Greetings!!!

This is my first attempt at editing ..... anything. My goal for Lambda Notes is to develop communication among our chapters and our prospective members, and to publish at least two Lambda Notes issue each year... O. K. Duane, maybe even three or four.

I have recruited the talented Miss Willie M. Webb, from the University of Maryland to add some credibility to this effort. I would also like to thank Barbara Howard for her past editing efforts and for giving us a good example to follow. Thanks also to Dave Dyrck for inputs from his experience with the Buffalo Chapter newsletter.

What's new for Lambda Notes? We are returning to the old pamphlette format. Also, one SRE chapter will be featured in each issue. These chapter feature articles will include chapter meeting descriptions, schedules, membership interests and contacts. Washington Chapter this time. Next issue — Buffalo Chapter. Other chapters should begin to prepare for following issues by preparing chapter histories, list of upcoming events, current club member information and by maintaining club meeting summaries.
President's Message
Duane Cook

To all SRE members I say "Welcome to the latest edition of Lambda Notes!" Richard Youngk has volunteered to be editor of this publication, and has several ideas which should make it a very effective newsletter. I hope that all chapters will find this newsletter to be a good source of information, and a tool to improve communication throughout our organization. I ask that all chapters make a diligent effort to keep Richard supplied with information about the good works they are doing.

We have other avenues of communication open to us as well. Our Web Page, at http://www.sre.org has a new Webmaster, Clarence Meese. Elsewhere in this newsletter Clarence has written a note appraising you of the information and direction the Web Page has. Clarence also asks that you keep him apprized of your chapter information.

It looks like a common theme. Our Society needs good communication in order to grow and prosper. I believe I speak for all the other officers when I say that we want to hear from you. Suggestions, chapter news, questions – all are welcome. My goal is to foster good communications between all of the chapters, so that SRE can become a useful information source for all of our members. Richard has placed a list of the officers, along with contact information elsewhere in the newsletter. Whether by telephone, fax, or e-mail, please keep in touch with me and the other officers.

Electronic mail (e-mail) has shown itself to be an invaluable aid to communication. I know that the officers stay in almost daily contact through this medium. The potential to keep all of the chapters informed is very great. Our Secretary, George Chernowitz, is working to establish SRE-Net, an email contact list which will enable everyone to instantly contact the rest of the organization. George is also compiling a membership database. Too often in the past, we had only one or two points of contact for any particular chapter. If we lost touch with them, we lost touch with an entire chapter. Please help George in his efforts, so that this will no longer happen.

Our Vice-President, Pat Larter, is working to renew contact with inactive and "lost" chapters. He may be contacting your chapter to try to find phone numbers and addresses. Please assist him as much as you can.

We have a new chapter! The University of Maryland has established a chapter for the students in their Reliability Engineering program. Join me in welcoming this fine group of young Reliability Engineers to our organization.

Finally, I just want to say how honored I am to be associated with such a professional group of people. I look forward to serving as your President, and hope you will be pleased with my stewardship.

Bringing Lambda Notes to Life
George Chernowitz

Even in this electronic age, there is a fully recognized need that serious, self-respecting technical societies develop a hard copy publication which reflects the common goals, interests, and contributions of their members to the discipline. SRE is no exception and the earlier editions of Lambda Notes provide full testimony with what can be accomplished by volunteer effort in a Society whose minuscule dues keep it from having a paid editorial and production staff.
Our objective in the "new Lambda Notes" is, of course, to provide still another means of communication and information sharing among our members. Additionally, it is to provide perspectives on the variegated interests of our members and our Chapters, and, finally, to have a mechanism for continuity and smooth publication of future issues.

We think that the concept of each issue featuring the activities of a different Chapter is a great one! This issue which features the Washington Chapter, naturally has a defense application focus. (The Washington Chapter has many members who work in the Navy's advanced technologies.) The next issue will move the scene to Buffalo, and on to our other Chapters. It's a fine opportunity to give the world a sense of what SRE is really about at its grass roots level.

