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Reliability Society

NEWSLETTER

Vol. 55, No. 1, June 2009

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**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](mailto:L.chase@ieee.org).

<b>March</b>	<b>Inputs due February</b>
<b>June</b>	<b>Inputs due May</b>
<b>September</b>	<b>Inputs due August</b>
<b>December</b>	<b>Inputs due November</b>

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**Society News**

**Tribute to the Contributions of John Musa to Software Reliability Engineering**

**Recollections of John Musa by Norm Schneidewind**

In the early 1970s there was not much respect for the field of software reliability. Helped by the advocacy of John Musa, who headed the software reliability engineering effort at AT&T Bell Labs, software reliability later became the discipline of Software Reliability Engineering (SRE). Some software developers claimed their software never failed. They said there was no such thing as software reliability because software did not wear out. In addition, software failure data was difficult to obtain. For example, as a professor at the Naval Postgraduate School, I was doing research on Navy Tactical Data System (NTDS) software reliability. Of course, to carry out my research objective I needed NTDS failure data. The CO of the Navy base was very reluctant to release it because he was paranoid about contractors getting hold of it and selling it back to the Navy! I had no intention of turning the data over to contractors, but the CO was always suspicious, even having his military staff monitor phone calls between me and the civilian in charge of the data. Another time, while visiting the NTDS facility, I happened to be carrying a wastebasket with a contractor's name on it when I encountered the CO in the hall. He demanded to know where I got the wastebasket. Before I could reply, a civilian employee leaped to his feet and explained that I was just a visitor and innocent of any wrongdoing! Thus, I was beginning to think I had gotten into the wrong field, but John helped change that perception. Assisted by the imprimatur of the Bell Labs, John lent a great deal of credibility to the field with the publication of his seminal article on software reliability in the Transactions on Software Engineering in the mid-1970s, followed by the often-quoted book by Musa, Iannino, and Okumoto [MUS87].

I met John at a software engineering conference in Los Angeles in 1975. I was nervous because in the audience for my talk was a noted researcher from the Naval Postgraduate School who happened to be the chairman of my tenure committee. He was there to evaluate my research capability. It did not help matters that there was a wise guy discussant from the Ivy League who claimed that software reliability had no validity. Thus, it was refreshing and encouraging meeting John after the session and having him compliment my talk. This was a characteristic in John I have always appreciated: a positive attitude and encouraging people in their work. I believe this is a major reason for the success of his seminars after he retired from Bell Labs. John was also very active in IEEE Computer Society activities, holding high-level positions on the Governing Board, the Technical Activities Board, and the Publications Board. I was privileged to work with him for many years on these activities.

In addition, he was one of the first software engineers to be elected a Fellow of the IEEE and also received the IEEE Reliability Society Reliability Engineer of the Year award.

#### **Recollections of John Musa by Herb Hecht**

Hardware failures and software failures are usually caused by very different events and are repaired by different processes. Yet, at the system level they produce the same effect: loss of service. Some of us concerned with system reliability and availability thought that this commonality of effect warranted a common use of terms and metrics, including software reliability and software failure rate. "Horrors!" was the response from a significant segment of the software community, "they don't understand techniques of software development". These arguments led to the name of a proposed conference (1975) to be changed from "International Software Reliability Symposium" to "International Symposium on Reliable Software". Also typical of the mindset of that period was the response that I received from a senior and technically astute Air Force officer when I suggested that we measure software failure rate during test: "We pay our contractors well to deliver error-free programs; how they get there I don't need to know."

John Musa stepped into this contentious arena with a paper [MUS75] that provided ample data from his Bell Labs environment to show how software failure rate decreases during test and that also distinguished between execution time and calendar time failure rates. These concepts have had tremendous influence on the developing field of software engineering and I am glad that we can now speak of software reliability without being marginalized. Thanks, John.

John made many contributions to SRE, here are two of the major ones:

#### **Operational Profile**

John was the key developer of the operational profile and its relationship to testing [MUS96]. John used the operational profile as the foundation for his reliability modeling work. According to John, the testing of software systems is subject to strong conflicting forces. A system must function sufficiently reliably for its application, but it must also reach the market at the same time as its competitors (preferably before) and at a competitive cost. Some systems may be less market-driven than others, but balancing reliability, time of delivery, and cost is always important. One of the most effective ways to do this is to engineer the test process through quantitative planning and tracking. Unfortunately, most software testing is not engineered, and the resulting product may not be as reliable as it should be, and/or it may be too late or inexpensive. Software-reliability-engineered testing combines the use of quantitative reliability objectives and operational profiles (profiles of system use). The operational profile guides developers in testing more realistically, which makes it possible to track the reliability actually being achieved. John described Software Reliability Engineering Testing (SRET) in the context of an actual AT&T project. SRET is an AT&T current best practice. Qualification as an AT&T best practice required use on eight to 10 projects and large benefit/cost ratios. Practitioners have generally found SRET to be unique in offering a standard proven means to engineer and manage testing in a way that lets them increase their confidence in the reliability of the software-based system they developed.

#### **Software Reliability Engineering Best Practices**

John was also instrumental in Software Reliability Engineering (SRE) best practices. In his paper [MUS99] he outlined the nature of the standard, proven, widespread best practice of SRE. According to John, it is widely applicable, low in cost, and its implementation has virtually no schedule impact. SRE helps organizations to develop and test more reliable software faster and cheaper. SRE can help solve the most important software development problem facing industry, making organizations more competitive. The principal threat comes from three risks, listed in order of their impact, as perceived by most customers: 1. Unreliability or unavailability of the released product, 2. Missed schedules, and 3. Cost overruns. These problems generally lead to loss of market share and hence profitability; hence there is overwhelming pressure on software developers to prevent them from happening. John defined some terms he used in his analysis:

*Reliability* is the probability that a system functions without failure for a specified time or number of natural units in a specified environment. *Availability* is the probability at any given time that a system or a capability of a system functions satisfactorily in a specified environment. Given an average down time per failure, availability implies a certain reliability. *Failure intensity*, used particularly in the field of SRE, is simply the number of failures per time unit.

John also advised that in discussing SRE, we should always be thinking of total systems that also contain hardware and often human components. Note that we deliberately define software reliability in the same way as hardware reliability. This is so that we can determine system reliability from hardware and software component reliabilities, even though the mechanisms of failure are different (Musa, Iannino, and Okumoto [MUS87]).

#### **References**

- [MUS75] J. D. Musa, "A Theory of Software Reliability and its Application", Transactions on Software Engineering, Vol, SE-1 No. 3 pp. 312-327, September 1975.
- [MUS87] John D. Musa, Anthony Iannino, and Kazuhira Okumoto, Software Reliability: Measurement, Prediction, Application, McGraw-Hill, 1987.
- [MUS96] John D. Musa, "Software-Reliability-Engineered Testing" IEEE Computer, IEEE Computer Society Press, Volume 29, Issue 11, November 1996, pages: 61 – 68.
- [MUS99] John D. Musa, "Developing More Reliable Software Faster and Cheaper," Fifth IEEE International Conference on Engineering of Complex Computer Systems (ICECCS'99), 1999, page.162.

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#### **Student Outreach Workshops**

The Reliability Society periodically holds student outreach workshops at colleges and universities in conjunction with local society chapters and activities. In the last year, there have been two of these workshops.

A workshop was held at the Hawaii Preparatory Academy in conjunction with the 42nd annual HICSS conference. ([see more here](#))

A workshop at University of Texas, Dallas (UTD) was hosted by the Dallas Chapter and the UTD CS department. ([see more here](#)).

The next Student Outreach Workshop is planned for the University of Greenwich in London, England in September 2009. ([see more here](#))

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#### **IEEE Fellow Meeting in Hawaii**

Reliability Society President Bill Tonti and Sam Keene, VP of Technical Activities met with Earl Bakken, inventor of the pacemaker and founder of Medtronic, Inc. ([see more here](#))

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#### Security & Privacy Magazine Special Issue

In the forthcoming issue of Security & Privacy, you will see the attached call for papers for the special issue on reliability and security of hand-held devices. I already have one paper (on the security side). John Viega and I are contacting people in industry and academia directly to get them to write articles. Please do the same. We need some really good papers on reliability of these devices. I would also like to receive papers that bridge to two disciplines. Let's work together to make this special issue a success. I also have a special issue coming up on embedded systems (reliability, safety, security). Please send me ideas for what to include in that call for papers, especially in terms of reliability. Security & Privacy magazine: CFP for Reliability and Security of Hand-held Devices

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#### TIP Codes

UPDATE YOUR TIP CODES: All members are encouraged to update your Technical Interest Profile (TIP) codes. Updating these codes will help IEEE develop programs, products and services that better support members and the profession.

To update your TIP codes, go to the Shop IEEE login page

<[https://sbwsweb.ieee.org/ecustomer/cme\\_enu/start.swe?SWECmd=Login&SWECEM=S&SW EHo=sbwsweb.ieee.org](https://sbwsweb.ieee.org/ecustomer/cme_enu/start.swe?SWECmd=Login&SWECEM=S&SW EHo=sbwsweb.ieee.org)> and enter your user name and password and click the "Login" button.

You will be directed to the Shop IEEE page. Once you are there:

1. Click the My Account tab.
2. Under the My Information Column in the far left, click the "Technical Interest Profile" link. Your Technical Interest Profile will appear in the center of the page.
3. Click the "New" button to the left of your profile to update your S/C TIP codes.

