to folded heaters were found to be superior.

Morton: As opposed to the what type of heater?

Knight: A folded type of heater wire. I'm talking about heater wire within indirectly heated cathodes.

Morton: Right. Okay.

Knight: We also found that double micas instead of single micas solved the vibration problem pretty darn well. (Mica spacers were used in tubes as the insulating structural material separating electrodes.) There were a number of other things. Further analysis of failed tubes lead to better designs and cooler cathode temperatures, and better-controlled ones, which we did and then provided the samples of those. As a mater of fact, at first ARInc bought them for the airlines and distributed them. This was done with the understanding that the airlines would take data on them, would let us go out and measure the conditions they were being used in, and they would keep track of the hours of operation. Further, they were to return any failures to us.

Morton: If I could ask a question - I'm sorry to interrupt but before you move on - I think you are leading on to something new. The stories you usually hear about tubes in this area is that there was pressure to miniaturize them, and you don't often hear about reliability issues that were involved in design. Were your clients, or were you' also under pressure to make these things smaller at the same time you were making them more reliable?

Knight: They were pretty small already. These were miniature tubes. Subminiature tubes had been used to some extent during the war particularly in military applications like artillery shells and fuses. But there was no real pressure on us to make them smaller. That was not a major factor. A major factor was getting rid of the heat. That was another application factor that was very poorly done in most equipment designs up to that time. We ran some experiments with various kinds of tubes shields. The type of tube shields being used made no contact with the tube envelope at all. I mean they were heat shields as well as electrical shields, and were holding the heat in rather than dissipating it. There was very little consideration given to thermal design in electronic equipment. Again, here is where I think application engineering was very important. I mean, heat problems aren't a one way street. For example, tubes generate heat but their reliability and other components in the vicinity can be jeopardized by excessive temperatures. I think we contributed quite a bit in that area.

This program within the airlines went on from about 1948 until 1950-51. The program was very successful within the airlines. The military had been following this airline effort right along, and so they asked ARInc if they would

take on a similar program to do the same sort of thing for the military. That was in 1951. And ARInc talked to GE and asked if they could borrow me. So I went down on a two-year leave of absence and never left - until I retired.

Morton: You started to tell a story earlier about the gathering of data on tubes that you provided, and I thought you were leading up to something. You didn't say what I expected you to say after that. But what was the result of that? Did that contribute significantly to reliability?

Knight: Yes. I have covered much of that in some papers I have written recently. Well, not terribly recently.

Morton: We don't want to rehash what you have produced already but ...

Knight: Well, you don't have to. It is not a matter of rehashing I think to call your attention to it. I don't know, I think I had prepared it for this special issue of the Transactions.

Morton: Oh yes.

Knight: I seem to have misplaced it and the most important ones. It's here somewhere. Some of the electronic tube picture there. It is not my participation with it.

Morton: Can I take this?

Knight: Let me say this. These two are my only copies.

Morton: Oh, okay.

Knight: You can borrow them as long as you return them.

Morton: Okay. Why don't you make copies of them and send them?

Knight: Well. I don't have facilities to do that.

Morton: I would be happy to do that.

Knight: I would appreciate it if you would.

Morton: All right, I'll make sure to get them back to you.

Knight: I think these too. The trouble with these is the military contract that I started to tell you about provided for our preparing reports for a rather widespread distribution. As a result, a lot of these things did not get into the technical press. They were printed by the company under these contracts and distributed rather broadly, quite broadly. It definitely had an effect on the development of reliability engineering. Particularly this one. I'm extremely proud of this one. But it seems to have been forgotten. I think it was one of the seminal contributions, you might say, in the quantization of reliability - showing the theoretical connections between various aspects of reliability.

Morton: You are going to hate this next question, but can you summarize this for a sort of layman? You said this was influential. What was the feel before, and how did this change it? Maybe you can answer that.

Knight: Before, reliability was talked about in general terms, loose terms. Failures were just failures. It was not quantitative. I think that was the important part. This provided the theoretical basis for quantizing reliability.

Morton: What kind of data were you gathering? Was it announced as a failed tubes or satisfactory operation?

Knight: We did both. We gathered failed tubes - not only tube failures but records of their operating hours (the hours of satisfactory operation up to the time of failure), which is really the basic essence of reliability, isn't it? It is the relationship between operating time and failures. We were able to do that as far

as tubes were concerned within the airlines. However, if you tried, for example, to get time information on tubes in military equipment, you had to face the likely fact that in the course of normal usage none of the tubes started their operating life at the same time in a given piece of equipment in the field. So we made special arrangements with the military and they were extremely cooperative. We completely re-tubed many pieces of equipment. We had our own field people out in eight or nine different military locations: a good many Air Force ones, Navy ones, and Army ones, even over in Europe. We replaced and decaled them, so we could determine, not only the time on the equipment but on the individual tube. Then we could relate that data with physical analysis once it failed. But we not only had the information on the ones that failed, we had the operational information on those that didn't fail. So we had the whole picture.

Morton: Did the data you gathered get fed back into the design or process, or was it just for maintenance?

Knight: Both. That was the whole purpose. We wrote many reports on maintenance procedures and equipment design and tube design. That lead into many things in that regard. We broadened the scope of our work after the first few years from tubes into total systems reliability. As a matter of fact, this project that I started became first, the Research Department of Aeronautical Radio, Inc. and later, a separate subsidiary company, the Arinc Research Corporation, and I ended up as Executive Vice-President. At the time I retired, in 1979 there were about 500 engineers at several locations.

Morton: What was the name of that company again?

Knight: Arinc Research Corporation. A subsidiary of Aeronautical Radio, Inc (ARInc.) You probably have never heard of it. You've never heard of ARInc characteristics for airborne - I mean airline avionic equipment? Basically, they are design specifications. They began with equipment like the early VOR receivers and DME immediately after the war. Are you familiar with all of this? VOR and DME were essential elements of the air navigation system. More recently the company has gotten further into the airline electronic business, designing, installing, and operating common systems like communication, inter-communications, and data systems at airports. For example, the flight arrival and departure information on the TV monitors - that entire system has to be designed and maintained by somebody. ARInc is doing a lot of this type of thing now. They did a similar design for the new airport in China. ARInc procured or built all the electronics for the new airport. It is a logical outcome of the whole picture. Reliability was extremely important to the airlines, and they were willing to pay for it, which is to say a lot of others were not at that time. A lot of people, of course, have taken a much more realistic outlook since then, the computer industry in particular. Then, of course, electron tubes are no longer familiar to you and others of your generation.

I presented a paper not too long ago in which I talked about electron tubes, and said to the engineers present, "I imagine that most of you around here don't even know what an electron tube is." They kind of chuckled at that, but that is probably getting to be true. So much for that.

