

## TUTORIAL DESCRIPTIONS

2020 Annual T&E Symposium

Monday, 14 September

### **Application of Scientific Test and Analysis Techniques (STAT) Beyond DOE in Test and Evaluation**

Gina Sigler and Sarah Burke, PhD, Scientific Test and Analysis Techniques Center of Excellence (STAT COE)

Sometimes a traditional design of experiments approach just won't work for a given situation. Scientific test and analysis techniques (STAT) can still be used when DOE can't to inject the necessary rigor into T&E. Join the STAT COE in a discussion on test design for simulations, model and simulation validation methods, test methods for software, and implementation and analysis of surveys.

### **Design of Experiments (DOE) for Promoters and Practitioners**

Mark Kiemele, Air Academy Associates

It is not widely known that the manner in which data is collected highly influences how easy or how hard it will be to analyze and evaluate the results once the data has been collected. This tutorial will address the fundamental principles of optimal data collection with regard to test and evaluation, with special emphasis on the ability to characterize the process or system under test after the data has been collected.

We will cover the major pillars for developing a culture of proper experimentation and demonstrate each of the principles using a miniature roman catapult. The principles covered will include a technique for reducing the impact of extraneous variation and the use of measurement system analysis for the purpose of ascertaining the quality of data from a statistical perspective as well as conducting uncertainty analysis of the measurements. The statistical analysis of experiments will be shown to be impacted by the principles of orthogonality, replication, randomization, and blocking. These techniques and principles are not a substitute for prior process knowledge, engineering knowledge, or experience. But without applying them, engineers, researchers, scientists, or practitioners will not be as effective or as efficient as if they were to use these powerful and proven, but still largely unknown, tools. This tutorial does not require any prerequisite knowledge and will be beneficial to anyone who is associated with test and evaluation activities or would like to know more about the Design of Experiments methodology which encompasses all of the above topics.

### **Ethically-aligned Experimentation and T&E for Decision Making with Complex Systems**

Keith Joiner, Malcolm G. Tutty, UNSW ADFA

Over the last three decades, Defence communication and information systems have been increasing the complexity and interconnectedness of systems that has pervaded society more broadly throughout the Information Age. Even more than society in the broad, Western Departments of Defence (DoDs) have sought to attain information dominance. The result has been a large number of complex systems, system-of-systems and families-of-system-of-systems. This Tutorial examines the Australian implications of the big challenges facing decision making in complex systems and the key assurance initiatives pursued systematically by the US DoD initiatives to effect these more integrated, interoperable and information-assured (I3A) capabilities, while also ensuring these capabilities remain resilient to the new cyber threats using ethically-aligned approaches to experimentation and T&E.

## **Hacking Methods and Their Effects**

Patrick Lardieri, Lockheed Martin and Paola Pringle, NAVAIR

When someone uses the word 'cyber' it immediately becomes a loaded phrase. What do they mean by 'cyber'? Is it the same use that defines what I mean by 'cyber'? Is it really out there? How can it possibly affect me directly? How can it affect the systems I work on? I don't think a hacker can catch an airplane going Mach 1 in the middle of the ocean, shouldn't I just deploy? Perhaps some of these questions go through your mind anytime cyber is mentioned. Learning the language is only the beginning of understanding the cyber domain. There is a need to understand the effects an adversary can have on us, and the systems we work with that are continuously connected and communicating in the field.

Much like our defense systems, an adversary working in the cyber domain also has a mission. They intend to use every tactic, technique and procedure at their disposal to access, pivot, deny, degrade, disrupt, destroy, or exfiltrate information from the target system. The adversary has an effects chain they follow in preventing our Warfighter from successfully completing their mission. In this discussion we will explore how an adversary working in the cyber domain can break the effects chain and what the possible effects would be once the chain is broken.

In this tutorial we will explore the basics of the cyber domain and how they apply to building safe, secure, and survivable systems. The students will learn about threat types and what they can do along with the various types of 'hackers' that can explore the possibilities and bring a risk based understanding of the cyber adversary and their effects on our missions. With demonstrations of hacking techniques the student will gain an understanding of how easily information can be accessed in a cyber world.

## **Introduction to Cybersecurity Test and Evaluation**

Pete Christensen, MITRE

This tutorial will familiarize attendees with Cybersecurity and Test and Evaluation as it applies to US Federal Government Programs and the U.S DOD. Note that the ideas and concepts presented also apply in principal to any acquisition program. Topics that will be addressed include Cyberspace as an operational domain, Cybersecurity threats, malware, DHS and DOD systems acquisition and associated Cyber T&E policy and process including "Cloud" Programs, requirements analysis, evaluation frameworks, cyber tabletop exercises, cooperative vulnerability assessments, adversarial assessments, cyber ranges and lessons learned.

## **Incorporating T&E into Acquisition Contracts**

Terry Murphy and Patrick Kastner, DHS T&E

This tutorial will provide the T&E professional an overview and process for inclusion of T&E equities into the acquisition contracting artifacts. The goal of this tutorial is not to make T&E professionals contract experts, but rather provide them a keen understanding of their "Key" role, responsibilities, and processes, and as key players within this process ensure T&E equities are included within acquisition contracts.

The main focus will leverage the initial procurement notice released to industry per Federal Acquisition Regulation (FAR) Part 15, the Request for Proposal (RFP). Topics will include:

- Request for Proposal background and content
- Detailed overview of each RFP Part and Section with discussion on inclusion of T&E equities based on lessons with examples

- Discussion on the Statement of Work (SOW) and or Statement of Objectives (SOO) - Differences, purposes, and how the T&E professionals assist in the development

### **Laser System T&E Challenges**

Douglas H. Nelson, Teknicare, Inc., Mark Stevens, Robert Harney, Naval Postgraduate School

An introduction to the challenges of testing and evaluating Laser Systems. An overview of the basic physics and terminology of these systems is included. The unique effects of Laser Systems are also discussed to provide a foundation for test objectives. Test and evaluation needs for Laser Systems including required diagnostic beam propagation and atmospheric measurements are briefly examined.

