

## REPORT OF THE 13th MEETING OF THE CCTF WORKING GROUP ON TWSTFT

held in Deft, the Netherlands  
on 15 and 16 November 2005

The 13th meeting of the Consultative Committee for Time and Frequency (CCTF) Working Group (WG) on Two-Way Satellite Time and Frequency Transfer (TWSTFT) was held on 15 and 16 November 2005 in Deft, the Netherlands. The WG meeting was organized by NMI Van Swinden Laboratorium (VSL) and was chaired by Bill Klepczynski of US State Department. Other contributions to the meeting are available on the BIPM web site:

<http://www.bipm.org/wg/AllowedDocuments.jsp?wg=TWSTFT>

### Agenda of the meeting

- 1) Report from BIPM (W. Lewandowski, BIPM)
- 2) Status Report on Progress of Northern Calibration Trip (TUG)
- 3) Status on discussions with INTELSAT (W. Klepczynski, US State Department)
- 4) Smoothing and interpolation techniques used for a TW measurement series (Z. Jiang, BIPM)
- 5) Redundancy in TW network and its combination with carrier phase information (Z. Jiang, BIPM)
- 6) Earth Station Delay Measurement by SATSIM (C. Lin, TL)
- 7) TWSTFT Activity and Future Plans in the Asia-Pacific Rim (Y. Takahashi, NICT)
- 8) Report on the Establishment of the NICT-PTB TWSTFT Link (D. Piester, PTB)
- 9) GPS Carrier Phase Solution (R. Dach, AUIB)
- 10) Standardization of TimeTech Software Releases (W. Schaefer, TimeTech)
- 11) A TWSTFT Experiment using the Telstar 5 Satellite (J. Bardin, California Institute of Technology)
- 12) USNO work on Redundant Observations (D. Matsakis, USNO)
- 13) Sources of Instabilities in TWSTFT [paper given at FCS/PTTI] (T. Parker, NIST)
- 14) Galileo Program Needs with respect to TWSTFT (J. Hahn, ESA)
- 15) Other instability effects that need to be studied (J. Palacio, ROA)
- 16) Reports from Participating Stations: CH, IEN, NICT, NIST, NMIJ, NPL, NTSC, OCA, OP, PTB, ROA, SP, TL, USNO, VSL ( included the current version of hardware and reduction software)
- 17) Planning for Southern Calibration Trip

### Summary of the meeting

**Intelsat agreement.** WG should more formalize relation with Intelsat. If not we can face a change of satellite imposed by Intelsat. B. Klepczynski is in charge of the relations with INTELSAT management.

**TWSTFT for Galileo.** J. Hahn of ESA briefed the WG on foreseen use of TWSTFT for Galileo time network (GTSP, PTF). Galileo management is interested in cooperation with WG, recognizing WG expertise in TWSTFT technology. This cooperation might be beneficial for both sides. Galileo proposal to join the TWSTFT group was discussed.

Galileo could join the group if the PTF clocks would contribute legitimately to TAI, since the agreement with INTELSAT is for the use of their satellite by laboratories contributing to TAI. Contribution of PTF clocks to TAI will be discussed with the BIPM. WG agreed to help Galileo in the early experimental phase.

During the next three years no lease of a transponder is envisaged since it is anticipated that the one PTF being currently developed should become integrated into the US \_ EU TWSTFT network. Practical coordination of operations would be at least partially PTB task (under the Fidelity contract building the GTSP). ESA has approached USNO to negotiate with INTELSAT whether the activities during the IOV phase could be covered by the Cooperative Research and Development Agreement currently under negotiations.

If later in the operational phase Galileo chose INTELSAT then WG would try to come under that arrangement.

***Is 10 ps uncertainty achievable.*** T. Parker reported on sources of instabilities in TWSTFT and possible improvements. It seems that 10 ps uncertainty is realistic. The biggest limitation could come from transponder instability during big traffics picks.

***Asia – Europe links.*** There are now two operational TWSTFT links: between VSL and TL and between NICT and PTB (operational since 1 November 2005). At PTB there is 1 km distance between PAS antenna and PTB time laboratory. Fibre optic used for connection is not temperature stabilized. Strong diurnal effect is observed between TWSTFT and GPS CP.

