News from the CIPM and update on Strategy development

Directors Webinar
October 2020

Wynand Louw
President of CIPM
Activities since October 2019

In March 2020, all physical meetings at the BIPM was postponed due to the lockdown

The CIPM held its working and task group meetings, originally planned for March and June, in June and August. All CIPM members participated in the meetings

A number of actions were finalised by correspondence. Official voting took place and the decisions were summarised for final noting at the next CIPM meeting

The official annual CIPM meeting (normally held in October) was held in three online sessions on 16, 17 and 18 October
Highlights of the October 2020 CIPM meetings (and decisions taken by electronic voting)

• MOU signed with THE INTERNATIONAL FEDERATION OF CLINICAL CHEMISTRY AND LABORATORY MEDICINE (IFCC)
• The draft MoU between the BIPM and the ITU was approved
• The MOU between the BIPM and THE PREPARATORY COMMISSION FOR THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY ORGANIZATION (CTBTO) will be voted on electronically in the next few weeks
OIML D1 (National Metrology Systems - Developing the institutional and legislative framework) was approved as a joint publication of BIPM and OIML.

The Terms of Reference of a BIPM and OIML Joint Task Group was adopted and CIPM members were appointed to the JTG.
• The focus of the JTG is to foster enhanced cooperation between the BIPM and OIML in order:
  - to facilitate both organizations in serving their member states better,
  - to make both organizations more attractive to states that do not currently participate in the activities of either/both organization(s)
The CIPM decided to allow Consultative Committees, CC Working Groups and CC Workshops to be held on-line and agreed version 3.1 of CIPM D-01.

A Timetable proposed by the Chair of the Sub-Committee on Finance (FSC) to address the issue of Advances created by the implementation of Resolution 5 of the 26th meeting (On the Financial Arrears of Member States and the process of Exclusion) was discussed and approved. The FSC was tasked to coordinate the process of reaching consensus amongst advancing Member States on the issue.
Highlights of the October 2020 CIPM meetings; #5

• Several decisions for BIPM oversight and the following were approved:
  • The audited financial statements, and the Director was granted quietus for the 2019 exercise,
  • the 2019 pension fund Actuarial study & choices for staff to join the “post-2017” option, and plans were discussed to improve the liquidity of the fund,
  • Amendments to the Rules, Regulations and Instructions applicable to BIPM Staff, that modernises the conditions of employment and better serve the interests of both staff and BIPM
Highlights of the October 2020 CIPM meetings; #6

- CCQM, CCT and CCTF reported on their on-line CC and WG meetings:
  - CCQM, 34 video conferences for the 11 WGs from April to July
  - Activities in support of Covid, two SARS-CoV-2 pilot studies
  - Series of Webinars:
    - Ensuring the reliability of measurements in response to the COVID-19 pandemic.
    - Accurate Monitoring of Surface Ozone
  - CCT established a Task group on body temperature measurements through radiation and rescheduled the 29th CCT as 5 on-line sessions from 20 October 2020 to Feb 2021
  - Going to launch repeat comparison of water triple-point-cells
Highlights of the October 2020 CIPM meetings; #7

- CCTF reported on their on-line CC meeting
  - Session 22-1: October 28-29, 2020
  - Session 22-2: March 11-12, 2021

- Roadmap towards the redefinition of the second
  - Creation + ToR of a task force with 3 subgroups:
    A – Request from user communities and NMIs
    B – Atomic frequency standards, and possible redefinition approaches
    C – TF Dissemination and time scales; Update of conditions and criteria to change the definition
• CCM reported on actions related to the kilogram;
  • The mise-en-pratique of the definition of the kilogram was updated in August 2020
  • The draft B report of the first Key Comparison of realization experiments is now available. The Final report is being approved by the CCM Working Group on Mass
  • The first consensus value for the dissemination of the kilogram will be calculated by the CCM Task Group CCM-TGPfD-kg end 2020
Activities since October 2019: Strategy Development

- The CIPM reported its plans for Strategy development to the Directors in Oct 2019.

- A series of meetings and workshops at the BIPM were planned from February 2020 onwards to discuss and develop the Strategy.

- After some discussions on-site in February 2020, the Strategy working group used online discussion forums and e-mails to develop the strategy.

