

**Minutes of the 2016 Meeting of the APMP  
Technical Committee for Time and Frequency  
Pullman Resort Hotel, Da Nang, Viet Nam  
14th–15th November, 2016**

Minutes taken by M. J. Wouters

## **I. Participants**



In total, 17 individuals representing 13 institutes in 12 economies participated in the 2016 meeting of the TCTF. The meeting was held at the Pullman Da Nang Beach Resort Hotel on November 14th (full day) and 15 (half day), 2016.

A*STAR	Meng Yusong
KRISS	Dai-Hyuk Yu
MUSSD	R.G.S.A. Perera
NICT	Yasuhiro Koyama
	Yuko Hanado
	Miho Fujieda
NIM	Zhang Aimin
NIMT	Piyaphat Phoonthong
NMIA	Michael Wouters
NMIJ	Tomonori Suzuyama
NMIM	Ahmad Sahar Bin Omar
NPLI	Ashish Agarwal
	Subhasis Panja
RCM-LIPI	A.M. Boynawan
TL	Chia-Shu Liao
	Yi-Jiun Huang
VMI	Trieu Viet Phuong

## **II. Day 1 0900-0930: Opening and Chair's Report (Chair: M. J. Wouters)**

### **A. Opening and adoption of the Agenda (M. J. Wouters)**

The Agenda as circulated prior to the meeting was presented and additions and amendments were invited; none were proposed. The agenda (available from the TCTF web pages) was adopted.

Apologies from G Gomah (NIS), S Ko (SCL), P Leones (ITDI), A van Braakel (NMISA), and A Dunford (MSL) and Dr K Hosaka (NMIJ) for being unable to attend were offered to the meeting.

## **B. Chair's report (M. J. Wouters)**

The Chair's report is available as a presentation on our website.

Q. How did purchasing of equipment for the Instrument Bank with TCI funds work in practise (Y Koyama, NICT)?

A. TCI funds were not typically used to buy equipment which went into the 'Instrument Bank'. The name 'Instrument Bank' was probably a misnomer; typically equipment was donated with a particular NMI(s) in mind and the equipment was never held by the APMP.

Q. When would the guidelines for TC Chairs be available (Zhang A, NMI)?

A. TC Chairs had been invited to send a list of the questions they had when starting in their role to the TCC Chair, and a draft document would be circulated in March next year.

Q. Can the matrix format used by some TCs for CMCs be used in T&F (Y Meng, SCL)?

A. As far as known, this is possible.

## **III. Day 1, 0930-1030: Institutional reports (Chair: M. J. Wouters)**

Short reports from each institute participating in the meeting were presented and discussed. Individual presentations are available on the APMP website and are not summarised here.

### **A. TL (C. S. Liao)**

Q. Is optical frequency measurement in your CMCs (M Wouters, NMIA)?

A. Not currently, but it will be added in the next submission

*Comment:* Optical frequency measurement was not currently claimed by any other NMI in the KCDB. It wasn't clear if it was properly a T&F CMC or Length CMC (M Wouters, NMIA)

Q. Regarding leap second distribution, did TL's NTP servers only get leap second notification in the last minute as per the IRIG-B specification (M Wouters, NMIA)?

A. The NTP servers had advance notification via the NIST leap seconds file.

Q. What is the status of the G1 GNSS receiver calibration campaign (A Agarwal, NPLI)?

A. The calibration system has been sent back to NIM.

### **B. NMIM (A. S. bin Omar)**

Q. What is the coverage area of the LF transmitter (P Phoonthong, NIMT)?

A. The study is at a very preliminary stage and this is not defined yet.

Q. What will be the power of the LF transmitter (T Suzuyama, NMIJ)?

A. Will have to check with colleague who is leading the study.

Q. Why is the Cs beam standard steered (D-H Yu, KRISS)?

A. The offset is maintained within 1 microsecond of UTC

*Comment:* NMIA follows the same procedure (M Wouters, NMIA)

*Comment:* BIPM recommends that the offset be kept within 100 ns (D-H Yu, KRISS)

