



23RD TEST
INSTRUMENTATION
WORKSHOP

Shaping the Future of T&E

May 14-16, 2019

Tuscany Suites & Conference Center | Las Vegas, NV

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and Antelope Valley Chapter

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While at TIW, if the need arises for a private meeting room with colleagues or customers, visit the Registration Desk to reserve space in the Pisa room. The room is located in the conference space and has seating for up to twenty people.

Event Guide

Registration Hours

Tue. 5/14 6:30am–5:30pm
 Wed. 5/15 7:00am–5:00pm
 Thur. 5/16 7:00am–5:00pm

Tutorials

Tue. 5/14 8:00am–5:00pm
(see pgs. 6–9 for complete tutorial info)

Exhibition Hours

Tue. 5/14 4:00pm–6:30pm
 Wed. 5/15 9:00am–7:00pm
 Thur. 5/16 9:00am–4:00pm

Technical Sessions

Wed. 5/15 10:30am–12:30pm / 1:30pm–3:30pm
 Thur. 5/16 10:30am–12:30pm / 1:30pm–3:30pm

Special Events

Happy Hour	Tue. 5/14 5:00pm–6:30pm
Opening Ceremony & Keynote Speaker	Wed. 5/15 9:00am–10:00am
Luncheon Speaker	Wed. 5/15 12:30pm–1:30pm
Plenary Panel	Wed. 5/15 4:00pm–5:30pm
Exhibit Hall Reception	Wed. 5/15 5:00pm–7:00pm
STEAMhack™ Challenge	Thur. 5/16 8:30am–11:30am
Keynote Speaker	Thur. 5/16 9:00am–10:00am
Lunch & STEAM Awards	Thur. 5/16 12:30pm–1:30pm
Plenary Panel	Thur. 5/16 4:00pm–5:30pm
CTEP Exam	Fri. 5/17 1:00pm–5:00pm

Networking Breaks in the Exhibit Hall

Wednesday 5/15 & Thursday 5/16
 10:00am–10:30am | 3:30pm–4:00pm

CONFERENCE LOGISTICS

All TIW events will take place on the 2nd floor of the Tuscany Suites & Conference Center. Please see page 18 for a map of the property and meeting room locations.

Wireless Access — The hotel offers free wireless access in the rooms and in the conference area. Upgraded WiFi is available for \$9.99 per day.

Parking — Parking is free! Valet is available.

Badging — Badges are required for admittance to tutorials, exhibit hall, and technical sessions and must be obtained at the TIW Registration Desk upon check in.

Authors & Speakers — All Technical Session speakers must check in at the Speaker Ready room, Florentine B, at least 24 hours prior to their scheduled presentation time.

Day Planner Agenda

> TUESDAY, MAY 14

8:00am–5:00pm Tutorials
 4:00pm–6:30pm Exhibits Open

Join us for Happy Hour in the Exhibit Hall at 5:00pm

> WEDNESDAY, MAY 15

9:00am–10:00am Opening & Keynote Speaker

Test and Evaluation for the Modern Battle Space

Brigadier General Christopher P. Azzano – Commander, Air Force Test Center, Edwards AFB

9:00am–7:00pm Exhibits Open
 10:30am–12:30pm Technical Sessions
 12:30pm–1:30pm Luncheon Speaker

U.S. Air Force Warfare Center's Vice Commander Shares Insights on T&E Engagement

Brigadier General David W. Snoddy – Vice Commander, Air Force Warfare Center, Nellis AFB

1:30pm–3:30pm Technical Sessions
 4:00pm–5:30pm Plenary Panel

Technologies Enabling AMT Operations in Non-Traditional Bands

Moderated by Thomas O'Brien – Test Resource Management Center (TRMC)

5:00pm–7:00pm Exhibit Hall Reception

> THURSDAY, MAY 16

8:30am–11:30am STEAMhack™ Challenge
 9:00am–10:00am Keynote Speaker

An Innovation Movement

Brigadier General E. John Teichert – Commander, 412th Test Wing, Edwards AFB

9:00am–4:00pm Exhibits Open
 10:30am–12:30pm Technical Sessions
 12:30pm–1:30pm Lunch & STEAM Awards
 1:30pm–3:30pm Technical Sessions
 4:00pm–5:30pm Plenary Panel

Shaping the Future — Ensuring Relevance to the Future Fight Through Innovation, Governance, and Culture Change

Moderated by Chris Klug – 412th Operations Group Technical Advisor

Business Center — The business center is located upstairs in the conference area. Attendees can access emails from the computers provided as well as print. This service is complimentary. Faxes can be done at the front desk. To access the business center use your room key.

Shipping — Any incoming packages for guests will be available at the Bell Desk.

Welcome to the 23rd Test & Instrumentation Workshop

Hosted by the ITEA Southern Nevada and Antelope Valley Chapter

Good morning and Welcome! My name is Chris Klug, and I have the privilege of chairing this year's Test Instrumentation Workshop. We appreciate everyone's — the presenters, keynote speakers, vendors, and attendees — dedication, passion, and interest in helping make this an insightful and transformative event.

Our theme this year is **“Shaping the Future of T&E.”** Our intent is to present ideas, spark new conversations, and connect people from across the T&E enterprise with the goal of solving the problems that will shape how we test and evaluate systems in the next 20 years. Typically we start workshop planning with a “Call for Papers”, this year we started with a “Call for Problems”. This is **your** Workshop, intended to answer **your** problems. We are all here to address the issues, topics, problems, and opportunities you will face today and in the future. That is what makes this a “Workshop” and a workshop that I believe will be talked about well into the future.



Chris Klug

Program Chair
412th Operations Group
Technical Advisor



Tim Chalfant

Technical Chair
Colsa Corporation



We've arranged 7 “interest tracks” of sessions that will talk Aircraft Instrumentation, Range Instrumentation, RF Telemetry, Cyber, Mission Control, Data Analytics, and Test Support areas. No question is too bold, no topic too uncomfortable — if it will shape our future — we can address it here. This Workshop will be as good as **you** make it! You must participate —take off your tie, roll up your shirt sleeves and let's get to work. Ask questions, engage in spirited discussions, meet new people, learn new ways of thinking about old problems, get comfortable being uncomfortable — this is a “workshop”!

Our success will be defined by the degree to which T&E Professionals are ready to test the future. Again, welcome and thank you for your active involvement. We hope you find these next few days informative and inspirational.

~ Chris Klug

ITEA Would Like to Thank Our Generous Sponsors!

Sponsorships are instrumental in helping to defray conference costs, as well as support the ITEA scholarship fund, which assists deserving students in their pursuit of academic disciplines related to the Test and Evaluation profession.

TUESDAY NIGHT HAPPY HOUR



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SYMPOSIUM OVERVIEW

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?

Join us and help us explore these ideas and others related to "T&E Challenges for Global Threats" as part of our 36th Annual International Symposium.

For information on exhibiting or sponsorships contact James Gaidry, 703-631-6220 or jgaidry@itea.org

REGISTER ONLINE AT: www.itea.org

➤ **Tuesday, May 14th**

Pre-Workshop Tutorials 8:00am–5:00pm
 ➤ See page 6 for room locations

Each of the 4-hour Pre-Workshop 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). See page 6 for tutorial descriptions and locations.

Happy Hour 5:00pm–6:30pm
 ➤ Exhibit Hall

Please join us for the soft opening of the exhibit hall at 4:00pm. Come get an early glimpse of the exhibits and network with your peers! The exhibit hall happy hour provides a great opportunity to network with colleagues and enjoy all that the exhibit hall has to offer! Grab a drink and some food and get your night started right! Sponsored by EWA Government Systems, Inc.

➤ **Wednesday, May 15th**

Opening Ceremony & Keynote Speaker 9:00am–10:00am
 ➤ Florentine A

Test and Evaluation for the Modern Battle Space

We are honored to have Brigadier General Christopher P. Azzano, Commander of the Air Force Test Center at Edwards Air Force Base as our Opening Keynote Speaker this year. A light continental breakfast will be served at 8:30am and the program will begin at 9:00am.

Luncheon Speaker 12:30pm–1:30pm
 U.S. Air Force Warfare ➤ Exhibit Hall

Center's Vice Commander Shares Insights on T&E Engagement

We welcome Brigadier General David Snoddy as this year's luncheon speaker. General Snoddy has been in his current assignment since May 2018. Come and listen as he shares his views on T&E Engagement, Cyber T&E, and other insights related to his role and responsibilities as Vice Commander of the USAFWC. Lunch will be served at 12:30pm and General Snoddy will begin promptly at 1:00pm.

Plenary Panel 4:00pm–5:30pm
 Technologies Enabling AMT ➤ Florentine A

Operations in Non-Traditional Bands

Thomas O'Brien with the Test Resource Management Center will moderate this panel of experts. Panelists include Kevin Cook, Georgia Tech Research Institute; Tony Triolo, Perspecta Labs; Mark Wigent, Lulima Systems LLC.

Wednesday Continued

Networking Reception 5:00pm–7:30pm
 ➤ Florentine A

Another opportunity to meet and network with your fellow peers and colleagues from across the industry. What a great way to connect with attendees, exhibitors, and speakers while you enjoy a fantastic night of food and fun!

➤ **Thursday, May 16th**

Academia Day 8:30am–11:30am
STEAMhack™ Chain Reaction Challenge ➤ Florentine F/G

Middle Schools and High Schools compete to see who can build the most impressive chain reaction-style machine based on their team's pre-contest design. Machines and teams will be judged based on functionality, creativity, spirit of whimsy & fun, and teamwork. This year teams need to "Feed a Pet." Attendees are welcome to come cheer on the students as they build their machines. Judging will begin at 11:30am. If you would like to be a judge, please see the ITEA registration desk. Awards will be presented during lunch.

Keynote Speaker 9:00am–10:00am
An Innovation Movement ➤ Florentine A

Innovation grasps for agility and takes nothing for granted. Our nation relies upon us to innovate because the future will look nothing like the past. The warfighter and our nation's future depends upon us to develop a culture of innovation today. Come listen as Brigadier General E. John Teichert, Commander of the 412th Test Wing at Edwards Air Force Base, addresses this important topic.

Lunch 12:30pm–1:30pm
STEAM Awards Presentation ➤ Exhibit Hall

Come enjoy a buffet lunch as awards are presented to the winners of the STEAMhack™ Chain Reaction Challenge.

Plenary Panel 4:00pm–5:30pm
Shaping the Future — Ensuring ➤ Florentine A

Relevance to the Future Fight Through Innovation, Governance, and Culture Change

Chris Klug, Technical Advisor for the 412th Operations Group will moderate this panel of experts that are actively engaged in shaping the future of Flight Test. Come listen as they discuss their challenges, successes, and opportunities in implementing Innovation, Governance, and Culture Change in support of the National Defense Strategy.

➤ TUESDAY, MAY 14TH | 8:00AM–12:00PM

Course**Accelerating the Analysis of Test Data Using Effective and Efficient Experimentation**

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

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

Mark Kiemele, PhD, Air Academy Associates

Basics of Aircraft Instrumentation Systems (Part 1 of 2)

This course will cover a wide variety of topics related to Aircraft Instrumentation. Data, Telemetry, Instrumentation System Block Diagram, Standards, Data Requirements, Transducers / Specifications, Video, 1553 Bus, Using Requirements to Configure an Analog Data Channel, Creating a PCM Map to Obtain a Sample Rate, Telemetry Bandwidth, Record Time, GPS, Audio, Telemetry Attributes Transfer Standard (TMATS), and Measurement Uncertainty - Interpreting the Results. This is great introduction for new hires or a refresher for current employees.

Bruce Johnson, NAVAIR

Introduction to Agile Test & Evaluation

Agile software engineering process models, such as Scrum, Kanban, or XP, have been popular for several years. Originally, Agile testing practice was focused on individual software projects and how automated test could be accomplished for small teams. As Agile has become a more accepted process model, organizations look to scale it for larger, more complex systems that are not all software-based, as well as identify how to perform test and evaluation in an Agile context using DevOps technologies. This tutorial introduces several Agile and DevOps process concepts, with a focus on Test and Evaluation. Topics for this lecture-based tutorial include:

- Review of the Agile process at the individual project level and scaled process models for larger systems
- Examples of agile testing practices

Location

Florentine F

Florentine G

Tuscany

One 4-Hour Tutorial: \$205 | Two 4-Hour Tutorials: \$385

Course

- Introduction to DevOps, particularly how test and evaluation fits into that paradigm
- Explore a case study of how agile test and evaluation was implemented on a large system of systems effort

Jennifer Rekas, The MITRE Corporation

IRIG 106-17 Chapter 7 Packet Telemetry Downlink Basis & Implementation Fundamentals

This course will focus on presenting information to establish a basic understanding of the 2017 release of the IRIG 106, Chapter 7, Packet Telemetry Downlink Standard. It will also focus on the implementation of airborne and ground system hardware and methods to handle IRIG 106, Chapter 7, Packet Telemetry data. It will address the implementation of special features necessary to support legacy RF Transmission, data recording, RF Receiving, Ground Reproduction, and Chapter 10 data processing methods.

Johnny Pappas, Zodiac Data Systems, Inc.

Troubleshooting Ethernet Data with Wireshark

This tutorial will use real-world aircraft data to demonstrate how to use the open source program Wireshark to both view data and troubleshoot problems. The class will include presentation and hands-on usage of Wireshark to look at data as if you were connected to the Ethernet network on an airplane and if you were connected to an IRIG 106 Chapter 10 recorder broadcasting data over UDP. We'll start out with a brief overview of Ethernet fundamentals and then get right on to using Wireshark.

Paul Ferrill, Avionics Test and Analysis Corporation

Video & Video Compression

With the growing complexity of flight test programs and the improved efficiency of compression algorithms, video is an ever increasing component of flight test data collection. This tutorial will provide a basic understanding of video interfaces. This will include a discussion of the signals, formats, resolutions and frame rates. Building on those basics the tutorial will then present a high level description of how video compression works and the trade-offs that can be made when selecting and implementing video compression components. An overview of various video compression algorithms will be provided, highlighting the differences between the algorithms. We will examine the effects of video compression on video quality and investigate some of the causes and resolutions of quality problems. Finally, there will be a brief overview of audio compression.

Gary Thom, Delta Information Systems

➤ TUESDAY, MAY 14TH | 1:00PM–5:00PM

Basics of Aircraft Instrumentation Systems (Part 2 of 2)

This course will cover a wide variety of topics related to Aircraft Instrumentation. Data, Telemetry, Instrumentation System Block Diagram, Standards, Data Requirements, Transducers / Specifications, Video, 1553 Bus, Using Requirements to Configure an Analog Data Channel, Creating a PCM Map to Obtain a Sample Rate, Telemetry Bandwidth, Record Time, GPS, Audio, Telemetry Attributes Transfer

Location

Siena

Florentine E

Firenze

Florentine G

>> Tutorials continued on page 8

(continued from pg. 7)

Course

Standard (TMATS), and Measurement Uncertainty — Interpreting the Results. This is great introduction for new hires or a refresher for current employees.

