Bureau International des Poids et Mesures

Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV)

Report of the 13th meeting
(16-18 November 2021)
to the International Committee for Weights and Measures

Comité international des poids et mesures

LIST OF MEMBERS OF THE
CONSULTATIVE COMMITTEE FOR ACOUSTICS, ULTRASOUND AND VIBRATION
as of 16 November 2021

President

Dr H. Laiz, Instituto Nacional de Tecnología Industrial [INTI], Argentina, CIPM member.

Executive Secretary

Dr G. Panfilo, International Bureau of Weights and Measures [BIPM], Sèvres.

Members

Central Office of Measures/Glówny Urzad Miar [GUM], Warsaw.

Centro Nacional de Metrología [CENAM], Querétaro.

D.I. Mendeleyev Institute for Metrology [VNIIM], St Petersburg.

Danish Fundamental Metrology Ltd [DFM], Hørsholm.

Federal Office of Metrology [METAS], Bern-Wabern.

Instituto Nacional de Metrologia, Normalizacao e Qualidade Industrial [INMETRO], Rio de Janeiro.

Korea Research Institute of Standards and Science [KRISS], Daejeon.

Laboratoire National de Métrologie et d'Essais [LNE], Paris.

National Institute of Metrological Research/Istituto Nazionale di Ricerca Metrologica [INRIM], Turin.

National Institute of Metrology [NIM], Beijing.

National Institute of Standards and Technology [NIST], Gaithersburg.

National Measurement Institute of Australia [NMIA], Lindfield.

National Metrology Institute of Japan, AIST [NMIJ/AIST], Tsukuba.

National Metrology Institute of South Africa [NMISA], Pretoria.

National Metrology Institute of Turkey/TÜBITAK Ulusal Metroloji Enstitüsü [UME], Gebze-Kocaeli.

National Physical Laboratory [NPL], Teddington.

National Research Council of Canada [NRC], Ottawa.

Physikalisch-Technische Bundesanstalt [PTB], Braunschweig.

The Director of the International Bureau of Weights and Measures [BIPM], Sèvres.

Observers

All-Russian Scientific Research Institute of Physical Technical Measurements, Rosstandart [VNIIFTRI], Moscow.

Bulgarian Institute of Metrology [BIM], Sofia.

Bundesamt für Eich-und Vermessungswesen [BEV], Vienna.

Centro Español de Metrología [CEM], Madrid.

CSIR National Physical Laboratory of India [NPLI], New Delhi.

Czech Metrology Institute [CMI], Brno.

Industrial Technology Research Institute/Center for Measurement Standards [CMS/ITRI], Hsinchu.

Instituto Português da Qualidade [IPQ], Caparica.

Kenya Bureau of Standards [KEBS], Nairobi.

National Institute of Metrology/Institutul National de Metrologie [INM], Bucharest.

National Metrology Centre, Agency for Science, Technology and Research [NMC, A*STAR], Singapore.

Slovak Metrology Institute/Slovenský Metrologický Ústav [SMU], Bratislava.

Liaisons

Comprehensive Nuclear-Test-Ban Treaty Organization [CTBTO], Vienna

International Electrotechnical Commission [IEC], Geneva.

International Organization for Standardization [ISO], Geneva.

FIRST SESSION TUESDAY 16 (11:00 – 13:00 UTC)

I-1 INTRODUCTION BY THE PRESIDENT OF THE CCAUV

The Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV) held its 13th meeting online on 16-18 November 2021.

The following delegates were present: R. Allen (NIST), K.M. Baik (KRISS), S. Barrera Figueroa (DFM), T. Bruns (PTB), A. Canu (LNE), A. Chijioke (NIST), W.H. Cho (KRISS), S. Crocker (NIST), R. Dias (INMETRO), L. Dickinson (NMIA), D. Dobrowolska (GUM), P.K. Dubey (NPLI), G. Durando (INRIM), J.S. Echeverría-Villagómez (CENAM), N. Garg (NPLI), R. Green (NRC), C. Hof (METAS), R. Horiuchi (NMIJ/AIST), Y.-T. Kim (KRISS), C. Koch (PTB), T. Koukoulas (NRC), A. Kozliakovskii (VNIIM), H. Laiz (CCAUV President, CIPM, INTI), M.J.T. Milton (BIPM Director), A. Mlynska (GUM), R. Nel (NMISA), H. Nozato (NMIJ/AIST), E. S. Olsen (HBK-DPLA - DFM), A. Pérez Matzumoto (CENAM), S. Rajagopal (NPL), G. Ripper (INMETRO), S. Robinson (NPL), D. Rodrigues (LNE), E. Sadikoglu (UME), A. Schiavi (INRIM), Z. Siejda (GUM), A. Y. Smirnov (VNIIM), Z.M.D. Soares (INMETRO), Q. Sun (NIM), C. Thomas (NMIA), A. Troia (INRIM), V. Tyalimpi (NMISA), C. Veldman (NMISA), J.H. Winther Eskildsen (HBK-DPLA - DFM), L. Wu (NRC), P. Yang (NIM), A. Yankovsky (VNIIM), M. Yoshioka (NMIJ/AIST).

Observers: M. Bartos (CMI), M. Blabla (CMI), J.-K. Chen (CMS/ITRI), S. Cui (NMC, A*STAR), S.R. Gacheru (KEBS), A. Horvath (BEV), A.E. Isaev (VNIIFTRI), M. Kamensky (SMU), D. Khoo (NMC, A*STAR), A. Maina (KEBS), V. Marcos (CEM), J. Mou (NMC, A*STAR), A. Nikolaenko (VNIIFTRI), L. Ribeiro (IPQ), P. Rosenkranz (BEV), S. Ruiz (CEM), C. Taiti (KEBS), T.-H. Tu (CMS/ITRI), Daniela Virovska (BIM).

Liaisons: B. Doury (CTBTO), J. Park (CTBTO), Y. Sid-Ahmed (CTBTO).

Representatives from Member States invited to attend as Observer: O. Kosterov (SE “NDI Systema”), F.A. Serrano (INTI).

Guests: F.N. Alsubaey (SASO-NMCC), R. Felix (INMETRO), T. LeBrun (NIST), K. Thomson (NRC), A. Volodchenko (BelGIM).

Also present: G. Panfilo (BIPM, CCAUV Executive Secretary), S. Picard (BIPM, KCDB Coordinator), O. Werhahn (JCRB Executive Secretary).

The President, Dr Laiz, welcomed the delegates to the 13th meeting of the CCAUV and introduced the CCAUV.

All participants introduced themselves.

I-2 WELCOME BY THE DIRECTOR OF THE BIPM

The Director of the BIPM, Dr Milton, welcomed the delegates to the 13th meeting of the CCAUV and presented his report. He recalled that there are currently 63 State Parties to the Metre Convention, and 39 Associate States and Economies of the CGPM. The Kingdom of Cambodia become an Associate at the beginning of 2021.

