# February 2014 Newsletter

## Joint-Section Chapter - Boston - New Hampshire - Providence

December 2013 – February 2014

http://www.ieee.org/bostonrel

Greetings,

We have continued with a great series of monthly presentations on various topics. Details on the December and January presentations can be found in this newsletter.

On December 11, 2013, Dr. Vanu Bose spoke to our group about "Survivability for Public Safety Networks". Dr. Bose is the founder and CEO Vanu Inc., which is dedicated to technical innovation to enable cellular coverage in areas that cannot be covered cost effectively with existing technology. We are pleased that he has taken the effort to plan a talk for our group that is focused on survivability and reliability, including an intriguing examination of the assumption that higher availability is an appropriate metric for a public safety network. This meeting was our annual December meeting when we honor the past Chairs of the Boston Reliability Chapter.

On January 15, 2014, Ethan Cascio, who is the Radiation Effects Test Program Manager at The Francis H. Burr Proton Therapy Center at Massachusetts General Hospital, spoke about "Those Upsetting Ions - The Effects of Radiation on Electronics." This topic is relevant to anyone interested in how electronic components are tested for deployment in a radiation environment, such as for space applications.

In February, Aaron Dermarderosian of Raytheon will speak about "Counterfeit Analysis & Prevention - Detection & QC Non-Conformance Issues; Hardware & Data Destruction Assured Domestic Electronics Recycling." In March, we will have a joint presentation with the ESDA (Electrostatic Discharge Association) about "Next Generation ESD Scanning Techniques for Protection Circuit Analysis and Debug." This presentation will address the particularly insidious "soft" ESD failures, which may pass testing and show up as failures later, in contrast to hard ESD failures, which can be identified during testing.

April, May, June, and September meeting plans are in progress. If you are interested in presenting, or have a suggestion for someone to present to our group, let us know. And, if you are interested in helping out in any way, big or small, please contact us. You can attend one of our AdCom (advisory committee) meetings to find out more about the many diverse tasks that we do. We are all volunteers, so any help would be appreciated. When you attend our next meeting, please introduce yourself to me.

Best regards,
Dr. Dan Weidman
Chair, IEEE Boston Reliability Chapter, joint with Providence, RI and New Hampshire

## Contents of this issue

### Recent Activities:

| | |
|---|---|
| December 11th, 2013 | Annual Past Chairs dinner and monthly meeting. The past dinner recognizes past chairs of the IEEE Boston Reliability Chapter for their years of contribution to the chapter activities.<br><br>"Survivability for Public Safety Networks" Dr. Vanu G. Bose presented network designs for public safety. |
| January 15th, 2013 | "Those Upsetting Ion - The Effects of Radiation on Electronics." Presentation by Ethan Cascio of Burr Proton Therapy center, MGH, Boston, MA. His talk will cover terrestrial, space, and manmade radiation environments, as well as basic radiation concepts. The history of the awareness of the effect of radiation on electronics was covered as well. |
| February 12, 2014 | Aaron Dermarderosian of Raytheon will speak about "Counterfeit Analysis & Prevention - Detection & QC Non-Conformance Issues; Hardware & Data Destruction Assured Domestic Electronics Recycling." |
| March 12, 2014 | A joint presentation with the ESDA (Electrostatic Discharge Association) about "Next Generation ESD Scanning Techniques for Protection Circuit Analysis and Debug." This presentation will address the particularly insidious "soft" ESD failures, which may pass testing and show up as failures later, in contrast to hard ESD failures, which can be identified during testing. |

### Upcoming Events:

Visit http://www.ieee.org/BostonRel to register

| | |
|---|---|
| *Tuesday,* April 8, 2014 | Bert Farabaugh, RTI Middleware," Increasing Data Availability and Reliability using Data Distribution Service for Real-Time Systems (DDS)," at MIT Lincoln Laboratory, Lexington, MA |
| May 14, 2014 | Leslie Gabriele, Gabriele & Company, "Personal Power and the Art of Perception,' at MIT Lincoln Laboratory, Lexington, MA |
| June 11, 2014 | Dr. David I. Heimann, "A Guide to the Revised IEEE 730 Software Quality Assurance Standard," at MIT Lincoln Laboratory, Lexington, MA |

### Announcements:

Details on other chapter and community related updates.