Bruce Johnson, NAVAIR

Location**iNET Telemetry Networks****Florentine E**

Chapters 21 through 28 of the Range Commanders' Council (RCC) IRIG-106 standards were developed to support a wide variety of components and system compositions. This tutorial provides a quick overview of these IRIG standards along with providing insight into the new capabilities that systems using these standards can utilize. The presentation includes current performance measured through the developmentally flight-tests. It is intended for anyone who wants an introduction or update on the current status of the TmNS technologies and system capabilities.

Thomas Grace, NAVAIR, PAX River & Ben Abbott, SwRI

Long Term Evolution Advanced (LTE-A) 4G Cellular Technology: Network Architecture, Physical Layer Structure and Procedures, and Signaling Aspects **Tuscany**

LTE has now reached the 11th year since its introduction. In its latest releases, LTE-A represents a mature 4G technology that encompasses a sophisticated suite of wireless communications techniques and includes all the lessons learned in the earlier generations of cellular technology. As the LTE global ecosystem of device and infrastructure vendors grows, the economies of scale accelerate the opportunities for its technology adoption. Testing Range Telemetry can be a direct beneficiary. In view of this opportunity, the course covers the following key areas: LTE Radio Access and Core Network Architecture; 3GPP Specifications Structure; Transport Channels; Physical Layer Structure and Procedures for Downlink and Uplink Communications (modulation, coding, Hybrid-ARQ, multi-antenna techniques, pre-coding, channel state information, channel structures, TDD/FDD configurations, scheduling); Carrier Aggregation; Signaling Mechanisms (radio resource control in idle and connected states, random access, initial access, registration, mobility management and handover, radio link control and mapping to IP flows); RF Planning and Network Structure for Terrestrial Networks; Performance Assessment at Link and System Level; Evolution Path.

Achilles Kogiantis, PhD, & Kiran Rege, PhD, Perspecta Labs

Real World Telemetry over IP **Firenze**

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

Gary Thom, Delta Information Systems

Course

The TENA and JMETC Solution for Distributed Test & Training

Location**Florentine F**

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 will address the current impact of TENA and JMETC on the Test and Training community; as well as its expected future benefits to the range community and the Warfighter.

Gene Hudgins, TENA

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OPENING CEREMONY & KEYNOTE SPEAKER

➤ WEDNESDAY, MAY 15TH

9:00AM – 10:00AM | FLORENTINE A

Test and Evaluation for the Modern Battle Space

The nature of warfare is changing, creating new challenges and opportunities which must be tested, vetted, and proven by the Test and Evaluation (T&E) community. The process and methods used to conduct T&E in the past must be updated to overcome future challenges and demands of multi-domain operations. T&E methods and the acquisition process need to evolve to support emerging technologies like hypersonics, autonomous systems, agile software development, and space-related capabilities. The T&E community must look “lead-time” into the future to be ready to test new systems and provide our warfighter with the best capabilities to meet the National Defense Strategy in an ever-changing global security environment.



Keynote Speaker:

Brigadier General Christopher P. Azzano

Commander, Air Force Test Center (AFTC),
Edwards Air Force Base

Brigadier General Christopher P. Azzano is the Commander, Air Force Test Center, headquartered at Edwards Air Force Base, California. He directs a \$31 billion enterprise of more than 18,000 military, civilian and contractor personnel across Edwards AFB, Eglin AFB and Arnold AFB. The AFTC provides developmental test and evaluation of experimental and research, manned and unmanned air, space and cyber systems for the military services, DARPA, NASA and international partners, in addition to operating the U.S. Air Force Test Pilot School.

General Azzano has flown more than 2,900 hours in 35 aircraft types as an instructor pilot, evaluator pilot, and experimental test pilot. He has conducted developmental tests on a wide range of aircraft and weapons, and has commanded at the squadron, group, and twice at the wing level.

General Azzano is a graduate of the Air Force Intern Program, the Air Force Legislative Fellowship, and the Air War College. He holds Master's degrees in Aerospace Engineering and Strategic Studies. He was previously assigned as the Director, Air, Space and Cyberspace Operations, Headquarters Air Force Materiel Command, Wright-Patterson Air Force Base, Ohio. In this position, he was responsible for shaping the workforce and infrastructure to test, field and sustain agile war-winning capabilities. He also developed the command's test, readiness, and information technology policy, while providing oversight of cyber resilience requirements, cross-domain system integration, and resource allocation for flight management, airfield and weather services, and command and control operations.

LUNCHEON SPEAKER

➤ WEDNESDAY, MAY 15TH

12:30PM – 1:30PM | EXHIBIT HALL

U.S. Air Force Warfare Center's Vice Commander Shares Insights on T&E Engagement

Come and listen as Brigadier General David W. Snoddy shares his views on T&E Engagement, Cyber T&E, and other insights related to his role and responsibilities as Vice Commander of the USAFWC. Lunch will be served at 12:30pm and he will begin promptly at 1:00pm.

Guest Speaker:

Brigadier General David W. Snoddy

Vice Commander, Air Force Warfare Center,
Nellis Air Force Base

Brigadier General David W. Snoddy is the Vice Commander of the U.S. Air Force Warfare Center (USAFWC) at Nellis Air Force Base, NV. The USAFWC's mission is developing innovative leaders and full spectrum capabilities through responsive, realistic, and relevant Air Force and joint testing, tactics development, and advanced training across all levels of war. The center ensures deployed forces are well-trained and well-equipped to conduct integrated combat operations. From operational testing and tactics development programs to the advanced training schools, exercises and venues, the center provides Airmen with proven and tested technology, the most current tactics, superb academic training and a unique opportunity to practice integrated force employment. The center functions as a team of innovative, highly-skilled Airmen providing effective weapons, tactics, and command and control integrated across air, space and cyberspace for the Joint Force Commander. The USAFWC is organized under Air Combat Command into four wings, two named activities, and one detachment with more than 11,000 Airmen serving in the 57th Wing, 53rd Wing, 99th Air Base Wing, 505th Command and Control Wing, the Nevada Test and Training Range, and the Air Force Joint Test Program Office.

General Snoddy graduated from Kent State University, Kent, Ohio, in 1992 with a Bachelor of Arts in technology and a minor in psychology. Upon graduation, he received his commission through the Air Force Reserve Officer Training Corps. He has commanded at the squadron and wing levels, and has served on staffs at headquarters Air Force, joint sub-unified command and Office of the Secretary of Defense levels. General Snoddy's professional experience includes cyberspace operations, policy development, executive services, architecture planning, network operations, and mission systems maintenance. His tactical experience includes service with Joint Task Force-Southwest Asia's Joint Intelligence Center during Operation Southern Watch and as the J6 for a Joint Special Operations Task Force during Operations Iraqi Freedom and Enduring Freedom. General Snoddy has commanded the 71st Communications Squadron and the 67th Cyberspace Wing.



PANEL DISCUSSION

➤ **WEDNESDAY, MAY 15TH**

4:00PM – 5:30PM | FLORENTINE A

Technologies Enabling AMT Operations in Non-Traditional Bands

As the spectrum sell-off continues and our need to support ever-increasing information-generating Systems Under Test (SUTs), it is incumbent on us to seek solutions that embrace concepts such as C-Band or millimeter wave. The focus of this panel is to highlight technologies that enable telemetry operation in non-traditional portions of the spectrum. Come listen as Thomas O'Brien with the Test Resource Management Center moderates this panel of experts.



Moderator:

Thomas O'Brien –

CTEIP Deputy Program Manager,
Test Resource Management Center (TRMC)

Panelists:



Kevin Cook – Senior Research Engineer, Advanced Concepts Laboratory at the Georgia Tech Research Institute

Kevin Cook is a Senior Research Engineer with the Advanced Concepts Laboratory at the Georgia Tech Research Institute. His work includes: the design of novel antennas through the use of Finite Difference Time Domain modeling codes, the design of RF feed networks to be integrated with these antennas, and the fabrication and testing of the resulting antenna systems. Mr. Cook has a broad range of antenna-related experience that has resulted in a good understanding of every aspect of the antenna prototyping process.

He is head of the Electronics Branch within ACL's Electromagnetics Division. Mr. Cook's branch designs the supporting electronics for most of the antenna prototypes that come out of the division. Additionally, the Agile Antenna Aperture (A3) technology is maintained and developed by the Electronics Branch.



Anthony Triolo, PhD – Chief Scientist and Senior Manager, Perspecta Labs

Dr. Triolo serves as Chief Scientist and Senior Manager at Perspecta Labs and is a member of the Executive Committee of the National Spectrum Consortium (NSC). As Chief Scientist, Dr. Triolo is responsible for programs related to spectrum sharing and other efficient uses of the wireless spectrum. As a member of the executive committee of the NSC, he works with other committee members to help advance the goals of the NSC to incubate new technologies to revolutionize the way in which spectrum is utilized. He is currently Principal Investigator for the NSC Cellular Range Telemetry effort and is Chief Architect of another NSC effort to develop real-time distributed spectrum monitoring systems. He led development of the Telcordia White Space Database System, which was one of the first regulator-approved spectrum sharing systems. Dr. Triolo has also led many other efforts in areas related to propagation measurement and modeling, spectrum management systems, and distributed and multi-antenna signal processing.



Mark Wigent – Principal Engineer and Co-Founder, Lulima Systems LLC

Mark Wigent is a systems engineer with over seventeen years of experience developing new technologies that enhance the capabilities, mission effectiveness, and interoperability of DoD test and training facilities. He has significant systems engineering and project management experience, during which he has led multi-disciplinary teams in a variety of projects, including not only research and development of test and evaluation technology and systems, but also in modeling and simulation of complex systems and networks, algorithm design and implementation, and software system integration and testing.

He has served as the principle investigator of numerous projects sponsored by the Test Resource Management Center (TRMC), including projects for the Central Test and Evaluation Investment Program (CTEIP), Test and Evaluation Science and Technology (T&E/S&T) program, and the National Spectrum Consortium (NSC). Mr. Wigent has been a member of ITEA for over ten years and is a regular presenter at ITEA conferences and workshops.

Mr. Wigent is a principal engineer at Lulima Systems which he co-founded. He has a BS in Electrical Engineering and a MS in Systems Engineering, both from the University of Virginia.

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KEYNOTE SPEAKER

➤ THURSDAY, MAY 16TH

9:00AM – 10:00AM | FLORENTINE A

An Innovation Movement

Innovation grasps for agility and takes nothing for granted. Our nation relies upon us to innovate because the future will look nothing like the past. The warfighter and our nation's future depends upon us to develop a culture of innovation today!



Keynote Speaker:

Brigadier General

E. John Teichert

Commander, 412th Test Wing,
Edwards Air Force Base

Brigadier General E. John “Dragon” Teichert is the Commander of the 412th Test Wing at Edwards AFB, CA. He leads a wing of 7,847 personnel in the developmental test and evaluation of the F-35, KC-46, F-22, F-16, B-1, B-2, B-52, C-17, C-130, KC-135, Global Hawk, joint remotely piloted aircraft and emerging technologies. Additionally, General Teichert is the Installation Commander responsible for operating the base and supporting more than 11,000 active duty, reserve, civil service and defense contractors at Edwards AFB, the second largest base in the Air Force.

General Teichert, a native of Port Angeles, Washington, received his commission through the Air Force Reserve Officer Training Corps program at the Massachusetts Institute of Technology in 1994. Throughout his career General Teichert has held a variety of operational, instructional, test and leadership positions. He has directed the F-22 Combined Test Force and commanded the 411th Flight Test Squadron, responsible for F-22 Raptor developmental test and evaluation. He has also commanded the 53rd Test Management Group, providing operational test and evaluation of Air Force fighters, bombers, combat search and rescue systems, remotely piloted aircraft, aircrew training devices, aircrew flight equipment, weapons and space systems. He has served as the Deputy Director of the Department of Defense Special Access Program Central Office, responsible for the governance, acquisition, oversight, protection and external liaison for all DoD programs protected under special access controls. Most recently, General Teichert commanded the 11th Wing and Joint Base Andrews, responsible for the security, personnel, contracting, finance, medical and infrastructure support for five wings, three headquarters, and over 80 tenant organizations, as well as 60,000 Airmen and families in the National Capital Region and around the world.

General Teichert is a command pilot with more than 2,000 hours in 36 different aircraft types. His combat experience includes operations Northern Watch, Deliberate Forge, and Allied Force.

PANEL DISCUSSION

➤ THURSDAY, MAY 16TH

4:00PM – 5:30PM | FLORENTINE A

Shaping the Future — Ensuring Relevance to the Future Fight Through Innovation, Governance, and Culture Change

An Observed Discussion between the people that are actively engaged in shaping the future of Flight Test. Chris Klug will moderate this panel of Flight Test leaders and Subject Matter Experts as they discuss their challenges, successes, and opportunities in implementing Innovation, Governance, and Culture Change in support of the National Defense Strategy.

Moderator:



Chris Klug – 412th Operations Group Technical Advisor

Chris Klug serves as the senior civilian and Technical Advisor to the 412 Operations Group Commander in all manning and organizational matters, strategic planning, and in administering mission related policies. After graduating from the University of Michigan with an Aerospace Engineering degree he began

his career as a flight test engineer with Boeing on the F/A-18E/F Super Hornet in St. Louis, MO, Patuxent River, MD, and China Lake, CA. In 2002 he started at Edwards AFB, CA as an engineer testing the integration of avionics and weapons on the F-16. In 2007 he was selected as the JSF Air-to-Air Store Certification Lead where his areas of responsibility included weapon separation and integration with the F-35 for the United States Air Force, Navy, Marines, and foreign partners. After earning a Master's degree from Georgia Tech in 2010 he was an avionics flight chief, then the Global Vigilance Combined Test Force Chief Engineer testing Remotely Piloted Aircraft such as the RQ-4B Global Hawk.

Panelists:



Colonel Scott Cain – Commander, Arnold Engineering Development Complex

Colonel Scott A. Cain is commander of the Arnold Engineering Development Complex, headquartered at Arnold Air Force Base, TN. The Complex employs more than 3,000 people and comprises more than 55 aerospace test facilities across six states. With facilities at Arnold AFB in middle Tennessee and operating locations at the Federal Research Center at White Oak near Silver Spring, Md.; at Ames Research Center, in Mountain View, CA.; Edwards AFB, CA.; Eglin AFB, FL.; Holloman AFB, Kirtland AFB and White Sands Missile Range, N.M.; and Wright-Patterson AFB, Ohio, AEDC offers a suite of test capabilities to simulate speed, temperature, pressure and other parameters over a wide range to meet the needs of aerospace system developers. The test facilities simulate flight from subsonic to hypersonic speeds at altitudes from sea level to space. All NASA manned spacecraft and every high performance aircraft, missile, most space launch systems and many military satellites in use by the Department of Defense today have been tested at the Complex.

