

## **Report of the Working Group D: Interaction with national and regional authorities and relevant international organizations**

1. The Working Group D on Interaction with National and Regional Authorities and Relevant International Organizations held its first meeting on 6 September 2007 under the chairmanship of International Association of Geodesy (IAG), International GNSS Service (IGS) and Fédération internationale des géomètres (FIG).
2. In accordance with the workplan (A/AC.105/879), the Working Group considered the following two specific assignments:
  - Define site quality, integrity and interference monitoring techniques;
  - Development of a common geodetic reference frame taking into account existing (regional) reference frames.
3. The Working Group noted that the Working Group on Compatibility and Interoperability discussed a similar action, i.e. develop a strategy for support by the ICG of mechanisms to detect and mitigate sources of electro-magnetic interference taking existing regulatory mechanisms into consideration. It was also noted that the results of the Working Group A was close coordination with the Working Group D on this aspect of interference.
4. The Working Group noted that the Working Group A agreed that it was not advisable at present to separate inter-system interference from any other interference to GNSS, whether unintentional, sporadic, casual and so forth. It was noted, that the Working Group A would further propose to the ICG that an Expert Session be planned for a future ICG meeting in order to address interference issues in terms of providing a venue and explore raising awareness of interference issues.
5. It was noted that the ICG could foster the exchange of information for independent assessment of interference of GNSS. Therefore the Working Group agreed to coordinate with the Working Group A on this issue and await the report and proposals of the Working Group A.
6. The Working Group held discussions on site quality and integrity. It was noted that a demonstration of the resources available from IGS in terms of station information, Site Guidelines, Frequently Asked Questions (FAQs), automated change-point analysis applied to the global tracking network (to determine any excursions beyond set levels of various data indicators and raise an alarm notification) should be promoted by the ICG as best practice for GNSS.
7. The Working Group further noted that the guidelines covered a number of different types of GNSS applications. It was generally agreed that one document source would be preferable and that extensions of IGS site guidelines could be considered by the Committee to include additional applications, for example, DGNSS, Real Time Kinematics (RTK).
8. The Working Group noted that the current guidelines were adopted with the IGS community which consists of more than 200 organizations in over 80 countries, discussed with many leading national mapping agencies, approved by the IGS governing board and currently adopted by regional reference frames (African Geodetic Reference Frame (AFREF), EUREF, GAGAN, Geocentric Reference System for the Americas (SIRGAS)).

9. The Working Group also noted that for these regional implementations extensions to the site guidelines for their specific requirements was quite reasonable, and the benefits of adopting a particular set of guidelines permit enhanced global interoperability amongst GNSS users. Therefore the Working Group encouraged the use, review, refinement and extension, as needed, of the IGS site guidelines.
10. The Working Group held discussions on regional reference frames. It was noted that all regional reference frames should be within the context of the International Terrestrial Reference System (ITRF) and its realization.
11. At the meeting of the Working Group, the chairman of the IGS presented a document (see Appendix I) entitled "Proposal to Establish a Working Group on Geodetic References within the International Committee on GNSS" outlining the objective "there is an emerging demand to recognize the International Terrestrial Reference System (ITRS) as the unique preferred system geo-referencing in science and applications".
12. After considering the presented document, it was noted that the Working Group should not lose sight of the importance of the regional reference frames. It was further noted that these are inseparable, the needed development of the global ITRS and the continental reference frames in order to continually improve both.
13. The view was expressed whether timing should be included in the proposed Working Group since it was a fundamental aspect of the Geocentric Terrestrial Reference System (GTRS).
14. The Working Group agreed that timing should not be included, however the Working Group should harmonize with existing bodies, BIPM, for close cooperation. It was noted that the Working Group A will propose a recommendation on "Coordination of Navigation Satellite Systems Space and Time References" (see Appendix II). The Working Group supported this recommendation.
15. The view was expressed that BIPM works on a legal basis, whereas the ITRS was not recognized on a legal basis, but globally adopted. The Working Group agreed to explore this issue and consider bringing a legal basis to the IGS/ITRF. The importance of having representatives of the service providers in the Working Group was noted.
16. The Working Group agreed to propose to the Committee an establishment of a Working Group on geodetic references.
17. The view was expressed that service providers should include in the information on the reference frame and timing system being used into the "Template for Information Sharing between GNSS Service Providers".
18. The Working Group proposed that the Committee should recommend the densification of the IGS network particularly in sparse areas, and encourage improved access to GNSS observation data from many existing and planned stations noting the wide benefit to society by having improved access to observational data.
19. The Working Group encouraged the Committee to support the recent IAG recommendations to place retro-reflectors on all GNSS satellites.

## Appendix I

### **Proposal to establish a Working Group on Geodetic References within the International Committee on Global Navigation Satellite Systems**

Claude Boucher, as of 8 July 2007

#### **Context**

##### *Promotion of the International Terrestrial Reference System*

There is an emerging demand to recognize the International Terrestrial Reference System (ITRS) as the unique preferred system for geo-referencing in science and applications.

Meanwhile, for various reasons, several communities (for instance civil aviation, hydrography) have formally adopted the World Geodetic System 1984 (WGS84) to play this role.

