CN460 Introduction to Strapdown Inertial Navigation Systems 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. Kevin E. Dutton, Honeywell International

Prerequisite: Some knowledge of mathematics and physics will be useful.

Intended Audience: Engineers, scientists, and managers interested in the area of strapdown inertial navigation systems (INS). The course provides a solid basis in the physics and mathematics of inertial navigation. It serves as a useful introduction to courses covering GPS and INS integration. The course is taught at a tutorial level.

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 physics and mathematics of strapdown inertial navigation systems. It provides sufficient information for the user to construct their own free inertial navigation solution.

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

- Basic inertial navigation with two-dimensional examples
- Vector and matrix notation and mathematics
- Coordinate frames
    - Inertial
    - Earth-Centered, Earth-Fixed
    - Local-level (East/North/Up, North/East/Down, Wander)
    - Body
- Coordinate frame transformations
- Attitude Fundamentals and Representations
    - Direction Cosine Matrix (DCM)
    - rotation vector
    - Euler angles
    - quaternions
- Earth geoid and gravity model
- Strapdown inertial navigation equations
- Vertical channel dynamics
    - inherent instability in vertical channel
    - stabilization of vertical channel using external information
- Coning and sculling
    - definitions
    - compensation

- Integration of navigation equations
    - attitude update
    - velocity update
    - position update

Course Outcomes: At the completion of the course, the user should understand the mathematics behind strapdown inertial navigation systems, and how to use inertial sensor measurements to update user attitude, velocity, and position. For additional knowledge on strapdown inertial navigation systems CN461 Introduction to Strapdown Inertial Navigation Systems II is recommended.