Colonel Cain received his commission from the U.S. Air Force Academy Class of 1995, where he was a distinguished graduate, earning a bachelor's degree in Astronautical Engineering. He attended undergraduate pilot

training in 1995 and was selected to fly the F-16 Fighting Falcon. After completion of F-16 training, he served as an operational F-16 pilot at Kunsan AB, Korea, and Misawa AB, Japan, flying combat missions in support of Operation Southern Watch. He also served as an F-117A Nighthawk pilot at Holloman AFB, where he attended the U.S. Air Force Weapons School F-117 Division. He was then selected to attend U.S. Air Force Test Pilot School at Edwards AFB, and he served a follow-on tour in the 416th Flight Test Squadron as a developmental test pilot. Colonel Cain completed the Air Force Fellows program at the Defense Advanced Research Projects Agency (DARPA), followed by duty as an Operations Officer and as Commander of the 40th Flight Test Squadron. Colonel Cain also served as Senior Military Evaluator for Air Warfare systems within the office of the Deputy Assistant Secretary of Defense for Developmental Test & Evaluation. He comes to Arnold after successful command of the 412th Operations Group, Edwards AFB.



Jason Korman – CEO, *Gapingvoid Culture Design Group*

Jason Korman is the co-founder and CEO of Gapingvoid Culture Design Group, based in Miami Beach, Florida. A serial entrepreneur, most of his business life was spent in the wine business. At age of 24, he created La Crema Winery, from the assets of a bankrupt Sonoma County wine producer, eventually farming nearly 200 acres of vineyard in Northern California.

Later, Jason went on to create Stormhoek, a South African winery, that became an early case study on utilizing social media to create a global brand. For this work, Stormhoek was awarded an AdAge 50, amongst a number of other marketing and winemaking awards.

After teaming up with Hugh MacLeod on Stormhoek marketing, they co-founded Gapingvoid Culture Design Group. The business was very much based upon work done with Stormhoek that demonstrated how it was possible to shift behavior and mindset using unique human centered change techniques. Gapingvoid was the first company to create end-to-end culture design™ based upon its proprietary Culture Science™ method. The company has assembled a cross functional team of creatives, consultants, writers, marketers, and psychologists all focused on developing new ways to execute and scale human centered change.

Jason believes that work must provide, purpose, connection and meaning, and link individuals to being part of something larger. Moreover, a business's success or failure hinges on how well they meet those needs.

Gapingvoid serves a variety of enterprise, mid-market, higher education and government clients including, AT&T, Microsoft, Genentech, Zappos, USC, USAF, MIT, and the US Department of Defense.



Brian E.A. "Beam" Maue, PhD – CEO, *AFWERX*

Brian Maue leads a talented mission team who connects innovators and creates accelerated technological and cultural agility for the 680,000 military and civilian members of the United States Air Force. Their AFWERX fusion of capabilities includes a system of

innovation hubs, a virtual collaboration network for Airmen, and a network of innovation offices across Air Force bases.

A veteran, he served 21 years as an Air Force officer, primarily in strategic deterrence roles—ICBM launch officer, nuclear budget analyst, treaty officer. He also journeyed with the Air Force's future leaders by instructing at the Air Force Academy.

Beam has benefited from many sources of human behavior insight, including structured coursework, a less structured household with an amazing wife and their five children, and personal excursions with Natural Law philosophies and their manifestations within marathons and martial arts.



Brigadier General E. John Teichert – Commander, *412th Test Wing, Edwards Air Force Base*

Brigadier General E. John "Dragon" Teichert is the Commander of the 412th Test Wing at Edwards AFB, CA. He leads a wing of 7,847 personnel in the developmental test and evaluation of the F-35, KC-46, F-22, F-16, B-1, B-2, B-52, C-17, C-130, KC-135, Global Hawk, joint remotely piloted aircraft and emerging technologies. Additionally, General Teichert is the Installation Commander responsible for operating the base and supporting more than 11,000 active duty, reserve, civil service and defense contractors at Edwards AFB, the second largest base in the Air Force.

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Advanced Test Equipment Rentals (ATEC) Booth 10

San Diego, CA

Web: www.atecorp.com

Advanced Test Equipment Rentals (ATEC) is a leading test and measurement equipment rental company that provides short and long-term rental solutions to the aerospace, defense, communications, consumer electronics, and EMC industries, as well as many others. Our extensive inventory, knowledgeable customer support, and next-day shipping make renting test equipment easy.

Air Academy Associates Booth T-5

Colorado Springs, CO

Web: www.airacad.com

For more than 25 years, Air Academy Associates, a SVDO5B, has been a leader in supporting government, business, industry and healthcare in training and implementing performance improvement methods. Areas of specialty include Design of Experiments, Design for Reliability, Test Optimization and other Advanced Test Designs, Big Data analysis, Predictive Analytical and Critical Thinking Methods. Our training aids, books, and powerful user-friendly software packages are integrated and can be available for purchase. Our certified trainers and coaches average more than 20 years of direct application, training, problem solving and mentoring. Helping the T & E community is our passion. Reach out to learn more: airacad.com or call 480-236-3639.

Apogee Labs, Inc. Booth T-1

North Wales, PA

Web: www.apogeelabs.com

Founded in 1993, Apogee Labs, Inc. is a leading supplier of data acquisition, data transport/distribution, testing, and specialty engineering solutions to the telemetry and communications communities. Our products include airborne and ground-based multiplexers, portable and rack mounted testers (BERTs), serial PCM input and output nodes (TMoIP), video encoders/decoders, digital switches, ruggedized tactical encoders, configurable multifunction displays, interface conversion equipment, and many other innovative products and system solutions.

Avionics Interface Technologies (AIT) Booth T-3

Omaha, NE

Web: www.aviftech.com

Avionics Interface Technologies (AIT) is a leading designer and manufacturer of high-performance flight modules, test and simulation modules, embedded solutions, databus analyzers, and support systems for both the commercial aerospace and defense industries. Our field-proven modules support MIL-STD-1553A/B, MIL-STD-1760E, ARINC 429, ARINC 615A, Combination MIL-STD-1553/ARINC 429, ARINC 664, and Fibre Channel.

CALCULEX Booth 22

Las Cruces, NM

Web: www.calculex.com

For 30 years, **CALCULEX** has been designing and delivering specialized mission-critical system solutions. **CALCULEX** has maintained a leadership role providing systems involving high-speed data and video acquisition and recording, data stream multiplexing, real-time data processing, and complex data routing. As co-author of the IRIG 106 Chapter 10 Standard, **CALCULEX** ensures interoperable systems for both avionic and telemetry applications. **CALCULEX**, an AS9100D-certified manufacturer, is always **mission ready!**

Compunetix Booth 19

Monroeville, PA

Web: www.compunetix.com

Compunetix, a US small business, provides mission critical voice communications for multiple command control applications including UAVs. Compunetix systems enable access, control and monitoring of multiple red/black VoIP and/or TDM voice sources. TDI-13 console enables integrated visual display of user mission environments/voice assets also see our 4 Star IP Gateway.

Dell EMC Booth 7

Irvine, CA

Web: www.emc.com

Dell EMC empowers Federal agencies to use information as a mission advantage. We focus on cloud, Big Data, and trusted infrastructure to give agencies the tools they need to deliver IT services in a more cost-effective and agile way.

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Delta Information Systems Booth 27

Horsham, PA

Web: www.delta-info.com

Delta Information Systems is the parent of four subsidiaries; **Ampex Data Systems** supplies airborne solid-state recorders, machine learning, and cybersecurity systems, **Delta Digital Video** manufactures video compression and scan conversion products, **GDP Space Systems** manufactures ground-based aerospace telemetry products, and **Acroamatics Telemetry Systems** manufactures high-performance real-time telemetry processing/display systems.

DEWESoft LLC Booth 6

Whitehouse, OH

Web: www.dewesoft.com

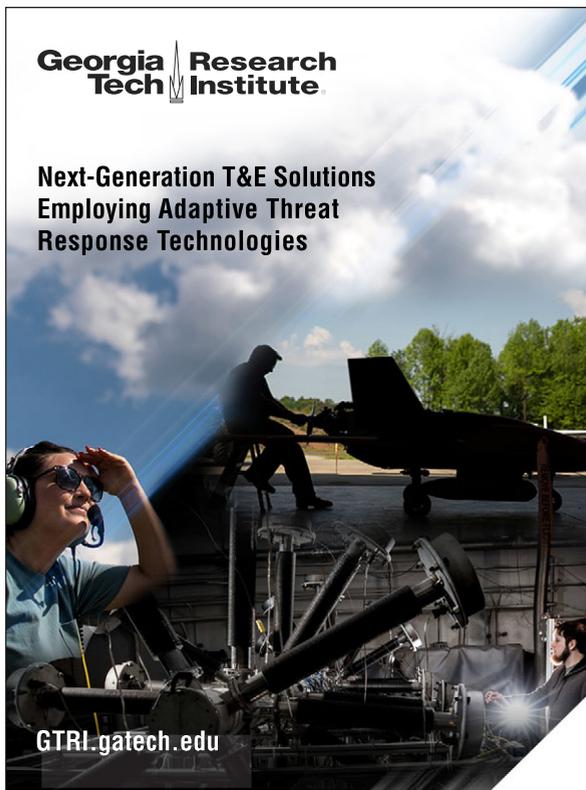
DEWESoft, is a World leading provider of data acquisition and Telemetry software and hardware serving all application. The DEWESoft synchronizes Analog, Digital, Video, GPS, CAN, ARINC 429/1553, PCM and Chapter 10. We also are a full Ground Station Telemetry software package. For more information please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

Emhiser Research, Inc. Booth 3

Verdi, NV

Web: www.emhiser.com

Emhiser Research Inc. is an ISO9001-2008 certified, small business located in Nevada. Specializing in the highest quality RF Telemetry products, Emhiser is the world's leading supplier of telemetry and video transmitters; and, command transmitter encoders, airborne receivers, and solid-state power amplifiers for both ground and air applications. Products serve the military and commercial markets; are utilized by DoD Agencies and prime contractors; and, are exported throughout the world. We are employee-owned, which accounts for its great efficiency, resulting in lower costs and personalized service to our customers.



Georgia Tech Research Institute

**Next-Generation T&E Solutions
Employing Adaptive Threat
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GTRI.gatech.edu

EWA Government Systems, Inc.**Booth 14**

Herndon, VA

Web: www.ewa-gsi.com

EWA Government Systems, Inc., a small business with nation-wide presence, specializes in Range Instrumentation solutions and Laboratory EW Threat Simulators. Our instrumentation solutions include EW Threat Systems, remotely operated tracking and Doppler radars, and RF-based data and control networks. We have the skills to provide solutions to your requirements.

Georgia Tech Research Institute (GTRI)**Booth 17**

San Diego, CA

Web: www.gtri.gatech.edu

Georgia Tech Research Institute (GTRI) develops advanced technological solutions and large-scale system prototypes to address the most difficult problems in national security, economic development and overall human betterment. Core research areas include complex and agile systems engineering, sensor design and integration, information management and cyber security, and defense technology development. GTRI performs independent modeling, testing and evaluation at the component, subsystem and system level of legacy, current and planned weapons and sensor systems.

JT4, LLC**Booth 20**

Las Vegas, NV

Web: www.jt4llc.com

JT4 is building on the legacy of support earned on the original J-Tech contract and will continue to provide award-winning service to the U.S Air Force and Navy on the new J-Tech II contract. JT4 and its teammates proudly provide technical expertise to utilize new technologies, test new and modified weapons systems, develop new tactics, and support ongoing military training at multiple Western test and training military ranges. Learn more at www.jt4llc.com

L3 Technologies**Booth 2**

L3 Corporate Headquarters: New York, NY

Web: www.L3T.com

L3 Technologies, Telemetry & RF Products is a full-service manufacturer of state-of-the-art communication and telemetry solutions for airborne, intel, space and terrestrial

applications. Our integrated solutions which combine latest-generation technologies and proven processes, are sold to defense, intelligence and government agencies, as well as international and commercial organizations.

Orocom**Booth T-4**Web: www.tmrep.net

Orocom is a manufactures representative company that has been in business for 20 years. We provide our customers with solutions for flight test instrumentation, avionics test and simulation; antennas; time code, and tracking antennas. We cover all of California, Nellis AFB, St Louis, and strategic accounts back east. Companies we represent are Curtis Wright, AIT, ESE, and WTW.

Saalex Solutions Inc.**Booth 16**

Camarillo, CA

Web: www.saalex.com

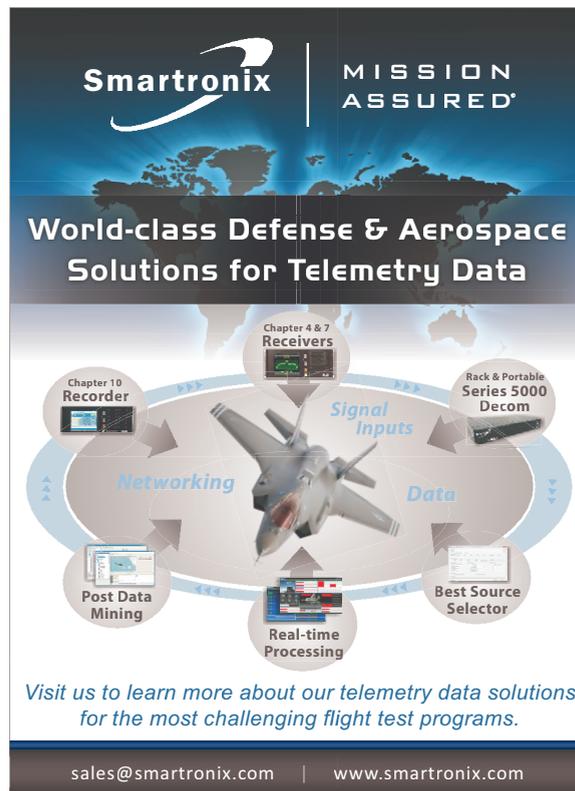
Saalex Corporation is an Engineering and Information Technology Services company with core competencies in Test Range Operations and Management, Engineering and Logistics Services, Data Analytics/Business Intelligence Services and Information Technology Services. Founded in 1999, Saalex Solutions is a Service Disabled Veteran-Owned and Operated business headquartered in Camarillo, California.

SEMCO**Booth 25**

Vista, CA

Web: www.semco.com

SEMCO is the world's leading provider of ground station receivers, over 2000, used on flight test ranges worldwide. Visit our booth to see our products which feature C-band, Space Time Coding, LDPC Forward Error Correction, Data Quality Measurement (DQM), Built-in-Test (BIT) including BERT demodulation and Blind Equalization. Explore the Linux based RC300 receiver and Ethernet only receivers that feature DMZ buffers for streamline IA compliance.



