Reliability & Risk Division
ASQ Excellence Through Quality®

Reliability & Risk Newsletter
December 2024 Edition

Page **CONTENTS**

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https://my.asq.org/communities/home/182

Chair's Message

Rong Pan
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As we close another productive quarter, I'm thrilled to share some remarkable news and updates from our division. It has been an exciting time for the Reliability and Risk Division, with significant achievements and plans for the upcoming year.

First, I am delighted to announce that both David Auda, our Vice Chair, and I have been elected to the prestigious rank of ASQ Fellow. This recognition represents the pinnacle of professional achievement within ASQ, and we are deeply honored to join the esteemed group of Fellows.

- I was elected "For outstanding contributions to the fields of reliability data analysis and reliability test planning; for excellent efforts in quality and reliability engineering education; and for continuing activities and leadership in related fields of industrial statistics and data science."
- David was elected "For support and altruistic contributions to the disciplines and practitioners of Engineering, Reliability, Quality, Safety, and Education to advance understanding of, and improvement of, people, products, and processes, for the betterment of our global society."

Our official induction as Fellows will take place during the 2025 World Conference on Quality and Improvement in Denver, Colorado. With these additions, our current leadership team now boasts five ASQ Fellows: Trevor Craney, Mohammad Pourgol, Jim Breneman, David Auda, and myself. Congratulations to David and to all our Fellows for their dedication to advancing quality and reliability engineering!

As we look to 2025, the division is gearing up for several impactful conferences:

- RAMS Europe, our inaugural overseas event, will take place in Amsterdam in August. This marks an exciting new chapter for the division as we expand our reach internationally in collaboration with IEEE Reliability Society. Tim Gaens will serve as the General Chair for this groundbreaking event.
- RMMR 2025 is scheduled for July in Charlotte, NC, with David Auda leading as General Chair. This annual event continues to serve as a cornerstone for reliability and risk professionals.
- RAMS 2025, the flagship Reliability and Maintainability Symposium, is fast approaching and will be held January 22-25 in Miramar Beach, Florida. I will have the privilege of teaching a pre-conference course on Machine Learning Applications in Reliability Engineering, showcasing how advanced technologies can empower reliability practitioners.

To be continued in Page 2

Chair Message (continued):

With these activities, 2025 is shaping up to be an eventful and rewarding year for the Reliability and Risk Division. We are excited about the opportunities to engage with members globally, share knowledge, and collaborate on advancing our profession. I would like to take this opportunity to thank all our dedicated volunteers, committee members, and leadership team who work tirelessly to make these initiatives a reality. Your efforts are what propel our division forward and enable us to create meaningful experiences for our members. As always, I encourage all members to stay connected through myASQ and contribute to our growing online community. Together, we can continue to foster innovation, learning, and collaboration in the reliability and risk field.

Upcoming ASQ RRD *Webinars*

December 12, 2024, **12:00 P.M. EST (US & Canada)**
ASQ RRD series webinar: Hazard Analysis Centered Risk Management, Presenter: Michelle Jirac

Thursday, January 9, 2025, **12:00 P.M. Eastern Time (US & Canada)**
ASQ RRD series webinar: 2024 AIAG CONTROL PLAN Manual review, Presenter: Richard Harpster

Thursday, February 13, 2025, **12:00 P.M. Eastern Time (US & Canada)**
ASQ RRD series webinar: How to Graph, Analyze, and Compare Sets of Repair Data, Presenter: Dr. Wayne B. Nelson

Calling all Webinar Authors!!

Dave Auda (davidauda@yahoo.com)

We would like to extend an invitation on behalf of the ASQ Risk and Reliability Division (ASQRRD). If you would be interested in being a presenter of an ASQRRD webinar, contact Dave Auda. Webinars run every 2nd Thursday of the month at noon EDT for 1 hour. The content should be something the attendees can use, Reliability-related knowledge, or skill.

