

## **GSAW 2015 Tutorial D:**

Introduction to Satellite Communications: Satellite Telemetry and Command Paths

**Length:** Half day

### **Overview:**

This session focuses on the digital processing of telemetry and command data as well as the ground network equipment. This half-day session extends last year's tutorial with the following:

- telemetry and command processing, including common CCSDS recommendations, SLE, and decommutation
- WAN and other networking considerations
- IP encapsulation
- Timing throughout the ground system

This half-day course provides attendees an introduction to digital satellite communications with a focus on the telemetry and command paths. Attendees will follow the flow of satellite telemetry and commands between the space-vehicle and the operator. Each step in the path (spacecraft, space link, antenna site, ground network and control center) is described; areas of complexity discussed; criteria for architectural decisions are highlighted; and technology trends are presented.

### **Course Outline**

- Introductions and Architectural Overview
- Telemetry Path
  - Onboard the Spacecraft
  - Space Link
  - Antenna Site
  - Ground Network
  - Control Center
- Command Path
  - Control Center
  - Ground Network
  - Antenna Site
  - Space Link
  - Command Verification
- Industry Trends
- Closing Question / Answer Session

**Instructors:** Rob Andzik, Randy Culver, and Dennis Connors, AMERGINT Technologies

### **Biographies:**

**Rob Andzik:** I love working in the space industry. I graduated from CU with a BS in Aerospace Engineering and Computer Science. Previous experience at Lockheed Martin and RT Logic. I am co-chair of the OMG Space Domain Task Force and co-author of the Ground Equipment Monitoring Service (GEMS) specification.

Fun Fact: I enjoy spending time with my family and riding my mountain bike. I also work with a small relief organization in Kenya and Ethiopia called Lalmba.

**Randy Culver:** I enjoy working with our customers to understand what they need to implement their systems. Systems Architect/Manager for 25+ years. MSEE – Purdue, BS – VA Tech ... Go Hokies! Prior Experience at IBM and RT Logic.

Fun Fact: Bike racing, travel, and outdoor activities keep me entertained.

**Dennis Connors:** I enjoy the theoretical side of modern design and algorithm design. Ph.D. E.E. – UCLA, MSEE – UCLA, BSEE – San Jose State University. Prior Experience at L3, NextWave Wireless, Trellisware Technologies, ViaSat, Texas Instruments, and Hughes Research.

Fun Fact: Raised just outside of Yosemite National Park, California; recent transplant to Colorado

#### **Description of Intended Students and Prerequisites:**

Students should be familiar with the space domain and have a basic understanding of satellite operations.

#### **What can Attendees Expect to Learn:**

Upon taking the course, students will have an understanding and appreciation of the ground and space communication links and the complexities involved.