



**36TH INTERNATIONAL
TEST AND EVALUATION SYMPOSIUM**

Challenges for Global Threats

November 12 – 15, 2019

2019 PROGRAM GUIDE

Kaua'i Marriott Resort ~ Lihue, Hawaii

**Jointly Hosted by the
*ITEA Mid-Pacific and Southern Cross Chapters***

ITEA is a 501(c)(3) professional education association dedicated to the education and advancement of the test and evaluation profession. Registration fees, membership dues, and sponsorship are tax deductible.

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WELCOME TO THE 36TH INTERNATIONAL TEST AND EVALUATION SYMPOSIUM!

Dear Test & Evaluation Professional,

Thank you for joining us for the 36th Annual International Test and Evaluation Symposium—the **T&E community's premier event!**

Global and regional threats are developing larger, more capable military forces. These adversary forces are armed with increasingly sophisticated weapon systems developed through incorporation of new technologies and new tactics. Some global threats have developed military capabilities that, in some areas, are on a trajectory to outpace those of the United States and allies. These more advanced threat systems are continuing to be improved in range, speed, lethality, stealth, and precision. As the United States and allies improve warfighting systems and capabilities to meet these global challenges, the test and evaluation (T&E) workforce and resources must be ready to more rapidly evaluate a systems suitability and effectiveness in representative complex environments. In some cases, increased use of simulation for testing will be crucial to complete early prototyping, analyze complex shortcomings, and maintain test security. The growing threat, new types of more sophisticated and flexible weapons, and advanced defensive systems will further complicate these tasks and will also challenge the T&E workforce. How will we meet these challenges? T&E for the United States and Coalition Partners must be ready to rapidly provide decision makers the data required to make critical decisions. How can we, as a team, maintain readiness to meet the upcoming T&E challenges and accelerate the development of solutions to global threats?

Sincerely,

Peter Nikoloff
SYMPOSIUM CHAIR

CONTINUING EDUCATION UNITS (CEUs)

Each of the 4-hour Pre-Symposium Tutorials provide 4 contact hours of instruction (4 CEUs) that are directly applicable to your professional development program, including the Certified Test and Evaluation Professional Credential (CTEP).

In addition to the Pre-Symposium Tutorials, the Annual Symposium provides 4 contact hours of instruction (4 CEUs) for each half-day, 8 contact hours of instruction (8 CEUs) for each full-day, or 20 contact hours of instruction (20 CEUs) for attending the full Symposium, that are directly applicable to your professional development program, including the Certified Test and Evaluation Professional Credential (CTEP).

A very special thanks to our host Chapter Presidents!

Mid-Pacific Chapter
Shannon Wigent
Laulima Systems

Southern Cross Chapter
Peter Nikoloff
NOVA Systems Australia

Your Symposium Committee

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Mike White

Geoff Wilson

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John Binns

Phil Hallenbeck

Mark Kiemele, PhD

Mike Laber

Patrick Lardieri

Martin Rivas

Ed Romero

VOLUNTEERS

Kerrie Grant

Steven "Flash" Gordon, PhD

Tim Morey

Terry Murphy

Erwin Sabile

TUESDAY MORNING, NOVEMBER 12TH – PRE-SYMPOSIUM TUTORIALS

(NOTE: SEPARATE REGISTRATION FEE REQUIRED)

T&E as a Part of Agile Development

Instructors: **Robin Poston, PhD** - System Testing Excellence Program, University of Memphis, and **Wayne Dumais** - Deputy T&E, Department of Homeland Security (DHS)

To discuss T&E in support of agile development, 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 appreciate the fit of agile methods with Software Development LifeCycle (SDLC) stages. Furthermore, in this tutorial we will also discuss when to use agile, the role of the tester on agile projects, and various kinds of testing applicable to agile software developments.

The International Test & Evaluation Program and TEP Agreements Overview

Instructors: **Bob Butterworth** - Director, Operational Test and Evaluation (DOT&E), and **Vicki Aardema**

Testing with our allies is essential. To ensure interoperability, and to eliminate, inefficient duplicative activities, the United States and its international partners must share test resources and information. However, few in the test community know the ins and outs of these international arrangements, and may miss the opportunity to take advantage of them. To set the stage for greater understanding and use, the Office of the Director, Operational Test and Evaluation (DOT&E) will offer a tutorial on the capabilities, benefits, and limitations of the DOD International Test and Evaluation Program (ITEP). Subject matter experts from the DOT&E ITEP Team will discuss their experiences developing, negotiating, and formalizing the bilateral and multinational agreements necessary in order to test with a foreign partner.

Laser Systems T&E Challenges

Instructor: **Douglas Nelson** – Teknicare

An introduction to the challenges of testing and evaluating Laser Systems is included. 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 Using TENA & JMETC

Instructor: **Gene Hudgins** – KBR Government Solutions - U.S.

Together, TENA and JMETC enable interoperability among ranges, facilities, and simulations in a timely and cost-efficient manner. TENA provides for real-time system interoperability, as well as interfacing existing range assets, C4ISR systems, and simulations; fostering reuse of range assets and future software systems. JMETC is a distributed, LVC capability which uses a hybrid network architecture; the JMETC Secret Network (JSN), based on the SDREN, is used for secret testing and 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 and training capabilities and simulations, as well as industry resources.

T&E: The Past is Prologue

Instructor: **Matt Reynolds** – Test and Evaluation Consulting

History sets the context for the future. In few arenas has that been more pertinent than in T&E. Five decades ago, it became obvious that T&E in all domains—but especially in national defense—was not adequately keeping up with technology. In defense, the result was less confidence that we would be able to counter ever-advancing threats. A key lesson learned was that T&E policies needed to be greatly strengthened and that tools and techniques needed to be continuously improved. This tutorial will review the evolution of T&E thought and practices over the years. The major policies now in place will be explored, along with the lessons learned that have helped to shape them. Today's hot topics and challenges will be discussed, including statistics-based test design, reliability growth testing, and cybersecurity verification. This tutorial will be a good primer to stimulate thinking about what the future of T&E will need to encompass.

Using Design of Experiments to Accelerate the Knowledge Gain from Test Data

Instructor: **Mark J. Kiemele, PhD** – Air Academy Associates

In a data-driven economy, industry and government leaders rely increasingly on skilled professionals who can see the significance in data and use data analytic techniques to properly collect data, solve problems, create new opportunities, and shape change. Data science can be defined as the art and science of solving problems and shaping decisions through the precise collection and analysis of data. This tutorial is intended for executives, leaders, managers, and practitioners who need to know how their critical thinking can be impacted by such things as Big Data, Predictive Analytics, Design of Experiments (DOE) and other tools in the Data Science toolkit. This tutorial will cover the need for critical thinking as well as a high-level view of a variety of data analytic tools that can be used to enhance critical thinking.

TUESDAY AFTERNOON, NOVEMBER 12TH – SYMPOSIUM DAY ONE
(EXHIBIT HALL OPEN 2:00 P.M. TO 7:00 P.M.)

Opening Symposium Plenary Session

1:00 p.m. Welcome: **COL Bill Keegan, USA (Ret)** – President, International Test and Evaluation Association, Equator Corporation

Presentation of the Colors - Color Guard
The United States National Anthem and The Australian National Anthem
– High School Chorus
Invocation - *Halau Hula O Leilani* with Kumu Hula Leilani Rivera Low

1:15 p.m. Opening Remarks: **Peter Nikoloff** – Symposium Chair, NOVA Systems

1:30 p.m. **Speakers' Forum: *The State of T&E***

Moderator: **Peter Nikoloff** –NOVA Systems

Panelists:

David W. Duma – Principle Deputy Director, Operational Test and Evaluation (OT&E), Director, Operational Test and Evaluation (DOT&E)

James "Jim" A. Faist – Director of Defense Research and Engineering for Advanced Capabilities, Under Secretary of Defense Research and Engineering, Office of the Secretary of Defense (OSD)

Steve Hutchison, PhD - Director of Test and Evaluation, Department of Homeland Security (DHS)

2:30 p.m. **Break with Exhibitors**

3:00 p.m. Featured Speaker: **Col. Ryan Blake** – Commandant, U.S. Air Force Test Pilot School

3:30 p.m. **Workforce Development Panel**

Moderator: **Terry Murphy** - Deputy Director, T&E, Department of Homeland Security (DHS)

Panelists:

Darryl Ahner, PhD – Director, Air Force Institute of Technology (AFIT)

Mindy Dowling – Computer Scientist, Federal Aviation Association (FAA)

Laura Freeman, PhD – Associate Director, Virginia Tech

Robin Poston, PhD – Director, System Testing Excellence Program, University of Memphis

Kenneth Stefanek – Learning Director, Defense Acquisition University (DAU)

5:00 p.m. to 7:00 p.m.

Reception with Luau Sponsored by KBR
(Symposium Registration OR Guest Reception Ticket REQUIRED)

WEDNESDAY, NOVEMBER 13TH – SYMPOSIUM DAY TWO
(EXHIBIT HALL OPEN 10:00 A.M. TO 7:30 P.M.)

Plenary Session

8:30 a.m. **Day Two Remarks - Peter Green**, Symposium Technical Program Chair, KBR
Government Solutions - US

8:45 a.m. Featured Speaker: **Malcolm G. Tutty, PhD, CPEng, CTEP, FIE(Aust), FRAeS** –
Vice-President of the ITEA Southern Cross Chapter

9:15 a.m. **The Changing Threat Panel**

Moderator: **George Rumford** – Principal Deputy Director (Acting), Test
Resource Management Center (TRMC)

Panelists:

RDML Stephen R. Tedford - Commander, Operational Test and Evaluation
Force (COTF)

James Wells - Deputy T&E, Department of Homeland Security (DHS)

Bradley Thomason – Director, Threat Systems Management Office

10:15 a.m. **Break with Exhibitors**

10:30 a.m. **Featured Speaker: Air Commodore Ross Bender, RAAF** – Director, General
Capability Integration, Test and Evaluation, Australian Defence Force

11:00 a.m. **International T&E Panel**

Moderator: **Adrian Britton** – T&E Campaign, QinetiQ Ltd. (UK)

Panelists:

John Binns - Asst. Head Evaluation Strategy & International Minister of
Defence, Ministry of Defense (UK)

Vivek Chanana, PhD, CPEng - SO1CD AFR/Chief Engineer, AF Ranges
Directorate

COL. Damien McLachlan - Australia Defence Force

Cathy O'Carroll - Global Campaign Director, Integrated Test & Evaluation
QinetiQ Ltd. (UK)

12:00 p.m. **ITEA T&E Professional Awards Luncheon**

**WEDNESDAY, NOVEMBER 13TH – SYMPOSIUM DAY TWO
(EXHIBIT HALL OPEN 10:00 A.M. TO 7:30 P.M.)**

2:00 p.m. **Featured Speaker: Patrick Lardieri** – Principal Architect, Cyber Support Ops, Lockheed Martin

2:30 p.m. **Future Range Panel**

Moderator: **Rob Vargo** – Director, Range Technology Innovation, Naval Air Warfare Center Aircraft Division

Panelists:

Mike Contratto - Technical Director, 96th Range Group, USAF

Tom Dowd – Director, Naval Air Warfare Center Weapons Division

Paul Harvey, PhD - Multi-Domain T&E Australian Defence Force Tactical Data Link Authority

Bob Kay - Technical Director, Pacific Missile Range Facility

3:30 p.m. **Break with Exhibitors**

4:00 p.m. – 5:30 p.m. **Technical Track Sessions**

<u>Time</u>	<u>Title of Presentation</u>	<u>Speaker</u>	<u>Organization</u>
Big Data & Knowledge Management Track (A)			
Technical Session Chair: Ryan Norman, Department of Defense			
Technical Session Deputy Chair: Mark Kiemele, PhD, Air Academy Associates			
4:00 PM	<i>JSAS Crowdsourcing to Enhance Development and Readiness</i>	Thomas (Ted) Dempsey	Rockwell Collins
4:30 PM	<i>Knowledge Management and the Big Data Evaluation Revolution with the F35: Northern Edge 2019 Support</i>	Tracy Mullendore	KBR Government Solutions - US
5:00 PM		Chris Moyer	DellEMC
Directed Energy Track (A) - CLOSED SESSION (Distro "D")			
Technical Session Chair: Andrew Lozano, Naval Surface Warfare Center Port Hueneme			
Technical Session Deputy Chair: Martin Rivas			
4:00 PM	<i>Mobile High Energy Laser Measurement (MHELM) Program</i>	Whitney Winchester	U.S. Army PEO STRI
4:30 PM	<i>Directed Energy Wind Tunnel Test & Evaluation</i>	Taylor Swanson, PhD	Arnold Engineering Development Complex (AEDC)
		C. Lynn Seborn, PhD	
5:00 PM	<i>T&E Instrumentation for EO-Laser System Modeling & Simulation</i>	Bryan Kelchner	Teknicare, Inc.
Future Range Track (A)			
Technical Session Chair: Rob Vargo, Naval Air Systems Command			
Technical Session Deputy Chair: Ed Romero, Naval Air Systems Command			
4:00 PM	<i>Connected Ranges & Digital Health, Safety, & Environment (HSE)</i>	Dennis Miller	Jacobs
4:30 PM	<i>Overcoming Challenges in Distributed T&E Using TENA and JMETC</i>	Gene Hudgins	KBR Government Solutions - US
5:00 PM	<i>Capabilities for Global Security Solutions Resident at the Nevada National Security Site</i>	Bart Jones	Mission Support & Test Services, LLC - Jacobs, Honeywell, HII

WELCOME TO THE 36TH INTERNATIONAL TEST AND EVALUATION SYMPOSIUM!

<u>Time</u>	<u>Title of Presentation</u>	<u>Speaker</u>	<u>Organization</u>
International T&E Challenges Track (A)			
Technical Session Chair: Adrian Britton, QinetiQ Ltd. (UK)			
Technical Session Deputy Chair: John Binns, UK Ministry of Defence			
4:00 PM	<i>Test & Evaluation Benefit Assessment Tool (TEBAT): A Risk Based Approach for the Prioritization of Test & Evaluation (T&E)</i>	Brian Gillett, Ceng MIET	UK Defence Scient & Technology Laboratory (DSTL)
4:30 PM	<i>Coalition and Multinational Testing Environments</i>	Floyd Reed	Jacobs / Joint Interoperability Test Command
5:00 PM	<i>Knowing the International Language of Test & Evaluation</i>	Mark Kiemele, Ph.D.	Air Academy Associates
Threat Picture Technical Session			
Technical Session Chair: Tim Morey, KBR			
Technical Session Deputy Chair: Mike Laber			
4:00 PM	<i>A Flexible Architecture for Range Safety System Based on DDS</i>	KyeongWon Park	Agency for Defense Development
4:30 PM	<i>Test and Evaluation (T&E) Infrastructure Development: Increased Efficiency in the Development of Test Fixtures Through the Use of Computational Fluid Dynamics (CFD) Modeling & Rapid Prototyping</i>	Wesley Ercanbrack	Jacobs / Dugway Proving Ground
		Brad Thacker	
5:00 PM	<i>Tester: Meet the Global Challenge: Simple Solutions to an Increasingly Complex World</i>	Paola Pringle	Naval Air Warfare Center Weapons Division
		Paul Fonua	
T&E S&T Track (A)			
Technical Session Chair: Geoff Wilson, General Infomatics, Inc.			
Technical Session Deputy Chair: Phil Hallenbeck, TRIDEUM Corporation			
4:00 PM	<i>Extending CRIIS for LVC in OT&E, Range Operations, and Training Applications</i>	Jon Skarphol	Collins Aerospace
4:30 PM	<i>Conducting Complex Underground Chemical Explosion Experiments for Nuclear Explosion Monitoring</i>	Lisa Garner	Mission Support & Test Services, LLC / Jacobs, Honeywell, Hill
5:00 PM	<i>Exploring Agile Acquisition Principles and Practices for Complex System Delivery</i>	M. Sybil E. Abraham	Federal Aviation Administration, WJ Hughes FAA Technical Center
		Timothy Sienrukos	
		Mindy Dowling	

5:30 p.m. to 7:30 p.m.
Networking Reception Sponsored by Jacobs
 (Symposium Registration OR Guest Reception Ticket REQUIRED)

**THURSDAY, NOVEMBER 14TH – SYMPOSIUM DAY THREE
(EXHIBIT HALL OPEN 10:00 A.M. TO 4:00 P.M.)**

Plenary Session

8:35 a.m. ITEA Annual Meeting: **COL Bill Keegan, USA (Ret)** – ITEA President, Equator Corporation

8:45 a.m. Keynote Speaker: **James Faist** – Director, Defense Research & Engineering for Advanced Capabilities, Office of the Secretary of Defense (OSD)

8:30 a.m. **Testing Hypersonics Panel**

Moderator: **Mike White** - Assistant Director for Hypersonics, Defense Research & Engineering for Advanced Capabilities, Office of the Secretary of Defense (OSD)

Panelists:

George Rumford - Principal Deputy Director (Acting), Test Resource Management Center (TRMC)

Ed Tucker - Tech Director, Arnold AFB

10:15 a.m. **Break with Exhibitors**

10:30 p.m. – 12:00 p.m. **Technical Track Sessions**

<u>Time</u>	<u>Title of Presentation</u>	<u>Speaker</u>	<u>Organization</u>
Big Data & Knowledge Management Track (B)			
Technical Session Chair: Ryan Norman, Department of Defense			
Technical Session Deputy Chair: Mark Kiemele, PhD, Air Academy Associates			
10:30 AM	<i>Big Data Analysis Techniques for Modern T&E</i>	Kenneth Sanchez	NAVAIR
11:00 AM	<i>A Unified Approach to Post Test Analysis</i>	Dale Jones	Symvionics Telemetry Systems
11:30 AM	<i>Accelerating Knowledge Gain from Test Data</i>	Mark Kiemele, PhD	Air Academy Associates
Cyber & EW Track (A)			
Technical Session Chair: Mark Phillips, Raytheon Missile Systems (RMS)			
Technical Session Deputy Chair: Patrick Lardieri, Lockheed Martin			
10:30 AM	<i>Planning and testing for an Dynamic Cyber Threat</i>	Alex Hoover	Department of Homeland Security
11:00 AM	<i>Safe and Secure Cyber T&E on Cyber-Physical Systems</i>	Suresh Damodaran	The MITRE Corporation
11:30 AM	<i>Cyber Compliance, Test and Evaluation Evolution</i>	Pedro Ramirez, Director	Jacobs Cyber Technology Group

