DOT Positioning, Navigation, and Timing Update

GPS Adjacent Band Compatibility and Civil Signal Monitoring

Space-Based PNT Advisory Board

December 10, 2014
January 2012 Space-Based PNT EXCOM Letter

- January 13, 2012 National Space-Based Positioning, Navigation, and Timing (PNT) Executive Committee (EXCOM) co-chair letter to National Telecommunications and Information Administration (NTIA) proposed to draft new Global Positioning System (GPS) spectrum interference standards:
  - Inform future proposals for non-space, commercial uses in the bands adjacent to the GPS signals.
  - Ensure such proposals are implemented without affecting existing and evolving uses of space-based PNT that are vital to economic, public safety, scientific, and national security needs.
DOT GPS Adjacent Band Compatibility Assessment

• GPS Adjacent Band Compatibility Assessment will:
  
  – Derive adjacent-band power limits, as a function of offset frequency, necessary to ensure continued operation of all applications of GPS services.

  – Determine similar levels for future GPS receivers utilizing modernized GPS and interoperable Global Navigation Satellite System (GNSS) signals.
Approach to DOT GPS Adjacent Band Certified Avionics Compatibility Assessment

- FAA refining necessary processes, assumptions and analyses to assess certified avionics compatibility in conjunction with RTCA in its Federal advisory capacity.
  - Document proposes specific questions for RTCA to address.
  - RTCA SC-159 (GPS Subcommittee) conducting technical meetings to vet assumptions/methodologies and provide opportunity for feedback using open, transparent processes.
  - Other RTCA committees to provide perspectives on safety and operational aspects of “exclusion zones” in interaction scenarios.

- FAA will assess RTCA response and plan to address any unresolved topics and conduct follow-on activities.
Approach to DOT GPS Adjacent Band Compatibility Assessment

• Non Aviation Certified effort (all other applications) led by DOT/OST-R Volpe Center
  
  - GPS Directorate, Aerospace, and Mitre participation
  - Stansell Consulting
  - DOT Extended Pos/Nav Working Group (Civil Departments and Agencies)

• Identify forums and provide public outreach to ensure the plan, ongoing work, and assumptions are vetted and an opportunity to gain feedback
  
  - Public workshops held
  - Open and transparent approach

• Goal is to protect existing and evolving uses of space-based PNT
Near-Term Focus

• Frequency Bands Adjacent to GPS L1
  - Focus on LTE concept (Base stations below 1559 MHz; handsets above 1610 MHz)

• GPS/GNSS Receiver Categories:
  - Aviation
  - Cellular
  - General Location/Navigation
  - High Precision
  - Timing
  - Networks
  - Space

❖ Develop a set of curves demonstrating the maximum aggregate power level as a function of frequency offset from GPS
Overview of GPS Adjacent Band Compatibility Assessment Implementation Plan

Tentative Schedule

1. Document GPS/GNSS use cases and identify current (representative) receivers: July - December 2014

2. Develop representative receiver masks for each application: November 2014 - April 2015
   A. Collect receiver and antenna specifications and available test data
   B. Develop a plan for testing GPS/GNSS receivers

3. Conduct GPS/GNSS receiver testing: June - July 2015

4. Develop GPS interaction scenarios: August – December 2015

5. Collect future GPS/GNSS receiver specifications: FY’16 - FY’17
Issues to Address

- Agreement on definition of harmful interference to GPS/GNSS
- Achieving Balance between Open/Transparent Process and Need to Protect GPS/GNSS Receiver Proprietary Design Information
- Agreement on Assumptions for Adjacent Band Service(s)
  - Currently Assuming LTE (Base Stations/Handsets)
- Spectrum Protection for GPS/GNSS Augmentation Services in MSS Band (StarFire, OmniStar, etc.)
- Spectrum Protection for Foreign GNSS
  - Other Systems Operate Closer to Adjacent Band
- Sufficient Resources for Receiver Testing
Civil Signal Monitoring
Performance Specification (CMPS)

• Issued by DOT in December 2005, rev. April 2009
  - Adopted by civil agencies as requirements for civil signal monitoring of GPS (193 requirements)

• Two key categories of monitoring requirements
  - Those that result in timely notification (minutes) of GPS operators to take action
  - Those that report GPS service performance levels against stated commitments, e.g. GPS Standard Positioning Service Performance Standard

• Explanation of what civil signal performance monitoring means
  - Metrics verification
  - Archive and retrieval of monitoring data and performance levels
  - Signal quality and navigation message monitoring
  - GPS Operator and Civil User notification

❖ CMPS was an OCX contract reference document
  - Not a requirements document
Civil Signal Monitoring Trade Study

Cost, effectiveness, & risk analysis of OCX/Non-OCX (Mar 2014)

• Three sources of study data
  – OCX: ROM estimate on prioritized CMPS-defined requirements
  – Non-OCX: ROM estimate on full CMPS-defined requirements
  – GPS Operators: Current procedures, OCX OPSCON

• Wide ranging study review team
  – OST-R, FAA, 2SOPS, AFSPC/SMC/GP-GPC-GPE representatives
  – CMPS primary authors

Recommendations on Path Forward

• Pursue a dual implementation with OCX and Non-OCX elements
  - Incorporate high priority requirements into OCX contract
• Engage with USAF on integrating Non-OCX monitoring into GPS operations
Hybrid OCX/Non-OCX Architecture
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