Why present? A large potential audience that we invite, an additional entry to your resume demonstrating competence, refining your presentation skills, AND earning recertification points. If you need support in developing, preparing, or presenting at such an event, we can support you. Become a recognized subject matter expert!

Social Media Update

Tim Gaens (tim@asqrrd.org)

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308 likes • 330 followers
LinkedIn:
Page: 1,112 followers
Group: 4,837 member

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ASQ-RD Latinoamerica 320 Followers
ASQ Reliability Div 754 Followers

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- Integrated suite
- Stand-alone tools
- FMEA, FMECA
- FRACAS, CAPA
- Fault Tree
- Reliability Prediction
- Reliability Block Diagram
- RCM, Maintainability
- Weibull
- ALT
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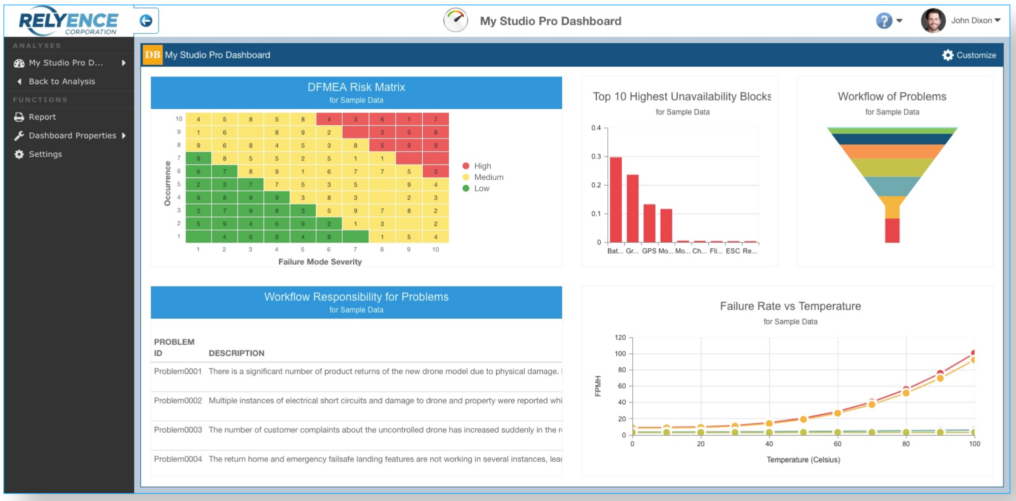

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RAMS® 2025

January 27- 30, 2025
Hilton Sandestin Beach Resort, Miramar Beach, Florida, USA

January 27 - 30, 2025
71st Annual Reliability & Maintainability Symposium (RAMS® 2025)
"R&M in the Era of AI"

Ming Li
General Chair, RAMS® 2025
Reliability and Risk Engineer at UR NRC

"The RAMS® Management Committee is very pleased to announce that we have received many excellent abstracts for papers and tutorials.

We are now gearing up to create another blockbuster program for you in January.

AI is all the buzz right now; you won't want to miss this coming symposium!

You will have the opportunity to participate in sessions and tutorials presented by top R&M experts, keynote session insights,networking and job-related opportunities &more. Also, plan to visit the exhibit floor featuring leading companies. --Ming Li

Every room at the **Hilton Sandestin Beach Golf Resort & Spa** is just steps away from the sparkling waters of one of the most beautiful beaches in the world. Combine a stimulating symposium with some R&R in Miramar Beach, Florida.

Register and book your room at RAMS.ORG

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RAMS Pre-Conference Course Announcement "Introduction of Machine Learning Techniques for Reliability Data Analysis"

This full-day course is designed for reliability engineers and professionals looking to enhance their skills with cutting-edge machine learning and artificial intelligence tools. The course will cover key machine learning concepts and focus on two main techniques: tree-based methods (including decision trees and random forests) and neural network-based methods (such as CNNs, RNNs, and LSTMs). Attendees will learn how to apply these techniques using no-code tools like Tabula, making it accessible even for those without formal programming training.