### **C. VMI (T.V. Phuong)**

Q. Will the redundant timescale be in Hanoi (Zhang A, NIM)?

A. Planning to move to a new campus; the two timescale systems will be in the same location.

Q. What algorithm is being developed for the timescale (S Panja, NPLI)?

A. This was not decided yet.

Q. What is the accuracy of the web clock (A Agarwal, NPLI)?

A. *[Some discussion; answer unclear, but displayed time has 1 s resolution]*

### **D. NICT (Y. Hanado)**

Q. *[question not recorded]*(A Zhang, NIM)

Q. What is the relative synchronization of the two LF transmissions (A Agarwal, NPLI)?

A. Synchronization is at the millisecond level.

Q. What kind of CSAC is being used (A Agarwal, NPLI)?

A. NICT will be modifying the electronics of a commercial CSAC.

Q. How many clocks are at the Kobe site (A Agarwal, NPLI)?

A. There are 5xCs and 2xH-maser (Anritsu)

Q. How frequently is UTC(NICT) steered using the PFS (A Agarwal, NPLI)?

A. *[answer not recorded]*

Q. What is the stability of the VLBI time-transfer (D-H Yu, KRISS)?

A. This is determined by the H-maser.

## **IV. Day 1,1100-1230 Continuation of institutional reports (Chair M Wouters)**

### **A. KRISS (D-H Yu)**

Q. Regarding the dual Cs-Rb fountain, do you have two complete systems within the fountain structure (S Panja, NPLI)?

A. Much of the structure is common. Both fountains can be run simultaneously.

Q. What locking scheme is used for the DBR lasers (A Agarwal, NPLI)?

A. This is complicated and best answered offline. A paper is being prepared for publication.

Q. Is the VCSEL in the CSAC a commercial device (A Agarwal, NPLI)?

A. Yes. There were some concerns about continued availability of the selected VCSEL but an alternate vendor has been found.

### **B. NIMT (P. Phoonthong)**

Q. How do you couple the 10 MHz signal into the optical fibre (A Agarwal, NPLI)?

A. We use a commercial fibre transceiver. It is relatively inexpensive, less than \$2000.

### **C. NMIA (M. Wouters)**

Q. What is the TIC used in the OpenTTP system (S Panja, NPLI)?

A. The FPGA is used for this. The TIC is just a 200 MHz counter so it has 5 ns resolution. This is adequate for the anticipated application.

Q. Will the Web timer be used for calibration (A S Boynawan, RCM-LIPI)?

A. The Web timer is intended to be used for checking stopwatches using an accredited source of time. In principle, it could be used for calibration.

### **D. RCM-LIPI (A. S. Boynawan)**

Q. Why are you using a standard performance Cs when you have a high performance Cs available (*not recorded*) ?

A. [*answer not recorded*]

Q. What synchronization accuracy is required by the banks (*not recorded*)?

A. [*answer not recorded*]

### **E. NMC (Heng)**

Q. Could you give some more detail about the metrology training that was being given to university students (Y Koyama, NICT)?

A. NMC staff are giving 2 or 3 days of lectures.

## **F. MUSSD (A G Perera)**

There were no questions or comments

## **G. NIM (Zhang A.)**

Q. Is the fountain operating continuously (Y Hanado, NICT)?

A. Yes

Q. Is the Cs fountain incorporated into UTC(NIM) (Y Hanado, NICT)?

A. Yes

## **H. NPLI (S. Panja)**

Q. How long do you expect development of the single ion Yb optical clock to take (M Wouters, NMIA)?

A. At least another 5 years.

*Lunch break 1230-1330*

## **V. Day 1, 1330-1500, Continuation of institutional reports, WG reports (Chair M. Wouters)**

### **A. NMIJ (T. Suzuyama)**

[There was a question from A. Agarwal, NPLI but this was not recorded]

### **B. WG MRA report (M. Wouters, NMIA)**

There were no questions or comments.

