CN406 Fundamentals of GNSS using GPS II
ION GNSS 2006, September 25, 2006, 1:30-5:00 pm, CEU: 3.0

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

Prerequisite: Knowledge of mathematics, computer science, and an introduction to satellite navigation systems (e.g., CN405 Fundamentals of GNSS using GPS I) will be useful.

Intended Audience: Engineers, scientists, and managers somewhat new to the area of satellite navigation using GPS, Galileo, and/or Glonass. The course provides a solid basis in the fundamentals of satellite navigation and in particular details on error source and their mitigation in GNSS systems. The course is more advanced than a simple user's or into to GNSS course, but not too detailed for the beginner to GNSS.

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 GNSS with emphasis on GPS in the presents of various error sources. The course provided details on the source and nature of various error source in satellite navigation systems, their impact, and methods for mitigation. The course concludes with an illustration of an error mitigated user state calculation, and provides an introduction to differential GNSS.

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

- GPS error budget (review)
- Overview of receiver types and receiver technologies
- Overview of various GNSS antenna types and antenna technologies
- Satellite orbit errors and mitigation methods
- Satellite clock errors
- Error mitigation by smoothing
- Signal Multipath Error characterization and mitigation techniques
    - Code phase multipath
    - Carrier phase multipath
- Atmosphere Errors:
    - Troposphere error sources and characterization (key points, wet & dry components, etc.), models and mitigation (Overview)
    - Ionosphere error sources and characterization
    - Ionosphere measurement methods and mitigation
    - Ionosphere models and mapping functions
        - GPS Broadcast model (i.e, Klobuchar Model)
- GNSS Receiver Autonomous Integrity Monitoring (RAIM)
- Introduction to differential GPS (DGPS) and different ways to implement it.

Course Outcomes: At the completion of this course, the attendee should have the ability to understand the fundamentals of GNSS in the presents of measurement error as applied to GPS. Additionally, knowledge gain in the understanding and implementation of various error mitigation techniques will enable an error mitigated user's solution.