Training Summit Presentation Abstracts

Huntsville Society of Reliability Engineers — U.S. Space & Rocket Center — RAM XVI Training Summit

Educator Training Facility, Huntsville, AL **Nov. 6th & 7th 2024**

Day Time	Room	Ses #	Presenter	Title	Abstract
Day #1 Ses# 1 Time: 0900 - 1030	A	A1a	Tony Donatelli	KEYNOTE in Auditorium	See B1a
		A1b	Tom Harrington MTA Ready. Right. Now.	An Overview of the Electrical Wiring Interconnect System (EWIS) and EWIS Data Analysis	Covering the aircraft Electronic Wiring Interconnect System (EWIS), this presentation will review the history of EWIS identification, the implementation of a EWIS integrity program, and how aircraft maintenance data can be used for EWIS improvement programs for United States Army aircraft.
	B	B1a	Tony Donatelli Reliant Technologies Incorporated	KEYNOTE: Advancing Reliability Engineering with AI	Large Language Models (LLMs) are revolutionizing artificial intelligence, offering powerful capabilities that can transform reliability engineering in the defense sector. This presentation provides an overview of LLM technology and its practical applications in enhancing reliability analysis and predictive maintenance. Drawing from recent projects at Reliant Technologies' Logistics Systems Integration Laboratory (LogSIL), we'll explore real-world examples including: 1. AI-powered document analysis for rapid processing of Contract Data Requirements Lists (CDRLs) and technical manuals 2. Natural language interfaces for complex reliability databases, enabling intuitive data retrieval and analysis 3. LLM-enhanced logistics simulations for improved lifecycle cost and operational availability predictions 4. AI assistants for proposal evaluation and requirements analysis in acquisition processes This presentation aims to equip reliability professionals with practical knowledge to leverage LLMs in their work, potentially transforming how we approach reliability challenges in defense systems.
		B1b	Nathan Rigoni Lockheed Martin	Systems of Agents	Advances in Artificial Intelligence have placed us in a whole new world when evaluating system performance and reliability. Where once software was a deterministic function with a guaranteed output, we now operate with Machine Learning and Artificial Intelligence systems whose decision making, responses, and outputs are determined by a sampling from a distribution. More specifically those of Large Language Model Agents. The future of Systems of Systems includes many autonomous agents as well as virtual agents whose decision making affects the outcome of any mission. In this presentation we will cover the capabilities of a System of Agents and step through some thought experiments on how to evaluate and measure the reliability of a system whose performance is based on non-deterministic responses.
Day 1 Ses#2 1045 - 1215	A	A2a	Jordan Mills, Russ Alexander, Michael Yohe, Danielle McDonnell Intuitive Research and Technology	The Technological Evolution of Statistical Analysis for RAM Data	For many years, statistical methods have been used to evaluate reliability, availability, and maintainability (RAM) data. These traditional methods can be used to uncover trends, patterns, and correlations in high-dimensional datasets. However, due to the high volume of data being captured for evaluation, statisticians are becoming burdened and cannot evaluate every aspect of the data. In these cases, engineering judgement is used, and the characteristics deemed most important to the overarching goal are evaluated. However, since the whole dataset is not evaluated, patterns may be missed. The implementation of technologies like artificial intelligence (AI) and machine learning (ML) have enabled the evolution and advancement of statistical analysis. The development and implementation of these cutting-edge statistical analysis techniques allows for a more extensive evaluation of RAM data. In relation to RAM data, these techniques can increase system effectiveness by improving operational readiness, aircraft certifications, condition based maintenance, and lethality. This presentation will discuss how statistical analysis using AI/ML for RAM data can be used to validate traditional statistical methods and discover more complex insights. The discussion will focus on how updated analysis methodologies can promote data-informed decisions related to weapon system performance. Specifically, these automated analysis methodologies, backed by traditional statistics principles, can identify, and quantify significant factors that affect weapon system performance.