He informed the CCAUV that the BIPM is investing in new communication methods. He gave four examples. The first is the recently launched e-learning platform that is accessible from the BIPM website. The second is the BIPM YouTube channel, which contains material from BIPM workshops as well as material from webinars organized by the Consultative Committees (CCs). The third is new BIPM website with more than 6000 individual user accounts. The website has been optimized so that it also works effectively in tablet and mobile-phone formats. The fourth method is the newly implemented KCDB 2.0 API (application programming interface), which enables direct digital access to the publicly available CMC data.

BIPM capacity building activities continue with ever increasing volume. Between January 2020 and September 2021, the BIPM hosted 1200 members of the NMI community, including those that attended a large workshop organized by the BIPM for the accreditation community.

World Metrology Day 2022 will be on the subject of the digital transformation.

Dr Milton's presentation is available on the CCAUV webpage (CCAUV/2021-I-02).

I-3 APPOINTMENT OF THE RAPPORTEUR

Dr Wu from NRC and Dr Durando from INRIM were proposed as the Rapporteurs. This was approved by the participants.

I-4 APPROVAL OF THE AGENDA

Dr Laiz introduced the agenda and asked participants if any changes or modifications were required. Two proposals were made. An agenda item '2.3. CCAUV pilot studies: proposal' was added to the second session and 'Reports from international observers and international meetings' was moved from the third session to the second session.

The revised agenda was approved and is available on the CCAUV website (CCAUV/2021-00).

I-5 REPORT OF THE 12TH MEETING OF THE CCAUV 2019, INCLUDING ACTIONS AND DECISIONS

The essential actions and decisions arising from the 12th meeting of the CCAUV (2019) are summarized below. The CCAUV President presented the actions and decisions for the benefit of the meeting. All five actions arising from the previous meeting have been addressed by the former CCAUV President, Dr Usuda and by the current president Dr Laiz.

CCAUV12/A1, CCAUV President to propose a liaison relationship with the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) to the CIPM: The CCAUV President informed the delegates that the practical arrangement has been signed by the BIPM and the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). The CTBTO is an official liaison of the CCAUV.

The BIPM-CTBTO arrangement was signed by Dr Lassina Zerbo, Executive Secretary of the CTBTO, on 4 May 2021 and Dr Martin Milton, Director of the BIPM, on 10 June 2021.

CCAUV12/A2, CCAUV President to propose further monitoring of the Hybrid Comparison operation including consideration of its naming to the JCRB: The CCAUV President informed the delegates the issue was discussed during the last CCAUV-RMOWG in September 2021. The action is ongoing.

CCAUV12/A3, CCAUV President to re-iterate to relevant CCs to examine the use of gn, the physical constant for the standard acceleration of gravity defined in CODATA, expressing concern of its expanding use over the SI unit: This was completed in October 2019. The CCAUV President reported to the 108th meeting of the CIPM (2019) regarding the CCAUV's concerns regarding the use of g_n, the physical constant for the standard acceleration of gravity defined in CODATA, instead of the SI unit.

CCAUV12/A4, CCAUV President to report to the CCU and CIPM about the needs of systematic communication with ISO TC 12 and IEC TC 25 for future revision of relevant standards for units: This was completed in November 2021. One point on the agenda of the 13th meeting of the CCAUV is connected to this point.

CCAUV12/A5, CCAUV President to inform to CIPM about the appointments of CCWG Chairpersons and Deputy Chairpersons: The CCAUV President informed the CIPM, during its 108th meeting (2019), about the appointments of CC WG Chairpersons and Deputy Chairpersons.

Decisions of the 12th meeting of the CCAUV

CCAUV12/D1	The CCAUV welcomed Ukraine to take part actively in the activities organized under auspices of the CCAUV for future application to observer status.

CCAUV12/D2	The next meeting of the CCAUV and its working groups will be scheduled from 5-8 October 2021.
CCAUV12/D3	CCAUV confirmed that the choice of CMCs format in either tabular or matrix form is the decision of the NMI (CCAUV allows either format).

Actions of the 12th meeting of the CCAUV

CCAUV12/A1	CCAUV President to propose a liaison relationship with the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) to the CIPM.
CCAUV12/A2	CCAUV President to propose further monitoring of the Hybrid Comparison operation including consideration of its naming to the JCRB.
CCAUV12/A3	CCAUV President to re-iterate to relevant CCs to examine the use of g_n, the physical constant for the standard acceleration of gravity defined in CODATA, expressing concern of its expanding use over the SI unit.
CCAUV12/A4	CCAUV President to report to the CCU and CIPM about the needs of systematic communication with ISO TC 12 and IEC TC 25 for future revision of relevant standards for units.
CCAUV12/A5	CCAUV President to inform the CIPM about the appointments of CCWG Chairpersons and Deputy Chairpersons.

The report of the last meeting including "Actions and Decisions" is available on the CCAUV website (CCAUV/2021-01).

I-6 OUTCOMES FROM THE CIPM MEETING

The CCAUV President, Dr Laiz, reported on the meeting of the CIPM, and other liaison activities that had taken place since the last meeting of the CCAUV.

The presentation addressed the preparation for the 27th meeting of the CGPM (2022), strategy up to 2030, and the new structure – Horizontal Forum and Digital Transformation.

Preparations for the CGPM (2022) include the preparation of six draft resolutions.

The President said that Draft Resolution A "On the evolving needs for metrology", recalls the strategic role of the International System of Units (SI) in providing confidence in the accuracy and global comparability of measurements needed for international trade, manufacturing, human health and safety, protection of the environment, global climate studies and scientific research. It highlights the critical and fundamental role of metrology in addressing global challenges, including climate change and environment, health and life sciences, food safety, energy, advanced manufacturing and digital transformation.

The CCAUV President reported that the CCs, Member States and National Metrology Institutes are invited to contribute to the work of the CIPM in addressing the evolving needs for metrology and in developing a new vision for the BIPM and to present proposals at the 28th meeting of the CGPM (2026). The CIPM encourages CCs to implement its proposal to establish multi-disciplinary ("horizontal") structures that will address these new challenges and will be complementary to the existing quantity-based ("vertical") structure of its CCs.

The main objects of the Horizontal Forums are:

- Advising the CIPM on all matters that influence international metrology in the field covered by the forum, including the BIPM work programme;
- Providing input to CCs to help shape their strategy and activities, including suggestions for international comparisons required to promote comparability of measurement values in the field of the forum;
- Liaising with RMO forums that are active in the same field.

The Horizontal Forums for 'climate change and environment' is working and the one in 'digital transformation' will be launched during 2022. The CCAUV should nominate the contact persons by the end of January 2022 **[Action A.1]**.

The Horizontal Forums 'health and life sciences', 'food safety', 'energy', and 'advanced manufacturing' will start their activities in 2023 and the CCAUV should nominate the contact persons by the end of December 2022 **[Action A.2]**.

The CCAUV President reported the principal topics discussed in Draft Resolution A "On the evolving needs for metrology", Draft Resolution B "On the global digital transformation and the International System of Units", Draft Resolution C "On the extension of the range of SI prefixes", Draft Resolution D "On the use and future development of Universal Coordinated Time (UTC)", Draft Resolution E "On the future redefinition of the second", and Draft Resolution F. "On universal adherence to the Metre Convention".

