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Hobbs Engineering Webinars with Recorded Links

The webinars listed below are based on a single user and the price listed is per person. We offer discounts if you have five or more from the same company. Upon purchase you will receive a link to view at your leisure that will be good for a limited time. Please contact us for more details.

Accelerated Test, Design and Analysis to Demonstrate Reliability by Dr. Alec Feinberg - $400 – 7/11/2018 – 4 hrs

This 4-hour course, which costs $400, is designed to focus on all aspects of Accelerated Testing, its Design and Analysis. We will first overview accelerated test historical models--for Temperature, Temperature-Humidity-Bias, Temperature Cycle, Temp Cycle Frequency Effect, Engelmaier Solder Joint Model, Vibration, Electromigration (Black Model, Silver migration), Capacitor-Voltage, Dielectric Breakdown, and General Power Law models. We will review how to determine key parameters for these models. We will then discuss accelerated test planning. How do we know what test to do and at what stage to do them in a program plan? How to use a top-down FMEA as a program planning tool. We will introduce a stage gate approach. Test design by failure modes will be utilized in planning. We will also overview general qualification test planning including multi-accelerated test design to demonstrate one failure rate with confidence bonds and accelerated end-of-life reliability test planning. Included will be a "CALT" like method for environmental profiling so that one can profile a product's environment more accurately as field stress conditions vary. This will help set realistic accelerated test goals and will make for more accurate MTBF predictions. In the analysis area we will look at statistical data methods, including Chi-squared accelerated multi-test planning, the new Chi-squared and other accelerated reliability growth methods, lifetime accelerated testing using Weibull/Lognormal test analysis, and multi failure mode assessment. What to do when multiple independent tests are performed and we wish to include all data in our analysis. This is an intense course, be prepared for the full session.

Course Outline:

Accelerated Test, Design & Analysis

- Key Published Standards on Qualification Testing
- Typical Accelerated Test Plans for Semiconductors, Hybrids and Assemblies
    - Using Test Standards
    - Designing Your Own Test Plan
- Test Design by Failure Modes Using Top Down FMEA
- Zero Failure Test Design
    - What is Confidence (Engineering vs. Statistical Confidence)
    - Chi-Squared Confidence Testing
    - Single Environment Test Design & Analysis (MTBF)
    - Multiple Environment Test Design & Analysis (Combined MTBF Assessment)
        - Confidence Testing for an MTBF value with multiple test environments
    - Importance of Device Hours
- Accelerated Lifetime Test Using Weibull & Lognormal Analysis
    - Main Distributions of the Bathtub Curve, Weibull,
    - Exponential, Weibull and Lognormal
    - Weibull Beta
    - Reliability Plotting (life data analysis, censored data)
- Reliability Growth Testing
    - Chi-Squared Accelerated Reliability Growth
    - DART Testing (Including HALT)
- Publishing Your Accelerated Test Results for Your Company

Accelerated Testing Models & Methods

- Temperature Arrhenius Model
  - Historical Activation Energies
  - Testing to Find an Activation Energy for a Failure Mode
- Temperature-Humidity-Bias Model
  - What to do if test biased causes the local relative humidity to change significantly due to device heating
  - Estimating the Local Relative Humidity Assessment in power devices
- Temperature Cycle Models
  - Coffin-Manson
  - Modified Coffin-Manson (Norris-Lanzberg)
  - Engelmaier Model
- Accelerated Vibrations Test Models
  - Sine vs. Random Accelerated Testing
- Voltage Acceleration (Capacitors) Model
  - Dielectric Breakdown
- Silver Migrations Testing
- Mechanical Accelerated Test Power Law Model
  - Power Exponent Testing
- Electromigration Black Model
- Environmental Profiling Your Product's Multiple Stress Use Conditions for Test Planning

Analyzing Censored Failure Time Data by Dr. Rong Pan - $200 - 08/23/2017 2 hrs

From reliability tests and field observations, it is common to encounter incomplete failure time information. In general, the exact failure time may not be obtained, but some partial information, such as survival time or the interval times between which the product fails, is available. Analyzing censored failure time data is an essential skill that a reliability engineer should master. The ASQ's Body of Knowledge of Certified Reliability Engineer demands 27 questions in the area of probability and statistics for reliability and 24 questions in reliability testing. Together, they consist of the biggest block of questions in the certification test.

In this webinar we present the techniques of how to recognize and classify censored failure time data, and how to analyze them in both nonparametric and parametric ways. In addition, based on the properties of reliability estimates, we can properly compare reliabilities of products from two and more manufacturers/suppliers, and construct statistically efficient tests to demonstrate reliability. As nowadays most data analysis can be performed by computer, we will show the reliability data analysis on multiple examples using Minitab® and JMP® , as well as some Excel® templates that are customized for specific reliability analysis tasks.

Applying HALT & AST in Robust Product Design by John Paschkewitz - $200 - 11/2/16 2 hrs

This 2-hour webinar, which costs $200, shows how to integrate Accelerated Stress Testing (AST), Highly Accelerated Life Test (HALT), and Quantitative Accelerated Life Test into a physics of failure and problem prevention product development process. This approach to reliability features understanding customer needs, robust design, risk assessment, accelerated test to failure, failure analysis and corrective action. It covers anticipating risks and failure modes, planning accelerated tests, applying the HALT methodology, finding empirical limits, using quantitative accelerated test, and failure analysis / corrective action. This approach to reliability engineering helps ensure robust products capable of operating reliably within the variability of operating stresses and manufacturing variation. The methods apply to traditional stage gate product development as well as newer lean and agile approaches to product development.

Applying the HALT Method to Products Other than Electronics by John Paschkewitz - $200 – 5/4/16 2 hrs

HALT training and application has focused primarily on electronic products. But, HALT is a methodology, and the basics can be applied to any product and stress. The basic approach to HALT is to apply a single stress in a stepwise manner until an operational limit or destruct limit is reached to find the strength margin of the product relative to that stress. Similarly, other stresses identified can be applied one at a time to find limits. Once the limits are found, an accelerated profile can be determined and the product is then cycled to reveal weaknesses in the design that can be corrected. For electronics, temperature, repetitive shock vibration, and power variation or on/off cycling are typical stresses applied in HALT.

To apply the HALT methodology to non-electronic products, we need to begin with an understanding of the stresses applied to the product and the potential failure mechanisms precipitated. Analysis of the design and application with tools like Failure Modes and Effects Analysis, Finite Element Analysis, or similar approaches help identify the stresses to use in testing the product, component, or assembly. A basic Physics of Failure approach is needed. Both overstress and cumulative damage wear out mechanisms will be discussed.

This 2-hour webinar, which costs $200, will look at applying this approach to some electrical and mechanical products to illustrate how the HALT method can help improve the design and reliability of products other than electronics. Although less work has been done to use HALT in these products, there is considerable benefit to applying the HALT methodology.

Ask the Experts! by Aldo Fucinari, Chet Haibel & Alec Feinberg – FREE – 1/17/2016 – 2 hrs

It has been brought to our attention that many of you would like to have a chance to ask questions of our instructors in an open forum style. This is your chance to do so. And it's free!

Many of you have just wanted to ask what if? Or why did my testing go this way? What is the key difference between Environmental Stress Screening (ESS) and true Highly Accelerated Stress Screening (HASS)? What are some strategies to get the most information from HALT before you "slay" all the test samples? On which part(s) of the Bathtub Curve does HALT effectively operate? Is HALT just "Shake and Bake" or is there more to it? How does one choose the best prototype samples to HALT? Are former HALT samples useful for anything?

Some of the focused expertise of the panel are in chamber operation and setup, HALT/HASS fixtures, vibration analysis, measurement and test setup and of course any reliability engineering related questions. Now is your chance to pick the brains of some of our highly qualified instructors!

Back to Basics: What, Why, When and How to Apply HALT & HASS by Kirk Gray - $200 – 2/13/2013 – 2 hrs

Reliability engineering historically has been focused on statistical and probabilistic models, which may not have a valid traceability to physical failure mechanisms. HALT on the other hand is a pragmatic empirical discovery process focused on finding stress limits, the causes of those limits and improving those limits. Despite the use of the word "Life Test" HALT is not for measuring life. Electronic systems in general have more life than is necessary and technologically obsolescence will come before wear out.

This two hour webinar is intended to provide both a basic overview of the theory and practice of HALT and HASS methods along with a case study of HALT to HASS that created a 90% reduction of warranty returns compared with traditional burn-in methods being used previously. It is intended as a review or introduction to the basics of HALT and HASS methodology along with some new advanced uses of HALT and HASS for stimulating detection of firmware/software operational reliability issues and use in Prognostics and Health Management (PHM) techniques.

Basic Reliability Statistics by Chet Haibel - $200 – 3/11/2015 – 2 hrs

Basic Reliability Statistics first looks at reliability definitions and categorizes failures by their occurrence in time and by their persistence, then shows mathematically why failures happen using the strength versus load viewpoint, justifying the bathtub curve. Mechanical component reliability is calculated from strength and load using Safety Margin and then using a Monte Carlo simulation.

The four reliability functions are presented and the simplest distribution, the exponential is focused upon. Obtaining the point estimate for the Mean Time To Failure experimentally is indicated. Confidence bounds and truncated testing are used to obtain MTTF with confidence. Serviceability and availability calculations are presented using an example of an X-ray tube.

Reliability Block Diagrams and how component and subsystem reliabilities are combined is shown. Series configuration is illustrated using an electrical circuit reliability prediction. Parallel configuration is introduced with its mathematics: cut sets, tie sets, shared load, and r of n redundancy are shown and illustrated with examples.

Common Sense on Reliability Engineering by Albertyn Barnard -$150 – 11/5/2014 – 1.5 hrs

"Unfortunately, the development of quality & reliability engineering has been afflicted with more nonsense than any other branch of engineering." PDT O'Connor

Using a common sense approach, reliability can be defined as the absence of failures in products. This viewpoint implies that reliability engineering should focus on prevention of failure during development and production and not on correction of failure during operations. Failure prevention can be pursued by using specific Analysis and Test activities, which should be selected for their ability to identify and to eliminate both design and process deficiencies.

This webinar provides some detail on the integration of reliability engineering into product development, with emphasis on both failure analyses (e.g. design FMEA) and engineering analyses (e.g. derating analysis), as well as on reliability testing (e.g. HALT & HASS). It explains why reliability engineering as discipline often fails (incorrect activities, incorrect people and incorrect timing), why prediction based on fundamentally flawed assumptions should not be used, why reliability should not be delegated to maintenance or logistics, and concludes with examples of good reliability engineering practices used by successful companies.

Cooling Techniques for Electronic Equipment Extensive Two Day webinar by Steve Carlson - $800 – 4/17-18/18 – 8 hrs

The purpose of this two day webinar is to show designers and engineers an **in-depth** overview of the quick methods for designing electronic equipment to withstand severe thermal environments without failing. Don't wait until your electronic equipment over-heats or fails because of poor cooling. Find out if your present systems are adequately cooled, how to avoid many common cooling problems and how to design efficient, reliable cooling systems for many different types of electronic cabinets. Techniques are presented which will permit the evaluation and design of cost effective, compact cooling systems, without the aid of a large digital computer. Learn simple design rules, and guidelines, which can improve the effective cooling of your sophisticated electronic components used in today's military, industrial and commercial electronic systems. Learn methods for determining thermal stresses in lead wires and solder joints due to a mismatch in thermal expansions.

This course is based upon the popular book Cooling Techniques for Electronic Equipment by Mr. Dave Steinberg. Questions are encouraged during the webinar, to make sure each participant understands the design techniques and application presented.