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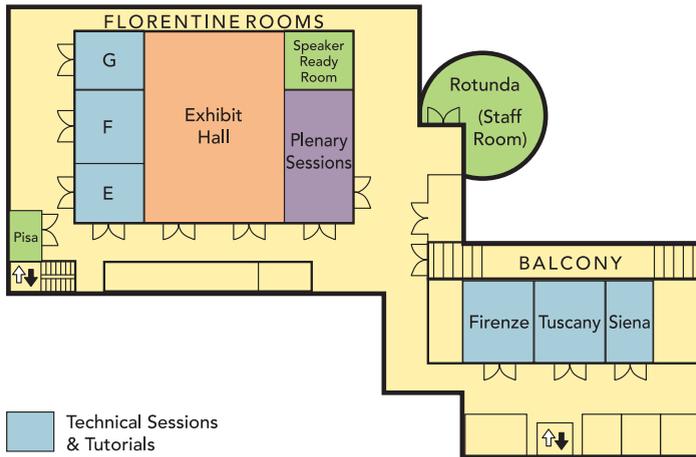


Exhibit Hall Hours

Tuesday, May 14, 2019 | 4:00pm – 6:30pm

Happy Hour 5:00pm – 6:30pm

Wednesday, May 15, 2019 | 9:00am – 7:00pm

Break in the Exhibit Hall 10:00 – 10:30am

Break in the Exhibit Hall 3:30 – 4:00pm

Reception 5:00pm – 7:00pm

Thursday, May 16, 2019 | 9:00am – 4:00pm

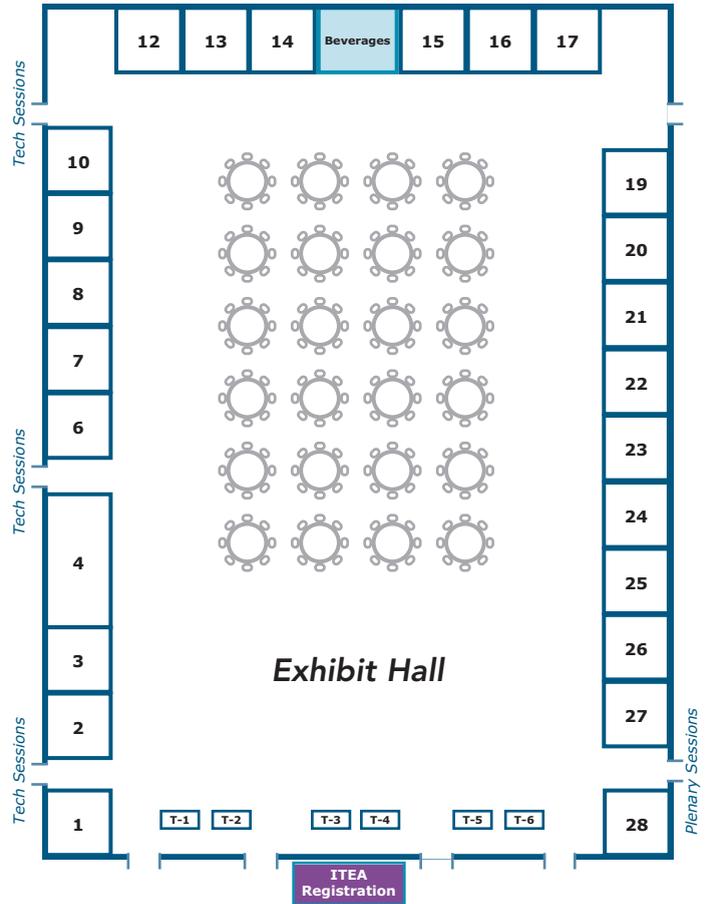
Break in the Exhibit Hall 10:00 – 10:30am

Break in the Exhibit Hall 3:30 – 4:00pm

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SYMVIONICS, Inc.
Telemetry Systems

Smartronix

California, MD

Booth 23

Web: www.smartronix.com

Smartronix is a U.S. based Technology Global provider. Offering All in One Telemetry Data Real-Time processing software, Receivers, Decom and CIO Recorder Systems. Compliant Range requirements supporting Chapter 7, Chapter 10, TMoP formats. Other data solutions with Deployable Tactical and net-centric IP systems, rugged USB. Compliant cloud and cybersecurity services.

Symvionics, Inc.

Palmdale, CA

Booth 15

Web: www.iads.symvionics.com

IADS is an interactive analysis and display system that provides engineers with advanced data organization, processing and display capabilities, in the real-time environment and at the office desktop. IADS includes high fidelity time history displays, eliminating the need for strip chart recorders and providing instant review capability for the entire test.

Telspan Data, LLC.

Concord, CA

Booth 12

Web: www.telspandata.com

Telspan Data, is a recognized leader in ground-based and airborne CH-10 technologies. Our Multi-Disciplined products leverage open standards and the latest SoC, data transmission and processing technologies. These products give Instrumentation engineers unparalleled flexibility and capability as the testing requirements change and grow.

Wideband Systems, Inc.

Silver Spring, MD

Booth 26

Web: www.wideband-sys.com

Wideband Systems, Inc (WSI) is a World Class manufacturer of high-performance IRIG 106 Chapter 10 telemetry recording systems. Our products provide flexible interfaces (Pre-d, Post-d, Direct IF, Video, Ethernet etc) and unmatched performance (1600Mb/sec to 4800+Mb/sec). With strong commitment to our customers, WSI provides unmatched

technical support and industry-leading two-year warranties. Additionally all WSI recorders include lifetime no-cost SW/FW upgrades and technical support.

Zodiac Data Systems

Alpharetta, GA

Booth 4,5

Web: www.zds-us.com

Zodiac Data Systems is a leading provider of flight-test instrumentation, data recording & replay, mission recorders, airborne & ground Telemetry solutions dedicated to the U.S. Department of Defense, aerospace, research, development and defense prime contractor communities. We specialize in providing high technology and cost-effective solutions comprised of high-quality, modular, off-the-shelf systems to a wide variety of military, industrial, utility, educational, and research organizations.





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If you are interested in learning more or join this community, please contact Corporate Member Chair, Kathi Swagerty at kswagerty@aircad.com.

ITEA TIW 2019

Technical Sessions

WEDNESDAY, MAY 15 • 10:30AM – 12:30PM

Track A: Airborne Instrumentation I – Wireless Instrumentation

Chair: Joe Dale, 812th AITS, Edwards AFB

Florentine A

10:30am “Commercial-off-the-Shelf Wireless Systems to Test the Feasibility of Wireless Instrumentation”

Hai Le, 812th AITS, Edwards AFB

Aircraft test instrumentation is synonymous with two things: the color orange and wires. While it is mandatory for orange to be on every test instrumentation systems, the push for innovation brought upon the novel idea of implementing wireless technologies to replace instrumented wirings. Over the past year, the team at Edwards AFB had been working on various wireless projects under an innovation directorate from Brig. General Schaefer. One team in particular used commercial off the shelf (COTS) wireless systems to test the feasibility of wireless instrumentation; laying the groundwork for future development of wireless systems specific to the needs of the instrumentation squadron. This presentation will present the steps and procedures the wireless team took to achieve the wireless innovation initiative, the various test cases, and the advantages and disadvantages of wireless instrumentation.

11:00am “Wireless Control and Status of High-Speed Camera Pod”

Ben Baird, 896th TSS, Eglin AFB

Airborne high speed cameras for weapon separation flight testing are one of the many instrumentation capabilities the 896 Test Support Squadron provides and supports for our customers. One of our biggest challenges for any instrumentation system is the aircraft downtime required for the T-2 modification install. This presentation will address the concept of using Wi-Fi to provide control and status of a high speed camera system installed in an AIM-120 shaped camera pod.

11:30am “Distributed Acquisition Wireless Network (DAWN)”

Robert Bieze, JT4 LLC, Edwards AFB

Recent Air Force innovation initiatives have spurred the test and evaluation community to re-evaluate all aspects of the flight test paradigm. Within the realm of flight test instrumentation, aircraft modification time was identified as a significant sink for both time and cost. This is largely due to the lengthy process of installing and/or removing large amounts of instrumentation, aka “orange wire”, throughout the aircraft. To combat this, several wireless instrumentation solutions are being developed. One such solution, dubbed the Distributed Acquisition Wireless Network (DAWN), was created with the aim of replacing large, long wire bundle runs from terminal aircraft locations, such as the wingtips and tail section, back to the centralized instrumentation hub near the center of the aircraft, with a wireless mesh network. This mesh network acts as a bulk wireless transport mechanism for the instrumentation data collected in these remote aircraft locations. DAWN was previously briefed in 2018, and this presentation

aims to update the T&E community on the progress, successes, failures, lessons learned, and our path forward with this type of instrumentation solution.

Track E: Mission Control I – Virtual Architecture

Chair: Bill Rauch, 412th RANS, Edwards AFB

Florentine E

10:30am “Growing Distributed Test Support”

Thomas Kegel, 412th RANS, Edwards AFB

VM architecture is reaching into all aspects of the computer world. How can we take advantage of this architecture to support our program needs? Can we create an integrated support package covering from the beginning to the end of the program as well as all areas (geographical and functional)? If we can accomplish this, we can create an integrated synergy within our programs. We can reach out and link all the work centers together, creating toolsets that supports the program with the same tools and creating the same products. Investing in that toolset for all the stakeholders can reduce time, establish common ground, reduce training, and create a cohesive support team. But will this new system support become too big and cumbersome and collapse under its own weight?

11:00am “Virtual Architecture 101”

Sean Conway & Alan Anderson, 412th RANS, Edwards AFB

What does it mean to have a virtual architecture and what are the key components that make up a virtual architecture? We will briefly look into a Type 1, native bare-metal hypervisor and look at the sub-components that make up the virtual hosts (machines) used to create the scalable server-client model.

11:30am “Video Performance in a Virtualized Environment”

Alan Anderson, 412th RANS, Edwards AFB

A virtualized system uses either zero, thin, or thick clients as display endpoints. This presentation will document the journey to measure video performance of many different clients attached to a virtualized system. Preliminary results of this study have produced some surprising results.

12:00pm “Virtualization Success: RAPIDS”

Michael Lockard & Christopher Moyer, DELL EMC

Data Ingest, Processing, and Visualization done on a Mobile Virtualization infrastructure. RAPIDS enables an elastic virtual infrastructure to dynamically support mission deployment needs while maintaining the same physical footprint. This Virtual Infrastructure streamlines software deployments and reduced cyber security overhead though the use of auto provisioning virtual desktops, hardware pass-thru's. It also supports high availability across mission critical applications and services.

Track C: RF Telemetry I – Future Spectrum Technology

Chair: Thomas O'Brien, Test Resource Management Center

Florentine F

10:30am “Electromagnetic Spectrum Reallocation”

Guenever Aldrich, Spectrum Reallocation Office, Department of the Navy

A discussion with a question & answer session on spectrum reallocation to include bands that have been auctioned off; and bands that are potentially coming up for auction. Including the AWS-3 auction, the Spectrum Efficient National Surveillance Radar (SENSR) feasibility studies, the 3450-3550MHz feasibility study, and other ongoing projects that affect the Test & Evaluation and telemetry communities, and examining the push towards spectrum diversity and efficiency.

11:00am “Cellular Range Telemetry Network: Field Test Results Overview”

Eric Beck, Shobha Erramilli, William H. Johnson, Achilles Kogiantis,

Jenny Maung, Kiran Rege, Anthony Triolo & Jeffrey Young, Perspecta Labs

In the Cellular Range Telemetry Network project, an initial field deployment and a test of live operation have been conducted at Edwards Air Force Base with LTE equipment tailored to accommodate aeronautical speeds. We present an overview of the key elements of the field test setup and the test results that were collected. In particular, we show the network architecture implemented, the radio components on the ground and in the test article, and the overall system configuration. Test data was collected with the test article installed on a ground vehicle moving

at regular vehicular speeds. In addition, test data were collected from the operation of a Test Article in an airborne C-12. The behavior of the LTE network is shown via illustration of time series data, showing signal strength, data rates, handover operation and Doppler handling. The results presented showcase the current capability of the LTE technology in the test range environments.

11:30am “Cellular Test Range Telemetry Enhancements with the Introduction of 5G Technology”

Achilles Kogiantis, Kiran Rege & Anthony Triolo, Perspecta Labs

Current implementations of Cellular Test Range Telemetry are based on the LTE technology, which includes enhancement concepts that have been introduced up to and including Release-14 of the specification standard. Currently, the same standards organization that implemented LTE (3GPP) has just completed the very first release (Rel-15) of the 5G standard. The new 5G standard is intended to be a radically new radio access and core network design, while maintaining some level of interoperability with the 4G LTE technology. This presentation provides an overview of the key new features and concepts that were specified for 5G, and which can offer new capabilities to the Cellular Test Range Telemetry. Specifically, the concepts presented are: expanded channel bandwidths and new operating bands, frame structure and architecture that allow for lower latency and integration of beamforming to the low-layer signaling operations, new concepts of enhanced handover with zero interruption, and additional concepts being worked on for use in unlicensed bands and for integrating access and backhaul use of radio nodes. Finally, the paper outlines how a network can evolve to allow co-existence of installed LTE equipment with the new 5G equipment that may be introduced, and the migration path from a fully LTE network into an exclusively 5G network.

12:00pm “Challenges in Implementing Telemetry over LTE”

Mark Radke & Tom Young, T&E S&T, Spectrum Efficient Technology, Edwards AFB

This presentation will discuss some of the implementation details concerning the adaption of the LTE (Long Term Evolution) to the AMT (Airborne Mobile Telemetry) environment. Topics will include process changes in scheduling, spectrum planning and technology limitations. Possible paths forward to address some of LTE’s challenges in the AMT environment will also be discussed to potentially provide a comprehensive solution for the AMT environment.

Track G: Data Analytics I – Big Data Techniques

Chair: Daniel Osborne, 412th Test Wing, Edwards AFB Florentine G

10:30am “Knowledge Management and the Big Data Evaluation Revolution with the F-35”

William Williams, Test Resource Management Center

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. This briefing will share some of the insights gleaned from the execution of the JSF-KM prototype effort to include successes, challenges, and lessons learned from a program management, workforce planning and organizational coordination aspect.

11:30am “Data Center of Tomorrow”

Michael Elliott, 812th AITS, Edwards AFB

“Test & Evaluation data is currently isolated & compartmentalized with little discovery or reuse outside of each respective acquisition program, minimizing its long-term applicability and effectiveness.” — Test Resource Management Center

Cross Platform Data Center is an Air Force Investment Program that has been funded to help address the issue stated above by implementing some of the tools developed by Test Resource Management Center. The adoption of Knowledge Management and cloud computing has the potential to be a game changer for the test community. The envisioned solution for this program will provide capabilities for our testers to take advantage of.

