

CN409 Precision Timekeeping, with emphasis on GPS
September 21, 2009, 6:45 pm - 9:30 pm, CEU: 2.5
GNSS Solutions® Tutorials prior to ION GNSS 2009, September 21-22, 2009
Marriott Savannah Riverfront, Savannah, GA

Instructor: Dr. Demetrios Matsakis, U.S. Naval Observatory

Prerequisite: None.

Intended Audience: Engineers, scientists, and managers interested in any aspect of the modern timekeeping part, particularly in the area of GNSS. The course is useful for people who must generate or engineer a timing application, for those who must use precise clocks for any purpose, and for those merely interested in learning about an exciting field which generates equipment and measurements precise to 15 decimal places – a greater precision than exists in any other scientific field.

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

Course Overview: This course emphasizes the fundamentals of timekeeping with emphasis on GNSS. The fundamental relationship between time and frequency, the methodology for categorizing and evaluating frequency standards will be presented, and the use of clocks to create timescales, and the means to compare distant clocks will be presented. This will be followed by applications to GNSS and radionavigation systems, and concluded by a historical overview of clock development – from Stonehenge to atomic standards.

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

- Basics of Timekeeping
 - Fundamentals
 - Statistics
 - Timescale creation
 - Generation of Coordinated Universal Time (UTC)
 - Clock Steering
 - Generation of GPS Time
 - Time Transfer
- Radionavigation
 - GPS as a user and provider of precise time
 - Galileo and interoperability
 - Glonass
 - ELORAN
- Parade of Clocks, and their applications
 - From Stonehenge to Optical Combs
 - Quartz, Rubidium, Cesium, Maser, Chip-Scale
 - Predictions for future

Course Outcomes: At the completion of this course, the attendee should have an understanding of the fundamentals of timing, especially as applied to GNSS systems and equipment.