Morton: The other couple of questions for you may be backtracking a little bit. How did that work? And did that have any connection to the …

Knight: Oh yes. It started out this way. Both the Radio-Television Manufacturers Association (RTMA) and the National Electrical Manufacturers Association (NEMA) had had interest in tubes. They set up what they called JETEC (Joint Electron Tube Engineering Committee). Each of the companies that were manufacturing tubes at the time had representatives on the committee. I was the GE representative. We prepared JETEC specifications for receiving tubes and provided engineering coordination between the various companies. For some reason or another, IRE wasn't interested in specifications of that sort at that time. I guess they still aren't really, as far as detailed specifications are concerned. But I was involved in it. At that time some work was being done to try to get reliability requirements more explicitly incorporated into tube specifications. So after I came to ARInc and got deeply involved in reliability I kept in touch with the people in the RTMA, and then later when it became EIA. They were very interested in promoting reliability in the early stages. Much more than I would say the IRE was.

Morton: Why do you think?

Knight: I don't know why. Well, I think basically due to their financial links to the industry. A lot of the early conferences on reliability were cosponsored by EIA or RTMA and the IRE. Well, as you see, even this present conference is still co-sponsored by a number of other engineering societies, ASQC and so on and so forth. So they asked me to write up a - I mean to do some committee work to

prepare a guideline for reliability for what I think was the EIA at that time. I believe it had just changed its name from the RTMA. So I formed a committee and put together a report. I don't have a copy of that one, but it was somewhat along the lines of some of this. Gradually in the early '50s, after I moved to Washington I became more active in the IRE. I won't say I started the Reliability Chapter down there; one had been chartered but never really activated. I activated it along with Hal Jones, who at that time was at the University of Maryland. He and I started the local chapter of the Reliability ----, at that time it wasn't a society. It was a Reliability ------.?

Morton: Professional group.

Knight: Professional group on Reliability in Washington. At that point I also got involved in the Symposium. The first one was in about 1955.

Morton: '54. Late '54.

Knight: ’54, yes. I was on the Paper’s Committee. No. Not for that one. For the second one, I was on the Paper's Committee. I mean Program Committee. I later got involved in the international aspect from inviting international participation. I had some airline work that involved international contacts. Then I became chairman for one of the committees called Special Guests. I continued to do that until 1980, about 15 or 16 years. In 1980, I became Historian, which I still am. I just submitted my resignation.

Morton: Now when you first got involved with this group, it was a professional group on quality control and later changed to reliability.

Knight: Well, when I first got involved it was not that. It was - if you remember I said I

didn't get involved with it right at the beginning when it was strictly quality. Actually, I got involved in the early '50s after it had become quality and reliability.

Morton: Well, my follow-up question still holds, I think. Are there two camps? What was the transition like - clearly quality control passed out of this society? How did that happen, and why?

Knight: Well, largely, I think, the reliability people felt that quality people had totally ignored what happened after the stuff was shipped out the door. That was reliability's primary concern, what happens to the product after it's out the door, the manufacturer's door. Not only that, the quality people at that time did not view engineering as important as manufacturing. The quality emphasis was on controlling manufacture, not engineering design for quality or engineering design for reliability. That's where the approaches differed. There wasn't the engineering content to the early quality picture. It was more of a matter of statistical control.

Morton: In what sense then?

Knight: Well, the bell curve, or the "normal" distribution - controlling manufacturing processes to assure that product characteristics stay within a normal range of variation, whereas reliability people were interested in controlling the life and maximizing it. Well, not maximizing, but making the lifetime good enough to fit the application, and seeing to it that the products were not only designed to do that, but that they were used in a way that they could do it.

Morton: To me it seems like both of those had a lot to do with design and the

manufacturing stage.

Knight: Oh. They do.

Morton: You have to build in a …

Knight: Reliability people don't have a chance if the manufacturers fail. In other words, certainly you can't make it last if it doesn't work when it goes out the door. But when it goes out the door, is it good enough to last?

Morton: Right. Right.

Knight: That's the difference.

Morton: Were there major sorts of methodological differences between the two groups? Were there - you mentioned the statistical methods that the quality control people used.

Knight: I think the real reliability emphasis was on application more than on process control. As a result, most of the early reliability engineers were the application engineers within the system design groups. Parts application was my basic background too.

Morton: Who was this group at this time? Were the people involved in it developing a new theoretical body of knowledge? What were the important theoretical advances?

Knight: That is what is in this. (Pointing to two reports)

Morton: That's what's in there?

Knight: I think it's here.

Morton: Yes.

Knight: It is in both of these really, but this is the one that I think is most definitive.

Again, it is one that has gotten relatively little recognition, openly, but it is the one accomplishment in my time that I feel the proudest of.

Morton: So let's talk about that.

Knight: I mean, look at it now and it doesn't seem like it is important at all. But it is, because at the time it was written it was totally new.

Morton: What was new about it? In other words, give me sort of an explanation for the layman. I don't know anything about this field. So how would you describe it to somebody like me?

Knight: How would I describe what?

Morton: What was different about this than what was happening before?

Knight: Well, it tied everything together. I mean it tied the ideas of failure rate, time to failure, and such terms as people were using, and still do occasionally, calling what we defined as availability as reliability also, which involves not only time to failure but the down time as well. It was all kind of a hazy mishmash of ideas, whereas this definitized the picture. It showed the mathematical interrelationships between those things. It also gave methods for estimating these things within reasonable statistical limits. More than that was in here.

Morton: You mentioned that this was widely circulated. How did it get out? What was the – you say this was an influential if under appreciated work – how was this distributed? Did it go out to…

Knight: Well, first of all let me say this, this one we did submit to the IRE. At that time the reliability part of it was not a society but rather a group, a professional group and wasn't terribly well-organized in terms of putting out publications. The IRE

proceedings at that time said this was too long an article and was too specialized for their interest. So we put it out as a company publication under the contract and distributed about four or five hundred copies.

Morton: Did people seek these things out or …

Knight: Oh, yes. There were a lot of people at that time on our mailing list. They had been put there because of their interest on the military side of things. We had a good following of the people working in the industry. They got not only these reports, but most of the others we put out.

Morton: So all the index says (seems?) to sort of follow here in the normal IRE places. This is almost the same audience that sort of received it. So people out in the industry actually working with this study read this and incorporated it somehow into their work.

Knight: Now there is one paper that is mentioned in there that, basically, was actually published.

Morton: How did you start to see the effects of this? How did you start to know that this had been influential?

Knight: Seeing people using the terms just the way we had written about them, presented them here, without attributing them to this report.

Morton: Why do you think it happened like that? Normally people …

Knight: Well, these things that are not strictly in the technical press - I mean company documents like this are not - don't get the same respect that something in the technical press does that way.