We're greatly interested in your thoughts regarding this new concept. It clearly does not mean that the activities of other Chapters are neglected in any issue of Lambda Notes - there is space for news and inputs from all our Chapters in all our issues. We're anxious to provide a Society-wide forum for our profession.

SRE WEB Page Notes
Clarence Meese

The SRE has a new Internet home. As a matter of fact, we have our very own Internet address! Check it out at www.sre.org and then tell your colleagues about it.

The contact information for 1998 International officers is there. And each chapter has at least one person identified as a contact. Check out yours! Plus, the last few Lambda Notes (including this one) are on-line. There's even a place for useful reliability software – some written by SRE members. We can add yours here too. Looking for a career change? Click on the Current Employment Opportunities link. There's more, but you're on your own to find it.

My immediate goal is to have accurate information on the SRE web page. I know there are plenty of slicker web pages out there, with lots more bells and whistles, than ours — there probably always will be. But right now our web page needs to have each chapter make a concentrated effort to review the chapter information and submit any changes to me at cmeese@nyx.net – these changes can be your chapter needs or wants or anything. The correct information becomes important to the local chapters when potential members are looking for local contacts. As a minimum, I think that every chapter should list all their 1998 officers with good contact information – i.e. phone numbers, addresses, and e-mail addresses. This seems like a good (and inexpensive) recruiting tool for all of us.

After the chapter information is in order, we should think about what to do next. I'm thinking along the lines of adding the SRE history, our mission, by-laws, etc. as the next step. What do you think? Submit specific improvements that you believe will make the SRE web page more attractive and more useful to both SRE members and the rest of the world. I just ask that you give me some details to work with. I've already received general type comments like "why don't we make the SRE web page look like so-and-so's web page," but that really doesn't help much. Of course, pointing me to a specific web page to see a specific example of what you think needs to be incorporated is helpful. If your chapter has its own web page, we can link to it from the SRE web page. Check out the Montreal Chapter and the Tucson Chapter for two fine examples. If your chapter doesn't have its own web page, we can include your basic info on the SRE server. See how the Belvoir Chapter and the Buffalo Chapter does it for some ideas you might be able to use in this manner.

For those chapters adventurous enough to want to create their web page, I can probably help get you started. For those who already have started a web page, but are looking for a suitable home for it, let me know. There are places that are FREE just for the asking. And that's a deal that is surely inexpensive enough for everyone's budget!
The sooner we "talk", the sooner your information gets on the Internet.

---

**Chapter Profile**
The Washington Chapter  
by Richard Youngk, Chapter President

The Washington Chapter of SRE is a well established and active organization which participates in the Society's national and inter-governmental activities. Most recently, it participated in "standing-up" our new Maryland Chapter, and provides representatives to our international standardization and specification activities. As you can see from the listing of their upcoming Chapter meetings, there's a broad focus: from models to management.

The Washington Chapter was organized in the early 1980's and is supported by reliability professionals in the Washington D.C., northern Virginia, suburban Maryland areas. The Department of Defense and other government organizations are well represented in the Chapter however private companies are also included.

Several founding members of the chapter continue to be active and provide academic and professional expertise and experience in support of the chapter. It is their combined backgrounds and personalities that are the "cornerstone" of the Washington Chapter of the Society of Reliability Engineers. The following founding members are recognized for their contributions over that past two decades: Dr. Pat Hartman, Palmer Luetjen, Dave Mandel, and Reid Willis.

The following articles include a commentary, summaries of recent meetings, a book review and an interview are written by the Washington Chapter members. These are provided as an example of the interest and technical pursuits of the chapter.

---

**Reliability Comes to the Fore**  
A Washington Chapter Commentary  
by George Chernowitz

On May 20 and 21, the satellite, Galaxy 4, failed, inconveniencing millions of people and putting significant commercial systems out of service. Suddenly, radio and television networks were scrambling to find alternate means of distribution, millions of pagers ceased to operate, and your friendly gasoline station which lets you buy gas on a credit card, had their systems suddenly fail to operate. It took less than an hour to plunge backwards in getting the benefits of technology some 10 years into the past.

