

MONDAY, SEPTEMBER 13TH – PRE-SYMPOSIUM TUTORIALS

*NOTE: Pre-Symposium Tutorials require a separate fee.
Single Tutorial - \$205, Two Tutorials - \$385 (use discount code "TWO-Tutorials" at check out).*

8:00 a.m. – 12:00 p.m. Morning Tutorials

Introduction to Cybersecurity Test and Evaluation

Pete Christensen, Consultant

The goal of this tutorial is to provide the attendees an understanding of the basic principles of Cyberspace Concepts and Cybersecurity Test and Evaluation (T&E). Upon completion of the tutorial, attendees will be able to apply those principles to plan effective and efficient T&E. The course material is arranged in 4 sections:

- Section 1: Overview of Cyberspace and Cybersecurity: Provide a basic understanding of Cyberspace Terms, Definitions, Threats and the Cyber Attack Lifecycle.
- Section 2: Overview of DOD and DHS Cybersecurity T&E Policy: Provide an overview of documents driving Cybersecurity in DOD and DHS Acquisition and Testing.
- Section 3: Cybersecurity T&E Process: Provide an overview of the Cybersecurity T&E Process and how that process can be implemented in support of acquisition programs including Cyber Tabletop Exercises and Cyber Ranges.
- Section 4: Cybersecurity Testing Lessons Learned. To provide a summary of key lessons learned in the planning, execution and reporting of Cybersecurity T&E.

Building a Culture of Analytic Excellence

Mark Kiemele, PhD, Air Academy Associates

Critical thinking theory tells us that analytical excellence is directly related to excellence in decision making, at all levels of an organization. This workshop/tutorial will address seven major building blocks needed to establish and maintain a culture of analytical excellence. It all starts with a recognized need for analytical excellence. If there is no need, then there is no reason to build it. But most organizations can use a boost in their decision-making capability. If an organization is interested in making decisions based on politics, that is one thing; but if an organization is interested in making decisions based on data, that is another. This presentation is about data science, not political science. There are no pre-requisites for this tutorial, as the analytical techniques presented will be demonstrated via computer.

Mind's Eye to Metal - T&E in the Acquisition and Development Team

W. David Bell, PhD, MITRE Corporation; C. David Brown, PhD, Consultant to The MITRE Corporation

Program Management (PM), Systems Engineering (SE), and Test and Evaluation (T&E) are often perceived as separate processes and communities. Nothing could be farther from the truth, and the leadership of Defense Acquisition has long been pushing the infusion of all three into an integrated development an acquisition process. This tutorial will not only help program managers, systems engineers, testers, and evaluators to understand one another, but will begin to educate this combined community on how these disciplines must integrate into a unified and rigorous technical process.

This tutorial will review and provide examples in each of the following subject areas:

- a. Top-level overview of Program Management, Systems Engineering, and Test & Evaluation
- b. T&E perspective on specification and design criteria. Includes creating requirements that are testable, verifiable, and designed to facilitate integration.
- c. Verification by analysis, demonstration, test and inspection. Criteria for selecting the verification type. T&E role in formal design reviews.
- d. T&E role in program planning and Program Management
- e. Management of T&E. Writing a Master Test Plan. Developing a T&E friendly WBS.
- f. T&E role in Earned Value Management and Risk Management
- g. Developmental and technical tests (DT), operational tests and customer testing (OT), the various types, uses and responsibilities. Importance of operational testing to the commercial as well as military markets.
- h. T&E in Agile development. Integrating formal T&E into an Agile development process.
- i. Organizational considerations to facilitate T&E. Use of Integrated Product Teams, including combined or integrated test teams, to improve technical, operational and cost/schedule performance.

Incorporating T&E into Acquisition Contracts

Terry Murphy, Department of Homeland Security, T&E

So you're a Test and Evaluation Manager (or Key Leader) of a program and you and your T&E working group have just finalized the programs T&E Master Plan. Looks like you've accomplished all the pertinent tasks for T&E and ready for execution. Right? Not so fast, have you ever heard the term if it's not written into the contract it probably won't happen? To many of our T&E professionals are steeped in technical

expertise and key on development of sound well defined T&E plans, but all too often they lack program management broness to understand they've missed critical steps. That being said, has the T&E manager coordinated with their programs contracting officer, contract specialist and or contracting officer's representative? Probably not.