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<u>Time</u>	<u>Title of Presentation</u>	<u>Speaker</u>	<u>Organization</u>
Directed Energy Track (B) - CLOSED SESSION (Distro "D")			
Technical Session Chair: Andrew Lozano, Naval Surface Warfare Center Port Hueneme			
Technical Session Deputy Chair: Martin Rivas			
10:30 AM	<i>Counter Directed Energy Weapons (CDEW); Evaluation of Naval Aircraft Defenses & Survivability Against Directed Energy Weapons</i>	Bonnie Johnson	Naval Postgraduate School Systems Engineering Department
11:00 AM	<i>Joint Laser Systems Effectiveness (JLaSE) Joint Test</i>	Scott Boyd	Naval Surface Warfare Center Dahlgren Division (NSWCDD)
11:30 AM	<i>Strategies for Satellite Safety During Laser Test and Evaluation</i>	Heather Witts	USAF JFSCCN359
Spectrum Technology Technical Session			
Technical Session Chair: Tom O'Brien, Test Resource Management Center			
Technical Session Deputy Chair: TBA			
10:30 AM	<i>Latest Development Status on the Commercial Derivative Aircraft Based Instrumentation Telemetry System (CBITS) Program</i>	J. Kyle Roudebush, TRSA PM	Naval Air Systems Command (NAVAIR)
11:00 AM	<i>Electromagnetic Spectrum Encroachment</i>	Guenever Aldrich, PE	Spectrum Reallocation Lead, DoN
11:30 AM	<i>Global Spectrum Demand Challenges for T&E AMT</i>	Guy Williams	ENS/ Air Force Test Center (AFTC)
Testing Hypersonics Technical Session			
Technical Session Chair: Mike White, Office of the Secretary of Defense (OSD)			
Technical Session Deputy Chair: TBA			
10:30 AM	<i>Application of Scientific Test and Analysis Techniques to Autonomous & Hypersonic Systems</i>	David R. Harrison	Lockheed Martin Corporation
11:00 AM	<i>Advanced Systems Test and Evaluation (T&E) on DoD Ranges</i>	Jay Clark	KBR Government Solutions - U.S.
11:30 AM	<i>Long Range Hypersonic Weapon (LRHW) Systems Integration Laboratory (SIL): A Unique HWIL Simulation and Test Architecture for Evaluating Rapid Prototyping of Critical Hypersonic Technologies</i>	Rachael Armayer	CCDC Aviation & Missile Center

CHALLENGES FOR GLOBAL THREATS

<u>Time</u>	<u>Title of Presentation</u>	<u>Speaker</u>	<u>Organization</u>
T&E S&T Track (B)			
Technical Session Chair: Geoff Wilson, General Infomatics, Inc.			
Technical Session Deputy Chair: Phil Hallenbeck, TRIDEUM Corporation			
10:30 AM	<i>Net-Centric Weapons Test and Evaluation Environment (NCWTEE)</i>	Jason Lucas	USAF - 96th TW (96 TSSQ)
11:00 AM	<i>The Architecture of the F-35 Lightning II Mission Systems Integration Lab - "Then and Now"</i>	Paul Garrison, Ph.D.	Lockheed Martin Corporation
11:30 AM	<i>Overwater Scoring and Surveillance (OWSS)</i>	Josue DeJesus	USAF - 96th TW (96 TSSQ)

Noon **Lunch with Exhibitors**

12:30 p.m. Exhibit Hall Tour for STEM students

1:30 p.m. **Speakers Forum Panel**

Moderator: **Peter Green** – KBR Government Solutions - US

Panelists:

Wayne Dumais – Deputy T&E, Department of Homeland Security

Charlie Hall - T&E Director, RDT&E, United States Coast Guard (USCG)

Captain Timothy H. Young - Commanding Officer Pacific Missile Range Facility (PRMF)

2:30 p.m. **Break with Exhibitors**

3:00 p.m. **Old School vs. New School Panel**

Moderator: **Wayne Dumais** – Deputy T&E, Department of Homeland Security

Panelists:

Antonia Pulley – T&E, United States Citizenship and Immigration Services (UNCIS)

Mark Raffetto - United States Marine Corps

Timothy Sienrukos - Federal Aviation Administration

Colby Stevens - KBR Government Solutions - US

4:00 p.m. Closing Keynote: **David W. Duma** – Principal Deputy Director, OT&E

FRIDAY, NOVEMBER 15TH – SYMPOSIUM DAY FOUR

- 8:00 a.m.** Pacific Missile Range Facility Tour (PMRF) – Tour Coordinator: Bob Kay
Space is limited. Separate registration required.
- 8:00 a.m.** U.S. Coast Guard Benjamin Bottoms - Fast Response Cutter Tour – Tour
Coordinator: Charlie Hall, T&E Director, RDT&E, United States Coast Guard
(USCG). Space is limited. Separate registration required.

8:00 a.m. – Noon Technical Track Sessions

<u>Time</u>	<u>Title of Presentation</u>	<u>Speaker</u>	<u>Organization</u>
Cyber & EW Track (B)			
Technical Session Chair: Mark Phillips, Raytheon Missile Systems (RMS) Technical Session Deputy Chair: Patrick Lardieri, Lockheed Martin			
8:30 AM	<i>Cyber-resilient Design and Test Using MBSE</i>	Frank Alvidrez	Spectrum, Inc.
9:00 AM	<i>Test & Evaluation Methodologies</i>	Donya Shakiba	Jacobs
9:30 AM	<i>Shifting Left of the Cyber Adversary</i>	Paola Pringle	NAWCWPNS
Directed Energy Track (C) - CLOSED SESSION (Distro "D")			
Technical Session Chair: Andrew Lozano, Naval Surface Warfare Center Port Hueneme Technical Session Deputy Chair: Martin Rivas			
8:30 AM	<i>Paradigm Shift in Directed Energy Test to Support NDS</i>	Mike Zmuda, PhD	WSMR - ATEC
9:00 AM	<i>Characteristics to Consider When Planning HEL Testing & Evaluation</i>	David Loomis	DNL Consulting
9:30 AM	<i>Requirements and Methods for High Energy Laser Test & Evaluation</i>	Keith Bush	Gryphon Technologies DE JTO
10:00 AM	Break		
<u>Time</u>	<u>Title of Presentation</u>	<u>Speaker</u>	<u>Organization</u>
Future Range Track (B)			
Technical Session Chair: Rob Vargo, Naval Air Systems Command Technical Session Deputy Chair: Ed Romero, Naval Air Systems Command			
10:30 AM	<i>The KBR Test Facility: Building a Homegrown Test Facility</i>	Scott Martin	KBR Government Solutions - U.S.
11:00 AM	<i>Developing Common Instrumentation Package</i>	Richard Wride	96th TW (96 OG)
		MAJ Daniel Welsh	AFRL/RWPlon
11:30 AM	<i>Advanced Weapons Effects Test-Capability</i>	Caitlin Ezell	96th TW (96 TSSQ)
International T&E Challenges Track (B)			
Technical Session Chair: Adrian Britton, QinetiQ Ltd. (UK) Technical Session Deputy Chair: John Binns, UK Ministry of Defence			
10:30 AM	<i>How Intelligent Asset Management (IAM) Enables the Range of the Future</i>	Robert Poche	Jacobs
11:00 AM	<i>Agile Test & Evaluation Regime for Woomera Test Range Remediation</i>	Vivek Chanana, PhD, CPEng, AF Ranges Directorate	Air Warfare Centre, RAAF Base Edinburgh
11:30 AM	<i>Challenges with International Collaborative Development and T&E</i>	Joyce Matias	NAWCWD
		Parth Patel	

1:00 p.m. Certified Test and Evaluation Professional (CTEP) Examination Session

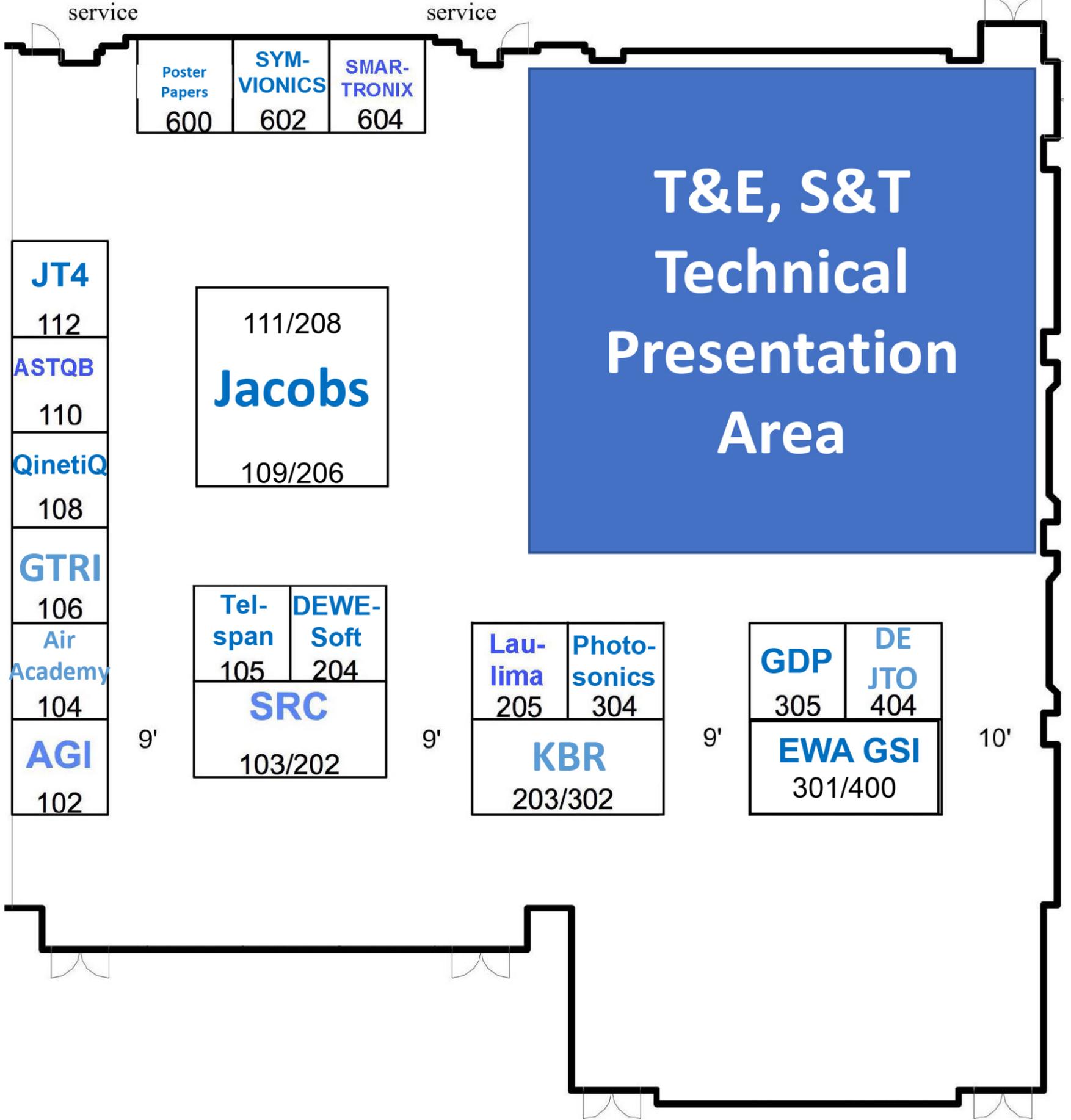
SYMPOSIUM EXHIBIT HALL

Kaua'i Ballroom

Halele'a

Kona

service



Exhibitor Profiles

Air Academy Associates (104)

Air Academy Associates is a leader in providing continuous improvement methods to industry and government through consulting, training and coaching services, textbooks, training aids and software. Since 1990 we have assisted clients in reducing variation and creating Better, Faster, and Lower Cost products and services. Emphasis in the TEST and Evaluation Community resides in our expertise in Design of Experiments.

Point of Contact: Kathi Swagerty

E-mail: kswagerty@airacad.com

Analytical Graphics, Inc. (102)

AGI develops commercial modeling and analysis software for the aerospace, defense and intelligence communities. AGI's core product suite, Systems Tool Kit (STK), is a flexible environment that enables scientific test and evaluation planning methods and supports the full life cycle of T&E requirements, planning, event design, execution and post-flight activity.

Point of Contact: Jodi Lyon

E-mail: jlyon@agi.com

American Software Testing Qualifications Board - ASTQB (110)

ASTQB, the American Software Testing Qualifications Board, is the U.S. board for the internationally recognized ISTQB software testing certification. The mission of ASTQB is to promote professionalism in Software Testing in the United States. We do this by providing and administering quality exams for the ISTQB, ASTQB and IQBBA certifications, by supporting and facilitating software training providers in delivering high quality courses, by actively engaging in the ISTQB working groups, and by supporting efforts to develop and encourage people who are already in or are entering the software testing profession.

Point of Contact: Andrew L Pollner

E-mail: apollner@alpi.com

DEWESoft (204)

DEWESoft, is a World leading provider of data acquisition software and hardware serving all application. The DEWESoft synchronizes Analog, Digital, Video, GPS, CAN, ARINC 429/1553, PCM and Chapter 10. We also are a full Ground Station Telemetry software package. For more information about DEWESoft please visit us at www.DEWESoft.com.

Point of Contact: Christie Nowicki

E-mail: christie.nowicki@dewesoft.com

EWA Government Systems, Inc. (301/400)

EWA Government Systems Inc. is a veteran-owned, small broad-based technology business providing professional services and specialized products to its customers. EWA prides itself on overcoming technological challenges and delivering on-time products for its customers. For over 40 years, EWA has been specializing in a broad array of EW products and services, including analysis, simulation and training, RF threat simulators and custom instrumentation for laboratories and OARs, signal analysis software, and embedded training hardware and software. We also provide engineering products and services in cyber defense, intelligence, security, training, tactical mission planning, information operations, wireless applications, range instrumentation, spectrum, radar development, force protection and counter-UAS.

Point of Contact: Eileen Redd

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GDP Space Systems (305)

GDP Space Systems is the preferred manufacturer of a wide selection of products and services that are used in the Aerospace, DoD, and Scientific communities for applications such as flight test, satellite launch and control, missile testing, and much more. For over 35 years, GDP has been well known for their quality and cost-effective solutions that provide reliable and successful support for their customers' missions.

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Georgia Tech Research Institute – GTRI (106)

Georgia Tech Research Institute (GTRI) has extensive T&E capabilities covering a broad range of engineering and scientific disciplines, including tracking new technologies and their effect on T&E, planning and executing programs for the Operational Test Agencies, and providing T&E professional education courses, conferences, and workshops. Visit www.terec.gatech.edu for T&E course information.

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Jacobs Engineering (109/111/206/208)

Jacobs Engineering (NYSE: JEC), one of the nation's largest engineering and technical services firms, with annual revenues of \$11.5 billion and approximately 50,000 personnel in over 300 locations worldwide. Jacobs has a more than 70-year heritage providing advanced technology engineering services to DOD, NASA, DOE, and industry. The Jacobs Aerospace, Technology, and Nuclear Line of Business provides a complete range of scientific, engineering, and technical services in the following core markets: test and evaluation; engineering; operations and maintenance; scientific, engineering and technical services; design/build/operate test facilities; and enterprise information services. Jacobs is a recognized leader in numerous technical fields, including: design of wind tunnels, engine test cells, and automotive test facilities; process re-engineering and management of change for highly technical operations; design of systems and mechanisms for space transportation and habitation; systems engineering and acquisition support; logistics management; asset management; complex facilities operations and maintenance; C4ISR systems development and sustainment; and range operations. Jacobs also provides a broad range of IT support, including network architecture, data center management, software development, and IT systems operation and maintenance. In addition, Jacobs provides full scope environmental services, including assessments, investigations, design, cleanup, and disaster response; humanitarian mission support; unexploded ordnance (UXO) clearance; and remote site work.

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Joint Directed Energy Transition Office - DE JTO (404)

In 2000, congress moved to implement the DoD Laser Master Plan to advance the state of the art, stimulate the industrial base, and pursue enabling technologies for High Energy Laser (HEL) systems. To do this, they formed the High Energy Laser Joint Technology Office (HEL-JTO) to direct and coordinate HEL technology development across academia, industry and government laboratories. In 2017 congress renamed HEL-JTO to the Joint Directed Energy Transition Office (DE-JTO), with a mission to also help with the increased interest to transition DE technology onto militarily useful platforms. Over the years, JTO has advanced state of the art (SoA) in DE technologies, and provided the Services with components necessary to perform initial system demonstrations. Typical funding activities for JTO include sponsoring flagship projects and funding university, military and government labs, and industry. Opportunities exist to team with JTO moving forward.

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JT4 (112)

JT4 provides engineering and technical support to multiple western test ranges for the U.S. Air Force and Navy under the Joint Range Technical Services Contract (J-Tech II). JT4 is supported by several teammate companies on the J-Tech II Contract. Together, we develop and maintain realistic integrated test and training environments. We prepare our nation's war-fighting aircraft, weapons systems, and air crews for today's missions and tomorrow's global challenges.

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KBR (203/302)

KBR Government Solutions ensures mission success for customers on land, at sea, in the air, and in space and cyberspace. We create value and drive innovation by combining engineering, technical and scientific expertise with our full life cycle capabilities, mission knowledge and future-focused technologies. We are known for excelling in complex and extreme environments and trusted to overcome the nation's most pressing challenges. When it's mission critical, customers call KBR first - We Deliver.

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Laulima Systems (205)

Laulima Systems is a woman-owned small business founded on Kauai that specializes in the research and development of new technologies and capabilities for the DoD's T&E ranges. Laulima Systems provides systems engineering, software development, and hardware design expertise. Technical domains in which we have expertise include development of systems which enable management and access to RF spectrum; spectrum efficient technologies; telemetry systems, including network telemetry as well as traditional serial streaming telemetry; and real-time data processing.

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Photo-Sonics (304)

Photo-Sonics (formally Acme Camera Corp) has been in business for 94 years and has been a trusted supplier to the U.S. Government since 1939. Today, we design and manufacture advanced optical tracking systems and custom gimbals. We produce turn-key Time-Space-Position-Information (TSPI) systems for use by Test Ranges around the world. These systems include the Mini-Sextant, Mobile Multi-Spectral TSPI System (MMTS), Cine-Sextant, Compact Tracking Mount (CTM), Nano-Sextant, and Super-RADOT. All of our systems are available with our ARGUS tracking mount control software, Multi-Station Processing and Control System, autofocus tables, ruggedized cameras and optics, trigger control electronics and IR-compatible target boards. Photo-Sonics has also been selected as the supplier of the next generation of optical trackers for the U.S. Test Ranges.

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QinetiQ (108)

QinetiQ is a leading science and engineering company operating primarily in the defence, security and critical infrastructure markets. We are an information, knowledge and technology-based company with the breadth and depth of more than 6,000 scientists and engineers and a wide array of unique facilities. We specialise in the creation of technology that is disruptive to give decisive advantage. We bring together our own and others' technology and know-how to provide distinctive specialist services and products. We are integrated across the life-cycle and all domains (land, sea, air, space and cyber), undertaking creative research and development, enabling test and evaluation and delivering readiness through training and rehearsal. We play a central role in delivering capability generation and assurance for our customers.

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Scientific Research Corporation – SRC (103/202)

Scientific Research Corporation is an advanced engineering company providing innovative solutions to the U.S. Government, private industry, and international markets. We are focused on providing the warfighter information, communications, intelligence, electronic warfare, simulation, training, and instrumentation systems through our engineering, integration, testing, support, and research and development activities.