- Although it was difficult to keep to the planned timelines, substantial progress were made on all the themes.
The Themes for the CIPM Strategy

1. Responding to Evolving Needs for Metrology
2. Addressing key scientific challenges to advance the global measurement system
3. Strategy for deepening engagement with other international organisations on measurement science issues
4. Reviewing the strategy for the future membership of the organisation
5. Modernising the operations of the organisation
Strategy Activity #1: Evolving Needs for Metrology

Challenge: how can the CIPM foster and promote international cooperation in response to evolving needs in metrology (that often are of horizontal nature)

A discussion document is being developed containing:
- General scene: evolving metrology needs, progress in measurement science
- Summary description of seven ‘Metrology Grand Challenges’ already identified
  - Background, sector challenges, metrology challenges, CIPM/BIPM actions
- Proposals for overall CIPM role and actions (and possibly new infrastructure) to support and stimulate international coordination in these areas
  - Possible impact on BIPM work programmes and possible CGPM resolutions
Identified ‘Metrology Grand Challenges’:
- Climate change and environment
- Health & life sciences
- Food safety
- Energy
- Advanced manufacturing

Including two horizontal challenges:
- Digital Transformation (e.g. AI, machine-readable / -actionable information)
- “New” metrology (e.g. intrinsic standards, sensor networks, distributed measurements)
Some initial ideas on how the CIPM could respond:

- To foster **closer links between metrology and stakeholders** making and using climate, pollution and other environmental observations
- To promote interdisciplinary communication and the establishment of interdisciplinary **ad-hoc task groups** within the Consultative Committees, observers/liaisons from outside the metrology community
- **Consult and agree with RMOs** best ways to co-operate for mutual benefit in this area
- **Promote international comparisons** relevant to the food sector related to food safety, labelling, authenticity and fraud
Further CIPM actions

- Complete present draft following CIPM meeting & Directors meeting
- Consult with CC presidents
- Assignment of CIPM contact persons for each theme

Discussion document with identified challenges and proposed CIPM / BIPM actions will be available for wider consultation and comment by February 2021

- First aim of the document is to trigger and steer CIPM actions
- It is not meant to be ‘definitive’ – further work will be needed in e.g. dedicated WGs
Strategy Activity #2. Addressing key scientific challenges to advance the global measurement system (1)

Challenges:
How can the CIPM foster and promote international cooperation
1) in response to the *implementation of the revised SI*
2) towards a possible *future revision of the SI*
3) in response of *primary metrology outside the NMI*s
4) in response of *the science of Systems Metrology*: the characterization of heterogeneous, large and complex systems of methods and sensors

*Slides prepared by Prof. Dr Joachim Ullrich*
Strategy Activity #2. Addressing key scientific challenges to advance the global measurement system (2)

1) Overseeing the implementation of the 2018 revisions to the SI:
   i. **Consult and assist** the NMIs, the CCs, RMOs and TC Chairs as well as the Quality-Infrastructure and scientific communities **with the implementation**
   ii. **Review scientific and technological developments** as well as **alternate metrological traceability paths** created by the 2018 revisions

2) The possible future revision of the SI:
   i. Develop a consensus roadmap for a **new definition of the second** and update the applicable **principles of traceability** in view of the enormous uptake of GNSS time signals globally
   ii. Consider the longer-term needs for a **quantum candela**
   iii. Consider fostering and leading an international collaboration towards an **optical-clock network on geostationary orbitals**
Strategy Activity #2. Addressing key scientific challenges to advance the global measurement system (3)

3) **Primary metrology outside the NMIs**

   i. Consider issues of *accreditation, traceability, remote calibration* as well as the use of *digital certificates* (metadata) in accreditation and legal control.

   ii. Consider *real time calibration* in cases where measurement instruments and, thus, metrology is directly implemented in industrial processes and products, so called *embedded measurements*

   iii. Consider *virtual metrology* and *virtual standards*, the prediction of post-process metrology and the confidence in models and data quality

   iv. Consider the development of *self-calibrating devices* (“NMI-on-a-chip”)
4) **Systems Metrology**: Disruptive developments, such as smart homes, smart mobility, smart cities, personalized medicine, a circular economy that relies on **thousands of measurement data** and **request systemic thinking in metrology**

i. **Metrological characterization of complex systems** with often hundreds of distributed networked sensors and measuring methods, each with different accuracy, reliability or weighting, as a basis for AI-based decisions

ii. Develop methods and infrastructures for the **validation of (AI) algorithms**
   - Development of basic requirements for reference data sets for simple and complex systems (e.g., distributed systems and AI applications)
   - Development of basic concepts and methods for reference data sets as "digital standard" of a traceability chain and basis of a "QI for AI"
Strategy Activity #2. Addressing key scientific challenges to advance the global measurement system (5)

Autonomous Driving: Metrologically sound testing of all relevant components

- Sensing (up to 400 sensors)
- Communication, e.g., using 5G
- Simulations (often AI-based)
- Influences of other road users

Challenges of systems metrology

- **What does an algorithm learn** from a given situation and how will it respond in the future?
- **How does the same algorithm react** if individual sensors measure with reduced accuracy, e.g., a camera blinded by rain or fog?
- **How do we assess the health condition** of a person from a multitude of personalized diagnostic data and what conclusions do we draw from it to devise personalized therapy?
Strategy Activity #2. Addressing key scientific challenges to advance the global measurement system (6)

Today: Physical units

In the future: Data and algorithms
- Test and reference data sets
- Reference and validation processes
- Reference results, ...