What happened? As of this writing, all that is known is that the attitude sense system that holds the satellite in its proper orientation failed. What failed? - Still to be determined - but almost as important, inherently the cause has to be guessed at - nobody can pull that satellite in from 22,000 miles out in space and take it apart. Instead, sophisticated guesses, and asking a limited number of questions will have to serve.

If there's ever an illustration of the day-to-day importance of reliability, this is it.

It's a chance to remind reliability engineers (as if we did need reminding!), and the public that reliability engineering is an important day-to-day, bread-and-butter part of our lives. It also reminds "us reliability engineers" that what we're doing is important and that the scope of reliability engineering encompasses not just the individual equipment, but the system that carries out the mission. What was really important is not only that the satellite failed, but that something could be done about it - not that satellite - but the mission of that satellite. At this writing, this is being accomplished by...
moving another satellite into place. An example of redundant design of the system to establish a "largely fail safe totality".

It also reminds all of us who do reliability engineering or management, that our discipline is centered around the mission of the system with which we are concerned. Success is composed of 1,000 details and that failures of trivial pieces or sub-systems or functions can prove fatal (remember the Challenger O rings, and local temperature that fateful morning?).

That's why the Society of Reliability Engineers exists - to foster public awareness, professional development, and technical communication and challenge to its members. Our Society's database is now being expanded to cover the professional interests of our members (watch this space for a questionnaire to develop the necessary focus to support our members).

---

### Upcoming Washington Chapter Meetings

**23 July**  
"Maintenance Engineering Technology Team (METT)"  
Mr. Pete Sisa

**27 Aug**  
"Showing Management the Impact of Reliability"  
Dr. Pat Hartman

**17 Sep**  
"Using Proportional Intensity Models to Optimize Preventive Maintenance Intervals"  
Harry Ascher

**29 Oct**  
"Reliability Modeling Algorithms"  
Reid Willis and John Miller

**19 Nov**  
"Portable Visit Assist Tool - Assessment of Equipment Condition"  
Mr. V. B. Pandit

---

### Network Survivability Analysis (NSA)

A Washington Chapter Presentation by Richard Talbott

**Abstract**

This paper describes the method for conducting NSA. NSA is a predictive analysis for cost/ maintainability/ survivability/ performance primarily developed for shipboard networks.

Survivability of networks is based on analysis of components (i.e. cables, CPU, multiplex, busses). These components usually have very high reliability values. Some analyses do not adequately reflect or compare the survivability of systems and fail to consider all aspects affecting survivability such as multiple system damage, ways damage can occur and production feasibility. The NSA model compares the probability of success considering all of the system states and the number of states where the system is expected to survive.
Biography

Mr. Talbott began work at John Hopkins University in 1974 supporting investigations relating to satellite solar panel mechanical design, black body radiation from TRIDENT rocket plumes and improvement of submarine based SONAR and navigation systems. Later efforts focused on a data collection system to support Navy P3 Aircraft Magnetic Anomaly Detection Systems.

Since 1981 he has worked on the AEGIS shipbuilding program and developed the Network Survivability Analysis (NSA).

In 1994 his priorities shifted to PEO (TAD) and he became the Technical Direction Agent for the Ship Self-Defense System (SSDS).

The Application of Reliability Centered Maintenance to Submarine Maintenance Plans
A Washington Chapter Presentation
by Mr. Peter Derby

Abstract

Peter Derby gave a talk on the application of Reliability Centered Maintenance (RCM) to submarine maintenance plans. Peter is from the Submarine Maintenance Engineering Planning and Procurement Activity (SUBMEPP), a field activity of NAVSEA 92, the Submarine Directorate of the Naval Sea Systems Command. SUBMEPP has been using RCM to refine the existing maintenance of the Navy's two predominate classes of operating submarines, the SSN688 and SSBN726 classes, for the past two years.

The analyses have consistently shown some existing preventive maintenance to not be applicable and effective in ensuring equipment reliability; and that maintenance has been eliminated or changed. So far, for each $1 that SUBMEPP has spent conducting RCM analyses, $125 in preventive maintenance reduction has resulted (over $64 million total).