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Smartronix (604)

Smartronix is a highly regarded, U.S. based technology, engineering, and global service solutions provider specializing in product solutions for aerospace and ground tactical applications. Our product offerings include telemetry data systems, deployable tactical systems, and net-centric everything over IP products. Smartronix is also a leader in secure and compliant cloud solutions, hyper-focused cyber security services, and innovative defense and aerospace engineering solutions for mission success. From expedited acquisition to rapid fielding and execution, our mission-critical solutions enable our customers to transform, evolve, and modernize their operations. The Smartronix Telemetry and Data Systems (TDS) mission is to provide world class aerospace system solutions for RF telemetry receiving, decom and parameter processing, compliant Chapter 10 recording, data archiving, and post mission data mining for domestic U.S. military test ranges, partner government defense contract groups, and industry clients on six continents with strict adherence and compliant interoperability to RCC IRIG 106 requirements.

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SYMVIONICS (602)

SYMVIONICS provides test and evaluation engineering and technical support services for the testing of aircraft systems. Primary customers include the Air Force Test Center and NASA Ames Research Center. SYMVIONICS' core competencies include real-time and post-flight analysis software systems for flight test operations, as well as modelling & simulation in support of aircraft test activities and training. SYMVIONICS' primary product is IADS®. The IADS® product provides more efficient Mission Control Room (MCR) data analysis, increased test safety and decreased post-flight data processing time. IADS® has been installed at the AFTC (Edwards AFB), AAC, NTTR, Vandenberg AFB, Hill AFB, NAVAIR (Patuxent River, Maryland), and Fort Rucker, AL; and at many other aerospace prime contractor facilities worldwide. SYMVIONICS has also been the modelling & simulation support contractor at the Test & Evaluation Modelling & Simulation (TEMS) facility at the AFTC, Edwards AFB, CA since 1995.

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Telspan (105)

Telspan Data is a recognized leader in ground-based and airborne instrumentation technologies. Telspan develops, manufactures and markets innovative hardware & software telemetry products and provides technical services, training and support to aerospace, military and government customers. Our expertise in IRIG 106 Chapter 10 data acquisition, recording and processing provide the core technology of many Telspan Data products. Rugged products include high-capacity solid-state Data Recorders for TAP and Endpoint applications, high-capacity Ethernet Switches, GigE Video Network System Controllers and Instrumentation Gateways. Ground based products include Bit Synes, PCM Decoms, Recorders and Reproducers and GPS-Based Time Code Generators. Our Windows-based software products provide real-time decoding, processing, display and distribution from IRIG106 Chapter 10 data sources and network based instrumentation systems.

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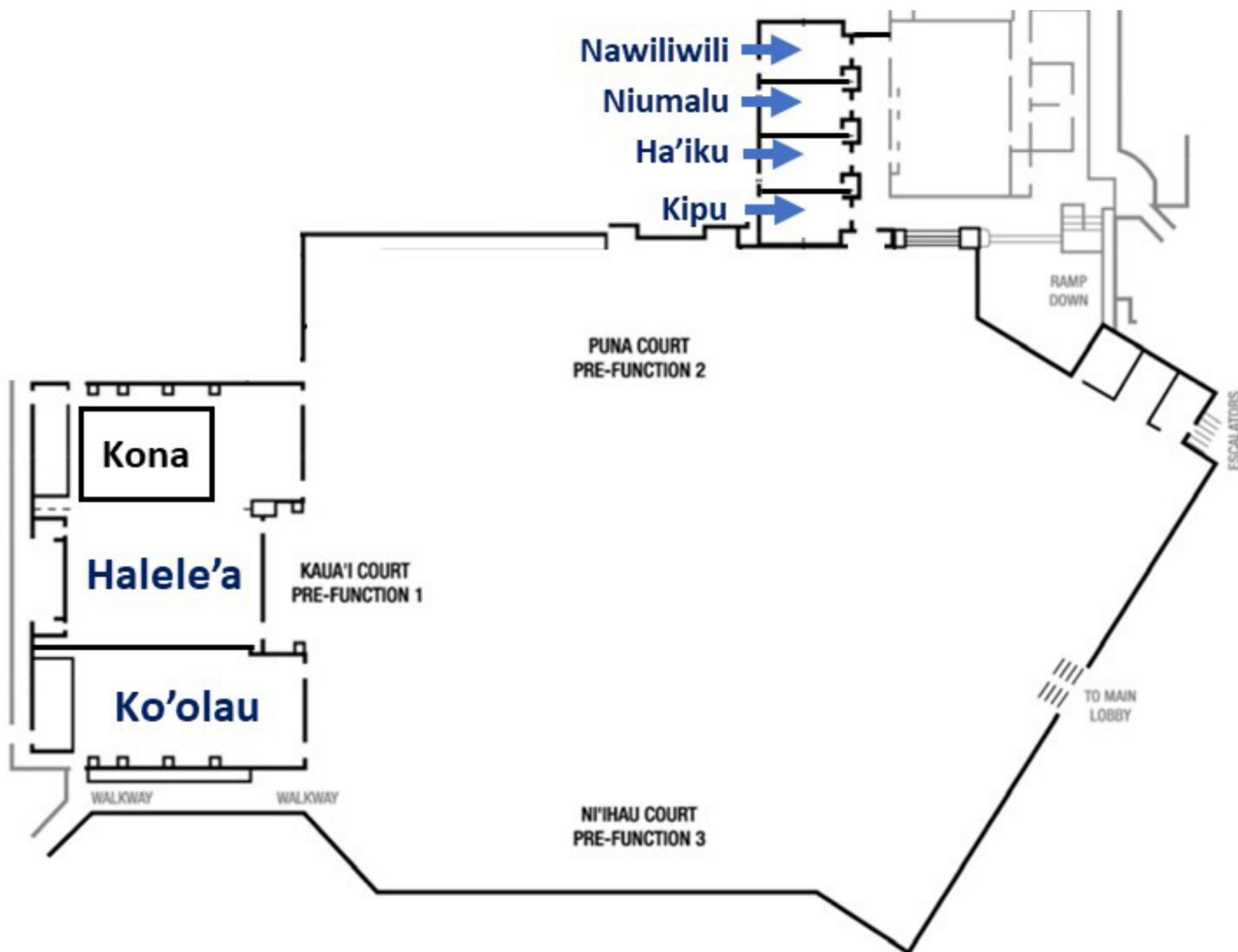
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Technical Track Session Abstracts

A Flexible Architecture for Range Safety System Based on DDS

KyeongWon Park, WonKyu Choi, and JeongBu Baek - Agency for Defense Development, Republic of Korea

Flight test carried out in the development phase of a guided missile is highly likely to result in unexpected emergency situations and a system that can predict and cope with them in advance is essential. Test range of Agency for Defense Development in the Republic of Korea has developed and operated various control systems to smoothly control tests and monitor risk factors. Among them, the Test Information Display System (TIDS) receives measurement data from equipment such as telemetry and tracking radar and displays data at the Mission Control Center (MCC) in a form such as numeric data, graphs, maps, and 3D models that can be easily identified by all test control personnel. So, there was a limit that satisfying to the test control staffs' different duties. In case of abnormalities of test object or deviations from the flight safety zone during flight testing, emergency destruction is performed for the safety. As this could cause severe damage, the fragment dispersion area and the instantaneous impact point (IIP) of the missile must be considered. Previously, the analysis system was operated separately by the development department of the guided missile system. In the process, it was difficult to operate the system due to differences in the communication protocol and data structure of each system. Thus, the integrated flight safety analysis system (FSA) was developed in 2018.

A Live-Virtual-Constructive Mission-Based Test Design Approach for C4ISR Systems-of-Systems (SoS) Test, Evaluation, and Certification

Luis A. Cortes, Ph.D., P.E. and Larry O. Harris - The MITRE Corporation/NIWC

The development, test, evaluation, certification, and fielding decisions of C4ISR systems are primarily informed with stand-alone performance data provided by individual Program of Records. Although most of these systems have major interfaces and dependencies on other systems, their performance and interoperability as a System-of-Systems (SoS) is often not completely characterized nor fully evaluated. Yet, the SoS environment is the targeted environment under which these systems are expected to prove their mettle. With the advent of enterprise architectures and distributed/networked environments, much of the cyber, agile, and reliability requirements can only be achieved with SoS level in mind. More robust and rigorous methods to evaluate the overall performance, interoperability, reliability, and cyber security of the SoS are needed. In this presentation we explore and illustrate a framework for the integration of a live-virtual-constructive (LVC) mission-based test design (MBTD) approach with tenets of design and analysis of experiments (DoE) at the SoS level. The integration of SoS mission-based test design and DoE in an LVC construct improves test efficiency and equips the decision-makers with objective, decision-quality data for development, test, certification, and fielding decisions.

A Unified Approach to Post Test Analysis

Dale Jones - Symvionics Telemetry Systems

In recent years, the IADS group has met with a number of engineering groups throughout the flight test community to learn about the types of tools that are currently in use in a typical post-test environment. This research has revealed that post-test analysis in general tends to be a fragmented and largely project-specific endeavor. Currently, it is very common for flight test engineers to spend an enormous amount of time developing post-test systems that meet the specific needs for their project. However, these systems are rarely (if ever) able to be used on subsequent projects due to their custom nature. Most post-test systems are created with focus only on the requirements of the current project, with little documentation or support. As a new project starts, the previously built tools often go unused and the process of building a new system repeats from scratch. Careful evaluation of the information acquired from these meetings has resulted in the discovery of a set of core common requirements throughout the majority of existing post-test systems. A comprehensive, unified platform that satisfies these requirements would benefit the flight test community as a whole by providing a toolset that allows flight test engineers to more efficiently accomplish their post-test goals without the burden of having to create a new system for every project. This presentation will highlight these common post-test needs, as well as some concepts and ideas that the IADS group has developed to meet those needs.

Accelerating Knowledge Gain from Test Data

Mark Kiemele, PhD – Air Academy Associates

It is not widely known that the test design from 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. More data is not necessarily better. This presentation will address the fundamental principles of optimal data collection with regard to gaining the “right” knowledge from test and evaluation. The analysis of test data will be shown to be impacted by the principles of orthogonality, replication, randomization, and blocking. A case study that compares the results of analyzing test data with and without the use of Design of Experiments (DOE) will be presented, as well as numerous examples of the use of DOE to accelerate knowledge gain from test data. 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 efficient in gaining knowledge as if they were to use these powerful and proven principles.

Advanced Systems Test and Evaluation (T&E) on DoD Ranges

Jay Clark, Maggie Arndt, and Patrick Nash - KBR

Hypersonic missiles are among the newest threats rapidly approaching operational capability with several global powers. Our best and brightest scientists, engineers and tacticians are hard at work developing hypersonic technologies, but how do we test a missile that can travel hundreds of miles in seconds or the new technologies required to defeat a threat traveling at hypersonic velocities? As weapons, defensive technologies, and tactics grow more complex, the physical area required for Test and Evaluation (T&E) becomes significantly larger and requires a concomitant increase in technical support. Although sophisticated model and simulation tools can be invaluable in the development of new technologies, capabilities, and tactics, no model or simulation can provide the fidelity and environmental factors that live testing and training provide. No existing Department of Defense (DoD) range has the capacity and size to support live testing of hypersonic weapons and defensive technologies, which requires thousands of square miles of testing area and sophisticated telemetry. For hypersonic T&E to be successful, it is imperative that DoD range and Research, Development, Test and Evaluation (RDT&E) leadership embrace creative solutions at the lowest possible risk. This track describes a proven solution for scheduling and coordinating complex T&E and training events that could be used as a framework to support hypersonic T&E events in the future.

Advanced Weapons Effects Test Capability

Kevin Stilwell, Chris Short, Margaret Wyatt, and Caitlin (Brooke) Ezell - 96th Test Systems Squadron

A key element to warfighter success is the ability to characterize weapon effects so as to facilitate the application of the right weapon to the right target. This characterization requires arena testing to collect fragmentation and blast characteristics data. Current arena test capabilities/methods do not capture sufficient fragmentation data to accurately assess weapon effectiveness. This results in the application of overly cautious Collateral Damage Estimate (CDE) rings in theatre. Combat experience has shown multiple instances where these overly cautious CDE distances required that smaller weapons be used. The end result is the escape of enemy combatants from lethal zones. The determination of the magnitude of the lethality and accurate CDE distances is dependent on the following fragmentation data: a) fragment mass and shape, b) fragment velocity, and c) the distribution of fragments around the blast. Current arena test methodology can only provide mass for a small percentage of fragments per test. In addition, fragment velocities are averaged and fragment distributions are extrapolated. The actual error bands for lethality and CDE distances are unknown due to these approximations and the overall sparseness of test data. To avoid hazard to our own troops and to minimize collateral damage, analysts default to conservative values for fragment size and velocity.

Agile Test & Evaluation Regime for Woomera Test Range Remediation

Vivek Chanana, PhD - Woomera Test Range

Woomera Test Range, situated in South Australia, is the largest land-based Test and Evaluation Range in the southern hemisphere. The Range is undergoing a major upgrade that is delivering new capability for it. This paper describes a case study of an agile test methodology we designed for acceptance testing and operational test and evaluation of the mission system acquired through the range remediation project. The aim of the remediation project valued at over 300M AUD was to provide a reliable, network centric and modern Test Range capability that could support Live Virtual Constructive (LVC) trials for the Australian Defence Force (ADF) operations and provide interoperability for activities with the US and other coalition partners. The scope of the mission system capability included phase array single object radars, multi object radar, surveillance radar, optical tracking system, target optics for behavioural imaging, telemetry, flight termination system, new range control centre, mobile range control centre, range network infrastructure, radio communication, and external connectivity for Link 16 and Defence Training and Experimentation Network (DTEN) for LVC support.

Application of Scientific Test and Analysis Techniques to Autonomous and Hypersonic Systems

David R. Harrison and Gary Downs - Lockheed Martin Corporation

Application of Scientific Test and Analysis Techniques to Autonomous and Hypersonic Systems
Autonomous systems often cite a, “near infinite state space,” and “continuous regression testing,” as barriers to test success. Hypersonics require a huge jump in material performance while programs have an ever-shortening timeline. Although slightly different, these issues are pushing the abilities of test and evaluation into new territory. Brute force requirement-by-requirement test designs are OK for current programs, but with an exponential increase in requirements plus the need for regression testing as the autonomous systems learn and improve, every data point must be optimized. This talk will go through how Lockheed Martin is approaching test and evaluation for both situations including requirements management, factor table formation, and analysis methods. While working with teams in both realms the question is not, “how are you using STAT in your testing?” it is, “how else would you design a test without STAT?”

The Architecture of the F-35 Lightning II Mission Systems Integration Lab – Then and Now

Paul E. Garrison, PhD - Lockheed Martin Aeronautics

At the November 2003 International Test and Evaluation Association International Symposium a paper was presented in which the planned integration and testing of the F-35 Joint Strike Fighter (JSF) avionics systems was presented. This paper presents what was planned, what happened and provides a view of the future of F-35 Lightning II Mission Systems Integration and Test (I&T). First, we will present an overview of the F-35 Lightning II describing the variants and the avionics architecture. Then we will present the Mission Systems I&T laboratories that were planned and how they were used. Next, we will present I&T capabilities that emerged during the System Development and Demonstration (SDD) program. We will conclude with lessons confirmed and lessons learned followed by a view toward the future of F-35 Lightning II Mission Systems I&T using modeling and simulation (M&S) in an agile development environment.

Assessing Structural Health with Distributed Strain and Temperature Sensing

Alex Tongue - Sensuron

As the nation’s infrastructure ages and air & space vehicles grow ever more complex, Structural Health Monitoring (SHM systems) and algorithms must be increasingly comprehensive, robust, and reliable. Fiber optic sensing (FOS) systems based on coherent Optical Frequency Domain Reflectometry (OFDR) are poised to dramatically improve upon current SHM technologies through unparalleled measurement capabilities and exclusive two-dimensional (2D) deflection sensing algorithm. This OFDR methodology involves the use of a continuous distribution of Fiber Bragg Gratings (FBGs) embedded within 70 micron diameter glass optical fibers coupled with very high performance digital signal processing. The fibers can be integrated within or adhered to the surface of the monitored structure in a manner analogous the human nervous system. Due to the light weight and flexibility of optical fiber and the high density of FBGs, a boundless number of sensor configurations can be employed and a multitude of key engineering parameters, including strain, can be monitored in real-time. The objective of a fiber optic sensing system in SHM is to continually observe and reliably assess the integrity of a structure or its components with a high level of confidence. FOS provides a dynamic, embedded replacement to traditional strain gage monitoring. FBG fiber optic sensors are more durable and sensitive than conventional foil strain gauges and can be multiplexed to sense more than a single engineering property continuously across a structure.

Big Data Analysis Techniques for Modern T&E

Kenneth Sanchez - NAVAIR

Military systems today and to support the future warfare concepts has become more complex with multiple data feeds spanning structured and unstructured data collected to assess platform performance during both Testing and Operation. In many cases, a system under test will produce thousands of data points per second of test. Consequently, it has become increasingly difficult for the T&E analyst to review and evaluate these data feeds and create usable metrics describing system performance. The quality of T&E must be improved to be able to assess these large datasets utilizing automation versus the current manual methods resulting in evaluation of only a small subset of data collected. No systematic anomaly detection, trend analysis, regression analysis, causality analysis, pattern recognition, simulation/test comparisons, perceived truth/ground truth comparisons are being done presently to examine system performance across the platform lifecycle. The timeliness of T&E must be improved in order to not only influence the current test but analyze the full dataset collected to report in a timely fashion the previous test results. Long data ingest times prevent proper debriefing of test participants after a test is over, since their statements cannot be correlated with data in real time. T&E issues with quality and timeliness is also impacting the cost of T&E resulting in more tests than necessary are being done, sometimes at enormous expense.

Capabilities for Global Security Solutions Resident at the Nevada National Security Site

Bart Jones, Michele Baker, and David Feather - Mission Support and Test Services, LLC – Jacobs, Honeywell, HII

Renamed the Nevada National Security Site (NNSS) in 2010, the former Nevada Test Site continues to evolve as a key element in the nation's nuclear deterrence strategy as well as providing a wide array of capabilities related to other Global Security threats and needs. The most recent U.S. Nuclear Posture Review indicates a need to revitalize the nuclear weapons complex and to strengthen U.S. strategic deterrence capabilities. In addition, the NNSS supports NNSA, DHS, DoD, and other Civilian Agencies with advanced sensing technologies and extensive testing and training capabilities that support U.S. nuclear nonproliferation and nuclear emergency response missions. As such, the NNSS's aging capabilities, facilities, and infrastructure are being modernized and expanded. The rejuvenated Site provides the nation a robust platform to perform scientific and engineering tests, critical to Nuclear Deterrence and Global Security. Learn about capabilities related to Dynamic Materials and Shock Physics; Sub-Critical Experiments utilizing relevant weapons configurations; Chemical Capabilities; Nuclear Explosion Monitoring; Radiological Detection, Aerial Measurement, and Consequence Management; as well as training in Radiological Detection and Consequence Management for Federal, Local, State, Tribal and International responders.

