Fundamentals of Antenna for CNS Systems

Instructor: Dr. Chris G. Bartone, P.E., Associate Professor, Ohio University, School of Electrical Engineering and Computer Science
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Prerequisite: Knowledge of electrical engineering, computer science, and mathematics will be useful.

Overview: This course begins with fundamental background for antenna systems. Data will be presented on the basics of several CNS Systems; voice and data Communications, Navigation (GPS, ILS, MLS, VOR, DME), and Surveillance (i.e., Radar, ATC, Mode-S) systems. Primary Radar will be covered, but not emphasized in this course. Various CNS antennas will be highlighted with respect to their size, cost, complexity, mounting consideration, radiation characteristics, and performance.

Course Content:

Antenna Fundaments:

1) Introduction to Antennas
2) Fundamental Parameters of Antennas
   - Radiation Resistance
   - Radiation Intensity, Directivity, Gain
   - Polarization
   - Input Impedance,
   - Voltage Standing Wave Ratio
3) Types of Antennas:
   - Linear Wire Antennas:
   - Dipoles, Monopoles, etc
   - Loop Antennas
   - Aperture Antennas, Horns, Dishes, Lenses, etc.
5) Array Antennas

CNS Fundaments and Antennas for CNS Systems:

1) Communications Systems - Overview
   - Voice, Data (ACARS, SELCAL, ELT, SATCOM, VHF Data, etc.)
   - Examples of Communications Antennas and their details with emphasis on monopole blades, patches, and combination antennas for aviation
2) Navigation Systems – Overview
   - Loran-C, VOR, DME, MLS, GPS
   - Examples of Navigation Antennas and their details
     - Electric monopoles and Magnetic H-field antenna for Loran-C
     - Mono and dipoles for VOR, DME

- MLS antenna systems (ground and air)
- GPS patch and advanced antennas for multipath mitigation

3) Surveillance Systems – Overview
   - Radar, Secondary Radar, ATC, Mode S, UAT
   - Examples of Surveillance Antennas and their details
     - Ground-based radar surveillance systems
     - Secondary radar directional antenna systems
   - Radar Altimeters

Handout Notes: A Handout Package of PowerPoint slides will be provided for material presented. This information will be copyrighted by the author and cannot be reproduced without the written permission of the authors. One Handout package will be provided per student. The Handout Package will be spiral bound with protective vinyl on the front and back cover (clear on front, navy blue on back).

Referenced Texts:

1. Balanis, Constantine, A., "Antenna Theory, Analysis and Design", John Wiley & Sons.
2. Couch, "Analog and Digital Communications Systems"
3. Ziemert and Tranter, " Analog and Digital Communication Systems",
4. Misra, P., Enge, P., "GLOBAL POSITIONING SYSTEMS, Signals, Measurements, and Performance", Ganga-Jamuna Press, ISBN: 0-9709544-0-9
5. Navstar GPS Space Segment/Navigation User Interface, ICD-GPS-200, available for download via web: http://www.navcen.uscg.gov/pubs/gps/icd200/default.htm
6. Skolnik, M. I., "Introduction to Radar Systems", Third Edition, ISBN: 0-07-290980, 2001.

Course Time: September 26-28, 2005.

Location: NASA, Glenn Research Center, Cleveland, OH

Host Responsibilities:

Facilities: Room, Restrooms, seats, chairs, etc, Cleveland, OH
Refreshments access or provided (coffee, soda, snacks, etc.)
Scheduling of students and fund coordination
LCD projector and white/chalkboard

Format: The course will be offered in a three day format. The maximum class size is 15 students.

Final Payment: Final Payment will be due 45 days after the completion of the course.

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