Greater Range for Greater Applications.

Dynamic test environments require high-performance, trusted solutions to deliver defensible data. There’s also no doubt that imagery instantly provides answers to challenging questions. See the power of IR data imagery with Teledyne FLIR’s wide range of radiometric infrared cameras, designed for long range tracking and measurement, RADAR enhancement, target signature research, and high-speed test captures.

Talk to a Teledyne FLIR expert for more information and to schedule a demonstration.

www.flir.com/rs-series
Welcome To TIW 2022

Event Guide

Registration Hours
Mon. 5/16 10:00am–5:00pm
Tue. 5/17 7:00am–5:00pm
Wed. 5/18 7:00am–5:00pm
Thur. 5/19 7:00am–5:00pm

Tutorials
Mon. 5/16 1:00pm–5:00pm
Tue. 5/17 8:00am–12:00pm and 8:00am–5:00pm
(see pgs. 6–9 for complete tutorial info)

Exhibition Hours
Wed. 5/18 9:00am–7:00pm
Thur. 5/19 9:00am–4:00pm

Technical Sessions
Wed. 5/18 10:30am–12:30pm / 1:30pm–3:30pm
Thur. 5/19 10:00am–12:00pm / 1:00pm–3:00pm

Special Events
Hands-On Lab* New! Tue. 5/17 1:00pm–5:00pm
Opening Ceremony & Keynote Speakers Wed. 5/18 8:00am–10:00am
Hands-On Lab* New! Wed. 5/18 1:30pm–3:30pm
Reception in the Exhibit Hall Wed. 5/18 5:00pm–7:00pm

* See pgs. 12–13 for more about the Hands-On Lab (HOL).

Networking Breaks in the Exhibit Hall
Weds. 5/18 10:00am–10:30am | 3:30pm–4:00pm
Thurs. 5/19 9:30am–10:00am | 3:00pm–3:30pm

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.

Parking — Parking is free! Valet is available.

Badging — Badges are required for admittance to tutorials, exhibit hall, plenary sessions and technical sessions. Badges can 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.

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

Conference Logistics

Registration Hours
Mon. 5/16 10:00am–5:00pm
Tue. 5/17 7:00am–5:00pm
Wed. 5/18 7:00am–5:00pm
Thur. 5/19 7:00am–5:00pm

Tutorials
Mon. 5/16 1:00pm–5:00pm
Tue. 5/17 8:00am–12:00pm and 8:00am–5:00pm
(see pgs. 6–9 for complete tutorial info)

Exhibition Hours
Wed. 5/18 9:00am–7:00pm
Thur. 5/19 9:00am–4:00pm

Technical Sessions
Wed. 5/18 10:30am–12:30pm / 1:30pm–3:30pm
Thur. 5/19 10:00am–12:00pm / 1:00pm–3:00pm

Special Events
Hands-On Lab* New! Tue. 5/17 1:00pm–5:00pm
Opening Ceremony & Keynote Speakers Wed. 5/18 8:00am–10:00am
Hands-On Lab* New! Wed. 5/18 1:30pm–3:30pm
Reception in the Exhibit Hall Wed. 5/18 5:00pm–7:00pm

* See pgs. 12–13 for more about the Hands-On Lab (HOL).

Networking Breaks in the Exhibit Hall
Weds. 5/18 10:00am–10:30am | 3:30pm–4:00pm
Thurs. 5/19 9:30am–10:00am | 3:00pm–3:30pm

Day Planner Agenda

MONDAY, MAY 16
11:00am–5:00pm Exhibits Setup
1:00pm–5:00pm Tutorials

TUESDAY, MAY 17
8:00am–5:00pm Exhibits Setup
8:00am–5:00pm Tutorials
1:00pm–5:00pm Hands-On Lab

WEDNESDAY, MAY 18
8:00am–8:30am Opening Ceremony
Welcome by Brigadier General Matthew Higer, Commander, 412th Test Wing Edwards Air Force Base
8:40am–9:20am Keynote Speaker
Major General Evan C. Dertien, Commander, Air Force Test Center, Edwards Air Force Base
9:20am–10:00am Townhall: Range of the Future
Moderated by George Rumford, (SES) Director (acting) & Principal Deputy, Test Resource Management Center (TRMC)
9:00am–7:00pm Exhibits Open
Reception 5:00pm – 7:00pm
10:30am–12:30pm Technical Sessions
12:30pm–1:30pm Luncheon in the Exhibit Hall
1:30pm–3:30pm Hands-On Lab
1:30pm–3:30pm Technical Sessions
4:00pm–5:00pm Featured Speaker
Hans Miller, Project Leader, OSD Programs, The MITRE Corporation

THURSDAY, MAY 19
8:00am–8:50am Featured Speaker
Sean McMorrow, (SES) Associate Center Director for Mission Support, NASA Armstrong Flight Research Center
8:50am–9:30am Featured Speaker
Tom Dowd, (SES) Director, Ranges / Targets Operations, Instrumentation & Labs, Naval Air Warfare Center Weapons Division, Naval Air Systems Command
9:00am–4:00pm Exhibits Open
10:00am–12:00pm Technical Sessions
12:00pm–1:00pm Lunch in the Exhibit Hall
1:00pm–3:00pm Technical Sessions
3:30pm–4:15pm Featured Speaker
Craig Miller, President, Viasat Government Systems
4:15pm–5:00pm Closing Keynote
George Rumford, (SES) Director (acting) and Principal Deputy, Test Resource Management Center (TRMC)
Welcome to the 25th Test & Instrumentation Workshop

Hosted by the ITEA Southern Nevada and Antelope Valley Chapter

Good Morning and Welcome! My name is Wendy Peterson, and I have the privilege of chairing this year’s Test Instrumentation Workshop. We appreciate each of our presenters, keynote speakers, vendors, and attendees for your dedication, passion, and interest in helping make this an insightful and transformative event.

Our theme this year is “Range of the Future.” Our intent is to present ideas, spark new conversations, and connect people from across the T&E enterprise with the goal of recognizing the importance of each Service working together in preparing to meet the challenges of current and future threat environments. Our vision of a complex orchestration of threats, advanced interceptors, and equally advanced data collection instrumentation as just another day at the world’s most sophisticated open-air test capability may not be a reality today; but it is closer than you think and for us to support emerging weapon systems today, we have to accelerate our instrumentation system developments to keep pace and assure readiness in these emerging challenging environments. This will be critical in order to prepare the Range of the Future.

This year’s edition of the Test Instrumentation Workshop will support our need to be alert and aware of all technological developments that may have an impact on our test and evaluation operations. This workshop will discuss selected tenets of the various sensor instrumentation support to include the network, communications, and the massive resultant data. Plenary discussions, tutorials and technical sessions will lead to a thorough and relevant discourse at this workshop and aid those in attendance to prepare for the future.

In addition to the numerous sessions and speakers at our workshop, we have arranged a first-ever Hands-on-Lab so you can experience the instrumentation equipment used during each phase of flight test.

This Workshop will be as good as you make it! I hope you’ll participate fully by meeting new people, asking questions, and sharing lessons learned and solutions to the problems we face in today’s constrained test and evaluation environments! Again, welcome and thank you for your active involvement. We hope you find these next few days informative and inspirational.

~ Wendy Peterson
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.

PLATINUM & NETWORKING RECEPTION SPONSOR

RAVEN DEFENSE

ONSITE GUIDE/LUNCH/BREAK SPONSOR

TELEDYNE FLIR

PLATINUM SPONSORS

GOLD SPONSORS

BRONZE SPONSOR

HANDS-ON LAB SPONSORS
Wednesday, May 18th

Opening Ceremony & Keynote Speakers 8:00am–10:00am
Brigadier General Matthew Higer, Commander, 412th Test Wing Edwards AFB kicks off the workshop with his opening remarks. A light continental breakfast will be served at 7:30am and the program will begin at 8:00am.

Keynote Speaker 8:40am–9:20am
Major General Evan C. Dertien, Commander, Air Force Test Center, Edwards Air Force Base

Townhall 9:20am–10:00am
Range of the Future
The Test Resource Management Center (TRMC) focuses on the readiness of the Department's test and evaluation infrastructure. To accomplish this mission, the TRMC forecasts future test requirements and invests in solutions to resolve test capability gaps. Mr. George Rumford, (SES), Director (acting) and Principal Deputy, TRMC will lead this discussion on the “Range of the Future” and initiatives to identify and address future requirements.

Featured Speaker 4:00pm–5:00pm
Test Range of the Future — Implications on Test Design and Instrumentation
Hans Miller, Project Leader, OSD Programs, The MITRE Corporation

Tuesday, May 17th

Pre-Workshop Tutorials 8:00am–5:00pm
Tutorials continued from Monday. Half day and full day tutorials are available. To sign up for a tutorial please see the registration desk. See page 6 for tutorial descriptions and locations.

Hands-On Lab 1:00pm–5:00pm
Florentine F/G
Please join us for the first ever Hands-On Lab Experience! See page 12 & 13 for more information on the Hands-On Lab.

Monday, May 16th

Pre-Workshop Tutorials 1:00pm–5:00pm
See page 6 for room locations
Each of the 4-hour Pre-Workshop Tutorials provide 4 contact hours of instruction (4 CPEs) 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.

Thursday, May 19th

Featured Speaker 8:00am–8:50am
Range of the Future — Adapting to the Research
Sean McMorrow, (SES), Associate Center Director for Mission Support, NASA Armstrong Flight Research Center

Featured Speaker 8:50am–9:30am
Where is the Range of the Future
Tom Dowd, (SES) Director, Ranges/Targets Operations, Instrumentation & Labs, Naval Air Warfare Center Weapons Division, Naval Air Systems Command

Featured Speaker 3:30pm–4:15pm
Craig Miller, President, Viasat Government Systems

Closing Keynote 4:15pm–5:00pm
George Rumford, (SES), Director (acting) and Principal Deputy, TRMC will recap key conference takeaways and discuss a way ahead for DoD test enterprise modernization.