		A2b	Eric Hunt *Missile Stockpile Reliability Solutions, LLC*	Developing an SRP Engineer	The Army missile Stockpile Reliability Program (SRP) is responsible for assessing aging missile systems throughout their lifecycle for safety, reliability and performance. Internal to the Army, there is a unique corps of government engineers that are responsible for managing the SRP programs for all Army missile systems. They extend shelf life on billions of dollars of missile systems annually. These engineers are responsible for developing the SRP Plan, developing all flight and component test plans, managing all budget activities from requirements to execution, analyzing the test data, and publishing technical reports providing justification for shelf life extensions or restrictions of billions of dollars of missiles. They need to understand the design and operation of every component of their assigned missile system from the motor nozzle to the warhead. They need to have the capability to perform design of tests, Reliability Engineering, safety risk assessments, trend analyses and statistical analyses. This is a monumental responsibility. It could be presumed that there must be a hundred well-trained Army SRP engineers working this effort, but the U.S. Army currently has less than 18 engineers working SRP on all Army missile systems. There is no school or defined certification program to train an engineer to work SRP. Each Army SRP engineer is built from scratch. This paper describes the author's 35 years of observations on what general training, experience and characteristics lend toward developing the best Stockpile Reliability Program Engineers.
	B	B2a	Matthew Carrell Intuitive Research and Technology Ann Marie Neufelder	Rapid Reliability Risk Assessment Utilizing Software Tools and MBSE in RAM Engineering	Systems Engineering processes help manage the complexities during system development including systems requirements development, architecture definition, system manufacturing, and system verification. The complexities for managing the products that support each of these areas becomes a challenge due to the amount of time it takes to produce the digital artifacts over the system development life cycle. Model-Based Systems Engineering (MBSE) has been the approach adopted over the years to provide an authoritative source of truth for managing system data within a system model. A system model enables the integration of multi-disciplinary artifacts/tools during system life cycle development, including RAM. The authors in this paper describe the integration of MBSE and RAM tools to automate Failure Modes and Effects Analysis (FMEA) to increase the reliability and safety of systems. FMEAs are critical in the evaluation of what could fail within a system that would produce an undesired outcome. The undesired outcomes could also impact to the safety of personnel and system components, both hardware and software. A significant amount of design analysis is required to reduce the likelihood of an undesired outcome. Mitigation methodologies and the identification of failure modes and effects requires extensive documentation review to include multiple requirements documents and architecture-related documents across multiple engineering disciplines. Our authors have experience using MBSE as the mechanism to minimize the extensive documentation review from traditional systems engineering. The data required in FMEA development is captured within an MBSE model. This presentation explores how to use a FMEA tool to auto-generate a FMEA based on data within an MBSE model. The authors have determined that an MBSE model becomes the input to the FMEA tool creating the ability to rapidly develop a FMEA through automation.

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Day 1 Ses#2 1045 - 1215	B	B2b	Charles Etheredge & Steven Thomas (INTUITIVE Research and Technology)	Leveraging Artificial Intelligence to Improve RAM Inspection Analysis	The analysis of manufactured components plays a key role in reliability, availability, and maintainability (RAM) activities. Visual inspections are traditionally employed by RAM engineers and analysts, with trained individuals able to inspect single components relatively quickly. As the number of component inspections increases for an inspector or team of inspectors, it becomes difficult and time consuming to analyze manufactured components accurately and consistently. Human inspectors are subject to fatigue, distraction, and inconsistency as the number of inspections increase, which can lead to errors or oversights in quality control processes. The emergence and implementation of technologies like artificial intelligence and machine learning has enabled the utilization of computer vision to alleviate these issues. The cost-effectiveness of using computer vision to automate inspection tasks has historically been a limiting factor in its adoption, but recent advancements in AI are rapidly tipping the scales toward economic viability. The hardware required for computer vision, including GPUs, cameras, and sensors, have also become more affordable. The implementation of a computer vision solution can be implemented at a fraction of previous costs, opening new possibilities for automation and innovation in the RAM domain. Computer vision systems are also becoming highly adaptable, capable of learning and improving over time, which allows for the inspection of new products without extensive reprogramming. This technology can also be combined with non-intrusive imaging, such as X-Ray, MRI, and CT technology to provide further efficiency and productivity benefits. This presentation will discuss how reliability and maintainability practices can utilize technological innovations in artificial intelligence and machine learning to increase detection accuracy, leading to significant time and cost reductions for manufactured component inspection analysis.