### **C. WG GNSS report (M. Wouters, NMIA)**

Q. Who can propose TC Initiative projects (S Pandu, NPLI)?

A. Projects can be proposed by anyone but they must be submitted through the TC Chair.

Q. Can an NMI make its own arrangements with a G1 lab for receiver calibration (A Agarwal, NPLI)?

A. Yes, this is possible.

### **D. Joint TCL-TCTF WG on OFM report (D-H Yu on behalf of K Hosaka)**

Q. [In the context of the timetable for submission of revisions to secondary representations of the second] Why is the CCTF meeting one year earlier than usual (M. Wouters, NMIA)?

A. The meeting is being held to clarify the role of the CCTF in the future definition of UTC, in advance of the 2018 meeting of the CGPM (Y Koyama, Y Hanado NICT).

### **E. WG on TWSTFT (M Fujieda, NICT)**

Q. Is NPLI within the coverage area of the new satellite (S Panju, NPLI)?

A. The new satellite ABS-2A will provide service on Feb. 2017. An evaluation will be made then.

Q. For the SDR TWSTFT, how is the transmitted signal generated (M. Wouters, NMIA)?

A. Signals are still generated by a Satre modem. The received signals though are processed using the SDR.

[This is Dr Fujieda's last report as co-ordinator of the WG TWSTFT]

#### **F. WG on Test and Calibration report (A S bin Omar, NMIM)**

Q. What is covered by the guidelines for the inter-laboratory comparison (A Agarwal, NPLI)?

A. The guidelines establish the principles that will allow an inter-comparison.

There were some questions about costs- who would pay customs duties and so on. Each NMI would be responsible for the costs at its end – import costs and shipping costs to the next laboratory.

Experience with a similar exercise with VSL indicated that the costs are not large.

Q. What is the purpose of testing the temperature sensitivity of the stop watches (Zhang A, NIM)?

A. This is motivated by the range of typical measurement conditions reported by the potential participants.

Q. [not recorded] (A G Perera, MUSSD)

The Chair thanked the participants for their contributions and remarked that it is an opportunity to learn about developments and issues in other NMIs that are not otherwise published.

## **VI. Day 1, 1530-1700: Reports and discussion (Chair: M. J. Wouters)**

### **A. Report on 2015 TC Initiative (M. J. Wouters)**

Q. How could an NMI obtain one of the time-transfer systems (Koyama, NICT)?

A. The design is fully open-source and it is intended that an NMI manufacture the system itself. It would be good if the equipment was manufactured by a third party.

### **B. Discussion on GNSS receiver calibration**

A discussion of GNSS receiver calibration took place with the aim of forming a definite plan to begin calibration.

The current information about calibration requirements was presented to the meeting by the WGGNSS co-ordinator. It was pointed out that a significant number of labs had never had their receiver calibrated or that their receiver was last calibrated more than 10 years ago.

Y. Hanado (NICT) asked if there were any special requirements. The WGGNSS co-ordinator said that two labs had longer cable runs (up to 100 m), and would probably need to use a line amplifier. This should then be supplied with the travelling system, and the travelling system calibrated with and without this line amplifier.

Each G1 lab summarised the current status of their travelling system.

NICT (Y. Hanado) said that their system is essentially ready with just the manual to be completed and the arrangements under which the receiver was sent to G2 laboratories to be finalized. NICT would need a contract with each participant and two kinds of contract were possible: a co-operative research agreement; and an equipment loan. The latter of these is simpler.

NIM (A. Zhang) is fully ready: their system has already been to TL for the MEDEA workshop and has been used to perform calibrations of receivers within China at NTSC and BIRM. As indicated last year, a deposit may be required from participating G2 laboratories to cover the possibility of damage to the equipment.

TL (C.S. Liao) is ready. TL will be piloting the MEDEA ILC next year so is already committed to a calibration campaign. It is expected that the results of this campaign will be submitted to BIPM.

NICT (Y. Hanado) suggested that a group of G2 labs be assigned to each G1 lab.

TL (C.S. Liao) thought that this could create problems eg if there was an equipment failure. All calibration activity within that group would then be delayed until the system could be replaced.