12:00pm “DoD Cloud Strategy Overview”

Jeffrey Corn, 812th TSS, Edwards AFB

The Department of Defense (DoD) has entered an age of warfighting where the digital battlefield is as important as the physical battlefield. Cloud technology is a critical component of the global infrastructure that will empower the warfighter with data to maintain the U.S. military advantage. This presentation will provide an overview of the DoD Cloud Strategy that was updated in December 2018 and released in February 2019, and will cover the following topics: (a) Strategic Environment, (b) Strategic Objectives, (c) Strategic Approaches, and (d) Implementation.

Track H: Test Support I – Program Management

Chair: Randy Doring, JT4 LLC Firenze

10:30am “Applying Theory of Constraints and Critical Chain Project Management Principles to Aircraft Modifications”

April Fowler & Michael Polucha, 896th Test Support Squadron, Eglin AFB

This presentation will describe the need for Critical Chain Project Management (CCPM) implementation, the 896th TSS’s implementation, current state, challenges, and future state. It provides insight into the first year of a Concerto implementation plan. It briefly describes the Theory of Constraints (ToC) and CCPM principles used. It describes the training, culture change, and management buy-in required to make the implementation successful. The goal of the presentation is to provide another case study as to how ToC and CCPM works in the government and how it can be successfully implemented in small organizations such as the 896th TSS.

11:00am “Controlling Work in Progress (WIP) — The Multi-Project Portfolio Scheduling Process”

Archie Clark, Project Management Branch, 412th TW/TMGG

This presentation will cover applying Theory of Constraints methods for transitioning to and maintaining low WIP in multi project, resource constrained portfolios. Lessons learned and real world examples are provided.

11:30am “A Conceptual Framework for Flight Test Management Utilizing Agile Development and Project Management Concepts”

Craig Hatcher, 412th Test Wing, Edwards AFB

Flight test and software development projects share similar characteristics. They both are very volatile and require constant management of changes. This presentation will outline a conceptual framework that describes how Agile techniques, concepts, and processes can be used to monitor and execute flight test. In addition, this presentation will show how Agile techniques enable a throughput metric to be constructed that can provide the basis for understanding the capacity of an organization to do work.

Track B: Range Instrumentation I – Special Topics

Chair: Arlene McKee, 96th RNCS, Eglin AFB Tuscany

10:30am “Multi-Caveat Security (MCS)”

Stanley Pitchford, 96th RNCS, Eglin AFB

LIMITED DISTRIBUTION: LEVEL C

This presentation will focus 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. 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. This presentation provides insight into why MILS will not work, MLS is still elusive and MCS is the answer.

11:00am “TENA/JMETC Solutions for Distributed Test and Training”

Gene Hudgins, TENA / JMETC Office, TRMC

TENA provides for real-time software system interoperability, as well as interfaces to existing range assets, C4ISR systems, and simulations. TENA has also been selected for use in JMETC events, well-designed for its role in prototyping demonstrations and distributed testing. JMETC is a distributed LVC testing capability developed to support the acquisition community during program development, developmental testing, operational testing, and interoperability certification, and to demonstrate Net-Ready KPP requirements in a customer-specific JME. This presentation will inform the audience as to the current impact of TENA and JMETC on the Test and Training community; and its expected future benefits to the range community and the warfighter.

11:30am “Emerging Technologies Combined Test Force: Future Range Capabilities”

Maj. Kyle Bergren, Capt. Steven DiMaio, Capt. Richard Agbeyibor, & Jacob Hass, Emerging Technologies Combined Test Force, Edward AFB

Truly autonomous aircraft systems featuring non-deterministic decision-making processes and adaptive capabilities are fast approaching. The current flight testing paradigm is insufficient to test and evaluate these systems in a timely manner and must be overhauled to enable quick and responsible fielding. This presentation presents the autonomy test and evaluation approach of the Emerging Technologies Combined Test Force (ET CTF) at Edwards AFB. The four key competencies identified to safely, effectively, and efficiently test autonomy are run time assurance (RTA), live-virtual-constructive (LVC) simulation capabilities, test range and platforms, and an open systems architecture. These four competencies are leveraged for flight testing of the Testing of Autonomy in Complex Environments (TACE) system which constitutes part of the ET CTF autonomy initial test capability. Finally, we discuss the ET CTF autonomy test roadmap and highlight our path towards future flight testing of autonomous aircraft.

12:00pm “Missile Application Condensed Message (MACM) Discussion Forum”

Alvia Sandberg, Missile and Sensors Test Directorate, US Army Redstone Test Center

MACM stands for Missile Application Condensed Message. Presently the message structure is built for LI information only. This is an open discussion forum on the topic of adding multiple frequency information to the RCC-264-04 standard, or the MACM message.

Track D: Cyber I – Cyber Table Top (CTT) & Accreditation Techniques

Chair: Anthony Rubino, 412th RANS, Edwards AFB

LIMITED DISTRIBUTION: LEVEL C

Siena

10:30am “How to Accomplish a Cyber Table Top (CTT)”

Megan Fisher, JT4 LLC/ATAC, 812th AITS, Edwards AFB

The Cyber Table Top (CTT) is an analytical, wargame-like tool that can be used to explore potential cyber-threats to a given system. Although this method is becoming more common, many people are unaware of the CTT process and its potential benefits to an organization. This presentation will provide a brief overview of the CTT process, help define under which circumstances a CTT might be a useful tool, discuss the resources needed to successfully execute a CTT and suggests ways to maximize the effectiveness and accuracy of the exercise.

11:30am “Airborne Instrumentation Cyber Table Top Lessons Learned”

Paul Waters, PhD, 412th Test Wing, Edwards AFB

The 412 Test Wing identified a need to link real cyber threats with the cybersecurity for airborne instrumentation systems. After looking into several of the approaches available to perform these linkages, we selected the Cyber Table Top (CTT) methodology offered by the Test Resource Management Center through the National Cyber Range. This presentation looks at the benefits of the CTT approach and the lessons learned in both the conduct of the CTT and in the risks that need to be addressed to increase the cybersecurity of the airborne instrumentation system.

12:00pm “Accreditation of Instrumentation Systems and a Few Ways Vendors Can Help”

Todd Jacob, 812th AITS, Edwards AFB

The USAF requires a cybersecurity Risk Management Framework (RMF) accreditation package to be approved by Authorizing Official (AO) to granted an Authority To Operate (ATO) for all instrumentation systems installed on USAF platforms. Vendors can help the USAF obtain an ATO by delivering software and hardware that implements best cybersecurity practices such as delivering software with reduced attack surface, secure delivery of software binaries, and secure methods for installing/validating firmware. Hardware designs can assist the accreditation processes by defining non-volatile memory (NVM) characteristics and reduce the operational issues by isolating NVM. Adding options for logging control-plane and data-plane network traffic is very helpful as instrumentation systems expand the use of connected networks.

WEDNESDAY, MAY 15 • 1:30PM–3:30PM

Track A: Airborne Instrumentation 2 – Special Topics I

Chair: Al Berard, 96th RANSS, Eglin AFB

Florentine A

1:30pm “Using Batteries to Power Data Systems and Sensors”

Jim Alich, 812th AITS, Edwards AFB

As we move forward with technology, the need for smaller/lighter data systems is increasing. One method for reducing size and weight is using a battery to power data systems and sensors. Modern Lithium Polymer batteries offer a good solution due to their small size and high output. They also present some challenges and safety concerns. If they are punctured they can catch fire. To control this we've designed a sealed enclosure. This enclosure will contain any fire or smoke should the battery fail in a catastrophic way. Another avenue we've explored is a new technology called a Lithium Metal battery. Once mature, this will present all the power benefits of the Lithium Polymer batteries, but none of the hazards from fire.

2:00pm “Quick Reaction Air-to-Air Flight Termination System”

Josef Von Niederhausern, 96 RANSS, Eglin AFB

A subsystem of the Eglin Test and Training Complex (ETTC) is the Aeronautical Mobile Telemetry (AMT) system which is responsible for capturing, processing and recording of data as accurately as possible. Critical to ETTC is the ability to provide flight termination from an airborne platform. This presentation provides status of recently developed B22 Terminator Pod for long range Flight Termination System (FTS) providing deep-water testing capabilities for long range standoff and large impact area weapons.

2:30pm “Energy-Harvesting Transducers”

Al Berard, 96th RANSS, Eglin AFB

Developmental test aircraft are broadly divided into two categories, Flight Sciences and Mission Systems. Flight Sciences aircraft are used to test aircraft performance, flying qualities, and air vehicle systems (propulsion, air-refueling, utilities and subsystems, etc.). The challenge for Flight Science instrumented aircraft is how to install transducers in a non-intrusive manner without running any lines for data or power. This presentation provides insight into existing market surveys of technologies that can be utilized in a non-intrusive manner.

3:00pm “F15 EPAWSS Real-Time Network Data Filtering”

Mark Buckley, 96 RANSS, Eglin AFB

The Air Force was looking to retire the F15's by mid-20's. On October 1, 2015 Boeing announced its selection by the U.S. Air Force to serve as prime contractor for the service's Eagle Passive Active Warning Survivability System (EPAWSS), a new electronic warfare suite planned for the F-15 fighter, extending the life of the aircraft to 2045 or greater. The instrumentation challenge faced by the 96 TW was to provide 100% avionics bus data collection at up to 12 Gbps and then telemeter a filtered subset of that data for real time operations. This presentation provides status of current EPAWSS F15 avionics bus recording, filtering and telemetering requirements and challenges.

Track E: Mission Control 2 – Virtualization Lessons Learned Round Table Discussion

Chair: **Bill Rauch, 412th RANS, Edwards AFB** **Florentine E**

This 2 hour Round Table and demonstration will provide an opportunity to discuss lessons learned, successes and failures, and concerns with attempts to initiate virtualization concepts. The goal is to provide insights into virtualization practices that are best suited for evolving real-time instrumentation, control rooms, and ground stations from racks of equipment to a single virtualization host.

Key Points: Processing performance, Virtual Desktop Infrastructure (VDI [Zero, Thin, Thick Clients]), Graphics Processing Units (GPU), proprietary equipment, data acquisition (IRIG 218, IRIG Chapter 10), user management, and security (Information Assurance [IA]).

Track C: RF Telemetry 2 – Antenna Developments

Chair: **Mark Radke, Bevilacqua Research Corporation** **Florentine F**

1:30pm “Broadband Conformal C-Band Antenna Project”
Max Apalboym, Airborne Instrumentation Systems Division, NAS PAX

With an available RF bandwidth of 599 MHz for telemetry and aeronautics, transition into C-Band spectrum operations across national test ranges demands development and maturation of critical transmit and receive components for weapons, targets, and aircraft applications. Through collaboration of the Test Resource Management Center and Department of the Navy, The Broadband Conformal C-Band Antenna (BCCA) project addresses design, characterization, and maturation of aerodynamic cylindrical conformal antennas in maximizing performance for optimal telemetry range wireless links. Presented development results will provide background and insight in achieving maximal effective radiated power (ERP) to that of legacy S-Band antennas while optimizing on gain variation effects across weapon system roll-angles to increase overall link availability and C-Band telemetry data quality.

2:00pm “Conformal L-, S-, and C-Band Antennas”
Tariq A. Mujahed, Toyon Research Corporation

NAWS China Lake and NAS Pt. Mugu are seeking an L/S/C telemetry system for the F/A-18 Super Hornet. Toyon Research Corporation is under contract to design, fabricate, and deliver flush-mount antennas in support of the Navy’s L/S/C telemetry effort. The telemetry antenna is approximately 5 inches in diameter and recesses into the aircraft about 4 inches. It covers the L band (1435-1535MHz), the S band (2200-2400MHz), and the C bands (4400-4900MHz, 5100-5150MHz, 6100-6700MHz). The patterns of the antenna resemble those of a blade or monocone antenna. The telemetry antenna is located on a panel on the nose section of the aircraft fuselage and a flush-mount L1/L2/L5 GNSS antenna is collocated on the same panel. The pair of antennas require a notch filter at the L1 GPS frequency to avoid self-jamming from the L band telemetry to the GPS receiver. Toyon has fabricated the antennas and characterized them in an anechoic chamber. The antennas have also been tested against environmental conditions required for flight approval on the F/A-18 Super Hornet. The telemetry antenna can easily be redesigned for other platforms.

2:30pm “Latest Development Status on the Commercial Derivative Aircraft-Based Instrumentation Telemetry System (CBITS) Program”

Scott Kujiraoka, GBL Systems; J. Kyle Roudebush, Jose Hernandez & Kenneth Sanchez, NAVAIR-Point Mugu; Michael Pace, Raytheon Albuquerque

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.

3:00pm “Steered Conformal Array for the Rotating Airframe Missile”

Kevin Cook, Georgia Tech Research Institute (GTRI)

GTRI is developing a system that will switch between sections of a conformal wrap-around antenna array activating small subarrays at any given moment. This will minimize the variation of the gain as the Rotating Airframe Missile rotates and reduce the required transmit power. The antenna was designed using GTRI’s fragmented aperture technology. Inside the RAM body there are two actively controlled switches that alternate switching which subarray they’re feeding, always ensuring that the two adjacent subarrays pointing in the desired beam direction are active. These active switches are controlled by an algorithm using roll rate data from an onboard gyroscope to dictate which subarrays should be active.

Track G: Data Analytics 2 – Data Analysis Tools

Chair: **Thomas Treakle, Dell EMC** **Florentine G**

1:30pm “DoD Artificial Intelligence Strategy Overview”
Jeffrey Corn, 812th TSS, Edwards AFB

Other nations are making significant investments in Artificial Intelligence (AI) for military purposes. In order for the U.S. to maintain its strategic position and prevail on future battlefields, it is critical that the DoD fully harness the potential of AI to empower the warfighter. This presentation will provide an overview of the 2018 DoD Artificial Intelligence Strategy that was released in February 2019, and will cover the following topics: (a) Strategic Objectives, (b) Strategic Approach, and (c) Strategic Focus Areas.

2:00pm “412th Test Wing Data Analysis via Open Source Tools”
Phillip Rogers, 412th Test Wing, Edwards AFB

Proprietary software languages come with cost and deployment issues. Open source software (OSS) can alleviate some of these issues. The Department of Defense has clarified their guidance on OSS which allows for its use as long as certain conditions are met. Python, which is an approved OSS, has matured and is capable enough to produce applications that can replace applications developed using proprietary software. The presentation will address the benefits of using Python and will give examples of post-test data analysis applications developed using Python.

2:30pm “KM/RAPIDS; ETL/Data Ingest”
Matt Smith, Dell EMC

DELL EMC Knowledge Management (KM) and Rapids enterprise test data management systems (ETDMS) enable timely and efficient Big Data Analytics through an integrated hardware, network and software solution. Optimized data ingest from variety of data sources enables analysts, pilots and developers to view test data and analytics results quickly. This presentation will cover ingest architectures, parallelization, data transformations and Hadoop/Hive table structures.