## Recent Chapter Activities

### "Survivability for Public Safety Networks"

Dr. Vanu Bose presented "Survivability for Public Safety Networks" on Wednesday, December 11, 2013 at MIT Lincoln Laboratory. Dr. Bose is the founder and CEO of Vanu, Inc. He gave a great presentation and it was well attended. This was our annual Past Chairs Dinner, where we honor the past chairs of our IEEE Boston Reliability Chapter. Dr. Bose tailored a talk for our group to the topic of reliability.


**Dr. Vanu Bose speaks to the IEEE Boston Reliability Chapter at our December 2013 meeting.**

Back in January 2009, I (Dan Weidman) presented a talk "Practical Reliability Engineering for Semiconductor Equipment." In that presentation, I said that if I were to choose a single metric that was most important, it would be availability, which is the amount of uptime as a percentage of all time. Ideally, availability is 100%. Cell phone networks far exceed 99% availability, with typically availability of about "5 nines," which is 99.999%. Vanu pointed out, however, that for survivability in a disaster, availability is no longer a reasonable or relevant metric. He said that redundancy is the key to a robust network that can survive a disaster. There are multiple cell phone carriers, but they share the same towers. A heterogeneous architecture, such as a mixture of wired and wireless, can be more reliable. Redundant links need to be subject to different failure modes. Such redundancy might not be more expensive. For example, two 4 9's links might cost less than a single 5 9's link.


**IEEE Reliability Chapter Chair Dr. Dan Weidman reviews 2013, and had the honor of introducing Dr. Vanu Bose.**

Vanu has invented technology for cell phone service in rural areas, which are typically underserved. Traditional cell phone technology involves larger antennas, which usually transmit more power to rocks and trees. Vanu's technology provides cell phone service along secondary roads, which covers where people live, where they work, and their commute, without transmitting power to large unpopulated areas. (98% of the US population is on 7% of the land.) Instead of 2 kW per transmitter-receiver site, each site is 50 W. Each site is mounted on a telephone pole, with about 1 mile spacing. There is sufficient overlap in coverage that if one site fails, its area can be covered by neighboring sites. Then, when many in the area need servicing, they can be serviced all at once. This is similar to street lamps. Servicing involves replacing the unit in the field, with the repair work done back at the factory, so highly qualified expensive labor is not needed out in the field.

Examples of the value of this redundant design are as follows:

> The LumiSolair street lamps, which are powered by wind or solar, were the only lights that were operating in Atlantic City after Hurricane Sandy (October 2012).
>
> Cell phone sites in Zambia can run on solar and batteries where wired electrical power is not available.
>
> Vanu's first major deployment is in Vermont. They sell service to the major cell phone carriers rather than dealing directly with many consumers.


**Audience members listen to the monthly IEEE Reliability Chapter presentation, December 2013.**

## "Those Upsetting Ion - The Effects of Radiation on Electronics."

On Wednesday, January 15, 2014, at MIT Lincoln Laboratory, Ethan Cascio presented, "Those Upsetting Ion - The Effects of Radiation on Electronics." Ethan is the Radiation Test Program Manager at the Francis H. Burr Proton Therapy Center, which is at the Massachusetts General Hospital in Boston. Mr. Cascio started his presentation by providing some basic definitions related to particles. Fluence is particles per $cm^2$. Flux is particles per $cm^2$ per second. Stopping power is energy loss per particle, which is also called "Linear Energy Transfer (LET)" or dE/dx. Photons, however, such as x-rays, scatter, and their intensity drops, but their energy remains the same. X-rays are typically not a radiation problem. Dose is the amount of energy per mass deposited by radiation. The SI (International System) unit for dose is the gray (Gy), which is 1 joule per kg. Often, people still use rads. 1 rad = 1 cGy.

Radiation effects are typically a concern when designing systems for space applications. Radiation in a geostationary orbit is much higher than the radiation levels in a low earth orbit, such as that of the space shuttle or space station. When in a low earth orbit, there is the South Atlantic Anomaly, which has about 100x the dose of the rest of low earth orbit. Ethan mentioned that as dose levels increase, deterministic effects get worse, while stochastic effects' probability increases.

