Thursday, October 23rd

NOTE: Short courses are a separate fee from the Conference.
Half-day course $500

1:00-5:00 FUNDAMENTALS OF AERONAUTICAL GROUND TELEMETRY SYSTEMS
Instructor: *Mark McWhorter, Lumistar*

This course will present a high-level overview of the fundamental design of a typical range telemetry data ground system. Topics to be discussed will include the major sub-systems and components used, such as auto-track antenna, multicoupler, receiver/combiner, demodulation, bit synchronization, data recording and playback, time, decommutation and simulation, and real-time displays 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. A section on system calibration and periodic maintenance will be presented. After having completed the course, the student will have a better understanding of concepts related to RF and data processing of flight telemetry on the ground side.

1:00-5:00 INTRODUCTION TO ANALYZING ETHERNET DATA
Instructor: *Jason Berry, JT4*

With the proliferation of Ethernet as a data transport on multiple commercial and military aircraft and weapon systems it is becoming even more important to get a basic understanding of how to analyze Ethernet data. This course will start with an introduction to the OSI model and lay out the basics that make up Ethernet traffic. Then we'll look at the open source Wireshark program and go through a crash course in using it to examine different types of Ethernet traffic. We'll also examine wireless traffic and how it differs from traditional wired Ethernet. Finally, we'll look at using the Python programming language along with several libraries to actually analyze and decode data embedded in Ethernet traffic.

1:00-5:00 OVERVIEW OF MACHINE LEARNING AND DATA ANALYTICS APPLICATIONS USING PYTHON
Instructor: *William (Bill) Schneider, Dell EMC*

Machine learning has become an indispensable tool for processing the large and complex data structures being collected by modern sensor and data acquisition systems at every Test Range. This course will cover the fundamentals of data manipulation, visualization, and machine learning with open source tool python in the context of typical time series data acquisition applications, and provide an overview of intermediate and advanced modeling. Public data sets will be used for illustration and demonstration activity. Basic knowledge of programming in any language is assumed, but not necessarily advanced knowledge of Python. No previous experience with machine learning is assumed.

1:00-5:00 INTRODUCTION TO SATELLITE COMMUNICATIONS AND TELEMETRY STANDARDS
Instructor: *Robert Ritter, IMI Technology*

The Introduction to Satellite Communications short course provides an overview of the theories and international standards for various means of space communications. It includes descriptions of practical applications for high-latency and error-prone links, describes the RF link characteristics, modulation schemes, various forms of error detection, correction and compression, practical mechanisms for data networking in space, considerations for IP, concerns over security, new applications of short and medium distance links, and interoperability interests between civil and defense systems. Questions related to new standards proposed for user interfaces are also explored. Optical communications and the new proposed Unified Space Link Protocols will also be introduced as the path forward for the international standards body, CCSDS (the Consultative Committee for Space Data Systems).

1:00-5:00 SENSOR-PRINCIPLES OF DATA ACQUISITION SYSTEMS
Instructor: *John Moors, Diversified Technical Systems, Inc.*

This course provides an overview of the fundamentals of collecting data in flight test, from the physics of what is being measured through analog to digital conversion. Topics include: sensor theory, common sensors and limitations, shunt and empirical checks, data acquisition system features and functions, anti-alias filtering, sampling error, analog considerations of channel to channel time synchronization, grounding and shielding, and specifying a complete system. Compared to others, this course is more "analog" in nature, focusing on the physical measurement before data is formatted and streamed. Real-world examples are explored along with common field-testing challenges.

1:00-5:00 SERIAL STREAMING TELEMETRY ENCRYPTION
Instructor: *Albert Gabaldon, NAWCWPNS*

This course will present a high-level overview of the fundamental concepts behind classical and modern secure telecommunication encryption systems. It is intended for a student looking to grasp a basic understanding of a highly complex but ubiquitous technology. The course will be limited to commercial encryption. The specific emphasis will be on implementations of the Advanced Encryption Standard (AES) with IRIG106 Chapter 4 serial streaming telemetry.

1:00-5:00 TELEMETRY OVER IP
Instructor: *Mark Roseberry, NetAcquire Corporation*

This course begins by introducing the capability of transporting PCM telemetry over an IP network (TMoIP), including discussion of the benefits and limitations of this technology. The three key RCC IRIG standards for TMoIP are described: IRIG 218, IRIG 106 Chapter 10 over UDP, and TmNS. Interactive and scripted setup, configuration, status, and diagnostics approaches are presented.

Advanced topics include minimizing latency, handling poor-quality WAN networks, inter-vendor interoperability, reliability and redundancy, one-to-many and mesh networks, configurable quality-of-service, and time/data correlation. The course ends with an overview of current and future trends in IP convergence and cloud-based architectures. Familiarity with basic networking and serial PCM telemetry concepts is presumed.