[CONFIDENTIALITY NOTICE - CUI]
Some technical sessions will contain Controlled Unclassified Information (CUI). Attendance is limited to DoD civilians and DoD contractors who are US citizens. DoD common access cards (CAC) will be required to be presented and attendees will be required to sign a register at the door prior to admittance.
### MONDAY, MAY 16TH | 1:00PM–5:00PM

<table>
<thead>
<tr>
<th>Course</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamentals of Telemetry Ground Stations</td>
<td>Firenze</td>
</tr>
<tr>
<td>This course is designed to present to the student the fundamental design features of a typical range telemetry ground system. Topics to be discussed will be the major sub-systems and components used, such as track antenna, multicoupler, receiver/combining, demodulation, bit synchronization, data recording and playback, time, decommutation and simulation, and real time display of telemetered parameters. The student will be exposed to a few mathematical exercises, such as “link analysis” calculations to help determine the “sensitivity” of the ground station and resultant system tradeoffs. After having completed the course, the student will have a better understanding of concepts related to RF and data processing of flight telemetry.</td>
<td></td>
</tr>
</tbody>
</table>

*Mark McWhorter, VP of Sales & Marketing, Lumistar Inc.*

| IRIG 106-17 Chapter 7 Packet Telemetry Downlink Basis and Implementation Fundamentals       | Tuscany  |
| 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. The presentation 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, Safran Data Systems, Inc.*

### TUESDAY, MAY 17TH | 8:00AM–12:00PM

<table>
<thead>
<tr>
<th>Course</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>5G NR Specification and System Engineering Aspects</td>
<td>Firenze</td>
</tr>
<tr>
<td>5G wireless cellular networks, based on the 3GPP standard, are being widely deployed in the United States and the rest of the world. 5G is expected to increasingly dominate the worldwide cellular communication market due to its flexibility, wide adoption, and an ever-expanding supplier global ecosystem. The flexible 5G architecture allows multiple networks widely differing in physical, reliability and power characteristics to be supported over a common infrastructure. This flexibility will be particularly useful to Testing Ranges where subnetworks simultaneously supporting high-bandwidth terrestrial communications, low-power sensors and broadband airborne telemetry systems can be flexibly implemented over a common 5G platform. This tutorial is intended to familiarize the Testing Range professionals with a) the key features of the 5G standards specifications — the basic vision, network architecture, the physical and MAC-layer characteristics of the air-interface, and b) the 5G system engineering aspects of deploying a new private network, dimensioning and planning, and its performance assessment. The first half of the tutorial will discuss the 5G standards specifications, while the second half will cover the 5G system engineering aspects.</td>
<td></td>
</tr>
</tbody>
</table>

*Achilles Kogiantis, PhD, and Kiran Rege, PhD, Peraton Labs*
Tutorials, cont.

JMETC uses a hybrid network architecture. The JMETC Secret Network (JSN), based on the SDREN, is the T&E enterprise network solution for secret testing. The JMETC Multiple Independent Levels of Security (MILS) Network (JMN) is the T&E enterprise network solution for all classifications and cyber testing. JMETC provides readily available connectivity to the Services' distributed test capabilities and simulations, as well as industry test resources. JMETC is also aligned with the Joint National Training Capability (JNTC) integration solutions to foster test, training, and experimental collaboration.

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

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

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

Gene Hudgins, JMETC/TENA

Test Foundations for Flight Test

Tuscany

The Test Foundations curriculum is designed to equip students with an introduction to the knowledge and skills necessary to be successful flight testers. The curriculum introduces the basic “vocabulary” of the various phases of a flight test program, from program initiation through final reporting. The curriculum begins with a basic Systems Engineering problem decomposition approach applied to various flight test programs. Next the various stages of the lifecycle of a normal test program are decomposed into the subparts of Planning, Execution, Analysis, and Reporting (PEAR). Planning: the basic development strategy for test planning with specific and achievable objectives and the concepts of hazard and risk identification in safety planning will be introduced. Execution: the fundamentals of flight test control and conduct will be presented with an emphasis on the elements required for safe and efficient test control and conduct. Consideration for test execution will include required personnel, mission preparation, test card generation, communications plans, execution techniques, and post-test debrief. Finally, basic analysis methods and approaches to presenting technical results will be presented. The course will culminate with an in-class exercise to apply the Test Foundations content to test vignettes based on real-world scenarios.

Jessica Peterson, Technical Director 412th Operations Group/Assistant Professor USAF TPS

Basics of Aircraft Instrumentation Systems

Siena

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, NAWCAD

WE ARE TELEMETRY™

DATA SYSTEMS

ACQUIRE

RECORD

TRANSMIT

TRACK

RECEIVE

PROCESS

SAFRAN
General Dertien has served as a Flight Test Squadron Commander, initial cadre instructor pilot for the first operational F-22 unit at Langley AFB, then served as an F-15, F-16 and F-22 test pilot and was also assigned as an evaluator pilot. His military flight experience includes combat missions in 40 aircraft types as an experimental test pilot, instructor pilot, and evaluator pilot. His military flight experience includes combat missions during Operation SOUTHERN WATCH.

Keynote Speaker:

Major General Evan Dertien
Commander, Air Force Test Center, Edwards Air Force Base

Major General Evan C. Dertien serves as the Commander, Air Force Test Center, Edwards Air Force Base, California. He directs a 31-billion dollar 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 Dertien was commissioned in 1993 from the U.S. Air Force Academy. He served as an operational F-15 pilot and completed three combat deployments prior to graduating from USAF Test Pilot School. He then served as an F-15, F-16 and F-22 test pilot and was also assigned as an initial cadre instructor pilot for the first operational F-22 unit at Langley AFB, Virginia. General Dertien has served as a Flight Test Squadron Commander, Test Wing Commander and various roles at the Center-level and MAJCOM.

General Dertien is a command pilot with over 3,100 flying hours in a variety of aircraft.

Townhall: Range of the Future

The Test Resource Management Center (TRMC) focuses on the readiness of the Department’s test and evaluation infrastructure. To accomplish this mission, the TRMC forecasts future test requirements and invests in solutions to resolve test capability gaps. You won’t want to miss this discussion on the “Range of the Future” and initiatives to identify and address future requirements.

Moderator:

George Rumford, (SES)
Director (acting) and Principal Deputy, Test Resource Management (TRMC)

George Rumford is the Principal Deputy Director for the Department of Defense (DoD) Test Resource Management Center (TRMC). The TRMC is a field activity under the Under Secretary of Defense for Research and Engineering responsible for the Department’s test and evaluation infrastructure. The primary mission of the TRMC is to ensure the Department is ready to test new systems in development. In addition, Mr. Rumford is responsible for the Department’s cyber test capabilities, including the National Cyber Range Complex.

Mr. Rumford started his 30-year career in test and evaluation at White Sands Missile Range, and he received degrees with honors in Electrical Engineering and in Computer Engineering from the University of Missouri.

Test Range of the Future — Implications on Test Design and Instrumentation

Featured Speaker:

Hans Miller
Project Leader, OSD Programs, The MITRE Corporation

Hans Miller, Col USAF (ret), is a principal test and evaluation subject matter expert and project leader at the MITRE Corporation. He has over 28 years of experience in combat operations, experimental flight test, international partnering, command and control, policy, and strategic planning of defense weapon systems. Prior to his position at MITRE, Mr. Miller was the Division Chief of Policy, Programs and Resources at the USAF Headquarters for Test and Evaluation. Mr. Miller was the Commander of the 96th (now 406th) Test Group at Holloman AFB and the Commander of the Global Power Bomber Combined Test Force at Edwards AFB supporting B-1, B-2 and B-52 testing. Mr. Miller has experience working with international partners through a NATO assignment and as the program manager of the DoD Foreign Comparative Test Program. He has served as an operational and experimental flight test pilot in the B-1B and as an F-16 chase pilot. He flew combat missions in the B-1B in Operation Allied Force and Operation Enduring Freedom. Mr. Miller graduated from the United States Air Force Academy with a B.S. in Aeronautical Engineering and a Masters of Aeronautics and Astronautics from Stanford University. He is a graduate of the USAF Air War College, USAF Test Pilot School and USAF Weapons School.
An End-to-End Flight Test Telemetry Educational Experience

Take a journey through the entire flight test telemetry data process. HOL represents seven different phases of flight test. Each of the seven phases is supported by a government Subject Matter Expert (SME) and partnering industry vendors. The SME provides an educational overview and the partnering industry vendors share a Hands-On experience with technical insight related to the specific phase they are representing.

**HANDS-ON LAB:**

**Tuesday, May 17, 2022 | 1:00pm - 5:00pm**

**Wednesday, May 18, 2022 | 1:30pm - 3:30pm**

**Florentine F/G**

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
<th>Phase 6</th>
<th>Phase 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft</td>
<td>Ground Station</td>
<td>Control Room</td>
<td>Post-Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sensor Data Generation</td>
<td>- Data Acquisition</td>
<td>- Data Decom</td>
<td>- Post-Flight Processing &amp; Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Aircraft Transmission</td>
<td>- Data Multiplexing</td>
<td>- Data Recording</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Onboard Data Recording</td>
<td>- Data Receiving</td>
<td>- Data Recording</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Data Transport</td>
<td>- Data Transport</td>
<td>- Real-Time Processing &amp; Display</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you to our HOL sponsors:
Range of the Future — Adapting to the Research

**Featured Speaker:**
Sean McMorrow, (SES)
Associate Center Director for Mission Support, NASA Armstrong Flight Research Center

Sean E. McMorrow is the associate director for Mission Support at NASA’s Armstrong Flight Research Center in Edwards, California. Appointed to this position in 2019, he is responsible for the center’s acquisition, transportation, logistics, facility maintenance and engineering, human resources, protective services, and export control in support of the center’s mission of advancing science and technology through flight.

Previously, McMorrow was the director for Mission Operations and the chief information officer for NASA Armstrong. As director, he was responsible for the development, acquisition, operation, and sustainment of the Dryden Aeronautical Test Range (DATR), Simulation Engineering, and Information Technology (IT) Services capabilities for the user community. Specific capabilities included information technology systems, IT security, flight test range operations, research aircraft telemetry, mission control rooms, air-to-ground communications, ground communications, flight data processing, and advanced flight simulations.

As chief information officer (CIO), his principal responsibility was to ensure the center mission and mission support IT investments aligned with agency enterprise architecture and standards while ensuring a safe and effective IT operating environment. As a member of the agency CIO Leadership Team (CLT), he provided center perspective to agency-wide policy decisions while ensuring local compliance with agency policy and direction.

McMorrow brings to his role at NASA Armstrong more than 30 years of collective experience in leadership, program management, information technology, flight test engineering, and software development. He served in a variety of leadership positions while employed at Edwards Air Force Base and private industry.

Prior to joining NASA Armstrong (then Dryden) in early 2011, McMorrow was director of the Plans and Programs Directorate at Edwards Air Force Base where he led a staff of more than 40 personnel. Other assignments included deputy chief information officer and deputy director of the Information Technology Directorate, later the 95th Communications Group.

