Tuesday, May 11th – Pre-Workshop Tutorials

NOTE: Pre-Workshop Tutorials require a separate fee from the Workshops.
Single Tutorial - $205, Two Tutorials - $385 (use discount code "Tutorial-Multi" at check out).

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

Basics of Aircraft Instrumentation Systems

Bruce Johnson, NAWCAD

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.

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

Johnny Pappas, Safran Data Systems, Inc.

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.

Predictive Analytics for Performance Assessment

Mark J. Kiemele, Air Academy Associates

Design of Experiments (DOE) is a method that can and should be used not only in the design and development of systems, but also in the modeling and validation of system performance. Building useful prediction models and then validating them can ease the burden of making procurement decisions. This tutorial will examine two prototypes that are built to satisfy a common set of requirements. DOE will be used to model the performance of each prototype. Then validation testing will be used to confirm the models and assess the performance capability of each prototype, i.e., how well the prototypes meet the requirements. This facilitates a comparison of the capabilities of the two systems, thereby enhancing the decision as to which system to pursue. There are no pre-requisites for this tutorial, as the analysis will be demonstrated via computer.

Troubleshooting Ethernet Data with Wireshark

Paul Ferrill, ATAC

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

Video and Video Compression

Gary Thom, Delta Information Systems

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

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

JPEGXS vs H.264/H.265: Why JPEGXS is Better, Faster, and More Reliable

Paul Hightower, Instrumentation Technology Systems (ITS)

There are three ways to see video; uncompressed, lightly compressed and highly compressed. For the small screen highly compressed video is widely used. For the big screen and for content generation lightly compressed video may be used. The best video of course is uncompressed. Uncompressed video delivers to your eyes what the camera sees; all the detail and all the colors with near instantaneous presentation (no latency). Few of us ever experience this level of video because storage and transport bandwidth simply cannot meet the requirements for its use. Very high end equipment is needed which quickly becomes out of economic reach except for the most demanding purposes.

Enter video compression technologies. Video compression has evolved to address transport and storage issues in general. However, two strategies emerged. The Motion Picture Experts Group (MPEG) focused on transport in narrow band environments and low storage capacity while maintaining good image quality. The Joint Photographic Experts Group (JPEG) remained image quality focused thus requiring more storage capacity and broader bandwidths for transport. MPEG became the most widely used system since endpoint distribution to the masses had to be delivered over narrow band channels (e.g., television, cable, satellite). At the turn of the century, storage costs were still high providing an additional economic pressure to reduce the size of video archived files. Compression ratios of 500:1 or more is needed to meet these challenges. MPEG 4 part 10 (aka H.264) met these challenges and is the most widely used compression system for video. As 4K video emerged, even more compression was needed (up to 2000:1)which was met with the development of H.265 (aka HEVC). H.264 and H.265 (HEVC) and produce relatively good image quality for the small screen in transport bandwidths of less than 10 Mb/s. The image quality is not good enough for the big screen and is not used. The compression tools used in MPEG also introduce significant latency from source to destination. Latency can be as high as 10 seconds! However, for distribution of pre-recorded videos latency is not an issue. It does limit its uses for man-in-the-loop applications such as camera positioning. MPEG enabled widespread distribution but compromises the image quality delivered by the camera. VCR features like fast forward, single step, and backwards play is difficult if not impossible. The high compression also increases the opportunity for corruption and total video stream loss with transport noise and packet loss.

In the year 2000, JPEG changed the underlying method of image compression to one which can provide light compression that is visually lossless when compared to the original image. Other advantages are very low latency (under a millisecond is achievable) more resilience to transport noise, full VCR playback features. Over the past ten years, storage costs have become miniscule and transport bandwidths have grown from a few megabits/second to tens of gigabits/second. These advances now enable a wider use of lightly compressed video using the JPEG standard. The new JPEG XS is a fast, low latency, low complexity, and visually lossless compression system for video streams. Combined, JPEGXS encoding offer the engineering and test community far superior image quality for evaluation and performance studies. Man-in-the-loop applications become practical due to the low latency. Frame-by-frame imagery is identical to that which the camera captured thus delivering all the investment made in the camera and lenses to your eyes. Each frame is individually encoded delivering high image quality at each frame, eliminates Group of Picture (GOP) image loss and enables smooth forward/reverse and frame step playback. Images reconstructed from a JPEGXS encoder exhibit no macroblocking and introduces few if any artifacts of compression.We will explore all these issues in depth and explain why JPEG XS is able to deliver these benefits.

iNET Telemetry Networks

Thomas Grace, NAVAIR

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

Real World Telemetry over IP

Gary Thom, Delta Information Systems

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

TENA, JMETC, and BDKM for Distributed Testing

Gene Hudgins, JMETC/TENA

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

JMETC is a distributed LVC testing capability developed to support the acquisition community during program development, developmental testing, operational testing, and interoperability certification, and to demonstrate Net-Ready Key Performance Parameters (KPP) requirements in a customer-specific Joint Mission Environment.

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

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

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

JMETC has demonstrated that applying enterprise distributed BDA tools and techniques to T&E, leads to faster and more informed decision making that reduces overall program cost and risk. This presentation 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.

Test and Evaluation of Laser and Electro-Optical Systems

Douglas Nelson, Teknicare, Inc.

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