To learn more about TIP Codes, or to get a full list of TIP codes, visit:

<[http://www.ieee.org/web/volunteers/tab/tab\\_tip\\_codes.html](http://www.ieee.org/web/volunteers/tab/tab_tip_codes.html)>.

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#### Safety: Impressive DVD from the US Chemical Safety and Hazard Investigation Board

The Honorable William E. Wright, United States Chemical Safety and Hazard Investigation Board, was the 2009 RAMS (Reliability and Maintainability Symposium) Keynote Speaker and his presentation included the showing of portions of this DVD. The web site where you can request (free) that Safety DVD is on the US Chemical Safety and Hazard Investigation Board Website: <http://www.chemsafety.gov/index.cfm> . After the web site opens, on the left side in the listing is a title, Request DVD, click that and enter the requested mailing information. The DVD is entitled, Safety Videos 2005-2008, a two-DVD collection containing all CSB safety videos issued from December 2005 to October 2008, including the most recent video, "Half an Hour to Tragedy." It is all chemically oriented, but very impressive -- explosions and resulting impacts. The Chemical Safety and Hazard Investigation Board produces these safety videos as part of their mission of preventing accidents.

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#### Society Solicitations:

Call for Expert Now Tutorial Authors/Presenters

The IEEE is cooperating with IEEE Educational Activities to develop and produce technical video tutorials from the reliability field.

We refer you to the direct link to the IEEE Expert Now "Call for Authors" web page, <[http://www.ieee.org/web/education/Expert\\_Now\\_IEEE/smerecruit.html](http://www.ieee.org/web/education/Expert_Now_IEEE/smerecruit.html)>

Those who are interested are invited to complete the presentation form and forward to Ms Marsha Abramo, [m.t.abramo@ieee.org](mailto:m.t.abramo@ieee.org). We plan to produce one or more such tutorials each year supporting the IEEE EA education base for our membership.

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#### Chapter Activities:

The most recent chapter activity reports are linked below:

[Boston](#)

[Dallas](#)

[Denver](#)

[Singapore](#)

[Twin Cities](#)

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## Technical Activities:

### Annual Technical Report

The 2008 Annual Technology Report has been released and is being published in the June issue of the IEEE Reliability Society Transactions. Not all material could be included because of space constraints, however, the full ATR is available on the Reliability Society Website. The full ATR contains 31 articles across a broad range of topics from general to technical. It is both informative and interesting. You are encouraged to check it out.

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### 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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## Announcements:

[Security & Privacy \(S&P\) Magazine](#)

[RAMS 2010 - Call for Papers](#)

[Frontiers of Prognostics & Health Management Conference 2010 \(PHM 2010 Macau\) - Call for Papers](#)

[Reliability and Security of Hand-held Devices - Call for Papers](#)

[Hawaii International Conference on Systems Sciences \(HICSS\) - Call for Papers](#)

[Reliability Outreach/Workshop 2009 at Greenwich University, England](#)

We are now approaching the "Early Bird" slot for discounted registrations. Register early to capture your discount. The scope of the Reliability OutReach event now includes more challenging presentations and discussions. The legitimacy of archaic "standards" is challenged. And the Workshop session will provide an additional forum to discuss the issues.

Details are in the attached brochure and at the website: <http://reliability-outreach.gre.ac.uk>

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## Final Key Points of HALT - HALT (Part 4)

By Lou Gullo

This article is part 4 of a 4 part series of articles on Highly Accelerated Life Testing (HALT) published in 4 consecutive IEEE Reliability Society (IEEE-RS) newsletters. This last article focuses on the final key points of HALT, design margin, sample size, and provides conclusions. An introduction to HALT was published in the March 2008 newsletter. Part 1 of the series described HALT as a method used to rapidly accelerate failure mechanisms, which may be latent manufacturing defects or design weaknesses. The failure acceleration occurs through the combination of environmental and electrical stress conditions. Part 2 of the series provided a detailed description of HALT, stating “what HALT is” and “what HALT is not”, and included a discussion of time compression and test coverage. Part 3 of the series contained step stresses and load cases for various environmental and electrical stress conditions.

### Design Margin

HALT provides a fast means to determine product design margin between the specification limits and the operating limits, and between the operating limits and the destruct limits. The specification limits are the documented requirements, which highlight the capability of the design. Design margin between the specification limits and the operating limits, also called operating margin, usually has very little overlap between the design strength and the applied stresses expected for the product. Small overlap between design strength and applied stresses translates into no physical fatigue, or physical fatigue that slowly develops over time and stress. This condition is depicted in Figure 1. The red outlined area in Figure 1 shows where the overlap occurs and reflects the operating area where failures are likely to occur. As the overlap between stress and strength increases, physical fatigue develops quicker, and the operating area grows where failure probability is likely. Early life wearout mechanisms occur when the physical fatigue accumulates to the point of failure or damage. When the stresses surpass the strength of the design, there is negative design margin, or overstress conditions. An example of an overstress condition is shown in Figure 2. In Figure 2, the stress area entirely overlaps the strength area, resulting in product failure every time the product is operated. When the design strength is greater than the applied stresses, there is positive design margin.

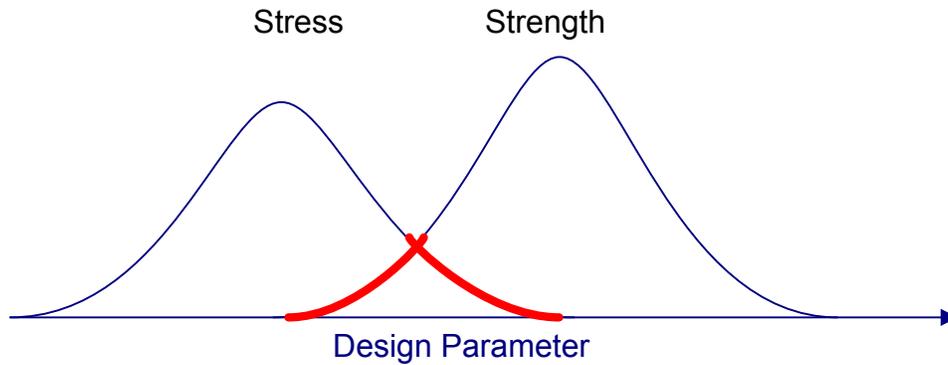


Figure 1

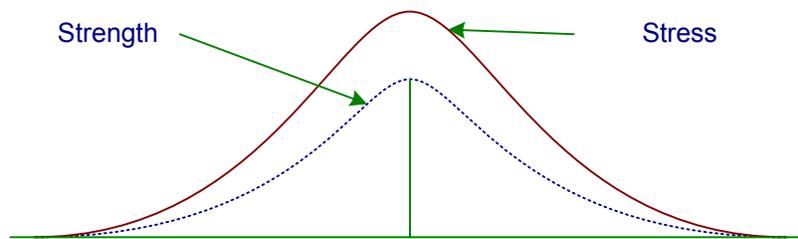


Figure 2

For instance, if a table was required to withstand weights of 100 lbs dropped from a height of 1 foot, one might design the table to handle 200 lbs from 1 foot. This increased design strength provides 100% design margin, which has a direct correlation on the high reliability or robustness of the table. The test measurements achieved from HALT output provides results in terms of percentage of design margin for that product design, which is very useful to the design engineer.

The design margin for thermal performance of the product after completion of HALT may be determined to be 50%, as an example. This 50% design margin means that the design operating limits are 50% beyond the specification limits. For example, if the specification for a particular design states that the operating high temperature requirement is 100 degrees F, or 30 degrees F above room temperature (70 degrees F), then 50% design margin for high temperature conditions means that the design will reliably operate up to 115 degrees F ( $30 \text{ deg F} \times 0.5 = 15 \text{ deg F}$ ) before failures are highly probable.

Using the example above, for a design with 50% design margin, this means the design is capable of operating at a high temperature that is 50% above the design specification's high temperature operating requirement. The high temperature operating limit is the actual level of operation that the design is able to withstand up to intermittent operation and the appearance of soft or hard failures.

This level of design margin (e.g. 50%) usually has some amount of overlap between the design strength and the applied stresses. When design strength does not overlap and exceed the design stresses, no failures will occur. There will be some distribution of failure points that may follow a normal distribution curve, as an example. The upper tails of the stress distribution may enter the lower tails of the design strength distribution in some units. When design strength distribution begins to overlap design stress distribution, the design experiences a non-zero probability of failure. As the strength and stress overlap continues, or increases, physical fatigue is accumulating at an accelerated rate. Early life wearout mechanisms of a design are precipitated with prolonged stress exposure. When the design continuously performs at the operating limit, the design margin is approaching zero.

The destruct limits are the levels of stress in which intermittent failures increase in frequency until the design fails to operate. This type of failure which is not able to recover is called a hard failure or a patent failure. At the destruct limit, the design margin is zero, and the margin is close to zero. The accumulated fatigue stresses exceed the strength of the design. The physical stress is too much for the design strength to handle. At this level, materials fail (fracture, melt or vaporize).

### Sample Size

The sample size for HALT is usually one or two units for testing. This decision is based on the cost of the units, and knowing that the units will not complete HALT in a condition to be sold to customers. When given a preference, I will select 3 to 6 samples for HALT. The 3 samples are selected as the minimum sample size and are initially tested in a sequence or in parallel to identify design weaknesses and early life wearout failure mechanisms that isolate a root cause failure pattern or trend. If only one unit is HALT tested, it is uncertain if a trend has been detected. If 2 units exhibit the same failure mode and root cause mechanism, there is a higher statistical significance that a trend has surfaced compared to a single failure. If 3 units are tested, this will increase the statistical significance of a trend if all 3 detect the same failure. It will also result in identification of a trend if 2 out of 3 units fail for the same failure cause.

