GSAW 2019 Tutorial F:

CCSDS Course – Review of the International Standards for Space Communications

Length: Half day

Overview:
The CCSDS 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 descriptions of practical applications for high-latency and error-prone links, reasons to include different forms of forward error correction and compression, practical reasons for using packets in space, considerations for making everything IP-based, concerns over security, new applications of short and medium distance wi-fi techniques, and interoperability interests between civil and defense systems. Questions related to new standards proposed for user interfaces are also explored. The new proposed Unified Space Link Protocol will also be introduced as the path forward for CCSDS.

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
- Introduction to the new Unified Space Link Protocol stack

Instructor: Robert Ritter, Integral Marketing

Biography:
Mr. Robert Ritter is the Chief Engineer and a partner in the manufacturer's representation firm, Integral Marketing and was formerly a Director of Communication Systems Engineering for RT Logic. He has 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, ESA 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 many CCSDS courses around the world. 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:
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. Students should have a general technical competency and understanding of communications theory, protocols and systems.

What can Attendees Expect to Learn:
Attendees will gain insight into the broad CCSDS standards of space communications used by a majority of the world's space agencies. There are hundreds of publications representing a wide array of challenges facing space program engineers and managers, and this course will help put the standards into perspective for considerations related to both civil and defense space missions.