Day #1 Ses#3 Time: 1315 - 1415	A	A3	Ana Wooley, (UAH The University of Alabama in Huntsville) Carelyn Martinez, (DEVCOM) Lisa Bates, (DRAPER) Michele Platt (AVNIK)	Women In Engineering Panel	The Women in Engineering Panel aims to shed light on the experiences, challenges, and achievements of women in the engineering field. This event brings together a diverse group of accomplished female engineers to share their career journeys, insights, and advice with aspiring and current engineers. The panel will address critical topics such as overcoming barriers, the importance of mentorship, strategies for maintaining work-life balance, and the role of diversity and inclusion in fostering a more equitable engineering environment. By highlighting personal stories and professional milestones, the panel seeks to inspire and empower the next generation of women engineers, encouraging them to pursue and thrive in their engineering careers. Through engaging discussions and interactive Q&A sessions, attendees will gain valuable perspectives on navigating and succeeding in the engineering industry, ultimately contributing to a more inclusive and innovative engineering community.
	B	B3a	Dave Nelson (ASI Andromeda Systems Incorporated)	Applying Crow AMSAA to In-Service Reliability	Failure events reflect the occurrence expected for a certain level of reliability. In-service or fielded reliability is the actual reliability of the item in the operating environment, meaning all the factors of the design reliability, operational impacts, environmental exposure, and human interaction are present in the operating environment. A statistical trending model known as Crow-AMSAA or reliability growth can be applied to documentation of in-service data. The Crow-AMSAA method does not rely on time in service data for individual assemblies or components. Instead, it requires observation periods of accumulated service life for a population with observed failure events in those periods. The periods applied in the method are calendar-based quarters with usage data (e.g., flight hours) in a quarter and a count of events in that quarter. The quarterly data is then accumulated chronologically to characterize changes in reliability in a population over time. The method can characterize any event that can be categorized in the data such as mission aborts, when discovered codes or diagnostic false positives. Modelling the data in the Crow-AMSAA/reliability growth model enables characterization of the reliability experienced by the population over time. Reliability can be stable, with little to no change over time, or can show the population experiencing a decline or improvement in reliability. The Crow AMSAA model is particularly useful in understanding the impact of changes implemented in the population at specific points in time. For example, a change in failure management strategy, maintenance interval, or configuration.
		B3b	Rachel Boydston (ASI Andromeda Systems Incorporated)	Incorporating AI into Data Analytics & Visualization	This session will detail various data analytics and visualization AI tactics used within the Naval Aviation Enterprise (NAE). The brief is intended to demonstrate how AI, visualization tools, and data analytics are being used to solve practical, real-world problems and streamline communication across the NAE logistics community. These typical reliability engineering processes and tools are being applied and utilized in the field today in order to provide tangible benefits to the warfighter. The benefits are realized in the form of better maintenance practices and scheduling, more accurate supply availability and predictions to prepare for operations, and determination of root causes of deficiencies. While this brief focuses on DoD applications, the processes and tools used are applicable to other industries.
Day #1 Ses#4 Time: 1430 - 1530	A	A4	Kelby Starchman (Bastion Technologies) Paul Britton (NASA)	Evaluation of Life Testing Schemes	We will explore the age old question: What reliability can we infer from a qualification life test with zero failures? Moreover, we will offer an alternate and more pragmatic way to approach this problem.
		A4b	William Janzer (Bastion Technologies) Paul Britton (NASA)	Value of Graphical Models for the Quantification or Risk	We will present the application of Block Diagrams, Fault Trees and Event Diagrams/Trees with an emphasis on collaborative development and division of labor throughout the modeling process.
