HOBBS ENGINEERING | EDUCATION AND CONSULTING
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Summer Professional Development Event

Summer can be one of the best times to invest in professional development. As project schedules shift and workloads become a little more manageable, it's a great opportunity to deepen your technical knowledge and explore new topics. During our **Summer Professional Development Event**, we're offering special savings on a selection of our most popular technical webinar recordings listed below.

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Accelerated Life Testing (ALT) by Dr. Julio Pulido - $300 #07092025 - 3 hrs

This course provides an in-depth understanding of Accelerated Life Testing (ALT) methodologies. It covers the principles, design, implementation, and analysis of ALT experiments to predict product reliability. Participants will learn how to apply statistical models to accelerate the failure mechanisms, perform data analysis, and make reliability predictions.
Course Objectives:
Upon completion of this course, participants will be able to:

- Understand the fundamentals of ALT and its role in reliability engineering.
- Design and implement effective ALT experiments.
- Analyze ALT data using appropriate statistical models.
- Interpret results to predict product life and reliability.
- Apply ALT for product improvement and risk mitigation.

Course Outline:
Module 1: Designing an ALT Experiment

- Selecting stress factors and levels
- Determining sample size and test duration
- Test setup and data collection
- Stress screening and planning

Module 2: Life-Stress Relationship Models

- Arrhenius Model
- Eyring Model
- Inverse Power Law Model
- Model selection and parameter estimation

Module 3: Statistical Analysis of ALT Data

- Data visualization and preprocessing
- Parameter estimation techniques (MLE, Regression)
- Confidence intervals and goodness-of-fit tests
- Case studies and examples

Module 4: Applications and Case Studies

- Real-world examples from industries (e.g., Semiconductor, Automotive, Consumer Electronics)
- Product improvement through ALT
- Risk management and decision-making

Accelerated Test, Design and Analysis to Demonstrate Reliability by Dr. Alec Feinberg - $400 #11052025 - 4 hrs

This course 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.

Cooling Techniques for Electronic Equipment Overview by Steve Carlson - $300 #09242025 3 hrs

The purpose of this 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.

Demonstrating Reliability by Chet Haibel - $300 #10052016 - 3 hrs

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 with Emphasis on Product Knowledge Via Data Analysis and Testing by Dr. Julio Pulido - $300 #11202024 - 3 hrs

This course focuses on the principles and practices of designing reliable systems, products, and processes. Students will explore the importance of reliability in various industries and learn how to integrate reliability considerations into the design phase. Topics include failure modes and effects analysis, reliability modeling, testing methodologies, and case studies of successful reliability engineering. Emphasis will be placed on creating robust designs that meet or exceed reliability requirements.

By the end of the course, students should be able to:

1. Understand the fundamental concepts of reliability engineering.
2. Apply reliability analysis techniques to identify potential failure modes.
3. Incorporate reliability considerations into the design process.
4. Develop strategies for testing and validating reliability.
5. Evaluate and select appropriate materials and components for reliability.
6. Analyze case studies of successful applications of Design for Reliability.

How to Add Machine Learning Based A/B testing Techniques to Your Reliability Engineering Toolkit by Dr. Ananth Narayanan - $300 #03122025 - 3 hrs