Morton: It's surprising that people wouldn't cite something if they took ideas from it or

something like that.

Knight: There are a lot of people around today that will remember this I'm sure. They may not remember this itself but they will remember. But these ideas were also put forth this way. First of all, this was very poorly laid out and printed. I had a copy of this at one time, but it was so poorly printed and everything else that I wouldn't have referred to it in anything other than this. I think it was published by the early professional group on reliable - professional group on quality control. That was before they were societies. That was in April 1955. I don't know if that's even available at IEEE Headquarters now, that publication.

Morton: Oh yes, the Transactions? Oh that - usually that stuff is preserved. It's some of the newsletters and things that have gotten lost, but almost everything is still out there.

Knight: Okay. You might look that one up. Again, I say it was very poorly done. We were not given a chance to criticize the way it was laid out or printed. But it did come out and I don't think anybody ever bothered to look at it. It was in the very early days of those publications.

Morton: Yes. Was it the societies themselves printing that? Or was it the IRE?

Knight: I don't remember that. I think the society was doing it itself. It was not the editorial department of the IRE. I'm sure they wouldn't put out a thing like that.

Morton: Can I ask you a question I've asked a couple of people today who were involved in reliability and related fields in the '50s? The story that the public knows about reliability, and maybe I misunderstand as I probably do, but the story the public knows is about the Japanese and their manufacturing. Was there any hint

that techniques developed in the United States, for example, were going to be employed so successfully overseas, particularly in Japan? Did you get any sense of how that unfolded? I mean you get the sense, for example, that overseas manufacturers were able to learn enough from reading to transform their …

Knight: Well, they were interested. No question about that. As a matter of fact, as I told you, one time I was Chairman of the Special Guest Committee and even arranged at one time through a Naval Office – well, the Office of Naval Research to pay the fares - I mean to arrange for transportation for some Japanese to come over to the reliability meetings. There is a reliability society under the IEEE, or chapter organization in Japan. I think the Japanese certainly learned from reading technical publications, but they did more than that. They took the work of Demler and - well, I think he was over there too. I think he helped them to really put these things to work. Not only that, but it had their management support. So I think one of the places where in our world reliability was a little short - I mean slow in coming - was because it didn't have management support, really, in the first place. It did at the top level in the military, but not in industry.

Morton: Now essentially when you say lacking management support, are you talking about the companies that were - I guess there were obviously complex relationships between some of these companies and the military. But was there a difference in attitude on these things between companies that were maybe primarily military contractors and had that special relationship with military

verses companies that were making consumer goods where the whole structure of pricing and funding for experiments and things like that is different? Or some sort of combination?

Knight: Well. Just a minute. I had a comment on that number one. I'm still very upset about the fact that I don't have one of my papers here that I thought sure I had included. I've got it at home.

Morton: Is it one of these? This is your 50 year - is that it?

Knight: Yes. No, no.

Morton: Is this? This is the thing given earlier to - and the last page.

Knight: Oh, yes, yes.

Morton: Sorry. I stuck this on the pile over here earlier.

Knight: Here I think is the summary in conclusion to this part. It's just this page and top of the next page. I think you might find that interesting.

Morton: Okay. So we'll skip that question?

Knight: Well, I think the question that might be answered in there is all I'm saying - the question you asked.

Morton: Well, we'll skip that one for the purposes of the taped interview.

Knight: Okay.

Morton: I noticed that you were involved in the society but didn't get to be president until the …

Knight: Wait a minute. If I may go back…

Morton: Yes.

Knight: I think this puts it in a nutshell - that question. Possibly the most gratifying

observation in my 50 years association with reliability has been the relatively recent voluntary adoption of reliability engineering by the automotive and electrical utilities industries as well as some others, in contrast to the mandated and too often perfunctory attention found in the defense industry.

Morton: That's interesting.

Knight: One does not need details to see tremendous gains in reliability all around us. Despite equally impressive increases in performance and complexity, automotive electronics, and personal computers are two of the most obvious examples. I think that voluntary adoption was the answer. In the military industry they were mandated into paying attention to reliability. As a result, a lot of it was not wholehearted. It didn't have the motivation that the automobile industry had when they found the Japanese were stealing their thunder by better reliability. That's motivation. That is a different kind of motivation than the military's.

Morton: I guess it is. I'm curious. I keep pressing on this …

Knight: Management is the real answer to a lot of it.

Morton: It's interesting to me that we don't hear much about the electronics industry. You get this story of the ascendancy of the Japanese manufacturing. All you hear about is the automobile industry, and they often mention that Japanese were also doing this in electronics. But actually they are two different industries both of which the United States followed in both of those fields. But you don't often hear the story of the electronics manufacturing in the '50s and '60s.

Knight: Well, I think that certainly the computer industry was reliability conscious

because they must live with their, IBM particularly, had to live with their product. They didn't just ship it out the door and forget it. They were one of the leading industries in improvement of system reliability and still are. I don't think one had to expect much more of that part of the electronic industry than what we got. I mean the advances in computers, considering the way complexity has increased the reliability, have been phenomenal. Again, I touch on this in this paper.

Morton: What about the other branches of the electronics industry, the consumer stuff for example, where you saw a decline in American manufacturing right at this time. What, previously has been related to management decisions and …

Knight: In general I think the competitive marketplace was the driving force. Again, the Japanese lead the way in a lot of the competitive marketplace. But just from the standpoint of staying in business, much of the electronic industry had to follow suit in this country. I say in this paper that this motivation had to be produced by foreign competition applying in a common-sense-manner methods and principles long known and even developed here.

Morton: I'm just curious, not knowing much of the history of this stuff. You see the automobile industry in the '70s and '80s, or I guess in the '80s, fighting to hold on to its manufacturing capability, whereas in the consumer electronics industries sort of throwing up their hands and saying, "Oh, we'll have them manufactured overseas," and someone over here wondering well - I mean the story as I understand it was one of economics and management. I'm wondering if there is also a reliability related side to this? If manufacturing wasn't - if the

electronics manufacturers in that segment of the industry weren't really willing to change their methods.

Knight: The electronic industry is hardly a single thing. It is very diverse. You'll find the differences, all the differences in the world, between computer manufacturers, like the IBMs and the Hewlett Packards. Hewlett Packard has been well-known for reliability, and so has IBM, and they have always been that way. Then you get down to the companies that may be making PacMan, or well, not PacMan, but the radios that some of these runners use to jog with. That's a different world. I mean they are different worlds, not just extremes. You cannot expect the people that are making stuff that sells for fifty cents or a dollar or even five dollars today to pay the same attention to product quality and reliability, certainly not reliability, as a company making a computer. This goes back to the days when I was in the radio business back in the forties. Manufacturers were making some radios, I mean the little old AC/DC radios at a price that if it failed it was cheaper to go out and buy a new one than to improve the quality of it. Economics controlled that too. But now if you have a mainframe computer from IBM, if that fails you don't go out and buy a new one. The same is true with the automobile. There was a time when you almost did that with automobiles. They almost got too cheap. But that's hardly the way anymore. I think economics actually drives a lot of this business.

