



March 15-18, 2016
 Crowne Plaza Redondo Beach Hotel
 300 N. Harbor Drive
 Redondo Beach, California 90277

COURSE 122 (OR 123) (1.2 CEUs)
GPS / GNSS Fundamentals & Enhancements
 Days 1 and 2 of Course 346 or Course 356

SAME AS DAYS 1 AND 2 OF COURSE 346. SEE REGISTRATION FORM	
DAY 1	DAY 2
Dr. Chris Hegarty, MITRE	
<p>8:30 Fundamentals of GPS operation. Overview of how the system works. U.S. policy and current status.</p> <p>GPS System Description</p> <ul style="list-style-type: none"> • Overview and terminology • Principles of operation • Augmentations • Trilateration • Performance overview • Modernization <p>GPS Policy and Context</p> <ul style="list-style-type: none"> • Condensed navigation system history • GPS policy and governance • Modernization program • Ground segment • Other satellite navigation systems <p>GPS Applications</p> <ul style="list-style-type: none"> • Land • Marine • Aviation • Science • Personal navigation • Accuracy measures • Error sources 	<p>GPS Principles and Technologies</p> <p>Clocks and Timing</p> <ul style="list-style-type: none"> • Importance for GPS • Timescales • Clock types • Stability measures • Relativistic effects <p>Geodesy and Satellite Orbits</p> <ul style="list-style-type: none"> • Coordinate frames and geodesy • Satellite orbits • GPS constellation • Constellation maintenance <p>Satellites and Control Segment</p> <ul style="list-style-type: none"> • GPS satellite blocks • Control segment components and operation • Monitor stations, MCS, and ground antennas • Upload operations • Ground control modernization
Lunch Is On Your Own	
<p>Legacy GPS Signals</p> <ul style="list-style-type: none"> • Signal structure and characteristics • Modulations: BPSK, DSSS, BOC • Signal generation • Navigation data <p>Measurements and Positioning</p> <ul style="list-style-type: none"> • Pseudorange and carrier phase measurements • Least squares solution • Dilution of precision • Types of positioning solutions <p>GPS Receiver Basics</p> <ul style="list-style-type: none"> • Types of receivers • Functional overview • Antennas 	<p>Error Sources and Models</p> <ul style="list-style-type: none"> • Sources of error and correction models • GPS signals in space performance • Ionospheric and tropospheric effects • Multipath • Error budget <p>Augmentations and Other Constellations</p> <ul style="list-style-type: none"> • Augmentations: local-area, satellite-based, and regional • Russia's GLONASS • Europe's Galileo • China's Compass (BeiDou) <p>Precise Positioning</p> <ul style="list-style-type: none"> • Precise positioning concepts • Reference station networks • RINEX data format
5:00	

JUST NEED THE FUNDAMENTALS?

Take Course 122, which covers all the major areas of GPS. It is the same as days 1 and 2 of Course 346. (Course 346 drills deeper on days 3 and 4.)

Instructor



Dr. Chris Hegarty

OR



Dr. Michael Braasch

Dr. Chris Hegarty will be the instructor for the March class.

Objectives

- ◆ To give an comprehensive introduction to GPS technology, system concepts, design, operation, implementation and applications.
- ◆ To provide detailed information on the GPS signal, its processing by the receiver, and the techniques by which GPS obtains position, velocity and time

Prerequisites

- ◆ Some familiarity with engineering terms is helpful but not essential.

Who Should Attend?

- ◆ Engineers and technical professionals seeking conceptual explanations of GPS / GNSS technology, operation, capabilities, applications, and development trends
- ◆ Professionals in navigation, positioning, and related fields who are concerned with the capabilities, operation and principles of GPS and related GNSS systems.
- ◆ System analysts and specialists who need general information on position data and its use.
- ◆ Managers concerned with GPS, GNSS activities, or the positioning field.

Materials You Will Keep

- ◆ A color electronic copy of all course notes will be provided on a USB Drive or CD-ROM. Bringing a laptop to this class is highly recommended for taking notes using the Adobe® Acrobat® sticky notes feature; power access will be provided.
- ◆ A black and white hard copy of the course notes will also be provided.

Course Fee Entitles You to the Following Books

Introduction to GPS: *The Global Positioning System*, 2nd ed., Ahmed El-Rabbany, Artech House, 2006., **OR** *Global Positioning System: Signals, Measurement and Performance*, P. Misra and P. Enge, 2nd ed., 2011. (Note: This arrangement does not apply to on-site contracts. Any books for on-site group contracts are negotiated on a case by case basis.)