Capitalizing on Stimulation Training Capabilities to Support Test and Evaluation

Rebekah Getz - EWA GSI

The United States Navy continues to invest in the development of Electronic Warfare (EW) detection and countermeasure capabilities to address rapidly evolving adversarial electronic spectrum threats. High fidelity embedded training systems are being designed and developed in parallel with the tactical systems targeting concurrent fielding in support of the warfighter. The main focus of the training systems currently is to properly stimulate the system for operator-based knowledge and proficiency training. As the complexity of the EW detection and countermeasure tactical capabilities increase so do the challenges in training, test and evaluation along with the data required to support both. Complex engineering analysis is required to develop testing techniques and strategies, test cases with expected results to ensure compliance to requirements. The design, development and integration challenges have grown exponentially as multiple components with required interdependencies are being built by numerous organizations on an identical fielding timeline.

Challenges with International Collaborative Development and T&E

Joyce Matias and Parth Patel - Naval Air Warfare Center Weapons Division – Point Mugu

There is an ongoing need to be able to transfer large amounts of classified information ranging from programming files to test data between U.S. Government teams and Allied partners. The current methods to exchange secure data files are hampered by size limitations and restrictions on file types, which significantly impact the efficiency of co-development efforts. Additionally, policies and restrictions that are required for export compliance and foreign disclosure & release, further complicate the ability to communicate and execute developmental test efforts in a collaborative manner. As the demand for International agreements to jointly design, develop and test advanced technologies and techniques continues to grow and evolve, it becomes more imperative to attain solutions that address and overcome the many challenges associated with implementing a secure cooperative environment.

Characteristics to Consider When Planning HEL Testing & Evaluation

David Loomis - DNL Consulting

This paper suggests ways to address unique characteristics of a High Energy Laser (HEL) when planning HEL testing (DT&E / OT&E). Where appropriate, comparisons will be drawn between KE weapons testing and HEL testing. Characteristics that must be taken into account when planning T&E scenarios include but are not limited to: laser effects (kill) mechanism (target vulnerability assessment), "time to effect" (instantaneous laser time (KE time of flight) coupled with duration to achieve effect (KE kill time), atmospheric effects on laser propagation. These unique characteristics drive requirements to plan the event as well as drive requirements for selecting specific aim points, identifying the optimum time to engage, developing specific measurements and diagnostics techniques and combining results with specific HEL performance models to evaluate results. These characteristics make it highly desirable to automate the engagement sequence to the maximum extent possible. Additionally, real-time (or near-real time) predictive models are used to determine optimum engagement time and duration. HELs also provide unique requirements for OT&E testing. Whereas, DT&T testing is focused on confirming the Laser Weapons Systems meets (or exceeds) program performance goals and requirements, OT&E testing is further focused on operational sustainability and suitability. Several characteristics of the laser must be addressed to fully test these requirements.

Coalition and Multinational Testing Environments

Floyd Reed - Jacobs

During Operation Enduring Freedom, the Afghanistan theater of operations provided valuable lessons learned where the United States (US) and North Atlantic Treaty Organization (NATO) were unable to effectively communicate which resulted in poor operational planning and failed intelligence information exchanges between the International Security Assistance Force (ISAF) mission partners. From those lessons learned, the US, NATO and the addition of other coalition partners signed on to contribute to the Combined Federated Battle Laboratories Network (CFBLNet). The Joint Interoperability Test Command's (JITC) Coalition Test and Evaluation Lab (CTEL) and Jacobs leverage the CFBLNet infrastructure to participate in interoperability trials and assessments with NATO and other countries. Within the CFBLNet, the CTET primarily use the Coalition Verification and Validation Environment (CV2E), which is a separate and federated enclave employed to support interoperability and validation events which authenticate the US Mission Partner Environment (MPE) and the NATO Federated Mission Network (FMN) concepts. The interoperability and validation initiatives range from conducting multinational assurance, verification and validation (AV&V) events to supporting demonstration and training exercises on a multinational level. The CTET with 20-plus countries successfully use CV2E together to test current and change management configurations of different Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems used between our nations to ensure the same operational problem-sets of Afghanistan are not repeated.

Conducting Complex Underground Chemical Explosion Experiments for Nuclear Explosion Monitoring

Lisa Garner, Michele Baker, Jonathan Jones, and Jesse Bonner - Mission Support and Test Services, LLC

The Nevada National Security Site (NNSS) conducts underground experiments aimed at increasing US capabilities in explosion monitoring. The Source Physics Experiment (SPE) objectives are to understand the prompt-signal phenomenology of the explosion source, including shear wave generation, and to improve numerical modeling codes. Since 2010, the NNSS has conducted eight (8) chemical SPE explosions in well-characterized granite and in alluvium emplacement media. The last two experiments were known as the Dry Alluvium Geology (DAG) experiments and required extensive planning, significant collaboration with execution partners, and resiliency in execution to overcome technological and operational challenges. Development of the DAG Test Bed made use of a site with an existing large borehole in alluvium geology near previous well-documented underground nuclear test sites. Equipment developed and used in the nuclear testing era was located, refurbished and qualified for use in the DAG experiments. This adaptive reuse of equipment and structures resulted in substantial savings and enabled more project funds to be spent on test and evaluation objectives. The DAG test bed development began in 2017 with the construction of a control and diagnostics trailer park and a borehole seismic network.

Connected Ranges and Digital Health, Safety, and Environment (HSE)

Dennis Miller – Jacobs

Connected Ranges and Digital Health, Safety and Environment (HSE): Range Operations places personnel in austere locations and hazardous conditions. In the past, workers would "head out" relying on connectivity through personal cell phones or limited range radios. Equipment was strewn about the range with only manually tracking processes to ensure accountability. HSE data from remote sites may have been a few paper forms and several days removed from landing in the HSE system of record, a lag that could lead to increased safety risk or potential regulatory violations. In this session we will discuss how to automatically monitor the location of equipment or staff, biometrics, and facilitate incident or spill reporting in areas where automation was once not possible to achieve. We will cover how offline tools can bridge gaps in connectivity, how modern Internet of Things (IoT) sensors can still be useful in remote areas, and how mobile-enabled applications can create a safer work site. We will also cover how today's leading HSE applications have evolved to bring simplified mobile interfaces and offline capabilities that not only shrink or eliminate that lag but also serve to enforce HSE business processes and best practices.

Counter Directed Energy Weapons (CDEW); Evaluation of Naval Aircraft Defenses and Survivability Against Directed Energy Weapons

Bonnie Johnson - Naval Postgraduate School Systems Engineering Department

The Naval Postgraduate School (NPS) is studying concepts, tactics, and methods for defending naval aircraft against adversarial directed energy weapons (DEW). The study includes high energy lasers (HEL) and high-powered microwave (HPM) devices as threats to naval aircraft. NPS is using modeling and simulation to understand, evaluate, and compare a variety of CDEW concepts against potential DEW threats. The CDEW concepts include coatings, electromagnetic shielding, aircraft body materials and thicknesses, aircraft types, aircraft kinematics and threat proximity, atmospheric, and active countermeasures. The study is investigating means of detecting and identifying DEW threats to naval aircraft. The modeling and simulation evaluation will consider a variety of threat scenarios including multiple naval aircraft, multiple DEW threats, and different types of HEL and HPM threats. The study includes developing requirements for the test and evaluation of CDEW concepts. This presentation will discuss progress to date and future plans.

Cyber Compliance, Test and Evaluation Evolution

Pedro Ramirez and Gus Tomé - Jacobs Cyber Technology Group

Industry has developed cyber security standards, processes, instructions and guidelines to account for cyber testing in systems across both industry and government. These guidelines could vary based on the specific area an organization supports, and location around the world. The two primary organizations for these standards are the National Institute of Standards and Technology (NIST), and the International Organization Standardization (ISO). The challenge to the implementation, and test and evaluation (T&E) of cyber compliance is automation, efficacy, and real-time validation based on standards, and at a speed that is adaptive to the constant evolution of cyber threats. Critical infrastructure – both legacy and emerging technology – following industry cyber security standards require the abstract understanding of technology, cyber threats, and T&E criteria needed to validate cyber security compliance and robustness of IT components and systems. To meet cyber security requirement, the cyber analysts need to configure, and test elements, while collecting evidence through software, hardware, and processes to certify cyber compliance to the Information System Security Officer (ISSO), based on either NIST or ISO standards. This is a lengthy and labor-intensive process that provides a single report that often expires at that very moment it is delivered, due to the IT ecosystem and cyber terrain ever changing posture.

Cyber-resilient Design and Test using MBSE

Frank C Alvidrez - Spectrum Inc

Cybersecurity continues to be a major topic and emphasis throughout the U.S. Government and Department of Defense. The exponential growth of cyber attacks on sensitive databases, the theft of technical proprietary data and the concern for cyber attacks on DoD Systems has led to the requirements for cyber-resilient design and testing for DoD systems, especially those systems on DOT&E oversight. Understanding the threat and the cyber boundaries of the system under test (SUT) is critical for acquisition decision in support of major programs. These presentations will outline a new approach to cyber-resiliency design and testing by using Model Based System Engineering (MBSE) and the Unified Architecture Framework (UAF) to start laying a basic foundation to build on for development and operational testing. The author makes the transition from cybersecurity testing under the NIST 800-53 series to the new Cyber-resiliency testing outlined by the Cyber Survivability Assessment (CSA) ratings.

Developing Common Instrumentation Package

Richard Wride and Maj Dave Welsh - 96 TW & AFRL/RW

Developing a “common” instrumentation suite that will be available to program offices & OEMs to install in their weapons systems and also provide encrypted bi-directional TM capabilities to other systems as well. Suite will consist of bi-directional TM, PCM encoder, encryption, redundant GPS, flight termination receiver, power conditioner, safe & arm controller, & explosive interface. A C-band module will also be available. The suite will be designed to use OMS (open mission systems) architecture, have multiple options to fit solutions from hypersonics to cruise missiles to small air-to-ground weapons to future air-to-air weapons to UAVs to allow the biggest bang for the buck.

Directed Energy Wind Tunnel Test and Evaluation

Taylor Swanson, C. Lynn Sebourn, and David Plemmons - AEDC

Directed energy (DE) is one of the five game changing technologies identified in “America’s Air Force: A Call to the Future,” a 30-year strategy document from 2014. DE weapons are an increasingly important component of the DoD’s current and future arsenal because they possess many advantages over kinetic weapons, including deep magazines, low cost per shot, adjustable effects, and speed of light propagation. AFRL is developing the Self-Protect High Energy Laser Demonstrator (SHIELD) which will be ready for flight test by 2021, MDA is developing UAV mounted lasers to shoot down enemy missiles, and the Navy deployed a high energy laser (HEL) on the USS Ponce in 2014. Military systems undergo rigorous test and evaluation through several phases: component lab test, prototype lab test, system ground test, and system operational test. Modeling and simulation (M&S) is utilized throughout each phase in a process termed integrated test and evaluation in which multiple sources of data are combined to produce better data and evaluation results than possible without integrating these methods. For aircraft with HELs, there are two primary categories of wind tunnel test, aero-optic and lethality, and two primary types of test articles, the HEL system alone, and the HEL system integrated into a platform.

Electromagnetic Spectrum Encroachment

Guenever Aldrich, PE - Spectrum Reallocation Lead, DoN

A discussion with a question & answer session on spectrum encroachment to include bands that have been auctioned off; and bands that are potentially coming up for auction. Including the AWS-3 auction, ongoing feasibility studies, the push for sharing or vacating the 5850-5925MHz, & 7125-8400MHz bands, and other ongoing projects which impact the Test & Evaluation and telemetry communities; and examining the movement towards spectrum agility, diversity and efficiency.

Exploring Agile Acquisition Principles and Practices for Complex System Delivery

Mindy Dowling, Timothy Sienrukos, and Sybil Abraham - Federal Aviation Administration, William J. Hughes Technical Center

The Federal Aviation Administration (FAA) mission is to provide the safest and most efficient aerospace system in the world. As such, the FAA supports both the sustainment of the current National Airspace System (NAS) as well as continued modernization initiatives by delivering new systems, operational improvements and enterprise capabilities. The overall objective is to increase the safety, efficiency, capacity, predictability, and resilience of American aviation through research, innovation, and collaboration with stakeholders. These increases allow the FAA to meet its vision of reaching the next level of safety, efficiency, environmental responsibility, and global leadership. In practice, this has led the FAA to earnestly investigate the most effective methods for delivering new capabilities to the NAS which cross multiple domains and systems. The development community has rallied around “Agile,” but after setting aside the hype and marketing promises of better/faster/cheaper systems, what does “Agile” really mean for the FAA? What does an acquisition framework look like that incorporates Agile principles and practices? How does the FAA’s acquisition workforce modify their processes and strategies to align with Agile values for safety and security critical systems and services? How is the FAA’s traditional Test and Evaluation (T&E) strategy influenced by Agile development? Finally, are the systems being developed for the FAA simply too complex and interdependent to effectively use Agile? This paper explores those questions and presents lessons learned within the test community and future perspectives of how Agile can be applied to complex system acquisitions at the FAA.

Extending CRIIS for LVC in OT&E, Range Operations, and Training Applications

Jon Skarphol - Collins Aerospace

As the DoD Test Ranges continue to deploy CRIIS for OT&E, Collins Aerospace has continued to work with multiple customers on leveraging inherent system capability, future system enhancements, and demonstrations. This briefing will cover some of the built-in system capabilities, standards-based open systems architecture, and ability to manage spectrum usage of the Common Range Integrated Instrumentation System (CRIIS) as envisioned by Collins Aerospace. The system was designed to meet the continued and evolving needs for Live, Virtual, and Constructive (LVC) enabled systems for test and training including certified RMF-hardened MultiLevel Security, distributed mission operations, and range encroachment. A specific mission example of LVC integration with an unclassified 1553 interface on a test aircraft to exercise inherent capabilities will be discussed along with potential upgrades to Mission Room Equipment that can improve capabilities at customer ranges while keeping the system MILS certified. Planned systems enhancements for lower cost SWAP constrained instances of CRIIS, leveraging LVC latent system capabilities, and roadmap details including how operational test and training will be merged are also addressed.

Global Spectrum Demand challenges for T&E AMT

Guy Williams - ENS/AFTC

This presentation describes the exponential growth in the demand for commercial spectrum globally and in the US. How the US is meeting the demand. Specifically, 5G demand and the bands that are being targeted. How the T&E Ranges are affected by this demand, specifically Aeronautical Mobile Telemetry (AMT) the lifeline of many scientific and test activities. Activities of the International Consortium for Telemetry Spectrum (ICTS) to protect telemetry spectrum. How the T&E Ranges are being upgraded to mitigate the loss of AMT spectrum through Spectrum Relocation Funds (SRF).

How Intelligent Asset Management (IAM) Enables the Range of the Future

Robert Poche - Jacobs

As weapons systems become more advanced, DoD test ranges are struggling to keep up technically. Speed and performance of systems are driving a sharp increase in live/virtual/constructive (LVC) test requirements. As systems become increasingly connected, operational testing is surfacing many cybersecurity issues, when it is too late to incorporate necessary protections into designs. Despite the need to continually improve test technology, funding is shrinking. The opposing realities of increased pressure to perform with increasingly less funds are creating operational execution difficulties. One solution to this dilemma is to leverage technology and process innovation to improve test capability while saving money with a connected range. This will enable situational awareness of test resources across a vast geographic test range, including people, test articles, data collection tools, and support equipment. A near-real-time big picture view of the range enterprise not only improves range safety/control, but also provides insight into how resources are applied across the enterprise, with a goal of improving efficiency for our customers.

Joint Laser Systems Effectiveness (JLaSE) Joint Test

Scott Boyd - Naval Surface Warfare Center Dahlgren Division (NSWCDD)

The Joint Laser Systems Effectiveness (JLaSE) Joint Test is a two-year project sponsored by the Director Operational Test and Evaluation (DOT&E). The purpose is to develop, test, and evaluate High Energy Laser weapon systems employment procedures used in the Joint Targeting Cycle for all-echelon weaponeering, risk analysis and mitigation, and intelligence collection for targeting. In support of JLaSE, the DOT&E Live Fire T&E Joint Technical Coordination Group for Munitions Effectiveness (JTCG/ME) is developing laser weapon Joint Munitions Effectiveness Manual (JMEM) lethality data and Joint Laser Weaponeering Software (JLaWS) that will complement the JLaSE targeting procedures. The JLaSE Joint Test product under development is a document titled the Targeting Procedures for Employment of High Energy Laser Weapons in the Joint Battlespace (TPH). These procedures will support both planned deliberate offensive laser weapon engagements as well as dynamic defensive engagements. Because of the precise targeting ability of laser weapons, JLaSE is addressing the need to develop new intelligence products for operational laser employment. These new intelligence products, incorporated as part of the weaponeering process, enhance the laser weapons planning for both offensive and defensive engagements. Once the Joint Test is complete, JTCG/ME will take ownership of the TPH product to transition it to the warfighting forces and continue to make any additions or modifications to build upon it. The JLaSE JT overview will address all of the items discussed above.

JSAS Collaboration to Enhance Development and Readiness

Ted Dempsey and Jon Skarphol - Collins Aerospace

Joint Secure Air-combat-training System (JSAS) is Collins' family of test and training systems. DoD Test Ranges' Common Range Integrated Instrumentation System (CRIIS) and US Navy's Tactical Combat Training System Increment II (TCTS II) are programs of record in the JSAS portfolio. JSAS provides and collects data across user-defined areas via secure connected-communications and secure platform interface(s). This briefing will cover some of the built-in system capabilities, standards-based open systems architecture, and ability to crowdsource data collection as envisioned by Collins Aerospace. It will also introduce the possibility to use JSAS for global data collection, dissemination, and analysis to collect more robust [test and evaluation (T&E)] data outside the restraints of test ranges. If employed, machine learning analytics and big-data repositories would allow the T&E enterprise to continually assess system performance for agile software capability inclusion. Evolving technology and adversary advancements demand rapid capability development to keep pace with need. System complexity, "battlespace" interoperability, and this pace of need combine to challenge effective capability delivery. JSAS was designed to meet the continued and evolving needs for Live, Virtual, and Constructive (LVC) enabled systems for test and training including certified RMF-hardened Multi-Level Security, distributed mission operations, and range encroachment.

The KBR Test Facility: Building a Homegrown Test Facility

Scott Martin - KBR Government Solutions

This paper and presentation will discuss the importance of “right-sizing” your test infrastructure in order to control cost. It explores the growth of the KBR Test Facility from its humble beginnings in a farmer’s field through its current location on a closed airfield where it prepares systems for testing on DoD ranges. It also reflects on the growth in sophistication of our test instrumentation, reviewing test requirements to acquire only the appropriate equipment needed during each phase of test and using creative solutions to reduce equipment costs. Finally, it looks forward towards future test facility growth, again using a review of new test requirements and outside-of-the-box thinking to find optimal test solutions.

Knowing the International Language of Test and Evaluation

Mark J. Kiemele, PhD - Air Academy Associates

This technical presentation will address the international language of test and evaluation. It will show that no matter what one’s native language is, the language of test and evaluation is a second language for everyone. In order for multiple entities to communicate, this language must be known and used in order to make the linkage between test and evaluation easy to understand. Multiple terms in this language will be defined and explained as to their significance in the T&E environment. The ultimate goal is to get the international T&E community to better communicate with regard to the most effective and efficient testing techniques and evaluation methodologies.