Once the root cause resolution is determined and the corrective action implemented to the design, another sample of 3 units are selected. These may be units that are reworked or repaired from the original test sample population, or it may be 3 new units built with the design change incorporated at initial assembly production. This depends on how many samples were build for the test phase, whether there are more units available to conduct a retest of the HALT, or the extent of the design change corrective action.

### Conclusions

During my experiences, I have demonstrated that with repeated HALT testing, using appropriate environmental and electrical step stress conditions, load cases, and a sufficient number of test samples, HALT is useful to help you improve product reliability and assure adequate design margin within customer application environments and stress

conditions. This is true only if failures are identified, and corrective actions are taken during and after HALT to increase the design margin. Reliability improvements can be made when the design is changed to either increase the design strength, or lower the design stress, or both.

*This is the 4<sup>th</sup> and last article of a 4 part series on HALT for the IEEE-RS newsletter.*

*Lou Gullo  
Raytheon*

# Comments on the Bathtub Curve for Electronic Components

By William Marsh

A recent article by Cooper [1] hypothesized that, since burn-in is an imperfect screening tool, one can expect that the failures experienced during burn-in will be repeated during the operating life. For example, if 2 failures were experienced during a 100 hour burn-in, and the burn-in acceleration factor were 4, one could expect that 2 failures could occur during the next 400 hours of operation under the application conditions. A vigorous response has been prepared by the author [2], primarily addressing the fact that burn-in alone should not be depended upon as an effective screen.

However, the discussion by Cooper has raised an interesting point, that the failures experienced during the operating life represent screening escapes. This can be expanded to claim that there are only two types of failures – substandard parts and wear-out failures (excluding application-related problems such as overstress or tolerance problems). This would infer that the bathtub curve for individual parts is incorrect, since there will be no such phase as a constant failure rate or constant hazard rate – only a continuation of the infant mortality phase. This makes sense, since the only reason for a part to fail prior to wear-out (excluding application-related problems) is a manufacturing defect or anomaly. Although not appropriate at the part level, the bathtub curve may be appropriate over the long term at the system level with maintenance, because the system will contain a mix of parts in the infant mortality phase, parts in the wear-out phase, and parts with different ages.

The implication of this is that a screening program should be divided into two parts: the first being an environmental screen of sufficient severity to remove environment-susceptible defects from the lot, and the second being a burn-in screen of sufficient intensity and duration to demonstrate the desired or specified maximum failure rate (where the probability of failure due to infant mortality has been reduced to a pre-defined level). Such an approach is currently being used for solid tantalum capacitors [3]. In accordance with this philosophy, the approach discussed by Cooper [1, 4] will be a valid and useful technique to determine the acceleration factors associated with the testing. As Cooper has pointed out, the acceleration factor depends on the activation energy of the various part defects, which vary widely. In addition, the distribution of the defect types should be expected to change with time as improvements are introduced into the manufacturing process.

## REFERENCES

1. Mark Cooper, Observations on Component Infant Mortality and Burn-In Effectiveness, *IEEE Transactions on Components and Packaging Technologies*, vol. 31, no. 4, December 2008, pp 914-916
2. William Marsh, Comments Regarding Mark Cooper's Paper on Burn-In Effectiveness, submitted for possible publication in *IEEE Transactions on Components and Packaging Technologies*
3. MIL-PRF-55365G, *Capacitor, Fixed, Electrolytic (Tantalum), Chip, Established Reliability, Nonestablished Reliability, and High Reliability, General Specification For,*

- ◆ U. S. Department of Defense, with Amendment 2 dated 3 October 2008
4. Cooper, M. S., ◆ Investigation of Arrhenius Acceleration Factor for Integrated Circuit Early Life Failure Region With Several Failure Mechanisms, ◆ *IEEE Transactions on Components and Packaging Technologies*, ◆ vol. 28, no. 3, September 2005, pp 561-563

## Reliability Society Outreach to the Hawaii Preparatory Academy



Sam, Bill, and Jeff with students at the Hawaii Preparatory Academy

Sam, Bill and Jeff took a day to visit HPA in Waimea, Hawaii. We all had participated in the Trust and Dependability workshop held in conjunction with the 42<sup>nd</sup> Annual Hawaii International Conference on System Sciences (HICSS). Professor Robert Mathews, University of Hawaii, had recommended this venue and arranged our outreach activity at this school. Professor Mathews works with Sam on the IEEE Critical Information Protection Committee (CIPC). The stated mission of the Hawai'i Preparatory Academy is to provide exceptional learning opportunities and a diverse community honoring the traditions of Hawai'i. Deighton Emmons is the Chair of the Science Committee at HPA arranged our day's activities, to talk about the reliability society, give a technical seminar and interchange with the science students and tour the campus.

## Reliability Society Student Outreach, University of Texas in Dallas

On January 23, 2009 the IEEE Reliability Society in Dallas Texas partnered with the Student IEEE Society at University of Texas at Dallas (UTD) to provide a technical symposium, “Developing Highly Reliable and Trustworthy Products and Systems”. Dr. Sam Keene gave a Computer Science Colloquium on *Software Reliability: Modeling, Insights and Management*. After that we had eight afternoon presentations covering reliability, safety and fault prediction for both hardware and software. The event was supported by the Executive and Administrative Committees of the IEEE Reliability Society, Dr. Bill Tonti, Reliability Society outgoing president and Mr. Alan Street, Reliability Society incoming president. We were fortunate to have prestigious IEEE speakers from around the country present on topics of reliability test, analysis and processes. There were over 60 attendees, which consisted of students, and professionals. Special thanks to the UTD CS department and Erik Jonsson school for hosting this event. We look forward to the next opportunity to join students and professionals in a learning environment.



## Fourth Announcement

# Reliability OutReach Seminar & Workshop

## Developing Highly Reliable and Trustworthy Engineering Systems

14-15 September 2009  
University of Greenwich,  
World Heritage Site, Prime Meridian, London, England

### Day 1 - Seminar

#### **Safety and Reliability on the NASA Space Shuttle-A Look Back**

Alfred Stevens, Director of the Safety Advocate's Office in Florida (Retired), United Space Alliance

#### **Reliability Prediction Methods: What We Should Use and Not Use**

Dr. Michael Pecht, Visiting Professor City U Hong Kong, Director CALCE University of Maryland

#### **Compliance is not enough**

Bob Page, Reliability Plus

#### **Product Reliability – Managing the Time-Bomb**

Dr. Nihal Sinnadurai, CEO & CTO, ATTAC

#### **Developing World Class Products with "Design for Six Sigma" (DFSS) Tools**

Dr. Samuel Keene, Six Sigma Master Black Belt, Keene and Associates

#### **Juggling the Software Assurance Puzzle Pieces**

Dr. Jeffery Voas, Technical Fellow and Director of Systems Assurance, SAIC

#### **Embedded Reliability & Test Engineering in MEMS enabled systems**

Prof. Andrew Richardson, University of Lancaster, and Prof. Nihal Sinnadurai, ATTAC

#### **System Prognostics**

Prof. Chris Bailey, Director, Computational Mechanics & Reliability, University of Greenwich

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## Fourth Announcement

# Reliability OutReach Seminar & Workshop

## Day 2 – Workshops & Breakout Sessions

Specific Topics will be selected from Day 1 Seminars to enable detailed discussion and debate. Breakout sessions will be held for specific topics to be pursued.

Also:

Discussion on “**Software Engineering Challenges & Solutions - A Baker’s Dozen**”, Dr. Jeffery Voas,

Discussion on “**Steps to Achieving Six Sigma Products**”, Dr. Samuel Keene

Discussion on “**Fit-for-Purpose Reliability**” “**Not irrelevant ‘Standards’**”, Dr Nihal Sinnadurai

### Accommodation

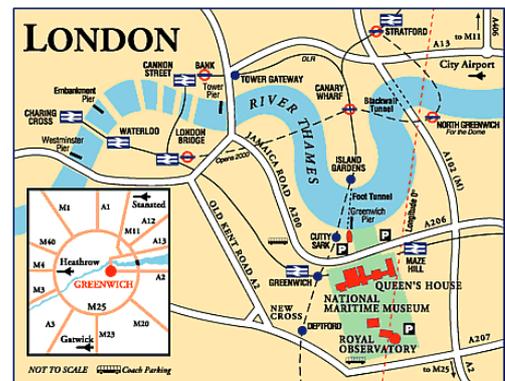
A number of hotels including the IBIS and Novotel are located within walking distance to the University. Some University accommodation may also be available. Further details will be announced in the near future.

### Greenwich

Located in South East London Greenwich is a World Heritage Site. With the stunning buildings of the University of Greenwich, the Maritime Museum and the Royal Observatory there is plenty to do. In addition to its historical heritage Greenwich has excellent restaurants, pubs and a street market.

### Travel

Greenwich is connected by train to all of the London Airports and well connected to the London Underground and Bus System. The nearest train station is Cutty Sark on the Docklands Light Rail (DLR) system which is a pleasant five minute walk from the University campus.



