REPORT OF THE 17th MEETING
OF THE CCTF WORKING GROUP ON TWSTFT

held in Poznań, Poland
on 20-21 October 2009

The 17th 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 20-21 October 2009 in Poznań. The WG meeting was organized by Jerzy Nawrocki of AOS, and chaired by Bill Klepczynski WG Chairman and Dirk Piester of PTB Deputy Chair. Other contributions to the meeting, and attendee list (*web doc. 17-08*), are available on the BIPM TWSTFT restricted access website:

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

Documents related to the details of financial issues, and attendee list with e-mails (*web doc 17-08*), are available for Participating Stations on TWSTFT the BIPM restricted access website:

http://www.bipm.org/en/committees/cc/cctf/

Agenda

1) Opening address – Stanisław Schillak, Head of the Astrogeodynamical Observatory
2) Approving Agenda
3) Laboratories reports
4) Status of the TWSTFT contract regarding the EU-EU, US-EU link – A. Bauch, D. Piester, PTB
5) Computation of TWSTFT for UTC/TAI Generations – Z. Jiang, W. Lewandowski and H. Konaté, BIPM
6) Report on the modified Recommendation ITU-R TF.1153 – A. Bauch, D. Piester, PTB
7) Eu-Asia link – Miho Fujieda, NICT
8) What future for Pacific Rim links in UTC/TAI generation – W. Lewandowski, BIPM
9) Tour of AOS time and laser facilities
10) Restore the TW Calibration with a GPS Bridge – Toward a Standard Procedure – Z. Jiang, BIPM and D. Piester, PTB
11) Report from TimeTech – W. Schaefer
12) Organization of the T2L2 experiment at AOS – J. Nawrocki, S. Schillak, AOS
13) Time and frequency transfer via optical fiber in Poland – M. Lipiński et al., AGH
14) Current and planned calibration exercises
15) Discussion

Summary of the meeting

1. Welcome and Presentation of the Astrogeodynamical Observatory - Stanisław Schillak

2. Approving agenda . Agenda as listed above was approved.

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

AOS. Temperature dependence: diurnal signatures on transatlantic links. Status of TA(PL) and UTC(AOS). End in break of TWSTFT observations. Development of TTS-4. Contribution to Galileo GTSP and PTF (*web doc 17-9*).

INRiM. Seasonal and diurnal dependence studies. There is no clear idea of the causes of these effects. TWSTFT stations operational at the end of 2009. Franco Cordara will be retiring at the end of November 2009, Luca Lorini and Ilaria Sesia will be out of laboratory most of 2010 (*web doc 17-10*).

METAS. New TW calibration by BIPM for T-11N implemented. Temperature stabilisation of outdoor units. UTC(CH) is now a hardware clock. Perform an evaluation study to stabilize transatlantic links (*web doc 17-11*).

NICT. TW link OP-NICT operational since March 2009. Hawaii station will be installed in November 2009. T2L2. Measuerement campaigne started on 12 October 2009 between OCA OP, AOS, NICT S, TL, NTSC, sigma 70 ps. TWSTFT short term stability 50 ps. .... (*web doc 17-12*).

NIM. NIM is just joining TWSTFT family. SATRE modem. Time Scale system will move to new campus. There will be temperature control of sensitive parts *(web doc 17-13).*

NIST. Current status: 3.7m motorized antenna with Ku-band RF equipment .Two-channel SATRE MODEMs, SATRE #78: backup (under evaluation after repair), SATRE #263 primary. Automated operations. Recent Activities: transatlantic and Europe to Europe 1Mchip/s TWSTFT experiment (March – July, 2009), Satellite switch-over from IS-3R to T-11N (chip rate change from 2.5Mchip/s to 1Mchip/s), Participation in the revision of ITU-R Recommendation TF.1153-2. *(web doc 17-14).*

NMIJ. JCSAT-1B station (1.8m, el. 46.5 deg, NEW). Temperature controlled box (outdoor unit). IS-4 (2.4m). Carrier Phase project underway with KRISS and NICT (*web doc 17-15*).