Biography

Mr. Peter Derby has worked for the U.S. Navy for more than 20 years. He is currently working at the SUBMEPP and is coordinating RCM efforts for the U.S. NAVY Submarines. Mr. Derby is available for speaking upon request.

Submarine Safety Program
A Washington Chapter Presentation
by Mr. Jim Lawrence

Abstract

Jim Lawrence spoke on the history of the Submarine Safety (SUBSAFE) and Unrestricted Operations/Maintenance Requirement Card (URO/MRC) Programs and the application of those programs to "Fly By Wire" Ship Control Systems.

The SUBSAFE Program was created after the loss of the USS THRESHER (SSN 593). The SUBSAFE and URO/MRC Programs have been used to ensure Safe and Reliable Operations of Submarines for over thirty years.
One challenge of the SUBSAFE program is its application to new technology. One example of this is "Fly By Wire" Ship Control Systems. After reviewing commercial and government specifications and the system design, a Team Submarine Process Action Team (PAT) decided:

1. Computer Systems do not belong in the SUBSAFE Program.
2. Requirement to demonstrate safe operations via the URO/MRC Program exists.

**Biography**

Mr. Jim Lawrence has worked for the U.S. Navy for more than 25 years. He is currently section head of the Submarine Safety and Engineering Quality Assurance Section of SEA 92T. He is responsible for determining the technical requirements of the SUBSAFE Program and manages the URO/MRC Program.

**Profiles in Reliability**

**Lessons Learned in Reliability Engineering Practice: an Interview with Reid Willis, SRE Washington Chapter.**

Reid Willis was a founding member of the Washington Chapter of the SRE. Originally from Southern California, he joined the Navy during World War II, retired 30 years later, worked as a reliability analyst in a local firm for another 20 years, retired again, and embarked on a third career as a consulting reliability engineer. He has a bachelor's degree in mathematics and a master's in operations research.

At a recent meeting at Maryland University concerning the Society of Reliability Engineers, Reid said there should be some way for current practitioners to pass on lessons-learned to students. George Chernowitz, then President of the SRE International, was there and he suggested I interview Reid. Hoist by his own petard, Reid had to agree. This is the interview.

**SRE:** What got you into the reliability business, anyway?

**Willis:** Whenever I reported aboard another ship I must have driven everybody crazy for a while because I had to know how everything worked, from the radars to the rudders. When the Navy sent me to college I majored in math because those seemed like the easiest courses, and later enjoyed a tour of duty as a math instructor at the Naval Academy. Then I happened to become associated with computers and liked scientific programming. When I left the Navy I found a job where all these interests came together. It's a great way to keep abreast of new technology, develop mathematical solutions to real problems, and use computers to implement them. And you get paid for it.

**SRE:** What do you really do, and how do you do it?

**Willis:** Some things are pretty standard. The development of a major product for the government, for example a ship or a helicopter, may specify that the prime contractor has to do certain analyses requiring mathematical models and computer simulation: mission time lines, reliability and maintainability analyses, failure modes and effects analyses, and like that. The objective is to assure that the delivered product meets its reliability specs. Somebody has to prepare a plan for all these tasks, manage the work, submit the results, and update it all at each stage of design and development. Somebody else has to review the results on behalf of the government and verify that everything's on track for a reliable, supportable product. I can go either way.

And some of the best jobs are entirely different. I've compared the reliability characteristics of alternative concepts for a new generation of commercial cargo ships, recommended machinery
upgrades during overhaul of a class of Coast Guard cutters to improve their reliability, and neat stuff like that. Currently I'm trying to develop Markovian reliability algorithms for computer simulation of complex systems.

**SRE:** How do you accomplish what you just described as 'standard work'?

**Willis:** You don't just say "Hmm, this looks like an FMECA method 3," and pull one out of your tool kit. I took a course once from Martin Binkin, who wrote books on operations research. One day he said "The greatest worth in a system analysis is how well the analyst understands the system." I wrote that down. An admiral I greatly respected had a brass plate on his desk that said "First one gets involved. Then one sees." The first step is to read the specifications for reliability deliverables carefully and resolve precisely what is wanted, and when. This may take some negotiation because sometimes nobody really knows. The second step is to thoroughly learn the product and its mission requirements. Get close to the project engineers. This step tells you what is really needed. More negotiation. Now you can replan the job. Then you guide the technical direction and do or supervising the work, to do the best job that can be done within your allocated resources of time and manhours. Finally, you need to deliver a good presentation and sound documentation of your recommendations.