→ Quality of Systems Metrology

→ International Harmonisation: Metre Convention

The international prototype metre and kilogram of the future
Strategy Activity #3: Deepening engagement with other international organizations on measurement science issues (1)

Signed MoUs
- BIPM-IUPAC MoU (signed in October 2019)
- BIPM-IFCC-ILAC Declaration of Cooperation establishing JCTLM (re-signed in Dec 2019)
- BIPM-ITU MoU (signed in July 2020)
- BIPM-IFCC MoU (signed in September 2020)

MoUs under preparation:
- Draft BIPM-CTBTO MoU – ready for the CIPM vote
- Draft BIPM-CODATA MoU - CODATA TGFC comments received on the first draft
- Draft BIPM-OIML MoU – first draft being prepared

OIML:
- World Metrology Day 2020 by AA&W Egypt (AFRIMETS) ‘Measurements for global trade’
- Work underway SASO Saudi Arabia (GULFMET) for World Metrology Day 2021 ‘Measurement for health’
- Revision of D1 - The Final Draft Document was posted for the 55th CIML meeting on 17 August, available at http://online-55ciml.oiml.org/ciml.html
- Joint BIPM-OIML task group established by Decision CIPM/108-5 of March 2019 and ToR approved on 13 October 2020

IUPAC – International Union of Pure and Applied Chemistry
IFCC – International Federation of Clinical Chemistry and Laboratory Medicine
ITU – International Telecommunication Union
CTBTO – Comprehensive Nuclear Test Ban Treaty Organization

Slide prepared by Dr Jim Olthoff
Strategy Activity #3: Deepening engagement with other international organizations on measurement science issues (2)

• In light of the progress with this activity and that the CIPM believe the CGPM resolution 2003: is being implemented; The CIPM decided that the strategy activity will be rolled into the other strategy activity action plans, where appropriate
Strategy Activity #4: Reviewing the strategy for the future membership of the organisation (1)

- The CIPM plans to bring forward a CGPM Resolution that would provide a *mandate to explore mechanisms* to enable more States to accede to the Metre Convention.
- The SI Redefinition in 2018 was a fundamental scientific change: *in principle, there is now universal access to the realizations of the Units*.
- The original treaty also embodies the *principle of universal participation*:
  - ‘...the High Contracting Parties desiring to ensure the international unification and the perfection of the Metric System.’

*Slides prepared by Dr Alan Steele*
Strategy Activity #4: Reviewing the strategy for the future membership of the organisation (2)

- Over the years many CGPM Resolutions, CIPM and BIPM actions, facilitate or encourage *universal participation*

- Encouragement efforts have been rather successful, particularly with the launch of the CIPM MRA. At the turn of the century there were 48 Member States, today we have:
  - 62 Member States representing 93 % of world GDP
  - 40 Associate States and Economies representing 4.7 % of world GDP
  - In total almost 98 % of the World GDP
Strategy Activity #4: Reviewing the strategy for the future membership of the organisation (3)

- BUT... membership includes only about 1/3 of the world’s countries
- There are 83 States that are neither Members nor Associates:
  - 20 to 30 States have an identifiable point of contact, typically because they are already a member of an RMO or a RLMO
  - 50 to 60 States are “outside the system” and we have no point of contact
- Existing engagement and inclusion strategy is unlikely to encourage all of the Associates to accede to the Convention, nor enable participation by the many very small States that use the SI without a voice
Strategy Activity #4: Reviewing the strategy for the future membership of the organisation (4)

- The draft Resolution will seek a mandate to learn from other treaties to evaluate and explore membership models that are more inclusive
  - Recognize we are not trying to change the mission, role, or existing participation for signatories
  - Recognize this is a big step that will require careful analysis, reflection, and discussion particularly to ensure no incremental unfunded burden of effort
  - Recognize the need to launch the work formally after CGPM 2022
  - Aim to develop options and bring forward a recommended solution to the CGPM for voting in 2026
Strategy Activity #5: Modernizing the Organisation

• New Rules of Procedure drafted in 2020
  – Summary of tasks and rules for the CIPM from the Metre Convention and its Annexes, CGPM and CIPM decisions
  – Proposals for policies in line with best practice amongst International Organisations
  – First discussion during the CIPM meeting October with broad support
  – Next step; formal online consultation and approval

• The Compendium will be updated for the CIPM activities and responsibilities

Basic message:
The Rule of Procedure of the CIPM will contribute to the modernization of the operation of the CIPM

Slides prepared by Dr Philippe Richard
Thank you

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