NPL. Not significant change from last year. T&F technical leader Patrick Gill. NPL current equipment. US links not operational. 1.8m antenna. Satre #74. NPL02 on new NPL building – aim to bring into operation at the end of 2009 then move NPL01 (*web doc 17-16*).

NTSC. NTSC is national authority for time, and is located in geographical centre of China. Two Earth stations and two kind of modem: 1.8 and 2.4 m antennas. There are TW links with PTB, OP, VSL. Asia – Pacific will be kept (*web doc 17-17*).

OP. Two 2.4m Ku band VSAT (OP01 & OP02). Operation of OP01 & OP02 during satellite change. Status of the link toward Asia network: since February 2009 the OP02 TWSTFT station operates in totally automated way for the link toward the Asia network; up

to now successful link is established with MIM, NTSC, TL, NICT, KRIS. Calibration with TUG station: the calibration done by the mobile TWSTFT station has confirmed that the delay introduced by the four port diplexer was correctly estimated..Satellite simulator operational from now. T2L2 project is starting. Draft report on synchronous fountain comparison was presented by Daniel Rovera (*web docs 17-18 and 17-34*).

PTB. PTB01 (link to European and US stations), PTB02 (link to USNO via X-band), PTB03 (link to Asia via IS-4 under NICT contract), PTB04 (spare station). New location for TWSTFT antennas in near future. On-site optical fibre links.. (*web doc 17-19*).

ROA. Upgrade for the SATRE modem. Purchase of a new SATRE modem in progress. 2nd TWSTFT station at the end of 2009. Temperature stabilization in near future (*web doc 17-20*).

SP. New satellite has a better feed. New CALR values according to BIPM.. Some new hardware. e (*web doc 17-21*).

TL. OP-TL TWSTFT experiment begun. Three stations TL00 (prepare for Hawaii), TL01 (Asia), TL02 (Europe). GPS Carrier-Phase cycle lips problems. Hawaii link planned. (*web doc 17-22*).

USNO. Set-up of TWSTFT station in Hawaii in Nov/Dec 2009, operational in January 2010. Continuous calibration updates: smaller/lighter equipment. Some discrepancies in calibrations of USNO/NIST and USNO/PTB (*web doc 17-23*).

VSL. Changes in 2009: changed from Mitrex to Sartre, satellite simulator (some temperature fluctuations). (*web doc 17-24*).

4. Contractual matters – D. Piester, PTB. Payment are ongoing smoothly. ESA and GSA are not showing right now much interest of using TW transponder for Galileo. They even do not reply to written requests. Annual cost per lab for European and US links about 8000 to 16000 USD (*web doc 17-25*).

5. Computation of TWSTFT for UTC/TAI Generation – Z. Jiang, W. Lewandowski, H. Konate.. 19 UTC labs operate TW. 28% over total 68 UTC labs. 13 used for UTC. They contribute to UTC/TAI with 253 clocks (71% of total) - 88% of total clock weight. 11/12 Primary Frequency Standards 91% are linked by TW. Important role (*web doc 17-26*).

6. Report on the modified Recommendation ITU-R TF.1153 – A. Bauch, D. Piester, PTB. Motivations for changes: Different interpretations of the ITU-R TF.1153-2 regarding the generation of data files caused problems in the computation of TAI; Problems arose in the computation of 1-sec data, TWSTFT network has grown to a „worldwide network"; There is a need for the clarification of the implementation of ITU-R TF.1153-2;T he Rec has been used as reference document during the development of the Galileo timing infrastructure despite of its weaknesses; We will have two Galileo Precise Timing Facilities as part of the EU-US network in 2010 (*web doc 17-27*).

7. Eu-Asia link – Miho Fujieda, NICT. Participants: in Europe PTB and OP, in Asia NICT, TL, NTSC, NIM, KRISS; VSL and NMIJ will join soon? 24 sessions per day.

Monthly payment works well until now. Policy for entry: Participant should share the link-fee. For fiscal year 2009, how to share is fixed. New entry until March 2010 is permitted. Applicant laboratories: VNIIFTRI(Russia), NPLI(India), ISRO (India, Bangalore) (*web doc 17-28*).