Reliability practitioners predominantly use frequentist statistical A/B testing techniques. This webinar will enable them to add a variety of Bayesian Machine Learning (ML) techniques that can significantly enhance their DfX process. As reliability practitioners our job is to make risk-based, data driven decisions. Every day we are expected to answer a variety of questions. Is tool A better than tool B? Is one coating technique more corrosion resistant than the other? Design engineers want us to select the best diffusion barrier and the finance team wants to know if product X has a higher warranty cost than product Y. To answer these questions, we perform several tests and analysis which fall under the broad umbrella called A/B testing. Although the name suggests that this is a binary selection technique (A Vs B), in the real world we may have multiple factors with multiple outcomes that may either be categorical or continuous. Categorical outcomes are discrete and finite. For instance, the outcome of a mission reliability experiment can be a pass or a fail. Predicting the failure mode(s) in a system that has multiple competing failure modes is an example where multiple categorical outcomes are possible. One could also envision cases where the outcome is continuous, for example, time to failure for a product will yield a continuous distribution. Reliability practitioners widely use inferential statistical techniques for A/B testing. For classification problems where the outcomes are categorical, a Chi square test is widely used. For regression A/B testing where the outcomes are continuous, Student's t-test is used. If the variances are unequal, Welch t-test is used and if the distributions are not Gaussian, other non-parametric tests like Mann-Whitney U test, Kruskal–Wallis test are used. We will briefly review some of these techniques and their applications. These techniques can be extremely powerful because they enable batch reliability testing and are straightforward to implement. But they are not without limitations. We will discuss the shortcomings of these tests using simulated data and justify the need for alternative adaptive techniques. We will then introduce the concept of ML based Bayesian approach to A/B testing. Central to the idea of this technique is the explore-exploit conundrum or the armed-bandit problem. The armed bandit problem is a classical problem in the field of machine learning and decision making. It is a scenario in which a decision maker must choose between multiple actions to maximize a certain objective, while receiving feedback about the quality of each action over time. The goal is to find a balance between exploration (trying out different actions to learn about their quality) and exploitation (focusing on actions that have shown to be successful in the past) to achieve the highest possible reward over time. Before discussing specific techniques, we will have a brief overview of Bayes theorem, conjugate priors, Bernoulli, Gamma, and other relevant distributions. We will review three Bayesian ML A/B testing techniques in detail in this webinar: 1. Epsilon Greedy 2. UCB1 3. Thompson sampling We will discuss the theory and implementation techniques for each of these algorithms and show how reliability practitioners can effectively use them in the DfX process. We will then discuss real life engineering case studies where these techniques can be implemented. We

will also discuss some caveats and disadvantages of these techniques and discuss when and when not to use them. Finally, we will discuss how to overcome tactical hurdles that reliability practitioners may face while embracing these techniques.

Key Elements of Reliability Engineering by Aldo Fucinari $400 2 sections 2 hrs each #0414-152026

The specialty of reliability engineering should be a key part of the development life cycle of any product. The failure of a product in the field can often lead to more revenue lost than earned by a company. There are cases where companies have lost billions of dollars due to a product field failure. Where does one start to get their arms around that? This course will introduce the key concepts of reliability engineering as a discipline and as a specialty. This discipline should be considered as part of the development of a product, including supply chain and manufacturing.

Day one we will cover:

- What is the core concept of failure mechanisms? How are the failure mechanisms manifested? What are the basic physical reasons for failure? How concepts of physics play into how we can control and demonstrate time to failure. What tools, resources and equipment do we need to demonstrate reliability?
- Systems Engineering approach to defining system/subsystem/component risk analysis. FMEA, FMECA, FTA, STA. What do they all mean? What are the practical applications?
- Defining the reliability plan from the requirements documents. What are the "Critical to Quality" metrics. How we can determine the plan to be as efficient and effective as possible.

Day Two we will cover:

- Probability and failure predictions. Introduction to the key tools.
- What is the best way to assure successful Validation and Verification (V&V) of medical devices?
- Analysis, data management, and ongoing metrics to assure constant quality and quality improvements actions. This is the author's proven method of closed loop quality and reliability management starting with products that are already in the field.

Much of the material presented by the instructor is gleaned from "The Certified Reliability Engineer Handbook". If any attendees are considering certification through the ASQ, this will be an excellent introduction to that core body of knowledge. The author's own experiences as a consultant and trainer for Hobbs Engineering are also tapped into. As always, he presents in a straightforward and understandable way.