Dr Laiz and Dr Milton discussed a survey on digital transformation to be circulated to CCAUV members **[Action A.3]**.

Dr Laiz's presentation is available on the CCAUV webpage (CCAUV/21-I-05).

I-7 REPORTS FROM WORKING GROUPS CHAIRS

Report from the CCAUV-SPWG

Dr Enver Sadikoglu, chair of the CCAUV Strategic Planning Working Group (CCAUV-SPWG), reported on its activities. He began the presentation with an overview of the SPWG structure, mission and current membership, with particular focus on the role of the co-chair of the sub-fields. The terms of reference of the CCAUV-SPWG were stated and the principal revisions of the CCAUV Strategy Document were presented. The strategy document issued in September 2019, has been slightly revised, based on the outcomes of discussions at the SPWG meetings.

The revised strategy document did not require substantial changes. General information about CCAUV operations were updated. More emphasis was put on issues like artificial intelligence and digitalization. New subjects have been introduced to be considered for future research for example,

acoustic spectroscopy and lung sonography. The timeline for comparisons has been revised and the appendix has been removed from the strategy document.

Dr Sadikoglu presented the future actions regarding the strategy document. By November 2021 the SPWG Chair will collect comments on the draft strategy document. By the end of 2021 the final version of strategy document and a short summary will be published **[Action A.4]**.

Dr Sadikoglu's presentation is available on the CCAUV webpage (CCAUV/21-I-08).

I-8 REPORT FROM THE CCAUV-KCWG

Dr Gustavo Ripper, chair of the CCAUV Key Comparison Working Group (CCAUV-KCWG) reported on its activities. He began the presentation by reporting the main outputs of the KCWG meeting, held remotely, in September 2021. He commented that the CCAUV-KGWG webpage (https://www.bipm.org/en/committees/cc/ccauv/wg/ccauv-kcwg/members) shows the NMIs as members and only one contact person per institution, even if there are NMIs with more than one person. Dr Ripper presented the KCWG members and their expertise. The KC workflow process was presented and analyzed.

Dr Ripper presented the current situation regarding comparisons carried out within the framework of the CCAUV.

Two key comparison results have been published in *Metrologia*:

- CCAUV.V-K4, a comparison on accelerometer low-shock calibration.
- CCAUV.V-K5 a comparison of calibrations of accelerometers in the frequency range from 10 Hz to 20 kHz.

The status of key comparisons in progress was reported:

- CCAUV.A-K6

  Dr Ripper reported progress with CCAUV.A-K6, a comparison on primary pressure calibration of the standard microphone LS2P. The comparison has thirteen participants including the pilot laboratories. The pilot laboratory reported to the KCWG about the stability problems of one microphone used in the key comparison. There was agreement to exclude INMETRO's data reported for this unstable artefact from the calculation of the Key Comparison Reference Value.

- CCAUV.W-K2

  Dr Ripper showed the status of the key comparison on hydrophone free-field calibration. There are seven participants in the comparison: NPL (pilot), INMETRO, NMISA, NIM-HAARI, NIST (USRD), TUBITAK-MAM and VNIIFTRI. The Draft A report is in progress and will be released soon.

The status of RMO key comparisons was presented. No Pilot Study has been published, and the Draft B report on COOMET.AUV.U-P1 was reviewed by the KCWG (2018).

The KCWG chairman presented the Strategic Plan for CCAUV Key Comparisons, remembering the periodicity of 10 years.

Dr Sadikoglu commented on the importance of updating the planning of comparisons for the coming years and added that, according to the newly published CIPM document on comparisons, the KCWG should not be involved in the review of either the tables or reports of supplementary comparisons.

Dr Thomas Bruns replied that, as the experience had shown, for supplementary comparisons, the involvement of the KCWG in the revision process is strongly recommended.

Dr Ripper introduced the CIPM MRA document "*Measurement comparisons in the CIPM MRA: Guidelines for organizing, participating and reporting"* (CIPM MRA-G-11, Version 1.1, 18 January 2021) recalling that the KCWG was recently requested to review the new version of the document (CIPM MRA-G-11 v1.2). The proposal includes suggestions received for the revision of some statistical aspects. The document will be circulated to KCWG members; the deadline for comments is March 2022 **[Action A.5]**.

Dr Ripper expressed the need to review the CCAUV guidance document "*Guidance for carrying out key comparisons within the CCAUV, November 2015*" (by June 2022) **[Action A.6]** and the guidance document "*Rules of Procedure of the Key Comparison Working Group of CCAUV, October 2013*" (by June 2022) **[Action A.7]** to adapt them to the new procedures introduced with the new KCDB2.0.

Dr Ripper reminded the delegates of the KCWG coordination and membership status; both the Chair and Vice-Chair of the KCWG are ending their four-year terms in 2021.

Dr Ripper's presentation is available on the CCAUV webpage (CCAUV/21-I-09).

I-9 REPORT FROM THE CCAUV-RMOWG

Dr Qiao Sun, vice-chair of the CCAUV Working Group for RMO Coordination (CCAUV-RMOWG) presented progress in the Joint Committee of the Regional Metrology Organizations and the BIPM (JCRB) and the RMOs. The report focused on discussions and outcomes from the CCAUV-RMOWG meeting held in September 2021.

The meeting was attended by WG members, the CCAUV President and Executive Secretary, the KCDB Coordinator and JCRB Executive Secretary as well as two guests from each of the RMOs. The agenda included 12 items, the most important of which were: report by the RMOWG Chair, KCDB Coordination presentation and Peer review database.

Dr Sun presented the contributions of RMOs to the CIPM MRA documents. He noted that some NMIs had sent their comments directly to the CCs rather than through their RMOs.

Dr Sun considered the most important focal point for the RMOWG should be the final recommendation to the JCRB for conducting hybrid comparisons (these types of comparison are not included in the CIPM MRA-G-13 document "*Calibration and measurement capabilities in the context of the CIPM MRA Guidelines for their review, acceptance and maintenance*").

He suggested that NMIs should discuss the CMC matrix form with their managers. Dr Sun highlighted that CMCs should not simply be added to artificially increase the number.

The peer review database was published 6 years ago by the BIPM and it should be updated. The requirements are based on the JCRB document CIPM/2007-25 "*Recommendations for on-site visits by peers and selection criteria for on-site visit peer reviewers*". This database should be completed by taking the JCRB document into consideration. A related action has been made during the RMO WG meeting.

Dr Sun's presentation is available on the CCAUV webpage (CCAUV/21-I-10).

SECOND SESSION, WEDNESDAY 17 NOVEMBER (11:00 – 13:00 UTC)

II-1 WELCOME (CCAUV PRESIDENT)

The President, Dr Laiz, welcomed the delegates to the second session of the 13th meeting of the CCAUV.

II-2 CCAUV KEY COMPARISONS

Comparisons and reports: published/in progress/proposed
CCAUV supplementary comparisons: published/in progress/proposed
CCAUV pilot studies: proposed

Dr Ripper presented the status of CCAUV key comparisons.