	B	B4a	Jillian Ivey (DEVCOM Army Research Laboratory)	Agile Software Development in the DoD	The shift towards Agile within the Department of Defense (DoD) reflects a broader effort to align with the fast-paced, iterative practices common in the commercial sector. This transformation, which began in the mid-2000s, gained significant traction in 2019 when Congress mandated Agile or other iterative development for eight key programs. By 2024, the Army further reinforced this shift with a directive establishing policies and responsibilities for adopting modern software practices across the service. In this presentation, we will explore the foundational principles of Agile development, including its core frameworks and methodologies. Attendees will gain a clear understanding of Agile concepts and how they apply to software and systems engineering within the DoD. This presentation sets the stage for a subsequent session that will delve into integrating Reliability, Availability, and Maintainability (RAM) principles within an Agile framework. Together, these sessions will provide a comprehensive view of how Agile methodologies can be leveraged to enhance both software development and overall system reliability.
		B4b	Ann Marie Neufelder	Applying RAM within an Agile Environment	Reliable software tasks such as prediction models, failure tracking and trending, software FMEAs, reliable software testing work whether the life cycle model is Waterfall, Agile or any other incremental model. This presentation will show where the reliable software tasks fit in with the DoD's Agile framework.

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Day #2 Session 5 Time: 0900 - 1030	A	A5a	Lisa Bates DRAPER	Embracing the Artificial Intelligence Age of RAM	In the ever-evolving landscape of reliability engineering, the rise of Artificial Intelligence (AI) presents both unprecedented opportunities and challenges. Join us at the Society of Reliability Training Summit in Huntsville, Alabama for a thought-provoking presentation that delves into the core theme of the "AI Age of RAM" and its implications for reliability engineers. During this one-hour class, we will explore how AI is revolutionizing the field of reliability, offering new tools and methodologies to enhance asset performance and optimize maintenance strategies. By harnessing the power of AI, reliability engineers can unlock valuable insights from vast amounts of data, enabling predictive maintenance, condition monitoring, and risk analysis like never before. Furthermore, we will delve into the critical role of digital engineering data management in this AI-driven era. Effective data management practices are essential for leveraging the full potential of AI technologies, ensuring data accuracy, integrity, and accessibility. We will discuss best practices for collecting, storing, and analyzing engineering data, highlighting the importance of data governance, security, and interoperability in the context of reliability engineering. Join us as we navigate the intersection of AI, reliability engineering, and digital data management, and discover how embracing the AI Age of RAM can propel your reliability initiatives to new heights. This presentation promises to equip you with practical insights and strategies to drive reliability excellence in the digital age.
		A5b	Philip Reiner RELIANT TECHNOLOGIES INCORPORATED	Leveraging AI and DE for RAM	This presentation explores how Artificial Intelligence (AI) and digital engineering technologies can enhance Reliability, Availability, and Maintainability (RAM) analysis in military systems development. Building upon the foundations of LogSIM and LogSIL, two advanced tools developed by the DEVCOM AvMC Logistics Engineering Laboratory, we demonstrate how AI and Large Language Models (LLMs) can significantly augment these capabilities. We showcase AI-powered interfaces that streamline interaction with technical documentation, simulation data, and analysis results, making complex RAM data more accessible and actionable. Furthermore, we discuss the practical integration of these advanced technologies into existing RAM workflows, illustrating how organizations can improve efficiency, reduce lead times, and enhance decision-making in RAM analysis. This presentation aims to provide RAM engineers and decision-makers with a clear understanding of how these transformative technologies can be applied to advance RAM analysis, ultimately leading to more reliable, available, and maintainable military systems.
	B	B5a	Luke Symasek (Grad Student) UAH The University of Alabama in Huntsville	Acceptance and Adoption of AI Technology in the Context of Reliability and Maintainability	The use of AI will continue to grow and expand into many different fields and industries. However, the acceptance and adoption of this technology will not grow at the same rate. Furthermore, there is not one totalizing factor that leads people to reject or accept a technology. Rather, there are many individual differences that exist among people that may influence a person's likelihood of adoption. The purpose of this study was to identify what individual differences exist in the acceptance and adoption of AI technology in order to better understand why the adoption rates of these technologies do not keep up with the growth and development of the technologies themselves. This literature review found 5 individual differences that played important roles in the acceptance and adoption of AI technology. These were trust, culture, enjoyment, social influence/subjective norms, and personality. It is important to understand these factors because they have implications for the reliability and maintainability of a system.