Ethan then went on to describe detailed effects, including specific electronic components. Of the various forms of radiation effects, it is mostly neutrons and protons that cause atomic displacement damage in silicon. Optocouplers are particularly bad in a radiation environment. ELDRS is Extremely Low Dose-Rate Sensitivity: some devices, perhaps due to the presence of oxygen, may exhibit much worse performance when exposed to extremely low dose rates than would normally be expected if typical radiation dose rates during testing were to be extrapolated linearly down to low dose rates.

Ethan then covered several other related topics, each briefly. In the 1970's, Single Event Upsets were first observed in satellites. A Single Event Upset is a type of Single Event Effect that has a temporary effect, such as changing the value of a bit in memory, rather than a permanent effect, such as latching the power to ground and shorting out the electronic device. In addition to space environments, terrestrial environments are also a concern for radiation effects. Ethan said that this is not so much due to increased sensitivity of smaller electronics, but rather that there are many more transistors. All terrestrial servers are built to recover from Single Event Upsets. Chips from different lots may have very different radiation sensitivity, because only electrical performance is guaranteed; this problem is mitigated by testing a sample from each lot. Power MOSFETs in particular should be used at half or even just one third of their rating. Radiation testing can be done on a component or at the system level.

Ethan then went on to tell us several anecdotes. Here are a couple of those. Radiation levels are so much higher in an airplane with less atmospheric shielding than on the ground that commercial pilots are exposed to more radiation than any other profession, because natural radiation levels are unregulated, in contrast, for example, to workers in a nuclear power plant; one heart pacemaker was so susceptible to cosmic rays on an airplane that it caused such a large increase in current draw that a two-year battery was drained in two days. In the mid 1990's, train engines were failing due to cosmic rays.

All in all, this was a very enjoyable and informative presentation that drew an unusually large audience. There was much interest, as expressed by the questions during and after the presentation.

## "Counterfeit Analysis & Prevention - Detection & QC Non-Conformance Issues; Hardware & Data Destruction Assured Domestic Electronics Recycling."

## Aaron C. DerMarderosian, Jr. - Raytheon Company, Integrated Defense Systems

The industry is aware of the on-going counterfeit component issues affecting components. OEMs (Original Equipment Manufacturers), authorized, franchised, and independent distributors are performing additional inspection, surface and analytical tests to determine component authenticity. Customers and suppliers lacking training, component construction knowledge, and experienced resources are not performing analysis correctly. Results are misinterpreted, rejecting potentially good components. Potential solutions to the various interpretation and analysis issues were explored. Aaron discussed a particular example of counterfeit electronics from VisionTech found by a mid-west vacuum-cleaner manufacturer. This is a consumer application. For government applications, including any company selling defense-related systems, there are strict requirements in the National Defense Authorization Act (NDAA) passed and then amended in 2011, 2012, and 2013. AS5553A is the aerospace standard for procurement and supplier requirements. IDEA-STD-1010B provides inspection guidelines for counterfeit inspection. Aaron gave a few examples of "suspect" counterfeit parts that turned out to be legitimately marked parts. To manage suppliers more closely, Raytheon has narrowed down from about 20 to 25 distributors to just four that have very good anti-counterfeiting practices.

The second half of this presentation focused on the final phases of the electronic systems product life cycle. How can we conclusively assure that these components will not end up as export e-waste & re-enter the components supply chain as new product? Potential solutions including secured hardware & data destruction were explored. Modern military integrated electronic systems contain a significant portion of high value electronics, desirable from a re-sale perspective to potential counterfeiters. This includes legacy processors, memory, FPGA's, system bus controllers and a host of logic devices. What do we do with replaced failed or upgraded electronic FRUs? How can we conclusively assure that these components will not end up as export e-waste & re-enter the components supply chain as new product? Potential solutions including secured hardware & data destruction were explored. Aaron said that ISO 14001:2004 covers the handling, disposal, and reclamation of materials, and that any recycler of disposal company should be certified to this standard, at least. He said that there are 432 certified recyclers worldwide. When looking for a reputable recycler, Aaron recommended checking that the company is working towards compliance with ISO 14001 version R2:2013 (or a later version). Aaron said that about 80% of electronic waste can be recovered to send back to plastic manufacturers and metal smelters.