**SRE:** How does a reliability practitioner go about managing his resources?

**Willis:** He makes a good plan to be sure the work gets done on time, monitors the plan continually, and revises it based on new discoveries. I think that anyone in this business, whether a new arrival or an old hand, should then concentrate on two primary aspects: the customer, and the data.

Your 'customer' could be the reliability manager, the prime contractor, or a government agency. Identify the person to whom you are going to deliver your results, and keep him informed regularly about what you are doing and why. You don't want him to tell you how to do it, but if you're putting time and effort on something he's going to reject as undesired or incomplete, you need to find that out early.

**SRE:** You said the other important issue was data. How do you handle that?

**Willis:** There are only two kinds of reliability analysts, those who say "Data is the problem" and those who say "Data are the problem." In our work, that usually means getting failure and repair data on the configuration elements of the product you are going to model. Most of your overall time and manhours are going to go into data collection. Here's how I go at it. First, plan the data collection to take maximum advantage of existing data, to minimize wasted effort. Second, start promptly, it's going to be a long road. Third, when you've expended half of your planned data collection resources, run preliminary simulations using generic or default values to fill in the data blanks. The results will tell you what's important and what isn't. Now commit the remaining data collection resources toward getting the important data that's missing. When that is done or when time runs out, whichever happens first, just update the simulation.

**SRE:** So then the job is done, right?

**Willis:** Wrong. Your plan should allow time to translate the simulation results into practical engineering recommendations. You'll find that even in a humongous product like an aircraft carrier, there might be three highly reliability-critical design elements, maybe a dozen more that could possibly become critical, and a thousand you can ignore. You've identified the design components that may need to be improved, but you haven't yet told the customer what to do, and the chances are nothing will happen. Go back to the engineers. They know where they forgot to tell you how they already fixed that, where they forgot to tell you about a new design feature that could be a reliability problem, and what the practical alternatives are for making important reliability improvements.
Maybe a new technology in electronic self-testing, or a more expensive but more reliable kind of air compressor, or whatever. They won't have the specific performance and cost data you need but they'll know who the vendors are, and probably the right people to talk to. Now you can submit recommendations that will get the customer's attention, initiate discussion and argument, and maybe even be carried into action.

**SRE:** *How do you know whether you did a good job?*

**Willis:** That's easy. Given that the final report is accepted, I measure success by whether there will be any design changes to improve product reliability.

We see new computer software coming on the market for reliability modeling and simulation. Does that make the work easier?

First of all, some tasks don't require reliability software, for example the analyst can do allocations on a spreadsheet and make simple calculations on the back of an envelope. If the product design is more complicated, special software can be a big help once you figure out how to use it, because it will become much easier to compare alternatives and to make updates. But you'll need lots of help learning how to work it and you deserve to understand its limitations. Read the manual carefully. Then find the right person on the vendor's support staff. Believe me, you'll be calling him frequently when the software does not perform as advertised or the manual is incomplete.

And don't believe everything in the brochure. FMECA programs and some maintainability analyses are deterministic, but reliability and availability predictions are stochastic and fraught with peril. For example in Monte Carlo simulation the system reliability and operational availability figures of merit are seldom precise to more than two decimal places unless the value is in the very high nines. Don't try to change relatively minor components of the model and compare the corresponding changes in the system prediction, because you'll just perturb the random number stream, which will have more effect on system results than the design change does. And some simulators can run for hours, so you'll have to plan carefully to get the results you need from a minimum of simulations.

**SRE:** *What trends have you seen, over time, in the reliability business?*

**Willis:** At first, all that the contractors (and some government agents) wanted was to check off a deliverable line item. Did they do a reliability allocation? Did they do an operational availability prediction? Was the report neatly bound and did it weigh more than two pounds? (well, I'm exaggerating there, but not much.) Gradually we learned how to make practical, solidly based engineering recommendations and began actually seeing some design changes or other decisions based on them. Currently I'm batting about .500 concerning accomplishing at least some product improvement, and to me that looks pretty good.