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, 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

It is critical that our T&E professionals have a full understanding of their "Key" role within the program contract development process. Without the T&E professional working side-by-side the contracting Team there are NO guarantees that T&E equities will be clearly articulated and communicated within the contracting documents. The T&E professional is the key to ensuring that T&E is accurately, effectively, and with clarity included within the program contract actions, thereby reducing:

- Confusion
- Miss-interruptions
- Unclear requirements

There is a gap for our T&E professionals within this area of knowledge, and it's for that reason, this tutorial is recommended.

Ethically-aligned Experimentation and T&E: A Human-Centric View of Complex Military and Safety Critical Intelligent and Autonomous Systems

Dr. Keith Joiner and Dr. Malcom G. Tutty, UNSW ADFA, International T&E Association Southern Cross Chapter- Australia

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 perspective on the big challenges facing decision making in complex systems and the key assurance initiatives pursued systematically by the US and Australian DoDs to effect these more integrated, interoperable and information-assured capabilities, while also ensuring these capabilities remain resilient to the new cyber threats using ethically-aligned approaches to experimentation and Test & Evaluation. This Tutorial will again explore the emerging best practices for a more human-centric view of such complex military and safety critical intelligent and autonomous systems.

1:00 p.m. – 5:00 p.m. Afternoon Tutorials

Successful Distributed T&E with TENA, JMETC, and BDA

Gene Hudgins, Test Resource Management Center Joint Mission Environment Test Capability (TRMC/JMETC)

The Test and Training Enabling Architecture (TENA) was developed as a DoD 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 JMETC events, is well-designed for its role in prototyping demonstrations and distributed testing.

Established in 2006 under the TRMC, JMETC provides readily-available connectivity to the Services' distributed test capabilities and simulations. JMETC also provides connectivity for testing resources in the Defense industry and incorporation of distributed testing and leveraging of JMETC-provided capabilities by programs and users has repeatedly proven to reduce risk, cost, and schedule. 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 is the T&E enterprise network solution for secret testing, and uses a hybrid network architecture – the JMETC Secret Network (JSN), based on the SDREN. The JMETC 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 JNTC integration solutions to foster test, training, and experimental collaboration.

TRMC 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 their expected future benefits to the range community and the warfighter.

Real World Telemetry over IP

Gary Thom, Delta Information Systems

As telemetry ranges are making the move to network centric architectures, it is worth considering the lessons learned over the previous 10 years of designing, installing, troubleshooting and optimizing telemetry data distribution over IP networks. This tutorial will begin with the motivation for moving to Telemetry over IP (TMoIP). It will then provide a basic networking foundation for understanding TMoIP and TMoIP formats. With this basis, we will be able to discuss network design considerations and tradeoffs for a successful TMoIP deployment. Finally, we will present some of the real-world problems and issues that may arise in a TMoIP system and the troubleshooting techniques that can be used to resolve them.

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

Robin Poston, PhD - System Testing Excellence Program, University of Memphis, and Mark Gillenson, PhD, University of Memphis

This tutorial will discuss T&E in support of Agile and DevSecOps, we need to explore the sequence of the evolution of the agile methods, rationale for the application of different methods, compare traditional and agile software development approaches, discuss research conclusions regarding the agile method's impact on software performance, review benefits and challenges of Agile and DevSecOps, and appreciate the fit of Agile and DevSecOps methods with waterfall Software Development LifeCycle (SDLC) stages. Furthermore, in this tutorial we will also discuss when to use Agile and DevSecOps, the role of the tester on these projects, and various kinds of T&E

applicable to iterative software development. The goal is for attendees to be able to evaluate whether T&E is being properly integrated into Agile and DevSecOps software development process, coordinate development of the operational test strategy into these software development environments, coordinate and oversee T&E in the development environment with government and contractor personnel, and specify T&E requirements in the Request for Proposal (RFP) for a software development project in which the Agile or DevSecOps approach is to be used. Practical examples from the Department of Homeland Security will be shared and discussed.