3:00pm “Lessons Learned From Developing Orange Flag Evaluation Data Analysis Tools”

Christopher Klug, 412th Operations Group, Edwards AFB

In order to leverage the tremendous value of multi-platform data, the data need to be reasonably accessible to many analysts. The development of the Foundational Data Analysis Tool (FDAT), to support Orange Flag Evaluations, focuses on making the data accessible – both physically and logically – in a scalable manner. This presentation will discuss the challenges and opportunities experienced while developing FDAT for large, increasingly complex data sets.

Track H: Test Support 2 – Production Facilities for RDT&E

Chair: **John “JB” Esch, Air Force Plant 42, Palmdale CA** **Firenze**

During this 2 hour session, you will be given a rare and unique opportunity to examine the critical role Air Force industrial complexes play in present and future aerospace development, for both military and civilian applications. This guided discussion will focus on the Air Force industrial preparedness enterprise, with special emphasis on Air Force Plant 42, Palmdale, California. This Production Flight Test Installation hosts three aerospace giants; Boeing, Lockheed Martin, and Northrop Grumman Corporations. Plant 42 sits adjacent to and supports the NASA Armstrong Flight Research Center Annex and Lockheed Martin Skunkworks. A panel of experts will discuss how government and commercial industry successfully produce the most advanced aerospace capabilities in the world.

Track B: Range Instrumentation 2 – TSPI Techniques for Test & Evaluation

Chair: Alvia Sandberg, US Army Redstone Test Center **Tuscany**

1:30pm “Gulf Range TSPI Instrumentation System (GRITS)”
Josef Von Niederhausern, 96th RANSS, Eglin AFB

A variety of test capabilities are required to support testing of military aircraft (A/C) and associated weapon systems. Technology shortfalls can result in capability gaps that can jeopardize achievement of test objectives. Providing Time Space Position Information (TSPI) is a major, necessary capability for aircraft and weapon testing for Air Force Test Center (AFTC) ranges at Eglin AFB and Edwards AFB. This presentation discusses the application and performance of the Government developed Gulf Range Instrumentation TSPI System (GRITS).

2:00pm “JAMI and TENA — A Fusion of GPS & IP”
Alvia Sandberg, Missile and Sensors Test Directorate,
US Army Redstone Test Center

The Joint Advanced Missile Instrumentation (JAMI) project has created a very effective high dynamic Time Space Position Information (TSPI) solution and the Test and Training Enabling Architecture is a very effective way to share data over a network. Can JAMI and TENA work together? This presentation answers that question.

2:30pm “The Benefits of Modernized GNSS in T&E”
Nick Cooper & Dave Stephens, QinetiQ UK

The Joint Advance Missile Instrumentation (JAMI) system, using single frequency (L1 C/A) GPS, has been used in the T&E of high dynamic systems for more than two decades and has delivered TSPI accuracy of better than 10m RMS whilst travelling at velocities in excess of 1500m/s. JAMI provides real-time range safety information using code measurements and supports post trials performance assessment using captured carrier phase information where the position accuracy can approach 30cm RMS. In recent years however the operational threat environment has changed with interference - both deliberate and unintentional - and signal spoofing becoming real world issues. The JAMI system was not designed to operate under these conditions, therefore the need to understand the performance of new capabilities being fielded when operating in these threat environments brings new T&E challenges that must be addressed. GPS and the wider GNSS systems are also going through a period of change with new constellations, frequencies and signals being deployed. This presentation will explore how the new capabilities offered by multi-constellation and multi-frequency GNSS can support the T&E challenges of the future. In addition, it will highlight some of the issues still to be addressed that may drive the need for new infrastructure and standards on the range.

Track D: Cyber 2 – Cyber (NIST/DoD) Focused Engagement

Chair: Anthony Rubino, 412th RANS, Edwards AFB **Siena**

1:30pm “RCC Cybersecurity Group — Threats Vulnerabilities and Mitigations”
Paul Waters, PhD, 412th Test Wing, Edwards AFB

The Range Commander’s Council Cybersecurity Working (RCC-CSG) was chartered to look at cybersecurity across all of the DoD Ranges. One of standing subcommittees is specifically looking at Threats, Vulnerabilities and Mitigations (TVM) that impact the Ranges. This presentation will describe the RCC CSG-TVM activities and the upcoming tasks that we are focused on for the next few years. The TVM subcommittee is chartered to investigate threats to, vulnerabilities of, and mitigation activities for RCC Ranges; will develop methodologies for sharing this information across the RCC Ranges. Specifically, we are working actions to develop a consistent interface with the Intel community to provide Range and T&E related threats to the Range community; to leverage Cooperative Research and Development Agreements (CRADA) to share threat information with vendors and to develop government processes to assess risks to government systems. Finally, the TVM is working to develop a holistic plan to maximize the benefits of Cyber Table Tops (CTTs) that are being conducted across the Ranges. The idea is to maximize the efforts of the CTT by sharing the results, minimizing multiple Ranges looking at similar systems, and identifying holes in the infrastructure where the risks have not been looked at by any Range.

LIMITED DISTRIBUTION: LEVEL C

2:00pm “Cyber Career Training Path and Way Forward”
Marc Holley, 412th RANS, Security Operations Center

Although cybersecurity has become a major buzzword, the problems faced within the cybersecurity domain requires continuous monitoring and assurance to safeguard and secure networks to meet present and future needs. One problem that is enveloped within this larger security paradigm is the creation of cyber teams and cyber professionals. This presentation offers a glimpse into the path created and perpetuated by the 412 Range Squadrons (RANS) to create cyber teams and increase the 412 RANS cyber body of knowledge. The cyber path defines a way forward for career development as well as career progression to make the 412 RANS government workforce more competitive, agile and valuable to best meet the mission requirements and increase and extend the capability of the flight as a whole.

2:30pm “Navigating Airborne Instrumentation Systems Authority to Operate (ATO) Requirements”
Bruce Johnson, AVMI, NAS Patuxent River

DoD is continually evaluating cyber risks on a wide variety of systems. This evaluation has resulted into more systems being included in the detailed analysis of cyber threats. For many years the Aircraft Instrumentation Division at the Naval Air Warfare Center Aircraft Division (NAWCAD) Patuxent River has maintained an Authority to Operate (ATO) that covered our laboratories, shops, and all of our computer hardware and software infrastructure. This ATO did not include the airborne instrumentation systems hardware. (e.g. Data Acquisition Units (and input sources), Recorders, Transmitters etc.). This presentation will address how the Aircraft Instrumentation Division at Patuxent River is attempting to balance providing the required information and doing what makes sense.

3:00pm “Cyber Policies, Procedures and Documents (PPD)”
Todd Jacob, 812th AITS, Edwards AFB

The Range Commanders Council Cybersecurity Working Group (RCC-CSG) is chartered with guiding the Cybersecurity of the Test & Evaluation community in support of its mission. The Policies, Procedures and Documentation (PPD) committee is concerned with standards, recommendations, examples, and reference documents aimed at improving Cybersecurity and optimizing the administration of Cybersecurity at member ranges. To assist member ranges to obtain accreditations, the PPD committee has adopted the “share-freely, steal everything you can” approach to speeding the accreditation process. The PPD committee is publishing a lexicon of Cybersecurity terms used by test-ranges and recommendations/example-documents on software assessments. In the near future the PPD committee will be sharing information that member ranges can use to ensure that Configuration Management (CM) practices implement proper Cybersecurity controls.

➤ THURSDAY, MAY 16 • 10:30AM–12:30PM

Track A: Airborne Instrumentation 3 – Advances in Sensors
Chair: Bruce Johnson, NAS Patuxent River **Florentine A**

10:30am “SkyTherm”
Russell S. Bauldree, 96th Test Wing; Samir Ibrahim, 96th Range Group;
Philip Richmond, 782th Test Squadron, Eglin AFB

The 782 Test Squadron supports on-going and emerging requirements to collect calibrated infrared signature measurements of threat vehicles, backgrounds, and denial and deception systems. Ideally, signature data should be simultaneously collected at multiple viewing geometries during a single instant in time to characterize thermal exchanges and transitions throughout the day. The current signature measurement process, using an instrumentation van with a telescoping mast, has significant collection time and viewing geometry limitations. A study was conducted to analyze different collection methods to reduce signature measurement times and provide more viewing geometries. The SkyTherm solution was chosen to address current limitations and future enhancements. This solution utilizes four towers that drive a cable-guided stabilized sensor platform. The four 130 ft. towers form a 400 ft. square collection area with an altitude limit of 90 ft. The SkyTherm solution offers an increase in overall viewing geometries with higher accuracy for sensor positioning and repeatability. Improved sensor platform speed reduces a single thermal transition signature collection from approximately 1-1/2 hours to 12 minutes. This presentation discusses system details, performance enhancements, future capabilities, and presents sample imagery from the SkyTherm solution.

11:00am “All-Weather Strain Gage Protection Test Results”

Sidney Jones, NAVAIR

When strain gages are mounted externally to an aircraft, they can be damaged by condensing water vapor from a flight regime that sees changes in altitude (pressure), temperature, and humidity. The gages can also be damaged through the direct application of water whether it's from rain at 250 KCAS or maintainers washing the aircraft with power hoses, brushes, and harsh cleaning agents. The Navy investigated better moisture protection for strain gage installations last year. We presented preliminary findings at last year's ITEA. Now that the project is complete, this presentation will recount its approach and test results.

11:30am “Determination of Attitude in MANPAD Type Missiles”

Robert Hill, 896th TSS Eglin AFB

In support of various counter measure programs the 96 RANSS develops instrumentation in support of Man-portable Air Defense Systems (MANPADS) missiles. Critical to determine effectiveness of countermeasure systems is the ability to assess attitude of the threat to evaluate the performance of the e system under test.. This presentation addresses challenges faced by the 96 RANSS in deriving attitude in a high dynamic environment for MANPADS systems.

12:00pm “Building Multi-Vendor T&E Systems in iNET”

Jakub Moskal & Mitch Kokar, VISTology, Inc.; Austin Whittington & Ben Abbott, SwRI; Jon Morgan, JT4, LLC, Edwards AFB

Despite their numerous benefits, T&E XML-based languages like MDL and TMATS do not address all of the challenges related to building multi-vendor T&E systems in a truly vendor-agnostic workflow. In particular, they cannot harness the complexity of constraints that may pertain to vendors' hardware or to express system-level constraints that span across entire networks of devices, and differ across different users. We developed a concept of TACL -- a language for formulating constraints on configurations represented in MDL and TMATS. A reference implementation of a TACL engine (xVISor) has been developed and integrated with the iNET System Manager. The resulting system is capable of fully configuring cross-vendor systems without relying on any vendor-provided software. In this presentation, we will describe the rationale for developing TACL, its main components, the effective system architecture and its long-term benefits for the T&E community.

Track E: Mission Control 3 – New Techniques

Chair: Bruce Lipe, NASA Armstrong Florentine E

10:30am “Using GPS Receiver IPPS Output to Verify Time Stamp Accuracy and Measure Propagation Delay”

Kevin Knudtson, NASA Armstrong Flight Research Center

A simple pulse overlay circuit using a logic OR gate was developed to overlay a precise leading edge 1 pulse per second time reference marker from a global positioning system receiver onto a non-return -to- zero-level pulse code modulation telemetry data stream to validate time stamp accuracy and measure propagation delay in telemetry equipment.

11:00am “Progress in the Migration of Flight Test Analysis Routines to Python”

John C. Bretz, Symvionics, Inc.

In recent years, the Python programming language and its associated scientific libraries have been increasingly accepted in the Flight Test Engineering community. Its ability to essentially replace high-cost engineering and scientific software for many disciplines, including Flight Test Engineering, makes its consideration imperative as an alternative. Python's open-source nature and status as a low-cost, low-risk alternative makes it popular in the engineering academic arena; many entry-level Engineers have experience coding engineering tools in Python. The IADS group has been working on practical uses of Python in Flight Test. This presentation will highlight the results of this work since the ITEA Instrumentation Workshop in 2016. Experience gained with some of the available Python libraries will be shared, and various tools that have been developed in Python by IADS programmers for their users will be introduced and described in detail.

11:30am “Vision and Challenges of a Networked Telemetry Environment”

Paul Waters, PhD, 412th Test Wing, Edwards AFB

This presentation will provide an overview of the developments associated with Networked Instrumentation, Networked Telemetry, Telemetry Processing, Mission Control Room Upgrades, Knowledge Management, and Big Data Analytics. The intent is to deliver flexible and dynamic flight test engineering test capabilities, from the instrumentation sensor to the mission control room display.

Track C: RF Telemetry 3 – Network Applications

Chair: Thomas Grace, AVMI, NAS Patuxent River Tuscany

10:30am “Using TmNS Based Systems on the Range”

Thomas Grace, AVMI, NAS Patuxent River

The extension of standard networking into the test range allows for more capable and complex systems. As a Range explores the fielding choices of the Telemetry Network Standards (TmNS) based system one must choose and integrate technological building blocks from the suite of standards to implement new test capabilities. This presentation will briefly explore some of the options available and the impacts.

11:00am “Evaluating the Effectiveness of Tracking Test Aircraft Using C-Band TM Signals”

Joseph Martin, Air Vehicle Modification Instrumentation, NAVAIR; Sebastian Day, Atlantic Test Range (ATR)

With the Test and Evaluation community's move to C-Band Telemetry, ranges are facing new challenges in delivering decision quality data to their customers. Recently, a team at NAS Patuxent River had difficulty acquiring reliable C-Band telemetry from a test aircraft, and undertook an investigation of the various contributing factors. Several C-Band specific contributing factors were examined, including relatively tighter beam widths, increased multipath effects, and the limitations of existing telemetry equipment. This presentation addresses how these challenges were identified, analyzed, and what steps are being considered to mitigate them. Topics include gathering data from ground tracking antennas and test articles, and performing a quantitative analysis of this data across multiple flights to assess C-Band tracking performance.

11:30am “NRES: Non-Blocking Ruggedized Ethernet Switch for Airborne Applications”

Dr. Ali Namazi & Dr. Chujen Lin, IAI

Testing at Major Range and Test Facility Bases (MRTFB) often involves multiple test articles that communicate critical information to one or more ground stations using a telemetry link. In addition, within test articles, the network infrastructure used in test articles, such as airborne systems, must be: 1.) Ruggedized and compliant with military standards (such as MIL-STD-810) to be able to work reliably in harsh environments. 2.) Fast and non-blocking to ensure a robust communication within the network. Telemetry communication and its transport/routing protocols are based on Ethernet standards. A key element of the network infrastructure is the Ethernet switch, which is the critical junction point of all devices on the network. Current ruggedized Ethernet switches do not support non-blocking solutions at 10Gbps speeds. To address the gap, IAI is developing an FPGA-based (Field programmable Gate Array) ruggedized Ethernet switch (NRES) that is true non-blocking and ruggedized with support for several 10Gbps ports and 10/100/1000 ports.