		B5b	Virginia Sullivan (PHD Student) UAH The University of Alabama in Huntsville	AI Age of RAM	In the AI age of reliability and maintainability, understanding the relationship between transparency and perceived reliability of AI systems is crucial for shaping the future landscape of AI technologies. Ensuring that AI systems provide clear and accessible explanations of their actions can significantly enhance user trust and acceptance, which is vital for the widespread adoption of such technologies. This study investigates how varying levels of explainability influence users' perceptions of an object detection AI system's reliability. Participants interacted with the AI system and accessed different amounts of textual information about how the object was detected, ranging from minimal to comprehensive explanations of the AI's decision-making processes. Preliminary results from 27 participants indicate that increased transparency correlates with higher perceived reliability of the AI system. Transparency was examined through two variables: the number of times participants clicked to receive more information and the time spent on the page viewing the information. While the number of clicks showed a weak, non-significant correlation with perceived reliability ($r = .083$, $p > .05$), the time spent on the page had a moderate, significant positive correlation with perceived reliability ($r = .443$, $p < .05$). Data collection is still underway, and these results continue to evolve. This study underscores the importance of transparency in enhancing the perceived reliability and maintainability of AI technologies. By contributing to a deeper understanding of these dynamics, the research highlights how reliability and maintainability considerations are pivotal in shaping the current and future landscape of AI technologies, promoting user trust and confidence through transparent and explainable AI systems.
		B5c	Danielle McDowel (Grad Student) UAH The University of Alabama in Huntsville	Application of Bayesian Inference for Increasing Rocket Engine Reliability and its Uncertainty Quantification	With the advent of newer technologies such as Additive Manufacturing (AM) and its potentials for rocket engine development, it is crucial to establish newer techniques in quantifying uncertainties and subsequently incorporate reliability early in design. This is particularly important considering production restart instances of powerful and reliable rocket engines such as the RS-25s, a repurposed version of the Space Shuttle Main Engine (SSME) for the SLS mission. Previous rocket engine design and development programs were predominantly dependent on deterministic Factor of Safety (FoS) techniques in order to overcome the significant sources of uncertainties in design and manufacturing. While it has been largely successful, the advent of probabilistic approaches (Bayesian Methods, Machine Learning Techniques) provides an opportunity to transform the deterministic nature of design to a probabilistic realm. Additionally, Bayesian methods have the potential to address AM uncertainties by relating process parameters, physical models, and final product qualities to one another. Probabilistic approaches have been useful and practiced often in the civil engineering world, its utilization in the rocket engine development world however requires increased attention. These approaches help in making informed design decisions and provides insights to improve designs where rocket engines are subject to increasingly complex operating conditions. Subsequently, the author (s) propose to present the importance of moving towards a probabilistic approach in which the application of Bayesian Inference is emphasized for design and development of rocket engines. This work will be demonstrated in the context of a Reliability-Driven Design and Test (ReDDT) method for propulsion systems.

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Day #2 Session 6 Time: 1045 - 1215	A	A6	Fayssal M. Safie (A-P-T Research, Inc.)	An Overview of Reliability Engineering	This tutorial is intended to provide a better understanding of reliability as an engineering design discipline, with focus on selected reliability tools and techniques commonly used by engineering professionals throughout Government and industry. The tutorial also discusses reliability engineering relationships to other disciplines such as maintainability, supportability, affordability, safety, and risk assessment. The material in this tutorial is based on over 30 years of extensive industry and Government experience in reliability engineering and risk assessment.