### **Overcoming Challenges in Distributed T&E**

Gene Hudgins, TRMC JMETC

The Test and Training Enabling Architecture (TENA) was developed as a DoD Central Test and Evaluation Investment Program (CTEIP) project to enable interoperability among ranges, facilities, and simulations in a timely and cost-efficient manner, as well as to foster reuse of range assets and future software systems. TENA provides for real-time software system interoperability, as well as interfaces to existing range assets, C4ISR systems, and simulations. TENA, selected for use in Joint Mission Environment Test Capability (JMETC) events, is well-designed for its role in prototyping demonstrations and distributed testing.

JMETC is a distributed LVC testing capability developed to support the acquisition community during program development, developmental testing, operational testing, and interoperability certification, and to demonstrate Net-Ready Key Performance Parameters (KPP) requirements in a customer-specific Joint Mission Environment. JMETC uses a hybrid network architecture. The JMETC Secret Network (JSN), based on the SDREN, is the T&E enterprise network solution for secret testing. The JMETC Multiple Independent Levels of Security (MILS) Network (JMN) is the T&E enterprise network solution for all classifications and cyber testing. JMETC provides readily available connectivity to the Services' distributed test capabilities and simulations, as well as industry test resources. JMETC is also aligned with the Joint National Training Capability (JNTC) integration solutions to foster test, training, and experimental collaboration.

TENA provides the architecture and software implementation and capabilities necessary to quickly and economically enable interoperability among range systems, facilities, and simulations. TENA also fosters range asset reuse for enhanced utilization and provides composability for assembling rapidly, initialize, test, and execute a system from reusable, interoperable elements. Because of its field-proven history and acceptance by the range community, TENA provides a technology already deployed and well tested within the DoD.

Enterprise Big Data Analytics (BDA) and Knowledge Management (BDKM) has the capacity to improve acquisition efficiency, keep up with the rapid pace of acquisition technological advancement, ensure that effective weapon systems are delivered to warfighters at the speed of relevance, and enable T&E analysts across the acquisition lifecycle to make better and faster decisions using data that was previously inaccessible, or unusable. BDA is the application of advanced tools and techniques to help quickly process, visualize, understand, and report on data. JMETC has demonstrated that applying enterprise distributed BDA tools and techniques to T&E, leads to faster and more informed decision making that reduces overall program cost and risk.

This tutorial will inform the audience as to the current impact of TENA, JMETC, and BDA on the T&E community; as well as its expected future benefits to the range community and the warfighter.

## **T&E across the DoD Acquisition Lifecycle**

Michael Flynn, PhD, Defense Acquisition University

An overview of the Adaptive Acquisition Frameworks guidance for Defense Acquisition System from a Test and Evaluation perspective with emphasis on the involvement in the Systems Acquisition Lifecycle and T&E's relationship to the Systems Engineering processes used throughout the lifecycle of major acquisition programs from requirements generation, through Post Milestone C. Coverage will include the latest policies and practices and the role of T&E with an overview of Agile Software practices, DevSecOps, Capabilities Based Test and Evaluation and the relationship between Developmental and Operational T&E. Focus will be on the major events that occur during each phase of acquisition, required documentation, and expected entrance and exit criteria for successfully achieving approval. The intended audiences are engineers, program managers, and industry for an understanding of DoD acquisition in relationship to T&E's involvement.

## **T&E in Support of Agile: Test and Evaluation for Information Technology Acquisition**

Robin Poston, University of Memphis, Wayne Dumais, DHS

This tutorial will help participants share and learn about new ways to think about agile development. We will talk about the ultimate Shifting Left in an Agile Environment given Testers participate on the team from the very start, potentially everyone on the team should be able to perform T&E related activities, and the role of Test-Driven Development work. We will discuss Testing Complexity and its fit with Agile Processes where Unit Tests might be written before code and many tools are used to help build quality into the development product, like automated build and deploy tools, static code analysis and code coverage, and whether this needs to happen every iteration. While we also include functional testers as part of the Agile team so functional tests gets conducted every iteration, what about Integration Testing, System Testing, Performance Testing and User Acceptance Testing? What are the T&E Activities in Agile and what is the best way to execute continuous T&E with continuous feedback and how do you test without fully documented requirements. Finally we will touch on The Human Side of Agile and what kinds of Testers are needed on the team and what role does the T&E professional play on these teams.

## **The Evolving Role of T&E**

Matt Reynolds, Consultant

In the last half century, the role of T&E in delivering capable systems has changed with ever increasing speed -- in consumer products, in construction projects, and particularly in national defense. No longer is T&E simply focused on validating what the designers had intended to build, but is now considered necessary for ensuring that the full and necessary operational capability is inherent at the time of initial delivery to the user. The policies and procedures to achieve this have not always been obvious, and themselves needed to be proven. Given that history sets the context for the future, this tutorial will review the evolution of T&E thought and practices over the years to gain insight into what its future holds. The major policies now in place will be explored, along with the lessons learned that have continued to shape them. Today's hot topics and challenges will be discussed, including statistics based test design, reliability growth testing, and cybersecurity verification. As a complement to the symposium's technical papers, this tutorial will be a good primer to stimulate thinking about what the future of T&E needs to be.