Machine Learning Here, Machine Learning There... Machine Learning in Test & Evaluation? An ML Tutorial for Everyone

Mark Tschopp, Ph.D., U.S. Army Research Laboratory

Machine Learning and Artificial Intelligence are ubiquitous within the commercial and defense sectors these days. But what is it really? As we are asked to design, test, and evaluate systems around artificial intelligence and machine learning (AI/ML) capabilities and technologies within the DoD, how much do we need to know about what is “under the hood” for these algorithms? If you find yourself asking these sorts of questions, this tutorial may be for you. The objective of this tutorial is to start at the beginning. I was like you a few months back. Some people do not actually remember how they learned machine learning, i.e., the intuition, the concepts, the math just sort of gradually seeped in over the course of their undergraduate or graduate degree—now they know it just as a few lines of code in Python. For me, I just learned this, so it is fresh in my mind – what concepts I grasped, which ones were harder to grasp, what are the key concepts that I would tell someone “if you know anything in machine learning, you got to know this.” I sat down, I listed what I felt were key concepts: regression, classification, linear regression, logistic regression, regularization, variance-bias tradeoff, loss/cost functions, activation functions, neural networks, dropout, convolutional neural networks, LSTMs, etc. The goal for this tutorial is to be a comprehensive entry point into machine learning. Since I am a DEVCOM ARL scientist, I chose an Army-related dataset—ballistic penetration of aluminum armor. No cat classification datasets or Boston housing price datasets here; just straight up bullets being stopped by armor. I have condensed 8 months of online machine learning courses into a few parts. You may ask, “Will I learn a whole bunch of Python or MATLAB syntax that I will never use?” No, let’s just do it in Microsoft Excel. Yup, let’s program a few neural networks to truly understand what’s going on and provide some intuition into what’s “under the hood” as collectively we incorporate more and more AI/ML capabilities into our defense systems.

Air Force's New MBCRA (Mission Based Cyber Risk Assessment) and Integrated Engineering Approach

Kevin McGowan, COLSA Corporation

The AF commonly uses numerous stove-piped cyber vulnerability assessment processes, executed in parallel, to characterize cyber attack surfaces and to identify potential cyber vulnerabilities and risks. This is an inefficient use of limited resources and results in products being generated for targeted audiences (i.e., not usable by multiple stakeholders). It also results in less informed products and decisions.

The Mission-based Risk Assessment Process for Cyber (MRAP-C) is the AF's new iterative Mission Based Cyber Risk Assessment (MBCRA) process which builds upon best practices from the Cyber Table Top (CTT), Cyber Test Prioritization Methodology (CTPM), Cyber BlueBook (CBB), and integrated engineering processes. The MRAP C combines bottom-up and top-down assessment approaches to identify critical components and system information, to assess potential cyber attack paths through the system, and to identify potential mission effects of cyber vulnerability exploitation. The MRAP-C analysis activities and Attack Path Vignettes generated during the MRAP-C process inform cooperative and adversarial developmental and operational cyber test events, cyber test strategy, cyber test plans, cyber requirements, cyber test resource lists, and cyber recommendations development. It also fulfills DoD Cyber Test and Evaluation Phase 1 and 2 requirements.

When combined with the USAF's integrated Systems Security Engineering (SSE) Cyber Workflow Process, programs are equipped with an iterative engineering process which assesses cyber vulnerabilities and risks throughout the acquisition lifecycle. When executed by the program's integrated Systems Security Working Group (SSWG), all member stakeholders are involved with performing the cyber vulnerability assessments and with performing key programmatic / engineering activities focused on developing a cyber secure and cyber survivable system for the warfighter.

This Tutorial provides an overview of the new MRAP-C MBCRA process and how it aligns with the USAF SSE Cyber Workflow Process.

Laser System Propagation T&E Challenges

Douglas H. Nelson, PhD, Teknicare, Inc., and Mark Stevens, Naval Postgraduate School

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