Morton: I guess - it seems. I don't know if this is really true or not but the perception is that the Japanese were able to make them cheaper and improve the quality, and they got the American manufacturers on every possible front. I guess that's the

question. I wondered whether there was something …

Knight: In essence the Japanese were heavily influenced by Demler, an American quality assurance consultant. His approach, overly simplified, was this: reduce variability. That was the essence of his approach. Not only reduce it, but continue to reduce it. I mean consider it to be an eternal process. I think this approach of reducing variability has gained recent popularity here. I am sure you have heard some of the people, including the CEO of GE, touting Six Sigma. Now, I'm not sure they know what that means.

Morton: I know; but I've at least heard the term.

Knight: I'll bet you I do. And I think I know why they are using it like that. It simply means this: do not be willing to accept a process that controls variation to three sigma limits, which means you are rejecting five percent. You do not have good quality control if you have that much variation in your product. Reduce that variation so that the same limits represent six sigma, which means one failure in something like 100,000 verses 2 in 100. This was the essence behind Demler's approach. Don't be satisfied just in reducing it a little bit but work towards perfection. This is the way that the Japanese did it, and they still are.

Morton: That's interesting. How do you compare that sort of idea to what was going on in say your own career? Were those two different lines of inquiry, or was that more or less...

Knight: I think it is part of the same thing. The Six Sigma approach not only does this to control a product, but also emphasizes designing a system and its use so that your chance of - I mean so that you can accept a component even beyond the six

sigma limit but it essentially never happens. Do you follow what I'm saying?

Morton: I think so.

Knight: I mean keep your variations down, but design the system so that it can accept wide variations in the product. That's the reliability side, if you wish, verses the strictly quality control side, but they go together. This is what GE's approach to six sigma means, and is also Motorola's approach to Six Sigma. I mean, it's this close to part of what was called by another buzzword, TQM, Total Quality Management. It's not just the product, I mean, controlling the manufacturing process and the quality of that the product you have, but controlling the way you use it and the way you design it into your system. That's reliability engineering, designing it into the system, verses quality control.

Morton: And was that sort of stuff developed much later, or does that have its roots in the '50s and '60s, or even '40s?

Knight: Well, I think it's all a part of the whole system. Frankly, I'm not sure everybody understood it that way. Let's see. Again, this is rather technical. But the relationship between "part failures and system failures" I defined in here as dependence. A popular word for that today is robustness, if you wish. In other words, designing your system so that it is fault tolerant, or not failure prone, so that it can accept a lot of weakness in the components and still work. I think a lot of that is handled right here. Maybe a little too esoteric for some people.

Morton: I see, formulas. That may be too much for me. Well let me - we should probably wrap it up. It looks like they want to get into the room here. If I left out anything or, well, I'm sure I left out a lot. But is there is something burning

we need to get on tape in parting shots before we quit?

Knight: I think you can answer that better than I can.

Morton: I don't have anymore questions so why don't we stop there.

Knight: Okay. Fine.

The IEEE Reliability Society Scholarship

http://www.ieee.org/portal/site/relsoc/

Description:
This scholarship recognizes active students who are members of the IEEE and who demonstrate promise in their academic and/or professional Reliability Engineering accomplishments.

Prize:
Multiple $2,000 scholarships are available per year.

Eligibility:
Full-time Graduate Students, Seniors, and Juniors in degree programs in engineering, computer science, or other well-defined reliability-related field who are active members or student members of the IEEE. At least one course in Reliability Engineering or closely related field should be completed. Minimum overall grade point average should be 3.0 for undergraduate students and 3.5 for graduate students.

Basis for Judging:
- Involvement in IEEE activities – 30%;
- Academic achievement (with preference given to those who demonstrate excellence in reliability) – 40%;
- Extracurricular activities related to your academic/professional interests – 10%; and
- Letter of evaluation by at least one of the instructors who taught you a course with reliability engineering content – 20%.

Deadline:
Multiple scholarships will be awarded each calendar year. Submission deadlines are:
- Summer Term – April 1st
- Fall Term – July 1st
- Winter Term – November 1st

Note: All material must be received by the submission deadline.

Submission Requirements:
- The IEEE RS Student Scholarship Application;
- An essay (not to exceed two pages) describing your academic accomplishments, professionally related extracurricular activities, work history, career goals, and the relevance of reliability engineering to them;
- An official academic transcript of all college courses completed;
- A degree plan with reliability-related courses clearly identified; and
- One or more recommendation letter(s) from the instructor(s) of reliability-related course(s) you have successfully completed.

Contact:
IEEE Reliability Society Scholarship
Attn: Dr. Robert Loomis
3865 Hidden Hills Dr.
Titusville, FL 32796

IEEE Reliability Society Scholarship Application

All APPLICANTS – Please provide the following information along with this application:

1. **An essay describing your academic accomplishments, professionally related extracurricular activities, work history, career goals, and the relevance of reliability engineering to them.**
2. **An official academic transcript of all college courses completed.**
3. **A degree plan with your reliability-related courses clearly identified.**
4. **One or more recommendation letter(s) from the instructor(s) of reliability-related course(s) you have successfully completed.**

Applications will be considered incomplete until all documents are received. With the exception of signatures and dates, documents should not be handwritten.

Please select your current level of education:

☐ **Junior** ☐ **Senior** ☐ **MS/ME Student** ☐ **PhD/DE Student**

Last Name	First Name	MI	GPA/Scale (e.g. 3.5/4.0)

Student Permanent Address	Student School Address	Student Telephone Number(s)

School Name and Address	School Telephone Number(s)

Major Field of Study (be specific – e.g. Electrical Engineering, Industrial Engineering, Computer Science, Physics, etc):

Email Address:

Authorization to Release Scholarship Information

Federal Law requires that we obtain written permission before releasing information to the news media regarding scholarship recipients. If you wish to give such permission, please sign. If you do not sign, we will not release information to the media. However, it will not adversely affect your scholarship application.

_____

Applicant's Signature and Date

I certify that all statements in this application and related materials are correct.

_____

Applicant's Signature and Date

Submission Deadlines (Note: All material must be received by the appropriate submission deadline):

- **Summer Term – April 1st**
- **Fall Term – July 1st**
- **Winter Term – November 1st**

Please submit all application material to:

IEEE Reliability Society Scholarship
Attn: Dr. Robert Loomis
3865 Hidden Hills Dr.
Titusville, FL 32796

IEEE Reliability Society Newsletter Submission
from the Boston Chapter
September 2007

Greetings, the summer season is quickly drawing to a close here in New England! Planning for the remainder of the FY07 meetings are nearly complete and the schedule for FY08 is in process.

