

## Report of the Working Group A: Compatibility and Interoperability

1. The Working Group A on Compatibility and Interoperability held its first meeting on 6 September 2007 under the chairmanship of Sergey Revnivkykh (Russian Federation) and David Turner (United States).
2. In accordance with the workplan (A/AC.105/879, ICG/WP/NOV2006), the Working Group considered the assigned actions.
3. The Working Group noted that a Providers Forum (Action A1), co-chaired by the United States and India, had held its first meeting, on 4 September 2007, during the second Meeting of the International Committee on Global Navigation Satellite Systems (ICG).
4. The Working Group noted with satisfaction that Action A1 of the workplan should be considered completed based on the successful establishment of the Providers Forum and the results of its first meeting.
5. The Working Group invited participants to make opening statements or presentations relevant to Action 3. Subsequently, a presentation to the Working Group included: "GLONASS system time" by A. Tyulyakov of the Russian Institute of Radionavigation and Time (RIRV).
6. The representatives of the Bureau International des Poids et Mesures (BIPM) were of the view that GLONASS should have its own system time, but steer to Coordinated Universal Time (UTC) linked to the National time scale of Russian Federation (UTC (SU)) just as GPS steers to UTC as maintained at the United States Naval Observatory (UTC (USNO)). It was also noted that GLONASS made the right choice regarding leap seconds following the international UTC standard that was nevertheless wrong for interoperability with other systems.
7. It was noted that the representatives of BIPM had volunteered to draft a paper recommending the elimination of the leap second from UTC to submit to the International Telecommunication Union (ITU) timing subcommittee after review and approval by the full Committee (see Appendix I).
8. In the interest of time, Action 5 was addressed by a subgroup of Working Group A under the chairmanship of Frederic Bastide of the European Global Navigation Satellite Systems (GNSS) Supervisory Authority, which met in parallel. Nevertheless, the action item was discussed briefly.
9. The Working Group took note that India volunteered to develop a paper on examples of interference to GNSS receivers from other radiocommunications services that occur despite compliance with ITU or domestic spectrum management regulations.
10. The Working Group agreed that Action A4 should be deferred to a future meeting of the working group in order to focus efforts on the core issue of compatibility and interoperability among global and regional satellite navigation systems comprising the overall global navigation satellite system-of-systems.
11. At the Working Group, the co-chairs made the statements outlining the work of the Providers Forum. It was noted that the subject of compatibility and interoperability was discussed at the Providers Forum meeting. It was also noted that the agreement on general definitions of these principles had been reached.

12. The Working Group had before it the definition of interoperability, as agreed upon by the providers, and documented in the report of the Providers Forum.

13. The Working Group was of the view that the importance of interoperability between systems and the degree to which it could be achieved probably varies for various GNSS applications and users. In accordance with that agreement, the Working Group recommended four additional activities to pursue in support of the Actions A2 and A3 of the workplan as follows:

- Fédération internationale des géomètres (FIG) and International GNSS Service (IGS) would draft a paper on the relative importance of different aspects of satellite navigation system interoperability from the perspective of various user applications;
- The Russian Federation, the United States, India, and FIG would form a subgroup to develop an agenda for an exchange of views on interoperability between system providers and representatives for various user applications, including industry. Sessions could be held during regional workshops on GNSS being organized by the ICG Secretariat;
- International Steering Committee of the European Position Determination System (EUPOS) and IGS would draft a definition of interoperability applicable to ground-based differential GNSS (DGNSS) networks to be submitted to the Working Group for consideration;
- Working Group's proposed revisions to the definition of interoperability would be submitted to the Providers Forum for consideration. An associated recommendation on timing and geodesy, which was reviewed by Working Group A in cooperation with Working Group D, had been prepared for consideration by the ICG at its plenary session (see Appendix II).

14. The revised definition of interoperability, based on the Provider Forum definition is given below:

*Interoperability refers to the ability of open global and regional satellite navigation and timing services to be used together to provide better capabilities at the user level than would be achieved by relying solely on one service or signal.*

- *Interoperability allows navigation with signals from at least four different systems with minimal additional receiver cost or complexity;*
- *For many applications, common centre frequencies are essential to interoperability, and commonality of other signal characteristics is desirable;*
- *Multiple constellations broadcasting interoperable open signals will result in improved observed geometry, increasing end user accuracy everywhere and improving service availability in environments where satellite visibility is often obscured;*
- *Geodetic reference frame realization and system time steerage should adhere to existing international standards to the maximum extent practical.*

15. The Working Group agreed that progress had been made in pursuit of its assigned workplan actions.

**Annex I****Proposed Note to the Radiocommunication Sector of the International Telecommunication Union (ITU-R) concerning the adequacy of Coordinated Universal Time for global navigation satellite systems interoperability and its possible redefinition**

The International Committee on Global Navigation Satellite Systems was established in December 2005. The objectives of the Committee are to benefit users of GNSS services encouraging coordination among GNSS core system providers and augmentation system providers to ensure that their systems are compatible and interoperable.

*The Committee notes*

that the already existing GNSS maintain internal system times that are steered to different time scales:

GPS time follows UTC modulo one second via steering to its local realization UTC (USNO);

GLONASS time follows UTC via steering to its local realization UTC (SU), and is consequently affected by one second discontinuities at the insertion of leap seconds;

Galileo system time will be steered to the GPS time.

that this variety of time scales have proliferated to avoid the use of a discontinuous UTC, not adapted to GNSS system operations, and

that at the second Meeting of the Committee on 6 September 2007 there had been consensus on the necessity of redefining UTC without leap seconds since the present situation does not favour the interoperability of the already operating GNSS and the future systems;

*and requests the ITU-R*

that a definition of a continuous UTC, without leap second adjustments be adopted, and

that the date of application of the new, continuous UTC be fixed as soon as possible.

## Appendix II

### Proposed Recommendation

The International Committee on Global Navigation Satellite Systems (ICG),

*Considering*

- the international value of having many GNSS operational with a composite contribution of several tens of satellites;
- the desirability of using all systems interchangeably;
- the use by GPS of references very close to UTC and International Terrestrial Reference Frame (ITRF);
- the GLONASS efforts to approach UTC and ITRF;
- the Galileo design referring to UTC and ITRF;
- that other important satellite navigation systems (Compass, IRNSS, QZSS, various SBAS) are now being designed and developed.

*Recommends*

- that the reference times (modulo 1 s) of satellite navigation systems be synchronized as closely as possible to UTC;
- that the reference frames for these systems be in conformity with the ITRF;
- that these systems broadcast, in addition to their own System Time (ST):
  - the time difference between ST and a real-time realization of UTC;
  - a prediction of the time differences between ST and UTC.