Electronics Cooling Background

- Heat Transfer within Electronic Systems
- Conduction
- Natural and Forced Convection
- Radiation
- Types of Thermal Analyses
- Steady-State and Transient
- Common Electrical Components and their Construction
- Types of Electronic Enclosures
- Material Properties and Unit Conversions

Practical Conduction Cooling Design Guidelines

- Calculate Temperature Rise
- Concentrated Heat Loading
- Uniform Heat Loading
- Determine Heat Flow
- Tracing a Heat Conduction Path from Heat Source To Sink

One and Two Dimensional Resistor Networks
Parallel and Series Heat Flow
Printed Circuit Boards (PCB)
Determine Component Junction Temperature: θ_{cb} & θ_{jc}
Using Internal Ground and Voltage Planes to Spread Heat
Calculate Effective PCB Thermal Conductivity
Mounting High Power Components on Circuit Boards
Calculate Thermal Interface Impedance
Bolted Contact Resistance
Effects of Surface Finish, Hardness and Pressure on Interface Resistance
Thermal Resistance Across Different Board Edge Guides
Sample Problems to Promote Better Understanding

Mounting Various Types of Components on Circuit Boards

Problems with Surface Mounting Components
Leadless Chip Carriers, Transformers, Ball Grid Arrays, Large Multi-Chip Modules, and Large Fine Pitch Leaded Components
Problems with Through Hole Mounting Components
Pin Grid Arrays
Small Axial Leaded Resistors
Lead Wire Strain Relief
Various Types of Lead Wire Strain Relief To Prevent Solder Failures
Avoiding Cracking of Chip Resistors and Capacitors
Case Histories on Successes and Failures

Effective Natural Convection and Radiation Cooling

Free Convection
Required Spacing Between Circuit Boards for Good Cooling
How Altitude Effects Natural Convection Cooling
Finned Heat Transfer Surfaces
Adding External Fins on a Box to Improve Cooling
Making Effective Use of Extruded Fin Heat Sinks
Methods for Increasing Convection and Radiation Coefficients
Combining Convection and Radiation Cooling
Radiation Heat Transfer
Sample Problems to Demonstrate Practical Applications

Methods for Improving Forced Convection Cooling

Cooling Fans
Air Flow Properties of Fans and Blowers (Fan Curve)
Working with Sigma Delta Pressure Drop
Fan Location
Typical Problems with Improper Fan Installation
How To Determine and Cure Short Circuit Cooling Air Flow Path
Flow Losses
Understanding Static, Velocity and Total Pressure
Flow Losses Due to Entrance, Exit, Expansion and Turns
Fan Selection
Matching the Impedance Curves for Chassis and Fan
Sample Problems to Illustrate Cost Effective Applications

Practical Design and Analysis Guidelines

Hand-calculations confirm Finite Element Analysis results
Coefficient of Thermal Expansion
Thermal Expansion Equilibrium Equations, Lead Wires, Solder
Slow Thermal Cycling Solder Creep Forces, Stresses, Fatigue Life
Case Histories to Promote Improved Electronic Design

WHO SHOULD ATTEND? R&D Electronic Engineers and Managers, Packaging Engineers, Quality & Reliability Engineers, Test Engineers, Manufacturing Engineers, Mechanical Engineers, Application and Sale Engineers

Cooling Techniques for Electronic Equipment Overview by Steve Carlson - $300 – 12/12/18– 3 hrs

The purpose of this 3-hr webinar is to show designers and engineers an overview of the quick methods for designing electronic equipment to withstand severe thermal environments without failing. Don't wait until your electronic equipment over-heats or fails because of poor cooling. Find out if your present systems are adequately cooled, how to avoid many common cooling problems and how to design efficient, reliable cooling systems for many different types of electronic cabinets. Techniques are presented which will permit the evaluation and design of cost effective, compact cooling systems, without the aid of a large digital computer.

Learn simple design rules, and guidelines, which can improve the effective cooling of your sophisticated electronic components used in today's military, industrial and commercial electronic systems. Learn methods for determining thermal stresses in lead wires and solder joints due to a mismatch in thermal expansions.

This course is based upon the popular book Cooling Techniques for Electronic Equipment by Mr. Dave Steinberg. Questions are encouraged during the webinar, to make sure each participant understands the design techniques and applications presented.

Who should attend: R & D Electronic Engineers & Mgrs, Packaging Engineers, Quality & Reliability Engineers, Test Engineers, Mfg Engineers, Mechanical Engineers, Application & Sales Engineers.

Correlating HALT & HASS in Lean Product Development & Manufacturing by John Paschkewitz - $300 – 11/14/2018 – 3 hrs

This 3-hour webinar introduces the basic elements and tools of lean product and production process development with emphasis on the opportunities they provide for ensuring product reliability. These methods focus on knowledge based product development with up front learning and reduction of variation. The emphasis is on applying accelerated tests like HALT and HASS effectively during lean product and process development.

During the upfront learning phase, analytical tools are used to enhance understanding of customer needs, modeling of the product and its margins in the operating environment, and Design Review Based on Failure Modes (DRBFM). With this knowledge in place, test planning to include Design of Experiments, HALT and Quantitative Accelerated Life Test are used enhance Design for Reliability. Design Review Based on Test Results (DRBTR) is used to capture learning from testing and identify corrective actions needed.

The lean methods also emphasize integrated product and process design to facilitate the transition to production. DRBFM can again be used to ensure issues in the production processes are identified and corrected. This leads to effective application of HASS and HASA to screen production and ensure variation is minimized. Finally, field return data is subjected to failure analysis and life data analysis to provide correlation with design and test data for further improvement as well as knowledge capture for re-use in follow-on product development.

Cutting Edge Useful Physics of Failure Reliability Methods and Tools by Dr. Alec Feinberg $400 – 5/22/19 4 hrs

This 4-hour course will provide very useful cutting edge physics of failure reliability methods for a number of important helpful areas to:

- Generate an SN Curve using established rules (including notches, grain size, etc.) for material when the SN curves are not available in the literature,
- Assessing how much work and life is available in your product using an ultimate work test method,
- Perform environmental profiling to determine ones equivalent use stress when products have multiple field use stress conditions so accelerated testing can be designed between stress and use conditions,
- Perform solder joint (BGA) thermal cycle life modeling with and without underfill using the Engelmaier model (without testing)
- Use the Weibull beta to obtain physics of failure power aging laws

- Understanding why a lognormal failure rate statistic can be relevant for certain physics of failure occurrences and how it can lead to accelerated cheaper testing
- Obtain a physics of failure (accelerated test) aging law - wear and creep provided as examples,
- Use noise analysis (not just in the acoustic sense) to determining impending failure in subtle aging situations when gross degradation parameters are not sensitive enough,
- Use multiple regression (for many variables) in excel for problems like DOE, thereby making more accurate predictions

Demonstrating Reliability by Chet Haibel - $300 – 10/5/16 - 3 hrs

This 3-hour webinar by Chet Haibel presents some of the highlights from the two-day seminar of the same title. Starting with the briefest review of the mathematics that describe them, this 3-hour webinar lays out a few test strategies to save you time and money. Several methods of reducing test time, number of cycles, and / or the number of samples are shown.

The following will be presented:

- Pass / fail tests of single-shot devices
- Sudden death testing of sample groups
- MTBF demonstrations
- Sequential Probability Ratio Tests (SPRT)
- Cycle tests of electro-mechanical components and assemblies
- Censored testing
- Other Techniques

For higher reliability and / or shorter tests, acceleration must be applied. This can be as simple as removing the dead time between cycles, but for even higher acceleration, stresses must be applied. Some well known relations of stress versus life are presented: Arrhenius (temperature acceleration) with examples of activation energies, Inverse Power Laws such as the Coffin-Manson relation for low cycle fatigue, Peck's modification of the Arrhenius relation to include effects of humidity, etc. The webinar culminates with an example of an accelerated life test with embedded information gathering properties to deduce the dependence of life versus stress.

Design for Reliability & Quality by Dr. Alec Feinberg - $850 – 5/15-16 & 5/23-24/2014 – 3.5 hrs, 4 days

This is an intense four-day webinar, which includes course material and reliability software (30-day trial) that makes learning fast. In today's rapid paced lean business environments, people are busy so the class is compacted to save down time and get engineers and managers back in the office to use the tools that they have learned. However, this is not a birds-eye view. The material provides depth and exposure to the industry's reliability science. We believe there is no better DfR course offered today.

We start by providing full explanation of how to grow reliability in a commercial environment and translate that into ROI dollars. Reliability growth starts in the design phase using tools like FMEA, reliability predictions, and reverse engineering. We move into the testing phase with prototypes, we describe how to organize an effective DART (design assessment reliability testing) plan that includes HALT and HASS development. A full or partial overview on HALT is available depending on class interest. Reliability statistical analysis is key and is accessible to the student through our professional DfRSoft software tool. Each student has the software to follow along during the course to help problem solve quickly. This jump starts ones capability.

Test methods such as shock and vibration and how to analyze your test using this software, for both physics and statistics problems are demonstrated for all accelerated testing, with clear exercises. The concept of test design by failure modes is presented. Examples are given. All the key accelerated test models (Arrhenius, Humidity, Thermal Cycle, Electromigration) are provided and illustrated. Both simple and advanced reliability math is overviewed and taught efficiently with software examples. The concept of design maturity testing using accelerated test methods and Chi-squared test planning and analysis, again with software exercises, are used to assess products failure rate/MTTF. We include Quality tools such as Cpk, lot sampling, sparing, availability and normality analysis. Overview methods to analyze field return data to derive an MTBF. As part of reliability analysis, a full session is given on Physics of Failure, what equipment to use and when (SEM, Auger, X-RAY, XRF, Focused Ion Beam) etc. Numerous failure analysis pictures are shown to see first-hand the challenging failure modes and how their mechanisms are identified using such equipment.

Key issues on RoHS are overviewed and depending on class interest are detailed. The course is concluded with how to ensure ROI and quantify reliability growth for management and its cost savings.

DAY 1

- Reliability in Today's Marketplace
- The Stage Gate
- Basic Reliability Mathematics
- Basic Quality Test Engineering
- Failure Modes Effects Analysis (FMEA)

DAY 2

- Advanced Reliability Mathematics
- Field Returns and Device Hours
- Design Assessment Reliability Testing (DART - HALT)
- Design Maturity Testing

DAY 3

<u>Special Topics – Included with Course</u>

- Advanced ESD Concepts
- Shock & Vibration
- Physics of Failure Analysis Tools - (Detail Analysis Pictures Showing Strengths of Instruments)

DAY 4

- Physics of Failure (Numerous FA Pictures)
- Physics of Failure 7 Step Problem Solving
- RoHS Challenges
- Parametric Reliability
- Putting It All Together

Finding Value with Reliability Engineering by Fred Schenkelberg $200 2/1/17 - 2 hours

A desirable outcome from our professional endeavors is to add value, to be valuable. To make a difference. To improve the world in some manner.

When designing a product or maintaining assets, we employ a range of reliability engineering tools. Not all are as useful as others for each specific situation. Selecting the right tools that add the most value is a learned skill. Let's discuss how to estimate the value of a reliability task before and after accomplishing the task. Let's discuss the importance of estimating value. Being able to clearly state the value of a reliability task helps you gain acceptance of proposed tasks and receive the recognition of achievements.

Another way to consider value is personal. How is our career providing the rewards we value? How ever you find value with your work, your ability to influence others is central. We rarely work alone and being able to persuade and guide a team is essential to our ability to create value. Let's discuss how you can improve your ability to influence. Data, facts, and analysis are only the start; at some point we will have to present a recommendation. Our ability to work with others to guide a course of action relies on our ability to persuade.

Our work in engineering allows us to create value for our customers and organization thru crafting reliable products and systems. Our work also may provide value to ourselves and career largely based on our ability to persuade. This webinar explores both the technical and soft side of creating value with reliability engineering.

Topics Covered:
How does value arise from reliability activities?
Estimating the potential value of a proposed task
Calculating the value of an accomplished reliability activity
Improving your ability to create value for your organization and your career
How your ability to influence others improves the value you provide

Focusing on HALT Vibration and Fixtures by Aldo Fucinari $200 3/20/2019 2 hrs

This webinar will explain why ED shaker results for your product alone are fine but HALT vibration will reveal more latent defects. There are really no viable transfer functions between the two.
Many people have attended the Hobbs Engineering HALT and HASS seminars in the past. This two hour webinar, will reveal the most frequently misunderstood issues that are raised in the seminars regarding HALT Vibration and Fixtures. The instructor will share his years of experience to help you understand how to design a robust fixture that will transfer sufficient energy to the device under test. This is a chance to ask our expert any questions that you might have about fixture design.

This 2-hour course covers:

- Understanding differences in HALT Vibration, How it Works and How to Measure and WORK WITH IT.
  - **Repetitive Shock and Vibration –** a detailed introduction into how it is different from ED shaker random vibration. Differences in table vibe explained.
  - **Measurement Techniques** – How to use accelerometers to measure product vibe. How to test materials in a static environment (nonoperational).
  - **Fixture Design and Set Up** – Real world examples of solutions. How and why HALT fixtures need to be approached differently from ED shaker fixtures!!
  - **HASS FIXTURES and Safety of Screen Examples –** Two real world examples will be discussed that cover most applications for high volume and low volume HASS applications.

HALT vs Electro-Dynamic vs Hydraulic Vibration Testing by John Lenss $200 6/7/17 – 2 hrs

This two hour webinar will look at various types of vibration tests, providing a comparison of the main types of tests, as well as some recommendations. Electro-Dynamic vs Hydraulic vs Highly Accelerated Life Testing vs Repetitive Shock testing. Which is the best test type of testing to run on a product, depends on what you need to know about the product? There is not a one test fits all when it comes to understanding how products behave in an environment where vibration may be present. This is very important because EVERY product made today, is subjected to some amount of vibration at some point in its lifetime. We will provide you with questions that you can ask to determine if you test protocol is effective, compared to other tests that you could/should be running. We will look at which type of vibration is best for troubleshooting, production, or development work.

After this webinar you will be better equipped to have intelligent discussions about why you are performing a particular test versus another test. This should lead to designing and building more reliable/robust products that will not break in the customer's hands, at least not during the warranty phase, which will mean more profits for your company.

How to Conduct a Reliability Program Assessment by Fred Schenkelberg $200 11/8/2017 2 hrs

Every product achieves the reliability designed and built into the product. The decisions made along the way shape the eventual product reliability performance. Understanding how an organization actually works to create the resulting reliability provides a means to identify ways to improve the program.

The reliability program assessment is not an audit. There are not right or wrong answers. The aim of the assessment is to understand what shapes the decisions across the entire product lifecycle. Let's talk about two ways you can quickly perform an assessment. How to ask question to get to the heart of the culture surrounding reliability thinking. Plus, how to organize, conduct, and analyze the collected data.