Prerequisites for this course include a basic understanding of statistics, probability, and reliability engineering concepts, as well as basic data analysis skills, such as those used in Excel. By the end of the course, participants will be able to preprocess and analyze reliability data, build and evaluate machine learning models, and understand the potential applications of recent AI technologies, including Large Language Models (LLMs), in reliability data

Time	Topic	Description
8:00 AM - 8:30 AM	Registration and Introduction	Welcome, course overview, introduction to machine learning and its relevance to reliability engineering.
8:30 AM - 9:30 AM	Fundamentals of Machine Learning	Definitions, types of machine learning, key concepts, overview of no-code machine learning tools.
9:30 AM - 10:30 AM	Data Preprocessing and Exploration	Importing and cleaning reliability data in Tabula, handling missing values, EDA techniques, visualization.
10:30 AM - 10:45 AM	Break	
10:45 AM - 12:00 PM	Traditional Reliability Data Analysis Methods	Survival analysis, reliability function, hazard function, parametric models, non-parametric methods.
12:00 PM - 1:00 PM	Lunch Break	
1:00 PM - 2:30 PM	Tree-Based Methods for Reliability Analysis	Introduction to decision trees, building and interpreting random forests, hands-on exercises using Tabula.
2:30 PM - 2:45 PM	Break	
2:45 PM - 4:15 PM	Neural Network-Based Methods for Reliability	Basics of neural networks, CNNs, RNNs, LSTMs, hands-on exercises using Tabula.
4:15 PM - 5:00 PM	Introduction to Recent AI Technologies	Overview of LLMs, applications of LLMs in reliability data analysis, demonstrations.

By the end of the course, attendees will have a solid understanding of how various machine learning techniques can be applied to reliability data analysis using no-code tools like Tabula. They will also gain insights into the potential applications of recent AI technologies, including LLMs, in their field.

Dr. Rong Pan is Professor of Industrial Engineering and Data Science in the School of Computing and Augmented Intelligence (SCAI) at Arizona State University (ASU). He is the Program Chair of Data Science, Analytics, and Engineering (DSAE) program at ASU. His research interests include failure time data analysis, design of experiments, multivariate statistical process control, time series analysis, and computational Bayesian methods. His research has been supported by NSF, Arizona Science Foundation, Air Force Research Lab, etc. He has published over 90 journal papers and 50+ refereed conference papers. Dr. Pan is a senior member of ASQ, IIE, and IEEE, and a lifetime member of SRE. He currently serves as the Chair of ASQ Reliability and Risk Division and the Editor-elect of Journal of Quality Technology.

ASQRRD 2024-2025 Active Volunteers

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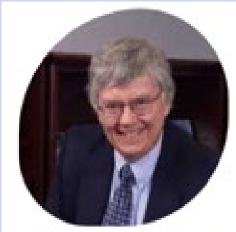
	Dave Auda Division’s Chair-Elect Webinars Exec Producer, Instructor davidauda@yahoo.com		Trevor Craney RAMS Board of Directors Division Treasurer Instructor treasurer@asqrrd.org
	Tim Gaens Webmaster, Social Media Manager tim@asgrrd.org		Jim Breneman, Instructor Newsletter Co- Editor weibullman@gmail.com
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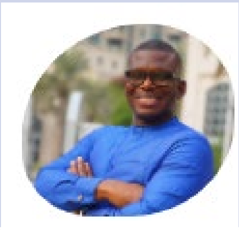
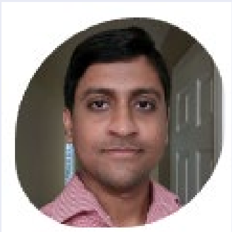
	Tamunoteyim "Tammy" Karibo Website support, Social Media Manager tammy.karibo@gmail.com		Angleat Shelikkoff Marketing Manager adshelikoff@gmail.com
	Pankaj Shrivastava RAMS Management Committee pankaj.shrivastava@halliburton.com		Yeshwanth Reddy Website support and Social Media Manager
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IEC/TC 56 Standard: Dependability-Part 1

By Jalal Raei, Ph.D
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Introduction

• Reliability standards have evolved from U.S. Department of Defense, such as MIL-STD-785 and MIL-HDBK-217, which focused on ensuring that military systems could withstand harsh conditions and operate reliably over extended periods.