In fact, there is no real technical problem, but rather an issue of terminology and proper understanding. A major proof of that is the recent agreement signed by the United States and the European Union about GNSS, and specifically about the interoperability between GPS and Galileo. This document specifies that each system will implement a realization of a system, which will be as close as possible to ITRS. It is recognized that WGS84 designates the United States implementation of ITRS for GPS (at least for the nominal operational service, i.e. Broadcasted data). As consequence, WGS84 should be understood as a realization of ITRS associated with the operational use of GPS (namely use of message). Similarly, the operational tracking network to be deployed for Galileo will be expressed as a frame designated by GTRF, as a particular realization of ITRS.

The International Union of Geodesy and Geophysics (IUGG) has recently formally approved the definition of ITRS and its use as unique preferred system through a resolution adopted at its General Assembly in Perugia (July 2007):

“The International Union of Geodesy and Geophysics

*Considering* the increasing importance of geodetic reference systems in Geosciences, and more generally in numerous scientific or technical activities, such as satellite navigation systems or geo-information,

*Noting* the IUGG Resolution 2 and IAG Resolution 1, both adopted in 1991 at the Vienna General Assembly, defining the Conventional Terrestrial Reference System (CTRS),

*Recognizing* the quality of the work done by several IAG services (IERS, IGS, ILRS, IVS, IDS) to actually realize these systems and provide regular access for numerous users within and beyond the geosciences community,

Endorses the definition of a Geocentric Terrestrial Reference System (GTRS) as a “System of geocentric space-time coordinates within the framework of General Relativity, co-rotating with the Earth and related to Geocentric Celestial Reference System by a spatial rotation which takes into account the Earth orientation Parameters”, in agreement with the IAU resolution B1.3, 2000,

Endorses the definition of the International Terrestrial Reference System (ITRS) as the specific GTRS for which the orientation is operationally maintained in continuity with past international agreements (so-called BIH orientation).

Furthermore adopts the ITRS as preferred system for any scientific application and urges other communities such as geo-information, or navigation to do the same.”

*International Committee on Global Navigation Satellite Systems*

The International Committee on Global Navigation Satellite Systems was established in December 2005 on voluntary basis as an informal body gathering any country, national or international organizations involved in GNSS, either as service provider or user. In particular, IGS and BIPM are already members of the ICG.

It is expected that the International Civil Aviation Organization (ICAO) or the International Hydrographic Organization (IHO) will also join the ICG.

**Proposal**

In recognition of the context, it is proposed to establish within the ICG a Working Group (or any equivalent structure) on Geodetic References.

The goals of this Working Group would be:

- (a) to gather all ICG participants interested by the subject (system and service providers, users);
- (b) to review the present situation (existing documents, resolutions or practices);
- (c) to discuss and agree upon a consistent terminology for geodetic references and related understanding;
- (d) to prepare a recommendation about ITRS and its realizations, both from GNSS suppliers and user point of view;
- (e) to discuss and sketch implementation plans in each concerned community (for instance modification of ICAO or IHO resolutions).

The recommendation of the Working Group A supported by the Working Group D: Coordination of navigation satellite systems space and time references.

**Recommendation**

The International Committee on Global Navigation Satellite Systems,

*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 ITRF;
- the GLONASS efforts to approach UTC and ITRF;

- the Galileo design referring to UTC and ITRF;
- that other important satellite navigation systems 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):
  1. the time difference between ST and a real-time realization of UTC,
  2. a prediction of the time differences between ST and UTC.

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\* *Compass, IRNSS, QZSS, various SBAS*

## Appendix II

### *Extract from*

**Resolutions adopted by the Council at the XXIV  
International Union of Geodesy and Geophysics (IUGG)  
General Assembly, Perugia, Italy, 2 – 13 July, 2007**

<http://www.iugg.org/resolutions/perugia07.pdf>

### **Resolution 2: Geocentric and International Terrestrial Reference Systems (GTRS and ITRS)**

The International Union of Geodesy and Geophysics,

#### *Considering,*

The increasing importance of geodetic reference systems in geosciences, and more generally in numerous scientific and technical activities, such as satellite navigation systems and geospatial information;

#### *Noting,*

The IUGG Resolution 2 and International Association of Geodesy (IAG) Resolution 1, both adopted in 1991 at the Vienna IUGG General Assembly, which defined the Conventional Terrestrial Reference System (CTRS);

#### *Recognizing,*

The quality of the work done by several IAG services (IERS, IGS, ILRS, IVS, IDS) to realize these systems and provide access for numerous users within and beyond the geosciences community;

#### *Endorses*

The definition of a Geocentric Terrestrial Reference System (GTRS) in agreement with the 2003 IAU resolution B1.3;

The definition of the International Terrestrial Reference System (ITRS) as the specific GTRS for which the orientation is operationally maintained in continuity with past international agreements (BIH orientation); and

#### *Adopts*

The ITRS as the preferred GTRS for scientific and technical applications; and

#### *Urges*

Other communities, such as the geo-spatial information and navigation communities, to do the same.