Day #2 Session 6 Time: 1045 - 1215	B	B6a	Jordan Evans (Grad Student) (The University of Alabama in Huntsville)	The Power of ChatGPT and Other Chatbot Platforms: A Management Approach	ChatGPT, an AI chatbot developed by OpenAI, has been programmed to interact with users in a "conversational" way, with the ability to answer follow-up questions, admit to mistakes, and reject inappropriate requests. While ChatGPT may be the most used and the most well-known chatbot, some other prominent chatbots today (produced by established companies) include Microsoft Copilot and Google Gemini. While ChatGPT is increasingly accurate and is well-suited for businesses that operate across the globe and in any industry, it is susceptible to error and can provide a security risk to some companies. However, when AI chatbots are used appropriately, they can result in statistically proven increased productivity within business operations, including providing employees with readily available information for making data-driven decisions and anticipating market trends. Chatbot platforms can also boost response time and can streamline operations by automating routine tasks. While human oversight and intervention is necessary to address complex or sensitive inquiries, there are endless possibilities to using AI chatbots to benefit reliability engineers with their assessments and analyses.
Day #2 Session 6 Time: 1045 - 1215	B	B6b	Shivangi Gupta (PHD Student) (The University of Alabama in Huntsville)	An Investigation of Transparent Methods for Improved Human-AI	The growing rapid integration of artificial intelligence (AI) into critical sectors— such as healthcare, transportation, and defense—has raised concerns about transparency and trust between humans and AI systems. In high-stakes applications like military operations, AI can significantly improve system capabilities by enhancing navigation, terrain mapping, target detection, and remote monitoring in complex environments. However, ensuring the reliability and transparency of AIdriven decision-making is essential for building trust and enabling widespread adoption, particularly in dynamic and unpredictable scenarios. This work will offer a comprehensive overview of current explainability methods specifically within the context of target detection in dynamic environment simulations. Additionally, we propose an interdisciplinary approach to analyze these explainability methods from the perspectives of computer science, psychology, and systems engineering to highlight the most effective strategies for improving explainability and fostering stronger human-AI interaction and trust in AI-driven decision making in autonomous systems.
Day #2 Session 6 Time: 1045 - 1215	B	B6c	Dylan Wright (PHD Student) (The University of Alabama in Huntsville)	Integrating Autonomous Agents into the OODA Loop for Optimized RAM Operations	This research investigates how autonomous agents, integrated with the Observe, Orient, Decide, Act (OODA) loop through Augmented Reality (AR), can optimize Reliability, Availability, and Maintainability (RAM) operations in critical scenarios. Using a hostage rescue simulation as our testbed, we evaluate how various mixed reality interface designs, offering different levels of information display density, impact operator performance. Autonomous agents generate real-time data to assist operators, providing insights at different levels of complexity. The simulation measures task performance, identifying conditions where the information density either supports attentive decision-making or leads to distraction via cognitive overload or underload. By optimizing the balance of information flow, we aim to improve response times and operational accuracy in high-pressure environments.
Day #2 Session 7 Time: 1315 - 1415	B	B7	Seth Farrington & Myles Chatman (DEVCOM Army Research Laboratory); Ronnie Knight (Bastion Technologies); Tony Donatelli (Reliant Technologies Incorporated)	AI Reverse Panel	The objective of this reverse panel is to share questions, experiences, issues, resolutions, and paths forward that can benefit government, industry, and academia. The use of artificial intelligence is growing at an astronomical rate and influencing a shift towards increased automation, data-driven decision-making, and the integration of AI systems into various economic sectors and areas of life that impact the job markets, healthcare, government, industry, and academia. This raises questions about the long-term effects, ethical implications, and risks, prompting discussions about regulatory policies to ensure the safety and benefits of the technology. Traditional goals of AI research include reasoning, knowledge representation, planning, learning, natural language processing, and perception. Data scientists and AI researchers have integrated a range of techniques, including search and mathematical optimization, formal logic, artificial neural networks, and methods based on statistics, operations research, and economics.
Day #2 Session 8 Time: 1430-1600	B	B8a	Devan Strazewski (Undergrad) (The University of Alabama in Huntsville)	RAM with AI	Brainstormed Ideas: How AI can help with the productivity of RAM. How AI can help answer questions about certain programs that work alongside RAM. Why AI could be useful in the future with RAM.