• As technology advanced and global markets expanded, the need for standardized reliability practices became apparent beyond military applications. This led to the development of the International Electrotechnical Commission's Technical Committee 56 (IEC/TC 56) in 1967, which focuses on the reliability of systems. IEC/TC 56 standards provide a comprehensive approach to reliability, encompassing methods and tools for dependability assessment, technical risk assessment and management of services and systems throughout the lifecycle of a product. These standards aim to harmonize international practices, ensuring that products meet safety and performance requirements while minimizing risks associated with failures.

• With the introduction of the Dependability technical committee, we will sequentially introduce the reliability standards from the next issue of the newsletter.

TC 56 Scope

• To prepare international standards in the field of dependability, in all appropriate technological areas, including those not normally dealt with by IEC Technical Committees. Dependability is the ability to perform as and when required and is time dependent in application. Dependability can be expressed in terms of core attributes of availability, reliability, maintainability and supportability that are tailored to application-specific functional and service attributes.

• Dependability is a technical discipline that is important in quality management, asset management risk management and financial decision making. It is managed through life cycle processes involving availability and its core performance attributes of reliability, maintainability and supportability, as well as application specific performance attributes such as recoverability, survivability, integrity and security for products and service dependability evaluation.

TC 56 Mission

• To promote the importance of dependability

• To provide an integrated view of the field of dependability and its application

• To develop and maintain standards for the benefit of all dependability users, operators and designers

Artificial intelligence in Reliability Engineering

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Artificial intelligence (AI) has firmly established itself in various fields, including reliability engineering, offering significant benefits while also presenting notable challenges. In this discussion, we will explore some advantages and disadvantages of AI in reliability engineering, using real-life examples, and highlight possible strategies to mitigate the associated risks.

One of the primary advantages of AI is its ability to facilitate predictive analytics, data capture, and analysis through sensors, helping to predict failures before they occur. For instance, General Electric employs AI through their Asset Performance Management (APM) system to monitor and analyze data from turbines and aircraft engines, enabling them to predict component degradation and schedule maintenance proactively. Similarly, BMW utilizes AI to monitor production lines and detect defects in real-time.

AI also enhances accuracy by processing vast amounts of data and identifying patterns and anomalies that human analysts might overlook. Tesla's AI algorithms for autonomous vehicles analyze millions of data points with high precision due to the safety implications associated with poor accuracy.

Let's face it: AI saves time. Although still in the early stages of adoption, Siemens has implemented AI to optimize the maintenance of its wind turbines, resulting in substantial cost savings and increased energy production. Artificial intelligence has provided management, engineers, and professionals across various industries with valuable insights and data-driven recommendations, improving the decision-making process. For example, AI has been used to analyze seismic data, predict equipment failures, and optimize drilling operations. I had the privilege of attending the Abu Dhabi International Petroleum Exploration Conference, where I witnessed a demonstration by Halliburton showcasing this technology in one of their fields.

Despite the numerous advantages, there are some drawbacks to using AI in reliability engineering that we should be aware of. AI heavily relies on the quality of the data it is trained on; poor quality or biased data can lead to inaccurate predictions and unreliable outcomes. For instance, an AI system designed for a reciprocating compressor produced inaccurate results because it had been trained using data from pumps and turbines.

As mentioned earlier in the context of the autonomous vehicle industry, data accuracy is crucial in safety-critical applications. However, AI models can often be difficult to interpret, and the lack of transparency regarding how AI decisions are made can lead to challenges in understanding the reasoning behind specific outcomes. Additionally, risks associated with cybersecurity pose a significant threat to AI in reliability engineering. Hackers could potentially attack AI models and manipulate them, creating severe security and safety issues across any industry.

