CN460 Introduction to Strapdown Inertial Navigation Systems I
ION GNSS 2007, September 24, 2007, 8:30 am-12:00 pm, CEU: 3.0

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.