You will walk away with a step by step process to conduct your own assessments, plus how to best identify the areas for improvement. You'll also receive a copy of the ebook Reliabilty Maturity. Bring your questions and as time permits we will even live practice asking questions to maximize what you learn during the assessment interviews. A proper reliability program assessment helps you prioritize reliability program improvement resulting in consistent creation of durable and robust product that meet your customer's exceptions.

Fred Schenkelberg is a reliability engineering and management consultant with FMS Reliability, with areas of focus including reliability, engineering management, training and accelerated life testing. He is able to bring the experience of over 100 design and maintenance programs to your team. He is spearheading the No MTBF movement and encourages your participation. Previously, he co-founded and built the HP corporate reliability program documenting over $100 million in savings. He is a lecturer with the University of Maryland teaching a graduate level course on reliability engineering management. He earned a Master of Science degree in Statistics at Stanford University in 1996. He earned his Bachelor's degree in Physics at the United State Military Academy in 1983. Fred is an active volunteer with a few reliability focused professional organizations and most proud of the ASQ Reliability Division Webinar program and the reliability calendar programs. He is a CRE and CQE.

Improving the Problem Solving Process by David Auda $100 - 10/7/2015 - 1 hr

Problem solving, causal analysis and decision governance……. Improving their mission effectiveness is very important. The recent white paper released by Deloitte on behalf of the AIAG, identified the 10 top issues that organizations face across the global landscape. Problem Solving ineffectiveness shows up at the top of the list. The Quality 2020 report which was focused on the current state of Quality and strategic paths forward, identified a key finding that capability maturity of Problem Solving needed to be improved. This 1-hour webinar, which costs $100, will take a unique approach in addressing this issue and prescribing corrective actions. This material covers the organizational challenge as well as the tools and the people using the tools.

Who should attend: Executives, directors, managers, leaders, master black belts, decision makers, change agents, etc.

Intermediate Reliability Statistics by Chet Haibel $300 – 4/8/2015 – 3 hrs

Please note that you must take the Basic Reliability Statistics webinar before taking this one. This Intermediate webinar briefly reviews the four functions in Reliability but then transitions from the Constant Hazard Rate to the general case covering the entire bathtub curve. Wear-Out failure modes are seen as time-varying Strength distributions, Fatigue Damage is presented, and three everyday Wear-Out examples are given to illustrate. Normal, Weibull, and Log-Normal are presented as the three most useful models for Wear-Out failure modes. Several class examples are worked designing minimal testing to discover Wear-Out failure modes, and to demonstrate they are sufficiently late-appearing.

Accelerated testing for Wear-Out failure modes is presented using Power Series, Inverse Power Series, Arrhenius, Reich-Hakim, and Arrhenius-Peck equations to relate life to stress. Strategies for constructing economical, self-calibrating, accelerated tests are presented and illustrated by examples. Reliability prediction techniques shown in the Basic webinar are extended to cover all three regions of the Bathtub Curve as are methods of combining Reliability elements in series and parallel for non-constant hazard rates (non-Exponential distributions).

Introduction to Reliability by Chet Haibel - $400 – 8/21-22/2013 – 4 hrs (10 minutes missing)

This two-day webinar series strives to bring those with no knowledge of Reliability to a level of qualitative understanding so they can discuss this most important topic at their company.

It is centered around failures! Briefly over-viewing failure mechanisms and some common failure modes, it broadly categorizes failures based on their time of occurrence and persistence. Strength versus load diagrams and the bathtub curve are introduced as convenient pictures of the various failure behaviors.

Wear-out failure modes are presented as resulting from some process (wear, corrosion, etc.) consuming a reservoir of material. Three everyday examples are discussed to illustrate reservoirs and consuming processes. Then the wear-out testing process is examined with special attention to potential issues in accelerating wear-out tests.

Random-in-time failure modes give no warning, but are avoided by attention to design margin. Overlap of strength and load distributions is shown to predict failure probability using Monte Carlo simulations. Highly Accelerated Life Test (HALT) is presented as the best method to sift through hundreds or even thousands of component applications to discover marginal strength versus load situations.

Manufacturing screening is the way to prevent out-of-box and early-life failures from reaching customers. Highly Accelerated Stress Screening (HASS), which was originally called Enhanced ESS, is featured as the ultimate method, but caution must be taken to preserve the useful life of good components. Safety of Screen is the way to ensure this.

The webinar finishes by contrasting HALT and HASS to avoid confusion, and recaps the methods of discovering, correcting, and preventing failure modes.

Introduction to Reliability Management by Fred Schenkelberg - $200 – 12/13/17 – 2 hrs

The purpose of this 2-hour webinar is to introduce an outline to guide the management of an effective reliability or maintainability program. Reliability, maintainability, availability, or the 'ilities' are common in our language with reference to products, services, equipment, and people. Joe is regularly available for the meeting; We can count on (depend or rely) Sara to finish the report on time; My car starts every morning without fail; and many more. What is meant by these concepts and specifically how do we manage achieving and sustaining business objectives related to these 'ility' concepts? Another purpose of this webinar is to provide an introduction to key concepts and approaches commonly used for reliability and maintainability management.

With some common sense, an appreciation of the goals, understanding of expected and past failures, and the proper application of reliability engineering tools, you can manage to improve profitability, increase throughput, or enhance a brand image. With a sound design, robust supply chain, consistent manufacturing, and adequate maintenance nearly any product or complex system can meet or exceed their reliability or maintainability goals.

Topics Covered:

Specifications – What makes a good reliability specification and how to craft a clear objective.

Apportionment – How to breakdown the goal to elements and suppliers of key elements of your product.

Feedback Mechanisms – Basic to any quality or reliability program is the feedback to decision makers. How to shorten the reliability feedback loop and enable decisions that improve product reliability.

Value – How to measure value of any reliability engineering task. Let's choose to only add value and let's talk about being valuable.

Introduction to Weibull Regression by Dr. Rong Pan $200 2/21/2018 2 hrs

Weibull distribution is widely used in failure time data analysis. In this two hour webinar, which costs $200, we will thoroughly discuss the Weibull regression model and its many applications in reliability testing modeling and data analysis problems. First, the properties of Weibull distribution, particularly the properties that are related to reliability, will be illustrated. Second, we will demonstrate how to fit the failure data, including censored data, to a Weibull model and how to assess the goodness of fit. Next, the Weibull regression method, which is one of the most popular data analysis methods for reliability data with covariates such as the data from accelerated life tests, will be introduced. We will discuss how to evaluate the effect of a covariate and how to conduct residual analysis. An iterative model building process will be presented in an exercise. Finally, we will compare the Weibull regression model with the Cox's proportional hazard model, another popular semi-parametric regression model.

In this webinar, we will focus on the statistical techniques for building failure time regression models and for predicting product reliability. In addition, based on the properties of reliability prediction, we can properly compare reliabilities of products from two and more manufacturers/suppliers and construct statistically efficient tests to demonstrate reliability. As nowadays most data analysis can be performed by computers, we will show the Weibull analysis on multiple examples using Minitab® and JMP®, as well as some Excel® templates that are customized for specific reliability data analysis tasks.

Lead-Free Solder Joint Reliability Basics by Dr. Jean-Paul Clech - $350 6/6/2018 – 3.5 hrs

Given the proliferation of lead-free solder alloys, and the dearth of lead-free reliability data and modeling tools, taking care of the basics is of utmost importance to designers and product engineers having to build in long-term solder joint reliability. This 3 1/2-hour webinar reviews basic board, component and board assembly parameters that effect solder joint reliability regardless of solder composition, tin-lead or lead-free. Rules-of-thumb and design-for-reliability guidelines are presented that are of help to improve solder joint life under both thermal and mechanical loading conditions. Accelerated testing procedures and acceleration factors are also discussed briefly. This introductory webinar will be of interest to beginners as well as experienced technical staff needing a refresher on designing for solder joint reliability in electronic assemblies.

This webinar is introductory in nature with emphasis on board and component effect and generic guidelines that can be used to minimize the risk of solder joint failures in circuit board assemblies. While the webinar ends with an overview of lead-free solder joint reliability trends, solder alloy specifics are not covered. Numerous rules-of-thumb (do's and don'ts) are presented based on established industry practices and field failures encountered by the instructor. Main topics include:

- Why bother?
  - ✓ Customer-driven requirements
  - ✓ Solder joint reliability trends
  - ✓ Field failure examples
- Metallurgical issues: contamination; intermetallic; voids; impact of reflow profile.
- Thermal expansion problems:
  - ✓ CTE mismatches: global vs. local CTE mismatches; CTE measurements
  - ✓ Solder joint damage drivers: shear strains, stress/strain cycles
  - ✓ Component parameter effects: size effects; effective component CTE.
  - ✓ Board parameter effects: board material, thickness, in-plane CTEs.
  - ✓ Assembly parameters effects: joint height, pad design and pad size effects
- Mechanical loading problems:
  - ✓ Solder creep under constant load
  - ✓ Vibration loading: board support, stiffener effects; impact of component location.
- Accelerated testing procedures and life data analysis:
  - ✓ Test profiles
  - ✓ Effect of thermal cycling dwell times
  - ✓ Sample size, failure statistics
  - ✓ Acceleration factors
- Lead-free reliability overview:
  - ✓ Lead-free vs. SnPb reliability
  - ✓ Alloy composition effects
  - ✓ Alloy proliferation issue and other challenges

WHO SHOULD ATTEND
Design, materials, manufacturing, quality or reliability professionals and managers, attorneys and others who are responsible for, or have to deal with solder joint reliability issues and the consequences of solder joint failures in the field.

PRE-REQUISITES: None other than basics physics and the business-drive to ensure that customer reliability requirements are met.

Microelectronic Packaging Issues and Failure Analysis by Thomas Green - $300 – 5/20/2015 – 3 hrs

The design and packaging of microelectronic devices such as hybrids, RF and microwave modules, Class III medical implants, and other types of packaged microcircuits intended for high reliability systems is a critical aspect of reliability engineering. This webinar is intended to review and highlight the typical kinds of microelectronic packaging related failures that occur during manufacturing, qualification, and unfortunately in the field, and present the Failure Analysis (FA) tools and techniques that are utilized to understand root cause and guide corrective actions.

The instructor shares his years of experience directing microelectronic packaging related root cause FA investigations. Mismatched CTEs and poorly designed package geometries often lead to mechanical failure at the die and substrate interface or cracking at the heel of a wire or ribbon bond interconnect. Careful de-lid, visual inspection followed by SEM and EDAX/Auger are required to identify root cause. Reliability engineers must be cognizant of the full range of FA tools available to diagnose failures and, resist the temptation to rush to judgment, which often happens destroying valuable evidence along the way. The instructor will review real world specific examples of packaging failures and resultant FA analysis and problem resolution.

This intermediate course is intended for reliability engineers, design, quality, and process engineers plus responsible mid-level managers.

Monte-Carlo Simulation Simplified--Reliability & Quality Applications Using Excel Spreadsheet by Dr. Andre Kleyner - $200 – 3/23/2016 – 2 hrs

This 2-hr webinar, which costs $200, will cover the basics of Monte-Carlo simulation and show how it can be applied to solve a variety of quality and reliability problems. It will discuss the most commonly used statistical distributions (both continuous and discrete) and how they can be sampled using the Microsoft Excel. Even though commercially available, Monte-Carlo simulation software is widely available; all you need to get started is Microsoft Excel and some basics of Monte Carlo simulation technique, which will be covered in this presentation.

After completing this webinar the attendees will be able to understand the main concepts of Monte Carlo simulation and be able to solve a number of statistical problems in the Quality and Reliability field.

Andre Kleyner has 30 years of engineering, research, consulting, and managerial experience specializing in reliability of electronic and mechanical systems designed to operate in severe environments. He received the doctorate in Mechanical Engineering from University of Maryland, and Master of Business Administration from Ball State University. Dr. Kleyner is a Global Reliability Engineering Leader at Delphi Electronics & Safety and an adjunct professor at Purdue University. He is a Fellow of the American Society for Quality (ASQ), a Certified Reliability Engineer, Certified Quality Engineer, and a Six Sigma Black Belt. He also holds several US and foreign patents and authored multiple professional publications including three books on the topics of reliability, statistics, warranty management, and lifecycle cost analysis. Andre Kleyner is also the editor of the Wiley Series in Quality and Reliability Engineering (John Wiley & Sons). For more information please visit www.andre-kleyner.com.

Physics of Failure Methods for Building Reliability into Products Overview by Dr. Abhijit Dasgupta - $300 – 04/4/2018 – 3 hrs

This course offers an introductory understanding of some of the key engineering accelerated test techniques needed to develop reliable electronic products. Participants are presented with various physics of failure methods to design and test for reliability.

Participants will….

- Learn how products really fail and understand key reliability issues.
- Become acquainted with the failure modes and mechanisms associated with various electronic devices and assemblies
- Determine the stresses associated with the qualification of reliable electronic equipment and examine techniques to address problems of reliability
- Investigate the usage and applicability of reliability standards and handbooks.

