

**CN441 GNSS Antennas I – Fundamentals**  
**September 16, 2008, 8:30 am-12:00 pm, CEU: 3.0, prior to ION GNSS 2008**  
**Marriott Savannah Riverfront, Savannah, GA**

**Instructor:** Dr. Chris G. Bartone, P.E., Associate Professor, Ohio University

**Prerequisite:** Knowledge of mathematics, engineering, physics or electromagnetics and introduction to satellite navigation systems (e.g., CN405/406 Fundamentals of GNSS I & II with emphasis on GPS or CN425/426 GNSS with emphasis on Galileo) will be useful. (Knowledge of vector calculus and Maxwell's Equations is not needed.)

**Intended Audience:** Engineers, scientists, and managers interested in the design, development, implementation, and/or use of GNSS antenna for GPS, Galileo, Glonass and/or other satellite navigation systems. The course provides a solid basis in the fundamentals of antennas and in particular for applications in systems where GNSS is used. The course is considered as an introduction to GNSS antennas course.

**Notes Provided:** Slides presented will be professionally spiral bound, with clear plastic cover, including color to add clarity where needed.

**Reference List:** A reference list will be provided as part of the note package for completeness and to allow the interested attendee to obtain additional information.

**Course Overview:** This course emphasizes the fundamentals of antenna for GNSS applications. The course will present a solid basis for understanding fundamentals of antennas, antenna types, design, development, tests, and implementation aspects of GNSS antennas.

**Course Content:** The main topics to be covered by this course are:

- Fundamentals of Antennas:
  - Antenna pattern and field descriptions
  - Mismatch losses ( $\Gamma$ , SWR, polarization)
  - Wave and antenna polarization
  - Antenna and receiver noise figure considerations
  - Antenna aperture
  - The Friis transmission equation
- Antenna Types: linear, helix, patches, arrays
- Common GNSS Antennas
- Antenna Specifications
- Antenna Siting Issues: Mask angle, multipath, etc.
- Antenna Multipath considerations: design, metrics, and technology comparison (patch, survey, integrated multipath limiting antenna (IMLA))
- Test/Design and Evaluation:
  - Computer simulation tools
  - Component level evaluations
  - Antenna test range options
  - Field test characterization

- Phase and group delay calibration (overview)

**Course Outcomes:** At the completion of this course, the attendee should have the ability to understand the fundamentals of antenna systems and their applications in GNSS. Additionally, knowledge gained in the understanding and implementation of various GNSS antennas will enable enhanced system performance. For further knowledge on GNSS antennas CN445 GNSS Antennas II – Special Topics is recommended.