McMorrow earned a Bachelor of Science in information systems from California Polytechnic University, Pomona, California, and a Master of Science in management from Golden Gate University in California.

Is the range of the future here today? Where is it? Will we know it when we see it? What are its key attributes? Bonus question — who controls the scheduling of it?

**Featured Speaker:**
Tom Dowd, (SES)
Director, Ranges / Targets Operations, Instrumentation & Labs, Naval Air Warfare Center Weapons Division, Naval Air Systems Command

Thomas Dowd has 34 years of Navy civilian service and became a Senior Executive Service member for the Department of the Navy in 2014. Since that time, he has held positions related to conducting Test and Evaluation of weapons and electronic warfare systems. He currently serves as the Senior Executive Director for the Ranges/Target Operations & Instrumentation Group at the Naval Air Warfare Center Weapons Division, China Lake & Point Mugu, CA. Mr. Dowd has a BS in Aerospace Engineering from Boston University (1988) and an MBA from Pepperdine University (2005).

Craig Miller serves as President, Government Systems at Viasat, Inc. In this role, he is responsible for leading the Company’s global defense business, which exceeds $1 billion in annual revenues by delivering cost-effective, innovative solutions to challenging defense requirements in satellite networks, tactical data links, information assurance, and cyber security.

Craig joined Viasat in 1995, and has held numerous technology, business and strategic leadership roles. Prior to serving as President of Government Systems, he was the segment’s Chief Technology Officer where he was responsible for establishing and communicating the technical strategy and roadmaps for a diverse portfolio of defense products and services: including satellite communications, tactical networks, information assurance, cyber/network security and Intelligence, Surveillance and Reconnaissance.

Craig also launched the Viasat Government Systems Space Business, which created XVI, the first Link 16-enabled LEO satellite; Viasat’s mobile satellite communications gateway systems; and Viasat’s Hybrid Adaptive Network capabilities. In addition to his role within Viasat’s Government Systems business, Craig also worked with the design team of Viasat’s Space and
Commercial Networks group, which developed the ViaSat-3 satellite constellation. In this role, he contributed to the design of Viasat’s next-generation satellite communications constellation and served as a liaison between Viasat’s commercial and government business segments.

Prior to Viasat, Craig worked at Hughes Missile Systems Group in Tucson, Arizona, where he was responsible for implementation of Electronic Counter Measures for the AAMRAM Missile System.

Craig holds a Bachelor of Science in Electrical Engineering, with emphasis on Communications and Signal Processing from the University of Arizona.

CLOSING KEYNOTE

Thursday, May 19th
4:15PM – 5:00PM | Florentine A

Test Resource Management Center Acting Director Mr. George Rumford will recap key conference takeaways and discuss a way ahead for DoD test enterprise modernization.

Keynote Speaker:
George Rumford, (SES)
Director (acting) and Principal Deputy, Test Resource Management

George Rumford is the Principal Deputy Director for the Department of Defense (DoD) Test Resource Management Center (TRMC). The TRMC is a field activity under the Under Secretary of Defense for Research and Engineering responsible for the Department’s test and evaluation infrastructure. The primary mission of the TRMC is to ensure the Department is ready to test new systems in development. In addition, Mr. Rumford is responsible for the Department’s cyber test capabilities, including the National Cyber Range Complex.

Mr. Rumford started his 30-year career in test and evaluation at White Sands Missile Range, and he received degrees with honors in Electrical Engineering and in Computer Engineering from the University of Missouri.

Corporate Membership
ITEA’s Corporate Membership provides a professional platform for your company and instantly affiliates you with the largest non-profit organization dedicated to the test and evaluation profession whose philanthropic mission is to provide scholarship funding for students and young professionals in the field.

If you are interested in learning more or join this community, please contact Lena@itea.org.

Supporting Range of the Future
* RF Front End
  - Multi-Band
  - Channelizer
  - Wide Band Digitizer
* Digital Combiner
* Digital Software Receiver
  - Demodulator
  - Bit Sync
  - Frame Sync
* Telemetry Processor

DESIGNING TEST EQUIPMENT THAT SIMPLIFIES THE ADVANCEMENT OF HUMANITY.
www.dewesoft.com
Advanced Test Equipment Corp. (ATEC)                               Booth 17
San Diego, CA                                           Web: www.atecorp.com
Advanced Test Equipment Corp. (ATEC) is a leading provider of test & measurement equipment rentals, sales, calibration, and service. Since 1981, test engineers, government agencies, and Fortune 500 companies have relied on ATEC to guide them to the right equipment, ship it quickly, and offer them the industry's best technical expertise and customer care. ATEC's broad inventory includes EMC, Power Supplies & Loads, RF Safety, Electrical, NDT, Environmental, Communications, and General Purpose test equipment.

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. Contact Joe Milan, Applications Engineering Manager at joe.milan@apogeelabs.com for more information.

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.

Avionics Test & Analysis Corporation (ATAC)                          Booth T-2
Niceville, FL                                               Web: www.avtest.com
ATAC provides avionic systems expertise for integrated weapon systems. We provide services and OEM applications to provide the development and operational community state of the art processes to achieve mission success. We are committed to providing the highest quality products and services to support military aviation missions. We develop analysis applications, data acquisition, distribution and formatting tools and modeling and simulation solutions. We are proud to have a highly qualified professional staff. We are a creative, innovative, and responsive, small company.

CALCULEX, Inc.                                                    Booth 19
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!
Curtiss-Wright Defense Solutions is an industry-leading supplier of COTS-based mission-critical modules and system-level products. Our products are the ideal solution for your instrumentation, telemetry, display and control, communications, recording, and network-based data acquisition applications.

DELL Technologies
Round Rock, TX
Web: www.dell.com/en-us
Transform on your terms with Dell Technologies. Whether you’re optimizing an existing infrastructure or exploring emerging technologies — 5G, AI/ML, data management — in the cloud or at the edge, we have the technology expertise. Create a secure IT foundation that allows you to adapt to change, deliver consistent experiences and confidently lead you well into the future. For more information, contact DellFederalSales@federal.dell.com or call us at 855-860-9606.

Horsham, PA
Web: www.delta-info.com
The Delta Family of Companies are committed to providing innovative solutions and meeting the exacting requirements of the Commercial and Military Flight Test communities. GDP, Acroamatics, DDV, and Ampex provide solutions for range telemetry systems, video processing, and the acquisition, exploitation, and protection of data for land, air, sea and space applications. For more information please contact Amanda Capoferrti at acapoferrti@delta-info.com.

DEWESoft
Whitehouse, OH
Web: www.dewesoft.com
DEWESoft, 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.

Dynetics, A Leidos Company
Huntsville, AL
Web: www.dynetics.com
Dynetics 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.

EWA Government Systems, Inc.
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)
Atlanta, GA
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
Las Vegas, NV
Web: www.jt4llc.com
JT4 provides engineering and technical support to multiple western test ranges for the U.S. Air Force, Space Force and Navy under the Joint Range Technical Services Contract (JTech II). Along with several teammates, we prepare our nation’s warfighting aircraft, weapons systems, and aircrews for today’s missions and tomorrow’s global challenges.

Lumistar
Carlsbad, CA
Web: www.lumistar.net
Lumistar designs and manufactures telemetry products for the flight test and antenna tracking communities. Board level products are manufactured with PCI, PCIe, cPCI bus interfaces as well as continuing support of ISA and VME legacy products. Lumistar products are also available without a PC interface or require an OS to operate. Serial, USB or Ethernet interfaces are used for control. Well documented application software with example code allows users to write their own applications for integration of Lumistar products into their telemetry systems.
**Exhibit Hall Hours**

**Wednesday, May 18, 2022 | 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 19, 2022 | 9:00am – 4:00pm**
- Break in the Exhibit Hall 9:30 – 10:00am
- Break in the Exhibit Hall 3:00 – 3:30pm

**Exhibitors**

- Advanced Test Equipment Corp. (ATEC) .................................................. 17
- Apogee .................................................. T-1
- Avionics Interface Technologies (AIT) .................................................. T-3
- Avionics Test & Analysis Corporation (ATAC) .................................. T-2
- CALCELEX, Inc. .................................................. 19
- Curtiss-Wright .................................................. 11
- DELL Technologies .................................................. 9
- DEWESoft .................................................. 14
- DIS | Acroamatics/Ampex/ Delta Digital Video/GDP Space Systems/Wideband Systems .................................. 22, 23
- Dynetics, A Leidos Company .................................................. 2
- EWA Government Systems, Inc. .................................................. 6
- Georgia Tech Research Institute (GTRI) .................................................. 8
- JT4, LLC .................................................. 3
- Lumistar .................................................. T-4
- Nomad GCS .................................................. 4
- Orca Technologies .................................................. T-5
- Parraid, LLC .................................................. 18
- Photo-Sonics, Inc. .................................................. 7
- Quintron Systems, Inc. .................................................. 21
- Raven Defense .................................................. 24, 25
- Safran Data Systems .................................................. 5
- Systems Engineering & Management Co. (SEMCO) .................................. 10
- Telspan Data, LLC .................................................. 13
- Trenton Systems .................................................. T-6
Exhibitors

Nomad GCS
Columbia Falls, MT
Web: www.nomadgcs.com
Nomad designs and manufactures the world's best-connected mobile operations solutions. From off-pavement, off-grid tactical vehicles to expansive mobile command centers (and all points between), we provide best-in-class products for government agencies, law enforcement, military, first responders, utilities, and businesses. Whatever the mission, Nomad creates integrated communications systems that work simply, and simply work… When Every Minute Matters.

Orca Technologies
San Clemente, CA
Web: www.orcatechnologies.com
ORCA Technologies manufactures custom high-precision time and frequency products and is managed by a team that has over 30 years of product design, management, and application experience in this field. You will find that our dedication to customer satisfaction is demonstrated by action. Simply stated, “We want to provide you with products that meet your need, deliver when you need it, or recommend another solution.

Parraid, LLC
Hollywood, MD
Web: www.parraid.com
Parraid is a U.S.-based technology and engineering company specializing in solutions for aerospace telemetry and tactical communications. Parraid Telemetry and Data Systems comprises world-class, feature-rich ground-based data processing and recording systems including solutions for receiving, processing, recording, archiving, and data mining for Government and industry clients on six continents.

Photo-Sonics, Inc.
Chatsworth, CA
Web: www.photosonics.com
Photo-Sonics, Inc. has been in a trusted supplier to the U.S. Government since 1939 and been selected as the supplier of the next generation of optical trackers for the US Test Ranges. This program will result in the development and production of the ARTIS/MITS Fly-Out and Close-In Tracking systems. Contact Philip Kiel at Pkie@photosonics.com for more information.