Knowledge Management and the Big Data Evaluation Revolution with the F35: Northern Edge 2019 Support

Tracy Mullendore, Ryan Norman, Chris Moyer, and Jason Bolin - KBR Government Solutions US

The Test Resource Management Center’s (TRMC’s) vision is to build a DoD Test and Evaluation (T&E) Knowledge Management (KM) and analysis capability that leverages commercial big data analysis and cloud computing technologies to improve evaluation quality and reduce decision-making time. To realize this vision TRMC is investing in Knowledge Management and Big Data Analytics technologies and algorithms specifically tailored to the data sets typical in large military test programs, such as parallel time series, and imagery, audio, and video. The TRMC is utilizing the Joint Strike Fighter (JSF) program as a pathfinder to ascertain how recent advancements in data mining, big data analysis and cloud computing technologies could be applied to T&E datasets and data centers. This successful pathfinder has investigated tools, techniques, policies, procedures and resources required to use private cloud technologies in conjunction with big data analytics to use data more effectively and efficiently in support of a single acquisition program. It is the TRMC’s intent to utilize lessons learned during the JSF-KM prototype within any future DoD Enterprise KM efforts and propagate those lessons throughout all acquisition programs and T&E sites in order to lay the foundation for a DoD Enterprise Knowledge Management capability.

Latest Development Status on the Commercial derivative aircraft Based Instrumentation Telemetry System (CBITS) Program

J. Kyle Roudebush and Jose Hernandez - NAVAIR-Point Mugu, and Scott Kujiraoka - GBL Systems

The Commercial derivative aircraft Based Instrumentation Telemetry System (CBITS) project will provide an advanced airborne telemetry system and capability to support the test and evaluation (T&E) of current and future military weapons and defensive systems. In conjunction with the Range Support Aircraft (RSA) contracts, the CBITS project will provide an autonomous airborne T&E asset capable of supporting Major Range and Test Facility Base (MRTFB) government ranges and open-ocean testing worldwide. The project will develop an improved S-Band airborne telemetry (TM) capability and a new L- and C-Band telemetry capability as a result of frequency spectrum selloff issues. These improved telemetry capabilities, along with the existing airborne Flight Termination System/Command Destruct (FTS/CD) capability, existing radar for Range Surveillance (RS) and Range Clearance (RC), and range unique augmenting communication systems will be integrated into a Gulfstream G550 Airborne Early Warning (AEW) RSA which will be replacing the current NP-3D Remote Area Safety Aircraft (RASA). This paper will discuss the latest developmental status of the CBITS project.

Long Range Hypersonic Weapon (LRHW) Systems Integration Laboratory (SIL): A Unique HWIL Simulation and Test Architecture for Evaluating Rapid prototyping of Critical Hypersonic Technologies

Rachael Armayer - CCDC Aviation & Missile Center

Low Frequency RTLS (real time location service) in GPS denied environments

Jon Kim – Geeks and Nerds

GPS is ubiquitous in all aspects of our daily lives, providing timing and position information. For T&E, GPS's role is critical in providing location and timing to test and evaluation infrastructure for data collection and evaluation. In situations where GPS is denied (unavailable, jammed, or spoofed), alternate means are needed to provide location and position information. This paper examines the use of alternate technologies for real-time location service (RTLS) for GPS denied environments. Specifically, an implementation using low frequency electromagnetic waves is examined, and technical results are disclosed.

Mobile High Energy Laser Measurement (MHELM) Program

Whitney Winchester - U.S. Army PEO STRI

The Army's Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI), funded by the Test Resource Management Center's (TRMC's) Central Test and Evaluation Investment Program (CTEIP), is developing several High Energy Laser (HEL) test and evaluation (T&E) capabilities. These capabilities include developing instrumentation to measure HEL irradiance at target on a variety of target platforms, a mobile ground diagnostic suite, a range simulator to support HEL integration and test efforts, as well as an integrated set of standardized software tools and related hardware instrumentation to support HEL test planning and validation.

Model Based Systems Engineering methods to support T&E of Agile Development

Turin Pollard, Evelyn Rockwell, and Peter Floyd - Alion Science and Technology

In order to keep pace with modern technological innovation we must adopt Agile development principals for hardware and software development. At the same time the traditional systems engineering "V" model is built on a solid foundation of lessons learned, providing a high degree of assurance to program sponsors that delivered systems will work as promised. This is particularly important in an integrated system of systems environment. Unfortunately, that delivery is frequently late to need. Agile Software development methods have been widely demonstrated to reduce development time and lower risk. Developed for enterprise software application development Agile methods based on a Test-Build-Test approach greatly reduce the time spent developing and documenting requirements, by moving directly from desired features to testable code. This ensures that features and requirements don't 'drift' during the requirements documentation process, as frequently happens during the acquisition of large-scale progra The downside of this approach is reduced clarity of specific requirements, and early definition of testable rigor.

Methodology for the Assessment of Active Protection Systems by Leveraging Robust Experimental Design and Advanced Data Analysis Techniques

William S. Harrell, and Scott Harris, PhD - U.S. Army Redstone Test Center

Over the past 25 years, RTC has developed and refined key methodologies for assessing the technical performance and operational impact of hard-kill active protection systems and optimizing test setups to collect data to support these assessments. This presentation will focus on the recent integration of design of experiments techniques in development of test matrices, APS test methodology evolution, and the integration of emerging artificial intelligence and machine learning (AI/ML) technologies to optimize data analysis. Additionally, the presentation will outline how the APS community is leveraging test techniques and lessons learned from the ASE test community. The merging of these two communities test techniques and methodologies will be summarized. The primary objective of any overarching test and evaluation strategy for APS must be to provide as much insight into the interruption of the adversaries kill chain as possible. Testing should provide insight into the probabilities associated with the kill chain in the context of the platforms operational environment. Without a robust experimental design, driven by an understanding of operational and system performance factors, the characterization of these probabilities is impossible. RTC has developed refined methodologies, optimized instrumentation design, and streamlined test data analysis to obtain this knowledge.

Multi-Caveat Security (MCS) Update

Stan Pitchford - 96 Range Control Squadron

This presentation will provide status update toward a solution for the Multi-Caveat Security (MCS) problem facing many test organizations. Status on security policy aspects, industry Request For Information (RFI) results, project submissions and way ahead will be covered. Previous presentation (23rd Test Instrumentation Workshop) focused on a security architecture issue that is rising in severity within the Special Access Program (SAP) world. Most DOD test organizations are familiar with the following two system security architectures: Multiple Independent Levels of Security (MILS) and Multi-Level Security (MLS). MILS is the predominant architecture that has been implemented by most of the Air Force test community and it has worked well. However, MILS is no longer viable due to recent proliferation of program caveats and the large amounts of data captured. MLS is somewhat of the “holy grail” considering it has been elusive and extremely difficult/costly to implement. This is forcing the test community to come up with a new solution - MCS.

Net-Centric Weapons Test and Evaluation Environment (NCWTEE)

Jason Lucas and Steve Pearce - 96th Test Systems Squadron

NCWTEE provides a distributed Live Virtual and Constructive (LVC) environment for test and evaluation of Net Centric Weapon (NCW) programs. Current distributed NCW testing relies on oversimplified communication methods between targeting systems and weapons over Link 16 and Combat Net Radio (CNR) Networks. NCWTEE develops emulations of Link 16 and CNR and incorporates scene generation technology to stimulate weapon sensors with high fidelity, validated target/environment models in order to realistically depict systems within a more complex environment. All of these capabilities will be designed for use on the Joint Mission Environment Test Capability (JMETC) network with architecture appropriate to support work on other networks. NCWTEE has delivered Link 16 capability at Eglin AFB, Redstone Test Center, and Patuxent (Pax) River and will soon deliver Combat Net Radio emulation. The capability is hosted on standard servers provided by the NCWTEE project, and it supports realistic connectivity of LVC systems to other Link 16 and CNR systems located at these locations via JMETC networks. NCWTEE will deliver a Distributed Scene Generation capability to Eglin AFB, Redstone Test Center, and Pax River as well.

Operational Testing of Innovation and Tactics Projects

Captain Dave Peter and Master Sergeant Robert Morada - Air Mobility Command Test and Evaluation Squadron

Air Mobility Command (AMC) Test and Evaluation Squadron (TES) conducts operational test and evaluation of AMC products. Over the past year, AMCTES has supported multiple Air Force innovation and tactics projects, requiring some modifications to its operational test processes. These innovation projects that include Phoenix Spark initiatives and work environment improvement ideas solicited from Air Force personnel would have remained outside the normal DoD acquisition process. Often these programs are non-traditional system acquisitions, with no Program Management Office to shepherd user requirements and testing. AMCTES supports the development of innovation projects by providing early input from a user and tester perspective. AMCTES’s multi-disciplinary test teams consist of operators, maintainers and support personnel trained as Test Directors that provide a unique warfighter perspective when combined with its career civilian Test Directors. AMCTES Test Directors provide user requirements and suggestions early during the test item design.

Over Water Scoring and Surveillance (OWSS)

Josue DeJesus - 96th TW (96 TSSQ), USAF

Asymmetric threats continue to proliferate in response to US domination in conventional warfare. While these threats tend to become more advanced, US is countering the threats by continuing to develop weapons capabilities such as significantly extending weapons range, increasing weapons speed to hypersonic and beyond, enhancing lethality, and increasing accuracy. The safety footprint of long range and also high speed weapons consume very large range spaces during testing and are often more easily accommodated into over-water ranges. However, there is no flexible and affordable instrumentation capability for over water precision impact scoring and assessment of weapons in an operationally representative scenario. Current maritime based scoring systems lack precision and repeatability, are limited in mobility, area of coverage, and operations in the weapon hazard zone. Current on-target scoring systems are relatively expensive for use as an expendable item and require large amounts of RF bandwidth. Long distances and line of sight as found in seaborne target operations limit the bandwidth and reliability of data links. The Over Water Surveillance and Scoring (OWSS) system is intended to provide an unmanned, mobile, accurate, flexible, and rapidly deployable impact scoring capability used for long range mobile precision scoring, range asset surveillance, and safety footprint management.

Overcoming Challenges in Distributed T&E Using TENA and JMETC

Gene Hudgins - KBR

Together, TENA and JMETC enable interoperability among ranges, facilities, and simulations in a timely and cost-efficient manner. TENA provides for real-time system interoperability, as well as interfacing existing range assets, C4ISR systems, and simulations; fostering reuse of range assets and future software systems. JMETC is a distributed, LVC capability which uses a hybrid network architecture; the JMETC Secret Network (JSN), based on the SDREN, is used for secret testing and 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 and training capabilities and simulations, as well as industry resources. This tutorial addresses using the well-established TENA and JMETC tools and capabilities to reduce risk in an often-uncertain environment; regularly saving ranges time and money in the process.

Planning and Testing for a Dynamic Cyber Threat

Alex Hoover - Department of Homeland Security

The cyber threat our IT and IT supported systems face is dynamic in nature. Not only are TTP (offensive and defensive) continually evolving, but the data, processing, and communication infrastructure all change (updates, "improvement", patches, etc.) often an independent of each other. This creates a challenging environment for testing the resilience of a system. Operational level modeling of our systems and the threat systems allows us to identify touch points for the decomposition of the threat interaction process. Just like breaking a kinetic engagement into Pd, Pi, Ph, and Pk, we can similarly decompose the cyber threat engagement into stages that can be treated independently. This allows us to take legacy and new data and analytically project it into new contexts, like the ones created by changes in the cyber environment.

Planning DE Tests with the Laser to Space Test Risk Assessment Tool (L-STRAT)

Isaiah Marquez, Chad Cogburn, Lt. Calvin Suratos, John Young, and Patrick Shriver, PhD - Aegis Technologies Group, Inc.

The Laser to Space Test Risk Assessment Tool (L-STRAT) is being designed to help the laser community quantify the risk of inadvertently illuminating and damaging satellites when propagating a laser beam above the horizon. Included within the scope of the overall L-STRAT effort is the production of a Test Planning Tool (TPT) that will enable test planners to maximize the test's probability of successful completion by minimizing the risk that a laser test will pose to satellites during the test design phase. The L-STRAT TPT utilizes Probabilistic Risk Assessment (PRA) methodologies, developed for and owned by the Air Force Research Laboratory's Satellite Assessment Center (AFRL/RDST), that enable test planners to understand the risk they pose to satellites for their test as designed. Not only will the TPT help test planners understand the risk they pose to space assets, but it will also suggest alternative test design options, within the acceptable bounds defined by the user, that lower both the risks of inadvertent illumination and damage to satellites and the inability to perform a test due to Predictive Avoidance (PA) window closures for laser systems categorized to be Category III under the DoDI 3100.11 and CJCSI 3225.01 guidance.

Requirements and Methods for High Energy Laser Test and Evaluation

Keith Bush (Gryphon Technologies / DE JTO), Steve Fiorino (AFIT), and Stephen Hammel (NIWC Pacific)

Safe and Secure Cyber T&E on Cyber-Physical Systems

Suresh Damodaran - The MITRE Corporation

Higher fidelity cyber Test & Evaluation (T&E) on Cyber-Physical Systems (CPS) may be conducted in cyber ranges in both Development Test & Evaluation (DT&E) and Operational Test & Evaluation (OT&E) phases. However, conducting live cyber T&E on CPS that are expensive or rare is a challenging proposition for system owners due to safety and security concerns for the System Under Test (SUT) and the environment. Consider a modern aircraft, which is operated by a system of systems with multiple components that exhibit physical, cyber, and electromagnetic (EM) aspects or dimensions simultaneously. An attack on any one of the dimensions, say cyber, may influence the behavior of the other dimensions, i.e., the physical and the EM dimensions, of that component and its connected components. These interactions across the dimensions are a legitimate source of safety concerns. The possibility that safe operating configurations may be changed in any one of the dimensions, or that remnants of a cyber-attack may still linger in the system, also raise security concerns.

Shifting Left of the Cyber Adversary

Paola Pringle and Timothy A. Foster - Naval Air Warfare Center Weapons Division (NAWCWPNS)

“Companies that consider security from the start assess their options and make reasonable choices based on the nature of their business and the sensitivity of the information involved. Threats to data may transform over time, but the fundamentals of sound security remain constant.” Start With Security – A Guide For Business, Federal Trade Commission, June 2015. In 2018 the White House released its first National Cyber Strategy in 15 years. Built on four pillars, the National Cyber Strategy defines the following principles. Protect the American people, the homeland and the American way of life; promote American prosperity; preserve peace through strength; and advance American influence. In turn, the Department of Defense (DoD) released a formal DoD Cyber Strategy calling for our community to build a more lethal force, compete and deter in cyberspace, strengthen alliances and attract new partnerships, reform the DoD by increasing cyber awareness, and cultivate talent. Let us examine how this translate to the Cyber Test and Evaluation (CyTE) professional. With the rapid advances in cyberspace and electromagnetic spectrum technologies, come equally rapid advances in technologies and TTPs to exploit them. The adversary is using both graduate level education in engineering and the sciences, as well as, improvised and asymmetric application of common sense to take advantage of the DoD’s slow and often cumbersome acquisition lifecycle.

Strategies for Satellite Safety during Laser Test and Evaluation

Heather Witts - USAF JFSCCN359

The unique characteristics of lasers can present hazards to certain satellites. Given the proliferation of lasers in society, science/technology and various military mission areas, satellite safety from unintended illumination is an on-going concern for the U.S. Department of Defense (DoD). Since 2000, the U.S. Strategic Command Laser Clearinghouse (LCH) has been the centralized office for fostering safe and responsible laser firings above the horizon or into space. DoD policy is to perform a comprehensive risk management process to identify and mitigate the risks of laser hazards to satellites. One mitigation is to provide satellite safety coordination and notification services to laser owners and operators when resources allow. U.S. Strategic Command has developed several methods of laser deconfliction that provide analytical means for promoting satellite safety. The suitability of these approaches for use by laser test and evaluation programs will be explored in this presentation. The LCH uses a six-step systems analysis process to identify laser hazards to satellites, analyze deconfliction approaches for mitigating the risks, and verify the deconfliction processes and capabilities of systems. Based on its work with some 100 laser programs, including numerous T&E projects and test ranges, the LCH has developed strategies to streamline and optimize the centralized deconfliction approach. In addition, there are laser programs with relatively mature software-controlled solutions for deconfliction, including standardized solutions. In this presentation we describe the risk management process, explain how various solutions provide satellite safety, discuss the process and documentation involved in working with the LCH, and identify complementary initiatives that could be leveraged by the T&E community. The focus is satellite safety in the context of Directed Energy test and evaluation.

Telemetry Data on Demand: The Key to Understanding the Telemetry Network Revolution

Carl Reinwald - Laulima Systems

The telemetry network revolution takes aeronautical flight testing from a broadcast-only paradigm to a TM-data-on-demand paradigm. This paper explores this paradigm shift, focusing on fundamental architectural changes enabled by incorporating telemetry networking technologies into a flight test system. Two concepts are presented to help understand the TM-data-on-demand paradigm: retrieving and processing recorded data from a test article during a mission and onboard dynamic data analysis and compression. An example flight test system with both SST and TmNS components provides a foundation to further explore the paradigm-shifting capabilities a telemetry network brings to flight test. In addition to TM-data-on-demand, the current static spectrum allocation methodology must also be replaced with a more agile, bandwidth-on-demand paradigm. When both TM-data-on-demand and bandwidth-on-demand capabilities have been realized, a new era of efficient flight testing will emerge.

Test and Evaluation Benefit Assessment Tool (TEBAT), a Risk Based Approach for the prioritization of Test and Evaluation (T&E)

B Gillett, CEng, MIET - UK Defence Science and Technology Laboratory (Dstl)

An investigation into the use of a Risk Based Approach for the prioritization of Test and Evaluation (T&E) within acquisition. The UK MOD Defence Science and Technology laboratory (Dstl), in conjunction with industry, carried out an investigation into the benefits that can be derived from using a risk based approach to permit prioritization of Test and Evaluation activities within acquisition projects. The research has developed a risk based approach that assists project teams to identify and prioritize the evaluation requirements within MOD acquisition programmes. It provides a means to assess the adequacy of a planned programme of T&E activities to addresses identified risks., where T&E is broadly defined to cover a wide range of methods for gathering information to support decision making – not just physical tests - throughout the acquisition life cycle. The approach enables users to review their planned T&E programmes to decide whether it should be changed to address risks more fully, prioritize better T&E activities against the risks or respond to project or risk changes. The Excel based tool (TEBAT -Test and Evaluation Benefit Assessment Tool) not only permits the assessment of how thoroughly T&E actively addresses the prioritized risks but compares the benefits with estimated costs, to provide a measure of the value for money of the different parts of the T&E programme.