Aaron DerMarderosian, Jr. is a Principal Electrical Engineer in the Materials Engineering Failure Analysis Laboratory at Raytheon Company Integrated Defense Systems (IDS) in Andover, MA. He has worked in engineering for more than 20 years focusing on: reliability analysis and assessment, failure investigation, product / program FRACA (Failure Reporting and Corrective Action), design verification test, systems & circuit analysis, accelerated testing, product, process and test engineering. Recent analysis and investigation activities include counterfeit component detection, techniques, best practice avoidance methodologies, hardware security and anti-tamper assessments. Aaron is a Senior Member of the IEEE and has served as a Boston IEEE Joint Reliability Chapter AdCom (Advisory Committee) Officer since 2005. He received a technical innovation and inventors award in 1991 (Raytheon) for an innovative test method, leading to a patent. He was the recipient of IDS Engineering technical honors in 2004 and 2007. He has a B.S. in Electrical Engineering Technology from Northeastern University.

This meeting was held on Wednesday, February 12, 2014 at MIT Lincoln Laboratory in Lexington, MA.

## Upcoming Events

**6:00 PM, Wednesday, March 12, 2014 at MIT Lincoln Laboratory in Lexington, MA**

**"Next Generation ESD Scanning Techniques for Protection Circuit Analysis and Debug."**

**Jeffrey Dunnihoo - Founder of Pragma Design**

While there are numerous solutions for characterizing and qualifying ESD transient robustness levels and hard-failures, there are extremely limited options for soft-failure, or "ESD upset" root-cause identification and analysis.

Pulse simulator systems have been developed by the industry with reasonable repeatability for product characterization and qualification. However, these techniques were never intended for use by the system design engineer as root-cause analysis and debug tools.

This presentation will discuss in detail a new solution to this problem that has adapted EMI/EMC 3D scanning systems in conjunction with injected pulse generator simulators in both "current reconstruction" and transient susceptibility scanning modes. These systems attempt to identify which individual components and nodes actually "feel" the residual and induced transient pulses, how much, and to what effect.

Location:
Building: Main Cafeteria
MIT Lincoln Laboratory
244 Wood Street
Lexington, Massachusetts
Date: 12-Mar-2013 Time: 05:30PM to 08:00PM
Registration: On-line at the IEEE Reliability joint section chapter website, http://www.ieee.org/bostonrel

***Tuesday,*** April 8, 2014 Bert Farabaugh, RTI Middleware," Increasing Data Availability and Reliability using Data Distribution Service for Real-Time Systems (DDS)," at MIT Lincoln Laboratory, Lexington, MA

Wednesday, May 14, 2014 Leslie Gabriele, Gabriele & Company, "Personal Power and the Art of Perception,' at MIT Lincoln Laboratory, Lexington, MA

Wednesday, June 11, 2014 Dr. David I. Heimann, "A Guide to the Revised IEEE 730 Software Quality Assurance Standard," at MIT Lincoln Laboratory, Lexington, MA

## Announcements

### Reliability Chapter's Facebook Presence

The chapter recently established presence on Facebook, so check it out. Visit the page at https://www.facebook.com/pages/IEEE-Boston Reliability/231112043598940, or search Facebook for "Boston Reliability". Click "Like" and friend us. The latest meeting announcements are posted on the wall. Your feedback is most welcome.

### Annual Reliability Chapter Awards for 2013

The annual Reliability Chapter awards were presented on June 22nd, 2013 in Gaithersburg, Maryland. The IEEE Boston chapter was awarded the second best IEEE reliability Chapter in the world. The award selection criteria are based on membership, meeting attendances, number of meetings, workshops or conferences, training sessions, written papers, technical tours and other pertinent activities. Dr. Weidman, Chapter Chair, attended the award ceremony and accepted the honor on behalf of chapter.

## Society Participation

For updates on upcoming events: http://ewh.ieee.org/r1/boston/rl/events.html.


We are interested in having you help out as a volunteer contributing as much or as little as you would like. We have a good team of volunteers that help us keep things going, so if you would like to join us, there is probably ample opportunity to choose how you would like to contribute. Email or talk to any of us at the next monthly presentation, or attend one of our Advisory Committee meetings.

---

## The IEEE Reliability Society Joint Section Chapter
## Boston - New Hampshire - Providence
### February Newsletter is available at the following link:

Boston - New Hampshire - Providence Joint-Section Chapter Newsletter

or copy and paste the URL below on your browser

http://ewh.ieee.org/r1/boston/rl/newsletters/boston_chapter_newsletter_feb14.pdf