Quintron Systems, Inc
Santa Maria, CA
Web: www.quintron.com
Quintron offers integrated solutions to enhance security and enable business- and mission-critical communications in even the most challenging environments. Please contact Dominick Barry at dbarry@quintron for more information.

Raven Defense
Albuquerque, NM
Web: www.ravendefense.com
Raven Defense is a technology company dedicated to providing high quality engineering services, expert program consultation, and highly specialized technical equipment to meet our customer’s demanding requirements in satellite communications and ground stations, deployable sensors, and cutting-edge research, development, test and evaluation systems. Established in 2018 as a privately held small business, Raven Defense is focused on being an agile and responsive partner able to react to your changing needs.

Safran Data Systems
Norcross, GA
Web: www.semco.com
Safran Data Systems Inc. is a world leader in aerospace test instrumentation, telemetry, and space communications. As a US government agencies provider, it offers complete data acquisition, recording and processing solutions for flight tests as well as equipment and solutions for satellite tracking and real-time space surveillance ground-based data. Contact Johnny Pappas at Johnny.pappas@safrandatasystemsus.com for more information.

TelspanData
DataHUB Portable
CH10 Recorder, Publisher & Reproducer
Web: www.telspandata.com
TelspanData offers a comprehensive suite of products including DRAGON Portable, 4G LITE, 5G LITE, and DataHUB Portable, designed for reliable and efficient data collection in challenging environments. Their solutions are ideal for a wide range of applications, from military and defense to industrial and environmental monitoring.

Telspan Data, LLC. Booth 13
Centennial, CO  Web: www.telspandata.com

Telspan Data is a leader in ground-based and ruggedized telemetry technologies. We design and manufacture ruggedized recorders, switches, gateways & TAPs along with telemetry ground systems & “data fusion” software. Our Multi-Disciplined product architecture leverages open standards and the latest SoC, data transmission and processing technologies. These products give Instrumentation & Test Engineers unparalleled flexibility and capability as the testing requirements change and grow. Contact Chris Lloyd at Clloyd@telspandata.com for more information.

Trenton Systems Booth T-6
Atlanta, GA  Web: www.wideband-sys.com

Trenton Systems is a small business located in Atlanta that has become a trusted computing innovator for our U.S. military prime contractors. Our core competencies include designing, manufacturing, assembling, testing, and supporting ruggedized HPC solutions for the aerospace and defense industry. For more information contact our Chief Commercial Officer, Sean Campbell, at 770-403-7802.
Session 1: TmNS Devices
Chair: Brian Keating, SA-TECH

10:30am “Development of a TmNS Compatible Radio”
Farhad Daghigh and Brandon Rosso, Curtiss Wright

The Telemetry Network Standards (TmNS) was recently released for the telemetry community in the IRIG 106-19 defining the network-based telemetry system. These standards identify interfaces for configuration, management, network transport protocols, telemetry link, and various other system and component capabilities. TmNS system is a new tool for the flight test telemetry industry and its system requirements touch all of the standard flight test equipment, including data acquisition units (DAU), switches, recorders, radios, and the ground complements such as the antenna and the ground system software. As the development program whines down, the US ranges are rolling out TmNS aware equipment and such is becoming operational on range for current flight test programs. This paper discusses the current progress in developing a TmNS radio, the TTC nXCVR-3140A-2, the status of the radio system and the additional equipment designed to enhance the system performance. The paper concludes with a snapshot of 5G, and other radio solutions, being tested today and intended to support the TmNS of the future.

11:00am “Software Tools for TmNS-Based Systems”
Todd Newton, Southwest Research Institute

As defined in IRIG 106 Chapters 21-28, the Telemetry Network Standard (TmNS) provides a framework for end-to-end network connectivity between instrumentation systems and control rooms. It defines a two-way RF telemetry link, network protocols, and a common configuration language for TmNS components. While the INET program produced the TmNS and tested some of the capabilities of systems based on the TmNS, the task at hand today is how to effectively utilize the TmNS for improving test capabilities on the ranges. The TmNS serves as a toolbox with several tools that have been tested and ready for use in a deployed system. Some of these tools are software tools to help manage, monitor, configure, and control components in the system, and other tools are new capabilities, such as a two-way telemetry link, that can support new and improved concepts of operation. However, there is still room in the toolbox for additional capability support. As ranges look to implement and deploy TmNS systems, their needs may vary from range to range. These needs will lead to the development and refinement of the software tools and capabilities. This presentation will discuss recent flight test results, TmNS software tools, and an implementation strategy for TmNS-based system deployment.

12:00pm “Modern Network Based Data Acquisition Units”
Dan Green, Safran Data Systems

Modern, network-based data acquisition systems are increasing the capabilities of flight test organizations to include increased accuracy, higher data rates and more network friendly data formats. The resulting information flow from the test article to the analysis engineer is more accurate, more flexible and faster than ever before. We will explore what is currently possible with network-based data acquisition systems and where we think we can go from here with future capabilities.

Session 2: Opening the Door to Digital Engineering
Chair: Eduardo Lucero, KBR

11:00am “Advancing the State of Software Engineering in the OT&E Ecosystem”
Ricoh Glover and Melissa Glazener, BrainGu

In this briefing a managed multi-tenant environment that is a platform on which AFTC can cost-effectively orchestrate software development activities in compliance with applicable DoD and Air Force guidance. We refer to it as “Big Bang as a Service” (BBaaS) in the sense that adapts DoD’s accredited software factory paradigm for rapidly building and sustaining applications specific to AFTC’s T&E mission.

12:00pm “Optimizing Antenna Placement Using Modeling and Simulation”
Frank Cruz, DAF, Applied Spectrum Technology Research Office (ASTRO)

This report examines how modeling and simulation (M&S) can be used in the initial design phase to optimize telemetry antenna placement on a Rascal Pod. Multiphysics software was used in the modeling of the antenna, placement on the Rascal Pod, and resulting radiation pattern trade-off analysis. Three locations were chosen to analyze optimal placement with a focus given to ground plane. The goal of the simulations was to optimize radiation pattern uniformity coupled with beam angle dependency. The result of this M&S work identified an optimized location for antenna placement, which is resulting in pod modifications to support the new location.

Session 3: Cellular Telemetry
Chair: Thomas O’Brien, Test Resource Management Center (TRMC)

10:30am “TRMC Overview”
Thomas O’Brien, Test Resource Management Center

11:00am “Analysis of the Application of Cellular Wireless Technology for AMT”
Charles Havasy, Charles Bartlett, Peter Weed, and Hans Miller, The MITRE Corporation

The TRMC is developing a strategic framework for the application of cellular wireless technology to support test missions across the MXRTF locations. The initial focus of this framework was the application of cellular wireless technology to support Aeronautical Mobile Telemetry missions. As part of this framework, MITRE conducted an analysis of different test mission scenarios across multiple use case categories. The analysis looked at the value gained from these technologies and the technical and operational challenges they present as it applies to different use cases over time. A key takeaway the analysis supports is that use of cellular wireless on the range is not a one size fits all migration from existing serial streaming telemetry and that, for the foreseeable future, a hybrid approach of legacy and cellular wireless technology will be necessary depending on the use case. This analysis also highlights that there are several potential trades between components like size, weight and power of an airborne terminal, with the ground station configuration and intersite distances that are essential to understand to most effectively leverage this technology.
11:30am “5G Telemetry Low SWAP Airborne Transceiver”
Achilles Kogiantis, PhD, Kiran Rege, PhD, and Eric Beck, Peraton Labs

A novel 5G compliant airborne transceiver is being designed and developed to support 5G cellular-based aeronautical mobile telemetry (AMT). To support operation at speeds likely to be encountered in airborne telemetry, the transceiver implements the Velocite solution for on-board Doppler pre-compensation. The unit is designed for meet the 5G-enhanced Mobile Broadband (eMBB) service objectives. An overview is given of the airborne transceiver’s overall design approach that includes a commercial 5G mobile modem and a field-programmable gate array (FPGA)-based Doppler compensator. We also describe the planned capabilities of the transceiver and the ground network architecture needed to support cellular telemetry, as well as system-level operation aspects. We conclude with a description of specific design aspects to be considered for AMT, including a ruggedized design for integration with the test airframe to support AMT at the testing range.

12:00pm “5G Cellular Telemetry using Zero-Trust Architecture Principles”
Sampath Rangarajan, Achilles Kogiantis, PhD, Giovanni De Crescenzo, and Ta Chen, Peraton Labs

In this presentation, we discuss a ZTA architecture that we have developed and implemented and the various security features that jointly provide the end-to-end solution and applies to any vertical network implementation. The key features of our architecture are: 1) authentication of the end-point devices, including the IoT devices and the servers, 2) periodic attestation of the software running on these devices to detect any anomalies and malicious behavior, 3) authorization of the devices to communicate with each other, and 4) encryption of the data between the end nodes. Novel features of our solution include: a) Remote attestation of software on the IoT devices, b) Implementation of a hybrid-encryption scheme that uses a combination of public key cryptography and shared symmetric keys, that accommodates resource and battery constrained IoT devices, c) Development of a model for periodic rekeying of the shared keys to satisfy the security requirements as determined by the deployment environment, and d) Use of trusted protection modules (TPM) and trust zones to secure our ZTA software. We illustrate our architecture using an implementation tailored towards a private network environment.

Session 4: Cybersecurity
Chair: Brandon Hyneman, 412 RANS/ENR

10:30am “Coping with Complexity in Security Data”
Steven Schiavoni, 412th Communications Squadron

In addition to the enormous quantity of operational and business data, security tools generate their own overhead of data that can be overwhelming. In addition to the raw generation of security data, the planning that goes into placing the tools gathering the data, the enrichment and analysis, and the operationalization of the insights gathered from the data all add complexity to an already complicated endeavor. As humans we tend to simplify complexity past a certain point, either out of subconscious bias away from dealing with it or out of a misplaced attempt to cut the Gordian Knot in seeking a solution. This presentation will explore the sources of complexity in security, the pitfalls that come with addressing it, and strategies for trying work within the uncertainty complexity breeds rather than tilting at the windmill of “solving” what is frequently an irreducible problem set.