One new trend that impresses me is the integrated product team concept, IPT. After some experience working in a General Dynamics IPT, I think it offers serious opportunities to make reliability considerations an integral part of system design. If the approach catches on, new reliability analysts may find themselves working in an IPT environment. Some bright reliability engineers should tell them how to do that.*

**SRE:** *What have we left out?*

**Willis:** Well, we might mention two things: reporting results, and getting help. Facility at English composition and mastery of the simple declarative sentence are attributes that will impress the customer and startle the employer. And remember, whenever you need advice, do not despair, help is at hand. Call the SRE and they'll get you in touch with someone in the reliability discipline who can probably suggest what to do next.
**SRE:** *How much of this is important to people just entering the field?*

**Willis:** A new entrant can expect to be assigned specific tasks such as performing an allocation, FMECA, reliability or maintainability analysis, etc. Or perhaps to an engineering job where they need somebody who is also familiar with reliability studies. Understanding the system, collecting data, using software, and translating outcomes into recommendations ... those things apply to everybody in the field, old hands and new graduates. We're all learning all the time.

A short course in the practical side of reliability engineering. Thank you.

* (Interviewer's note: Reid is putting us on there. He and I are working on a paper on the IPT environment, to be presented to the Washington Chapter in May. Watch these pages.

---

**Book Review**

by Harold Ascher, Member, Washington Chapter

"Reliability Engineering", by Elsayed A. Elsayed Reading, Massachusetts: Addison Wesley Longinan, 1996, xxii 4 - 737 pages plus disk, $62.95

This book is intended to be a comprehensive reference for practitioners in the quality and reliability engineering areas. Consistent with this goal, a number of topics are covered, which seldom appear in reliability texts. For example, under Accelerated Life Testing, Statistics - Based Models, Physics - Statistics - Based Models, Physics - Experimental - Based Models and Physics-of-Failure Models are addressed in separate sections. In addition, the book covers On-Line Surveillance and Monitoring topics such as Vibration Analysis and Corrosion Monitoring. The text concludes with six case studies, intended to bridge the gap between theory and practice.

Software, which is intended to be comprehensive for reliability estimation, is provided. However, the statistical techniques covered in the book, and in the software, have a glaring omission. There is no discussion of statistical techniques for distinguishing between repairable systems undergoing reliability growth (times-between-successive-failures tending to get larger) and systems whose times-between-successive-failures are varying randomly around the same mean. The fact that design changes are discussed as early as the second paragraph of the Preface, underscores the discrepancy. Nor is the problem due to lack of suitable techniques: one-of many-appropriate tests dates back to Laplace!

The book does introduce the nonhomogeneous Poisson process (NHPP), a probabilistic model which is suitable for modeling reliability growth. Ironically, however, Part III of the book, titled, "Reliability Improvement: Warranty and Preventive Maintenance" discusses only NHPP's which have increasing rates of occurrence of failures (ROCOF). Often, exactly the same functional form, with different parameter values, can be used to model decreasing ROCOF, i.e., reliability growth. All of the discussion is probabilistic, i.e., the author does not even acknowledge that statistical techniques, to distinguish between increasing (or decreasing) ROCOF and constant ROCOF, have not been presented. Moreover, it is clear from the text that the reason such essential material is ignored is that the author believes that appropriate techniques have been given.