***GPS Carrier Phase.*** R. Dach of Bern University briefed the WG on GPS CP performance and commented possible cooperation with TWSTFT community.

***Reports from Participating Stations*** (see full reports on BIPM TWSTFT web-site).

***Pacific Rim status.*** The NICT modem is operational at NICT since 1st February 2005. Atlantis modem stopped on 28 July 2005. First calibration exercise using NICT portable system was conducted in August 2005 in Japan. Next year more calibrations are foreseen for Asia-Pacific Metrological Program (APMP). Future plans include: full automatism, developing carrier techniques (excepted 0.1 ns precision), link to Hawaii, closure around the world.

***TWSTFT calibration trips.*** Report of the last summer European TWSTFT calibration trip is not yet available. Planning of European Southern Calibration Trip was not discussed due to lack of time. It should be addressed through e-mail or during EFTF PS meeting.

***BIPM Time Links Reports.*** BIPM Time Section is now providing monthly updated comparisons of various time transfer techniques. The results are arranged on <ftp://tai.bipm.org> or <http://www.bipm.org/en/scientific/tai/Links> under the main directory “TimeLink/LkC” with one sub-directory for each month YYMM.

***TimeTech equipment.*** A. Pawlitzky reported on standardization of software releases.

***Changes at VSL.*** Due to retirement of Gerrit de Jong now contact persons for T&F activities are Jan de Vreede (project leader) and Erik Kroon (technician).

**Organization of WG.** D. Piester has replaced G. de Jong (retiring) for coordination TWSTFT activities in Europe.

### **Gerrit de Jong**

Dr Gerrit de Jong, one of the pioneers of TWSTFT technology and world leading experts in time metrology, co-chairman of this WG, is retiring from the NMi-VSL in December 2005. Dr. Ed de Leer, the NMi-VSL Scientific Director hosted on 15 November a reception celebrating Gerrit de Jong's retirement. In a series of speeches the Direction of the NMi-VSL and WG meeting attendees expressed their gratitude to Gerrit. Participants to the meeting offered to Gerrit a book with words of thanks and sympathy.

### **Forthcoming meetings**

It was agreed that the next meeting of participating stations would be held in March 2006 during the EFTF. The next full meeting of the Working Group will be held at the Paris Observatory (OP), Paris, France, most likely on 5 and 6 September 2006. These dates should be confirmed by the OP.

W. Lewandowski  
Secretary of the CCTF WG on TWSTF

## APPENDIX

### List of participants

#### 13th TWSTFT WG Meeting attendee list

Organization	Family name	First name
1 AUIB	Dach	Rolf
2 BIPM	Jiang	Zhiheng
3 BIPM	Lewandowski	Włodzimierz
4 CCTF WG TW	Klepczynski	William
5 CH	Schlunegger	Christian
6 CIT	Bardin	Joseph
7 ESA	Hahn	Joerg
8 IEN	Lorini	Luca
9 IEN	Sesia	Ilaria
10 IPQ	Marques	Fátima Silvério
11 NICT	Takahashi	Yukio
12 NIST	Parker	Tom
13 NMIJ	Imae	Michito
14 NMIJ	Suzuyama	Tomonari
15 NPL	Whibberley	Peter
16 NTSC	Li	Huanxin
17 OCA	Baumont	Françoise
18 OCA	Oneto	Jean-Louis
19 OP	Achkar	Joseph
20 PTB	Bauch	Andreas
21 PTB	Piester	Dirk
22 ROA	Palacio	Juan
23 SP	Jaldehag	Kenneth
24 SP	Rieck	Carsten
25 TimeTech	Pawlitzky	Alexander
26 TimeTech	Schaefer	Wolfgang
27 TL	Lin	Calvin
28 TL	Tseng	WenHung
29 USNO	Matsakis	Demetrios
30 VSL	de Jong	Gerrit
31 VSL	Kroon	Erik
32 VSL	Vreede, de	Jan