Webinar Outline:

- What is reliability?
- Why assess reliability?
- What reliability metrics make sense?
- What is physics of failure?
- Failure mechanisms, failure sites and failure modes
- Lifecycle conditions and how they affect failures
- The PoF process as a proactive way to design and build reliability into a product
- PoF tools
- How do the manufacturing process and supply chain affect reliability?
- PoF examples
- Reliability assessment and product qualification with accelerated stress testing
- Design of accelerated stress tests based on PoF principles
- PoF Failure acceleration models
  Temperature - Moisture & harsh chemical contaminants - Mechanical & Electrical stresses - Combined stresses
- Case Study: Example of PoF –based accelerated stress testing

Physics of Failure 4 Day Webinar by Dr. Abhijit Dasgupta - $850 – 09/25 & 27 and 10/2 & 4/2018 – 14 hrs

Webinar Objective:

This is a 14 hour webinar (broken down into 4 half days) which costs $850. This course offers an expanded understanding of some of the key engineering accelerated test techniques needed to develop reliable electronic products. Participants are presented with various physics of failure methods to design and test for reliability.

Course Outline:

Why Do Electronics Really Fail?
Do the Old Standards Do the Job?
The Physics of Failure Approach
Stress Analysis Approaches
Failure Models
Case Studies
- Ball Grid Array Interconnect Reliability
- Vias and PTHs
- Conductive Filament Formation
- Wire Bond Failures in Glob-Top Chip-On-Board Packages

PoF Approach for Accelerated Qualification
- The 5-Step Approach for Accelerated Life Testing
- Virtual Qualification and Stress Margins
- Acceleration Transforms
- Testing and Data Post-Processing
- Case Studies:
  - Thermal & Power Cycling
  - Vibration and Mechanical Shock
  - Combined Thermal Cycling and Vibration
  - Combined Temperature and Humidity

The PoF Approach for Process Verification Testing
Types of Screens:
  - Non-Destructive Screens
  - Proof Tests
  - Accelerated Wearout Screens

The two-step approach for Screening Summary

Who Should Attend:

This course is intended for those who are involved in the design, analysis, material selection, manufacture and test of microelectronic components, printed circuit/wiring boards and assemblies. Participants will receive an understanding of the various reliability tradeoffs in electronic packaging.

Physics of Failure Tools, Mechanisms, Modeling and New Methods by Dr. Alec Feinberg - $400 – 5/23/2018 4 hours

There are many aspects to the science of physics of failure. In this course we approach the subject by dividing it up into four main sections:

Physics of Failure
- *Tools*
- *Mechanisms*
- *Modeling*
- *And Measurement Techniques*

This course is an in depth approach to physics of failure. It is designed for the engineer who wants a good knowledge base including the state-of-the-art in this area.

The following outline provides an overview for each section

Physics of Failure Tools
- SEM (FE-SEM, EDS)
- Digital Microscopy
- Focused Ion Beam
- Real Time Radiology, X-Ray Maps
- C-SAM
- Thermal Imaging
- FTIR
- Scanning Auger
- Atomic Force Microscopy

- SIMS
- Other Tools Including ESD Simulator
- Sample Preparations

Physics of Failure Mechanisms

- Diffusion - Substitutional, Kirkendall
- Intermetallics - Au Embrittlement, Purple Plague
- Bond wire failures - non stick, intermetallic
- Eight Types of Corrosion - Area effect, and Prevention
- Dendritic Growth, Ag Migration & Electromigration
- Modes of Mechanical Failure
- Fatigue Failure
- Wear
- Stress-Strain – Yielding, Vibration,
- CTE's Mismatch, Thermal Fatigue
- Electronic Failure modes from shock, vibration
- Creep, Solder Creep, Creep Resistance in Plastics
- Organic contamination
- Popcorn Cracking, Voiding Delamination
- Assembly Errors
- Solder Failures (non wetting, grain size, leaching, coverage)
- Contamination – Solder non-wetting, Epoxy non-stick
- Plating Contamination
- RoHS Lead Free Solder Issues
- Cu Dissolution
- BGA, Tin Whiskers
- PCB Finishes
- ESD & EOS - Dielectric Breakdown
- Current Density & Fusing of Bond wires and wires
- Junction Temperature Issues

Physics of Failure Modeling

- Four main types of aging
- Engelmaier IPC Solder Joint Life Model, BGAs
- Junction Temperature Modeling
- Circuit trace and wire bond current density limit modeling
- Wear
- Creep
- *Miner' Fatigue Rule (Thermal, Mechanical, Combined)*
- *Advances in S-N Curve Modeling*
- *New Maximum Work Strength Modeling*
- Transistor FET & Beta Degradation

Physics of Failure Measurement Techniques

- *Fatigue Damage Spectrum (FDS)*
- *New Mesoscopic Noise Measurements*
- *Parametric Failure Rate Modeling*

Practical Reliability Engineering for Industry by Dr. Alec Feinberg - $850 - 4/2 3 9 10/2019 - 4 days 3.5 hours per day

This is an intense, practical course for industry focusing on applying reliability in real world situations. It uses a stage gate approach to reliability as product transition from the Idea Phase, Evaluate, Develop, Transition and lastly to the Production Stage. This is a two-day webinar, which costs $850, (broken down into 4 half days) and includes course material and reliability software (30-day trial) to accelerate learning. The material provides depth and exposure to the industry's reliability science.

We start with basic methods in reliability & quality, providing full explanation of how to grow reliability in a commercial environment and translate that into ROI dollars. Reliability growth starts in the Design Idea phase using tools like FMEA, reliability predictions, and reverse engineering. Here we provide a formal method for providing a detailed reliability plan for the product. We describe how to develop the plan with management and engineers so that everyone is involved and sample sizes and cost are obtained up front. We move into Evaluation stage gate demonstrating and analyzing reliability in the testing phase with prototypes. We describe how to organize an effective DART (Design Assessment Reliability Testing) plan that includes HALT. We detail the method of test design by failure modes. As the product matures and the design becomes frozen, we move into the Development stage gate where we often do Design Maturity Testing demonstrating reliability with qualification testing. We go over the common specification and describe how to design test with and without specifications. Reliability statistical analysis is key and is accessible to the student through our professional DfRSoft software tool. Each student has the software to follow along during the course to help problem solving quickly. This jump starts ones capability. We then move into the Transition stage gate. Here we are concerned with production screening such as HASS. Finally we move into production monitoring where we monitor reliability with a sampling strategy.

Test methods such as temperature, temperature cycle, humidity, shock and vibration and how to analyze your test using this software, for both physics and statistics problems are demonstrated for all accelerated testing, with clear exercises. The concept of test design by failure modes is presented. Examples are given. All the key accelerated test models (Arrhenius, Humidity, Thermal Cycle, Electromigration) are provided and illustrated. Both simple and advanced reliability math is overviewed and taught efficiently with software examples. The concept of design maturity testing using accelerated test methods and Chi-squared test planning and analysis, again with software exercises, are used to assess products failure rate/MTTF. We include Quality tools such as Cpk, lot sampling, sparing, availability and normality analysis. We also describe methods to analyze field return data to derive an MTBF. As part of reliability analysis, we present special topics tailored to the classes needs. This includes Physics of Failure, what equipment to use and when (SEM, Auger, X-RAY, XRF, Focused Ion Beam) etc. Numerous failure analysis pictures are shown to see first-hand the challenging failure modes and how their mechanisms are identified using such equipment. Other topics include a strong overview in understanding in Shock and Vibration, Advanced ESD methods, RoHS challenges, and parametric reliability analysis.

Preventing Thermal & Vibration Failures in Electronic Equipment Overview

by Steve Carlson - $300 10/24/2018 – 3 hrs

This webinar is an overview of the 2-day seminar and will focus on these three topics:

- To understand how variations in coefficients of thermal expansion (CTE) can affect the magnitude of the displacements, forces, and stresses that are developed in electronic assemblies during thermal cycling environments and how these factors affect fatigue life.
- To understand how resonant conditions can affect dynamic displacements, forces and stresses in electronic assemblies during different sine and random vibration environments.
- To understand the concept of "damage accumulation" and how it can be used to determine the approximate fatigue life of various electronic assemblies due to different combinations of fatigue accumulated in thermal cycling and vibration environments.

This course is based upon the popular book Preventing Thermal and Vibration Failures in Electronic Equipment by Prof. Dave Steinberg. It includes expanded tips and techniques using real-world examples with information on incorporating Finite Element Analysis to evaluate electronic hardware.

Preventing Thermal Cycling & Vibration Failures in Electronic Equipment 4 Day Webinar by Steve Carlson - $850 – 3/5-6 12-13/2019 – 13+ hrs

This webinar is the extensive 2-day seminar presented in four 3 hour sections and will focus in depth on these three topics:

1. To understand how variations in coefficients of thermal expansion (CTE) can affect the magnitude of the displacements, forces, and stresses that are developed in electronic assemblies during thermal cycling environments, and how these factors affect fatigue life.
2. To understand how resonant conditions can affect dynamic displacements, forces and stresses in electronic assemblies during different sine and random vibration environments.
3. To understand the concept of "damage accumulation" and how it can be used to determine the approximate fatigue life of various electronic assemblies due to different combinations of fatigue accumulated in thermal cycling and vibration environments.

This course is based upon the popular book *Preventing Thermal and Vibration Failures in Electronic Equipment* by Mr. Dave Steinberg. Questions are encouraged during the webinar, to make sure each participant understands the design techniques and applications presented.

For a complete description of this course contact Hobbs Engineering. This extensive course will cover:

- PHYSICS OF FAILURE IN ELECTRONIC SYSTEMS
- MOUNTING METHODS FOR VARIOUS TYPES OF ELECTRONIC COMPONENTS
- ESTIMATING FATIGUE LIFE – THERMAL AND VIBRATION ENVIRONMENTS
- THERMAL EXPANSION DISPLACEMENTS, FORCES, AND STRESSES
- THERMAL CYCLING STRESS FAILURES IN SURFACE MOUNTED COMPONENTS
- VIBRATIONS OF SIMPLE STRUCTURES AND PRINTED CIRCUIT BOARDS
- DESIGNING ELECTRONIC EQUIPMENT FOR SINUSOIDAL VIBRATION
- ASSESSMENT OF RANDOM VIBRATION ON ELECTRONIC DESIGN
- COMBINING THERMAL CYCLING AND VIBRATION FATIGUE DAMAGE
- FINITE ELEMENT ANALYSIS METHODS AND TECHNIQUES
- CASE HISTORIES OF FAILURES AND FAILURE ANALYSIS

WHO SHOULD ATTEND? R&D Electronic Engineers and Managers, Packaging Engineers, Quality & Reliability Engineers, Test Engineers, Manufacturing Engineers, Mechanical Engineers, Application and Sale Engineers

Problem Solving/RCA Evidence Based Analysis by David Auda $150 – 5/2/2018 1.5 hrs

Course Description: One of the necessary practices in development, maintenance and failure recovery is Root Cause Analysis. This term gets used almost synonymously with Problem Solving, as if the two were somehow the same thing. Albeit, I can have a problem, fix it, and never perform anything that resembles a Root Cause Analysis. I can also perform Root Cause Analysis (more appropriately termed "Causal Analysis") to gain understanding or make changes that do not necessarily stem from a "Problem". Delineating Problem Solving from RCA is important conceptually. This one and a half hour webinar, which costs $150, will illuminate the differences between the two and share, by example, how to effectively and efficiently facilitate Problem Solving, RCA, or both when needed. This is an Evidence Based approach that supports informed decision making (defensible in the face of challenges). Upon completion of the course, the attendee will be able to determine the correct path to take when presented with the need to make a decision. Based upon that decision, the attendee will have learned how deploy the appropriate method(s) to achieve the desired goal, whether it be solving a problem, making causal determinations, or both in conjunction.

Recent Advances in Design of Experiments by Dr. Douglas Montgomery - $300 – 2/27/19 - 3 hrs

The last 20 years have seen many important and fundamental changes in how experiments can be designed. These changes have come about because of increases in computing power and the development of efficient algorithms for implementing optimal design methodology. This enables engineers, scientists and other that use designed experiments to create designs that are customized to the specific characteristics of their problem and not have to rely on tables of libraries of standard design from textbooks or software. This 3-hr webinar gives a basic overview of optimal design methodology and demonstrates how it is implemented in modern computer software. Examples of how this approach can be used to create custom designs are shown for a variety of situations, including cases where there are constraints on the region of experimentation, restrictions on the number of runs that can be made, or non-standard models that need to be fit to the results. Some specific new developments in DOX that have origins in optimal design methodology that will be discuss include no-confounding fractional factorial designs, designs that include one-step screening and response surface modeling, and designs for computer experiments.

Reliability and Risk Management through the Product Development Cycle by Chet Haibel – $150 – 7/16/2014 – 1.5 hrs

This 1½ hr webinar starts by illustrating a generic New Product Development Life Cycle with four phases before release of product to customers. Enough detail is shown to hint at best practices, but descriptions are at a high-enough level to be general so as to apply to individual cases.

Next Fault Tree Synthesis is shown. This is a technique to "architect" the product at the earliest time to avoid expensive and "design-jerking" Risk Control Measures later. The discussion of how to avoid expensive Risk Control Measures continues by showing how Risk Management can guide the design effort and be painlessly incorporated into Verification and Validation.

The start of a project when inputs are gathered is amplified to illustrate how to avoid large changes downstream in the project. Setting specifications to minimize the time and cost of Verification testing is featured and the sample size for Attribute data allowing finite failures is shown. The advantages of Variable data compared to Attribute data is demonstrated.