8. What future for Pacific Rim links in UTC/TAI generation – W. Lewandowski, BIPM. There are some excellent internal Asian TW links as for example TL/NICT and KRIS/NICT having uA uncertainties below 200 ps, but there are not used for UTC generation because use of a single pivot PTB. Also when operational PTB/NICT has uncertainty around 200 ps. During discussion there were some concerns that introducing second pivot NICT, would not improve links of these laboratories because of two legs connections to PTB (*web doc 17-29*) .

9. Visit to AOS site. The AOS is an observatory of the Space Research Center, and is located about 30 km south of Poznań, It has three main sections: time, laser and geodesy. Time laboratory has grown during last years considerably and is now equipped with all available time transfer techniques including T2L2. Show of laser ranging capabilities was of special interest for attendees (*web docs 17-9 and 17-32*).

10) Restore the TW Calibration with a GPS Bridge – Toward a Standard Procedure – Z. Jiang, BIPM and D. Piester, PTB. TW calibration bridging by GPSPPP and TW X-band was detailed. Use of Triangle Closure Calibration was also described(*web doc 17-30*).

11) Report from TimeTech – W. Schaefer. New deliveries mainly to Russia and India.

12) Realization of T2L2 experiment at AOS – J. Nawrocki, S. Schillak. AOS T2L2 is operational. Delay calibrations problems: delay of photodiode uncertainty of overall calibration can be higher than 100 ps. October is not a good month for campaign due to unfavorable weather conditions. Longer time period of campaign is necessary. First successful measurements give a good prospect for future (*web doc 17-32*).

13) Time and frequency transfer via optical fiber in Poland – M. Lipiński et al. Thermal dependence of light propagation delay in the optical fiber is the fundamental factor limiting the precision of FO time/frequency transfer. It is possible to build a long-haul bidirectional FO links for precise time/frequency transfer with a several picoseconds precision (*web doc 17-33*).

14) Current and planned calibration exercises. There are planned new TWSTFT European calibration exercises of laboratories involved in Galileo. AOS, OCA, ROA and SP are most interested and shall take part in these exercises. USNO will continue its calibrations of PTB/USNO link. In Asia there is a strong interest in new calibrations. For the BIPM repeated TWSTFT calibrations are of utmost interest for the quality of UTC network.

15) Discusssion. The situation in Pacific-Rim needs a quick improvement: most of stations are operational but do not contribute to TAI. Pacific Rim TW Links should be calibrated ASAP.

Actions

a. TW calibration in Europe: AOS, OCA, ROA and SP will contact TUG on individual basis for participation in next calibration trip.
b. Pacific Rim TW use for UTC/TAI: BIPM staff will examine best use of excellent TWSTFT Asian links for UTC/TAI.

Departure of Bill Klepczynski

Bill was an outstanding and long-term Chairman of our Working Group. He was appointed Chairman in 1997. Under his leadership our WG became one of most active and recognized among working groups of CCTF, and TWSTFT technique became a major contributor to UTC/TAI. Recently Bill has decided to retire, and was invited guest to this meeting. During a ceremony speaches were pronounced by Jerzy Nawrocki, Dirk Piester, Wolfgang Schaefer, Włodzimierz Lewandowski and Bill Klepczynski. Participants to the meeting offered to Bill a book with words of thanks and sympathy. The book is on Wielkopolska and its chief place Poznań, a region of Poland , where are ancient roots of Bill`s family.

New Chairman of Working Group

Working Group appointed a new Chairman Dirk Piester of PTB, until now European regional co-Chairman.

Forthcoming meetings. Next meetings of Participating Stations will be held in April 2010 during the EFTF. The next full meeting of the Working Group will be held during autumn 2010 at the NIM, Beijing, China. It is foreseen that 2011 Working Group meeting will be held at the NMIJ, Tsukuba, Japan.

W. Lewandowski
Secretary of the CCTF WG on TWSTF