Printed Circuit Board Modeling: A Critical Step in Evaluating Electronic Assembly Reliability Through Accurate Material Properties by Dr. Jean-Baptiste Libot - $200 #04292026 - 2 hrs

Printed Circuit Boards (PCBs) are laminated structures made of conductive copper layers and insulating layers, known as laminates and prepregs. These insulating layers are composite materials with an organic matrix, usually epoxy resin, reinforced with fiberglass fabrics. PCBs provide both mechanical support and electrical interconnection for soldered electronic components, and they play a crucial role in the reliability of electronic assemblies exposed to harsh thermomechanical environments as well as mechanical stresses such as vibrations and shocks. Therefore, in electronic equipment design, understanding the physical properties of PCBs is essential for assessing assembly reliability, which in turn requires the development of suitable computational models. This webinar presents a methodology for evaluating the physical properties of multilayer PCBs, using a Representative Volume Element (RVE) for the laminates and prepregs, and a Representative Copper Layer (RCL) for the conductive layers. It provides the foundation for determining key PCB properties, including density, Young's modulus, Coefficient of Thermal Expansion (CTE), flexural modulus, thermal conductivity, and specific heat. The models are based on continuum mechanics, strength of materials theory, and classical laminate theory, and are validated with experimental results across different PCB stackups. Attendees will learn from practical examples how PCB stack-up affects electronic assembly reliability. This webinar offers engineers and electronic designers a set of practical models to help ensure the reliability of their equipment.

Reliability Demonstration: Theory and Practical Applications by Dr. Andre Kleyner - $300 #03262025 - 3 hrs

This 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 Physics: How to Field Reliable Products by Dr. Abhijit Dasgupta - $400 #03042026 - 4 hrs

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

Participants will….
• Learn how/why products really fail and understand key methods to make products sufficiently reliable
• Become acquainted with the degradation 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 reliability problems
• 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 reliability physics ?
- Degradation mechanisms, failure sites and failure modes
- Lifecycle conditions and how they affect failures
- Reliability physics process as a proactive way to design & build reliability into a product
- Reliability physics tools
- How do the manufacturing process and supply chain affect reliability ?
- Reliability physics examples
- Reliability assessment & product qualification with accelerated stress testing
- Design of accelerated stress tests based on Reliability Physics principles
- Reliability Physics Failure acceleration models
  - Temperature
  - Moisture and harsh chemical contaminants
  - Mechanical stresses
  - Electrical stresses
  - Combined stresses
- Case Study: Example of accelerated stress testing based on reliability physics principles

Structuring a Reliability Engineering Program and Introduction to HALT & HASS by Aldo Fucinari - $300 #07152026 - 3 hrs

This webinar will be a detailed discussion on what a reliability engineering program should entail and how to go forward setting one up. Many clients that we work with are just starting out on a reliability engineering program and reach out to Hobbs Engineering for guidance and training.

This webinar will be a high-level view of the ASQ Certified Reliability Engineer Handbook. The attendee will receive a discussion of each topic covered in the material applied to real world application. The webinar is not intended to be a primer for the exam, but it does serve as an intro to the study guide.

HALT (Highly Accelerated Life Tests) and HASS (Highly Accelerated Stress Screening) are heavily laced into the materials and the last hour of the webinar will serve as an introduction to HALT and HASS.
All levels of engineering management will appreciate the business advantages that are gained by having product development methods with a structured reliability emphasis. Especially leveraging HALT in the development process can speed the process and create a mature product upon release.

The topics covered will be:

- The leadership foundations of a management supported reliability program. What is Design for Reliability (DFR)
- Cost of poor reliability and safety. Methodologies. What are the four causes of latent field defects. What is the Annual Failure Rate. Do you know your AFR?
- Risk management. By the authors 3 major product categories, Consumer, Industrial, Life Support (includes defense).
- Probability functions, distributions, basic statistics of strength/stress
- Testing. In-house vs. outside help when planning your program. Budget considerations.
- Reliability planning in the development process. What modeling methods can be employed to get started.
- Lifecycle Reliability. Planning for service intervals, use case modeling, the bathtub curve including the drain hole in the bathtub.
- Introduction to HALT and HASS, terminology, what is state-of-the-art in HALT and HASS.
- Why do products fail. The physics of failure approach.
- Cost of implementing HALT and HASS in your lab or factory. ROI vs. cost of outside labs and the advantages of concurrent HALT in the development process.

Using Finite Element Analysis with Electronic Equipment: Thermal Cycling, Heat Transfer and Vibration Analysis by Steve Carlson - $350 #02042026 - 3.5 hrs

This webinar 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.