Test and Evaluation (T&E) Infrastructure Development: Increased Efficiency in the Development of Test Fixtures Through the Use of Computational Fluid Dynamics (CFD) Modeling and Rapid Prototyping

Wesley Ercanbrack – Jacobs, and Brad Thacker – Dugway Proving Ground

A challenge for the Department of Defense is to adequately resource and utilize testing infrastructure that supports more operationally representative threat simulations. The tightening of T&E budgets demands that design and maintenance of testing infrastructure must be sized for the mission. At the Dugway Proving Ground (DPG), it is critical that we develop chemical warfare agent (CWA) testing facilities that accurately represent real world threats and are cost effective. Design choices can have direct impacts on cost, data quality, and mission capability. At DPG, the West Desert Test Center and Jacobs have implemented a new process for developing T&E test fixtures which focuses on streamlining fixture development. This process begins with iteratively developing clear test objectives, includes developing 3-D models of the fixture, and evaluation of its functionality and properties using CFD modeling. A prototype of the model is created through additive manufacturing and evaluated with CWA simulants. Based on prototype data, the fixture design is adjusted and finalized. This presentation will show successful implementation of the process in the development of three new test fixtures at Dugway Proving Ground.

T&E Instrumentation for EO-Laser System Modeling & Simulation

Bryan Kelchner, Douglas Nelson, and Steve Watson - Teknicare, Inc.

Modeling and Simulation plays a key role in the development of all weapons systems, but especially in the development, integration, and testing of electro-optical (EO) and laser subsystems for precision strike application or countermeasures that require precise pointing control. The instrumentation needed during the T&E of these systems are used not only to measure the system performance, but also for the verification and validation (V&V) of the performance and mission models for the EO-Laser Subsystem. This presentation will highlight the T&E Instrumentation for the V&V of the Modeling and Simulation for EO-Laser Systems.

T&E Methodologies

Donya Shakiba - Jacobs

Joint Interoperability Test Command (JITC), the DoD's sole Joint Interoperability Certifier for Information Technology (IT)/National Security Systems (IT/NSS) and Operational Test Agency (OTA) is modernizing test and evaluation (T&E) methodologies in Agile/DevSecOps, and cloud-based environments, by participating in pilot programs, evaluating lessons learned and applying industry best practices. This effort is being organized under the Enterprise Test Management (ETM) program to create new standards for applying risk-based T&E evaluation methods in the acquisition processes. ETM aims to either create or to better leverage existing technical verification and operational validation methods to reduce security risks throughout the acquisition cycle. JITC will unify test support capabilities and will provide training for what is expected of the Mission Partner (MP) to complete development test and verification and meet the entry criteria for operational test and validation. The effort is to have ultimately have a joint integrated test evaluation approach and updated areas of evaluation based on security. The goal is to put in place cybersecurity-based T&E procedures as early on in the lifecycle process as possible, and ideally as part of requirements definition and design documentation events.

Tester: Meet the Global Challenge: Simple Solutions to an Increasingly Complex World

Paola Pringle and Paul Fonua - Naval Air Warfare Center Weapons Division

There is no shortage of news that global forces are challenging our deployed platform. With an acquisition, process that extends several years we see our Naval community continue to push us to keep shifting left and, in the words of NAVAIR Vice Admiral Dean Peters, ‘Deliver new Capability with Increased Speed’. We are challenging the traditional methodologies and looking to industry best practices to help increase our speed to fleet. The concept of shifting left sounds like a great idea but how can we begin to put this idea into practice? Standing behind Rear Admiral Scott Dillon’s ‘three essential defining characteristics’ we begin to apply critical thinking, professionalism, and empathy to working within our teams as we apply the latest approach to the latest methods in product development. Starting with critical thinking, we will examine what it is we are creating. Whether you are involved with an aircraft, a ship, a radar, weapon system or any of the myriad of components and subcomponents that are part of any platform, one thing we can agree on is that all of us are part of deploying capabilities that allow our warfighters to penetrate adversarial defenses, deter or destroy those defenses and survive. We are part of building the entire Naval defense mission to counter threats from the air, underwater, surface and land. The headlines tell us the time to be ready for action is now.

Transforming the UK MOD T&E Enterprise to meet the T&E Challenge of New

John Binns - UK Ministry of Defence

The UK MOD Modernising Defence Programme highlighted that advances in information and communications technology have drastically increased the speed at which attacks can unfold and that newer domains of warfare continue to grow with new and more sophisticated and flexible weaponry providing greater scope for hostile action. In response to these challenges the UK MOD has established a mobilise, modernise & transform agenda that will enable the delivery of military capability through innovative technology-led solution, highlighting the importance of driving innovation through-out the Defence enterprise. As a critical enabler for success of the mobilise, modernise & transform agenda the UK MOD has established a T&E transformation programme to proactively position its T&E capabilities and people to meet these future challenges. The programme aims to transform the UK MOD T&E enterprise to meet the challenges of the information age to deliver a T&E enterprise that harnesses the best and most affordable mix of government, industry and international T&E that is dynamic, agile and primed to meet Defence’s future technological and operational challenges.

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ITEA thanks these Life Members for their devotion, dedication, and support of the Association, and their personal commitment to the professional excellence embodied in advancing the test and evaluation industry.



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Please join us in congratulating these T&E professionals on their achievement!

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Speaker Biographies

Sybil Abraham is a Computer Scientist for the Federal Aviation Administration (FAA). After completing her undergraduate studies, Ms. Abraham began working at the FAA William J. Hughes Technical Center as a federal employee in 2002. She started her government career as a test automation developer and is currently the Lead Test Director for a NextGen weather systems program in the Enterprise Services Test and Evaluation (T&E) Division – Aeronautical & Weather Services Verification Branch. Ms. Abraham leads a team of computer scientists and engineers through Development Test (DT) verification evaluations and the creation of Operational Test (OT) procedures for functional, integration, risk reduction and performance validation. She also served as a FAA Technical Representative (FTR) having traveled to numerous flight service stations across the state of Alaska during her tenure on the OASIS Flight Service program before taking on the role of Project Lead from 2014 - 2016.



Darryl K. Ahner, PhD, P.E., is the Director, Scientific Test and Analysis Techniques Center of Excellence (STAT COE) and was instrumental in shaping its operational concept leading up to its establishment by the Office of the Secretary of Defense in 2012. He is also a Professor of Operations Research at the Air Force Institute of Technology. As Director, he is responsible for executing the Center's mission to provide independent advice and assistance to designated major acquisition programs in the application of scientific test and analysis techniques in the development of test & evaluation strategies and plans. The Center also conducts externally funded applied STAT research, provides STAT education, and develops best practices and case studies in the employment of STAT.



Frank Alvidrez is a senior flight test engineering working to support AFOTEC DET 5 at Edwards AFB in support of Air Force operational flight testing for Cybersecurity and Electronic Warfare (EW). He specializes in advanced system engineering and architecture techniques and their applications to Operational Test and recently led various recent efforts of cybersecurity planning and test execution for the B-2A” Spirit” Bomber. He has 30+ years of experience in system engineering of aerospace programs. He is a Certified Enterprise Architect (DoDAF and UPDM). He currently supports a number of major Department of Defense efforts in Flight Test, Cybersecurity, System Engineering, Model Based System Engineering, Program Management, Enterprise Architectures, NetCentric Data Strategy, SysML, and DoDAF/UPDM Training.



Air Commodore Ross Bender, RAAF, currently serves as the Director, General Capability Integration, Test and Evaluation, Australian Defence Force, and has had an incredible career with the Australian Air Force. His career in the air force started simply enough, seeing the RAAF as a way to complete his university degree. From there, he went on to become an aeronautical engineer, then pilot, and so on up the ranks until he reached his current rank of Group Captain – director of combat capability for the RAAF in Canberra. He’s flown over 20 different types of aircraft, from Second World War fight planes to massive four-engine C130 Hercules. But his favourite by far is the American F-15.



John Binns is the Assistant Head of Evaluation Strategy and International relations at the UK Ministry of Defence (UK MOD) in Whitehall, London. He is responsible for policy, resource and oversight of UK MOD future T&E strategy development to ensure the UK proactively positions its T&E capabilities and people to meet future technology and operational challenges. John is a weapons and ordnance professional spending over 40+ years with the UK MOD managing and regulating aspects of UK Test & Evaluation Ranges to deliver safe and suitable environments for weapons testing. In his current role John is capitalising on his experience from his operational, research and international roles to deliver the necessary strategies and policies for T&E standards, techniques, facilities and people that UK Defence needs to field technology rich capabilities as we enter the information-age.



Col Ryan Blake is the Commandant of the U.S. Air Force Test Pilot School, Edwards AFB, California. As Commandant, he is responsible for leading the world's premier flight test school as it educates and trains the next generation of flight test professionals. The Test Pilot School graduates 48 students annually with a Master of Science degree in Flight Test Engineering and executes the largest and most diverse flying operation in Air Force Materiel Command, leveraging over 4,000 flying hours and a budget of \$40 million. Col Blake earned his commission in 1997 from the Air Force Reserve Officer Training Corps at the University of Texas at Austin. He served two operational assignments flying the F-15E Strike Eagle, deploying to the Middle East for combat three times in support of three separate conflicts (Operations SOUTHERN WATCH, ENDURING FREEDOM and IRAQI FREEDOM). He holds graduate degrees from the Air Force Institute of Technology and the USAF Test Pilot School. Col Blake has been a flight test squadron director of operations, has served at the Pentagon as the F-35 Program Element Monitor, and has commanded a flight test squadron and an operations group.



Adrian Britton, PhD, joined what is now QinetiQ in 1985 where he undertook and then led research programmes addressing seekers for complex weapons. He then was the Research Delivery Lead for a large contract defining and delivering a portfolio of complex weapons related research, and also provided advice and assistance to the UK MOD on the design and testing of Complex weapon systems. More recently he led a team providing advice on Integrated Test Evaluation and Acceptance within the UK MOD. He is currently the Chief Engineer within QinetiQ's Global Test and Evaluation campaign and is the President of the Western European Chapter of ITEA.



Keith Bush is a Senior Scientist with Gryphon Technologies. He has supported the DE JTO for the past 12 years as a SETA specializing in tactical Beam Control research efforts. Mr. Bush has 40+-years of experience in modeling optical and imaging systems and in evaluating their performance. Education includes graduate studies in optical engineering at the University of New Mexico and a BS in Applied Physics from Georgia Tech (1976).



Robert M. Butterworth joined the Office of the Director, Operational Test and Evaluation (DOT&E) in 1999, an independent organization in the Office of the Secretary of Defense (OSD). He monitors and addresses issues that could affect the capability of the Defense Department's test infrastructure to support operational testing. In addition, he administers the International Test and Evaluation Program that is delegated by the Secretary of Defense to DOT&E for execution. Mr. Butterworth's previous civilian government service was in the Office of the Director, Test, Systems Engineering and Evaluation (DTSE&E). In that organization he addressed issues affecting the capability of the Department's test infrastructure to support its acquisition programs. Also, he prepared assessments of developmental maturity for all naval weapon systems and shipbuilding programs. His assessments supported deliberations of the Defense Acquisition Board.

Jay Clark has served since 2003, as KBR's Project Officer of the Fleet Forces Atlantic Exercise Coordination Center (FFAECC). Responsible for the arrangement of assets and services necessary for the successful training of all east coast Naval forces. Manages a team of fourteen KBR contractor personnel. The FFAECC Team serves as the single point of contact for coordinating assets, ranges, and services for fleet exercises to facilitate the training of 7 East Coast Carrier Battle Groups, 4 Expeditionary Strike Groups, Foreign Militaries, Standing Naval Forces Atlantic, UNITAS and Sustainment groups as required. Project Officer and veteran retired Naval Warrant Officer with 29 years of honorable service with ten operational deployments. Highly decorated for exceptional operational performance and numerous corporate recognitions and awards.



Michael R. Contratto is the Technical Director of the 96th Range Group, Eglin Air Force Base, Florida. He serves in a multi-discipline environment as the Group's senior technical engineer with project management, execution and Test & Evaluation responsibility to support Eglin's Test and Training Complex, the largest Major Range and Test Facility Base in the Department of Defense. Additionally, he chairs the Eglin Range Configuration and Control Committee and is the Eglin Technical Representative to the National Range Commander's Council. Before entering civil service, Mr. Contratto completed a 25-year active duty career initially serving as an operational bomber pilot participating in combat operations during JOINT ENDEAVOR, DESERT STRIKE, DESERT FOX, and ALLIED FORCE before entering the test pilot and acquisition community.



Timothy S. Dare is the Deputy Director for Developmental Test, Evaluation and Prototyping (DD(DTEP)). As the DD(DTEP), he serves as the principal advisor on developmental test and evaluation (DT&E) to the Secretary of Defense, Under Secretary of Defense for Research and Engineering (USD(R&E)), and Director of Defense Research and Engineering for Advanced Capabilities (DDRE(AC)). Mr. Dare is responsible for DT&E policy and guidance in support of the acquisition of major Department of Defense (DoD) systems and providing advocacy, oversight, and guidance to the DT&E acquisition workforce. Mr. Dare is also the senior DDRE(AC) official responsible for prototyping and manages DDRE(AC)'s annual \$500M prototyping portfolio. In support of USD(R&E)'s mission to develop capability overmatch for our Warfighters, he establishes policy and advances leading edge technologies through the development of advanced technology concepts and prototypes. By working closely with interagency partners, academia, industry and governmental labs, he identifies, develops and demonstrates multi-domain technologies and concepts that address high-priority DoD, multi-Service, and Combatant Command warfighting gaps.

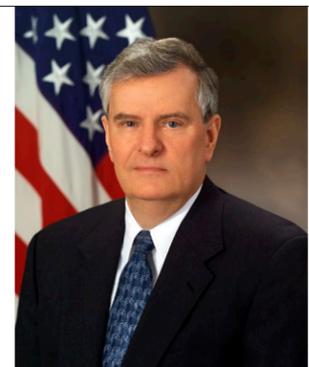


Josue DeJesus is a test engineer for the 96th Test Wing, Test Systems Squadron at Eglin Air Force Base and holds a master's degree in nanoscale materials engineering. Mr. DeJesus serves as part of the Development team for the Over Water Surveillance & Scoring project, or OWSS. The OWSS system is a proven prototype capability which provides an unmanned, mobile, accurate, flexible, and rapidly deployable capability used for long range mobile precision scoring, range asset surveillance, and safety footprint management. Josue also serves as the unmanned systems Team Lead for his squadron.

Mindy Dowling is a Computer Scientist working for the Federal Aviation Administration (FAA) at the William J. Hughes Technical Center (WJHTC) located in Atlantic City, New Jersey. She joined the FAA in 1996 and is currently working as a Senior Test Engineer with the Air to Ground Communications Branch (ANG-E62). Ms. Dowling's expertise lies in the field of Test and Evaluation (T&E) where she works in the development and conduct of operational test activities to support the implementation and sustainment of multiple air traffic/air to ground communications systems. Ms. Dowling has in-depth knowledge of the FAA's Test and Evaluation Handbook and the WJHTC Process Description Documents. She has worked on many highly complex Air Traffic Control (ATC) systems. On the Data Communications (Data Comm) Test Program, she was the Operational Test (OT) director and led a team over a six-year period in defining test objectives, identifying operational issues, establishing test milestones, and developing test requirements and test plans for the Data Comm program office.



David W. Duma is the Principal Deputy Director, Operational Test and Evaluation. He assumed this position in January 2002. Prior to returning to government service, he worked in private industry managing a variety of projects involving test and evaluation; requirements generation; command, control, communications, intelligence, surveillance and reconnaissance; modeling and simulation; and software development. He was acting Director, Operational Test and Evaluation from February 2005 to July 2007. Duma completed 30 years of Naval service which included serving as the acting Deputy Director for Conventional Systems in DOT&E and Director, Test and Evaluation Warfare Systems for the Chief of Naval Operations. His Naval career also included service as the Deputy Commander, Submarine Squadron TEN and Commanding Officer of the nuclear-powered submarine USS SCAMP (SSN 588). Duma holds two Masters of Science degrees, one in National Security and Strategic Studies and another in Management. He holds a Bachelor of Science degree in Nuclear Engineering. He is a member of the International Test and Evaluation Association and the National Defense Industrial Association.



Wayne Dumais has recently been promoted to the Deputy Director for the Office of Test and Evaluation at DHS, where he provides T&E oversight for Customs & Border Protection (CBP), Citizenship & Immigration Services (CIS), Federal Emergency Management Agency (FEMA) and Immigration & Customs Enforcement (ICE) programs. Mr. Dumais has also served as the DHS Science & Technology (S&T) LNO in Key West FL, with Joint Inter Agency Task Force – South (JIATF-S). Prior to DHS, Mr. Dumais was with General Dynamics Land Systems as a Senior T&E Engineer working the EFV and Abrams Tank programs. Wayne was GDLS's LFT&E lead responsible for the planning and conduct of live fire events for a number of programs and R&D efforts.



Heather Elsley, BA(Hons), CPFA, is the Programme Manager for Threat Evaluation within the UK Ministry of Defence, Science and Technology Laboratories (Dstl) and a Chartered Public Finance Accountant. After an early career in actuarial science, Heather obtained a 1st Class Honours Degree in the History of Science, followed by professional qualifications in Management Accounting, Business Management and Programme Management. She is a career Civil Servant and joined the Ministry of Defence in 1979. Heather has worked in a number of UK Defence establishments and roles including; International Project Officer for the Master General of the Ordnance (MGO), Business Manager for the Army Training and Recruitment Agency and Project Manager for both the Army Foundation College and the Defence Veterinary College.



Wes Ercanbrack has been providing support as the Jacobs Scientific Technical Manager for the past three years on the Dugway Field, Range, Chamber and Laboratory Support Services (FRC & LSS) contract at Dugway Proving Ground. Wes's position involves researching and developing trace detection techniques using a variety of laboratory instrumentation. He has developed new methods for chemical warfare methodologies. He is proficient with GC, GC/MS, GC/AED, LC, LC/MS, ICP/MS, LC-ICP/MS, Preparatory LC, XRF, and TOC. Wes oversees the laboratory portions of the safety air monitoring operations, and has implemented new Government-mandated airborne exposure levels for chemical warfare agents. He also acts as the Project Scientist for the Agent Persistence Test Program and MIST test programs. He is responsible for developing the test procedures, methodology, proof of concept, data review, and scheduling test conduct, and also manages the Laboratory Information Management System (LIMS).



James "Jim" A. Faist is the Director of Defense Research and Engineering for Advanced Capabilities, reporting directly to the Under Secretary of Defense Research and Engineering within the Office of the Secretary of Defense. Jim directs an organization whose mission is to recognize, explore, and accelerate the development and integration of new technology to maintain U.S. technological superiority. He is responsible for establishing a Department of Defense joint mission engineering capability, oversight of developmental testing and test facilities as well as demonstration and validation of technology prototype and rapid fielding activities. Jim serves as the mission area advisor for warfighter portfolios in hypersonics, space, autonomy, and networked command, control, and communication architectures. He also provides independent technical risk assessments of major acquisition programs.