The force of mortality (FOM), $h(x)$, of a distribution of time to failure of a non-repairable item, is defined as

$$h(x) = \frac{f'(x)}{1-F(x)}$$

where $f(x) = \Pr \{ \text{time to failure} < x \}$. Hence, $F(x)$ is a measure of how likely it is that one failure will occur soon, given that it has not yet occurred. Of course, to estimate $h(x)$ properly requires
multiple times to failure of multiple nonrepairable items. This causes confusion with the ROCOF of a stochastic process, \( v(t) \), which is defined as

\[
v(t) = \frac{dE[N(t)]}{dt}
\]

Where \( n(t) \) is the observed number of failures in \((0, t)\) and \( E[.] \) denotes expectation. The functions \( h(x) \) and \( v(t) \) can be represented by the same functional form, but - totally unlike the FOM - the ROCOF is a measure of how rapidly multiple failures are occurring in a single repairable system. Since they are inherently different, it is very simple to specify a model for successive failures where the FOM increases to infinity, infinitely often but the ROCOF decreases asymptotically to zero. In the author's terminology, however, this would have to be expressed as the "failure rate" increases to infinity, infinitely often, but the "failure rate" decreases asymptotically to zero! The widespread promulgation and perpetuation of such slipshod and/or incorrect terminology by most theorists has led the author - and most other statistical practitioners - to believe incorrectly that a distribution with decreasing (increasing) FOM can represent a situation where times between successive failures are tending to become larger (smaller).

Oliver Wendell Holmes' poem, "The Deacon's Masterpiece, or The Wonderful One-Hoss Shay" is presented in the book's Prelude. In the poem, the One-Hoss Shay is designed so perfectly that each of its parts survives exactly one hundred years and a day, and then they all fail simultaneously. This ideal design cannot be achieved, but if it is approximated, the system's ROCOF will increase rapidly as its constituent parts' FOM's increase rapidly.

In summary, the book covers many topics which are usually ignored or given token treatment, so it is a valuable resource. However, almost all systems of interest in Reliability Engineering are designed to be repairable, rather than to be discarded after one failure. For such systems, the book's probabilistic treatment is inadequate, since reliability growth is ignored. Even more seriously, no statistical techniques are given which can distinguish between (1) a set of data for which times - between - successive - failures are tending to become shorter (e.g., an "approximate" one-hoss-shay), (2) the same numbers in exactly reversed chronological order, i.e., where times-between-successive failures are tending to become larger and (3), the same numbers in randomized order. The reader must look elsewhere for this material, which is basic to Reliability Engineering.

---

**Reliability Classified**

Subject: Microcircuit failure rates

I'm trying to find a list of microcircuit gate counts and their failure rates or Lambda's. Could you please help me thanks. Mail reply to Tfitch4917@aol.com. Chris Fitch

---

**Notice of Position Available**

Black & Decker, located in Towson, MD, has an immediate opening for an experienced Reliability Engineer. A B.S. degree in Mechanical or Electrical Engineering is required.

Black & Decker is a global marketer and manufacturer of quality products used in and around the home and for commercial applications.

Qualified applicants should forward their resume along with salary history requirements to:

Human Resources Operation
Black & Decker
Black & Decker (U.S.) Inc.
Towson, MD 21286
Dept. LT
or
e-mail resume to
Ted.Mitrou@bd.com

Equal Opportunity Employer M/F/D/V

---

**Society of Reliability Engineers Officers**

**President**
Duane E. Cook, Belvoir Chapter
(703) 704-2871, decoook@erols.com

**Vice President**
Pat Larter, Rocky Mountain Chapter
(719) 556-2571, larterpc@cisf.af.mil

**Secretary**
George Chernowitz, Washington Chapter
(201) 945-8203, georgec1@erols.com

**Treasurer**
Woody Rabon, Belvoir Chapter
(703) 806-7827, wrabon@erols.com

---

**Application for Membership**

Last Name: ____________________ First Name: ____________________ Middle Initial: _____

Company/Organization Affiliation: ________________________________

Company/Organization Address: ________________________________

Department: ____________________ Mail Code: ____________________

City: ____________________ State: _______ Postal Code: _______ Country: _______

Home Address: ________________________________

City: ____________________ State: _______ Postal Code: _______ Country: _______

Day Time Phone Number: ______________ Fax Number: ______________

Home Phone Number: ______________ E-mail: ____________________

Signature: ____________________ Date: ______________

Please include a check for $10.00 (US funds) made out to:
Society of Reliability Engineers
C/O Dr. J. A. Nachlas
250 New Engineering Bldg.
Virginia Tech
Blacksburg, Va. 24061-0118