12:00pm “The DNA of a Network Flight Recorder”

Mark Wigent, Lulima Systems

Network telemetry is characterized by a set of mission requirements that are more encompassing than traditional serial streaming telemetry, specifically including use cases which require real-time analysis and instantaneous retrieval of data from the test article during flight. The IRIG 106 Chapter 10 standard, which was designed primarily for system interoperability during post-flight mission reconstruction and does not explicitly address needs for real-time data retrieval. While Chapter 10 does include an option for recorders to replay data while recording, the recording format itself is not well suited for real-time data mining and analysis. The purpose of this presentation is to compare and contrast the capabilities of traditional Chapter 10 recorders with network flight recorders and to highlight the ways in which differences in functionality should drive system architecture and design.

Track D: Cyber 3 – Cyber T&E

Chair: Harry Cooper, JT4 LLC

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Siena

10:30am “Risk Management Framework (RMF) for Airborne Test Instrumentation Updates”

Robert Hill, 896th TSS, Eglin AFB

While RMF has been widely implemented on new DoD acquisition programs, it has only recently been emphasized for Test and Evaluation (T&E) systems. One notable part of the T&E environment is the embedded airborne instrumentation that is installed in DoD test aircraft. The 896th Test Support Squadron (896 TSS) has recognized that these unique instrumentation systems have posed an unknown cybersecurity risk. This paper will follow up the previous discussion as to the process taken by the 896 TSS to address cybersecurity compliance requirements. The paper will detail the efforts to implement policies to address cyber security risks and ensure personnel are involved in the management and compliance with cybersecurity procedures, as well as efforts to address separate instrumentation systems that supplement the primary/core instrumentation. The paper will also follow up on efforts to develop CONOPS to address the operation of instrumentation systems in different environments under varying security requirements.

11:00am “A Vendor Perspective in Support of Cybersecurity of Information Systems”

Jeff Rusincovitch, Safran Aerosystems, Data Systems

The U.S. Government, OEMs and prime contractors are recognizing the importance of cyber security and continuing to mature cybersecurity requirements. These requirements apply not only to protecting data on vendor networks but also require a comprehensive mitigation plan for the flight test products, to include supply chain integrity and software development processes. This presentation will summarize from this vendor’s perspective, our efforts to implement Risk Management Framework (RMF) and discuss the strategy, progress, and commitment for achieving a robust RMF system. This presentation will summarize the cyber threats and vulnerabilities we have identified in our product’s lifecycle. Next, it will describe our approach to identifying the Security Controls to implement and document in order to support our customers achieve Authorization to Operate (ATO). Finally, this presentation will describe our experience with the most recent Defense Security Service (DSS in Transition) inspection process.

11:30am “Getting Inside the Cyber OODA Loop: Agile T&E Support in Cyberspace”

Jason Schalow, 412th CS, Edwards AFB

Shrinking schedules, more advanced weapon systems platforms and increasing threats from near-peer competitors have driven a new focus on innovation and, with it, an increasingly reliance on cyberspace capability in both test mission systems and mission support systems. Can cyber support for T&E keep up with the demand? This presentation explores ways in which cyber and communications support is transforming to meet the ever-growing need for secure, agile and innovate cyber systems to support modern flight test. Focus areas include agile software development, business intelligence and spectrum management along with a discussion of the increased AF focus on defensive cyber operations as a key mission enabler.

12:00pm “Defensive Cyber Operations Testing During Systems Development”

Georgianna K. Shea, PhD, The MITRE Corporation

Developmental Testing includes testing the system requirements, which extends beyond the explicit functional requirements. It also includes the implied operational requirements. For Defensive Cyber Operations (DCO) the developmental requirements should be incorporated into the overall architecture to insure that the system is prepared to effectively defend against Cyber attacks the day it goes operational.

➤ THURSDAY, MAY 16 • 1:30PM–3:30PM

Track A: Airborne Instrumentation 4 – Special Topics II

Chair: Chris Stewart, 896th Test Support Squadron, Eglin AFB Florentine A

1:30pm “Succession Planning for Airborne Instrumentation”

Brian Keating, Aircraft Instrumentation Division, NAS Patuxent River

Aircraft instrumentation is a very specialized field that requires specialized engineering, technical knowledge, and skills that take years to develop. Current workforce demographics, upcoming

retirements and gaps of experience in aircraft instrumentation are driving the Navy to focus on creating a formal succession planning process and succession plan. This succession plan will identify key positions within the Aircraft Instrumentation Division that will potentially turn over in the next five years and help to improve the health and capability of the organization.

2:00pm “Technical Training for Airborne Instrumentation Engineering”

Chris Stewart & Bruce Lowmiller, 896th Test Support Squadron

The 896th Test Support Squadron designs, installs, and supports unique Airborne Instrumentation to support the development and acquisition of DoD weapons systems. To accomplish this mission, 896th TSS aircraft T2 modification engineers require knowledge and experience in various technical aspects of airborne instrumentation, such as, Pulse Code Modulation & Sampling Theory, Aircraft bus architecture (e.g. 1553, Fiber Optic), Signal Conditioning & Filtering, Ethernet, Airborne Data Recorders, RF Transmission, and measurement of Dynamic Force, Pressure & Acceleration. New engineers have a steep learning curve and turnover requires sustainable core training. Due to the broad spectrum of engineering knowledge required, an effective formalized training curriculum does not exist for 896th TSS engineers. This presentation discusses current and future challenges facing the DoD airborne instrumentation community to provide sustainable & executable technical training, and one potential solution being pursued by the Air Force Test Center.

2:30pm “Airworthiness Assessment for Contractor-Owned, Contractor-Operated Instrumentation Systems”

Abigail (Abbe’) Reuter, Airworthiness Director of Engineering/Delegated Technical Authority, Air Force Test Center (AFTC)

The AFTC continues to use Contractor-Owned Contractor-Operated Air Systems to support test operations. However, due to increasing concerns about the liability that these aircraft may be exposing the Air Force to, the Airworthiness Process has developed significantly over the past year. This process, designed to assess the risk to the Air Force of using each aircraft that is contracted to support test, now includes an Airworthiness Data Package request at the start of the contracting process as well as a Maintenance and Operations Assessment to take a deep dive into contractors’ processes to understand how their aircraft are maintained and operated. Each of these changes serves to provide a better understanding of the risks involved in contracting specific aircraft so that the leaders that sign the risk acceptance letters for the Air Force can have confidence in the Airworthiness Assessment. This presentation will look at the process changes and provide a couple of examples of the AFTC customers that have used the improved airworthiness process.

3:00pm “F-35 Quick Response Instrumentation Package”

Jeffery Hite, 812th AITS

The F-35 Flight Test & Evaluation (T&E) community identified the need for an airborne instrumentation package that could be installed on non-instrumented production aircraft in order to collect mission systems and vehicle system bus data for analysis to identify and resolve anomalies. From this requirement, a QRIP1 (Quick Response Instrumentation Package) was rapidly developed, qualified, manufactured, and delivered to the 59TES at Nellis AFB for installation on the F-35. Additional requirements to miniaturize and relocate the package predicated the development of QRIP3, which significantly increased the performance of QRIP1, and is a smaller, more non-intrusive instrumentation package that combines signal conditioning and recording with Ethernet capabilities for additional external distributed modular systems.

Track E: Mission Control 4 – Serial Streaming Telemetry (SST) Transmitter C2 Forum

Chair: Tim Chalfant, Colsa Corporation

Florentine E

1:30pm “Command and Control (C2) of Serial Streaming TM (SST): Open Issues for Achieving Interoperability II”

Ron Pozmancier, 412th TENG/ENI

Needs/requirements for real-time C2 of Serial Streaming Telemetry (SST) transmit and receive systems will be presented. SST transmitter command configurations/characteristics will be discussed. Ties to the Advanced Wireless Services (AWS) -3 Auction, Department of Defense, Transition Plans, from the various services will be addressed. Expanded candidate Concepts of Operation (CONOPS) will be presented along with the associated challenges and limiting factors. Preliminary candidate approaches for the RF link will be discussed. Requirements for

interoperability and compatibility at the Major Range and Test Facility Base ranges will be stressed throughout the presentation. Proposed road map for MRTFB Ranges' collaboration on C2 SST design and implementation will be presented.

2:00pm “Real-Time Test Article Telemetry Frequency Agility; Problems and Issues Forum”

Tim Chalfant, Colsa Corporation

The ability to change test article TM frequencies in flight has been a long desired goal of many (defiantly not all) over the years. The capability to change telemetry frequencies in flight to avoid interference, avoid interfering, real-time de-conflict, etc. has been a goal of any Ranges' future plans and visions. Progress has been made, but we are still pretty far from implementation. Transmitter command and control is now reflected in many SRF plans, developed under the iNET program, and published as RCC TG's Telemetry Network System (TmNS) standards. Due to the distributive nature of this concept (real time TM frequency changes) and the cross-organizational impacts this would have (frequency assignments, scheduling, de-confliction, mission control), many barriers will need to be removed before we can realize this capability. While TmNS allows this capability, actually doing it creates significant organizational and policy challenges. How do we obtain Frequency Assignments (JF/12, 1494, GMF) for a dynamically frequency agile TM transmitter? How do we schedule (TRMS, CSE) dynamic/agile frequency assignments on our Ranges? How do we synchronize receiver/transmitter changes across range systems (between services)?

We Recommend Test Schedulers, Range Operations, Frequency Managers, Instrumentation operations, mission control, and industry folks attend this Discussion.

Track C: RF Telemetry 4 – Spectrum Modeling, Utilization and Visualization Tools

Chair: Benjamin Tomlinson, 812 AITS, Edwards AFB **Florentine F**

1:30pm “Spectrum Needs Estimation Using Different Methods”

Michael Painter, P.E., Kannan Swaminathan, P.E., Kalyan Vadakkevedu, Satheesh Ramachandran, PhD, Knowledge Based Systems, Inc.; Charles H. Jones, PhD, C. H. Jones Consulting, LLC

Aerial telemetry (ATM) spectrum demand is on the rise. Meanwhile, there continues to be growing pressure to relinquish the DoD's claim on choice parts of the electromagnetic spectrum to accommodate commercial applications. For the Test and Evaluation (T&E) community to better plan for and share limited spectrum, they need ways to better estimate current and future spectrum needs. Several approaches were investigated, including analytics-, simulation-, and knowledge-based models. Each presents its own strengths and weaknesses. Ultimately, a combination of methods may be required to fulfill the need. The purpose of this presentation is to discuss the latest developments of the Spectrum Efficiency Through Metrics (SETM) project toward providing methods and tools for spectrum needs estimation.

2:00pm “Spectrum Usage Measurement System (SUMS)”

Mark Wigent, Laulima Systems

One of the key recommendations put forth in the DoD CIO's Electromagnetic Spectrum Roadmap and Action Plan is the creation of a spectrum usage monitoring program at the DoD test and evaluation (T&E) and training ranges. The primary goal of such a spectrum usage monitoring program is to enable the DoD to continually assess its needs and usage of spectrum in order to guide development of regulatory policy surrounding electromagnetic spectrum. In response, the Spectrum Usage Measurement System (SUMS) is being developed to capture the DoD's use of spectrum at the test and training ranges, to provide a framework for analysis and visualization of spectrum use and requirements, and ultimately to provide data to DoD frequency managers and policy makers regarding electromagnetic spectrum. This presentation will discuss the SUMS system capabilities and benefits.

2:30pm “Enhancements to Channel Model Tool Based on Bidirectional Analytic Ray Tracing and Radiative Transfer (CBAR)”

Satya Ponnaluri, PhD, IAI

CBAR is a wireless channel modeling software developed for Test Resource Management Center to predict telemetry performance. CBAR uses ray tracing and physical optics to predict the telemetry link performance accounting for the effects of terrain, antenna patterns, receiver

operating characteristics, and transmitter modulation characteristics. In addition to channel modeling, CBAR also predicts communication performance of various telemetry waveforms such as PCM/FM, SOQPSK-TG, ARTM CPM, LDPC-coded SOQPSK, and space-time-coded SOQPK. We will present the performance curves for the above waveforms. Additionally, CBAR provides the ability for a user to provide executable to predict the communication performance of a communication waveform developed by the user. This feature allows the user to test the performance of waveforms beyond those that are standardized. In this presentation, we will discuss the enhancements to CBAR since the original version was developed and presented at ITEA in 2015.

Track B: Range Instrumentation 3 – Common Range Integrated Instrumentation Systems (CRIIS)

Chair: Brian Duhart, 412th Test Wing, Edwards AFB **Florentine G**

1:30pm “CRIIS Status and Progress”

Dennis Quirao, CRIIS Program Office, Eglin AFB

The Common Range Integrated Instrumentation System (CRIIS) is a modern, Global Positioning System (GPS)-based range data system that uses a high-capacity, spectrally-efficient data link to transmit precise TSPI data from airborne test participants to a ground station for processing and analysis. Developed under the Central Test and Evaluation Investment Program to replace the legacy Advanced Range Data System, CRIIS employs a Multiple Independent Levels of Security (MILS) encryption technology capable of operating Top Secret, Secret, and Unclassified test missions simultaneously to pave the way for T&E mission support for 5th generation aircraft and other advanced weapons systems. In this presentation, the CRIIS Program Office, AFLCMC/EBYC, Eglin AFB, FL, will provide a status and update to the planned activities to complete the fielding of this needed capability at seven Major Range Test Facility Base Locations in preparation for the transition of its sustainment to the GPS Sustainment Management Office in May 2020.

2:00pm “Discussing Lessons Learned Integrating CRIIS with External Systems”

Robert Wolterman, 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 LVC integration with an unclassified 1553 interface on a test aircraft to exercise inherent capabilities in Common Range Integrated Instrumentation System (CRIIS). In addition, it will cover integration of potential upgrades to Mission Room Equipment that can improve capabilities at customer ranges while keeping the system MILS certified.

2:30pm “Tri-Service T&E Range Integration and Certification Challenges for the “Common Range Integrated Instrumentation System” (CRIIS) Hardware/Software Suite”

Dick Dickson, Dynetics, Tri-Service GPS Sustainment Management Office

This presentation will highlight the challenges faced by the Tri-Service T&E ranges for integrating, certifying, and qualifying the new CRIIS GPS TSPI hardware/software suite for support of T&E range customers. Emphasis will be placed on the RMF certification process challenges as well as maintaining commonality of the ground segment installation, and the ability to ensure cross range CRIIS TSPI data communication during testing evolutions. The presentation will also address challenges with installation and integration alongside the existing Advanced Range Data System (ARDS), and the Air-to-Air Range Infrastructure, 2nd Generation (AAIRI-2) (West Coast Ranges) GPS TSPI systems which also use the same remote ground station locations and the same Data Link Transceiver frequencies (1350 – 1390MHz) as the CRIIS system.