AI's automation of tasks has begun to profoundly impact the workforce. While it can create new opportunities, personnel must acquire new skills and adapt to changing requirements. To address AI-related challenges in reliability engineering, robust data management practices must be established. Standardizing the quality and integrity of data and implementing effective data management systems are essential.

Furthermore, incorporating human supervision into AI systems can help prevent catastrophic failures. A notable example is the Boeing 737 Max aircraft, which experienced catastrophic crashes due in part to an over-reliance on automated systems without adequate human intervention.

Lastly, in my opinion, developing and adhering to ethical AI frameworks is crucial for reducing biases and ensuring fair decision-making processes. While AI presents great potential in reliability engineering, it also introduces challenges. By understanding its advantages and disadvantages, we can enhance system reliability using AI and harness its full potential.

1. An engineer feels confident that the failure probability on a new electro magnetic relay is less than 0.01. The specifications require, however, only that $p < 0.04$. How many units must be tested without failure to prove with 95% confidence that $p < 0.04$?
   A. 65 B. 73 C. 74 D. 75
2. Suppose a hurricane eye's probability of entering Palm Beach County is 0.1 per season. How many hurricanes should you expect in a decade? What is the probability of 4 or more hurricanes in a decade?
   A. 0.0001 B. .001 C. 0.4 D. 3.85×10^{-6}
3. The probability that a golfer hits the ball onto the green if it is windy as he strikes the ball is 0.4, and the corresponding probability if it is not windy as he strikes the ball is 0.7. The probability that it will be windy is 0.3. Find the probability that he hits the ball onto the green.
   A. 0.61 B. 0.39 C. 0.49 D. 0.12
4. If the CDF for times to failure is $F(t)=1-\frac{100}{(t+10)^2}$, Find the failure rate as a function of time.
   A. $\lambda(t) = \frac{2}{(t+20)}$ B. $\lambda(t) = \frac{3}{(t+20)}$ C. $\lambda(t) = \frac{2}{(t+10)}$ D. $\lambda(t) = \frac{1}{(t+10)}$
5. The MTBF for truck tire punctures is 150,000 miles. A truck with 10 tires carries 1 spare. What is the probability that the spare will be used on a 10,000-mile trip?
   A. 0.0645 B. .0.9355 C. 0.0323 D. 0.87
6. Suppose that a device undergoing accelerated testing can be described by a Weibull distribution with a shape factor of $\beta = 2.0$. Under accelerated test conditions, with an acceleration factor (AF) = 5.0, 50% of the devices are found to fail during the first month. Under normal operating conditions, estimate how long the device will last before the failure probability reaches 10%. (i.e.B10 life).
   A. 1 month B. 2 months C. 3 months D. 4 months
7. At rated voltage, a microcircuit has been estimated to have an MTTF of 20,000 hr. An accelerated life test is to be carried out to verify this number. It is known that the microcircuit life is inversely proportional to the cube of the voltage. At least 10% of the test circuits must fail before the test is terminated if we are to have confidence in the result. If the test must be completed in 30 days, at what percentage of the rated voltage should the circuits be tested?
   A. 1.25 B. 2.7 C. 3.6 D. 1.43
8. Fatigue specimens were put on test. They were *all* tested to failure and the failure times were 150, 85, 250, 240, 135, 200, 240, 150, 200, and 190 hours. What is the B10 life?
   A. 110. hrs B. 120. hrs C. 98 hrs D. 140 hrs
9. A failure PDF for an appliance is assumed to be a Weibull distribution with β= 4.622 and η = 5.44 years. What is the design life at a reliability of 90%?
   A. 4.55 yrs B. 1.78 C. 3.34 yrs D 2.56 yrs
10. Consider the following PDF: $\begin{cases} f(x)=1/2 & 0<x<2, \\ =0 & \text{otherwise} \end{cases}$

    Determine the mean and variance.
    A. 1, 0.333 B. 1, 0.577 C. 1, 0.666 D. 2, 0.75