Finally, the aggressive way to accomplish reliability testing, which is much more effective and saves project time and prototype quantities is recommended.

Reliability Demonstration: Theory and Practical Applications by Dr. Andre Kleyner $300 - 5/8/2019 - 3 hrs

This 3-hour webinar covers a number of reliability demonstration techniques including success based testing, test-to failure, degradation analysis, and other tools utilized by reliability engineers in the industry to demonstrate the reliability during a product test and validation process. It also includes the latest developments on converting test reliability into population reliability and cost improvements techniques, such as test sample size reduction utilizing prior product knowledge.

Webinar Content:

- Success Based Testing
- Accounting for the failures during Success Based Testing
- Test to Failure and Weibull analysis
- Using Degradation Analysis for reliability demonstration
- "Composite" Techniques:
- The tradeoff between test duration and test sample size using Parametric Binomial
- Continuous testing
- Availability vs. Reliability
- Additional Reliability Demonstration Tools
- Cost reduction by minimizing the test sample size utilizing a prior product knowledge
- Correlation between the reliability demonstrated during a test and field population reliability (demonstrating high reliability with a reasonable sample size)
- Reliability Demonstration Cost Models and Cost reduction recommendations

Reliability Prediction Based on Multiple Accelerated Life Tests by Professor Joseph Bernstein - $200 – 1/24/2018 – 2 hrs

To this day, the users of our most sophisticated electronic systems that include opto-electronic, photonic, MEMS device, etc. are expected to rely on a simple reliability value (FIT) published by the supplier. The FIT is determined today in the product qualification process by use of HTOL or other standardized test, depending on the product. The manufacturer reports a zero-failure result from the given conditions of the single-point test and uses a single-mechanism model to fit an expected MTTF at the operator's use conditions.

The zero-failure qualification is well known as a very expensive exercise that provides nearly no useful information. As a result, designers often rely on HALT testing and on handbooks such as Fides, Telecordia or Mil Handbook 217 to estimate the failure rate of their products, knowing full well that these approaches act as guidelines rather than as a reliable prediction tool. Furthermore, with zero failure required for the "pass" criterion as well as the poor correlation of expensive HTOL data to test and field failures, there is no communication for the designers to utilize this knowledge in order to build in reliability or to trade it off with performance. Prediction is not really the goal of these tests; however, current practice is to assign an expected failure rate, FIT, based only on this test even if the presumed acceleration factor is not correct.

We present, in this tutorial, a simple way to predictive reliability assessment using the common language of Failure In Time or Failure unIT (FIT). We will evaluate the goal of finding MTBF and evaluate the wisdom of various approaches to reliability prediction. Our goal is to predict reliability based on the system environment including space, military and commercial. It is our intent to show that the era of confidence in reliability prediction has arrived and that we can make reasonable reliability predictions from qualification testing at the system level. Our research will demonstrate the utilization of physics of failure models in conjunction with qualification testing using our Multiple – HTOL (M-HTOL) matrix solution to make cost-effective reliability predictions that are meaningful and based on the system operating conditions.

In this seminar, you will learn:

- Understanding of constant-rate failure prediction (MTBF and FIT)
- Limitations of the standard Single-Failure-Mechanism approach
- How accelerated tests can be designed for multiple mechanisms
- How multiple-mechanism models can be linearly combined
- How this linear combination can make realistic reliability predictions

Reliability Testing of Hermetic and Near Hermetic Packaging for Military, Space, and Medical Implants by Thomas Green - $300 – 2/22/2017 – 3 hrs

Hermeticity of microelectronic packages and hermeticity test techniques continue to be critical reliability concerns. Specifically, in the area of microcircuits, hybrids, microwave modules, MEMS, optoelectronic devices, sensors and other types of packaged components for the military and aerospace industry. Hermeticity is an important reliability consideration, but also a significant cost driver. There have been many recent advancements in non-hermetic packaging, and given the potential for tighter hermeticity spec limits in TM 1014, and the associated costs of hermetic packaging, more OEMs are now looking at "non-hermetic" packaging alternatives. This webinar looks at some of the critical technical aspects of both technologies.

There are a variety of ways to create a hermetic seal. The basic theory of moisture ingress and rationale for the military RGA 5000 PPM specification will be described. We then examine the conventional hermeticity fine and gross leak test techniques as prescribed in MIL-STD-883 Test Method 1014. This misunderstood test method is often a source of frustration and confusion. We'll discuss the theory behind the test method and point out some of the common pitfalls.

Optical Leak Test (OLT) is a method that makes use of a laser interferometer to measure out plane deflection on a lid surface in response to a changing pressure and relates these measurements to an equivalent helium leak rate. Cumulative Helium Leak Detection (CHLD) is a hermeticity test technique that can measure leak rates as low as 10E-13 He cc/sec. Both methods allow for both gross and fine leak detection in a single test cycle and without the use of a liquid. The radioisotope Kr-85 method is widely used especially for small cavity, high volume packaged parts.

For years the community has lived with a 1E-06 air leak rate for the larger volume hybrid style packages as specified in TM 1014. Recently some specs have changed and adopted a two order of magnitude decrease in the allowable air equivalent leak rate. This presentation will examine the ramifications of a tighter leak spec.

Packages made from polymeric materials, (e.g. LCP or Teflon) as opposed to traditional hermetic seals (e.g. metal, ceramic etc) require a different approach from a hermeticity testing standpoint. The problem is now one of moisture diffusion through the barrier and package interfaces, which is different that water vapor permeating a crack in a glass to metal interface. This will require new test methods and new procedures for component qualification.

Reorganization of Reliability Engineering by Chet Haibel - $200 – 2/4/2015 – 2 hrs

Reliability Engineering can be a dauntingly broad field:

- Statistics (Designed Experiments, Weibull Analysis)
- Environmental Test (Temperature, Humidity, Altitude, Shock and Vibration, Dust and Fluid Ingress, etc.)
- Power Line (Voltage, Frequency, Distortion, Transients, Dropouts)
- Highly Accelerated Life Test
- Electrostatic Discharge
- Accelerated Life Test
- Electromagnetic Compatibility (Radiated Emissions, RF and Conducted Susceptibility)
- Fragility Boundary and Packaging
- Reliability Demonstration
- Highly Accelerated Stress Screening
- Ongoing Reliability Test

How does a company best acquire the knowledge and infuse it throughout New Product Development. How does one "cover the waterfront" with a finite headcount and budget?

With credit to Jim Deane (former Quality Manager of Hewlett-Packard Disk Drives in Boise, Idaho), Chet Haibel will explain how a typical, ineffective, Reliability Engineering department was reorganized into a group of world class experts who were instrumental in achieving a ten-fold increase in the reliability of HP Disk Drives. Chet then went on from HP to IVAC, a medical device company, and applied the same reorganization process with the same result, illustrating its universal applicability. This two-hour webinar will show how to increase both the depth of understanding and the breadth of application of reliability engineering knowledge in your organization.

Shock & Vibration – Test, Design and Design Assurance by Dr. Alec Feinberg - $850

4 day webinar March 20-21 and 27-28, 2018 3.5 hours each day

Understanding of vibration and shock stresses is important for the design of reliable products for diverse applications, ranging from consumer portable devices to safety critical equipment operating in extreme environments. The initial section of the course covers vibration and shock concept, test methods and test equipment in detail. How to use vibration and shock equipment as design aids is also covered. Practical examples are used to illustrate the concepts and the attendees will perform the calculations themselves to help reinforce learning.

Design methods for vibration and shock are covered in the next part. We start by looking at the typical design maturity stages and how these will relate to different activities for the design process. For the actual design, we look at material selection relative to shock and vibration stress environmental conditions (issues for material modulus, yield strength, hardness, creep requirements, wear issues, fatigue, etc). We then detail isolation and damping design methods to protect against vibration and shock environments. We then look at design margins to assure robustness. A Monte Carlo method is introduced for stack up issues. A key to a successful design program and managing a project is the FMEA tool. We will overview both a top down and bottoms up approach to assure product success.

We then look at design assurance some of which was initially covered with the stage gate approach in design. We discuss reliability and quality analysis so the engineer has an understanding on their importance for design. We then go over some visual inspection methods that help in final product release. The course includes physics of failure and analysis methods so the engineer also has a chance to look at potential historical failure modes in manufactured products, how they occur and what failure analysis tools are needed to help determine root cause issues.

The course targets designers, engineers, test engineers and management. However, different sections vary in engineering level. We provide software to help in test and analysis to make the math easier. Students will be given a trial version of the DfRSoft software (30 day activation) for this course which is not mandatory but helps to accelerate learning. DfRSoft software is a multi-level program with different tools that includes shock and vibration module which greatly helps in teaching this course.

The Essentials of Risk Assessment and Risk Mitigation by David Auda - $200 7/24/19

2 hours

Course Description:

Risk analysis can be part of the preventive efforts in development as well as part of the process that is activated once an unanticipated failure has occurred, referred to as Risk Mitigation. On the preventive side it may include things like Preliminary Hazards Analysis, Risk Assessment, Failure Modes and Effects Analysis, Fault Tree Analysis, etc. It may also include things like Designed Experiments, Accelerated Life Testing and/or Highly Accelerated Life Testing when new technologies, new materials and/or new applications are explored. On the reactive side of risk, when a failure has already presented itself, the effort would include Root Cause Analysis along with some of the aforementioned testing approaches to confirm solutions. All of the above mentioned tools should be evidence based, and as such, require guidance on decision making given the available evidence. The supporting data of a failure may be very limited in some cases and reliance could depend on testimony and/or beliefs. This webinar will serve those practitioners that are tasked with deciding on what tool is appropriate, what level of competence is required, and what types of evidence are acceptable. With systems complexity outpacing the ability of traditional risk investigation tools to deliver robust results, some discussion of 'next steps' will be included, time permitting.

The HTOL King Has No Clothes! by Professor Joseph Bernstein - $200 -1/23/19 2 hours

Modern Reliability Prediction Requires Multiple Accelerated Life Tests
To this day, the users of our most sophisticated electronic systems that include opto-electronic, photonic, MEMS device, etc. are expected to rely on a simple reliability value (FIT) published by the supplier. FIT is incorrectly determined today due to the product qualification use of HTOL (High Temperature Operating Life) and JEDEC or other standards. Manufacturers reports 'zero-failure' data from single-point tests using a single-mechanism model to fit an expected MTTF at the operator's nominal expected 'use' conditions, giving erroneous and misleading results.

The zero-failure qualification is well known as a very expensive exercise providing nearly no useful information to the user. As a result, designers often rely on HALT testing and on handbooks such as Fides, Telecordia or Mil Handbook 217 to estimate the failure rate of their products, knowing full well that these approaches act as guidelines rather than as a reliable prediction tool.

Furthermore, with zero failure required for the "pass" criterion as well as the poor correlation of expensive HTOL data to test and field failures, there is no communication for the designers to utilize this knowledge in order to build in reliability or to trade it off with performance. Prediction is not really the goal of these tests; however, current practice is to assign an expected failure rate, FIT, based only on this test even if the presumed acceleration factor is not correct.
We expose, in this tutorial, the actual lies that are propagated today based on incorrect use of statistics by JEDEC and other standards organizations. We then demonstrate a simple way to achieve accurate predictive reliability assessment by way of "Failure In Time" (FIT). We will evaluate the goal of finding MTBF and evaluate the wisdom of various approaches to reliability prediction. Our goal is to predict reliability based on the system environment including space, military and commercial. It is our intent to show that the era of confidence in reliability prediction has arrived and that we can make reasonable reliability predictions from qualification testing at the system level. I will demonstrate how physics of failure models in conjunction with qualification testing through a Multiple Test Operational Life (MTOL) matrix solution makes cost-effective reliability predictions that are predictive and based on the system operating conditions. Furthermore, we will show experimental evidence that the thermal activation energy is non-constant over the operational temperatures as well as a non-constant voltage acceleration factor in standard devices.

In this seminar, you will learn:
Understanding of constant-rate failure prediction (MTBF and FIT)
Statistical inconsistencies and outright lies propagated by JEDEC
How accelerated tests can be designed for multiple mechanisms
How multiple-mechanism models can be linearly combined using FIT
How this linear combination can make realistic reliability prediction

About your instructor:

Professor Joseph Bernstein is an expert in several areas of nano-scale micro-electronic device reliability and physics of failure; including packaging, system reliability modeling, gate oxide integrity, radiation effects, Flash NAND and NOR memory, SRAM and DRAM, MEMS and laser programmable metal interconnect. He has licensed his own technology and consulted for RFID and SRAM applications related to fuse and redundancy and for programmable gate arrays and system-on-chip. He directs the Laboratory for Failure Analysis and Reliability of Electronic Systems, teaches VLSI design courses and heads the VLSI program at Ariel University. His Laboratory is a center of research activity dedicated to serving the needs of manufacturers of highly reliable electronic systems using commercially available off the shelf parts. His latest project is to qualify COTS for satellite operation. His 2006 publication entitled, "Electronic Circuit Reliability Modeling," *Microelectronics Reliability* has been referenced over 100 times. Since that time, his formulations have become integrated throughout much of the electronics industry. He lectures around the world, presenting his common-sense approach to reliability testing and reliability. He also closely works with both testing and reliability software companies.