Welcome to the Reliability OutReach Seminar and Workshop at the University of Greenwich



**Fourth Announcement**  
**RELIABILITY OUTREACH SEMINAR & WORKSHOP**  
**REGISTRATION FORM**

Title \_\_\_\_\_ First Name \_\_\_\_\_ Surname: \_\_\_\_\_

Company / Institution Name: \_\_\_\_\_

Address: \_\_\_\_\_

Tel: \_\_\_\_\_ Fax: \_\_\_\_\_ E-mail: \_\_\_\_\_

If claiming IEEE Member discount: Membership Number: \_\_\_\_\_

Any Dietary requirements? \_\_\_\_\_

The workshop and seminar fees are detailed in the table below. An early bird discount is given when registering **before, or on, 14<sup>th</sup> August 2009**. Fees include lecture material and notes, lunches, morning and afternoon tea/coffee.

	<i>(Please tick one box)</i>	<i>Early Bird</i>	<i>Regular Price (after 14th August 2009)</i>
<b>Presenter</b>	<input type="checkbox"/>	Free	All presenters confirmed
<b>IEEE Student</b>	<input type="checkbox"/>	Free	£150
<small>(because the free places are strictly limited, students receiving the free places must commit to attend and not block out others)</small>			
<b>Student Signature:.....</b>	.....		
<b>IEEE or IMAPS-UK Member</b>	<input type="checkbox"/>	£120	£150
<b>Non IEEE or IMAPS-UK Member</b>	<input type="checkbox"/>	£140	£170

**Please note, all fees must be paid before the commencement of the workshop. An e-mail confirmation will be sent once payment has been received.**

I enclose a cheque for

£
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**Cheques must be made out to "The University of Greenwich", drawn on a UK bank, and sent for the attention of: Mrs Marilyn Greenaway, University of Greenwich, Maritime Greenwich Campus, Old Royal Naval College, School of Computing and Mathematical Sciences, Park Row, Greenwich, London, SE10 9LS**

**Or**

Please debit my Master/Visa card:

Card No.

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Expires \_\_\_\_ / \_\_\_\_ Security code (the 3 digits on the back of your card) \_\_\_\_\_

Full name and address of the card holder (if different from above) including street number and postcode

\_\_\_\_\_

\_\_\_\_\_

Amount £ \_\_\_\_\_ Signature \_\_\_\_\_

**Or**

Please invoice my company (payment must be received before the event):

Contact name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

Tel. \_\_\_\_\_ Fax \_\_\_\_\_ E-mail \_\_\_\_\_

**Please Fax or e-mail this form to Marilyn Greenaway, University of Greenwich,  
 Tel: 0208 331 9329, Fax: 0208 331 8665 Email address [m.a.greenaway@gre.ac.uk](mailto:m.a.greenaway@gre.ac.uk)**

## Fourth Announcement

Cancellations not allowed after 14<sup>th</sup> August 2009.

Please note that if you do not attend the course, no refund will be available.

Reliability OutReach Seminar & Workshop

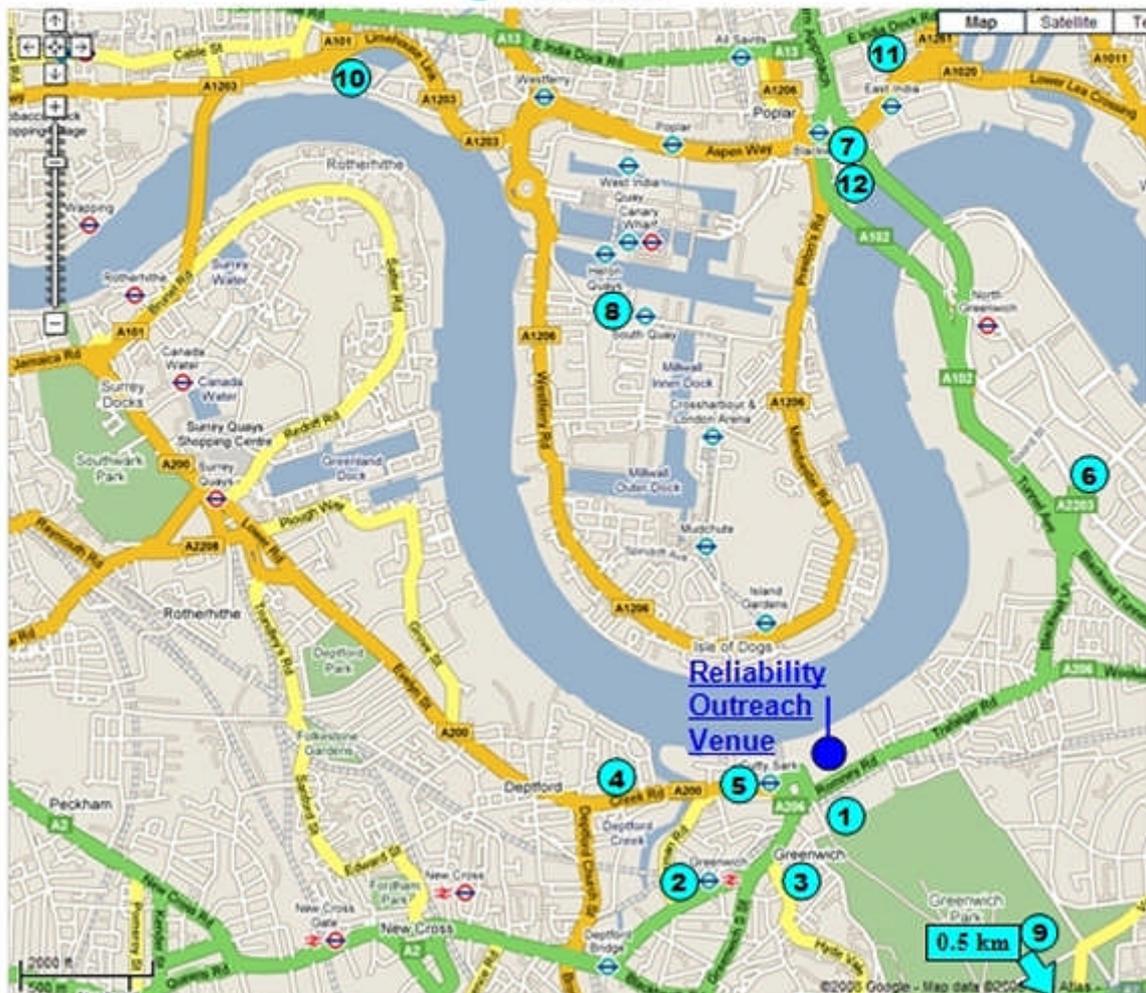
## Recommended Accommodation

The Reliability Outreach Venue is a five minute walk from the Cutty Sark Station on the Docklands Light Rail (DLR) and a 10 minute walk from Greenwich Mainline Station. Both stations connect to the whole London Underground system and to all major airports

A limited number of hotel rooms are reserved for the event participants. Please book your accommodation early as only limited rooms are made available and for a certain period of time. Also, it may be worth checking the hotel websites for details of cheaper on-line rates.

- |                                 |  |   |
|---------------------------------|--|---|
| 1 Devonport House               | 5 Cutty Sark Hall of Residence         | 9 The Clarendon Hotel                         |
| 2 Novotel Greenwich             | 6 Express by Holiday Inn-<br>Greenwich | 10 Express by Holiday Inn-<br>Limehouse       |
| 3 IBIS Greenwich                | 7 IBIS London Docklands                | 11 Travelodge, East India Dock                |
| 4 McMillan Hall of<br>Residence | 8 Britannia Hotel                      | 12 Radisson Edwardian New<br>Providence Wharf |

 DLR Stations



## Fourth Announcement

### **Devonport House Hotel**

*King William Walk, Greenwich, London SE10 9JW*  
Tel. +44 (0)870 609 1143  
<http://www.devere.co.uk/venues/devonport-house/>

The four-star Devonport House is about 7 minutes walk from the University of Greenwich site.

Double room for single occupancy rate per night: £109 (inclusive VAT and breakfast)

**To book please contact Caroline Linhares and quote "The University of Greenwich booking rate" Phone: +44 (0)20 8269 5443 or Email: [CLinhares@deverevenues.co.uk](mailto:CLinhares@deverevenues.co.uk) (Subject to rooms availability)**



### **Novotel Greenwich**

*173–185 Greenwich High Road, London SE10 8JA*  
+44 (0)208 312 6800  
<http://www.novotel.com/>

A new-built four-star hotel close to Greenwich rail and DLR stations. About 12 minutes walk from the University of Greenwich site.

Reservation number: 093727 001 (phone reservations only) Double room for single occupancy rate per night: £115 (inclusive VAT and breakfast)

**Limited number of rooms allocated until: 12 August 2009**



### **Hotel Ibis, Greenwich**

*30 Stockwell Street, Greenwich, London SE10 9JN*  
Tel. +44 (0)208 305 1177  
<http://www.ibishotel.com/>

A two-star hotel about 8 minutes' walk from the University of Greenwich site.

**We recommend on-line bookings on the hotel web site (no reference required) (Subject to rooms availability)**



## Fourth Announcement

No rooms in Student Halls of Residence have been arranged formally but might be available at the dates of the event. To check availability and make booking arrangements please call directly the halls of residence.

### **McMillan Student Hall of Residence**

*Creek Road, London SE8 3BU*

*Telephone Number: +44 (0)20-8691-8996*

### **Cutty Sark Student Hall of Residence**

*1 Welland Street, Greenwich SE10*

*Telephone Number: +44 (0)20-8319-5767*



**For more hotels near Greenwich, London visit:**

<http://www.hotelroom.com/pcln/location/en/unitedkingdom/england/greaterlondon/london/greenwich>

## IEEE Fellow Meeting in Hawaii



Reliability Society President Bill Tonti (right) and Sam Keene (left), VP of Technical Activities met with Earl Bakken (center), inventor of the pacemaker and founder of Medtronic, Inc., in Hawaii in January. Earl is an IEEE Fellow, as well as a member of the Heart Rhythm Society, the Will C Sealy Surgical Society, and the Biometric Engineering Society.