3:00pm “Tri-Service GPS Sustainment Management Office — Transition and Preparation for the “Common Range Integrated Instrumentation System” (CRIIS) Sustainment Activities”

Dick Dickson, Dynetics, Tri-Service GPS Sustainment Management Office

This presentation will highlight the Tri-Service GPS SMO's activities to date, in preparation for assuming long term sustainment of the CRIIS system in May 2020. Information will be provided relating to the unique aspects of CRIIS sustainment that were not part of the original Advanced Range Data System (ARDS) sustainment. It will also discuss current aspects of the GPS SMO sustainment activities that will have to be modified to meet the new and unique requirements of

the CRIIS sustainment. This presentation will also cover a brief overview of the current Navy Combat Environment Instrumentation Systems (CEIS) prime contract and the associated GPS-Based Range Instrumentation Equipment (GPS-BRIE) task orders, and how the CRIIS system sustainment will be integrated in.

Track H: Test Support 3 – Acquisitions, History, and Culture

Chair: David Smith, 412th Test Wing, Edwards AFB **Tuscany**

1:30pm “Rapid Acquisition Methods”

Jacob C.K. Arola, Engineering Support Branch, Directorate of Contracting, Air Force Test Center (AFTC), Edwards AFB

With a renewed focus at the highest levels within the DoD on rapid acquisition methods, it is critical that all Government employees are aware of Contracting rules and regulations. This presentation will provide an overview of basic Contracting regulatory guidance as well as provide insight into acquisition alternatives that may aid requiring activities in meeting their contracting needs within their budgetary limitations and acquisition guidelines.

2:00pm “Weaponizing Air Force History and Archives”

Stephanie M. Smith, PhD, History Office, Edwards AFB

Local field historians work at all levels of the Air Force command structure to collect and preserve the documents, film, photographs, history and heritage of their organization and provide research and heritage services to their commanders, senior leaders, their organizations, and to the media and the public. One primary duty has remained since the program was established, and that is the periodic history report of the local organization, preserved and archived at the Air Force Historical Research Agency. While the format and content have changed since the 1940s, the periodic history remains one of the key means of preserving Air Force history and significant documentation. Recent work to make these documents shorter and more efficient as a means of preserving documents at the Agency also supports the idea of “weaponizing Air Force history.” Weaponizing the Air Force history means several things. It means supporting our leadership first, by anticipating their need for historical products and publications that reinforce their messaging to higher headquarters and the Department of Defense. It means focusing on the Air Force’s and our organization’s history and heritage to help build comradery and identification with the mission through handouts, presentations, talks, displays, and appearances at commander’s calls and other events. It means using our history to bolster our future, our Airmen, and our leadership.

2:30pm “Designing Cultures to Steer Innovation”

Jason Korman, Gapingvoid Culture Design Group

Innovation is really a metaphor for change. We all understand that innovation involves building new capabilities, but innovation is also a critical construct for building organizational mindsets to deliver sustainable, extraordinary outcomes. Mindset change in bureaucratic environments is very difficult, and is one of the great challenges of our time. In his talk, Jason will address how to design cultures that drive innovation and greater engagement at scale.

Track D: Cyber – Mission Voice Communication Cyber Security Round Table

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Chair: Bill Rauch, 412th RANS, Edwards AFB **Siena**

This 2-hour Round Table will center on the deployment and Cyber Security accreditation of Compunetix Mission Voice Communication Systems. The discussion will provide the attendees an opportunity to discuss the issues, lessons learned, problem areas experienced and solutions, successes and failures associated with the deployment and accreditation of Range Mission Voice Communication Systems.

Key Points: Compunetix Centric discussion, deployment successes, lessons learned, Cyber Security approaches, RMF concerns, and Telemetry “Hot Mike” solutions.

Proceedings will be uploaded to the ITEA website approximately one week after the workshop concludes. Please visit www.ITEA.org

ITEA Upcoming Events

- CTEP Examination Session: 17 May 2019
- CTEP Examination Session: 18 June 2019
- Accelerating Test and Evaluation with LVC and Agile Workshop: 17–20 Sept. 2019
- 36th International Test and Evaluation Education Symposium: 12–15 Nov. 2019

ITEA Journal Issues

- Accelerating Test and Evaluation with LVC and Agile (Issue 40-2, June 2019)
- Aligning Modernization of DoD Test Ranges with National Defense Strategy (Issue 40-3, September 2019)
- Drowning in Data: How to Gain Timely Information and Knowledge from Data (Issue 40-4, December 2019)

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The Certified Test and Evaluation Professional (CTEP) Credential

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ITEA administers, manages, and awards the Certified Test and Evaluation Professional (CTEP) credential which provides significant benefits to T&E professionals, organizations, and their customers. Over 500 T&E subject-matter experts (SMEs) have been involved in the development of this credential. These SMEs — T&E executives, managers, supervisors, individual contributors, and technicians — have come from a diverse cross-section of the T&E profession, representing industry, government, academia, laboratories, ranges, weapon systems, information technology, transportation, electronic communications, consumer electronics, and more.

PURPOSE OF THE CTEP CREDENTIAL

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- Recognize those individuals who demonstrate:
 - > **KNOWLEDGE, SKILLS, AND ABILITIES:** They meet the minimum level of competency in the requisite KSAs that have been identified by T&E subject-matter experts (SMEs).
 - > **COMMITMENT** to maintain currency in the field.
 - > **DEDICATION** to advancing the profession.
- Develop and promote common standards, principles, procedures, processes, and terms for the T&E profession.
- Support professional development and education to enhance the KSAs of T&E professionals.



PROFESSIONAL CERTIFICATION VS. “CERTIFICATE” PROGRAM

Please note that a “professional certification credential” is quite different from the “certificate” programs that are currently available to test professionals. “Certificate” programs award a certificate of completion or achievement to individuals after they successfully complete a course of study or meet some minimum requirements. In contrast, a professional certification credential:

- Is a time-limited recognition requiring periodic submission for re-certification to demonstrate continued currency in the profession, including demonstration of full-time employment in the field and continuing education.
- Awarded based on the candidate’s passing a competency exam, which could be written and/or observational, and would not be related to the completion of any specific course or curriculum of courses.
- Bestows upon an individual the right to use the credential’s designation in conjunction with their name (e.g. CSE, CPA, or CPM) after an assessment and verification that they have met predetermined and standardized criteria.
- Confers occupational identity and provides a method for maintaining quality standards of knowledge and performance, and stimulating continued self-improvement.
- Provides differentiation among test professionals, using standards developed through a consensus driven process and based on existing legal and psychometric requirements.
- Requires adherence to a Professional Code of Ethics.

**CTEP EXAMINATION
WILL BE HELD IN THE CHIANTI ROOM
ON FRIDAY, MAY 17TH**

Schedule At A Glance

TUESDAY, MAY 14	Tutorial Rooms >							Halls
	TIME	Florentine E	Florentine F	Florentine G	Tuscany	Firenze	Siena	
	8:00 AM to 12:00 PM	Troubleshooting Ethernet Data with Wireshark	Accelerating the Analysis of Test Data Using Effective and Efficient Experimentation	Basics of Aircraft Instrumentation Systems (Part 1)	Introduction to Agile Test and Evaluation	Video and Video Compression	IRIG 106-17 Chapter 7 Packet Telemetry Downlink Basis and Implementation Fundamentals	SETUP
	1:00 PM to 5:00 PM	iNET Telemetry Networks	The TENA & JMETC Solution for Distributed Test and Training	Basics of Aircraft Instrumentation Systems (Part 2)	Long Term Evolution Advanced (LTE-A) 4G Cellular Technology	Real World Telemetry over IP	HALL OPENS 4:00 PM	
5:00 PM	Happy Hour in the Exhibit Hall (5:00 PM – 6:30 PM)							

WEDNESDAY, MAY 15	9:00 AM	Exhibits Are Open from 9:00 AM to 7:00 PM							OPEN	
	9:00 AM to 10:00 AM	Opening Ceremony & Keynote Speaker > Florentine A “Test and Evaluation for the Modern Battle Space” Keynote: Brigadier General Christopher P. Azzano – Commander, Air Force Test Center, Edwards Air Force Base							CLOSED	
	10:00 AM to 10:30 AM	Break in the Exhibit Hall Come visit the Exhibitors and enjoy some refreshments!								
	Session Rooms >		Florentine A	Florentine E	Florentine F	Florentine G	Tuscany	Firenze	Siena	
	10:30 AM to 12:30 PM	Technical Sessions:	A1. Wireless Instrumentation	E1. Virtual Architecture	F1. Future Spectrum Technology	G1. Big Data Techniques	B1. Range Instrumentation: Special Topics	H1. Program Management	D1. [L,C] Cyber Tabletop Accreditation Techniques	
	12:30 PM	Lunch & Guest Speaker > Exhibit Hall “U.S. Air Force Warfare Center’s Vice Commander Shares Insights on T&E Engagement” Guest Speaker: Brigadier General David W. Snoddy – Vice Commander, Air Force Warfare Center, Nellis Air Force Base							OPEN 9:00 AM to 7:00 PM	
	1:30 PM to 3:30 PM	Technical Sessions:	A2. Airborne Instrumentation: Special Topics I	E2. Virtualization Lessons Learned Round Table Discussion	F2. Antenna Developments	G2. Data Analysis Tools	B2. TSPI Techniques for T&E	H2. Production Facilities for RDT&E	D2. [L,C] Cyber (NIST/DoD) Focused Engagement	
	3:30 PM to 4:00 PM	Break in the Exhibit Hall Come visit the Exhibitors and enjoy some refreshments!								
	4:00 PM to 5:30 PM	Plenary Session > Florentine A “Technologies Enabling AMT Operations in Non-Traditional Bands” Moderator: Thomas O'Brien – Test Resource Management Center (TRMC) Panelists: Kevin Cook – Georgia Tech Research Institute (GTRI); Tony Triolo – Perspecta Labs; Mark Wigent – Lulima Systems								
	5:00 PM	Reception in the Exhibit Hall (5:00 PM – 7:00PM)								

THURSDAY, MAY 16	8:30 AM to 11:30 AM	STEAMhack™ Chain Reaction Challenge > Florentine F/G Come cheer on Las Vegas Middle Schools & High Schools as they compete to see who can build the most impressive chain reaction-style machine based on their team’s pre-contest design.							CLOSED
	9:00 AM	Exhibits Are Open from 9:00 AM to 4:00 PM							
	9:00 AM to 10:00 AM	Plenary Session > Florentine A “An Innovation Movement” Keynote Speaker: Brigadier General E. John Teichert – Commander, 412th Test Wing, Edwards Air Force Base							
	10:00 AM to 10:30 AM	Break in the Exhibit Hall Come visit the Exhibitors and enjoy some refreshments!							
	Session Rooms >		Florentine A	Florentine E	Florentine F	Florentine G	Tuscany	Siena	
	10:30 AM to 12:30 PM	Technical Sessions:	A3. Advances in Sensors	E3. Mission Control: New Techniques	F3. STEAMhack™ Challenge	G3. STEAMhack™ Challenge	C3. Network Applications	D3. [L,C] Cyber T&E	
	12:30 PM	Lunch in the Exhibit Hall							
	1:30 PM to 3:30 PM	Technical Sessions:	A4. Airborne Instrumentation: Special Topics 2	E4. Serial Streaming Telemetry (SST) Transmitter C2 Forum	F4. Spectrum Modeling, Utilization and Visualization Tools	B3. Common Range Integrated Instrumentation Systems (CRIIS)	H3. Acquisitions, History & Culture	D4. [L,C] Mission Voice Communication Cyber Security Round Table	
	3:30 PM to 4:00 PM	Break in the Exhibit Hall Come visit the Exhibitors and grab some refreshments!							
	4:00 PM to 5:30 PM	Plenary Session > Florentine A “Shaping the Future – Ensuring Relevance to the Future Fight Through Innovation, Governance, and Culture Change” Moderator: Chris Klug – 412th Operations Group Technical Advisor Panelists: Brian “Beam” Maue, PhD – CEO, AFWERX; Colonel Scott Cain – Commander, Arnold Engineering Development Complex; Jason Korman – CEO, Gapingvoid Culture Design Group; Brigadier General E. John Teichert – Commander, 412th Test Wing, Edwards Air Force Base							
4:00 PM	Exhibits Are Open Until 4:00 PM								

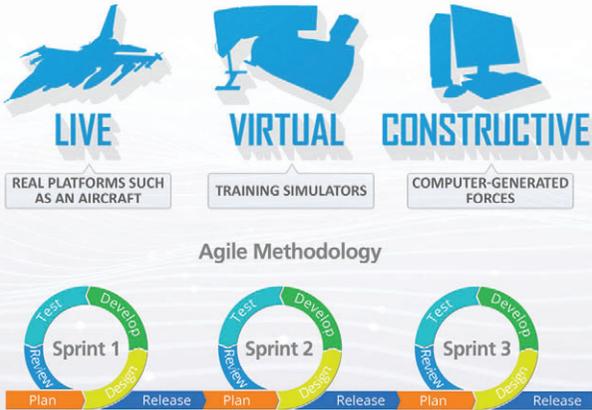
[L,C] = [LIMITED DISTRIBUTION: LEVEL C]

Accelerating Test and Evaluation with LVC and Agile Workshop

Hosted by the ITEA Central Florida Chapter

Orlando, Florida • September 17-19, 2019

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PROGRAM OVERVIEW

Fielding effective, secure systems to warfighters at the speed of need is essential, but this goal is difficult to achieve given that industrial-age acquisition and systems engineering processes, including Test and Evaluation (T&E), do not mesh well with development and use of modern software-intensive systems. Agile software processes that combine acquisition events with developmental and operational testing show promise in decreasing historic timelines. Combining software development (Dev) with built-in information technology security and assured hardware platforms (Sec) with information technology operations (Ops) throughout the DevSecOps software build is also streamlining the delivery of secure software-intensive systems. Finally, increasing the focus on what the warfighter needs now and what is necessary for potential conflicts will provide more usable and effective systems. Other key ideas for improving effectiveness and accelerating this process include early prototyping via modeling, simulation, and gaming; evaluating hardware prototypes; combining test events; the use of Artificial Intelligence to improve data gathering and reporting; and evolutionary program development.

Confirmed Speakers:

- Mr. Alan Shaffer, Deputy Under Secretary for Acquisition and Sustainment
- Dr. Melanie Loncarich, Office of the Deputy Under Secretary of the Army for T&E
- Dr. Steve Hutchison, Director for Test and Evaluation, Department of Homeland Security
- Dr. Eileen Bjorkman, Deputy Director, AF/TE
- Mr. Nicolas Chaillan, DoD Enterprise DevSecOps initiative Lead and Incoming OUSD (A&S) Chief Software Officer for Air Force Programs
- Dr. Hans Miller, The MITRE Corporation (Panel Chair and Tutorial)
- Dr. Robin Poston, University of Memphis (Panel Chair)
- Dr. C. Dave Brown, Chesapeake Systems Engineering (Panel Chair and Tutorial)
- Mr. Pete Christensen, The MITRE Corporation (Tutorial)
- CDR Joe McGraw, COMOPTEVFOR Section 41, Under Sea Weapons & Expendables

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