Top 10 Most Frequently Asked Questions on HALT & HASS by Aldo Fucinari – $200 – 8/1/2018 – 2 hrs

Over many years of conducting seminars in HALT and HASS, some of the same questions come up time and time again. These questions are also posed when people are just starting to consider the benefits of product ruggedization using the HALT discovery technique. Mr. Fucinari encapsulates lessons learned from Dr. Gregg Hobbs and Chet Haibel as well as his own 15 years of HALT and HASS testing and consulting. No matter what type or category of product that you have these principles will apply.

1. *I don't like going beyond the product's specs or the components' specs. Isn't that wrong?*

In this first segment we will look at the economy of current methods vs. the economy and effectiveness of HALT. A probability of failure chart based on stress levels will be compared with expected field AFR for a product (annual failure rate).

2. *Once my product design is Ruggedized using HALT, why do I ever need to run HASS?*

The instructor will reveal real world examples of manufacturing and supplier defects that can only be found during HASS testing.

3. *Isn't HALT vibration really just shock, not vibration? How are Gs of swept sine related?*

Understanding the difference between vibration modes are key to the way HALT works. Random vibration and 6 degree of freedom vibration will be explained.

4. *How can I use HALT To Predict the Life of My Product?*

This is probably the most frequently asked question of all. An example will be provided that explains this phenomenon in real terms. You will be provided with the instructors approach which has been proven in virtually every case where there is existing field AFR data.

5. *Our products are already shipping, won't I need to wait for the next generation product development to do HALT?*

This is very common misunderstanding. It is actually extremely valuable to run HALT on an existing shipping product for a number of reasons.

6. *One part of my HALT vibration table reads at a different Grms level than another part. Shouldn't they be exactly the same?*

Probably the 2^{nd} most frequently asked question. The instructor will answer this question then proceed to an example of how to qualify the vibration levels on a multiple unit HASS fixture. We will also look at coupling losses and how to work with them.

7. *I already have fixtures designed and in use for my ED shaker testing. Why can't I use them for HALT?*

The way HALT vibration is generated is very different from an ED shaker. The differences will be explained including instantaneous peak head room which is 10X in HALT compared with 3X with ED shakers.

8. *I don't feel comfortable running HASS, doesn't HASS remove life from my product?*

All cycle fatigue will remove some fractional amount of life. However, HALT, when done properly, extends the expected life of the product. Safety of screen insures that the product can be confidently shipped and still survive well past warranty.

9. *Can I use my HALT fixtures for HASS?*

Depending on the product under test and how the HALT fixture is designed, HASS requires the maximum number of units are populated in the chamber at one time. Examples will show how to optimize a HASS fixture.

10. *What stress levels do I start with to design a HASS test profile?*

We will look at different product classifications and how much stress is appropriate for our HASS test. The instructor will walk through 3 different product classifications and the correct "Depth of Screen" to apply to each.

Top 5 Most Frequently Asked Questions on HALT & HASS by Aldo Fucinari & Chet Haibel – FREE – 10/31/2013 - 1 hr + Q&A

Aldo Fucinari and Chet Haibel team up to answer the top 5 most commonly asked questions about HALT and HASS in this free one hour webinar. This is a chance to not only hear their responses to these questions, but also to ask any additional questions that you may have in an interactive session.

The following questions will be covered on HALT & HASS:

1. I don't like going beyond the product's specs or the components' specs. Isn't that wrong?

2. Once my product design is Ruggedized using HALT, why do I ever need to run HASS?

3. My current test regimen calls for shock testing my product, isn't HALT only a vibration test? How are swept sine G's related to G rms?

4. How can I use HALT To Predict The Life of My Product?

5. I don't feel comfortable running HASS--doesn't HASS remove life from my product?

Over the years working with many client companies, these seem to be the top 5 recurring questions that people ask about HALT & HASS. In this webinar, we will concentrate on these 5 questions as topics to present. For each topic we will reveal the answers in plain and simple terms along with diagrams, pictures and some references to real world examples. The presenters have many years of collective experience and interaction with companies that have deployed HALT & HASS and are still being asked the same questions, seemingly due to misunderstandings of the techniques. You are welcome to attend as an introduction to our webinars and to learn about deeper related topics that we have to offer from our instructors at Hobbs Engineering.

Understanding Shock & Vibration by Dr. Alec Feinberg - $350 – 11/7/2018 – 3.5 hrs

This course provides excel based software to aid the student in quickly learning shock and vibration fundamentals. With the DfRSoft Shock and Vibration Software, the student will be able to specify shock tests and perform a number of analyses. The course will start with the basics, defining such terms as "G", "g", "Grms", and "G-Force". We will explain the physics of shock and vibration in understandable terms. At the end of this course the student will be able to clearly understand shock and vibration, its terms, how tests are specified, and have the capability to apply software as a test aid. Every section described below will have many examples to aid the student.

Shock Test and Analysis
The course will overview the different types of mechanical shock and test methods, including drop shock and electrodynamic shock pulse and Shock Response Spectrum (SRS) testing (and how these tests are specified). The software will help the user specify drop height, Gs, pulse durations and the need to calibrate the equipment.

Constant Acceleration
We will overview constant acceleration physics and testing. The student will understand the basics terms (RPN, Gs, and equipment radius) and how to specify this test and what key elements are needed to perform a successful constant acceleration test.

Sine Vibration
Sine vibration fundamental and physics will be explained in understandable terms, including natural and forcing frequency, damping, Q, and resonances. The student will be able to use the software to understand vibration testing and the interrelationships between sine amplitude, frequency, velocity and acceleration. We will discuss circuit board and equipment sine search resonance track and dwell testing, definition of an octave, sweep rate, graphical sine estimation of Q from the data and how to estimate if the resonance is too large and requires damping. The software will help the student understand the proper octave sweep rate for resonance searching and key locations to place an accelerometer. We will introduce S-N fatigue curves and the use of Minor's rule. A discussion on time compression will follow for the vibration acceleration model and how to use it for fatigue life testing.

Random Vibration
Here we will introduce why we do random vibration, how to understand the frequency domain and the test specification, including common tests that are specified. The student will be able to estimate from the G2/Hz Power Spectral Density

(PSD), the G-level content for both simple and complex spectra. An overview of basic random as well as sine on random, random on random, tri-axial and angular vibration testing will be discussed. We will explain how to use random vibration to estimate Qs observed in the PSD spectra. We will discuss the time compression for the random acceleration model and how to use it for fatigue life testing. Repetitive shock will be overviewed which is used in HALT testing and how this spectrum differs from random vibration. What are the strengths and weakness of repetitive shock? When to use HALT versus electrodynamic (ED) random vibration testing? An introduction to HALT testing will be provided. Finally we will discuss how it is possible to do a HALT like test on an ED shaker. This will help the student understand some of the differences between HALT and ED test capabilities.

Required Tool from DfRSoft.com
DfRSoft.com software module requires Excel 2003 or higher. This will be supplied for free.

Using Finite Element Analysis with Electronic Equipment: Thermal Cycling, Heat Transfer and Vibration Analysis by Steve Carlson - $350 – 1/20/2016 – 3.5 hrs

This 3.5-hour webinar, which costs $350, expands on David Steinberg's techniques and incorporates finite element analysis to determine electronic component junction temperatures and fatigue life due to random vibration and thermal cycling. This webinar is intended for beginners who have not yet had a course in finite element theory. The emphasis is on the engineering reasons to complete a valid finite element analysis. For completeness, it has been necessary to select specific software to illustrate the various stages. Most commercial solid modeling and finite element analysis systems are very similar, and the overlap in their capabilities is probably 90% or more. Solidworks has been selected due to its rapid learning curve and ability to perform most common finite element analysis for electronic hardware. Students will learn the stages of finite element analysis and work multiple examples with Solidworks Simulation and Cosmos/M Geostar. We will Incorporate Professor Steinberg's methods with FEA techniques to perform heat transfer, random vibration, and thermal cycling analyses.

Using Full Scope of Environmental Testing to Gain Rapid Design Cycles & Product Maturity by Aldo Fucinari - $300 – 3/5/2014 – 3 hrs

This webinar is a continuation of Mr. Fucinari's series of webinars on how HALT adds value to the design, development and manufacturing processes. This webinar will focus on the following topics.

• To understand the most efficient ways to integrate HALT into the design process so that it is most effective at ruggedizing products and reduces total design cycle time.

• To best understand how to gain the most useful information during testing to maximize the learning process and re-use of key data for future design efforts and value streams.

• Dr. Gregg Hobbs 6 step HALT process is amplified in the context of Lean engineering principles. Those steps are Precipitation, Detection, Failure Mode Analysis, Corrective Action, Validation of Corrective Action and finally knowledge storage and retrieval.

This webinar is based upon Mr. Fucinari's own experiences as well as the book *Accelerated Reliability Engineering* by Dr. Gregg K. Hobbs.

Who should attend:
• R&D, Engineering and Program Management
• New Product Introduction Teams
• Quality & Reliability Engineers and Management
• Test Engineers
• Mechanical Engineers
• Application & Sales Engineers

Using HALT Limit Comparisons for Improving Operational Reliability by Kirk Gray - $200 – 1/31/2012 – 2 hrs

Reliability engineering historically has been focused on component wear-out or "absolute life" where a component or subsystem catastrophically fails. Operational reliability, that is, failures of operation that can be recovered from by power cycling may not have been typically a part of HALT. Even though HALT has been used by many companies to insure that their designs are robust and reliable, many of the same companies may have significant levels of warranty returns that when tested have no apparent problems. Many of these apparent failures can be due to lot-to-lot marginal signal integrity or variations in signal timing and propagation. This can lead to costly churn of apparently good parts replacing good parts.

This webinar provides a basic review of the misdirection of traditional reliability theories and approaches. It will cover the difference in the HALT approach and present some new combinations of stress HALT for evaluations of operational or functional limits to make component and sub-system selection during design plus insure margins during HASS. This all leads to the rapid discovery of intermittent or marginal signal integrity and timings particularly in digital circuits. We show how the use of thermal stresses and limit comparisons result in more tolerance of lot-to-lot and second source parametrics variations during design and later to use for HASS during production.

Vital Methods for Reliability & Quality by Dr. Alec Feinberg - $350 – 5/13/2015 – 3.5 hrs

This course is designed to help one enhance their background with key topics in reliability and quality as both are paramount in the daily workplace. Knowledge of one without the other will leave gaps in ones capability and be costly in the workplace. Understanding the analytical methods available, can be of great benefit in making the best choices in products development. Excellent reliability is a partner to high quality and vice versa. This course is put together in a time efficient manner to fit everyone's tight schedule. We will overview important reliability and quality methods that are used for success from a technical point of view. The course will help the attendee acquire a sound technical foundation. On the reliability side, we will cover Field Return Analysis, Exponential analysis and basic Weibull Plotting, Weibull Mixed Modes field return analysis, product Strength and Load usage Interference for assessing reliability, and Availability and Sparing. In the quality area we will not spend time on items like house of quality, but rather work on the technical side of the quality area as these are often not well covered in courses. We will cover Understanding and performing Design of Experiments, the related method of Multiple Regression using Excel, Cpk-Yield analysis, Normality, Six Sigma Analysis, Defects per Million Opportunities, Stack Up, SPC Charting, and Lot Sampling. This is an intense course, be prepared for the full session.

We will start on the reliability side with field data. How best to obtain a good MTBF value from return data? What are the best ways to characterize field failure rate. How do we translate MTBF into percent defective? Can we do something like a Weibull plot to assess field data? This will lead us to the basics of Weibull and Exponential analysis and a discussion on mixed modes, multiple distributions in Weibull analysis.

Often our MTBF can be a poor number that we do not wish to present to our customer. We discuss alternatives like providing customer satisfaction through great availability numbers. High availability includes a successful sparing plan. We discuss how to know what spares one should keep for the highest probability of success.

Lastly, in the reliability area we will look at the concepts of strength and load Interference analysis. How can we determine the reliability from knowledge of applied load and product's strength characteristics?

We will then move into the quality topics diving into the area Design of Experiment (DOE). We will Look at a 2 factor and a 3 Factor L8-type of DOE. Full and fractional DOEs are discussed. We will explain how multiple regression is related to DOE analysis. We will go over the L8 main effects, interactions, and ANOVA table. We then go over some basic quality metrics starting with Cpk, yield, normality and six sigma math and how it is applied. We describe key goals and the best ways to understand how to use these valuable quality tools. We suggest an alternate graphical method to better assess normality other than the bell shaped curve.

We will then look at stack-up which has a compounding effect in parts variation impacting quality control in production. We will go over the basic principles of stack up and also an advanced method where we teach the Monte Carlo stack up approach using Excel.

Studying deviations and defects in this way allows us to move into the area of six sigma which focuses on the improvement of product deviations and defect. Six Sigma is a term that is often confused with the statistic itself. We can compare a six sigma calculator to a Cpk calculator to understand these differences. This will lead us to using the quality statistic of defects per million opportunities in testing? We cover these key six sigma statistical tools. We will also look at statistical process control charting. When do we pair X-bar charts with R-charts rather than S-charts? How do we define the SPC lot size? Not to be confused with lot sampling. Lot sampling is also covered to understand how to assure proper lot acceptance or rejection. Understanding risks using the Operational Curves (OC), Average Quality Level (AQL) and its related Lot Tolerance Percent Defective (LTPD). These are key metrics to devising a good sampling plan. Sometimes it can actually be cost effective to do double sampling which is also discussed.