Bill and Sam were involved in a Trust and Dependability workshop presentation at the annual HICSS conference on the big Island of Hawaii. Through Sam's connections in the IEEE Critical Information Protection Committee, Sam and Bill were invited to meet with Earl Bakken. Earl is a most impressive engineer and an incredible person. He is also a very down to earth gentleman who just turned 85 years of age. We felt blessed to have this special time with him.

He shared his life story and life perspectives with us. Just to set the background, Earl has been granted 5 doctorates plus an honorary MD degree from the University of Minnesota – the only one they have ever granted. He was always a tinkerer as a youth and had an abiding interest in electricity. He also found he could fix anything electrical and was routinely called, while he was in college, by the local hospital to keep their instrumentation operating. There he saw opportunities to develop the external, battery-

operated, transistorized pacemaker. Medtronic has also gone on to develop implantable devices to manage Parkinson's disease, pain, and depression. Every Christmas, instead of a party, Medtronic has 6 patients and their doctors come and talk to the company employees about the improvement in their quality of life through the Medtronic implantable devices. Medtronic continues to refine the pacemaker until they can eliminate the leads, which he said were the most unreliable component in the system. His reliability focus resonates with us.

Currently Earl is involved with many organizations including a new hospital in Hawaii that emphasizes high touch as well as high tech, incorporating 68 care innovations. He also has helped establish hands-on labs for students to learn more about engineering. Additionally, his philanthropic support has reached nearly 900,000 students of all ages to encourage study and careers in Science and Technology. He is such an example to all of us.

We felt honored to have Earl share an afternoon with us.

**IEEE Reliability Society Newsletter Submission**  
**from the Boston Chapter**  
**November 2008 / March 2009**

Greetings! this is a combined November 2008 & March 2009 Boston chapter newsletter, where we will report on several meetings & chapter developments. We are now in the planning stages of our 09-10 meetings, through June 09.



Gene Bridgers, Principal Reliability Engineer Mercury Computer. 32 Members & Guests in Attendance

- July 2008 TDC workshop, held at Mercury Computer Images courtesy of AdCom member Aaron D. (Raytheon)

**July 08 Technology Development Workshop:** We completed the last 07-08 season meeting in July, with a Design for Reliability technology workshop at Mercury Computer (*Chelmsford, MA.*) hosted by AdCom member Gene Bridgers. Gene presented: “Automated MTBF-DfR Demonstration”, where he showed participants a semi-automated real-time on-line tool developed and employed at Mercury. With the automated process in place, Mercury Computer’s development organization is able to quickly assess the Reliability of a particular product design, improving product the development cycle. We had a total of 32 members & guests at this meeting.

**August IEEE Chapter Re-alignment:** The former IEEE area Section, Central New England Council (Includes IEEE: Boston, New Hampshire, Providence, Maine and Worcester County) was dissolved per IEEE Section ExCom vote and Region 1 MGA approval in August. This was due in part to reallocate IEEE funds to the local sections. The CNEC consisted of 19 Society chapters (including the Boston Reliability chapter), which served IEEE society members in the 5 area sections. Smaller chapters benefited from this regional alignment by serving area society professionals within the 5 sections.

Following approval, all former CNEC society chapters were asked to determine which of the 5 sections would become the parent IEEE section to report into. Per IEEE by-laws, all society chapters must be part of a parent IEEE section or become a member of a parent IEEE Region. The Boston Reliability chapter along with (2) other society chapters were moved under Region 1, until the chapter AdCom could convene and determine our chapter’s path forward.

The chapter AdCom reviewed membership data during follow on meetings & determined that while **70%** of the chapter members reside or work in the IEEE Boston section area, **30%** work in the IEEE New Hampshire, Providence & Worcester county sections. In addition, guest monthly meeting participants which represent approximately 50% of our attendees were split evenly between Boston and the other former CNEC sections. Based on member and guest participant data analysis, the AdCom unanimously voted to become a Joint section chapter between Boston, New Hampshire, Providence & Worcester County (Worcester county declined our request).

In November per Region 1 MGA approval, the Boston Reliability chapter officially became a joint section chapter between Boston, New Hampshire & Providence. The AdCom believes this alignment will best serve the needs of it's regional members & participating guests which we encourage to participate in the chapter's activities.

We would like to thank Dr. Howard Michel (IEEE Region 1 Director), our Joint Section leaders IEEE Boston John Conrad (chair) & Bob Alongi (business mgr.), IEEE New Hampshire Jim Anderson (chair) & IEEE Providence David Casper (chair) for considering and approving our joint section chapter request. We are excited about the new alignment which will ensure the vitality of our local chapter for years to come!

**08-09 meetings & Events: (Sept - Dec)**



September kickoff meeting at EMC Corporate Headquarters. Well attended RoHS Reliability panel discussion



47 members & guests in attendance. Gene Bridgers receives a Boston Reliability chapter lifetime achievement award & honorarium

- Sept. 2008 kickoff RoHS Reliability panel discussion, Images courtesy of AdCom member Aaron D. (Raytheon)

We held our **September** kickoff meeting at EMC Corporation Headquarters located in Hopkinton. AdCom member Gene Bridgers hosted a RoHS Reliability Panel Discussion. Several area professionals that work with RoHS compliant interconnect & platings were on hand for this lively discussion. Panel members included: Paul Bodmer (Benchmark Electronics, FA Expert), Bob Landman (H&L Instruments, L.L.C.), an Active RoHS student & IEEE Reliability ALERT Initiative Co-Chair with Ramon De la Cruz (Teradyne Inc.), Darryl McKenney (Mercury Computer, RoHS COTs Design Lead) and Dr. Anthony Rafanelli (Raytheon, RoHS Team Member). Discussion topics included the long term reliability issues associated with the migration to lead-free interconnects and the impact and implications this has industry wide on systems that are exempt from the RoHS legislation (Defense electronics, aerospace, medical electronics).

This meeting was well attended, we had a total of 47 members & guests at this meeting.

Following the meeting, we had the great honor of presenting Chapter AdCom member Gene Bridgers with a Plaque & honorarium awarded by the Boston Reliability chapter for his twenty five years of volunteer service to the chapter. The Boston Reliability chapter lifetime achievement award presented reads in part: *“For 25 years of exemplary service, promoting key reliability concepts & engineering best practices. In recognition & appreciation for mentoring many chapter professionals through education, guidance & support. Most of all, for being a friend always willing to lend a helping hand!”*. Gene moved back home to North Carolina in September but continues to work for Mercury Computer and participates in our AdCom planning meetings remotely. Gene, we are grateful and thank you for your continued support!



October ASQ 57th Conference, Membership table (top left) ; Presenter Nihar Senapati (top right)



Presenter Ken Rispoli (bottom left) ; Raytheon Authors & Presenters: Phil, Ken, Jim, Matt & Aaron Jr. (Pam Winters not shown)

- Boston chapter hosted a Reliability track, Images courtesy of Aaron D. (Raytheon) & Ramon De la Cruz (Teradyne)

**In October**, we canceled our regular monthly meeting session to support the ASQ New England Quality Council’s 57<sup>th</sup> Conference, held in Marlborough MA. The Boston Reliability chapter hosted the Special & Reliability Tracks for days 1 & 2 of the conference, as we did in 2006. The Special track included presentations on Medical device quality, while the Reliability track had an emphasis on Industry wide Reliability practices and lessons learned. The Boston Reliability chapter would like to extend our thanks to the following Reliability track Authors & presenters at this year’s Conference:

**Presentation 24A:** *“Delivering a Compliant and Risk Focused DFR (Design for Reliability) Program for Medical Devices”* ; Author- Nihar Senapati Sr. Reliability Engineer ; General Electric Healthcare (Chapter AdCom member)

**Presentation 24B:** *“An Improved Approach to Fault Detection / Fault Isolation (FDFI) Verification”* ; Author- Philip A. Bedard Sr. Principal Systems Engineer ; Raytheon Company- IDS

**Presentation 24C: “Power Supply Reliability- COTS Integration, Lessons Learned”** ; Authors- Kenneth P. Rispoli Sr. Principal Engineer (*presenter*) ; Aaron C. DerMarderosian, Jr. Sr. Electrical Eng. II *w/honors* (*Track Session Chair*) ; Raytheon Company- IDS  
**Presentation 24D: “The Impact of Spares on Availability”** ; Authors- Mike Flanagan Reliability / Maintainability Engineer (*presenter*) ; James Perreira Engineering Fellow ; Pamela Winters Reliability / Maintainability Engineer ; Raytheon Company- IDS  
**Workshop Session 24E: “New European Legislation, Asian Pollution Levels – How Packaging Can Increase Electronic Reliability in the Face of These Challenges”** ; Authors- Keith Donaldson (*presenter*), President Engineered Materials Incorporated ; Joe Spitz, President Liberty Packaging Company

The IEEE Boston Reliability chapter also hosted a membership table outside the track session conference room. Vice-Chair Ramon De la Cruz manned the table and answered conference attendee questions about the IEEE and Reliability society membership.



