

**CN425 Future GNSS Signals and Systems with emphasis on Galileo I**  
**September 20, 2010, 8:30 am-12:00 pm, CEU: 3.0**  
**GNSS Solutions® Tutorials prior to ION GNSS 2010, September 20-21, 2010**  
**Oregon Convention Center, Portland, Oregon, USA**

**Instructor:** Dr. Tony Pratt, Orbstar Consultants

**Prerequisite:** Some knowledge of mathematics and computer science will be useful.

**Intended Audience:** Engineers, scientists, and managers interested in the area of GNSS for GPS, Galileo, Glonass, and other satellite navigation systems. Emphasis will be on signals and systems used in GNSS and in particular Galileo. The course provides a solid foundation for navigation signal formats and their characteristics.

**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 provides a solid foundation of GNSS signal formats, basic concepts in signal decoding and emphasizes the new signal and services for Galileo and other providers. Details on GNSS signal formats, spreading codes, and their characteristics are provided.

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

Introduction to different GNSS Signals and Providers:

- GPS, Glonass, Galileo, Compass, IRNSS, QZSS
  - Status of Navigation Systems deployment
  - Giove A & B – new technology initiatives
- Spread Spectrum Signal Characteristics
- Description of different spreading modulation
  - CDMA, BPSK, BOC, AltBOC, MBOC, TMBOC, CBOC, FDMA
- Basic Concepts in Signal reception and decoding
  - Correlation; fast convolution
  - Signal replica generation
  - Search, acquisition and tracking
- Signal Spectra in L1, L2, L5, E1, E5, E6
  - Signal ranging requirements for satellite navigation
  - Bandwidth
- Signal Multiplexing – different ways for hosting many services on a single carrier
  - Phase Plane Plots
  - Quadrature phase, Interplex, Modified Interplex, CASM, Majority Voting
  - Data bearing and pilot signals, data rates

- Spreading Codes
  - Gold codes, m-sequences, random sequences, primary, secondary codes
- Navigation Message Overview
  - GPS and Galileo

**Course Outcomes:** At the completion of this course, the attendee should have a solid understanding of the fundamentals of navigation signals, methods of decoding and their characteristics used in GNSS. For further information on Galileo, CN426 Future GNSS Signal Performance with emphasis on Galileo II is recommended.