Paul Fonua started his career as a civil servant in 1991 with his career focused primarily in Test & Evaluation. His began as a flight test engineer providing support to a wide variety of missile systems, including HARM, JSOW, and Tomahawk. In 1999, he served as the NAWCWD liaison to the Commander, THIRD Fleet providing expertise in weapons and the use of the various NAVAIR test ranges for training. On his return, he served as the lead test engineer for Naval Surface Fire Support programs. In 2002, Mr. Fonua supported DARPA as the Government liaison at Northrop Grumman on the X-47A unmanned system program. In 2004, Mr. Fonua was selected as the Strike Warfare Branch Head in the Weapons Evaluation Division (5.1.8), supervising flight test engineers and continuing to provide guidance on weapons testing and supporting several new technology programs. Mr. Fonua then became the Branch Head of the Weapon Programs Test Branch in the Systems Test and Experimentation Management Division (5.1.1), providing guidance to lead test engineers on a variety of Navy and Marine Corps weapon systems on the West coast.



Laura Freeman, PhD, is a Research Associate Professor and the Associate Director of the Intelligent Systems Lab at the Virginia Tech Hume Center. Her research includes cybersecurity, data analytics, machine learning, and developing new methods for test and evaluation focusing on emerging system technology. She is also the Assistant Dean for Research in the National Capital Region; in that capacity she works to shape research directions and collaborations in across the College of Science in the National Capital Region. Previously, Dr. Freeman was the Assistant Director of the Operational Evaluation Division at the Institute for Defense Analyses. In that position, she established and developed an interdisciplinary analytical team of statisticians, psychologists, and engineers to advance scientific approaches to DoD test and evaluation.



Lisa Garner is a Project Manager with Mission Support and Test Services, LLC, the operations contractor for the Nevada National Security Site. MSTs is made up of Honeywell International, Inc, Jacobs Engineering Group, Inc and HII Nuclear, Inc. Lisa has managed large integrated experimental projects at the NNSS for the past 3-1/2 years, and was involved in Subcritical Experiments at the NNSS while working at the Los Alamos National Laboratory (LANL). Lisa has a strong background in nuclear facility operations and. Previously, Lisa worked at LANL in New Mexico, the Rocky Flats Plant in Colorado, the Hanford Site in Washington State and the National Energy Technology Laboratory in Pennsylvania, all National Nuclear Security Agency (NNSA) sites. Lisa has a degree in Environmental Engineering from Montana Tech.



Brian Gillett, BSc, CEng MIET is a principal adviser for Test & Evaluation (T&E) within the UK Ministry of Defence, Science and Technology Laboratories (Dstl). He is a Project Technical Authority (PTA) for the science and technology research into T&E, responsible for the technical quality of the research outputs in this area. He is also the Lead Technical Review (LTR) for major threat evaluation projects. Following the completion of an engineering apprenticeship in the automotive industry, Brian obtained qualifications in mechanical engineering design from the Royal Aeronautical Society, followed by a Degree in System Engineering from Nottingham University. Brian is a Chartered Engineer in the Institution of Engineering and Technology. Brian has worked at a number of organizations including; UK Atomic Energy Authority (UKAEA), Vickers PLC, Brown & Root, Smiths Industries, Dowty Defence System and ABP Limited. In 2007, Brian joined the Defence Science & Technology Laboratories (Dstl), part of UK MOD, at Porton Down. Brian's focus has been on how evaluation within Dstl and MOD can be performed in a more efficient and effective manner through the use of innovative techniques and technologies.



Pete Green is KBR's Senior Vice President and General Manager of the Engineering Business Unit. He is responsible for customer interface, profit and loss, business development, strategic planning, and leadership in a \$800M per year Business Unit. KBR's Engineering Business Unit has more than 3,300 engineers, scientists, analysts, and technicians providing systems engineering, program management, test and evaluation, information operations, security solutions, and sustainment engineering support to the DoD and intelligence community at over 30 locations nationwide. Mr. Green has been an employee of the KBR heritage companies since 1985. Prior to assuming his current role, he served as the Aerospace Group's President. Previously he served as the Group's Vice President of Business Development / Strategic Planning, a contract test pilot supporting NAWCAD for 16 years, a systems engineer, a program manager, and the organization's Chief Pilot for over 20 years. A 1977 graduate of the United States Naval Academy, he holds a Bachelors of Science in Physics, a Masters of Science from the University of Southern California in Engineering Management, and also completed the Darden School of Business Executive Management Program at the University of Virginia.



Charles D. Hall leads a diverse team of engineers, operators, and subject matter experts in the planning and execution of Test and Evaluation (T&E) activities in compliance with Coast Guard (CG) and DHS acquisition policy. The effort includes extensive experience in the technology and development of small boats, high endurance cutters, icebreakers, fixed wing and rotary aircraft, and various information technology systems, including the Rescue 21 Advanced Communication, Nationwide [maritime] Automatic Identification, Integrated Logistics Information Management (LIMS), Financial Management Services Improvement Initiative (FMSII), and Electronic Health Record (eHRA) systems.



Phil Hallenbeck is a Systems Engineering Lead with the Trideum Corporation, currently working with the Cyber Vulnerability Assessment Test Environment (CVATE) at Redstone Test Center, Alabama. A graduate of the US Military Academy, he has over 25 years' experience in leading technical teams of all sizes, including leading the first-ever large-scale operational tests at the US Army National Training Center (NTC), co-creating a model of combat and an accompanying application by which the realism of a simulation or training event can be assessed and improved, and leading the creation of a ground-breaking initialization capability for DoD C4ISR systems and simulations. Phil is an INCOSE Certified Systems Engineering Professional, an ITEA Certified T&E Professional, and has Master's Degrees from Purdue University (Mechanical Engineering) and the University of Texas at Austin (Software Engineering).



David Harrison leads the Integration, Test, and Evaluation functional leadership team at Lockheed Martin. This team works to research and incorporate advances in IT&E throughout the corporation. This research covers project management, test planning, agile methods, statistical test design, data collection, and test data analytics. David earned a Bachelor's of Science in Mechanical Engineering from Kansas State University before earning a Master of Science in Materials Science at the Colorado School of Mines. Recent study in Statistical Engineering led to a Masters of Engineering in Engineering Management and a Master Black Belt certificate from the University of Colorado.



Gene Hudgins works for KBR as Director of Test and Training Environments and supports the Test Resource Management Centers' (TRMC) Test and Training Enabling Architecture (TENA) Software Development Activity (SDA) and Joint Mission Environment Testing Capability (JMETC) as the lead for the TENA and JMETC User Support Team. Since October 1998, the Central Test and Evaluation Investment Program (CTEIP) has overseen the development of the TENA – which drastically improves range interoperability and resource reuse among DoD range systems, facilities, and simulations. As a key member of the TENA SDA and JMETC Program Office, Gene is responsible for Distributed Event Coordination, Design, and Integration.



Steven J. Hutchison, PhD, is the Director of Test and Evaluation in the Department of Homeland Security (DHS) Science and Technology Directorate. Dr. Hutchison retired from the US Army in 2002. His military career included assignments in the 82nd Airborne and 3rd Infantry divisions, the Department of Mathematics at the United States Military Academy, and the Army Test and Evaluation Command. Prior to coming to DHS, Dr. Hutchison served in various test and evaluation roles in the DoD, including assignments with the Army Test and Evaluation Command, Defense Information Systems Agency, and both the Developmental Test and Evaluation and Operational Test and Evaluation offices in the Pentagon. Dr. Hutchison earned a Bachelor of Science degree from the United States Military Academy, a Master of Science in Operations Research at the US Naval Postgraduate School, and a Ph.D. in Industrial Engineering from Purdue University.



Keith Joiner, CSC, PhD, MSc, MMgmt, BEng(Aero), CPPD, CPEng, MAIPM, MIEAust, joined the Air Force in 1985 and became an aeronautical engineer, project manager and teacher over a 30-year career before joining the University of New South Wales in 2015 as a senior lecturer in test and evaluation. From 2010 to 2014 he was the Director-General of Test and Evaluation for the Australian Defence Force where he was awarded a Conspicuous Service Cross. He was responsible for Defence-wide test and evaluation policy, ensuring all new capability submissions to Government had test plans, for conducting trials on all proposed new capabilities (prototypes and off-the-shelf), and operational field evaluations for new Army and joint capabilities. During his tenure in this role he testified to the Senate Inquiry into Defence Procurement (2012) and was tasked by the Service Chiefs with developing and implementing new reforms in test and evaluation.



Bart Jones currently serves as the Mission Support and Test Services (MSTS) Mission Execution Senior Director and Jacobs Division Vice President for the MSTS contract, and provides overall integration of Mission Delivery and directing test, experimentation and evaluation, applied technology, incident prevention and response and more. Jones has 40 years of related experience, including Vice President of Jacobs Asset Management Group, where he led a region-wide strategic growth initiative recognizing Jacobs as a world leader in Intelligent Asset Management. He also served as Jacob's Vice President/General Manager and Contract Executive at NASA Michoud Assembly Facility, where he supported NASA's space launch system and multiple commercial operations. Prior to that he was Jacob's Director of Test Assets, Capital Investments and Support for Arnold Engineering and Development Center, the world's largest aerospace ground test facility. From 1979 until 2000, he proudly served in the U.S. Air Force in several roles supporting the ICBM field. He provided strategic guidance, program management, ground and flight test and evaluation for both Minuteman and Peacekeeper weapon systems, and oversight of both operations and maintenance programs as well as gained hands on experience both as a launch control officer and maintenance technician.



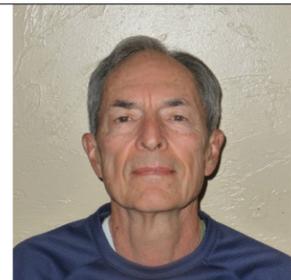
Bryan Kelchner is currently serving as the Vice President of Engineering at Teknicare, Inc., headquartered in Albuquerque, New Mexico. Teknicare provides engineering, safety, and data management support to the Department of Defense, specializing in directed energy systems engineering and beam control and laser systems design, development, integration and testing. Bryan is a graduate of the USAF Academy and the Air Force Institute of Technology, with BS degrees in Physics and Astronautical Engineering, and a MS degree in Solid State Physics. He has over 35 years of experience in the development and testing of electro-optical and laser systems. Bryan was instrumental in the early phases of the Airborne Laser Program (ABL), as the Government Lead for the beam control and fire control IPT and then as the Deputy Director for air vehicle integration.



Mark J. Kiemele, PhD, President and Co-founder of Air Academy Associates, has more than 30 years of teaching and consulting experience. Having taught or mentored more than 30,000 leaders, scientists, engineers, managers, trainers, practitioners, and college students from more than 20 countries, he is world-renowned for his Knowledge Based KISS (Keep It Simple Statistically) approach to engaging leaders and practitioners in applying performance improvement methods. His support is requested by an impressive list of global clients, including Sony, Microsoft, GE, Apple, GlaxoSmithKline, Samsung, Hyundai, Kia, PerkinElmer, Danaher, John Deere, Xerox, BASF, and a host of DoD contractors and organizations. Mark earned a B.S. and M.S. in Mathematics from North Dakota State University and a PhD in Computer Science from Texas A&M University.



David Loomis has over 50 years' experience in test & evaluation, systems engineering and program management. He started his career with the Navy as a civil servant rising to the level of Division Head of the Weapons Test Division. He was responsible for testing the Surface Navy Weapons System RDT&E programs including Standard Surface to Air Missile, the Vertical Launch System, the surface-launched Harpoon, the surface-launched Tomahawk, the Phalanx Close In Weapons System (CIWS), the Rolling Airframe Missile, 5 inch and 8 inch Guided Projectiles. He provided significant contribution to the revision of Navy testing policy and guidance. He subsequently worked for Lockheed Martin, Denver Colorado and was responsible for developing the test requirements for Flight 9-18 of the Peacekeeper test program. He was the Program Manager for the Zenith Star / Alpha - LAMP Integration Program and was responsible for technical management, cost and schedule for this state-of-the-art Space Based Laser ground test program.



Dennis Miller is a Jacobs Division Vice President and leads the Advanced Connected Enterprise Solutions (ACES) division. ACES is an \$80M+ portfolio that is composed of multiple Government contracts for software development, IT/Cyber support, software field support, and Jacobs' commercial intelligent asset management product - ion. Dennis leads more than 425 people across the division, including 220 software development professionals developing products for the USAF, foreign military, and commercial sales. Specifically, ion provides capabilities to commercial and Government energy, nuclear, water industries as well as Army test ranges. Dennis has been with Jacobs for 13 years and has multiple degrees including a BS in Meteorology from Penn State and MS in Computer Science from Boston University.



Tim Morey currently works for KBR as the Director of Armament & Commercial Test and Evaluation leading all engineering and test for Kinetic Effects, Non-Kinetic Effects, and Test & Training Environments. Technical capabilities include Air-to-Air Missiles, Airborne Electronic Attack, Rapid Response T&E, Improvised Threats, Big Data/Knowledge Management, Test Range Modernization, and Live, Virtual, and Constructive (LVC) Test and Training Environments. Operations are located at Naval Air Warfare Center Weapons Division (China Lake and Point Mugu, CA), Niceville, FL, and at various distributed test sites worldwide. Tim flew the F-14B in support of Operations Desert Shield / Desert Storm and was an Adversary Instructor Pilot flying the T/A-4J, A-4E, F-5E/F, F-16N and F/A-18A. Tim has experience in all facets of flight testing and management of several aerospace vehicles including FA-18A-G, F-14A-D, AV-8B, AH/UH-1W/Y/Z, HH-1N, MH-60, T-39D, P-3, C-130, S-3, MQ-9, and experimental technology demonstration aircraft.



Terry Murphy has, for over 40 years, positively impacted our nation's security. Since October 2016, Mr. Murphy has served as Deputy Director, Policy and Workforce Development within the Department of Homeland Security (DHS) Office of Test and Evaluation. In this role, he develops, staffs, and adjudicates key DHS Test and Evaluation (T&E) policy directly impacting Office of Test and Evaluation responsibilities and authorities. Mr. Murphy joined DHS July 2015. He previously served as Senior Analyst within the Office of the Deputy Assistant Secretary of Defense, Developmental Test and Evaluation from 2011 to July 2015. During this time Mr. Murphy led the update of DoD T&E policy; and development of the T&E Management Guide, Cybersecurity T&E Guide, and Incorporating T&E into Acquisitions Guide. From 2007 to 2010, as T&E Manager for Combat Support Equipment, Marine Corps Systems Command, Mr. Murphy supported system portfolios including Medical, First Responders, and Shelters to facilitate real-world operations.



Cathy O'Carroll MSc, BSc, MRAeS, has worked for QinetiQ and its predecessors since 1985. Cathy's technical career started in the air weapons domain within the Royal Aircraft Establishment undertaking research into the design of warheads to defeat hard target structures involving numerical modelling, materials research and the undertaking of trials. On the formation of QinetiQ in 2001, Cathy became Business Group manager for the Airspace Weapon Systems Group with operational responsibility. In 2004, she became Business Development Manager for the Weapons Division with responsibility for growing the business and providing strategic and tactical sales planning. Cathy has been actively involved in and led a number of strategic weapons related initiatives including leading the creation of the Weapons Technology Centre – a partnership between UK MOD and industry delivering Complex Weapons research.



Kyeongwon Park received the BS and MS degrees in Information Communication Engineering from Chungnam National University, Daejeon, Republic of Korea, in 2016 and 2018, respectively. She is currently a researcher with the Agency for Defense Development. Her research interests include digital communication and communication system design.



Robert Poche is a Division Vice President and the Director of Asset Management for Jacobs; he performs this role within the Jacobs Aerospace, Technology, and Nuclear (ATN) line of business. Robert is a recognized leader in asset management with over 16 years of experience in Engineering, Construction, and Operations and Maintenance (O&M) for industrial and commercial facilities world-wide. Robert leads a multi-disciplined team of individuals chartered to develop, deploy, and integrate connected-facility solutions by leveraging available data and employing rigorous data analytics to improve decision-making as part of the Jacobs Intelligent Asset Management (IAM) Strategy. Robert and his team utilize IAM to build upon Jacobs' whole-life asset management approach, bringing together extensive domain expertise, technology solutions, and O&M experience and pedigree to deliver value-added solutions that optimize the return on invested capital for clients.



Robin Poston, PhD, is the Director of the System Testing Excellence Program for the FedEx Institute of Technology at The University of Memphis, and she is a Professor and Dean of the Graduate School at The University of Memphis, which has 4,200 graduate students studying in 126 graduate programs. Dr. Poston is a recipient of the Memphis Alumni Association Distinguished Teaching Award and she leads the annual International Research Workshop on Advances and Innovations in Software Testing attended by hundreds of academic and industry professionals. Dr. Poston's current research focuses on understanding the alignment within the IT unit among developers and testers, client managers' responsibilities and governance especially in mitigating vendor silence and managing vendors in outsourcing of software testing projects, and online security threats.



Paola Pringle has served as the Maritime Patrol Reconnaissance Aircraft (MPRA) P-8A Interoperability and Cyber Test Engineer. As a member of the Integrated Warfare Test and Evaluation Division, Cyberspace Test and Evaluation (T&E) Branch, Ms. Pringle continues to provide P-8A with engineering expertise and technical leadership promoting Capabilities Based Test & Evaluation. She supports P-8A in refining testing environments using available tools and infrastructure to support interoperability and cybersecurity testing. She also works towards establishing collaborative environments consisting of resources within and external to Commander Naval Aviation (NAVAIR) Systems Command Test and Evaluation that support Capability Based Research, Development, Test and Evaluation (CB RDT&E).



Antonia Pulley has over 20 years of experience as an Information Technology professional. She holds certifications as a Certified Software Tester (QAI), a Certified DHS T&E Level 3, and a Scrum Master. She currently works for Department of Homeland Security U.S. Citizenship Immigration Services as an IT Specialist. Within the Office of Information Technology Applied Technology Division, she is the Operational Test Director. In this role, she oversees all Quality Assurance and Operational Testing activities relating to the Verification Modernization program to include documentation and process assessments; design, code, and test analysis; stage review coordination and facilitation.



Lieutenant Colonel Raffetto serves in the Operations Research Department at Naval Postgraduate School as the MCCDC OAD-NPS Liaison Officer and Military Assistant Professor specializing in teaching Weapon Systems Test and Evaluation. His operational experience includes multiple deployments at the Infantry Company, CH-53E Squadron, MEU, and Wing levels to Okinawa, Korea, OEF, and OIF. He has held key billets from Operations Officer, to Aircraft Maintenance Officer, to Wing Future Operations/Plans Officer operationally, and as an Operational Test Project Officer, Operations Analyst, and Chief of Test for the USMC at MCOTEA in support of Acquisitions.



Pedro E. Ramirez brings over 23 years of experience as an Enterprise Architect, an Information Technology and Cyber Network Expert and is recognized for his achievements in areas such as cybersecurity and technology innovations, program management, and deploying security solutions across the Federal Government and Commercial industry. He is a highly motivated, innovative leader who directs the strategic planning of multi-million-dollar operating budget and supports over 100 staff and multiple departments and agencies. He oversees a broad spectrum of resources encompassing over 100 systems, platforms, and networks for the enterprise as a cybersecurity solutions expert. Pedro has a degree in Information Technology, and an MBA, in addition to achieving multiple levels of professional certifications in the different fields, that include CEH, CHFI, Security +, Network +, CNDA, JNCIS, JNCIS-SP, JNCIS-FWV, among others.