CCAUV KC published

CCAUV.V-K4 was published in *Metrologia*, 2019, **56**, Tech. Suppl. 09003.

CCAUV.V-K5 was published in *Metrologia*, 2021, **58**, Tech. Suppl. 09001.

CCAUV KCs in progress

CCAUV.W-K2

Dr Stephen Robinson reported on the progress with the key comparison on hydrophone free-field calibration from 250 Hz to 500 kHz (CCAUV.W-K2). Two hydrophones were used (the first one from 250 Hz to 100 kHz, the second from 100 kHz to 500 kHz). There are seven participants in the comparison: NPL (pilot), INMETRO, NMISA, NIM-HAARI, NIST (USRD), TUBITAK-MAM and VNIIFTRI. In addition, NIOT (India) participates as a guest (results not included in the KCRV). It was noted that since two participants measured at higher water temperatures than recommended in the protocol (which may have affected their results), NPL has undertaken to calibrate the devices over the temperature ranges using the NPL Acoustic Pressure Vessel, so that empirical corrections may be applied. In the frequency range from 250 Hz to 50 kHz and from 100 kHz to 500kHz there is good agreement between participants, agreement in the range 50 kHz to 100 kHz is not good for several NMIs.

The Draft A report will be circulated in November 2021; it will be released soon.

CCAUV.A-K6

Dr Dominique Rodrigues reported progress with CCAUV.A-K6, a comparison on primary pressure calibration of standard microphone LS2P. The comparison has thirteen participants including the

pilot laboratories: LNE (pilot), CENAM, HBK-DPLA, GUM, INMETRO, KRISS, METAS, NMIA, NMIJ, NMISA, NRC, UME and VNFIITRI.

The Draft A report was circulated in September 2021 and the final report will be released by the end of 2021.

CCAUV KC proposal (item 7)

The key comparison proposal has been analyzed for every sub-field:

Airborne sound

Dr Salvador Figueroa presented the proposals for future comparisons in the acoustic field.

- Comparison of Laboratory Standard microphones type LS2 (repeat of CCAUV.A-K4), free field sensitivity in the frequency range 1 kHz to 30 kHz, planned to start in 2022.
- Comparison of Laboratory Standard microphones type LS1 (repeat of CCAUV.A-K5), Pressure sensitivity in the frequency range 2 Hz to 20 kHz, planned to start in 2022.
- Comparison of Laboratory Standard microphones type LS2 (repeat of CCAUV.A-K6), Pressure sensitivity in the frequency range 2 Hz to 25 kHz, planned to start in 2032.
- Comparison of Laboratory Standard microphones type WS3, Pilot study, (Extension of the frequency range up to 150 kHz), free field sensitivity in the frequency range 10 Hz to 150 kHz, planned to start in 2022.
- Comparison of Laboratory Standard microphones type LS1/LS2, Pilot study, (Calibration in a diffuse field), diffuse field sensitivity in the frequency range 2 kHz to 20 kHz, planned to start in 2022.
- Comparison of Laboratory Standard microphones type LS1/LS2/WS3, Pilot study, (Calibration using optical techniques), pressure and free field sensitivity in the frequency range 1 Hz to 200 kHz, planned to start in 2023.

Five key comparisons have been planned to start in the next two years (2022-2023). The workload connected with key comparisons is not sustainable for many of the laboratories involved, for this reason, after discussion among the delegates, it was decided to activate the procedure for:

- Comparison of Laboratory Standard microphones type LS2 (repeat of CCAUV.A-K4), free field sensitivity in the frequency range 1 kHz to 30 kHz, planned start in 2022. DFM will cover the role of Pilot Laboratory. Participants: NMIJ, INMETRO, DNDI, LNE, KRISS and NMIA.
- Comparison of Laboratory Standard microphones type WS3 (PILOT STUDY), extension of the frequency range up to 150 kHz, planned start in 2023. DFM will cover the role of Pilot Laboratory. Participants: NMIJ, LNE, KRISS and NIM.

The Comparison of Laboratory Standard microphones type LS1, repeat of CCAUV.A-K5 (Pilot laboratory LNE) and Comparison of Laboratory Standard microphones type LS1/LS2, calibration in diffuse field random incidence (PILOT STUDY) have been postponed to 2023-2024.

Vibration and Shock excitation

Dr Thomas Bruns presented the proposed comparisons in the vibration and shock excitation field over the coming years.

- Comparison of primary calibration of magnitude and phase, (Coverage of traditional calibration services in acceleration CCAUV.V-K3, KC repeated on a 10 year interval), 0.1 Hz to 40 Hz, planned to start in 2025.
- Comparison of primary calibration of magnitude and phase, (Coverage of traditional calibration services in acceleration CCAUV.V-K5, KC repeated on a 10 year interval), 0.1 Hz to 20 kHz, planned to start in 2027.
- Comparison of primary calibration of magnitude, (Increasing number of NMIs with capabilities and demand for CMCs), 0.1 Hz to 40 Hz, planned to start in 2022.
- Primary calibration according to ISO 16063-13, (Increasing number of NMIs with capabilities and demand for CMC CCAUV.V-K4, KC repeated on a 10 year interval), 500 m/s^2 to 5000 m/s^2, planned to start in 2026.
- Primary calibration high intensity according to ISO 16063-43, (Pilot Study), up to 100 km/s^2, planned to start in 2022.
- Regarding the key comparison in primary calibration of angular acceleration sensors, only NIM (China) expressed a need with some urgency. PTB can provide results for a bilateral or hybrid comparison. It is proposed that the two institutes will prepare a bilateral comparison and contact the KCWG accordingly.
- Several members of the CCAUV expressed the need for comparison measurements in primary shock calibration of accelerometers. After discussion among the NMIs that will potentially be involved, the pilot study on shock calibration based on ISO 16063-43 originally planned for 2022, was postponed.

Following presentation of the CCAUV pilot comparison of single-ended accelerometer (without dummy mass), Dr Hideaki Nozato (NMIJ/AIST), will propose a pilot study at the next CCAUV meeting in 2023.

Ultrasound and Underwater Acoustics

No proposals in the next two years period.

REPORTS FROM THE KCDB AND REGIONAL METROLOGY ORGANIZATIONS

II-3 KCDB

The KCDB coordinator, Dr Susanne Picard, presented progress with the KCDB 2.0 and gave a short presentation.

The KCDB 2.0 was launched in October 2019; videos, help documents, and FAQs are available at: https://www.bipm.org/en/cipm-mra/kcdb-help.

Capacity Building and Knowledge Transfer training sessions for the KCDB 2.0 were given to RMOs, writers, TC Chairs and pilots. Monthly software updates were made within the terms of a support contract, anomalies were removed and improved navigation has been implemented.

Some examples concerning quantity-based equations used by ILAC were reported.

An Application Program Interface (API) has been integrated into the KCDB website to facilitate CMC searching. The API includes queries on the KCDB as well as extended statistics, allowing a « Big Data » approach. The API was implemented in June 2021 and was tested by METAS, PTB, VNIIM, CENAM and NRC.

The presentation is available on the CCAUV webpage (CCAUV/2021-II-03).