Technology development workshop:

On June 22nd, AdCom member Gene Bridgers held a technology development workshop at Mercury Computer, Chelmsford. Dr. Craig Hillman from DfR Solutions presented *"Post RoHS CCA Materials Selection"*. This included discussions on processing and reliability issues associated with CCA lead free assembly processes. CCA board finishes for various lead free solder formulations were also reviewed. A total of 14 members and guests participated in this event.

2007 International Military & Aerospace / Avionics COTs Conference & Seminars:

This year's Conference was held in Cleveland Ohio, August 20th - 22nd. A Seminar on *"Counterfeit Electronics, how to protect your products"* was held Monday afternoon. This was presented by Dr. Diganta Das from the CALCE center, University of Maryland.

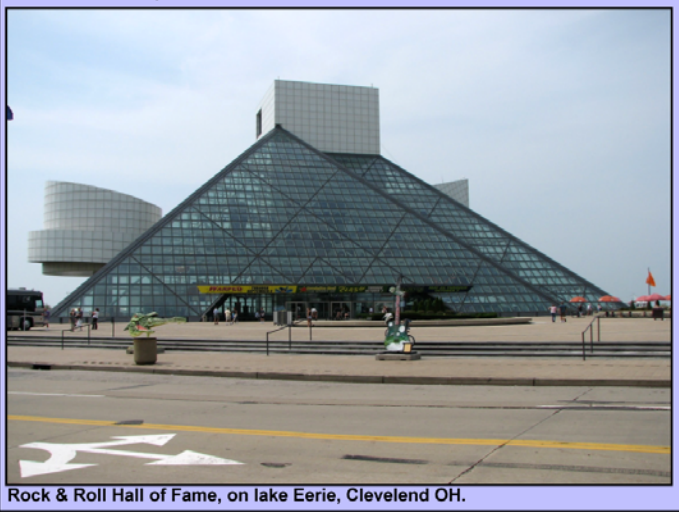
There were several presentations in the 2 day conference, in Three session categories:

Session 1: Proactive parts management
Session 2: Dormancy, logistics & instrumentation
Session 3: Application & assessment of COTs

Chapter AdCom member Aaron DerMarderosian Jr. was chair & moderator of session 3.

COTs Conference, Marriot Downtown

Public Square, Downtown Cleveland, OH.



Rock & Roll Hall of Fame, on lake Eerie, Clevelend OH.

"Birthplace of Rock & Roll", dedication

- images courtesy of AdCom member Aaron D. (Raytheon)

Annual chapter awards results: *IEEE Boston Reliability chapter takes 2nd place*

The 2006 Reliability chapter awards were announced on September 6th, with the Boston Chapter placing 2nd, close behind the Singapore chapter. This includes a $300.00 award for the chapter, which will be used to host technical meetings scheduled for the 2007/2008 season. Points are awarded for number of technical meetings, chapter member participation and chapter involvement in arranging or sponsoring conferences. Points are also awarded to members who publish or present at technical conferences, seminars, participate in chapter training events, act as conference or session chair or actively participate in IEEE committee meetings. This is a means by which all of us can use our technical & professional activities throughout the year to give back to the chapter.

The AdCom would like to thank all of our chapter members who participated in this year's awards competition, Thank you!

2006 Reliability Society Chapter Awards results:

1. Singapore (88 points) - $500
2. **Boston (82 points) - $300**
3. Twin Cities (73 points) - $200
4. Baltimore, Cleveland, Denver, Italy, Japan - $100 each

AdCom membership Update:

We have had some changes in the chapter AdCom membership since the beginning of 2007. Joe Dzekevich stepped down from the vice-chair position, allowing other AdCom members to assume additional chapter responsibilities. Over the years, Joe has served in several capacities including Lecture series instructor, secretary and has chaired and coordinated arrangements for many chapter meetings. Joe will continue to remain active with the chapter, serving in the capacity of member at large. We would like to thank Joe for his years of dedication and service to the chapter and IEEE, Thanks Joe!

AdCom member Eddie Robins will take on the responsibilities of Vice-chair & Secretary for the remainder of 2007. Chapter member Ramon De la Cruz has also joined the AdCom, and will assist with some of the arrangements & activities, please join us in welcoming Ramon! We also welcome Jay Yakura (Analog Devices) to the chapter, moving to Boston, from the Denver. Jay Previously served as the vice-chair of the Denver chapter. Note that Officer candidates for 2008 will be selected in mid-October & announced at the follow on November monthly meeting.

Fall Kickoff: (planned meetings; chapter meetings are scheduled for 2nd wed. of every month)

Meetings will resume on Wednesday September 12th, at EMC Corporation in Hopkinton. Dr. Eddie Robins (EMC Corporation) will present "Proactive Reliability", focusing on Reliability process best practices. The October 10th meeting will be held at RSA Bedford, Gene Bridgers (Mercury) & Romano Annecchiarico (Teradayne) will present "ALT/ORT Reliability Testing", which will review examples of hardware process reliability screening methodologies.

Upcoming Meetings: (tentative meetings; check website for updates)

In November, Michael Gust (Mercury) will present COTs assessment methods for Deployed "Ruggedized" applications. The December annual meeting will feature guest speaker Bob Kuper (Army) who will brief the chapter on DoD Reliability initiatives. In January, Dr. Craig Hillman from DfR Solutions will overview the BQR "fiXstress" electrical stress analysis tool.

The Boston Reliability chapter advertises upcoming meetings, registers attendees & uploads past presentations on our web-site:

http://www.ieee.org/bostonrel.

If you would like to present a reliability based topic at a future meeting, have meeting topic suggestions or ideas about how to improve our meetings, we want to hear from you! Please send an e-mail to any of the AdCom members or go to our website and use the suggestion tool.

You can request to be added to the chapter e-mail distribution on our website or send a request to: dermarderosiana@ieee.org

Best Regards,

Aaron C. DerMarderosian Jr. - Chair, Boston Chapter

Dallas Chapter

Lon Chase, Past Chair

The Dallas Chapter held the following recent presentations:

Title: "Understanding Failure and Root-Cause Analysis in Pb-Free Electronics"

******** Date:** August 22, 2007
****** Speaker: Dr. Craig Hillman, DfR Solutions

The chapter summer break ended with a joint meeting with the local Electronic Device Failure Analysis Society (EDFAS) Lone Star Chapter and featured a special presentation by Dr. Craig Hillman, CEO and Managing Partner for DfR Solutions located in College Park, Maryland. Dr. Hillman spoke on the topic of "Understanding Failure and Root-Cause Analysis in Pb-Free Electronics".** This presentation covered an in-depth understanding of the failure mechanisms that are unique to Pb-free electronics and provided a comprehensive review of the tools and techniques to identify those mechanisms.** Mechanisms were addressed based upon the packaging level in which they are affiliated, including component packaging, discrete components, printed circuit board, and interconnects.** A physics of failure
(PoF) based approach to the mechanisms are taken, with an outline of drivers of these mechanisms, including defect-driven, overstress, and wearout, and how an understanding of these stress-strength interactions can provide guidance on the appropriate corrective and preventative action.** A wide variety of case studies, including red phosphorus in epoxy encapsulants, creepage corrosion in immersion silver, and solder joint failures, were provided as valuable examples.

