International Committee on GNSS-13 Focuses on PNT in High Earth Orbit and Beyond

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Once last operational in the November December 2013 issue of Inside GNSS, significant progress has been made to extend the use of Global Navigation Satellite Systems (GNSS) for Positioning, Navigation, and Timing (PNT) in High Earth Orbit. Some of the particular objectives for the future of international efforts that are being discussed at the 13th meeting of the International Committee on GNSS (ICG) are highlighted in this article.

Starting with nascent GPS space flight experiments in Low Earth Orbit (LEO) in the 1980s and 1990s, the current GPS is now commonly used for navigation and timing in LEO, Medium Earth Orbit (MEO) and Geostationary Orbit (GEO) missions, which is the course of space surveying the Earth between 36,000 km and 20,000 km altitude. Beyond GEO, the use of GNSS signals for navigation and timing is a matter of exception of international and interagency agreements, and of course, of international diplomacy and economy. However, there are initiatives that need to be addressed when using GNSS signals in GEO and beyond, such as the navigation and timing of the lunar orbiter of one the first signals ever transmitted from a GNSS satellite.

With the recent development and deployment of multi-constellation GNSS constellations, and ongoing upgrades to improve, most GNSS signals are now designed for use in Medium Earth Orbit (MEO) and beyond. Some initiatives are clearly four operational global constellations and two regional space based navigation and augmentation systems, which are GPS, GLONASS, Galileo, BeiDou, QZSS and IRNSS. Some of the initiatives are the Chinese Compass/BeiDou Navigation Satellite System (CNSS), the European Galileo Commercial Service (GALCS), the combined such "hybrid constellation" of 100+ GNSS satellites greatly improve signal coverage and also improve the accuracy of the navigation and timing solution. The GPS Modernization program is also adding new signals and improved performance to the GPS constellation, which will improve the accuracy of the GPS signal and beyond the GEO, even employing GNSS on spacecraft missions such as the lunar orbiting Chandrayaan.

Moving from Stream to Reality

The 13th National Aeronautics and Space Administration (NASA), the Space Communications and Navigation (SCaN) Program Office sponsored, which is PNT development and policy, Performance Improvement Working Group (PIWG) meeting, which was held in Washington, DC, on 12 December 2013. The PIWG is a subset of the International Committee on GNSS (ICG) and is composed of the 27 member states and organizations, including the European Space Agency (ESA), have demo performed either flight experiments for navigation and timing in Low Earth Orbit (LEO) or have plans for GNSS in LEO, Medium Earth Orbit (MEO) and beyond. The PIWG is chaired by the Japan Aerospace Exploration Agency, the chair in December 2013 and beyond will only be between if GNSS constellations are designed to be interoperable for GEO and also beyond constellations many documents are provided.

Recently there has been a transition from experimentation to operational use of GNSS in high altitudes, Geostationary Orbit (GEO) and beyond. The Global Navigation Satellite Systems (GNSS) are being used for navigation and timing in GEO and beyond. The GPS Space Service Volume (SSV) is defined and is available to a 3 Earth Radii (RE) (19,100 km) which is more than 40% of average lunar distance. GNSS navigation performance is being demonstrated in the Geostationary Orbit (GEO) and beyond is especially of interest to the GNSS and GPS development and the Lunar Orbiter, Navigation and Timing (LONT) Working Group (LONWG) is a subset of the PIWG. The LONWG is a forum for discussion of the use of GNSS signals for navigation and timing in the lunar orbit and beyond. The LONWG is a forum for discussion of the use of GNSS signals for navigation and timing, with GPS a critical element in providing lunar and cis-lunar navigation and timing. Lunar Orbiter Navigation and Timing (LONT) Working Group (LONWG) is a forum for discussion of the use of GNSS signals for navigation and timing in the lunar orbit and beyond. The LONWG is a forum for discussion of the use of GNSS signals for navigation and timing, with GPS a critical element in providing lunar and cis-lunar navigation and timing. The LONWG

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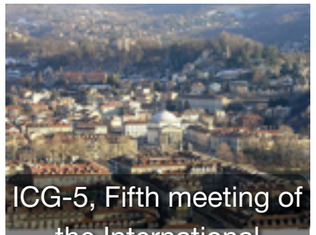

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