11:00am “Beyond Compliance: Developing a Cyber Defense Mindset”
Jason Schalow, 412th Communications Squadron

With active adversaries who are constantly adapting their cyber tactics and are intent on leveling the technical playing field, the range of the future will need to be capable detecting and defeating active cyber attacks against its key terrain in order to keep critical test and training data out of enemy hands. This presentation will explore what it takes to move beyond the traditional cyber compliance focus and into the active defense mindset required to counter these threats.

11:30am “The CMMC 2.0 Reset: Back to NIST 800-171”
Jeff Kalibjian, Peraton Inc.

The Department of Defense (DOD) introduced the Cybersecurity Maturity Model Certification (CMMC) 1.0 to address the introduction of better cybersecurity practices by federal contractors making up the Defense Industrial Base (DIB). However, the CMMC 1.0 paradigm was daunting—five evaluation levels, mandated third party external audit, with no option for Plan of Action and Milestones (POAMs). Recently the DOD has introduced CMMC 2.0 which attempts to address potential implementation challenges in CMMC 1.0 impacting both Small and Medium Business (SMB) enterprises, as well as large corporations. Evaluation levels have been reduced to three, with a large majority of the DIB now eligible to perform self-assessments. The opportunity to employ POAMs has also been introduced. While indeed a distinct change from CMMC 1.0, CMMC 2.0 still provides an opportunity for the DOD of achieving its goal of gaining better traction with respect to employing robust cybersecurity practices across the DIB. After reviewing CMMC 1.0 and the proposed changes for CMMC 2.0, the implications of these changes will be discussed for federal contractors supporting T & E activities, with emphasis on strategies for implementation, audit and self-assessment.

12:00pm “A Low Cost Data Diode For Cross Administration”
Greg Uhland, Josh Mathis, and Ryan Elder, 96th Range Control Squadron

How to build, test and implement a low cost and approvable Data Diode. The concept of a data diode is straightforward; like its semiconductor namesake where current flows in only one direction, a data diode only allows data to flow in one direction. For the application at hand, the data diode will allow data to flow from one classified network into another classified environment at the same classification level, but with different handling caveats. This solution prevents any data flow in the reverse direction. The data diode described in this paper utilizes a pair of IMC Networks Giga-MiniMc Switching Media Converters, specifically connected to produce the desired one-way data flow effect while preventing data flow in the opposite direction.

Session 5: TmNS Implementation Plans and Lessons
Chair: Thomas Grace, NAVAIR

1:30pm “Refinement of TmNS Capabilities”
Thomas Grace, NAVAIR

Efforts are underway in refining TmNS capabilities and working to ease transitions from existing systems such as Common Airborne Instrumentation System (CAIS) and Chapter 10 recording. Within the RCC Telemetry Group, work has been ongoing for an approach to incorporated Chapter 11 data types into the TmNS networking data structures that will be discussed. Furthermore, discuss the refining of the Metadata Descriptive Language (MDL) in describing component capability attributes and advertising those capabilities in a standardized fashion. Lastly, will briefly touch on test results of some the more advance networking capabilities.

2:00pm “Airborne Network Instrumentation”
Alfredo Berard, 96th Range Support Squadron

In order to support flight testing of a new aircraft platform, the test team at Eglin Air Force Base would require a robust and sustainable instrumentation system that would be easily interoperable with the exiting test infrastructure. In a departure from traditional practice in which the prime contractor would provide the instrumentation system in support of a new aircraft system or sub-system, the System Program Office (SPO) in cooperation with the Eglin Instrumentation Team from the 96th Range Group (96 RN), took the approach in which the Government would specify and procure the test instrumentation equipment (Group B) and provide to the Prime Contractor as Government Furnished Equipment (GFE). The prime contractor, in turn, in cooperation with the Eglin Team, would design the instrumentation modification and install the wiring and mechanical assemblies (Group A) in support of the Eglin provided Group B.

This approach would ensure that all instrumentation equipment (recorders, data acquisition systems, transmitters, etc.) would be standard compliant and remain interoperable with the Eglin Test Range Infrastructure. In addition, the instrumentation team, leveraging technology and instrumentation components developed under an I&M program, developed the first sole network-based instrumentation system.

This network instrumentation system completely abandons the traditional Common Airborne Instrumentation System (CAIS) bus connectivity between components, replacing all linkage between instrumentation components with an Ethernet based architecture. Additionally, the data stream used for real-time transmission of Telemetry (TM) data is no longer based on the legacy Pulse Code Modulated (PCM) format; instead the instrumentation system is utilizing the network...
publishing format of IRIG 106 Chapter 10 data stream; this allows all real-time data to be received as a network (Ethernet) stream which allows for much more options in terms of bandwidth optimization or data prioritization and reconfiguration for future Command & Control capability.

This briefing will outline the formulation of this instrumentation architecture/design and the lessons learned in implementing and testing this design as well as the benefits of this approach in contrast to previous efforts.

2:30pm “NASA AFRC Telemetry Network Technology Implementation”
Bruce Lipe, NASA Armstrong Flight Research Center
Armstrong Flight Research Center performs aeronaunics research for the National Aeronautics and Space Administration at Edwards Air Force California. This presentation will provide an overview of efforts at AFRC to implement telemetry network technology in research aircraft, support aircraft and at the Dryden Aeronautical Test Range.

3:00pm “What is the Future of Telemetry at Armstrong Flight Research Center?”
Tom Young, Deputy Director Mission Operations, Code 600, NASA Armstrong Flight Research Center
Armstrong Flight Research Center executes aeronaunics research and development for NASA. Telemetry is a key data component used to validate the R&D process and more importantly provide a critical safety element. This presentation will offer information that supports efforts to investigate the Future of Telemetry at a Test Range, specifically AFRC.

Session 6: Range Instrumentation
Chair: Douglas H. Nelson, Teknicare, Inc. Firenze

1:30pm “LASER T&E Status at the Point Mugu Sea Range (PMSR)”
Robi Garcia, NAWCWD
PMSR has been directed to develop a robust capability to support Navy High Energy LASER (HEL) testing in a realistic environment. The long distances of the LASER hazard patterns, the evaluation of the LASER beam quality, and characterizing the atmosphere have been the major challenges. This presentation outlines how the PMSR has leveraged ongoing Test Resource Management Center (TRMC) investments in developing solutions to known gaps in HEL testing, nationwide. In addition some internal Naval Air Warfare-funded initiatives will be highlighted, describing upgrades to the TRMC initiatives for maritime conditions, fire control cueing improvements and remote scoring capability.

2:00pm “Directed Energy Low Altitude Maritime Baseline Research and Analysis (DELAMBRA)-I Initial Results”
Justin Lee, NAWCWD
DELAMBRA is an internally funded initiative by Naval Air Warfare Center, Weapons Division (NAWC-WD). In 2014 some initial measurements of optical turbulence by the Navy Post Graduate School at San Nicolas Island on the Point Mugu Sea Range indicated that there is a significant increase in optical turbulence in the lower Maritime Atmospheric Surface Layer (MASL). This feature was confirmed to be non-Kolmogorov in its intensity by NAWC-WD in 2016. The DELAMBRA-I campaign was designed to further research this MASL feature and evaluate sensors appropriate for use on an open-ocean test range. This presentation will provide the overview of the DELAMBRA-I campaigns and some initial findings.

2:30pm “ATMOBUOY Development for the PMSR”
Kyle Edwards, NAWCWD
The Point Mugu Sea Range (PMSR) sponsored a $1.5M Small Business Innovative Research (SBIR) Project to develop a comprehensive deep-ocean buoy that can provide all necessary atmospheric and oceanographic measurements to conduct live-fire testing in open-ocean arenas. This presentation is an overview and development report of the Atmospheric Turbulence, Meteorological and Oceanographic Buoy (ATMOBUOY) initiated in 2019 and completed in 2021. The ATMOBUOY has leveraged small tactical weather station technologies to provide a modular, scalable, and easily deployed system for use on the PMSR. The design is still going through improvements, but the basic capability has been demonstrated during three prototype deployments at sea and a number of shoreline deployments. Sensor accuracy and the future roadmap of improvements will be described in detail.

3:00pm “Directed Energy Test Range Support Instrumentation from Test Resource Management Center (TRMC)”
Jeffrey S. Schleher, American Systems
TRMC acting through PEO STRI (Army) provides various test ranges with sensors, data acquisition systems, and sources (threat representative or to develop US system) to US ranges to support developmental or rapid acquisition testing. This presentation addresses advanced sensors and associated data acquisition systems developed either through S&T projects or acquisition programs. In addition, this presentation is limited to addressing radio frequency test equipment, although we also acquire equipment supporting laser and nuclear effects testing. Advanced Electro-Optical and Magneto-optical sensors for observing high very and low Electrical-Fields (MV/m), and Magnetic-Fields (KA/m) without intruding on those fields are the presentations focus. With directed energy weapons not contributing to the effects on the target as metal probes do is also an important characteristic of these probes. Wide area tests such as counter-Improvised Explosive Devices or counter-Umanned Arial Vehicle test activities portable highly shielded data acquisition systems are also required, and it is always good to give the test director instant information on how well (or poorly) the system under test is performing; the presentation also addresses how that is accomplished.

Session 7: TM Phased Array Antennas: Interfaces, Architectures, and Test Results
Chair: Dan Skelley, Perrygo Consulting Group Tuscany

1:30pm “Framework for a TM Phased Array Antenna Interface Control Document (ICD)”
Dan Skelley, Perrygo Consulting Group
This presentation will describe a set of Interface Control Documents (ICDs) for a Telemetry Phased Array Antenna. The ICDs were created in partnership with the leading developers of Telemetry Phased Array Antennas. As a result, the ICDs are vendor and architecture agnostic. Current and emerging Telemetry Phased Array Antennas, from the major developers, are compatible with the ICDs. While focused on a specific example, mounting a TM Phased Array Antenna on a Gulfstream business jet, the interfaces can be easily adapted to any platform (cargo aircraft, drone, and terrestrial based antenna pedestals, etc.)

2:00pm “Advanced Phased Array Technology for Telemetry Operations”
Satya Ponnaluri and Adam Hartman, Intelligent Automation Incorporated (IAI)
Major range test facility bases across the country use large and small parabolic dishes to track test articles conducting flight tests. The use of dishes however limits performance in terms of portability, efficiency, and number of targets one dish can track across frequency bands. Phased array antenna systems alleviate some of these problems by providing a wider field of regard, while simultaneously tracking multiple targets. Today we see technological breakthroughs in digital technologies such as Xilinx RFSoCs that integrate multiple high-speed ADC/DAC channels and powerful processors such as FPGA in a single chip of size 40 mm x 40 mm. These devices can support sampling rates as high as 5 Gsps with analog bandwidths reaching 6 GHz or more. This has now brought the dream of a truly digital phased array antenna system in a small package to reality. In this talk, we will present an overview of one such all-digital phased array technology, the benefits, challenges and the current state of development and test. This talk will show how a single phased array antenna can replace and provide the function of more than half a dozen legacy parabolic dishes, with improved flexibility, future adaptability, and logistics support.