Dr. Hillman's specialties include best practices in Design for Reliability, strategies for transitioning to Pb-free, supplier qualification (commodity and engineered** products), passive component technology and printed board failure mechanisms. Dr. Hillman has published over 40 papers in the areas of electronics quality and reliability, and has presented to more than 200 companies and organizations world-wide.

Title: "Noise Modeling of MOSFET Devices with High-k Materials "

************ Date:**** September 20, 2007
********** **Speaker:** ****Tanvir Hasan Morshed**

This meeting was a presentation by Tanvir Hasan Morshed, a University of Texas at Arlington Ph.D candidate.
His presentation focused on the flicker noise modeling differences between MOSFET devices with high-k dielectric materials and conventional native oxide (SiO_2) devices. He also described the differences between the currently successful flicker noise model - the Unified Model - and the new MSUN Model, which incorporated the distinctions of the high-k gate stacks from the native oxide dielectric .

Tanvir Hasan Morshed is working as a Graduate Research Assistant at the Electrical Engineering Department of the University of Texas at Arlington. Currently he is working at the Nanotechnology Research and Teaching Facility at UT Arlington, under the supervision of Professor Zeynep ***elik-Butler towards his Ph.D. degree. He received B.Sc. (Honors) and M.Sc. degrees in Applied Physics and Electronics from the University of Dhaka, Bangladesh, in 1997 and 1999. In 2002 he received

M.Sc. in Electrical Engineering from the University of Texas at Arlington.

A special presentation featuring Dr. Michael Pecht, Director of Center for Advanced Lifecycle Engineering (CALCE). Dr. Pecht is a world renown expert on component technologies.

Title: "China's Electronics Industry: What are the Risks to US Companies and Consumers"

Date: Thursday, November 15, 2007 , 6:00 P.M.
Speaker: Dr. Michael Pecht, Director of CALCE at the University of Maryland

This meeting was a joint meeting with the local Electronic Device Failure Analysis Society (EDFAS) Lone Star Chapter and featured a special presentation by Dr. Michael Pecht, founder and Director of the CALCE Electronic Products and Systems Center (CALCE EPSC) at the University of Maryland. Dr. Pecht's presentation highlighted China's Science and technology policies as well as the risks (ie. intellectual, counterfeit, supply chain, etc.) presented to US companies and consumers.

Dr. Pecht has written over twenty books on electronic products development, use and supply chain management. He has also edited a series of books on the Asian electronics industry including recent books titled *The Chinese Electronics Industry, Korea's Electronics Industry,* and *Electronics Industry of India*. Please see attachment for more details on the speaker and topic.

Denver Chapter

The leaders of the Denver chapter are planning to meet with Technical operations pillar meeting in Golden Colorado on Saturday September 29 for strategic planning for society technical initiatives, broadening the impact of the society and better meeting the needs of members and the technical community at large.

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Sam: -)

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Samuel Keene, PhD, FIEEE
Six Sigma MBB

Singapore REL/CPMT/ED Chapter September 2007

In June, the Rel/CPMP/ED Singapore Chapter organized three technical talks. On 22th June, Drs Chih-Hsun Chu and Yong-Fen Hsieh, a husband and wife team from Taiwan who started and now run the company Materials Analysis Technology which specializes in providing failure analysis service to the semiconductor industry, gave two talks. In his talk on "Non-Planar Oxidation of Silicon" Dr Chu discussed different scenarios and gave many examples that he has seen over the course of his career. Dr Hsieh spoke on "Ion Implantation and Related Defect Formation by Latent Stress".

On 25th June, an EDS Distinguished lecturer, Prof. Vijay K. Arora of Wilkes University USA, gave a talk entitled "Performance Evaluation of Nano Circuits and Systems with Ballistic Carriers.

In July, the Rel/CPMP/ED Singapore Chapter and ED/SSC Hong Kong Chapter jointly organized the 13th Workshop and IEEE EDS Mini-colloquium on NAnometer CMOS Technology (WIMNACT) which was held in Hong Kong on 23rd July and Singapore on 25th. The workshops were co-sponsored by the EDS Distinguished Lecturer (DL) Program.

The Singapore workshop, attracted about 70 people and was opened with a welcome address by the Chapter Chair, Dr. Alastair Trigg, followed by an Introduction to EEE Microelectronics Center, co-organizer of the workshop, by the Director, Prof. Kin-Leong Pey. DLs from Singapore, Hong Kong, Malaysia, USA and India presented talks at the Singapore workshop.

- Prof. Juin Liou from Univ. of Central Florida: "*On-Chip Spiral Inductors in CMOS Technology for RF Applications*"

- Prof. Ramgopal Rao from IIT-Bombay: "*Device Design and Optimization Challenges for Nano-scale Multi-gate MOSFETs*",

- Prof. Kin-Leong Pey: "*Silicided Hyper-shallow p+/n- Junctions Formed by Pulsed Laser Annealing for Nanoelectronic Devices*"