Floyd R. Reed is an Intelligence Systems Analyst with Jacobs Technologies working with the Joint Interoperability Test Command. Prior to working with JITC, he spent 24 years in the United States Army as an All Source Intelligence Analyst working with coalition partners during numerous operations over the course of his Army career. Those operations include Operation Joint Endeavor, Bosnia-Herzegovina; Operation Southern Watch, Kuwait; Operation Northern Watch, Turkey; Operation Iraqi Freedom, Mosul and Baghdad, Iraq; and Operation Enduring Freedom, Khost, Afghanistan. After retiring from service, Mr. Reed became a Test Engineer in JITC working on the Coalition Interoperability Assurance and Validation (CIAV) program. There he worked with the North Atlantic Treaty Organization (NATO) nations and other mission partners on coalition interoperability issues in battlespace management, battlespace awareness, joint targeting and logistics. Mr. Reed received his bachelor's degree in Arts with a focus in Intelligence Studies from the American Military University.



Matt Reynolds started his career as a Navy civilian in a ship acquisition program office. Early in that job, he established the Navy's Total Ship Test Program, which remains very prominent today. In 1979, he was assigned to staff, organize and manage the Naval Sea Systems Command's Test and Evaluation Office, which he ran for 23 years until his retirement in 2002. Since that time, he has been an independent consultant on T&E, supporting a wide variety of Navy acquisition programs. Matt has written numerous manuals, directives and articles on T&E, and in 1997, published an award-winning book "Test and Evaluation of Complex Systems." He is a charter member and past President of ITEA, and has taught courses and tutorials for ITEA for over two decades. In 2009, he served on the prestigious Defense Science Board study of Developmental T&E.



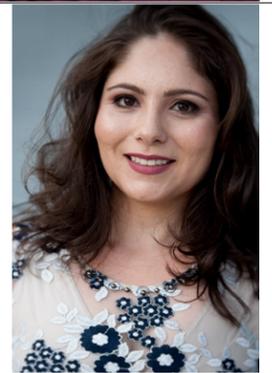
George Rumford is the Acting Principal Deputy of the Department of Defense (DoD) Test Resource Management Center (TRMC), a field activity that reports directly to the Under Secretary of Defense for Research and Engineering within the Office of the Secretary of Defense. The TRMC mission is the readiness of DoD test infrastructure to support testing and delivering new weapons to the warfighter. The TRMC provides governance over DoD test resources (open air test ranges, ground test facilities, hardware-in-the-loop laboratories, measurement facilities, software testbeds, and modeling & simulation used for testing), including the Major Range and Test Facility Base (MRTFB). Furthermore, the TRMC invests in the modernization of test resources, partnered with the Services/Agencies (Army, Navy, Air Force, DISA, DTRA, MDA, DARPA), to improve joint or multi-Service DoD test capabilities that support acquiring advanced warfighting capabilities. Previously, Mr. Rumford was responsible for Major Initiatives and Technical Analyses in the TRMC, serving as the Program Manager for the Test and Evaluation / Science and Technology (T&E/S&T) Program.



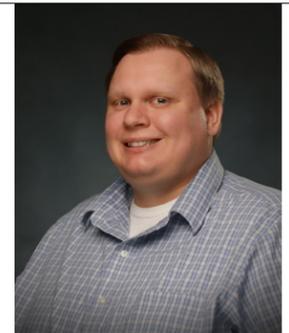
Lynn Sebourn is employed by Quantitech and is the Facility Engineering SME at Arnold Engineering Development Complex in Tullahoma, TN. Lynn has 24 years of experience in performing test facility analysis, feasibility studies, and modeling & simulation of the AEDC wind tunnels, turbine and rocket altitude test facilities, and hypersonic facilities. Lynn has previously co-authored a paper on directed energy testing in wind tunnels, “Aero-Optic Scaling Effects in Subscale Wind Tunnel Testing”. Lynn has an undergraduate degree in Aerospace Engineering from Missouri S&T and a Ph.D. in Aerospace Engineering from the University of Tennessee.



Donya Shakiba is a Professional IT Task Lead with a B.S. in Computer Information Systems from UMBC, and currently pursuing a Master's degree in Cybersecurity Management and Policy at UMGC. Before graduating, she started working for BG&E to build a document management and change control system in order to satisfy the Sarbanes-Oxley Act. Mid-career, she served as SME, Relationship Manager, and technical requirements lead for Department of Homeland's Security flagship program, Secure Flight. Currently, she is decomposing and rebuilding Test & Evaluation methods for the DOD Joint Interoperability Test Command (JITC) to improve processes and maximize effectiveness on agile/DevSecOps programs for cloud-based systems.



Tim Sienrukos serves as the Test Director in the Network Communications Branch, part of the Enterprise Services Test & Evaluation Division of the FAA William J. Hughes Technical Center. His role and responsibility is to lead the Test & Evaluation efforts for the National Airspace System (NAS) Common Reference (NCR) service, one of the FAA's first end-to-end Agile projects to reach the NAS. Tim's undergraduate work at Seton Hall University and Stockton University culminated in a Bachelor of Science Degree in Computer Science. Subsequent education includes graduate-level work at the Stevens Institute of Technology.



Jonathon C. Skarphol is a Mission Systems Architect and the Test and Training Instrumentation (TTI) Discipline Chief at Collins Aerospace. He is a regular presenter at ITEA events, former chief engineer for the Common Range Integrated Instrumentation System (CRIIS), and currently manages the technical strategy and roadmaps for the TTI and Tactical Cyber product lines focused on providing innovative cybersecure solutions to modernize air combat training and T&E. Jon holds a B.S. in Electrical Engineering from North Dakota State University, a MBA from the University of Iowa, and a Systems Engineering and Architecting graduate certificate from Stevens Institute of Technology. Skarphol has 20 years of experience in technology, innovation, and engineering across the defense and high-performance computing industries.



Ken Stefanek is the Defense Acquisition University (DAU) Learning Director for Test and Evaluation where he is responsible for the curriculum used to certify DoD's test and evaluation workforce in accordance with the Defense Acquisition Workforce Improvement Act (DAWIA). His portfolio includes a distance learning course and two in-residence courses, all on the role of test and evaluation in the DoD acquisition system. Additionally, he oversees maintenance of nine continuous learning modules on different aspects of test and evaluation. Prior to joining DAU in June 2016, Mr. Stefanek spent 30 years in the U.S. Air Force, primarily flying F-16s operationally at bases around the world and twice as an operational test and evaluation pilot where he tested F-16 hardware and operational flight programs and weapons like the Joint Direct Attack Munition.



Colby Stevens graduated Texas A&M University in 2003 with a Bachelor's degree in Computer Science with a minor in Mathematics. He worked at Raytheon for 7 years as a software developer and team lead on real-time data acquisition systems. He joined KBR in 2011 as a Flight Test Engineer for a US Navy airborne radar focusing on flight test design, execution, and analysis. He was Project Manager for the KBR Test Facility (KTF) at Lubbock, TX during its inception and was instrumental in bootstrapping it into a high availability, flexible and cost-effective test center. Since 2018 he has been KBR's Program Manager for the Advanced Sensors program leading a multi-discipline team of systems engineers, aircrew, test engineers, and security professionals in Dallas, TX.



Rear Adm. Stephen Tedford, a native of Huntington, New York, was commissioned an Ensign through Naval Reserve Officers Training Corps, and was designated a Naval Aviator in 1993. He received a Bachelor of Science in Aerospace Engineering from the Pennsylvania State University and graduated from the United States Naval Test Pilot School (USNTPS) Cooperative Program at the Naval Postgraduate School in Monterey, California. Upon graduation from USNTPS, Tedford earned a Master's of Science degree in Aeronautical Engineering. During his operational tours, Tedford served as commanding officer of Air Test and Evaluation Squadron 30 (VX-30) in Point Mugu, California, where more than 13,000 flight hours in the P-3C Orion, C-130 Hercules and S-3B Viking aircraft were executed during his tenure. Other tours included Patrol Squadron 9, located at Barbers Point, Hawaii, and Patrol Squadron 47 in Kaneohe Bay, Hawaii, during which time he deployed to Diego Garcia; Misawa, Japan; and Bahrain.



Bradley O. Thomason, entered Government service as an intelligence analyst assigned to the US Army Intelligence Agency. In that role, he performed technical assessments of adversary systems and supported development and fielding of highly classified assets used in joint testing and analysis. He performed related roles during assignments with the US Army Intelligence and Security Command, and the Missile and Space Intelligence Command. After reorganization of the intelligence community in 1992, he was reassigned to Project Manager Instrumentation, Targets and Threat Simulators, and SOF Training Systems (PM ITTS). PM ITTS is the Army's threat systems acquisition supporting testing and evaluation. Mr. Thomason's background is unusual within the personnel management system. He is certified in both the intelligence and the acquisition career fields.



Gus Tome has over 19 years of IT engineering and critical system design experience - including 15 years as a leader in Cybersecurity. He has earned numerous technical certifications and patents. As Jacobs' Cyber Solutions Business Unit Leader and acting CTO, Mr. Tome currently manages over 400 employees. His drive for cyber innovation and strategy has grown the company's Cybersecurity revenue from \$0 to \$60M over the past 7 years. Mr. Tome was instrumental in winning key accounts for Blue Canopy and then building their respective Cybersecurity capabilities - this includes the Federal Deposit Insurance Corporation (FDIC), Health and Human Services Centers for Medicare & Medicaid Services (HHS CMS), and the Department of Education Office of Federal Student Aid (DoED FSA).



Ed Tucker is the Senior Technical Director of the Arnold Engineering Development Complex, headquartered at Arnold Air Force Base, TN. He serves as the principal technical advisor to the commander and is responsible for providing technical direction for the planning, execution, analysis and reporting of AEDC's test programs, test capabilities, and infrastructure. The Complex employs more than 3,000 people and comprises more than 68 aerospace test facilities valued at over \$12B across at 10 sites in eight states. Mr. Tucker has over 30 years of experience within the DoD, NASA and industry in the research, development, test and evaluation, and acquisition of many different aircraft, missiles, jet engines, rocket systems, and test facilities.



Malcolm G. Tutty PhD, CPEng, CTEP, FIE(Aust), FRAeS, has served in the Royal Australian Air Force, Public Service and Industry in a multitude of national and international test, operations, technical, research and development, engineering, staff, project management and command roles for over 30 years. He has also been included in the Who's Who of the World for Engineering and Science since 2003 and is the Managing Director of JAIME Enterprises Australia Pty Ltd. He has enjoyed lecturing at several national and overseas universities and conferences while supervising/assisting Masters and PhD level students for many years. He has authored /co-authored over 50 peer reviewed papers/journal articles and several hundred engineering, design and experimentation/test reports. Currently he is a research fellow with the Air Power Development Centre lecturing and assisting with the Beyond Planned Air Force initiative with Defence S&T Group.



Robert Vargo is Director of the Atlantic Test Ranges (ATR) – the Navy’s preeminent East Coast flight test range – and oversees more than 400 personnel who design, develop, integrate, and operate instrumentation, communications, and digital data gathering/handling equipment for DoD flight testing. Mr. Vargo began his career in 1985 as an Electronics Engineer at the Naval Air Test Center, Chesapeake Test Range, Patuxent River, Md. From 1992 through 1996, Mr. Vargo served the Tactical Training Range Program Office (PMA-248) and Joint Tactical Combat Training System as Team Lead for Performance and Lead Systems Engineer. During this time, he was awarded the Navy’s Meritorious Civilian Service Award. During 1997, he served as Deputy Program Manager for the Navy’s MRTFB program, which included T&E facilities/ranges at NAWCAD Patuxent River, Naval Air Warfare Center Weapons Division (NAWCWD) Point Mugu and China Lake, Calif., and Atlantic Underwater Test and Evaluation Center, Andros Island, Bahamas.



James Wells is the Deputy Director for Cyberspace and Homeland Security Enterprise programs in the Department of Homeland Security Office of Test and Evaluation. In addition to managing the T&E oversight of a wide range of major acquisition programs across DHS, he led the development and coordination of the Department’s first policies on cyber resilience operational T&E and threat assessment in support of T&E. Prior to joining DHS, Mr. Wells served as the Deputy Director for Cyber & Information Systems under the Deputy Assistant Secretary of Defense for Developmental Test & Evaluation where he managed a team responsible for overseeing the developmental T&E of major acquisition programs across all four DoD Services and many of the Defense Agencies. Mr. Wells became a T&E professional over the course of eight years and a variety of positions in the Army Test and Evaluation Command following ten years of active duty service in the US Army.



Guy W Williams has thirty years’ experience at the Air Force Test Center (Edwards AFB CA) in aircraft flight test, Test and Evaluation (T&E) infrastructure development to include real-time Mission Control Rooms (MCRs), Modeling and Simulation capabilities supporting Electronic Warfare (EW) testing, flight simulators, telemetry systems, TSPI, and data acquisition and processing. Mr. Williams served as; Program Manager (PM) for the Real Time/Post Flight Processing (RT/PFP) program and the Air Warfare Mission Simulator (AWMS) program; Director of Projects for Acquisition, Chief of Acquisition Program Management for the 412TW Engineering Directorate; and is currently the Air Force Test Center Spectrum Encroachment/Spectrum Relocation Fund (SRF) PM, where he has responsibility for the successful transition of Aeronautical Mobile Telemetry (AMT) out of 1755-1780MHz for AF Gulf and South West Ranges. He also currently chairs the International Consortium for Telemetry Spectrum (ICTS), which informs the international telemetering community of vital issues and alerts its members as needed to preserve this critical scientific capability.



Geoff Wilson is the Deputy Program Manager of the Test and Evaluation / Science and Technology Program (T&E/S&T) for the Test Resource Management Center (TRMC) and assumed his duties in December 2016. He is responsible for development, execution and transition of science and technology projects enhancing the Department of Defense’s test infrastructure. Other responsibilities include serving as the lead for TRMC Hypersonics initiatives. Mr. Wilson began his career in private industry with the Lockheed Martin Space Systems Business Unit. As an engineer there, he was tasked with the design of components that would comprise the primary structure for the Service Module on the Orion manned spacecraft program before assuming a role in satellite operations responsible for the mission planning of on orbit satellite systems.



Heather L. Witts is the Directed Energy Engineer for the Combined Space Component Command, Vandenberg Air Force Base, CA. Ms. Witts provides professional engineering support in the execution of the DOD Laser Clearinghouse; performing mission planning for worldwide lasers and protecting all on-orbit payloads from DOD, government, and civil laser operations. She also serves as an engineering consultant for laser and satellite programs throughout their program life cycle, from design aspects to operational employment. Additionally, Ms. Witts participates with decision-makers in policy development and implementation while architecting unique deconfliction systems and processes. Ms. Witts entered the Navy under the Nuclear Propulsion Officer Candidate Program in February 2001. She has a bachelor’s degree in Math and Physics from Luther College and master’s degree in Engineering Management from Old Dominion University.



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JOIN US IN ORLANDO, FL

SAVE THE DATE

Sept. 14-18, 2020

37TH ANNUAL INTERNATIONAL
Test and Evaluation
SYMPOSIUM

Test and Evaluation – Enabling
Acquisition and Capability Delivery

Hosted by the ITEA Central Florida Chapter

Registration Opens
in December 2019

Wyndham Orlando Resort
International Drive
Orlando, FL

The poster features a globe with the ITEA logo, a night view of a city with palm trees, and three small images: a group of people, a person working at a computer, and a group of dolphins.

Call for Tutorials, Presentations, and Panel Topics for the 2020 ITEA Symposium in Orlando

- Delivering Capability to Warfighters at the Speed of Need: Accelerating Delivery of Full Capability
- Threat System Test and Evaluation (T&E) Using Live, Virtual, and Constructive (LVC) Representations
- Synchronizing Developmental, Operational, and Live-Fire Test with Acquisition
- Early Experimentation and LVC Prototyping for Early Warfighter Engagement
- Evolutionary Delivery of Hardware, Software, and Systems for Development and Test
- Agile Methods for Software Delivery to Programs and for Ease of Testing as Delivered
- Growing the T&E Workforce via Innovative Incentives and Outreach to Key Academic Majors
- Artificial Intelligence for Facilitating T&E, Security Evaluation, and Accelerated Acquisition
- Early System Prototyping for Warfighter Evaluation and Feedback for Accelerated Improvements
- Improving Cyber Security Tools, Accelerating Cybersecurity, and Growing the Cyber Security Workforce
- Weapon Systems Cyber Hardening for New and Legacy Weapons Systems and Supporting Infrastructure
- DevSecOps and Agile Methods for Accelerated Delivery of Capable Software with Built-in Cybersecurity
- Development and Testing of Autonomous Systems to Reduce Risk and Increase Availability
- Accelerate and Improve T&E via International Government, Industry, and Academia Collaboration
- Model-Based Engineering and T&E to Manage Complexity and Deliver Advanced Systems Faster
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CYBER SECURITY WORKSHOP

Solutions to Cybersecurity T&E Challenges

Hosted by the ITEA Emerald Coast Chapter

March 30 - April 3, 2020
Fort Walton Beach, FL

OVERVIEW

Cyberspace is one of the most critical domains in maintaining our nation's superiority. However, the 2018 General Accounting Office (GAO) report on "Weapon Systems Cybersecurity" states, by using basic tools and techniques, testers were able to take control of major weapon systems under development with ease and operate largely undetected. Challenges of weapon systems cybersecurity include complex and intense software in systems, common tactical networks, lack of test infrastructure and tools, lack of test assets and cyber T&E workforce, data rights issues and many more. This workshop will focus on solutions and approaches to overcome these challenges with special emphasis on the Weapon Systems. Our goal is to share practical knowledge and information to rapidly enhance the Weapon Systems Cybersecurity posture.

At this workshop, we will have exhibits and dedicate a technical track for hands-on tool demonstrations and interactive sessions. We encourage the government, industry and academia to showcase their capabilities.

Please join us in Okaloosa Island, Florida, as members of the T&E community from academia, industry, and government discuss the evolving discipline of Cybersecurity T&E. Come share your thoughts, connect with others, and learn from some of the leading experts at this Workshop.

TOPICS FOR CONSIDERATION

- Cyber T&E methodologies
- Cyber and Artificial Intelligence
- Quantum Computing
- Software Testing and Assurance
- Supply Chain
- Microelectronics Security
- Avionics Cyber Tools
- Cyber T&E Ranges
- Big Data and Cloud Cyber Testing
- Tactical Edge Network Cyber T&E
- Cyber and EW Convergence
- Workforce Development
- LRU Virtualization
- ICS/SCADA
- Cybersecurity and Acquisition
- Cyber Testing in LVC
- Cloud Environments or Cybersecurity Operations in the Cloud

PROGRAM COMMITTEE

Workshop Chair
Ms. Min Kim, 96th Cyberspace Test Group

Technical Program Chair
Mr. Bob Baggerman, ATAC

Tutorial Chair
Mr. Gene Hudgins, KBRWyle

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Join Us in Florida – Mark Your Calendars TODAY!

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