PUBLIC VENUE OR ON-SITE COURSE
Course 122: GPS/GNSS Fundamentals & Enhancements (1.2 CEUs)
(Days 1 and 2 of Course 346)

SAME AS DAYS 1 AND 2 OF COURSE 346

DAY 1  |  DAY 2
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**Fundamentals of GPS operation. Overview of how the system works. U.S. policy and current status.**  
**GPS System Description**  
- Overview and terminology  
- Principles of operation  
- Augmentations  
- Trilateration  
- Performance overview  
- Modernization  
**GPS Policy and Context**  
- Condensed navigation system history  
- GPS policy and governance  
- Modernization program  
- Ground segment  
- Other satellite navigation systems  
**GPS Applications**  
- Land  
- Marine  
- Aviation  
- Science  
- Personal navigation  
- Accuracy measures  
- Error sources  
**Legacy GPS Signals**  
- Signal structure and characteristics  
- Modulations: BPSK, DS/SS, BOC  
- Signal generation  
- Navigation data  
**Measurements and Positioning**  
- Pseudorange and carrier phase measurements  
- Least squares solution  
- Dilution of precision  
- Types of positioning solutions  
**GPS Receiver Basics**  
- Types of receivers  
- Functional overview  
- Antennas  
**GPS Principles and Technologies**  
- Clocks and Timing  
- Importance for GPS  
- Timescales  
- Clock types  
- Stability measures  
- Relativistic effects  
**Geodesy and Satellite Orbits**  
- Coordinate frames and geodesy  
- Satellite orbits  
- GPS constellation  
- Constellation maintenance  
**Satellites and Control Segment**  
- GPS satellite blocks  
- Control segment components and operation  
- Monitor stations, MCS, and ground antennas  
- Upload operations  
- Ground control modernization  
**Error Sources and Models**  
- Sources of error and correction models  
- GPS signals in space performance  
- Ionospheric and tropospheric effects  
- Multipath  
- Error budget  
**Augmentations and Other Constellations**  
- Augmentations: local-area, satellite-based, and regional  
- Russia’s GLONASS  
- Europe’s Galileo  
- China’s Compass (BeiDou)  
**Precise Positioning**  
- Precise positioning concepts  
- Reference station networks  
- RINEX data format

**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**

**What Attendees Have Said**
- “I liked the overall flow and design of the course, especially because I was trying to take the full 4-day [course]. I feel we touched pretty much all major points.”
  — Devashish Chandekar, Spirent, San Jose, 2018
- “I came into the course with only basic GPS knowledge. The course provided a wealth of information appreciation of GPS technology. The course exceeded expectations.”
  — Rex Roebuck, USCG, 2016
- “My main objective was to gain a better understanding about the GPS system as a whole. The course met my objectives and having the course content in hard/soft copy is a great bonus!”
  — Military Attendee, Name withhold upon request, 2016

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.)

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