

CCT Task Group on Digitalization (CCT-TG-Dig)

Dr. Patrick Rourke, *Online Briefing on the establishment of a
Forum for Metrology and Digitalization, 22 May 2023*



CCT Task Group on Digitalization (CCT-TG-Dig)

Creation

30th meeting of the CCT, February 2022

Purpose

To support the Digital SI efforts of the BIPM within the purview of CCT

- **Machine-readability of the SI Brochure, its associated *Mises en Pratiques*, and further key documents of the Consultative Committees**
- Advisory role to the CCT and BIPM
- Wider “new metrology” issues such as “*in-situ* traceability”, “self-calibrating sensors” and “points of truth” in sensor networks are not in the scope of this TG (MRA / traceability / equivalence)
⇒ Another CCT TG may be established to consider them

CCT-TG-Dig:

Support the Digital SI efforts of the BIPM within the purview of CCT

Terms of reference

The general objectives of the CCT-TG-Dig are to:

- Identify information that should be machine readable in the documents related to the *MeP-K*, such as the ITS-90 text, Guide, appendices, *etc.*
- Recommend an indexing and archiving approach for the documents

Tasks:

- Identify the relevant documents and advise BIPM staff on which documents need to be machine readable
- Identify equations, tables, *etc.* in the documents that are commonly implemented in software applications
- Recommend an indexing and archiving approach to make both current and former versions of the documents more findable, by internal and external search functions
- Test beta versions of relevant documents and functions established by BIPM staff

Present CCT-TG-Dig membership

Chair

- Dr. Patrick Rourke, NRC Canada (member: CCT-WG-CTh, CCT-WG-SP)

Members

- Prof. Jovan Bojkovski, MIRS/UL-FE/LMK Slovenia (chair: CCT-WG-**CMC**; member: CCT-WG-SP)
- Dr. Christof Gaiser, PTB Germany (chair: CCT-WG-**CTh**; member: CCT-WG-SP)
- Dr. Roberto Gavioso, INRiM Italy (member: CCT-WG-CTh)
- Dr. Yasuki Kawamura, NMIJ/AIST Japan (chair: CCT-WG-**NCTh**; member: CCT-WG-SP, CCT-TG-CTh-ET)
- Prof. Graham Machin, NPL UK (chair: CCT-TG-NCTh-IRT; member: CCT-WG-NCTh)
- Dr. Mohamed Sadli, LNE-LCM/Cnam (member: CCT-TG-NCTh-IRT, CCT-WG-NCTh)
- Dr. Peter Saunders, MSL New Zealand (member: CCT-WG-**Hu**, CCT-TG-Env-AirT)
- Dr. Shahin Tabandeh, MIKES Finland (member: CCT-WG-CTh)
- Dr. Inseok Yang, KRISS Korea (member: CCT-WG-CTh)
- Dr. Jintao Zhang, NIM China (member: CCT-WG-CTh)

Co-opted members

- Dr. Ingmar Müller, PTB Germany



Broad
expertise &
connections
across CCT
areas

CCT-TG-Dig 1st year done

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CCT-TG-Dig 1st year done

Digital data identification, extraction and validation from top priority CCT documents:

- *The International Temperature Scale of 1990 (ITS-90)*
- *The Provisional Low Temperature Scale from 0.9 mK to 1 K (PLTS-2000)*
- *Technical Annex for the International Temperature Scale of 1990*
- *Supplementary Information for the Realization of the PLTS-2000*
- *MeP-K Annex: Absolute Primary Radiometric Thermometry*
- *MeP-K Annex: Relative Primary Radiometric Thermometry*
- *MeP-K Annex: Uncertainty Estimation in Primary Radiometric Temperature Measurement*
- *MeP-K Annex: Low Temperature Johnson Noise Thermometry*
- Review article supporting the MeP-K: Moldover *et al.*, Acoustic Gas Thermometry *Metrologia* (2014)
- Review article supporting the MeP-K: Gaiser *et al.*, Dielectric-Constant Gas Thermometry *Metrologia* (2015)

Began restructuring MeP-K to improve its machine readability

Example: ITS-90 coefficients

Why digitalize?

- Coefficients used for all standard platinum resistance thermometers calibrated on the ITS-90 world-wide
- Scanned PDF
- Many coefficients, many digits
- Transcription errors could be hard to detect

TABLE IV

Platinum resistance thermometer

The constants $A_0, A_i; B_0, B_i; C_0, C_i; D_0$ and D_1 in the reference function of equations (9 a); (9 b); (10 a); and (10 b) respectively

A_0	- 2,135 347 29	B_0	0,183 324 722
A_1	3,183 247 20	B_1	0,240 975 303
A_2	- 1,801 435 97	B_2	0,209 108 771
A_3	0,717 272 04	B_3	0,190 439 972
A_4	0,503 440 27	B_4	0,142 648 498
A_5	- 0,618 993 95	B_5	0,077 993 465
A_6	- 0,053 323 22	B_6	0,012 475 611
A_7	0,280 213 62	B_7	- 0,032 267 127
A_8	0,107 152 24	B_8	- 0,075 291 522
A_9	- 0,293 028 65	B_9	- 0,056 470 670
A_{10}	0,044 598 72	B_{10}	0,076 201 285
A_{11}	0,118 686 32	B_{11}	0,123 893 204
A_{12}	- 0,052 481 34	B_{12}	- 0,029 201 193
		B_{13}	- 0,091 173 542
		B_{14}	0,001 317 696
		B_{15}	0,026 025 526
C_0	2,781 572 54	D_0	439,932 854
C_1	1,646 509 16	D_1	472,418 020
C_2	- 0,137 143 90	D_2	37,684 494
C_3	- 0,006 497 67	D_3	7,472 018
C_4	- 0,002 344 44	D_4	2,920 828
C_5	0,005 118 68	D_5	0,005 184
C_6	0,001 879 82	D_6	- 0,963 864
C_7	- 0,002 044 72	D_7	- 0,188 732
C_8	- 0,000 461 22	D_8	0,191 203
C_9	0,000 457 24	D_9	0,049 025

CCT-TG-Dig 2nd year plans

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Future of CCT-TG-Dig

31st meeting of the CCT, May 2024

Anticipate current TG tasks to be complete by May 2024.

- Report and recommendations to the CCT
- Beyond May 2024 – CCT discussion:
 - Should CCT-TG-Dig be renewed with new Terms of Reference?
 - What digitalization activities within the purview of CCT and aligned with CCT-TG-Dig expertise would be most helpful to stakeholders?
 - Evolving BIPM Digital SI priorities?
 - Interaction with the Forum?

Thank you

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