2:30pm “Applications of Universal Beamforming Technology”
Anand Kelkar, Creative Digital Systems Integration (CDSI)
Universal Beamforming Technology (UBT) has been developed and matured by TRMC through the Spectrum Efficient Technologies (SET) office at Edwards AFB as a lightweight, flexible Telemetry
Emerging Photo-Optical White Sands Test Center (WSTC) — Raven Advanced Phased Array Telemetry hardware onboard the aircraft. Data in real-time during flight, that can be used without additional flight test instrumentation can be optimized, saving the users time and reducing the overall cost of ownership. This paper in the air and sending just the results down over PCM in real-time, the PCM bandwidth usage helps, such as performing analysis on the platform itself. For example, by performing FFT analysis on very dynamic sources in the L band and C-band TM spectrum. The first multi-band application will be a ground-based antenna system using physical shaping to distribute G/T to coincide with specific classes of missions. Technical challenges, successes (and myths) encountered during the development phases are presented for consideration along with the and integration and test methodology.

3:00pm “Raven Advanced Phased Array Telemetry Resource (RAPTR)” Chris Patscheck, Raven Defense

This presentation provides an overview of the design, implementation, testing, and transition to operations of the Raven Advanced Phased Array Telemetry Resource (RAPTR) antenna system to support ongoing telemetry collection requirements at the Atlantic Test Range on board the unique BT-67 airborne test and evaluation platform. The session addresses the importance requirements definition to support rapid acquisition program requirements as delivery schedule becomes a more prominent feature of DoD acquisition strategy. Details of the system characterization and test approach are discussed, showing the incremental confidence building progression of test events leading to the system's first operational use as a test resource.

Session 8: Spectrally Efficient TM Chair: Mike Cook, 412th Communications Squadron

1:30pm “Initial Results on Forward Error Correction for PCM/FM and ARTM CPM” Erik Perrins, University of Kansas

Forward Error Correction (FEC) codes have demonstrated their effectiveness on serial streaming telemetry (SST) links with SOQPSK-TG. This has motivated an expansion of FEC use cases into SST links with PCM/FM and ARTM CPM. However, these additional use cases require FEC codes that are explicitly designed to work with the characteristics of continuous phase modulation (CPM). This presentation outlines the general problem formulation and gives preliminary results on capacity-approaching FEC codes for these use cases.

2:00pm “Observations of 16-APSK C-Band Aeronautical Telemetry System Performance” Daniel DePardo and Erik Perrins, University of Kansas

The implementation of more advanced modulation formats, such as Amplitude Phase Shift Keying (APSK), would increase aeronautical telemetry system spectral efficiency and offer more robust adjacent channel interference performance, in comparison current modulation schemes. This presentation will detail laboratory measurements of 16-APSK telemetry transmitter and receiver prototypes and observations of 16-APSK modulation performance in comparison to SOQPSK-TG and Multi-h CPM.

2:30pm “Optimizing PCM Bandwidth Usage in Flight Test by Real-Time Data Analysis During Flight” Pat Quinn and Brandon Russo, Curtiss-Wright Defense Systems

There is an ever-increasing demand for more data to be captured during flight test, placing more demand on the limited bandwidth available for PCM data transmission. Some strategies can help, such as performing analysis on the platform itself, for example, by performing FFT analysis in the air and sending just the results down over PCM in real-time, the PCM bandwidth usage can be optimized, saving the users time and reducing the overall cost of ownership. This paper discusses data analysis methods, specifically Fast Fourier Transform (FFT) analysis on accelerometer data in real-time during flight, that can be used without additional flight test instrumentation hardware onboard the aircraft.

Session 9: WSMR Instrumentation Chair: Zoe Aguirre, White Sands Missile Range (WSMR), Florentine E. Rangel, WSMR, Range Operations, Lead Engineer/Optics

10:00am “Emerging Photo-Optical Instrumentation Capabilities” Roicio Rangel, WSMR, Range Operations, Lead Engineer/Optics

The new operational paradigm of the photo-optical instrumentation systems integrates modern digital imaging sensors with enhanced networking capabilities through the use of automation and remote functionality for data collection. Critical areas affected by this pivotal shift are the area support non-tracking systems and the precision optical tracking systems. The next generation of area support non-tracking systems requires improved operational concepts and technologies for precision timing, amplification and synchronization across networks and GPS denied environments that extend to the last mile of a digital sensor's position at a test site. The next generation of precision optical tracking systems is the Multispectral Imaging and Tracking System comprised of the Fly-Out Systems for providing long range tracking and the Close-In System for providing short range tracking. With modern imaging subsystems such as Short Wavelength Infrared, Medium Wavelength Infrared, High Speed Visible cameras and Visible Metric Zoom Lenses, motion imagery, phenomenology data and associated metadata will significantly improve the functional performance characterization of the system under test. Collectively, this will provide the Department of Defense Test Ranges with a common set of remotely-operated photo-optical instrumentation systems as evolving interoperable capabilities are enhanced for conducting future operations.

10:30am “White Sands Test Center (WSTC) — Radar Branch TSI Solutions” Brian Johns, WSMR, Range Operations, Lead Engineer/TSI

The Radar Branch at White Sands Test Center (WSTC) collects Real-Time Time Space Position Information (TSPI) from various types of instrumentation radars and Global Positioning System (GPS) equipment. There is a growing need to track smaller and faster targets, more simultaneous targets, and all at an increased accuracy and precision. To accomplish these requirements a US Army Major acquisition program was setup to replace WSTC's 1960-1980 aged radars. A Central Test and Evaluation Investment Program (CTEIP) funded effort was also recently completed to provide WSTC with Common Range Integrated Instrumentation System (CRIIS) that will help solve GPS instrumentation deficiencies. Efforts have also been made locally to come up with solutions to track small drones with Marshall Radio Telemetry systems. The Radar Branch is now poised to expand its capabilities with modern instrumentation and satisfy data requirements for Flight Safety and WSTC's various customers.

11:00am “WSMR Telemetry Capabilities Overview” Jesus Nevarez, WSMR, Range Operations, Lead Engineer/Telemetry

The Department of Defense (DoD) anticipated the eventual sell off of a portion of the Aeronautical Mobile Telemetry (AMT) frequency spectrum (from 1755-1780 and 2155-2180 MHz), prompting the telemetry (TM) community to develop systems with higher spectral efficiency as well as augmented frequency band capabilities. Through the Advance Wireless Systems 3 (AWS-3) funding, White Sands Missle Range (WSMR) augmented legacy telemetry capabilities with systems capable of operating in a portion of the C-Band spectrum (4400-4990 MHz and 5091-5150 MHz) and addressed spectrum efficiency by integrating Tier I and Tier II modulation schemes into the telemetry system architecture. Although these advancements have solved several gaps in telemetry support at WSMR, other gaps created by more complex mission scenarios and a reduced personnel footprint need to be addressed. This brief presents the current telemetry system architecture at White Sands Missile Range and highlights path forwards that will address capability gaps.

11:30am “Switched Optical Transport Networks” Alejandro Salazar, WSMR, Range Operations, Lead Engineer/Transmissions

In recent years, range modernization efforts have been undertaken to provide a transition away from legacy time division multiplexing (TDM) and synchronous optical networks (SONET) technology to more packet centric services and optical multiplexing technology. Dense Wave Division Multiplexing (DWDM) has provided a solution to increase the effective capacity of the existing fiber plant and also provide fast and dynamic provisioning of network connections.
Session 10: Mission Control Room / Distributed Test Operations
Chair: Sean Conway, 412th Test Wing
Firenze
10:00am “Edwards AFB Mission Control Rooms Modernization Upgrades”
Steven Price, 412th Range Squadron
The modernization of current Mission Control Rooms (MCR) at Edwards Air Force Base (AFB) is a multifaceted effort and an ever evolving path that the next generation MCRs will take. One aspect of this modernization is the reduction of the multiple data types utilized (telemetry, timing, video, and audio) in the MCR into network Internet Protocol (IP) infrastructure. An additional avenue of approach to the modernization is the use of emerging technologies. Some of these technologies that are getting implemented into Mission Control Rooms will be IEEE-1588 Precision Timing Protocol to enable nanosecond resolution to ensure synchronization of the system. Virtualized disk drives will be utilized to enhance the security of the system through the reduction of physical drives and reduce data contamination. Through the deployment of Network Device Interface (NDI) software solution for video switching, this will enable extreme cost savings and bring what was completed in hardware to the realm of software. Transitioning to a network-based IP packet infrastructure within the MCR will ensure that the current interface implementation is significantly streamlined and reduced. This brings about the benefit of making the MCRs operational and maintenance support easier for the current and next generation workforce. Some of the challenges that need to be overcome with this multifaceted modernization effort are new equipment required that exclusively has network IP interfaces and the security aspects of having bi-directional network connections while traversing classification levels. Once these challenges have been addressed and the Edwards AFB MCR is running with this new IP based infrastructure, these MCRs will evolve to implement some of the new telemetry data streaming technologies such as, Telemetry Network Standards (TmNS) to allow initial capabilities of configuring the telemetry acquisition equipment present on the aircraft direct from the MCR, and PROTN which will combine telemetry and satellite technology into the testing MCR atmosphere here at Edwards AFB.

10:30am “Using UDP Multicast for Telemetry Data Distribution”
Gary Thom, Delta Information Systems
With the rapid growth of Telemetry over Internet Protocol (TMoIP) for distributing telemetry data on flight test and launch ranges, it is important to understand the benefits of and requirements for using UDP multicast on range networks. While multicast provides many benefits for the efficient distribution of telemetry data, it also imposes some requirements on the network systems for the successful distribution of that data. This paper explores these benefits and discusses the resulting network requirements.

