GSAW 2018 Tutorial E:

Standards for Ground and Space Communications (CCSDS)

Length: Half day

Overview:
This tutorial provides an overview of the Consultative Committee for Space Data Systems (CCSDS) standards for communications. It includes an organizational and technical background to the standards that have been adopted by a majority of the world's space agencies. It presents descriptions of the publications and adopting agencies, and example protocol implementations for ground-ground, ground-space and space-space communication links. It provides a graphical depiction of the CCSDS protocol stacks with references to the more common OSI stack. It includes specific descriptions of the optimized stack components for high-latency and error-prone links, and includes basic frame and packet formats. It also addresses issues such as security, authentication, encryption, error detection/correction, and co-use of assets (including DoD and civil programs). The course focuses on standard commanding, telemetry and node-to-node communication operations for spacecraft, and also covers the growing interest of adapting bi-directional IP links to space and other high-latency, error-prone networks. It also introduces broad new changes being considered for CCSDS which include USLP, adaptive coding, and optical communications standards.

Course Outline
- About CCSDS
- Members
- Publications
- Missions
- Why Standardize
- DoD and Civil Space cooperation and differences
- Optimizations for Space and Ground
- General ground and space architectures
- OSI and CCSDS Stack
- SLE
- COP-1
- CFDP
- IP Encapsulation
- PROX-1
- Delay Tolerant Networking
- Security and Encryption
- SOA and CCSDS
- Modulation techniques
- Error Detection and Correction
- PCM Formatting
- Frame Formats
- Packets
- Commanding and Verification
- Telemetry
- Asynchronous Messaging Service

- Global initiatives in broadening interface standards
- Unified Space Link Protocol
- Optical communications standards

Instructor: Robert Ritter, RT Logic and Integral Marketing

Biography:
Mr. Robert Ritter is the VP and , Chief Engineer in the manufacturer's representation firm, Integral Marketing. He was formerly a Director of Communication Systems Engineering for RT Logic Corporation, of Colorado Springs, Colorado, and founder of the telemetry products group for Avtec Systems, Inc., of Chantilly, VA. He has more than 30 years of experience in designing ground system architectures for satellite missions, and data communication networks. Robert has been involved in many worldwide programs implementing CCSDS Standards, and he has worked closely with DoD, NASA, NOAA and other agency personnel to find practical means for standards adaptation and co-utilization of assets. He has designed boards for communications and signal processing, has written signal processing and simulation software, and has taught numerous courses in the past, including CCSDS in many international locations. Mr. Ritter has a BSEE from the University of Virginia, an MSEE from Virginia Tech, and an MBA from George Mason University.

Description of Intended Students and Prerequisites:
Students should have a general technical competency and understanding of communications theory, protocols and systems.

What can Attendees Expect to Learn:
The CCSDS tutorial is an introductory program for engineers and managers who are designing or specifying spacecraft ground or space communication systems. It is applicable for spacecraft designers who are contemplating adaptation of standards for buses and payloads. It is also useful for mission planners and space agency personnel who are involved in specifying or approving communication and control systems.