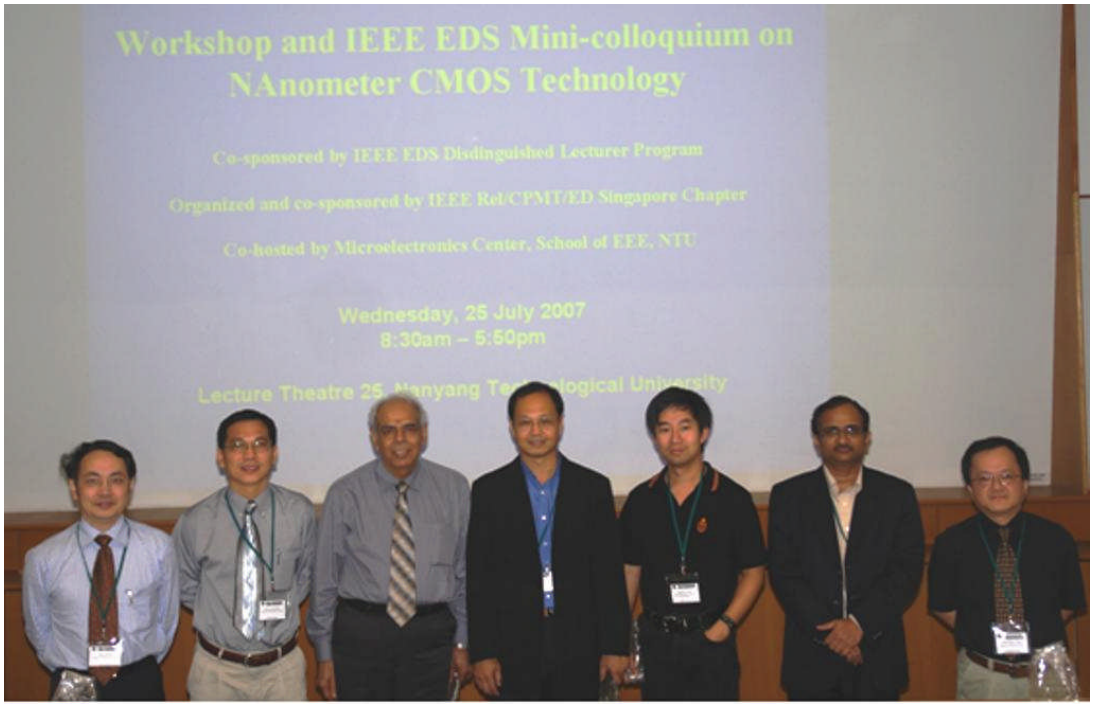
- Prof. Mansun Chan of HKUST: "*Application of Integrated Circuit Technology for Biological Material Analysis*"

- Prof. Xing Zhou from Nanyang Technological Univ.: "*Unified Compact Modeling of Emerging Multiple-Gate MOSFETs*",

- Mr. Chih-Hang Tung from Institute of Microelectronics: "*Advanced Transmission Electron Microscopy for Nano-electronics Device and Process Analysis*".

- Prof. Vijay Arora of Wilkes University and is visiting professor at Universiti Teknologi Malaysia: "*Physics-Based Models for Performance Evaluation of a Nanoscale MOSFET*".

This first attempt at a joint mini-colloquia, proved very successful as well as economical due to shared travel funds.



DL speakers at WIMNACT-Singapore. ***From left to right*: Xing Zhou, Kin-Leong Pey, Vijay Arora, Juin Liou, Mansun Chan, Ramgopal Rao, Chih-Hang Tung.**

Further information on the 13th WIMNACT, including past history of WIMNACTs, can be found at the website:
http://www.ntu.edu.sg/eee/eee6/conf/WIMNACT07.htm

Two of the DLs extended their stay in Singapore. Prof Juin J. Liou gave a one-day short course on "Electrostatic Discharge (ESD) Protection in BiCMOS/CMOS Technology on 26th July and a day later on 27th July, Prof. Mansun Chan gave a talk on "IC Industry in China: Challenges and Opportunities".

This year, the Chapter's flagship conference on failure analysis, the International Symposium on the Physical and Failure Analysis of Integrated Circuits 2007, was held from 11-13 July in Bangalore, India. It was organized by IEEE ED/SSC Banglore Chapter and co-sponsored by IEEE Rel/CPMT/ED Singapore Chapter
It comprised one day of tutorials and two days of Symposium and equipment exhibition. Full details can be found at:
http://ewh.ieee.org/reg/10/ipfa/html/2007/index.htm

Planning is now underway for IPFA 2008 which will be held in Singapore from 7th to 11th July 2008. The first call for papers has been issued and will be available on the Chapter website at http://www.ewh.ieee.org/soc/cpmt/singapore/

Chapter's packaging conference, the 9th Electronics Packaging Technology Conference (EPTC 2007) will be held at Grand Copthorne Waterfront Hotel Singapore in Singapore from 10th to 12th December. Full details of EPTC can be found at the website: http://eptc2007.confs.org/

Twin Cities Chapter

Two meetings are planned for the fall by the Twin Cities chapter

On Sept 18 John Starr of CirVibe will talk upon vibration testing and how to use numerical estimates of cumulative fatigue for reliability.

October 16 th meeting will be at BAE systems and be joint with the local chapter of IEST. It will include a guided tour of the Large Equipment
Reliability Test lab and a talk by the lab Manager Andy Anderson, Lab Manager on "Reliability Evaluation Testing".

The Nov 20th meeting is not set yet.

On Oct 15 the Twin Cities chapter will sponsor a reliability track of 4 speakers at the Minnesota Annual Quality conference.

Jim McLinn

Part II

(see the last and next newsletters for part I and III)

IEEE Reliability Society Annual Technology Report
Reliability Landscape, Progress, and Challenges

Dr. Samuel Keene, FIEEE
VP Technical Operations
February 15, 2007

Implementing Commercial Off The Shelf (COTS) Equipment in Rugged Applications – Lon Chase (l.chase@ieee.org)

Commercial off-the-shelf (COTS) *is a term for software or hardware products that are ready-made and available for sale, lease, or license to the general public. They are often used as alternatives to in-house developments or one-off government-funded developments (GOTS). The use of COTS is being mandated across many government and business programs, as they may offer significant savings in procurement and maintenance. (Source: Wikipedia)*

The use of Commercial Off-The-Shelf (COTS) equipment is an attractive approach to system development even with severe system requirements of some Military, Aerospace, and other rugged applications. COTS equipments are purchased items which are available off-the-shelf as existing designs (i.e. catalog items). In this definition, COTS equipments are not individual purchased piece parts but would be considered assemblies when included at the system level. Examples of COTS equipment may include processor cards, IMU assembles, GPS cards, power supplies, etc. Other categories of COTS include Ruggedized COTS (ROTS) and Modified COTS (MOTS). In most respects, the issues and processes for ROTS, MOTS, and COTS are the same.

Catalog items promise shorter development cycles and lower cost. However, system designer inexperience with the differences between implementing COTS equipment and developing designs internally may result in program risk which can negate any benefit. Some of the differences include; the "what your see is what you get" scenario, inadequate or no testing that covers critical system requirements, lack of design authority and control, supplier inexperience with similar system requirements, the lack of design knowledge in-house, and the tendency to design around unique COTS characteristics resulting in obsolescence and refresh issues. Each program which anticipates, or is, using COTS Equipment in a rugged application must develop and/or deploy processes, guidance, and tools to ensure design engineers and managers plan for and counteract the risks of selecting and using COTS equipment.

