Proposal for the Redefinition of UTC: Influence on NGA Earth Orientation Predictions and GPS Operations

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Outline

• NGA’s Role in GPS
• DoD GPS Monitor Station Network
• NGA and GPS Operations
• Redefinition of UTC - Effects on NGA GPS Operations
• Summary
NGA’s Role in GPS

NGA’s mission is to provide timely, relevant and accurate geospatial intelligence in support of national security objectives.

NGA’s GPS Mission
- Provide global geodetic reference frame and geophysical models (WGS 84)
- Provide satellite tracking data to GPS OCS
- Provide Earth Orientation Predictions to GPS OCS
  - UT1-UTC, Xp, Yp
- Generation and distribution of GPS precise ephemerides and GPS clock solutions
  - Precise geodetic surveying world-wide
- GPS contributes to the determination of WGS 84

Signatory (as DMA) on 1975 GPS JPO Charter
All GPS Monitor Stations are located on the Rotating Earth and will be for the foreseeable future.

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NGA & GPS Operations

- NGA 24/7 GPS observations
  - Directly improve GPS Broadcast Accuracy
  - Directly improve GPS Integrity Monitoring
- NGA GPS Precise Ephemeris
  - Supports World-Wide Geodetic Surveying
  - Quality control for GPS operations
- Daily Earth Orientation Predictions and Post-fit estimates
  - Used in Earth-fixed to Inertial Reference Frame Transformations

- Collaboration
  - Sharing of data
  - Anomaly resolution
  - Real-time support
  - Provide GEOINT technical assistance to the USAF
NGA Earth Orientation Predictions

Requirements Driven

- Interface Control Documents (ICDs)
  - ICD-GPS-211 between NGA and the GPS OCS
  - ICD-GPS-811 (in prep) between NGA and the OCX
  - Indicates that the UT1-UTC parameter is to be less than 1.0 second

- Automated ‘Limit Checks’ have been established in code to assure compliance with ICDs.

- Handling of leap seconds has been ‘institutionalized’ with procedures and documentation

ICD-GPS-211D Requirements

<table>
<thead>
<tr>
<th>Predictions (days)</th>
<th>Polar Motion X &amp; Y (mas)</th>
<th>UT1-UTC (ms)</th>
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<tr>
<td>1</td>
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Redefinition of UTC - Effects on NGA GPS Operations

- Modification to Interface Control Documents (ICDs)
  - ICD-GPS-211
  - ICD-GPS-811

- A regular source of UT1-UTC predictions will continue to be needed for NGA, GPS and other DoD Satellite Operations

- Modification to Operational Software
  - Code requiring modification will have to be identified
  - Code modified and its documentation updated
  - Execution will then need to be tested, verified, and certified for operational use
  - At NGA, GPS OCS, and other users of ICD-GPS-211 data
  - Required resources and schedule are not identified at this point

- Redefinition of UTC (Elimination of LS) offers no benefits to NGA GPS operations
Summary

- DoD GPS Monitor Stations, the ‘starting point’ for all GPS Positioning, Navigation and Timing (PNT) are located on the Rotating Earth
- A regular source of UT1-UTC predictions will continue to be needed for NGA, GPS and other DoD Satellite Operations
- Allowing UT1-UTC to grow beyond the current 1 sec limit
  - Will require resources to modify existing ICDs and operational software
  - Offers no benefits to NGA or GPS Operations
NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

Know the Earth... Show the Way... Understand the World