A poll was taken to see which G2 labs wanted their receiver calibrated in the next year. Most labs present (NPLI, NMIJ, MUSSD, NMC, LIPI, KRIS, NIMT, VMI, NMIM, NMIJ) wanted calibration as soon as possible.

NICT (Y.Hanado) said that they will check which NMIs they already have a co-operative agreement with. They will also circulate copies of the two possible agreements so that these can be considered.

TL will check with PTB how many G2 labs will be supported by the MEDEA ILC (potentially 6).

It was resolved to decide on the G1/G2 allocation by the end of January.

## **VII. Day 2 0900-1030 (Chair: M. Wouters)**

### **A. MEDEA Workshop (C. S Liao)**

Dr Liao gave a presentation on the workshop recently held at TL.

Q. What are the details of the time-transfer systems (T Suzuyama, NMIJ)?

A. There was one system each from NIM, NICT and NMIA

Q. Did you compare the offsets of the travelling systems (Y Koyama, NICT)?

A. No. Only demonstrations were made.

Q. Is the followup workshop limited to the ILC participants (M Wouters, NMIA)?

A. Yes, but it is hoped that a few more participants can be invited.

Q. Will the followup workshop be held at TL (Y Koyama, NICT)?

A. Yes

Q. Why is the ILC being limited to 3-4 labs (M.Wouters, NMIA)?

A. There are 6 possible participants but time constraints (the MEDEA project ends in 2017) mean that not all labs can participate.

## **B. ATF Workshop (Y. Koyama)**

Q. [To the TCTF meeting] Should we hold a workshop next year (M Wouters, NMIA)?

A. The consensus was that we should.

There was some discussion about finding sources of funding to support attendance. Corporate sponsorship was suggested. D-H Yu pointed out that if the workshop is held in conjunction with the GA, then this would conflict with the APMP's own sponsorship arrangements.

Y Koyama said that NICT may not be able to sponsor the workshop since it sponsored the last ATF in 2015 with NIM and it expects more NMIs to participate in the sponsorship program as well. He encouraged the TCTF members to enquire as to possible funding from their home institutes.

D-H Yu considered that the Workshop might hold a tutorial as part of its programme. The WGs were encouraged to suggest possible topics.

## **C. Election of the incoming TCTF Chair**

There was one nomination for the position of TCTF Chair.

Dr Aimin Zhang (NIM) was unanimously elected as the incoming TCTF Chair.

The TCTF congratulated Dr Zhang on her election.

## **D. Confirmation of current organizational details**

The list of peer assessors was updated to remove Dr Tsukasa Iwama. The current peer assessors are therefore:

ASTAR	Liu Yan Ying
KRISS	Taeg Yong Kwon
KRISS	Sang Eon Park
KRISS	Dai-Hyuk Yu
MSL	Tim Armstrong
NICT	Mizuhiko Hosokawa
NICT	Yasuhiro Koyama
NICT	Hiroyuki Ito
NIM	Gao Xiaoxun
NIM	Zhang Aimin
NPLI	Ashish Agarwal
NMIA	Michael Wouters
NMIA	E. Louis Marais
NMIJ	Takeshi Ikegami
NMIJ	Masaki Amemiya
NMIJ	Tomonari Suzuyama
TL	Chia-Shu Liao
TL	Huang-Tien Lin

NPLI nominated a new CMC review contact (Dr V. N. Ojha?) . The current CMC review contacts are:

Dr. Liu Yan Ying	ASTAR
Dr. Dai-Hyuk Yu	KRISS
Dr. Tim Armstrong	MSL
Dr. Ito Hiroyuki	NICT
Dr. Zhang Aimin	NIM
Dr. Thayathip Thongtan	NIMT
Dr. Michael Wouters	NMIA
Dr. Suzuyama Tomonari	NMIJ
Dr. Mohd Nasir Zainal Abidin	NMIM
Dr. V. N. Ojha?	NPLI
Mr. Yan	SCL
Dr. Chia-Shu Liao	TL
Mr. Trieu Viet Phuong	VMI

Dr S Panju nominated as new sub-coordinator for the WG OFM.

