Report of Working Group D: Reference Frames, Timing and Applications

4 – 6 November 2015, Boulder, Colorado, United States

Co-Chairs: Zuheir Altamimi, Ruth Neilan, Neil Weston
Alternates: Chris Rizos and Mikael Lilje

1. INTRODUCTION

The Co-Chairs welcomed all to the meeting. Unfortunately Zuheir Altimimi could not attend ICG-10. Mikael Lilje supported Neil Weston during the transition phase as the FIG representative. Chris Rizos acted as chair of the meeting while Neil and Mikael served as secretaries. The participants list can be found in appendix A. The meeting was split into two days with discussions devoted primarily to Geodetic References and Timing References.

2. REVIEW OF MINUTES FROM ICG-9 MEETING

The minutes from the working group meeting at ICG-9 in Prague were reviewed.

3. TASK FORCE ON GEODETIC REFERENCES

Discussion on progress with WG-D Recommendations:

Particular emphasis on WG-D Recommendation # 23:

The ICG WG-D recommends that the GNSS Providers consider the possibility of making available the following list (or a sub-set) of satellite data for better orbit dynamics modeling. The Providers are invited to update the WG-D on the follow up of this recommendation.

4. Presentations on Recent Developments in Geodetic References:

1. Influences of Interoperability of Coordinate Reference Systems among Navigation Satellite Systems, Prof. Yuanxi YANG
2. The development of geodetic support means in the Russian Federation. I. Gusev (presenter), S. Karutin, V. Fateev, I. Silvestrov, A. Ipatov, I. Gayazov, D. Pleshakov, A. Zueva, E. Novikov, I. Stolyarov
3. Status of the Glileo Terrestrial Reference Frame (GTRF), by Werner Enderle, on behalf of the GGSP Consortium.
4. Why the Greenwich meridian moved, Steve Malys, NGA, USA

5. TASK FORCE ON TIMING REFERENCES

Discussion on progress with WG-D Recommendations:
Report on actions since ICG-10
Outcome of the CCTF
Calibrations of GPS equipment for UTC
BIPM Circular T and Rapid UTC, updates
GLONASS Time and UTC, update
Status of submission of templates of GNSS times
Actions at ITU-R on the revision of the definition of UTC

6. Presentations on Recent Developments in Geodetic References:

1. The EGNOS system time J. Delporte (CNES, France)
2. Progress for broadcasting the GGTO in GPS E. Powers (USNO, US)

3. Absolute calibration of GLONASS receivers at VNIIFTRI V. Palchikov, N. Koshelyaevsky (VNIIFTRI, RF)
4. The IGS Working Group on clock products, an update M. Coleman (IGS)
5. National time scale UTC(SU) and GLONASS system time scale: current state and perspectives. A. Goncharov, I. Norets, A. Tiuliakov, I. Silvestrov (presenter), P. Bogdanov.

7. Working Group D Activities and Achievements

1. Implementation by Providers of improvements to Geodetic & Timing References... updated documentation
2. Following Rec #20: The Consultative Committee on Time & Frequency passed in 2015 a Recommendation on Predictions of UTC disseminated by GNSS?... BIPM will implement the related changes in the Circular T bulletin
3. Following Rec #19: The rapid UTC (UTCr) is an official product of the BIPM
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7. UN-GA resolution on the Global Geodetic Reference Frame (GGRF) passed February 2015... GGRF WG developing roadmap
8. UN-GA resolution on the Global Geodetic Reference Frame (GGRF) passed February 2015.
9. Joint FIG, IAG &ICG ?Reference Frames in Practice Workshop?, Singapore July 2015... another to be run in 2016
10. IGS Multi-GNSS Experiment (MGEX) and Real Time Service (RTS)... reference frame issues, precise multi-GNSS positioning, intersystem bias investigations, provide framework for IGMA activities.

8. NEXT STEPS and Possible Actions FOR WORKING GROUP D

1. Prepare a single table/document/PPT-slide that lists all WG-D recommendations and their status (suggest use following descriptors: completed, ongoing, long-term, no-action), so that in future reports we can present such a table or slide.
2. Start preparing a “workplan”… it need not be detailed at first, just some bullet points, that emphasise priorities, because we need to show the value of WG-D not just as harping after geodetic & timing reference frames, but also raising new issues that we want to address… and in such a way help guide the organisation of future WG-D sessions so that we also give appropriate voice to these other issues… e.g. related somehow to “applications” (see below at 4)).
3. Revise template, and re-send to organise update of information… as Gerard stated that Felicitas was going to do for the Timing Reference in mid-January 2016… we must coordinate with her.
4. Coordinate with WG-B re “applications”… a brief chat with the chairs of WG-B made it clear that they are not interested in the “high precision and/or non-PNT applications of GNSS”. In that case, should WG-D take on this task? E.g. raising the issue of PPP using multi-GNSS and the implications for “interoperability” (such as the many inter-system biases)?
5. Address the problematic recommendation #12… i.e. see slide 14… Action: Need to give explanation of the benefit to Providers, and need to provide clearer guidelines on the amount, type and volume of ranging data that is sought.
6. Address the problematic recommendation #23… i.e. see slide 15-18… Action: Need to explain why we would get better quality orbits than we currently do, and why that is needed for improved geodetic references, to identify most critical satellite but must be coordinated with WG-B because they also want satellite information (RF/antenna characteristics).

APPENDIX 1: ATTENDANCE LIST

November 4th, 2015

Yuanxi Yang	China
Haibo Yuan,	China
Jerome Delporte,	EU
Leonardo Gagliardi,	Italy
Kazutoshi Sato,	Japan
Yudai Sato,	Japan
Hiroshi Takiguchi,	Japan
Anna Dorofeeva,	Russia
Roman Fatkulin,	Russia
Igor Gusev,	Russia
Maxim Sanzharov,	Russia
Igor Silvestrov,	Russia
Christopher Herbster,	US
Larry Hothem,	US
John Labrecque,	US
Michael Lombardi,	US
Brian Luzum,	US
Stephen Malys,	US
Jules Mcnef,	US
Stephen Mitchell,	US
Andrew Novick,	US
BijunathPatla,	US
Ed Powers,	US
Stefania Romisch,	US
Francine Vannicola,	US
Neil Weston,	FIG
Steve Fischer,	US
Jian Yao,	US
Shengkang Zhang,	US
Victor Zhang,	US
Werner Enderle,	ESA
Markku Poutanen,	EUREF
Matt Higgins,	FIG
Mikael Lilje,	FIG
Chris Rizos,	IAG
Gerard Petit,	BIPM
Grant Hausler,	Australia

November 5th, 2015

Yuanxi Yang,	China
Haibo Yuan,	China
Pieter De Smet,	EU
Jerome Delporte,	EU
Yudai Sato,	Japan
Hiroshi Takiguchi,	Japan
Anna Dorofeeva,	Russia
Roman Fatkulin,	Russia
Igor Gusev,	Russia
Maxim Sanzharov,	Russia
Igor Silvestrov,	Russia
Larry Hothem,	US

John Labrecque,	US
Brian Luzum,	US
Stephen Malys,	US
Stephen Mitchell,	US
Ed Powers,	US
Francine Vannicola,	US
Neil Weston,	FIG
Werner Enderle,	ESA
Markku Poutanen,	EUREF
Mikael Lilje,	FIG
Chris Rizos,	IAG
Gerard Petit,	BIPM