II-4 JCRB

Dr Olav Werhahn presented progress in the Joint Committee of the Regional Metrology Organizations and the BIPM (JCRB) with a focus on CCAUV updates. The presentation mentioned the governance of the Mutual Recognition Arrangement and the status of CMCs. At the time of the presentation there were 1296 AUV CMCs published in the KCDB. A chart was presented on the number of AUV CMCs compared with other metrology areas. Dr Werhahn commented that the number of new approvals in the AUV area has been decreasing since 2017. Statistics on AUV KCs/SCs in the KCDB 2.0 were presented.

The presentation is available on the CCAUV webpage (CCAUV/2021-II-03).

II-5 REPORTS FROM REGIONAL METROLOGICAL ORGANIZATIONS

AFRIMETS

Mr Riaan Nel, chair of AFRIMETS' TC-AUV Working Group presented progress within AFRIMETS. Three NMIs are very active in the AUV field with one NMI observing: KEBS (Kenya) acoustics and vibration; NIS (Egypt) acoustics and ultrasound; NMISA (South Africa) acoustics and vibration; and RSB NMD (Rwanda) observing. AFRIMETS is a very active RMO reviewer with 100 registered AUV CMCs in the KCDB (as of 26 July 2021).

Members of the AFRIMETS TC-AUV Working Group are currently involved in seven ongoing CIPM or RMO key and supplementary comparisons. Two additional AFRIMETS supplementary comparisons are planned.

Mr Nel gave an outline of new developments for new capabilities and emerging needs within AFRIMETS. Finally, he welcomed the new chair elect, Ian Veldman of NMISA (South Africa) and vice chair, Anderson Maina of KEBS (Kenya).

The presentation is available on the CCAUV webpage (CCAUV/2021-II-05-01).

APMP

Dr Ryuzo Horiuchi, chairperson of the APMP TC-AUV, reported on the APMP, highlighting activities in a variety of key comparisons. A total of 12 economies are active in the AUV field: NMIA (Australia), NIM (China), CMS (Chinese Taipei), SCL (Hong Kong), NPLI (India), SNSU-BSN (Indonesia), NMIJ (Japan), KRISS (Republic of Korea), NMIM (Malaysia), NIMT (Thailand), NMC/A*STAR (Singapore) and VMI (Viet Nam). In addition, NIS (Egypt) and NMISA (South Africa) have the status of associate economies in the APMP TC-AUV. APMP has

306 AUV CMCs in the KCDB (as of November 2021) and provided seven inter-RMO CMC reviews over the past two years. The reported contents are summarized as follows.

1. Seven inter-RMO reviews
2. Current status of four ongoing APMP TCAUV comparisons (APMP.AUV.U-K3, a comparison of on ultrasonic power and APMP.AUV.V-K3.1, a comparison on pressure sensitivity and phase, and APMP.AUV.V-K5, a comparison on charge sensitivity and phase shift)
3. Five peer review assessments completed
4. Three challenging areas in the field of AUV
5. TC Initiative Project TCAUV_03_TCI 2018
6. Inter-comparison of sound level meters for reliable noise measurement

Dr Horiuchi provided the technical information about the sound level meter being circulated in response to a question asked during the presentation.

The presentation is available on the CCAUV webpage (CCAUV/2021-II-05-02).

COOMET

Mr Anatoli Volodchenko, COOMET TC-AUV chairperson, presented progress within the COOMET TC-AUV. The NMIs from 15 COOMET member countries were represented in AUV. There are eight NMIs, (Azerbaijan, Armenia, Belarus, Cuba, Georgia, Russian Federation, Uzbekistan and Ukraine) that submit their AUV CMCs via COOMET, and seven NMIs (Bulgaria, Germany, Lithuania, Slovakia, Romania, Turkey and KDPR) that submit through other RMOs. Only three countries to date: Belarus, Russian Federation and Ukraine have published their CMCs in AUV. COOMET has 133 CMC entries in the KCDB. The reported contents are summarized as follows.

1. COOMET TC-AUV meeting held online on 29 September 2021
2. Two comparisons in progress
3. Three comparisons planned
4. Two new proposals to the COOMET programme of comparisons discussed
5. Five inter-RMO reviews.

The presentation is available on the CCAUV webpage (CCAUV/2021-II-05-03).

EURAMET

The report from EURAMET was presented by Dr Enver Sadikoglu, EURAMET TC-AUV Chair. Three Sub-Committees (SCs) are organized under the EURAMET TC covering three technical areas: SC-A “Sound in Air”, SC-U “Ultrasound and Underwater Acoustics”, and SC-V “Vibration and Acceleration”. There are 24 members of EURAMET TC-AUV, and 19 NMIs and DIs have a total of 506 CMC entries approved and published in the BIPM KCDB. EURAMET TC-AUV members are involved in seven CIPM or RMO key and supplementary comparisons. The status of EURAMET TC-AUV projects was presented with two completed and six in progress.

TC-AUV participates in the European Metrology Programme for Innovation and Research (EMPIR). There were three active projects involving TC-AUV members: “Metrology for the Factory of the Future” (17IND12 Met4FoF, 2018 – 2021), “Radiotherapy coupled with hyperthermia – adapting the biological equivalent dose concept” (18HLT06 RaCHy, 2019 – 2022),

and “Metrology for low-frequency sound and vibration” (19ENV03 Infra-AUV, 2020 – 2023). A brief introduction of these projects was given with a dedicated presentation by Dr Thomas Bruns during the CCAUV meeting on 18 November 2021.

The TC-AUV and the three Sub-Committees meet typically on a yearly basis. The 2020 meetings were held on 17-18 September 2020, and the 2021 meetings were held on 10-11 May 2021. The future meetings for 2022 were planned.

The presentation and the report are available on the CCAUV webpage (CCAUV/2021-II-05-04 and CCAUV/2021-II-05-04a).

GULFMET

Mr Fheed Alsubaey, GULFMET TC-AUV Chair, gave a presentation on AUV activities within member states of GULFMET and other RMO. SASO-NMCC (Saudi Arabia) is the only member that has AUV activities. The detailed measurement capabilities of SASO-NMCC were presented. The status of two bilateral comparisons and two key and supplementary comparisons was reported. An accreditation assessment was planned for the first week of December 2021.

The presentation is available on the CCAUV webpage (CCAUV/2021-II-05-05).

SIM

Dr Gustavo Ripper, chair of the SIM MWG-9 (SIM TC-AUV Chair), reported on the activities of SIM, which is active in all fields of AUV. Currently, SIM has ten NMIs and one DI with an interest in AUV. Five of them have CMCs published in the BIPM KCDB. However, five SIM MWG-9 members, including NMIs from Bolivia, Colombia, Costa Rica, Peru and Paraguay do not yet have any CMCs in the AUV field. SIM MWG-9 members are currently involved in four ongoing CIPM or RMO key and supplementary comparisons. Dr Ripper took over as Chair of SIM MWG-9 during the recent SIM MWG-9 meeting due to Dr Gaitan’s (NIST/USA) retirement, and Dr Akobuije Chijioke (NIST/USA) is the vice-chair.

