Principles of Communications and Networks

Course Description:

The critical role of communications and networking in the defense community is widely recognized. The field is both broad and dynamic; while progress proceeds at a phenomenal pace, new issues and problems arise almost as fast. The underlying principles, however, change either slowly or not at all. A conceptual understanding of these principles can help those who work in all aspects of the field see the forest through the ever-changing trees. The course presents an introduction to the technical concepts that underlie the field: analog and digital communications, packet and circuit switching, voice and data networks, and the physics of radio, terrestrial, and satellite links.

OBJECTIVE

This course is intended to provide an overview of the key principles of communications and networking theory, using operational military communications systems to illustrate these principles. This is not an instruction course on how to design or operate specific systems, although it can help all technical professionals understand the nuances of their systems better. Rather, the objective is to provide a mixed technical and non-technical audience with a conceptually rigorous technical foundation. It deliberately covers a wide array of topics, based on the view that in the future all forms of military communications and networking will be tied more closely together, and thus a broader understanding will be of use to all. If successful, this course will further allow the graduates to converse more intelligently with subject-matter experts, and pave the way for further learning in more specific areas. While equations are kept to a minimum, the concepts presented are rigorous.

WHO SHOULD ATTEND

Those who have responsibilities for planning, acquiring, managing, monitoring, operating, and/or regulating communications or networking programs or systems in a military-oriented environment. The course is specifically intended for those who do not have an extensive formal background in the principles of communications but find themselves in a position where such a background would prove useful. It should also be of interest to engineers trained in other areas, and communications specialists seeking to review and expand their knowledge of the theory and practice of military communications.

COURSE OUTLINE

Day 1: Fundamental Communications Principles

- Electricity and the Origins of Modern Communications
- Monochromatic Waves and Superposition
- Modulation; Frequency Division Multiplexing
- Sine Wave Orthogonality – OFDM
- Radio Waves
- Dipole Antenna Radiation
- Analog Modulation: AM & FM
- The Link Budget Equation

Day 2: Digital Signals and Communications

- Digital Signals and Digital Signal Processing
- Time Division Multiplexing
- Bandwidth of Digital Signals
- Nyquist Bandwidth and Shannon's Law
- Digital Modulation Techniques
- Modulation and Pulse Shaping
- Channel Encoding

Day 3: More Digital Communications; Introduction to Networking

- More Channel Encoding: E_b/N_o
- Digital Radios and Software Defined Radios
- Networking; The Original Electric Network
- Voice Networking and Circuit Switching
- Packets and Virtual Circuits
- Protocols
- Local Area Networks; Ethernet
- The Internet: Origins and Basic Concepts
- Quality of Service

Day 4: Special Topics (requestors may choose 3-4 after discussion with lecturer)

- Code Division Multiple Access (CDMA) / Spread Spectrum
- Fiber Optics and Optical Carriers / Networks
- Cell Phone and "Wireless" Technologies
- Net Centric Warfare
- Military Satellite Communications – Narrowband, Wideband, Protected
- Global Positioning System (GPS)

LECTURER

Mr. Terry L. Stockholm

Terry Stockholm is a retired Air Force Lieutenant Colonel in Communications/Electronics and Information Technology Specialist with over 35 years of expertise in the C4ISR arena. He has served at FEMA as the Deputy Chief of IT operations and Chief of IT Disaster Operations nationwide. He was a contractor supporting DHS CIO during the standup of that department, division chief in the DHS Wireless Management Office, and after Hurricane Katrina was tapped by the Secretary of Homeland Security to evaluate and recommend changes to ensure all levels of responders can communicate during a similar disaster. He had multiple tours at national and international spectrum management offices and deployed to Operations Desert Storm and Provide Comfort as a Senior Communications Planner. He has commanded a communications squadron and served a tour of duty on the National Airborne Operations Center supporting the President in nuclear command and control. He attended the Communications-Electronics Maintenance Officer School, Inter-Service Radio Frequency Management Course, U.S. Marine Corps Command and Control Systems Course and the Air War College. Terry holds a Master's in Systems Management from the University of Southern California and a Bachelor's in Chemistry and Biology from Wright State University.

HOURS OF COURSE: 8:00 AM to 4:30 PM. Sign in at the classroom commences at 7:30AM.

DRESS: Business Casual