Nov. 2008 Presenter Andrew Olney (Analog Devices, left), Images Courtesy of AdCom member Aaron D. (Raytheon)  
 - Nov. 2008 ESDA-NE / Boston RelSoc meeting, Images courtesy of AdCom member Aaron D. (Raytheon)

**In November**, we held a joint meeting with the ESDA Northeast chapter & Dangelmayer Associates, where Andrew Olney (Director of Quality- Analog Devices; Chapter & ESDA member) presented: "Real-World Charged Board Event (CBE) ESD Failures" at 171 EMC Corp. Andrew provided an overview of the various ESD models used to characterize sources of potentially damaging ESD events that occur in the electronics industry. In particular, the Charged Board Model (CBM) was discussed at some length. Andrew provided several examples of ESD damage and how EOS & ESD physical damage can be easily misinterpreted in the FA Analysis process. We had a total 44 Members & guests in attendance at this meeting.

The IEEE-RS announced **2007 Annual Reliability Chapter awards** this year on November 6<sup>th</sup>. The overall score for each competing chapter is calculated based on the number chapter of meetings, number of participants, member participation in IEEE & non-IEEE based technical conferences (as author / presenters) & member technical contributions to the IEEE Reliability Society.

The Competition results are as follows:

- 4th place: \$200.00;** Shared- Baltimore, Cleveland, Denver Japan, Ottawa, Taipei/Tainan (Taiwan), Twin Cities, UK/R I
- 3rd place: \$400.00;** Italy - 69.0 points
- 2nd place: \$600.00;** Singapore - 71.0 points
- 1st place: \$800.00; Boston - 84.4 points**

We want to thank all of our chapter members for your participation in this year’s competition. The money received from the award will be used to host additional technical meetings & provide financial contributions to our joint member sections.



Dec. 2008 Annual past chairs & Dinner monthly meeting ; Presenter David Pinsky (top left)



Award presented by AdCom to Aaron DerMarderosian Jr. (bottom right), Pictured: Ramon, Aaron Jr., Don & Jeff  
 - Dec. 2008 presentation EU-REACH overview, , Images courtesy of Ramon De la Cruz (Teradyne) & Aaron D. (Raytheon)

**In December** we held our annual chapter past chairs & dinner meeting. A chapter brief was presented highlighting chapter meetings & activities through 2008 and results of our annual Chapter officer elections. For the 2009 term our Vice Chair Ramon De la Cruz (Teradyne) was voted into the Chair position, Aaron DerMarderosian Jr. (Raytheon) will be vice-chair & past chair, Don Markuson (Sierra Atlantic) was re-elected to chapter Treasurer & Eddie Robins (EMC Corporation) was re-elected as Secretary. For our annual dinner meeting, we had several past chapter chairs in attendance. Amongst those recognized for their contributions were:

**Donald Dawes: Chair, 1971 - 1972**

**Don Markuson: Chair, 1990 - 1991 & 1995 - 1996**

**Jim Fahy: Chair, 1999 - 2000 & 2004**

**Jeff Clark: Chair, 2000 - 2003 & 2005**

**Aaron DerMarderosian Jr.: Chair, 2006 – 2008**

Prior to the start of the evening presentation, the AdCom presented Aaron DerMarderosian Jr. with an appreciation award (pictured above) for leadership, dedication & contributions to the chapter, as the chair for 2006 - 2008. Aaron was grateful & humbled to receive such a recognition from chapter colleagues!

Our featured guest speaker was David Pinsky, Raytheon Company Engineering Fellow presented "EU Commission- REACH Overview, implications on material Reliability & Availability" at RSA, the security division or EMC, in Bedford MA. Dave provided details around the recent implementation or European Union REACH (Registration, Evaluation, Authorization and Restriction of Chemicals)

legislation and it's impact on availability & reliability of materials that are used in electronic systems. REACH effects an estimated 30,000 substances beyond those realized by the banning and reduction in use of 6 hazardous substances as defined by RoHS (Reduction of Hazardous Substances) legislation which came into effect in 2006. We had a total of 37 members & guests at this meeting.

### 08-09 meetings: (Jan - Feb)



Jan 2009 Presenter Dan Weidman (Advanced Electron Beams) Discussed semiconductor Reliability Engineering processes  
- Presentation on semiconductor Reliability engineering, Images courtesy of AdCom member Aaron D. (Raytheon)

**In January**, we were back at RSA the Security division of EMC (Bedford MA.) where Dr. Daniel Weidman Principal Process engineer from Advanced Electron Beams presented "Practical Reliability Engineering for Semiconductor Equipment". Dan's presentation discussed how to compile & analyze in process and field data to assess & improve product reliability. The examples used related to semiconductor equipment manufacturing but could easily be applied in several other industry sectors. We had a total of 41 members & guests at this meeting.

**In February**, Leslie Gabriele from Gabriele & Company presented "Revitalizing your Job Search, Mind over Market" at RSA, the security division of EMC. Leslie, a friend of the chapter and a past presenter at our chapter meetings is a lecturer, career councilor, coach and high-tech recruiter. Her presentation focused on seasoned technical professionals, who are familiar with career positioning and job hunting but need additional guidance on techniques utilized to take advantage of future job opportunities. A portion of the evening was dedicated to inter-personal networking as several attendees are looking for new job opportunities. With the current economic climate, this event was extremely well attended and received. We had a total of 51 members & guests at this meeting.

### Upcoming meetings:

**In March**, Michael Benedek Sr. Principal Engineer & Reliability team lead from Raytheon RF Components will present "Microwave Device Reliability Characterization-The Mechanics of Life Test Execution and Analysis", this meeting will be held on Tuesday March 10<sup>th</sup> at Teradyne's N. Reading facility. Registration for this event is open on the Boston Reliability chapter website and will close Friday **March 06<sup>th</sup>**, 2009.

**In April**, we will hold our meeting at EMC Corporation Headquarters in Hopkinton. IEEE Fellow Dr. Shubu Mukherjee who is a Principal engineer at Intel Corporation will present "Super-Linear Increase in Soft Error Rate from Doubling the Cache Size: Bug or Phenomenon?". Dr. Mukherjee will review detectable unrecoverable errors experienced in the expansion of processor L2 Cache. Registration for this event is open on the Boston Reliability chapter website and will close Monday **April 13<sup>th</sup>**, 2009.

**Our May** monthly meeting is currently in the planning stages. As we did last year, we are considering several possible topics for Technology Development workshops, over the summer. Please check our website periodically for updates on these upcoming events!

<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 Click on: [Suggest a Monthly Meeting Topic](#).

To participate or provide input to chapter technology development activities, sign up to become a TDC committee participant using our website. Click on: [Join Technology Development](#).

You can also be added to the chapter e-notice distribution via our website, click on: [Join our E-Mail Distribution List](#) or send a request to: [dermarderosiana@ieee.org](mailto:dermarderosiana@ieee.org) (Past chair, notices & registration).

Best Regards,

Ramon De la Cruz. - Chair, Boston Chapter

Aaron C. DerMarderosian Jr. - Past Chair, Boston Chapter

## Dallas Chapter

Chair: Faye Bilger

**The chapter welcomes** Eric Wong the chapter staff as 'University Relations Officer'. He was instrumental in coordinating the recent University of Texas Dallas (UTD) Student Outreach Workshop.



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### UTD Student Outreach Workshop

On January 23, 2009 the IEEE Reliability Society in Dallas Texas partnered with the Student IEEE Society at University of Texas at Dallas (UTD) to provide a technical symposium, **Developing Highly Reliable and Trustworthy Products and Systems**. Dr. Sam Keene gave a Computer Science Colloquium on *Software Reliability: Modeling, Insights and Management*. After that we had eight afternoon presentations covering reliability, safety and fault prediction for both hardware and software. The event was supported by the Executive and Administrative Committees of the IEEE Reliability Society, Dr. Bill Tonti, Reliability Society outgoing president and Mr. Alan Street, Reliability Society incoming president. We were fortunate to have prestigious IEEE speakers from around the country present on topics of reliability test, analysis and processes. There were 60 attendees, which consisted of 43 students, and 17 professionals. We look forward to the next opportunity to join students and professionals in a learning environment.

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### Title: " How I Learned to Stop Worrying and Design Reliability In "

◆◆◆◆◆◆◆◆ Date:◆◆◆◆◆◆◆◆ March 26, 2009

◆◆◆◆◆◆◆◆ Speaker:◆◆ Cheryl Tulkoff, DfR Solutions



#### Program Summary:

The foundation of a reliable product is a reliable design. However, PCB designers are finding that assuring the reliability of their design is becoming increasingly complex as failure can be induced by multiple drivers. In addition, predicting reliability is becoming problematic as MTBF calculations can tend to be inaccurate and a **physics-of-failure (PoF)** approach can be time-intensive and not always definitive.

A critical aspect of all three activities (design assurance, MTBF, PoF) is component stress analysis and stress derating. Due to the manual calculations required, these activities have been constrained by time and money. Companies have responded to these limitations by performing component stress analysis only once in the new product development (NPD) process, limiting the scope of component stress analysis, or simply making assumptions so as to provide input into MTBF spreadsheets.



This talk will present to circuit designers and reliability practitioners new tools that automate the component stress, stress derating, and MTBF processes. The resource reductions provided by these tools demonstrate that these analyses no longer exist outside the boundaries of viable business

models. Cases will be presented showing that comprehensive stress analysis is both critical and realistic and the results from this activity open the door for greater adaptation of PoF-based reliability prediction. It will be shown that customers should expect full stress analysis from their suppliers and suppliers will be made aware that this is no longer an unreasonable expectation. Similarities and differences in design strategies between US and foreign companies will also be explored.