Technical Quality Methods & Tools Outline

Reliability Area

- **Field Returns & Supporting Concepts**
  (MTBF, AFR, Device Hours & Exponential Distribution)
    - Constant Failure Rate/MTBF Math
    - Exponential Distribution Math
    - Company Metrics Often Used MTBF and AFR
    - MTBF and AFR Basic Math
    - Device Hours Concept
    - Percent Failure BX% & MTBF
    - Basics of Field Returns
    - Translating returns data into MTBF
- ***Introduction to Basic Weibull & Exponential Analysis***
    - Weibull Model
    - Concept of Beta and Bathtub curve
    - Life Data Analysis
    - Reliability & Failure % Estimation
    - Returns Data Analysis
- **Plotting Mixed Modes**
    - When to use Weibull methods for field returns
- **Availability & Sparing**
    - Why availability is likely a better number for your customer
    - Availability basics
    - Sparing optimization
- **Obtaining Reliability from Product Strength and Applied Load**
    - Assessing reliability from product strength and load variations

Quality Area (90, 1 hr 50 min)

- **DOE & Multiple Regression**
    - Introduction – DOE Basics
    - Factors & Setting
    - Measuring the Outcome
    - P- Values
    - ANOVA Table
    - Advanced L8 DOE Example
    - Full vs. Fractional
    - Multiple Regression & DOE
    - Multiple Regression in Excel
    - L8 Runs and Outcome
    - Main Effects & Interactions
- **Cpk, Yield, Normality**
    - Translating Cpk into Yield
    - Assessing normality
    - Central limit theorem and proper sample size
    - Cpk goal
- **Six Sigma Analysis**
    - Difference between Six Sigma and a Cpk calculator
    - Six sigma goal
- **Defects per Million Opportunities & Your Six Sigma Process Value**
    - Production assessment of defects
- **Normal/Lognormal Histograms and CDF plots**
    - Bell shape curve vs alternative methods to look at normality
- **Stack Up**
    - Compounding deviations
    - Monte Carlo Method for stack up assessment using Excel
- **SPC Control Charting**
    - X-bar, R Charts or S charts
    - SPC Lot size
    - Charting rules for flagging poor process trends
- **Lot Single & Double Sampling**
    - Hypergeometric vs Binomial sampling
    - Consumer and producer Risks using OC curves

- Single sampling
- Double lot sampling to save money

Weibull Engineering Intro Using Weibull Plotting Software by Wes Fulton - $300 6/5/2019

Course Description: There's Weibull, and then there's Weibull Engineering (WE). The Weibull model was promoted originally by Waloddi Weibull before, during, and after the 1950's. Weibull is the most widely-used probability model for how failure mechanisms affect product lifetime, key for problem analysis and problem solving and problem forecasting, but that's not the only application. Although Dr. Weibull is no longer with us, his methods and insights carry on in countless new applications here in the 2000's. **WE** extends the Weibull model to real engineering application throughout all product cycle phases especially for continuous improvement efforts.

This 3-hr **WE** DEMO session features overview of topics in The New Weibull Handbook(c) latest edition authored by Dr. Bob Abernethy, the #1 world expert in Weibull for over 35 years. Each session attendee receives unlimited use of the free SuperSMITH(R) DEMO software for installation on Microsoft Windows(R) platforms or Windows simulators. The latest version of this software is available for free download at http://www.WeibullNEWS.com on the internet. Also, a free PlayTIME(TM) DEMO tutorial booklet in ".PDF" format is available at the same internet address. The tutorial booklet has over 50 case-study examples with step-by-step instructions for solution and covers every type of problem and every related software option. Each session attendee is encouraged to follow the steps on their own computer to solve using the free DEMO software and tutorial.

This overview is designed to bring the novice up to rigorous understanding of **WE** capability. Topics include type of input data to acquire, how to make a Weibull plot, alternate fitting methods, alternate models, better solution for small data sets, failure analysis, failure forecasting, optimal preemptive parts replacement for parts that wear out, cost analysis, confidence, test planning, accelerated testing, and the importance of a Weibull database especially for Weibull slope values. Relevant questions at any time are welcome during the session.

NOTE: The DEMO software performs actual solution for previously-saved data sets provided for the overview and allows for exercise of all options in the software. Other input data, not previously saved from this software, is randomly altered before analysis. This arrangement allows for free distribution of the DEMO software.

Who should attend: Original Equipment Manufacturers (OEM's), Suppliers, Source Control Document (SCD) Writers, Design Professionals, Reliability Professionals, Quality Professionals, Manufacturing Professionals, Test Planners, Test Technicians, and Equipment End-Users (EU's).

When is MTBF Right? by Chet Haibel - $200 - 8/26/2015

MTBF has gotten a bad reputation. Is it deserved?

This 2-hour webinar, which costs $200, first looks at what causes failures in general and what mathematics govern all failure types. Then Mean Time To Failure (MTTF) is shown as a very general property of any (non-repairable) part or component, independent of its failure type or failure distribution. MTTF sometimes provides useful information and sometimes it is deceptive. An example of a deceptive MTTF is illustrated by an X-Ray tube whose failures are Exponentially distributed. Delving into detail, the Exponential distribution is seen to also have its useful points.

Next the distinction between Repairable and Non-Repairable products is explored, noting how that changes the relevant metrics and introduces some new cautions. Then Mean Time Between Failures is displayed, warts and all. Examples of using it correctly and some examples where one can get into trouble are illustrated. The X-Ray tube is revisited with a different underlying distribution to introduce the Weibull Distribution. The Weibull Distribution is presented as the Crown Jewel of Reliability Engineering because of its ability to accurately direct improvement efforts.

This webinar has some unavoidable mathematics, but much of it is presented as "nerd fodder" and can be bypassed for those not inclined to snuffle in the details.

When To Do A HALT/HASS Test vs Electrodynamic (ED) Shaker Test by Dr. Alec Feinberg - $200 - 11/4/2015 - 2 hrs

Vibration testing has actually gotten more confusing today than people realize. HALT has become so popular, that many people do not even take the time to understand vibration exposure and the types of tests that are available on Electrodynamic (ED) shakers including shock and sine testing; as well many people may not even understand that ED shakers do random vibration as well. This short course will clarify when to do an ED test instead of a HALT test and vice versa and what type of test to do.

This two-hour course, which costs $200, will cover the strengths of ED shakers compared to HALT. HALT and ED shakers both produce high intense vibrations that can test and screen your product. In this short course we will explain the use of one method over the other. How does the quality of HALT vibration compare to electrodynamic vibration? How are these tests methods different? Are we actively using one tool too much due to limited options? Also, is there a difference from an analytical view point or is the bottom line simply vibration exposure? We need to understand our analytical limits as well. It is important to understand the differences as vibration testing is very expensive and time consuming; we need to make wise investments decisions when testing. In this course we will address these concerns. We will look at our options and when these tests can actually overlap and when they do not. We will provide insight to help guide one in smart test choices.

Why HALT Will Not Give You a MTBF & Why You Should Not Care by Mark Morelli – FREE – 6/4/2014 – 1 hr

Managers and engineers eagerly anticipate accelerated stress test results for various reasons. Some look forward to verify that their products are “reliable”, others look to identify weaknesses in a new design, and still others think that a “reliability number” can be calculated based upon the results.

This webinar will focus on making the case for recommending that results from a particular form of accelerated testing, Highly Accelerated Life Testing (HALT), are not used in the calculation of reliability parameters such as Mean Time Between Failures (MTBF). HALT should instead be used as a means to make a product more robust, which can then withstand the manufacturing and end use environments.

The traditional definition of MTBF is the cumulative total operating time divided by the number of failures occurring in a repairable fleet of products. The equation $MTBF = OT/N_F$ is used in the airline industry. For example in a fleet of units fielded with 15 failures occurring in 10 million operating hours the MTBF would be equal to 10 million/15 = 666,667 hours. It doesn’t provide any indication of the underlying failure distribution.

HALT is a process typically applied to electronic products that uses temperature, vibration, and electrical stress in various combinations on a few test articles in order to identify potential weaknesses. Those defects that are likely to occur in the field under expected operating conditions should have corrective action implemented and verified.

Why HALT doesn’t give you a MTBF This section will provide some examples of why HALT cannot provide a MTBF value.

Why Weibull?...Why Not! by Dr. Joseph Bernstein – $200 - 4/29/2015 - 2 hrs

All reliability professionals are required to report reliability in simple-to-understand yet meaningful metrics. Typically, Mean Time To Fail (MTTF) or Defective Parts Per Million (DPPM) is used by many industrial practitioners as a way to communicate the calculated reliability of a product, device or system. Most metrics for reliability assume a constant hazard rate or constant failure rate statistical approach. This is mathematically described as a time invariant Poisson process. This is exactly the "exponential" reliability model as is well known by most industries and is the working assumption when using MTTF or other such metrics.

In reality, everyone knows that some equipment have wearout or fatigue mechanisms that accumulate over time and makes the likelihood of an older product inherently more susceptible to failure than a new piece of equipment. Similarly, companies are constantly working on reliability growth and improvement with each generation making the decision to upgrade implicitly a decision to improve long-term reliability. Also, defects are often seen during product introduction and decreasing failure rates are observed.

This 2-hour tutorial, which costs $200 per person, will focus on the mathematical basis for exponential reliability models and how they are justified by physics of failure and basic assumptions of thermodynamics. The physics and statistics are then extended to justify using the Weibull distribution to describe more accurately the failure distribution in the field. However, this information is often lost in communication since MTTF is not appropriate once the Poisson model is no longer used. Furthermore, Weibull describes both decreasing as well as increasing failure rates and the information contained therein is lost when converted to a single MTTF parameter.

This tutorial will develop the understanding needed in order to decide when it is appropriate and when it is not appropriate to use Weibull statistics as opposed to Poisson statistics. Participants will learn the tools to develop their own insight as to when the MTTF statistic is meaningful and can be used for making proper reliability decisions. Through some simple mathematical formalisms and basic understanding for thermodynamics, participants of this webinar will learn for themselves how Weibull is often a useful measure for describing reliability and how it is often inappropriately used. Our goal will be to clarify any confusion that exists as to the proper way to report reliability using single statistical metrics or when more sophisticated metrics are required.

Our Instructors:

David Auda is a senior Reliability engineer working in the commercial vehicle domain. David has experience in automotive, energy, aerospace, medical devices, instrument development, nonprofits and has worked across the disciplines supporting new product development, manufacturing, management and leadership. David is a validated ASQ trainer and is a recurrent presenter at international conferences and symposia.

Albertyn Barnard received the degrees M Eng (Electronics) and M Eng (Engineering Management) from the University of Pretoria, South Africa. He has provided consulting services in reliability engineering to the defence, nuclear, aerospace and commercial industries since 1982. He won the Best Paper Award at the 2004 INCOSE SA conference in Pretoria, South Africa, as well as the Gold Award at the 2009 International Applied Reliability Symposium in Barcelona, Spain. He served as President of INCOSE SA in 2008, and established the first commercial HALT laboratory in South Africa.

Professor Joseph Bernstein is an expert in several areas of nano-scale micro-electronic device reliability and physics of failure; including packaging, system reliability modeling, gate oxide integrity, radiation effects, Flash NAND and NOR memory, SRAM and DRAM, MEMS and laser programmable metal interconnect. He has licensed his own technology and consulted for RFID and SRAM applications related to fuse and redundancy and for programmable gate arrays and system-on-chip. He directs the Laboratory for Failure Analysis and Reliability of Electronic Systems, teaches VLSI design courses and heads the VLSI program at Ariel University. His Laboratory is a center of research activity dedicated to serving the needs of manufacturers of highly reliable electronic systems using commercially available off the shelf parts. His latest project is to qualify COTS for satellite operation. His 2006 publication entitled, "Electronic Circuit Reliability Modeling," Microelectronics Reliability has been referenced over 100 times. Since that time, his formulations have become integrated throughout much of the electronics industry. He lectures around the world, presenting his common-sense approach to reliability testing and reliability. He also closely works with both testing and reliability software companies.

Steven Carlson has 20 years of extensive experience in defense/aerospace industry dealing with design and analysis of electronic hardware with a strong understanding of thermal and structural analysis. He is the principal engineer at Carlson Mechanical Engineering and has provided mechanical analysis services to Northrop Grumman, Physical Optics Corporation, and multiple other electronic manufacturers for military and commercial applications. Steve holds a Masters in Mechanical Engineering and currently works at Jet Propulsion Laboratory (JPL) performing thermal and structural analyses on space based electronic hardware.

Steve learned the classical techniques for analyzing electronic hardware from Joel Sloan (author Design and Packaging of Electronic Equipment) who was a colleague of Dave Steinberg (author of multiple thermal and vibration analysis books) at Litton Guidance and Control Systems. Steve has expanded the classical techniques to include modern solid modeling and Finite Element Analysis to reduce analysis time, improve accuracy, and decrease product development time.

He worked under the mentorship of Joel Sloan at Litton Guidance and Control Systems on navigation grade systems (LN-100, LN-200, and LN25x) and development programs (Fiber Optic Gyro and Silicon Accelerometer). Steve has worked on multiple flight programs at JPL including the Mars Science Laboratory and Juno performing heat transfer and vibration analyses on electronic hardware at component and system level.