11:00am “Eos – A New Approach to Telemetry Decommutation”
Kevin Tacke and Robert Brainerd, 96th Range Control Squadron
Telemetry decommutation has historically been approached as a hardware solution to process Pulse Code Modulation (PCM) serial data streams. IRIG-106 standards including Chapter 7, Chapter 10, and Chapter 11 have transitioned away from traditional Chapter 4 telemetry to TM-over-IP (TMoIP) solutions, and there is an urgent need to support the multitude of data stream configurations. Eos is a government developed and owned TRL-6 100% software decommutation solution that addresses telemetry from an IP first approach. Eos is designed to adhere to open architecture principles with extensive modularity, allowing rapid implementation and integration of new data processing modules. This product allows easy configuration to process a myriad of IRIG-106 compliant data stream arrangements consisting of various formats, such as, Chapter 4, Chapter 7, Chapter 8, Chapter 10, and Chapter 11. Eos delivers payloads of Engineering Unit (EU) converted parameterized data, digital video frames, audio, or MIL-STD-1553 values to a variety of different output feeds. While Eos is still in development, it is currently employed at the Eglin Test and Training Range (ETTR) to support various TMoIP feeds from the J-15, F-18, and A-10 platforms, demonstrating the core functionality for telemetry decommutation. As this software reaches maturity, it will be a viable option for integration into T&E range architectures that require telemetry processing. Eos only accepts Ethernet input; serial streams can be packetized via commercially available serial-to-IP solutions. The 96th Range Control Squadron at Eglin has committed to adopting Eos as the squadron’s telemetry decommutation solution during the transition away from the existing hardware solution.

Session 11: Current/Future Secure Telemetry Directions
Chair: Ron Pozmantier, Chief Engineer, 812 AITS/ENI
Tuscany
10:00am Check In
This session will contained Controlled Unclassified Information (CUI). Attendance is limited to DoD civilians and DoD contractors only. DoD common access cards (CAC) will be required to be presented and attendees will sign a register at the door.

10:30am “Current and Future Secure Telemetry Bulk Encryption Solutions for Serial Streaming Telemetry (SST) and Telemetry Over IP (TMoIP)”
Ronald Pozmantier, 812 AITS/ENI, DAF
Current SST and TMoIP Solutions will be presented. Current Unified TMoIP Secure Telemetry Program will be presented. Capability and status of the UTMOST Ground Unit will be discussed. Proposed developments UTMOST Airborne Equipment will be presented. Limitations, Flexibilities and Use Cases will be presented for discussion.

11:00am “Commercial Encryption to Secure Your Telemetry Data”
Paul Cook, Curtiss Wright Corporation Defense Solutions
In the United States, the telemetry industry has traditionally relied on the National Security Agency (NSA) to provide leadership and/or solutions to encrypt telemetry data for streaming applications. However, with the current heightened concern to protect data for programs with short development cycles, encryption solutions based on the commercial Advanced Encryption Standard (AES) algorithms offer options that augment the NSA solutions. This presentation describes the development of an encryption — decryption module, and the attendant trades in using AES block-cipher based encryption algorithm for streaming applications, resulting link performance, and the certification choices and requirements.
10:00am “Telemetry Re-radiation Upgrades”  
Nathan John B. Ferrer and Ron Pozmantier, 812 AITS/ENIC, Edwards, AFB  
Basic function, configuration and technical performance information on the current telemetry re-radiation (TTC/CW RTAS-2000) system will be presented. Recent, new mission support requirements and weapons TM signal changes will be discussed, as to how they drove RTAS upgrades requirements. Upgrades to the RTAS TM receivers and TM transmitters that form the system (to support higher TM bit rates, greater link margin, while also supporting on-board recording) will be presented. Impacts of using Low Density Parity Check (LDPC) coding (per IRIG-106-20, chapter 2, appendix 2-D) will be introduced; data quality and spectrum utilization effects will be discussed. Resulting RTAS system performance improvements, that support increased slant range between the test article and the TM acquisition sites will be summarized.

10:30am “Connecting Aircraft Instrumentation Remotes Wirelessly”  
David Hodack, Naval Air Warfare Center, Aircraft Instrumentation Division  
In the aircraft instrumentation world there is always a push to minimize down time during the installation of the instrumentation system. Advances in technology allow the Aircraft Instrumentation Division (AID) to instrument aircraft in a more effective and efficient manner and collect the data in less intrusive ways. There is now a move toward the use of wireless instrumentation technologies to help shorten the instrumentation installation downtime. This presentation will cover the possibility of using a wireless transmission between instrumentation data acquisition unit nodes to eliminate running physical wiring the length of the aircraft. In particular it will look at an AID project that focused on using these wireless techniques for instrumenting a tailhook.

11:00am “Water-proofed Microphone Environmental Test”  
Sid Jones, Naval Air Warfare Center, Aircraft Instrumentation Division  
Water-proofed conventional (covered with a waterproof membrane) and fiber optic microphones were provided by the Wet Aircraft Sound Pressure (WASP) project for testing. The WASP project was developed by the TRMC T&E/S&T Program. The Environmental Testing Lab at Patuxent River ran the sensors through a number of simulated flight test profiles. The Environmental Lab has the ability to simultaneously change temperature, humidity, and pressure altitude (vacuum). So while we can simulate a flight profile, there is no ability to exercise the sensors with a dynamic pressure during the test. The purpose of this test is to see that the sensors can survive a freezing, moisture induced flight profile at altitude, not whether they can operate while frozen.

11:30am “Expanding Versatility with Wireless Instrumentation Systems”  
Grecia Roman and Clinton Mazone, 812th AITS/ENIE  
The 812th AITS/ENIE is researching the effectiveness of using wireless communication in an intra-plane instrumentation system. Motivations are to provide capability to overcome the limitations of wired connections; and to reduce the amount of orange wire in aircraft, aircraft down time, and material cost & weight. Test objectives are to characterize timing over wireless links, prove RF link performance and reliability, and demonstrate functionality in an operationally relevant environment.

Session 12: Airborne Instrumentation  
Chair: Larry R. Dale, Director, 812th AITS/ENI  
Siena

10:00am “Type 1 HAIPPE Encryption for Securing Current and Future Telemetry Data Distribution and Transmission”  
Jason Forte and Ken Ottaviano, General Dynamics Mission Systems  
Presentation will address current Type 1 HAIPPE equipment used to secure network data in transit. The current TACLANE HAIPPE product family will be discussed as they bring unique capabilities to the TMoIP mission space. Latest features such as advanced zeroization techniques, heartbeat signaling, and modern remote management will be discussed. We will also address the use of HAIPPE secure encryption of TMoIP data as related to TMNS. Presentation will conclude with future capabilities for next generation HAIPPE.

11:00am “Open Air Battle Shaping (OABS)”  
Capt. Andrew Haug, USAF  
The term “open air battle shaping” is used to define a family of capabilities that tie in virtual and constructive elements into a live test. This capability is in use today in the operational test of fifth-generation fighter aircraft platforms, and development continues to ensure that open air battle shaping meets the future test and training needs of military aviation. While initially developed for operational test of fighter aircraft, this technology is becoming increasingly important for training and an important aspect of integrated developmental and operational test of all military aircraft. In this presentation, the current state of open air battle shaping will be discussed, and on-going efforts to align the services into a system with ties into test and training range facilities across the United States will be detailed.

11:30am “Data Infrastructure in Pursuit of Big Data Analytics”  
Louis Dube, DAF  
In today’s Agile acquisition world, geographical separation of data stakeholders is becoming standard while the volume of data collection on test assets and ranges is increasing at a rapid rate. Efficient data governance is required to ensure timely and complete access of data to stakeholders to enable accelerated development cycles and advanced data exploration and analysis. In this presentation, the F-35 test enterprise data infrastructure will be used as a case study to demonstrate key tenets of data governance as they pertain to flight test: connectivity between test sites, labs and ranges; opportunities for test ranges to augment and enable next-gen data analytics; and efforts to converge data sources to enable big data analytics, machine learning and artificial intelligence.
**Session 14: Tomorrow’s Airpower…Vision to Victory**

Chair: Dr. Roderick Davis, Air Force Production Facility, Plant 42

1:00 pm  **“412 TW Operating Location Air Force Plant 42”**

Dr. Roderick Davis, 412th Test Wing, Plant 42

In the 1996 movie “Independence Day,” Julius Levinson (played by Judd Hirsch) stated, while trying to explain how the much-speculated Area 51 was funded, “You don’t actually think they spend $20,000 on a hammer, $30,000 on a toilet seat, do you?” Of course, there’s that “whole extraterrestrial-thing.” You’ve seen it, usually on late night TV. It hypnotizes stealth technology and other aeronautical advancements are products of reverse engineering, garnered from other-worldly craft that crashed on our blue-green oasis from the Milky Way galaxy. The reality is found at the heart of America’s Industrial-Military complex; and how government, industry, and out-of-this-world innovation comes together. This presentation will provide a guided tour of the past, present, and future of this rarely-seen realm. Come see … “The truth is out there.”

1:30 pm  **“Air Force Plant 42 … Enterprise … Where No Man Has Gone Before”**

Sandra Stapleton, 412th Test Wing, Plant 42

Got a commercial or military “cool thing” to build, test and fly? We have two 12,000-foot runways and the human capital pool in the Antelope Valley, aka Aerospace Valley, situated in a 5,700-acre industrial production secure landscape for new and emerging programs. We are excited to showcase our Enterprise to support and promote a Total Force integration. We have a mission to explore new opportunities to gain efficiency and effectiveness. Come and learn how we can “do things better together.” It all starts at Plant 42!

2:00 pm  **“Assimilating Cyber Teams in Test and Evaluation”**

Steven Nastally, 412th Test Wing, Plant 42

Testing and evaluating complex software driven weapons systems against Advanced Persistent Threats (APT) within the cyber terrain requires a T&E program and project manager to overcome the challenge of structuring, integrating, and implementing cyber talent in each of the six cybersecurity T&E phases. The evolving terminology and concepts of cybersecurity may be overwhelming to program and project managers with limited or no knowledge of software or hardware development. Models reduce the fog of cyber-techno jargon and provide clarity to a program or project leader who must have a working knowledge of general cybersecurity requirements and the system under test to leverage talent effectively. This talk will review the DOD cyber T&E model which drives the need for specific cybersecurity professionals throughout the acquisition lifecycle. Next, it will examine the information security color wheel which may be used to organize cyber professionals into proficient and effective teams suitable to each cyber T&E phase. Finally, it will explore cybersecurity T&E resources for the audience to further explore and equip themselves with critical knowledge and situational awareness necessary to ensure cybersecurity is integrated throughout a weapon system’s lifecycle.