The new co-ordinator of the WG TWSTFT, Mr Yi-Jiun Huang, invited interested parties to contact him regarding the position of sub-coordinator.

Dr Y Koyama suggested that the ATF be added to the TCTF structure, since it is an ongoing activity. This was accepted by the meeting. The TCTF structure for 2017 is therefore:

<i>Mutual Recognition Agreement (MRA)</i>			
	Co-ordinator	Mr E. Louis Marais	NMIA
<i>Global Navigation Satellite Systems (GNSS)</i>			
	Co-ordinator	Dr Michael Wouters	NMIA
	Sub-coordinator	Dr Jia-Lun Wang	TL
<i>Two-way Satellite Time and Frequency Transfer (TWSTFT)</i>			
	Co-ordinator	Mr Yi-Jiun Huang	TL
	Sub-coordinator	TBA	
<i>Optical Frequency Metrology (OFM) (joint TCL/TCTF)</i>			
	Co-ordinator	Dr K Hosaka	NMIJ
	Sub-coordinator	Dr S Panja	NPLI
<i>Asia-Pacific Workshop on Time and Frequency</i>			
	Chair of Organizing Committee	Dr Y Koyama	NICT
<i>Test and Calibration</i>			
	Co-ordinator	Mr Ahmad Sahar Bin Omar	NMIM
	Sub-coordinator	Mr Stephen Quigg	NMIA

## **E. Discussion topic: Leap seconds**

M. Wouters (NMIA) introduced the topic by recounting the outcome of the November 2015 meeting of the ITU which considered the status of leap seconds in UTC, as the culmination of a long study period. Although a decision was deferred until 2023, pending further consultations, the CCTF was asked to consider its role in the definition of UTC, including leap seconds MORE HERE

Y. Koyama (NICT) confirmed this summary of the issues.

In consequence of the request from the ITU, the CCTF will be holding its next meeting one year earlier than usual in June 2017 to consider the issue so that a recommendation can be made at the next meeting of the CGPM in 2018.

Y. Hanado (NICT) said that the CCTF has formed a sub-WG to prepare a draft document with a first draft anticipated by the end of January 2017.

M. Wouters (NMIA) outlined some problems that NMIA had seen in consequence of the June 2015 leap second. The TCTF was invited to share their experiences; no particular problems were reported.

D-H Yu (KRISS) commented that there was no central place to report problems associated with the leap second. It was likely that many problems were not reported.

*Coffee break*

## **VIII. Day 2, 1100-1230: Discussions**

### **A. Supporting development of CMCs**

A Agarwal (NPLI) introduced a new topic as a result of an informal discussion about ways that the TCTF can be useful to its members. The TCTF was asked to consider how we might strengthen the MRA. In particular, some economies with T&F capabilities have not yet published a T&F CMC. How can the TCTF increase participation in the MRA? One possibility was extended placements as a training activity.

It was suggested that this could be a joint activity between the WG MRA and WG TC.

Some economies which participated in the recent MEDEA workshop were identified as candidates : Bangladesh, Nepal, Pakistan, ....

M Wouters (NMIA) commented that the MEDEA program was likely to be renewed for a further four year period and that this could be a source of funding

A S bin Omar (NMIM) suggested that we should compile a list of CMCs and match these with the needs of candidate economies.

A G Perera (MUSSD) suggested on-site training as an alternative. Another possibility was that a visiting expert could help develop a case to present to government for improvements to capabilities.

A Agarwal (NPLI) indicated that the DEC had funds available to support workshops, for example.

D-H Yu (KRISS) said that KRISS funds an education program (2 weeks) in metrology. No applicants had been received in T&F. KRISS had advised one NMI and helped them to develop their T&F CMCs.

A S bin Omar (NMIM) summarised by saying that there are two possibilities: an expert visited an NMI; or someone was sent to an NMI to work with their experts.

It was resolved that the Chair would contact candidate NMIs to gather some information about what they consider might be of benefit to them.

The Chair closed the meeting at 11:30 am.