

**Report of Working Group B: Enhancements of GNSS Services Performance**

1. The Working Group B on Enhancement of global navigation satellite systems (GNSS) Services Performance held its first meeting during the 2<sup>nd</sup> ICG Meeting on 6 September 2007 (see A/AC.105/901) and its second meeting during the 3<sup>rd</sup> ICG Meeting on 11 December 2008 (see A/AC.105/928), in accordance to the ICG workplan (see A/AC.105/879).

2. The Recommendations of the Working Group, as modified in the second meeting, are summarized below:

- (i) The Working Group recommends to align its further work on models and algorithms for ionospheric and tropospheric corrections for GNSS systems;
- (ii) The Working Group agreed that the problem of multipaths and related mitigation actions, affecting both GNSS systems and user receivers, especially for mobile ones, would be addressed by the use of:
  - (a) Implementation of progressive methods of modulation to minimize the multipath errors (binary offset carrier (BOC), MBOC, etc.);
  - (b) Selection of ranging codes to improve tracking and acquisition performances of GNSS receivers for indoor positioning;
  - (c) Definition of Signal-In-Space (SIS) center frequencies of present and planned GNSS;
- (iii) The Working Group noted that the extension of GNSS Services for indoor applications is closely linked with terrestrial mobile service technology, modulation schemes such as: Frequency Modulation (FM), Orthogonal Frequency Division Multiplex (OFDM), and evolving technologies for Broadband Wireless Access (BWA) like WiFi and Worldwide Interoperability for Microwave Access (WiMAX), with advanced techniques for personal computers and mobile phones;
- (iv) For the extension of GNSS SIS performances the use of Internet wireless technology has proved to be highly effective in various part of the world, like it has been demonstrated by the European Space Agency (ESA) SISNeT technology;
- (v) The Integration of SATCOM/SATNAV technologies for positioning based service need to be further explored. The candidate technologies are:
  - (a) All augmentation systems (SBASs) and their extension for indoor positioning;
  - (b) Real-time GIS (Geographical Information Systems) visualization on mobile end user terminal (PDAs, PND, etc.);
  - (c) Redundant and parallel terrestrial and satellite-based technologies.

3. All GNSS system providers are highly encouraged to provide the system's characteristics in order to enhance positioning navigation and timing accuracies.

These characteristics need to be included in two different documents:

- (i) One document to be shared inside the scientific community including the standards relative to GNSS civil accuracies, integrity, availability, etc.;
- (ii) One containing the technical recommendations for user receivers manufacturers (ICD).

**Recommendation for Committee Decision**

**Prepared by:** Working Group B or individual Members or Associate Members

**Date of Submission:** 11 December 2008

**Recommendation of Committee Action:**

The Working Group recommends to align its further work on models and algorithms for ionospheric and tropospheric corrections for GNSS systems with a paper entitled “Ionospheric effects on GNSS for Aviation Operations” submitted by the International Civil Aviation Organization (ICAO) GNSS Panel.