2:30 pm  **“Enhancing Community Partnership — “I love my job, but ...””**

Chad Morris, 412th Test Wing, Plant 42

For thousands of years military leaders have struggled with the Mission verses People question. Most leaders have adopted the catch phrase “take care of the people, and they will take care of the mission.” What does taking care of the people mean? For all the efforts to build family focused installations, there is only so much that can be done inside the fence line and the world’s most advanced Test and Evaluation industrial plant. This presentation will explore what one “Great American Defense Community” has done to live long and prosper.
ITEA Upcoming Events

• Multi-Domain Operational Environment Workshop: Optimizing the T&E Process for Multi-Domain Operations
  Radisson Hotel El Paso Airport
  July 19-21 | 2022

• 39th International T&E Symposium: Forging the 21st Century T&E Tools in an Era of Great Power Competition
  Westin Virginia Beach, VA
  September 27-30 | 2022

• Cybersecurity Workshop: New Domains in Cybersecurity T&E
  Embassy Suites, Destin, FL
  October 18-20 | 2022

The ITEA Journal of Test and Evaluation, published four times each year, is the premier publication for the Test and Evaluation industry. First published over 30 years ago, The ITEA Journal quickly became and remains a leading journal in the field of test and evaluation, earning its stature as an authoritative international voice and eliciting ongoing acclaim for editorial excellence. Engineers, researchers, technicians, and academicians worldwide look to The ITEA Journal for the valuable information they need.

Each issue serves as a forum for authors of treatises on the cutting edge of testing science and technology, and publishes papers on technical aspects ranging from basic research to applied research and development to operational testing. The ITEA Journal brings you the details of developments in this rapidly expanding area of technology long before they are commercial realities.

The ITEA Journal archives contain an extensive resource collection covering all the developments and trends in the test and evaluation field as they originated and evolved, an unsurpassed treasure trove of information at one’s fingertips! ITEA members receive free, unlimited, online access to the current issue as well as the issue archives.

Upcoming Issues

• Test and Evaluation and Digital Data Strategy
  June 2022 (Issue 43 No 2)

• Digital Engineering’s Impact on Test and Evaluation
  September 2022 (Issue 43 – Vol 3)

• Cyber T&E — Testing for Resilience
  December 2022 (Issue 43 – Vol 4)

• Test and Evaluation across the Acquisition Lifecycle
  March 2023 (Issue 44 – Vol 1)

Articles of general interest to ITEA members and The ITEA Journal of Test and Evaluation readers are always welcome, and authoring these articles is a great way to contribute to our industry. Authors do not need to be ITEA members. For more information contact journal@itea.org.

Mini Sextant Tracking Mount

Photo-Sonics is pleased to announce the addition of the Mini-Sextant to our line of optical tracking mounts!

The Mini-Sextant is designed to collect TSPI and 6DOF data from high dynamic airborne targets.

The Mini-Sextant can be equipped with up to four long range optical sensors
The Certified Test and Evaluation Professional (CTEP) Credential

Now Offering Two Levels of Certification

**Foundational** certification will be awarded to candidates with a Baccalaureate Degree and 1 year of relevant T&E work (or equivalent) and successfully pass the Foundational exam.

**Practitioner** certification will be awarded to candidates with a Baccalaureate Degree and 3 years of relevant T&E work experience (or equivalent) and successfully pass the Practitioner exam.

**PURPOSE OF THE CTEP CREDENTIAL**

*Elevating the Test and Evaluation Profession with a Globally Recognized Credential*

- 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.
- 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.

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. A committee of T&E subject matter experts (SMEs) has been involved in the development of these new credentials over the past year. 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.

**Test and Evaluation Courses Offered:**

- Short Courses 1–5 days (in person, virtual or in modules)
  - Fundamentals of T&E Process
  - What T&Er’s Need to Know about Program Management and System Engineering and Why
  - Cyber Security and Information Assurances
  - Operational Design of Experiments for the T&Er
  - STAT Scientific Test and Analysis Techniques
  - Systems T&E Skills, Traditional and Agile

Contact education@itea.org to learn more.
## Schedule At A Glance

### Tutorial Rooms

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Florentine F</th>
<th>Florentine G</th>
<th>Tuscany</th>
<th>Firenze</th>
<th>Siena</th>
<th>Halls</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 PM to 5:00 PM</td>
<td>Troubleshooting Ethernet Data with Wireshark</td>
<td>Telemetry over IP</td>
<td>5G NR Specification &amp; System Engineering Aspects</td>
<td>IRIG 106-17 Chapter 7 Packet Telemetry Downlink Basis &amp; Implementation Fundamentals</td>
<td>Fundamentals of Telemetry Ground Stations</td>
<td>OPEN</td>
<td>Halls</td>
</tr>
</tbody>
</table>

### Hands-On Lab

**Florentine F/G (1:00 PM – 5:00 PM)**

### Session Rooms

#### Technical Sessions:

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Firenze</th>
<th>Tuscany</th>
<th>Siena</th>
<th>Florentine F</th>
<th>Florentine G</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:30 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:30 PM to 5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Lunch in the Exhibit Hall

Come visit the Exhibitors and enjoy some refreshments!

### Plenary Session

**Florentine A**

"Test Range of the Future – Implications on Test Design and Instrumentation”

Featured Speaker: Hans Miller – Project Leader, OSD Programs, The MITRE Corporation

### Reception in the Exhibit Hall (5:00 PM – 7:00PM)

### Tutorial Rooms (Tues., May 17)

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Tuscany</th>
<th>Firenze</th>
<th>Siena</th>
<th>Florentine F</th>
<th>Florentine G</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 AM to 10:00 AM</td>
<td>Basic Overview of Telemetry</td>
<td>Test Foundations for Flight Test (Part 1)</td>
<td>Test and Training Solutions with TENA, JMETC, and BDKM</td>
<td>Basics of Aircraft Instrumentation Systems (Part 1)</td>
<td>OPEN</td>
<td>CLOSED</td>
</tr>
<tr>
<td>10:00 AM to 12:30 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:30 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:00 PM to 5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hands-On Lab

**Florentine F/G (1:00 PM – 5:00 PM)**

### Session Rooms (Wed., May 18)

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Firenze</th>
<th>Tuscany</th>
<th>Siena</th>
<th>Florentine F</th>
<th>Florentine G</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 AM to 12:00 AM</td>
<td>9. WSMR Instrumentation</td>
<td>10. Mission Control Room / Distributed Test Operations</td>
<td>[CUI] Current/Future Secure Telemetry Directions</td>
<td>12. Airborne Instrumentation</td>
<td>OPEN</td>
<td>4:00 PM</td>
</tr>
<tr>
<td>12:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:00 PM to 3:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:00 PM to 5:00 PM</td>
<td>14. Tomorrow’s Airpower… Vision to Victory</td>
<td>15. Hypersonic Range Readiness &amp; Gaps</td>
<td>[CUI] Artificial Intelligence/Machine Learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Lunch in the Exhibit Hall

Come visit the Exhibitors and enjoy some refreshments!

### Plenary Session

**Florentine A**

“Where is the Range of the Future?”

Featured Speaker: Tom Dowd, (SES) – Director, Ranges / Targets Operations, Instrumentation & Labs, Naval Air Warfare Center Weapons Division, Naval Air Systems Command

### Reception in the Exhibit Hall (5:00 PM – 7:00PM)

### Tutorial Rooms (Thurs., May 19)

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Firenze</th>
<th>Tuscany</th>
<th>Siena</th>
<th>Florentine F</th>
<th>Florentine G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 PM to 3:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:00 PM to 5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hands-On Lab

**Florentine A**

Closing Keynote: George Rumford, (SES) – Director (acting) and Principal Deputy, Test Resource Management Center (TRMC)

### Reception in the Exhibit Hall (5:00 PM – 7:00PM)

### Tutorial Rooms (Fri., May 20)

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Firenze</th>
<th>Tuscany</th>
<th>Siena</th>
<th>Florentine F</th>
<th>Florentine G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 PM to 3:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:00 PM to 5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hands-On Lab

**Florentine A**

Featured Speaker: Craig Miller — President, Viasat Government Systems

### Reception in the Exhibit Hall (5:00 PM – 7:00PM)

### Tutorial Rooms (Sat., May 21)

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Firenze</th>
<th>Tuscany</th>
<th>Siena</th>
<th>Florentine F</th>
<th>Florentine G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 PM to 3:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:00 PM to 5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hands-On Lab

**Florentine A**

Featured Speaker: Tom Dowd, (SES) – Director, Ranges / Targets Operations, Instrumentation & Labs, Naval Air Warfare Center Weapons Division, Naval Air Systems Command

### Reception in the Exhibit Hall (5:00 PM – 7:00PM)

### Tutorial Rooms (Sun., May 22)

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Firenze</th>
<th>Tuscany</th>
<th>Siena</th>
<th>Florentine F</th>
<th>Florentine G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 PM to 3:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:00 PM to 5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hands-On Lab

**Florentine A**

Featured Speaker: Craig Miller — President, Viasat Government Systems

### Reception in the Exhibit Hall (5:00 PM – 7:00PM)

### Tutorial Rooms (Mon., May 23)

<table>
<thead>
<tr>
<th>Time</th>
<th>Florentine E</th>
<th>Firenze</th>
<th>Tuscany</th>
<th>Siena</th>
<th>Florentine F</th>
<th>Florentine G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 PM to 3:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:00 PM to 5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hands-On Lab

**Florentine A**

Featured Speaker: Tom Dowd, (SES) – Director, Ranges / Targets Operations, Instrumentation & Labs, Naval Air Warfare Center Weapons Division, Naval Air Systems Command

### Reception in the Exhibit Hall (5:00 PM – 7:00PM)
Thank you to the Hands-On Lab SME and participating vendors:

- DEWESoft
- Safran Data Systems
- CALCULEX
- Curtiss-Wright TTC
- Lumistar
- DIS | GDP
- DIS | Acroamatics
- Parraid, LLC
- Curtiss-Wright IADS
- DELL Technologies with CHEETAS
- ATAC with DPS and Project OPAL

Hands-On Lab Experience

The Hands-On Lab (HOL) is a holistic journey through the entire flight test process. HOL represents seven different phases of flight test. Each of the phases is supported by a government Subject Matter Expert (SME) and partnering industry vendors. The SME provides an educational overview and the partnering industry vendors share a Hands-On experience with technical insight related to the specific phase they are representing.

This experience was designed to allow attendees an opportunity to follow the flight test process through visualization of the signals, sampling of the data, interaction with the processes, understanding how changes in the test article translate to results in the test data, and how system formats are designed to be standardized for improved test interoperability, providing the integration of different vendors to achieve Development Test & Evaluation (DT&E) success.