**Speaker:**

Cheryl Tulkoff has over 15 years of experience in electronics manufacturing with an emphasis on failure analysis and reliability. She worked in both circuit card fabrication and assembly and semiconductor fabrication processes.

Cheryl earned her Bachelor of Mechanical Engineering degree from Georgia Tech. She is a published author, experienced public speaker and a Senior member of both ASQC and IEEE. She holds leadership positions in the IEEE Central Texas Chapter, IEEE WIE (Women In Engineering) and IEEE ASTR (Accelerated Stress Testing and Reliability) sections. She chairs the annual IEEE ASTR workshop and is also an ASQ certified Reliability Engineer.

She has a strong passion for pre-college STEM (Science, Technology, Engineering and Math) outreach and volunteers with several organizations that specialize in encouraging pre-college students to pursue careers in these fields.

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**Title: " Designing for Health; An Integrated Methodology for Diagnostics/Prognostics "**

◆◆◆◆◆ Date: ◆◆◆◆◆ May 28, 2009◆

◆◆◆◆◆ Speaker: ◆ Larry Butler, Raytheon

◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

**Program Summary:**

A critical element of system readiness is the effectiveness of integrated diagnostics and prognostics.◆ Errors in detection and isolation of failures cause unnecessary maintenance actions requiring additional troubleshooting time and replacement of could not duplicates (CNDs).◆ Integrated diagnostics/prognostics is achieved through a systems engineering closed loop process from start to finish.◆ Every step from conceptual phase through program shut down thrives on an integrated approach to insure maximum coverage of faults and unambiguous isolation while minimizing false alarms and re-test okays (RTOKs).◆ An integrated health management system (HMS) methodology, proposed in this paper, connects functionality, failure modes and diagnostics/prognostics under one umbrella providing a conduit for tight traceability from requirements through design, analysis, integration, verification and validation, factory testing, and fielding while encouraging maturation through data collection.◆

This framework minimizes errors between diagnostic/prognostic analyses and actual performance, maximizes test verticality, and paves the way for a lower risk fielded product.◆ Iterative analyses and trade studies during the concept and development phases optimize diagnostic/prognostics approaches

and architecture. ♦ Analyses and simulations during the development phase optimize health sensor selection, sensor placement, test effectiveness, and test strategies (i.e. embedded vs. external, test flow, test type etc.). ♦ Analyses and test data provide the foundation for the fidelity and accuracy of a diagnostic/prognostic reasoner, which selects test sequence, filters information and reports faults and their location. ♦ A data collection system facilitates diagnostic/prognostic effectiveness trending and identifies target areas for improvement as a function of maturation during the deployment, operations and support phases. ♦ This paper describes how all these segments weave together to create a seamless closed loop diagnostic/prognostic process that fits into the new DoD 5000.2 Instruction: ♦ Integrated Defense Acquisition, Technology and Logistics Life Cycle Management Framework.

**Speaker:**

Larry is a member of the NDIA Integrated Diagnostics Committee and active member of U of Maryland Center for Prognostics Health Management. ♦ He is the Raytheon Health Management Systems TIG Co-chair. Larry has established an extensive HMS network with industry to include NAVAIR, Army, AFRL, Boeing, Rockwell Collins, U of Maryland, Georgia Tech, Impact Technologies, Ridgetop Corporation, SmartSignal, Sun Microsystems, Sandia Labs, etc.

## Denver Chapter

Our January guest speaker was Dr. Gregg K. Hobbs, the inventor of and world leader in the HALT and Hass methodology. He gave a 1-hour presentation on "Correct HALT Techniques" for successful programs. This was followed by a tour of the Hobbs Environmental test facilities in Northglen, Co.

### Denver Chapter joint meeting with ASQ - May 2009

◆ **Tutorial Topic:** Solutions to Quality Problems Can Sometimes Be Steamrolled in the Manufacturing World

**Tutorial Speaker:** John Medvetz of Spirax Sarco, Inc

**Abstract:** In the early 19th century, a gun maker conceived of a faster, more efficient way to make flint-locks. He observed that the major obstacle to volume production was the hand fitting of the sub-assemblies, so he devised the notion of interchangeability of parts based around standard sizes and feature locations. Unfortunately, he was at the Harper's Ferry plant (in the South), not the Springfield plant in the North. The entrenched feudal mentality of the people who ran the plant resisted his progressive efforts and doomed the project to failure. This story reminds us that there are certain environments where even the best ideas are unable to take root and grow. In that event, a change of venue is probably the most practical option. Listeners are encouraged to draw their own modern-day parallels.

**Feature Topic:** DFSS for Software

**Feature Speaker:** Sam Keene of IEEE / Reliability Society

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Sam :--)

## Singapore REL/CPMT/ED Chapter

December of 2008 saw the 10th anniversary of EPTC, one of our Chapter's two flagship conferences. EPTC has grown rapidly since its beginning in 1997 when just 51 technical papers were presented. This year it features 50 technical sessions with over 250 paper presentations by researchers from 28 countries. There are 3 keynotes and a plenary session by 6 pioneers from around the world. It now includes professional short courses and a technical exhibition.

The day began with a Lion Dance to celebrate the 10 year anniversary followed by short opening addresses by Dr William Chen, President of CPMT, and Dr Alastair Trigg chairman of the IEEE Rel/CPMT/ED Chapter. The first keynote address was given by Dr G Q Zhang, Senior Director of NXP Semiconductors, on the topic of the Changing International Landscape of semiconductors. This was an excellent review of the challenges ahead as we move into the "More than Moore" era. In the second keynote, Prof Michael Pecht of University of Maryland described different challenges, those of maintaining reliability in the face of adverse environmental conditions, increasing complexity, cost constraints and shorter times to market. He explained how the solutions to these challenges lies in the use of prognostic based qualification testing; a concept which I am sure was new to most of the audience. In the third keynote, Prof C P Wong of Georgia Tech showed the potential of nano-particulate metals, nanocomposites and carbon nanotubes to revolutionise the materials science of the semiconductor industry. Prof. Martin Goosey of Loughborough University in the UK had this to say "extremely well organized and well attended conference. With such a wide range of technical information being presented, the EPTC 10<sup>th</sup> Anniversary Conference really was a special event. The conference organizers are to be thanked for all their hard work and congratulated for making EPTC such a great success."



EPTC 1st Keynote Speech by Prof. GQ. Zhang



EPTC Plenary Session Speakers (from left): Dr. William Chen, Prof. Keyun Bi, Prof. Rao Tummala, Prof. Herbert Reichl, Hirofumi Nakajima, Dr. John Lau

At the beginning of 2009 Dr Francis Benistant, Manager of the TCAD Group of Chartered Semiconductor Mfg., gave a technical talk on “TCAD Support for Semiconductor Manufacturing” on 16 January in Nanyang Technological University, which attracted many faculty, students as well as people from industries. He presented the role TCAD has played in technology development and methodologies in calibrating TCAD tools.

Our chapter’s next conference will be IPFA 2009 in Suzhou, China in July. Suzhou is an historic city famous for its gardens but now equally famous as a high-technology centre. It is one hour’s drive from Shanghai, right in the heart of the Chinese Microelectronics industry. Even with the economic downturn casting gloom over Asia, we believe China’s huge domestic market and the Chinese Government’s efforts to accelerate the pace of infrastructure projects should ensure that the Chinese Microelectronics industry does better than most. The deadline for abstracts has just passed and there were a record number of over 200 submissions. More information can be found at the website <http://www.ieee.org/ipfa>.

Submitted by Alastair Trigg, Secretary, Singapore REL/CPMT/ED Chapter

## **Twin Cities Chapter**



On Jan 20th we had 22 people attend a tour of a new HALT lab in the Twin Cities. Time Compression Labs was shown by John Lenss with its capability and equipment.



February 17th was Dr Greg Hetland doing Reliability and Gage R&R for 23 people at the meeting.



March 17th was Scott Savage of Medtronic talking about the failure modes of ceramic and Tantalum capacitors.



April 24th was an all day seminar by Richard Fries on the Design of Biomedical equipment.



-- Jim McLinn

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**The Annual Reliability & Maintainability Symposium**  
**Doubletree Hotel**  
**San Jose, California USA**  
**January 25-28, 2010**

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<http://www.rams.org/newsletter/>

The RAMS 2010 theme is "Transcending Traditional Reliability Approaches - from Theory to Practice," and we are seeking papers and tutorials related to the theme. See the Call for Papers for details. The Symposium is in San Jose, California, USA in January 2010, and given the proximity to many technical sectors and industries, such as semiconductor development and manufacturing, medical device technology, telecommunications, aerospace, and government high technology, RAMS is looking forward to providing this wide audience an excellent training and communication opportunity in the R&M disciplines. We invite you to share your theoretical and practical research, success stories, lessons learned, R&M knowledge, and R&M discoveries at the RAMS 2010.

◆Do you know the way to San Jose?◆

With 300+ days a year of sun, and surrounded by history and great sightseeing opportunities, San Jose is the perfect place for RAMS 2010. Industry abounds in the famous Silicon Valley with aerospace, medical device, telecommunications, semiconductor and many other industries represented. San Jose, in the center of Reliability, Availability and Maintainability activity, provides a great opportunity to communicate with your peers or learn the latest and greatest. If you are not from the area, come to San Jose in January 2010 to participate with your colleagues in the annual gathering of the world's RAM professionals to learn, grow, and share the latest state of the art in the disciplines that drive improvement and performance!◆

If you are in San Jose, bring your co-workers and take advantage of the RAMS 33% discount on 6 or more registrations. Or, take advantage of our Corporate Registration and bring as many folks as you like, one at a time to enjoy individual sessions or a whole day at the Symposium.