The following cooperative activities have been developed by SIM MG-9 members to disseminate technical knowledge and exchange experience during the last two years.

1. Two meetings held
2. Six key and supplementary comparisons; 17 participated
3. Two ongoing cooperation projects between SIM MWG-9 members
4. All CMCs posted for interregional review analyzed by SIM
5. Nineteen CMC revisions and four CMC updates
6. Four SIM comparisons planned.

The presentation is available on the CCAUV webpage (CCAUV/2021-II-05-06).

II-5.1 REGIONAL KEY COMPARISONS AND LINKS TO CCAUV COMPARISONS: PUBLISHED/IN PROGRESS/PROPOSAL

Dr Gustavo Ripper passed the screen to Dr Qiao Sun as he had already presented some comparisons and did not have any additional slides to show.

II-5.2 REGIONAL SUPPLEMENTARY COMPARISONS: PUBLISHED/IN PROGRESS/PROPOSAL

Dr Qiao Sun presented the outline and status of regional key comparison APMP.AUV.V-K5. Eleven NMIs will participate in the comparison and the technical protocol is complete. An additional transfer standard was selected to reduce the transverse resonance found in CCAUV.V-K5. Measurements will start in June 2022 and finish in August 2023.

The presentation is available on the CCAUV webpage (CCAUV/2021-II-05.01-03).

THIRD SESSION, THURSDAY 18 NOVEMBER (11:00 – 13:00 UTC)

III.1 WELCOME (CCAUV PRESIDENT)

The President, Dr Hector Laiz, welcomed the delegates and guests to the third session of the 13th meeting of the CCAUV.

Reports from international observers and international meetings, originally scheduled for the second session on Thursday 17, was postponed to the third session.

[Last item on the agenda of the second session].

III.2 REPORTS FROM INTERNATIONAL OBSERVERS AND INTERNATIONAL MEETING

IEC Technical Committee 29

Dr Salvador Barrera-Figueroa presented the activity report of IEC TC 29: Electroacoustics. The report summarized the activities in the working groups, WG5 Microphones and AHG26 Alignment of standards for measurement microphones, sound level meters and sound calibrators.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-02.01).

IEC Technical Committee 87

Dr Stephen Robinson reported on IEC TC87 activities. He recalled that the scope of TC87 is to prepare standards related to the characteristics, methods of measurement, safety, and specifications of fields, equipment and systems in the domain of ultrasonics. Close liaison is maintained with TC 62 and TC 29 in fields of common interest. TC87 has seven working groups, one joint working group and 30 participating countries (P and O members).

The last physical plenary meeting of IEC TC87 took place in Shanghai (China) in October 2019. The latest plenary meeting of IEC TC87 was held as an online meeting in March 2021.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-02.02).

ISO Technical Committee 108

Mr Ian Veldmann reported on recent activities of ISO/TC 108 Mechanical vibration, shock and condition monitoring. The scope of activities of ISO/TC 108 covers standardization in the fields of mechanical vibration and shock and the effects of vibration and shock on humans, machines, vehicles (air, sea, land and rail) and stationary structures, and of condition monitoring of machines and structures, using multidisciplinary approaches. The plenary meeting of ISO/TC 108

"Mechanical vibration, shock and condition monitoring" was planned for 28 October 2021 but was cancelled due to the retirement of then chair, Dr Michael Gaitan. The position of chair is still vacant and, therefore, another meeting has not yet been scheduled. Mr Veldmann also reported activities of ISO/TC 108/WG 34. The working group has ten work programmes.

After the presentation, Dr Thomas Bruns mentioned issues in the current state of conditioning amplifier calibration for dynamic measurements (ISO/WD 19665) due to the copyright. However, it was already standardized by DKD in German. It is copyright free in the German version (https://doi.org/10.7795/550.20190425EN).

The presentation is available on the CCAUV webpage (CCAUV/2021-III-02.03).

ISO Technical Committee 43 SC3

Dr Stephen Robinson reported ISO/TC43/SC3 activities to the CCAUV.

ISO TC43 SC3 (Underwater Acoustics) has five working groups: WG1: Measurement of noise radiated by ships, WG2: Underwater acoustic terminology, WG3: Measurement of radiated noise from marine piling, WG4: Standard target of calibrating active sonar, and WG5: Underwater acoustics – measurement of underwater ambient sound. ISO/TC43/SC3 has eight work programmes and 21 participating countries (P and O members).

The last meeting of ISO/TC43 SC3 was an online Zoom meeting held in parallel with meetings of SC1 and SC2 in September and October of 2021. The next meeting is scheduled for 2-6 May 2023 in Montreal (Canada) in conjunction with meetings of SC1 and SC2 of ISO/TC43. A later meeting is planned for Paris (France) in autumn 2024. A new Secretary has been provided by ANSI/ASA (USA), and the next meeting will coincide with a meeting of ISO/TC43/SC1 and SC2 in June 2021 in Paris (France).

The presentation and the report are available on the CCAUV webpage (CCAUV/2021-III-02.04 and CCAUV/2021-III-02.04a).

III.3 DISCUSSION ON LIAISON ORGANIZATIONS

III.3.1 PREPARATORY COMMISSION FOR THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY ORGANIZATION (CTBTO)

The CCAUV President introduced the presentation by the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) representatives highlighting the importance of the memorandum of understanding (MoU) signed by the BIPM and the CTBTO.

A presentation on Standards and Measurement Science for Seismo-Acoustic Monitoring Technology prepared by Mr Benoît Doury and CTBTO Provisional Technical Secretariat (PTS) colleagues was presented by Mr Doury, Seismo-Acoustic Engineering Officer of the CTBTO. The International Monitoring System (IMS) has 337 facilities using four monitoring technologies. Among these technologies, three are in the AUV area. There are missing links in the metrological traceability chain. The challenges are: there are no validated CMCs to cover the IMS infrasound

monitoring range from 0.02 Hz to 2 Hz; there are no validated CMCs to cover the IMS seismic monitoring range from 0.02 Hz to 0.1 Hz; and there are no validated CMCs to cover the entire IMS hydroacoustic monitoring range from 1 Hz to 100 Hz. To address these challenges, the CCAUV and CTBTO identified common goals and CTBTO traceability needs for seismo-acoustic technologies were included in the CCAUV 2017-2027 Strategy and the CCAUV 2019-2029 Strategy. Collaboration between the CTBTO and CCAUV started immediately after the 11th CCAUV meeting (2017). Mr Doury discussed the details of seven collaboration milestones. In June 2021, a practical arrangement was signed between the BIPM and CTBTO covering collaboration on the metrological traceability of measurements of infrasound, seismic activity and radioactivity. The CCAUV and CCRI are now official liaisons of the CTBTO.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-03.01).

