



Thursday, October 29th

NOTE: Short courses are a separate fee from the Conference.

Half-day course \$550

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: Paul Ferrill, Avionics Test and Analysis Corporation

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 **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 **IRIG CHAPTER 7 PACKET TELEMETRY DOWNLINK BASIS AND IMPLEMENTATION FUNDAMENTALS**

Instructor: *Dan Green, Safran Defense & Space, Inc.*

This course will focus on presenting information to establish a basic understanding of IRIG 106, Chapter 7, Packet Telemetry Downlink Standard. It will focus on the implementation of airborne and ground system hardware, what to consider for use cases using Chapter 7 Packet TM and methods to handle Chapter 7, Packet Telemetry data on the ground. The class will address how to multiplex packet telemetry into your existing IRIG Chapter 4 legacy PCM stream. Other subjects such as latency, compatibility with Test Range Instrumentation System compatibility such as RF Transmission, data recording, RF Receiving, Ground Reproduction, and Chapter 10 data processing methods.

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 **PHASED ARRAY ANTENNAS**

Instructor: *Anand Kelkar, CDSI, Inc.*

This course is designed for entry-level engineers, technical managers, or students with a basic electrical engineering background seeking to understand how multiple antenna elements collaborate to steer a beam electronically without physical movement. We begin with an introduction to phased array systems through the lens of ray-optics principles, followed by a comparative analysis of the benefits and trade-offs between dish antennas and various phased array designs. We will then explore array fundamentals, specifically focusing on how element and array factors contribute to the overall antenna pattern. This section delves into beam steering approaches across different geometric configurations and addresses critical design consequences such as sidelobes, grating lobes, beam squint, and inter-element mutual coupling.

The course then examines modern design approaches by highlighting the distinctions between active and passive arrays, alongside the advantages and complexities of analog, digital, hybrid, and optimal beamforming techniques. Moving into practical applications, the session covers instrumentation and implementation details specifically for telemetry, emphasizing the role of



modeling and simulation during the design phase. To ensure a comprehensive understanding. Calibration and testing techniques for verifying the underlying assumptions of the design are explored. The program concludes with a challenging real-world case study and solution, followed by a summary and a Q&A session.

1:00-5:00 **SERIAL STREAMING TELEMETRY ENCRYPTION**

Instructors: *Albert Gabaldon & Jaron Guisa, Naval Air Warfare Center, Weapons Division*

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.