1000 at RAMS in 2010! ...◆  
<http://www.rams.org/about/>

**RAMS 2009 Combo Pack**

If you missed RAMS 2009 you can still be a virtual attendee with our combo pack deal and get a discount on your RAMS 2010 registration. For the low price of \$115, we will send you two CD-ROMs: the Proceedings with all the papers in the RAMS 2009 technical program and the Tutorial Notes with all the Tutorials offered at RAMS 2009. In addition, we will send you a coupon worth \$50 on a member or non-member registration for RAMS 2010 in sunny San Jose, California. We know the

way to San Jose, and hopefully you do too, so don't miss out on this excellent opportunity to be a "virtual attendee" at RAMS 2009 and get in for less in 2010!

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The Annual Reliability and Maintainability Symposium

23 Fairway Drive, P.O. Box 1407

Grantham, NH 03753-1407 USA

# FRONTIERS of PROGNOSTICS & HEALTH MANAGEMENT CONFERENCE 2010 (PHM-2010 Macau)



## Call for Papers

12-14 January 2010

University of Macau, Macau, P.R. China



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### Introduction

Prognostics is the process of predicting the future “effective reliability” of a product by assessing the extent of deviation or degradation of a product from its expected normal operating conditions. Health monitoring is the process of measuring and recording the extent of deviation and degradation from a normal operating condition. Today, all the leading companies in the world are looking at the implementation of PHM in their products and systems.

PHM-2010 Macau is the second conference of its kind to promote the realization and application of PHM as a key enabler for growth for a broad range of electronic industries in the Asia Pacific region. The conference will bring together experts and leaders from industries, government organizations, and leading research centers who will share their aspirations for the application of PHM in their respective areas. This event will be an important platform for exchange and networking among leading players in the emerging PHM field, especially in the Asia Pacific region.

### Abstracts and Papers

Researchers and participants from academic and government organizations are invited to submit papers on the following topics:

Principles	Methods	Results
<ul style="list-style-type: none"> <li>Physics of failure</li> <li>Sensors</li> <li>Structural sensing</li> <li>Health management system design and engineering</li> <li>Modeling and simulation</li> </ul>	<ul style="list-style-type: none"> <li>Data-driven methods for anomaly detection, diagnosis, and prognosis</li> <li>Model-based methods for fault detection, diagnostics, and prognosis</li> <li>Standards and methodologies</li> <li>Automated reconfiguration</li> <li>Verification, validation, and maturation</li> <li>Component-level PHM</li> <li>PHM for electronics</li> <li>Structural health management</li> </ul>	<ul style="list-style-type: none"> <li>Innovation applications</li> <li>Industrial applications</li> <li>Informed logistics</li> <li>Lessons learned from PHM system design and integration</li> <li>Systems and platform applications</li> <li>Component-level prognostic results</li> </ul>

June 30, 2009	Abstract Submission
August 15, 2009	Abstract Acceptance
October 15, 2009	Full Paper Due

An electronic copy of a one-page, 300-word abstract with name, address, phone and fax numbers, and email address must be submitted to the technical committee by email at [p hmconf@cityu.edu.hk](mailto:p hmconf@cityu.edu.hk) before June 30, 2009. Instructions for preparing the full paper will be sent to authors whose abstracts are accepted after review. Accepted papers will be placed into IEEE Xplore, with some selected papers being placed into a special IEEE issue on PHM. Participants will be required to register for the conference upon notification of acceptance of their full papers.



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## About Macau

Macau is a glorious slice of the Mediterranean tucked away on the South China Sea. It is this rich history that makes the cultural heritage of Macau special. There are many museums, monuments, churches and temples in Macau. A Portuguese colony for more than 500 years, Macau has retained much of its colonial charm, such as Largo do Senado, (Senado Square) contains some of the most quintessentially Portuguese buildings in the city. The square is next to the main road, Almeida Ribeiro. Just north of the square lies the impressive ruins of Sao Paulo, (St Paul's), once the biggest church in Asia.

If you're looking to explore the angel of Chinese Macau, you should head for a stroll along Rua De Felicidade. This district is packed with traditional shops, as well as Macau's oldest restaurant, Fat Siu Lau, which serves up a specialized roasted pigeon.

And if culture doesn't interest you, there is always the "Las Vegas of the East". Macau has recently outstripped Las Vegas to become the gambling centre of the world. In 2008, Macau pulled in US\$13.7 billion in revenue and outstripping the reported in Las Vegas to become the world's biggest casino draw. The Venetian Macau is twice the size of the Las Vegas original and offers a mind-boggling 10.5 million square feet. The attraction of Macau has clocked 30 million visitors in 2008!!

## Places to go

**The A-Ma Temple** is located in the southeast portion of the Macau Peninsula, which is just next to the inner harbor at the bottom of Barra Hill. The temple is over 600 years old and was erected before the Portuguese ever arrived. The A-Ma Temple is a destination offering silence and spectacular views. The temple contains six main parts which together make up a series of classical Chinese architectural treasures. Each year on the birthday of Macau and on Chinese New Year, disciples gather here to pay homage and pray for good fortune.

**Ruins of St. Paul's Church** was built in 1602 next to the Jesuit College of St. Paul's, the first Western college in the Far East. It was here that missionaries such as Matteo Ricci and Adam Schall studied Chinese before serving at the Ming Court in Beijing. After the expulsion of the Jesuits, the college was used as an army barracks.

**Macau Fisherman's Wharf** is just a five-minute walk from the Macau-HK Ferry Terminal and is a landmark for passengers arriving by ferry and helicopter. It is an energetic, fun place to go for shopping and eating. The Fisherman's Wharf complex includes over 150 stores and restaurants in buildings built in the styles of different world seaports.



## International Centre of Excellence in Prognostics and Health Management, City University of Hong Kong

In collaboration with the CALCE PHM program, City University of Hong Kong (CityU), with headquarters in Hong Kong, is opening a CityU International Centre of Excellence in Prognostics and Health Management (PHM) in Shenzhen, China. This new center has been established because of growing interest in PHM implementation on the part of a large number of companies in China, particularly electronics companies in the greater Guangdong area, which includes ShenZhen. Avionics, aerospace, computer, telecommunications and power companies are welcome and expected to become members of the new Center.

The CityU PHM Center is being started with a grant of over HK\$16M for the first two years in addition to extensive facilities, meeting rooms, and offices. CityU is also supporting grants for three post-doctoral positions and numerous graduate students interested in obtaining a higher education in the field of prognostics and health management. The initial studies of the new CityU PHM Center will focus on advancing system-level PHM hybrid (pattern recognition and physics of failure) algorithms, and implementing PHM methods for the Chinese electronics industries. Sensor technologies with embedded PHM algorithms will also be developed. The CALCE PHM Center will be cooperating with the new CityU PHM Center to co-develop state-of-the-art methods and technologies. Prof. Pecht is a visiting chair professor at CityU, coordinating activities of the new CityU PHM Center and its cooperation with CALCE PHM to promote high quality prognostics research and development.

CityU is an outstanding university in China with a worldwide reputation in mathematics and engineering. Its new president, Prof. Way Kuo, is a member of the U.S. National Academy of Engineering, Academia Sinica (Taiwan), the International Academy for Quality, and the Chinese Academy of Engineering. President Kuo is a strong proponent of design-for-reliability methods and prognostics and is actively supporting this new center with help from Prof. Pecht.





should be 6,000 words, maximum, with a maximum of 15 references. Articles should be understandable to a broad audience of people interested in security and privacy. The writing should be down to earth, practical, and original. Authors should not assume that the audience will have specialized experience in a particular subfield. All accepted articles will be edited according to the IEEE Computer Society style guide.

For information on submitting an article, please visit our [Author Resources](#) page.

## Call for Papers

**43<sup>rd</sup> Hawaii International Conference on Systems Sciences (HICSS)**  
**Kauai, Hawaii January 5-8, 2010**

### Mini-Track on Trust and Dependability

IT functions as the information and decision and control system for the operations of our public and private institutions in agriculture, food, water, power, public health, emergency services, government, defense industrial base, transportation, banking and finance, and postal and shipping. The resulting cyberspace-based infrastructure is a dynamic and adaptive system employing hundreds of thousands of interconnected computers, servers, routers, switches, and fiber optic cables that enable our critical infrastructures to support societal functions. Society has, therefore, come to depend upon and trust these systems.

Papers presenting best practices and research are invited in the following areas:

- ◆ computer security technology for networked information systems;
- ◆ the impact of computers and networks on infrastructure security in
  - finance
  - transportation
  - utilities
  - health care
  - telecommunications
  - other critical services
- ◆ interactions among such technologies
- ◆ issues surrounding privacy, ethics, legislation, law enforcement, and national security
- ◆ closely related technical and social considerations

### Submission Instructions

Please visit the HICSS website [http://www.hicss.hawaii.edu/hicss\\_43/](http://www.hicss.hawaii.edu/hicss_43/) for submission instructions and deadlines or contact the workshop chairs for more information.

### Workshop Chairs:

*Phil Laplante, Penn State, [plaplante@psu.edu](mailto:plaplante@psu.edu)*

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