III.3.2 ISO TECHNICAL COMMITTEE 12

Dr Laiz presented the ongoing action, with the support of the BIPM, of formalizing the liaison between the CCAUV and the Joint WG ISO/TC 12 and IEC TC 25 as a follow up of Action 4 of the 12th CCAUV meeting (2019). The work with ISO/TC12 on the 80000 series of standards is jointly undertaken with IEC TC 25 (the ISO series of standards are joint ISO and IEC standards). Dr Robinson (NPL), who is already a member of the joint working group on behalf of ISO/TC43/SC3, was proposed as “liaison officer”. Dr Robinson commented positively on this action as it represents the formalization of an existing liaison and he accepted the role.

Dr Robinson gave a presentation about ISO/TC 12 (IEC TC 25). The relevant work concerns ISO 80000-8: published in 2020 and led by ISO/TC 12 and ISO 80000-15, which has reached the CD stage. ISO 80000-8:2020 – Quantities and Units - Part 8: Acoustics has significant improvements over the previous edition, but the definition of decibel is omitted (and omitted from the new part 3). For decibels, the new ISO 80000-15 chooses to break the link between the units, an approach similar to Mills and Morfey’s published in *Metrologia*, 2005, **42**, 246-252. For frequency ranges, both decadal and octave frequency ranges are correctly defined in new Part 15. Dr Robinson concluded that ISO/TC 12 had learned the lesson from the past for not widening consultation with the stakeholder community.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-03.02).

III.4 SCIENTIFIC CONTRIBUTIONS FROM MEMBERS AND LIAISONS

The abstracts of the presentation given during this section are available on the CCAUV webpage (CCAUV/2021-III-03.00)

CCAUV-CTBTO collaboration: Infra-AUV

Dr Thomas Bruns, showed the progress on the project through the presentation “Infra-AUV: Metrology for low frequency sound and vibration.”

The presentation gave an overview of the European Infra-AUV-Project, which was triggered by a request from the CTBTO to the members of the CCAUV in 2017. Dr Bruns introduced the goals, project structure and current status of the project. Further steps of the project were discussed.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-03.00e).

CCAUV-CTBTO collaboration: Ocean noise

Dr Stephen Robinson presented "Investigation of COVID quietening in deep ocean noise during determined from the CTBTO hydroacoustic stations" to the CCAUV.

In collaboration with scientists at the CTBTO, the NPL has used data from the CTBTO hydroacoustic stations to investigate trends in deep ocean noise using a machine learning technique, including the so-called 'COVID quietening period' during the 2020 pandemic.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-03.00h).

NIST optomechanical accelerometer

Dr Thomas LeBrun (NIST) presented "Assessing the intrinsic accuracy of an optomechanical accelerometer based on an optical frequency comb" to the CCAUV.

Combining an optomechanical accelerometer with optical frequency comb-based readout allows accelerations above tens of m/s^2 to be measured with high sensitivity and intrinsic accuracy. In addition, it enables measurement of acceleration directly in terms of optical frequency rather than electrical quantities. The report presented recent comparisons that demonstrate agreement of 0.2 % to the static acceleration due to gravity and 2.1 % to the NIST primary vibration calibration system between 0.1 kHz and 15 kHz.

Dr LeBrun admitted that the team is aware of the issue of the response of the proof mass to the outside acceleration in reply to a question asked by Dr Bruns.

APMP pilot study

Dr Qiao Sun presented "APMP pilot comparison of optical tachometer calibration."

Dr Sun gave the background to this study, mainly, the importance and the existing standards, as well as addressing the technical concerns. By definition, rotational speed is a mechanical quantity, not a frequency quantity. Rotational speed is the most important dynamic parameter attributed to centrifugal acceleration. Various rotational speed measurement standards from different NMIs were discussed. This study is still open for participation.

There was a discussion about which CC (CCAUV versus Consultative Committee for Time and Frequency (CCTF)) should conduct this study. The consensus is that CCAUV should do so as this is angular velocity similar to angular acceleration.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-03.00d).

Ultrasound: instantaneous acoustic pressure measurement

Dr Masahiro Yoshioka presented the report "Study on measurement techniques for instantaneous acoustic pressure using complex deconvolution of hydrophone sensitivity."

NMIJ has investigated precise measurement techniques of instantaneous acoustic pressure necessary to evaluate the safety of diagnostic ultrasound. This technique requires hydrophone

sensitivity with a broader frequency range than the bandwidth of the diagnostic ultrasound. However, a calibration certificate provides the sensitivity in a limited frequency range, and extrapolation out of the range might be an effective approach. NMIJ introduced a method for evaluating the effectiveness of extrapolation. The details of the method were discussed in the presentation.

The abstract and the presentation are available on the CCAUV webpage (CCAUV/2021-III-03.00c and CCAUV/2021-III-03.00f).

SIM IADB Project (Lung ultrasound)

Dr Rodrigo Costa-Felix gave a presentation on metrological evaluation of lung ultrasound using a virtual vector machine for diagnosis of acute respiratory distress syndrome (ME-LUS-VVM-ARDS). The participating NMIs are: CENAM (Mexico), INMETRO (Brazil), INTI (Argentina), and NIST (USA). Lung ultrasound (LUS) can help in the diagnosis of acute respiratory distress syndrome (ARDS). LUS is widely available, has a relatively low cost, and is accessible as Point of Care Testing (POCT). During the COVID-19 pandemic, many researchers used LUS to diagnose the gravidity of the disease. However, as a human-based image evaluation analysis, rapidness and accuracy may be jeopardized. The use of a Virtual Vector Machine (VVM) is a well-known tool to process images. This project aims to develop an accurate VVM to diagnose ARDS based on LUS for POCT. The project started in October 2021, and the outcomes are expected to be available in 24 months.

The presentation and the abstract are available on the CCAUV webpage (CCAUV/2021-III-03.00a and CCAUV/2021-III-03.00b).

CCAUV COMMITTEE ISSUES

III.5 APPLICATIONS FOR NEW MEMBERS OR OBSERVERS

A presentation from Ukraine's DP NDI "Systema" – National Acoustical standards of Ukraine, in support of its membership application, was given.

DP NDI "Systema" is one of four NMIs in Ukraine and is the designated Institute of Ukraine in the field of AUV (sound in air and sound in water). It maintains three State primary standards for Ukraine in the field of acoustics, which were approved as State reference standards by the Ministry of Economic Development and Trade of Ukraine.

DP NDI "Systema" participated in four key comparisons and three supplementary key comparisons. DP NDI "Systema" has three ongoing research projects in the field of sound in air and ultrasound. A short list of 14 publications in the last three years shows the contribution it made to AUV metrology. Its laboratory has been accredited to meet the requirements of ISO/IEC 17025 and its quality management system has been approved by COOMET peer review.

The CCAUV President thanked the institute for its membership application. The delegates met after the plenary meeting to discuss the application. Three delegates gave details of their working experience with the institute. No objection was raised from the delegates for the application of observer status.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-03-04).

Decision: The CCAUV President will recommend to the CIPM for the application by DP NDI "Systema" for observer status.

III.6 CHAIRS AND MEMBERS OF WORKING GROUPS.