Company processes must support conducting a rigorous evaluation of both COTS selection decisions and risk in implementation, both at the program level and in Supply Chain Management (SCM). Understanding the program risk at the make-buy and selection decision points mitigates potential large cost and schedule impact. After selection, establishment of appropriate, knowledge-based risk mitigation strategies start

during development and can continue throughout the system lifecycle. Tools may be incorporated into the process at any or all of these process points. The following are critical points of process insertion:

- Make-Buy Decisions
- COTS Supplier / Product Selection
- System Development / Implementation
- Lifecycle Support

Each company may establish their own areas of critical risk, depending on company processes, policies, types of systems and system applications. Some of the general areas of concern may include:

- Supplier relationship
- Quality
- Configuration management
- Performance (electrical, mechanical, software, reliability)
- Lifecycle Management

Guidance and tools may be developed to assist the program in supporting these processes.

Several sources of information exist to assist companies in establishing COTS guidance. These include published papers, government documents, commercial products, magazines, websites, and conferences. A sampling of some, but certainly not all, are listed below.

Documents, Products and Sites

FAA COTS Risk Mitigation Guide: Practical Methods For Effective COTS Acquisition and Life Cycle Support
http://www.faa.gov/aua/resources/cots

SD-2 Buying Commercial and Nondevelopmental Items: A Handbook
Office of the Under Secretary of Defense for Acquisition and Technology

Commercial Off-the-shelf And Non-developmental Items Handbook
NAVAL SEA SYSTEMS COMMAND at http://cots.navsea.navy.mil

Reliability Information Analysis Center (RIAC) Products
Reliability Toolkit: Commercial Practices Edition
COTS-WD - Evaluating the Reliability of COTS Items
SELECT - Selection of Equipment to Leverage Commercial Technology
http://quanterion.com/riac/

Defense Acquisition Guidebook DoD5000 Chapter 4.4.5 COTS Design Consideration

COTS Based Initiative (CBT) - primarily software
COTS-based engineering, Carnegie Mellon University.
http://www.sei.cmu.edu/cbs/

COCOTS: A COTS Software Integration Lifecycle Cost Model
CSE Center for Software Engineering -
http://sunset.usc.edu/research/COCOTS/index.html

Journals and Magazines

COTS Journal
http://www.cotsjournalonline.com/

Penton's Military Electronics
http://www.milelec-digital.com/milelec/

MILCOTS DIGEST
www.mil**cots**digest.com/

Military Embedded System
www.mil-embedded.com

Military & Aerospace Electronics
www.milaero.com

Conferences
INTERNATIONAL MILITARY & AEROSPACE/AVIONICS COTS CONFERENCE

ICCBSS: International Conference on COTS-Based Software System

Automotive Reliability - Yang, Guangbin (G.) [gyang1@ford.com]

Guangbin Yang has authored a book, titled *Life Cycle Reliability Engineering*, to be printed by John Wiley and Sons in January 2007. This book covers all major practical and up-to-date reliability techniques implemented in industry and uses many examples from the automotive industry.

System of Systems Challenges to be addressed by the reliability community - Bret Michael – (bmichael@nps.edu)

Assurance Tech Ops: There are key areas of our reliability discipline that need to be tailored in some way to address the development of systems-of-systems. A system-of-systems is an amalgamation of legacy systems and developing systems that provide an

enhanced capability greater than that of any of the individual systems within the system-of-systems. Consider that systems of systems are:

- Open systems: operational concepts are not completely known during requirements elicitation—there is a lack of stability; there are no fixed system boundaries; and individual systems are operationally and managerially independent.
- Systems that exhibit emergent behavior: each legacy system exhibits individual and unique emergent behavior and a system-of-systems will exhibit emergent behavior that is not predictable by the study of the independent systems in isolation of one another.
- Systems that operate in an environment that can be unpredictable and therefore difficult to model.
- Reconfigurable systems: the configuration of the system can change to adapt to changes in the environment

Typically one performs reliability analyses against a fixed known model, not a radically changing environment. Adaptive systems can have lots of configurations, which in turn can be hard to characterize, because each instance of a component has a different view of the system. The set of things in the environment is neither closed nor stable. The implication is that it might be possible to create a sufficiently large closed world so that one can deal with all of the system hazards, but even so, there will still be a challenge to validate an upper bound on the probability of a system failure leading to a given hazard. One might believe that this problem is intractable from a reliability perspective. However, for a system-of-systems the challenge is to think in terms of integration properties, that is, to identify the emergent requirements from the collaborations (i.e., value-added).

Warranty – Judy Koslov (Judith.Koslov@Sun.COM)

Bill Heavlin, Google, and I are working on a contributed paper for JSM, which will indicate that for analyzing systems reliability data, the principal approach uses mean cumulative functions (MCFs), the repairable-system analog to hazard functions. MCFs implicitly focus on the time-ordered slices at which failure events occur. Using models conditioned on these time slices, MCF-based methods can adapt the Mantel-Haenszel and Cox proportional hazard approaches for estimating the relative-risk coefficients associated with particular factors. Further, when the number of candidate risk factors is large, a modification to classification trees may be used for model reduction. This modification is conditional on the risk sets, and exploits random permutations within the risk sets to calculate significance.

Reliability technology patent – Louis Guillo (louis.gullo@ieee.org)

This patent describes a meta analysis method of combining available data from similar applications and merging it with analysis data. This work has been protected and recognized by US Patent No 6,684,349 B2. The believeable reliability assessments are accomplished in two steps by combining results from:
1, Similarity Analysis - A Structured Comparison Of The Elements Of The Equipment Being Assessed With Those Of Predecessor Equipment For Which In-Service Reliability Data Are Available.
2. Failure Cause Modeling - A Reliability Assessment Approach Where Reliability Metrics Are Assigned To Failure Causes Specified By The Plan Owner, And Combined To Determine The Equipment Reliability Metric.

Nano Technology and Health Care – Bill Tonti (wtonti@us.ibm.com)

Patients can have a stint inserted in their blood vessels to clear a blockage. Doctors can now also embed a passive sensor in proximity of the splint to monitor blood flow and assure the continuing benefit of the stint.

Other ATR 2007 Contents

Part I (Contained in the June 2007 newsletter issue)

The Latest Reliability Standard In Development at the IEEE-RS - IEEE P1624 – Louis Gullo (Louis_J_Gullo@raytheon.com)

Design for Reliability Committee -- Dev Raheja (Draheja@aol.com)

Software Reliability and Six Sigma – Samuel Keene (s.keene@ieee.org)

Mechanical Reliability – Dick Doyle (ddoyle@ddoyle.cts.com)

DoD Current Perspective – Tom Fagan (tfagan@ChannelLogistics.com)

Part III (Coming in the next newsletter issue (December 2007))

On line web reliability education (CEUs) – Marilyn Catis (IEEE EA - mg.catis@ieee.org)

Prognostics and Health Management (PHM) / Condition Based Maintenance (CBM) – Dennis Hoffman (d.hoffman@ieee.org)