Dr. Jean-Paul Clech has 25+ years of practical experience in SMT design, soldering quality and reliability assurance. He maintains one of the largest databases of solder joint reliability data, material properties and life prediction models in the industry and is constantly challenged by problems brought about by new and emerging technologies. Jean-Paul is the founder of EPSI Inc. in Montclair, NJ, where his responsibilities include technical consultation and problem solving for clients across the electronics industry, and the development of engineering tools and training programs to prevent or solve reliability problems in electronic packages and board assemblies. He has also served as an expert-witness in product litigations involving package and solder joint field failures.

Jean-Paul previously was a Member of the Technical Staff and then consultant at AT&T Bell Laboratories. He received the Diplôme d' Ingénieur from Ecole Centrale de Paris, France (Materials Science major), and the M.S. and Ph.D. degrees in Mechanical Engineering from Northwestern University, Evanston, IL. He is the author of over forty technical papers, a frequent speaker at technical conferences, and has been an invited lecturer and instructor at various corporate events and professional venues in Asia, Europe and North America. He is an active member of ASME, IEEE, IMAPS, TMS and SMTA. In 2003, Jean-Paul received the SMTA Member of Distinction award. In 2006, he was presented with the IPC's Distinguished Committee Service award in appreciation and recognition of his contribution to the development of IPC-9701A, Performance Test Methods and Qualification Requirements for Surface Mount Solder Attachments. In 2009, Jean-Paul and his co-authors from Hewlett-Packard received a best paper award at the SMTA International Conference.

Dr. Abhijit Dasgupta, Professor of Mechanical Engineering at the University of Maryland, has conducted over 20 years of research on Physics of Failure (PoF) approaches for developing reliable, complex multi-functional systems that perform electronic, photonic, and mechanical functions. This research, sponsored by a consortium of leading electronics builders/users at the Center for Advanced Life Cycle Engineering (CALCE), focuses on industry-relevant projects in reliability assurance of electronic systems, MEMS, sensors, actuators, and 'smart' composite systems. He has consulted for many major electronics manufacturers, published over 250 journal articles and conference papers on these topics, presented over 35 short workshops nationally and internationally, served on the editorial boards of three different international journals, organized several national and international conferences, and received seven awards for his contributions in materials engineering research and education.

Dr. Alec Feinberg is the founder of DfRSoft. He has a Ph.D. in Physics and is the principal author of the books, Design for Reliability (DfR) and Thermodynamic Degradation Science: Physics of Failure, Accelerated Testing, Fatigue, and Reliability Applications. These books are written in an industrial environment, and are very practical. Alec has a logical approach to the DfR processes using a stage gate method since products are develop in these phases. Alec uses this method in his reliability training classes as well found on the DfRSoft website. Alec is also the principal developer for DfRSoftware which is the most thorough reliability tool currently available and is also used to accelerate learning in his training classes. Alec's industrial experience has allowed him to provide extensive reliability engineering services in diverse industries (AT&T Bell Labs, TASC, M/A-COM, Tyco Electronics, and Advanced Energy) for over 35 years on solar, thin film power electronics, defense, microelectronics, aerospace, wireless electronics, and automotive electrical systems. He has provided training classes in Design for Reliability & Quality, Shock and Vibration, HALT, Reliability Growth, and Electrostatic Discharge. Alec has presented numerous technical papers and won the 2003 RAMS Alan O. Plait best tutorial award for the topic, "Thermodynamic Reliability Engineering."

Aldo Fucinari has over 39 years' experience in design validation testing, electrical engineering and environmental testing and holds a BSCE degree in Computer Engineering. He has worked in various fields of engineering including reliability, verification and validation, process control, quality assurance, systems engineering, hardware, software and product development. He is currently senior consultant for RapidDiscoverySystems.com environmental testing consultants and is partnered with Hobbs Engineering and Quality Testing Services to provide end to end HALT, HASS and specialized environmental testing solutions. Now as an independent environmental reliability-testing consultant, he is involved with world-class companies in bio-medical, computer, consumer and automotive products. Currently he is doing reliability-engineering related work with ophthalmic measurement and surgical devices.

At Seagate Aldo was part of the initial deployment of Seagate's Design for Six Sigma program where he received certification as a Master Black Belt in DFSS and a Black Belt in Six Sigma process and transactional process.

Aldo has long-term experience with suppliers that are equipped to do full HASS and HASA testing. He is also a leading adopter of lean product development methods and design for manufacturability. He is a senior member of ASQ and a member of the Lean Product and Process Development Exchange.

Wes Fulton is the founder and CEO of Fulton Findings LLC, and the author of SuperSMITH(R) software, the leading Weibull Engineering program. The latest release of this software is touch-screen capable designed to work with Windows 10 but also to be backward compatible with other recent Windows versions. SuperSMITH is the only software fully compatible with the global Weibull specification IEC-61649 and 100% compatible with the world standard Weibull handbook by Dr. Robert B. Abernethy (Dr. Bob). Most material for this Weibull plotting class was originally developed by Dr. Bob, who was the head of supportability with Pratt & Whitney Aircraft Engines for decades. Dr. Bob's Weibull handbook is the seminar reference. Another publication provided with this session is the software tutorial booklet, "PlayTIME(R) with SuperSMITH DEMO".

Wes released the first widely-used Weibull plotting software in 1987. He has presented PRIVATE Weibull Workshops for the U.S. military, the FAA, the DOT, NASA, JPL, and over a hundred companies around the world. He has presented PUBLIC Weibull Workshops for the Society of Automotive Engineers (SAE), for the University of Tennessee, for the

American Society of Mechanical Engineers (ASME), for the American Society for Quality (ASQ), for the Reliability Information and Analysis Center (RiAC), and for Quanterion.

He has 16 years of experience as program engineer in the aerospace and nuclear industries focused on design, testing, fabrication, and customer service. Working at AiResearch Manufacturing Company, Wes was the responsible engineer for such programs as the F-16 fighter leading edge flap drive system, the IDF Taiwanese fighter leading edge flap drive system, the experimental X-31A leading edge flap drive system, and the 747 ride comfort control. While at AiResearch, he co-patented a multi-fusible shaft high-performance drive-train device.

Kirk Gray began working with Dr. Gregg Hobbs in StorageTek Corporation in 1989 and has 20 years of teaching and using HALT. He has over 32 years in the electronics manufacturing industry, the last 7 as a Senior Reliability Validation Engineer at Dell, where he created and implemented the HALT to HASA development process on Power Supply Units (PSU) that became a standard for all Dell PSU Suppliers and was recognized for being the highest ROI (Return on Investment) for the company. Kirk has presented papers at numerous conferences and authored articles for leading industry magazines. He holds a BSEE, University of Texas.

Thomas Green is the principle at TJ Green Associates LLC (www.tjgreenllc.com), a veteran owned small business focused on training and consulting for military, space and medical microelectronic devices. He teaches a variety of microelectronics packaging courses around the globe and in plant at major corporations and consults for a variety of companies in the military/industrial and medical device industries. He has thirty five years of experience in microelectronics working at positions in industry, academia and government. Tom has demonstrated expertise in die attach, wirebond, visual inspection, failure analysis, hermetic seal and leak testing processes. Tom is an active IMAPS member and Society Fellow. He has a B.S. in Materials Engineering from Lehigh University and a Masters from the University of Utah.

Chet Haibel, Master of Engineering – Instructor/Consultant: Demonstrating Reliability, HALT & HASS + Workshop, Medical Device Risk Management - Chet Haibel is an experienced leader in New Product Development, Reliability, Risk Management, and Quality. He has 29 years of reliability experience, including disk drives and a wide variety of medical devices. Chet holds Bachelor of Science and Master of Engineering degrees from Cornell University and is a certified Six Sigma Green Belt by Johnson & Johnson Company. Chet is a senior member of the American Society for Quality and is certified by ASQ as a Quality Auditor, Biomedical Auditor, Quality Engineer, Software Quality Engineer, Reliability Engineer, and Manager of Quality / Organizational Excellence.

Andre Kleyner has over 25 years of engineering, research, consulting, and managerial experience specializing in reliability of electronic and mechanical systems designed to operate in severe environments. He received the doctorate in Mechanical Engineering from University of Maryland, and Master of Business Administration from Ball State University. Dr. Kleyner is a Global Reliability Engineering Leader at Delphi Electronics & Safety and an adjunct professor at Purdue University. He is a Fellow of the American Society for Quality (ASQ), a Certified Reliability Engineer, Certified Quality Engineer, and a Six Sigma Black Belt. He also holds several US and foreign patents and authored multiple professional publications including three books on the topics of reliability, statistics, warranty management, and lifecycle cost analysis. Andre Kleyner is also the editor of the Wiley Series in Quality and Reliability Engineering (John Wiley & Sons). For more information please visit www.andre-kleyner.com.

John Lenss has worked with developing new products since 1985. Very early on in his career he was tasked with making sure the products he worked with were highly reliable. John has worked in many different industries from defense to medical devices; from power supplies, to digital signal processing. Mainly working on the microelectronics and software sides of the product, in a reliability/quality function. John holds a Bachelor of Science Degree in Physics and a Master's Degree in Counseling. He is a Senior Member of American Society for Quality. John has taught courses on many different topics including, DMAIC, Fault Tree Analysis, process capability, HALT, HASS, HASA, FMEA, and FMECA to name a few. John has written test plans at the unit test and system test levels. He has written quality and reliability plans and developed systems to measure the effectiveness of product modifications in the field to monitor both quality and reliability. He is the author of numerous articles for publication and has written over 90 test plans plus he has spoken at dozens of national and international conferences.

Mark Morelli has 32 years of reliability and test engineering experience on commercial, industrial, aerospace and military electronic, electrical, electromechanical and mechanical products and systems. In addition, he has taught mathematics and electrical engineering courses at the University of Hartford and has authored or co-authored and presented several technical papers on the subject of accelerated reliability methods, including a previous Hobbs

Engineering conference. He received a BSEE degree from the University of Hartford. Mark is a recognized leader in the field of accelerated stress testing, including Highly Accelerated Life Testing (HALT) and Highly Accelerated Stress Screening (HASS). He has planned, performed and supervised hundreds of tests in his career. On one product line, a 10:1 reliability improvement over the previous version (and millions of dollars in "cost-of-poor quality" savings) was realized within 3 years of implementing a HALT and HASS process.

Dr. Douglas Montgomery is Regents' Professor of Industrial Engineering and Statistics at ASU. He holds a BSIE, MS and Ph.D. degrees from Virginia Polytechnic Institute. Professor Montgomery's professional interests are in industrial statistics, including design of experiments, quality control, applications of linear models, and time series analysis and forecasting. He also has interests in operations research and statistical methods applied to modeling and analyzing manufacturing systems. He has lectured extensively throughout the Americas, Europe and the Far East. He has authored 13 textbooks and edited or co-authored 7 other research books or edited volumes. His research papers have appeared in many journals.

Dr. Rong Pan is an Associate Professor of Industrial Engineering in the School of Computing, Informatics, and Decision Systems Engineering at Arizona State University. He received his Ph.D. degree in Industrial Engineering from Penn State University in 2002. His research interests include failure time data analysis, system reliability, design of experiments, multivariate statistical process control, time series analysis, and computational Bayesian methods. His research has been supported by NSF, DOE, Arizona Science Foundation, Air Force Research Lab, etc. He has published over 50 peer-reviewed journal papers and many more refereed conference papers. He was the recipient of 2008 and 2011 Stan Ofsthun Awards and 2015 William A. Golomski Award. His papers won 2012 and 2013 Best Reliability Paper Awards in *Quality Engineering* and 2017 SPES award by ASA. He is a senior member of ASQ, IIE and IEEE, and a member of SRE and INFORMS.

John Paschkewitz has over 43 years' experience in product assurance, testing, reliability and sustaining engineering in several industries. He holds a B.S. in Mechanical Engineering from the University of Wisconsin - Madison and a M.A. in Business Management from Central Michigan University. He is a graduate of the Defense Systems Management College Program Management Course. He is a registered Professional Engineer and ASQ Certified Reliability Engineer (CRE), a Senior Member of ASQ and a Member of SAE and ASME. He is a Regional Councilor for the ASQ Reliability Division.

Fred Schenkelberg is a reliability engineering and management consultant with FMS Reliability, with areas of focus including reliability, engineering management, training and accelerated life testing. He is able to bring the experience of over 100 design and maintenance programs to your team. He is spearheading the No MTBF movement and encourages your participation.

Fred founded the reliability engineering professional development site Accendo Reliability. Where there are many voices providing tutorials, articles, podcasts, webinars, and courses for your professional development pursuits. Check out accendoreliability.com and become a member today.

Previously, he co-founded and built the HP corporate reliability program documenting over $100 million in savings. He is a lecturer with the University of Maryland teaching a graduate level course on reliability engineering management. He earned a Master of Science degree in Statistics at Stanford University in 1996. He earned his Bachelor's degree in Physics at the United State Military Academy in 1983. Fred is an active volunteer with a few reliability focused professional organization and most proud of the ASQ Reliability Division Webinar program and the reliability calendar programs. He is a CRE and CQE.

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