The CCAUV President presented the chairs of working groups as follows:

CCAUV Working Group for Key Comparisons (CCAUV-KCWG)

- Chair, Dr Gustavo Ripper
- Vice-Chair, Dr Ryuzo Horiuchi

CCAUV Working Group for RMO Coordination (CCAUV-RMOWG)

- Chair, Dr Qiao Sun

CCAUV Working Group on Strategic Planning (CCAUV-SPWG)

- Chair, Dr Enver Sadikoglu

Dr Sadikoglu mentioned he may ask his co-chairs to act as the vice-chair in turn.

III.7 PUBLICATIONS

Dr Gustavo Ripper, IMEKO TC22 Chairperson, presented a report from IMEKO TC22 to the CCAUV on Past and future Conferences/Congresses. The last meeting was held on 30 August – 3 September 2021. It was an online virtual conference. In addition to the publication of the IMEKO 2021 proceedings, selected papers are being published in Measurement: Sensors (Special issue for TC3, TC5, TC16 and TC22). The next TC22 conference will be held on 11-13 October 2022, in Cavtat, Dubrovnik (Croatia). The next IMEKO World Congress will be held on 26-29 August 2024, in Hamburg (Germany). Dr Ripper invited everyone to attend these conferences/congresses.

The presentation is available on the CCAUV webpage (CCAUV/2021-III-03-07).

III.8 RECOMMENDATIONS TO THE INTERNATIONAL COMMITTEE FOR WEIGHTS AND MEASURES (CIPM)

The CCAUV President made a recommendation to the CIPM to accept the application by Scientific and Research Institute for Metrology of Measurement and Control Systems (DP NDI "Systema" - Ukraine) for observer status.

III.9 ACTIONS RESULTING FROM THE 13TH CCAUV MEETING

Dr Durando showed the list of actions arising that was compiled during the meeting. Some corrections were proposed and duly made. The actions arising from the meeting, including these corrections are recorded in Appendix 2 of these minutes.

III.10 DATE OF NEXT MEETING

It was proposed that the 14th CCAUV meeting, and meetings of the CCAUV Working Groups, be held from in October 2023 (week 43). This was agreed by the participants.

III.11 CLOSING THE MEETING

Dr Laiz thanked the participants for their valuable contributions and expressed his great pleasure at being the president of the CCAUV.

The meeting closed at 13:50 UTC on 18 November 2021.

APPENDIX 1

Open working documents of the CCAUV can be found on the BIPM website (after logging in): https://www.bipm.org/en/committees/cc/ccauv/

Documents

CCAUV/2021-00	Agenda for 13th CCAUV meeting
CCAUV/2021-01	Minutes of CCAUV meeting (2019)
CCAUV/2021-I-02	BIPM Update
CCAUV/2021-I-05	CIPM Update
CCAUV/2021-I-08	CCAUV SPWG Report
CCAUV/2021-I-08a	Strategy document – Draft
CCAUV/2021-I-09	CCAUV KCWG Report
CCAUV/2021-I-10	CCAUV RMOWG Report
CCAUV/2021-II-02	KC Status
CCAUV/2021-II-02.01	CCAUV-W.K2 report
CCAUV/2021-II-02.03	Proposal of Pilot comparison (NMIJ)
CCAUV/2021-II-03	KCDB report
CCAUV/2021-II-04	JCRB Report
CCAUV/2021-II-05-01	AFRIMETS report
CCAUV/2021-II-05-02	APMP report
CCAUV/2021-II-05-03	COOMET report
CCAUV/2021-II-05-04	EURAMET report
CCAUV/2021-II-05-04.a	EURAMET report (presentation)
CCAUV/2021-II-05-05	GULFMET report
CCAUV/2021-II-05-06	SIM report
CCAUV/2021-II-05.01-03	APMP.AUV.V-K5 Status Report
CCAUV/2021-III-02.01	IEC TC29 report
CCAUV/2021-III-02.02	IEC TC87 report
CCAUV/2021-III-02.03	ISO TC 108 report
CCAUV/2021-III-02.04	ISO TC43 SC3 Report
CCAUV/2021-III-02.04a	ISO TC43 SC3 Report (presentation)
CCAUV/2021-III-03.01	CTBTO contribution
CCAUV/2021-III-03.02	ISO TC12 IEC TC25 report
CCAUV/2021-III-03.00	Scientific Contributions from members and liaisons: Abstracts
CCAUV/2021-III-03.00a	Abstract SIM contribution
CCAUV/2021-III-03.00b	Metrological evaluation of lung ultrasound using virtual vector machine for diagnosis of acute respiratory distress syndrome
CCAUV/2021-III-03.00c	Study on measurement techniques for instantaneous acoustic pressure using complex deconvolution of hydrophone sensitivity
CCAUV/2021-III-03.00d	APMP pilot comparison of optical tachometer calibration
CCAUV/2021-III-03.00e	Infra AUV: Metrology for low frequency sound and vibration
CCAUV/2021-III-03.00h	Investigation of COVID quietening in deep ocean noise during
CCAUV/2021-III-03.00f	Abstract: Study on measurement techniques for instantaneous acoustic pressure using complex deconvolution of hydrophone sensitivity determined from the CTBTO hydroacoustic stations
CCAUV/2021-III-03.01-01	CENAM report
CCAUV/2021-III-03.01-02	NMISA report

CCAUV/2021-III-03.01-03	PTB report
CCAUV/2021-III-03.01-04	USRD report
CCAUV/2021-III-03.01-05	NRC report
CCAUV/2021-III-03.01-06	NIM report
CCAUV/2021-III-03.01-07	KRISS report
CCAUV/2021-III-03.01-08	GUM report
CCAUV/2021-III-03.01-09	NIST report
CCAUV/2021-III-03.01-10	NMIA report
CCAUV/2021-III-03.01-11	NMIJ report
CCAUV/2021-III-03.01-12	NPL report
CCAUV/2021-III-03.01-13	INRIM report
CCAUV/2021-III-03-04	DP NDI Ukraine (presentation)
CCAUV/2021-III-03-07	Report from IMEKO TC22

APPENDIX 2

LIST OF ACTIONS AND DECISIONS RECORDED FOR THE MEETING

Dr Laiz went through the list of actions and decisions from the meeting, as recorded by the Rapporteurs.

Decision of the 13th meeting of CCAUV

CCAUV13/D1	The CCAUV President has confirmed for 2022-2026: Dr Enver Sadikoglu (UME) SPWG chairperson; Dr Gustavo Ripper (INMETRO) KCWG chairperson, Dr Ryuzo Horiuchi (NMIJ/AIST) vice chairperson; Dr Qiao Sun (NIM) RMOWG chairperson.
CCAUV13/D2	DFM (Denmark) will pilot the key comparison CCAUV.A-K7 on calibration of Laboratory Standard Microphones, free field sensitivity in the frequency range 1 kHz to 30 kHz type LS2.
CCAUV13/D3	The CCAUV president made a recommendation to the CIPM to accept the application by Scientific and Research Institute for Metrology of Measurement and Control Systems (DP NDI "Systema" - (Ukraine) for observer status.
CCAUV13/D4	The next meeting of the CCAUV and its working groups will be scheduled in October 2023.

Actions of the 13th meeting of CCAUV

CCAUV13/A1	CCAUV President to nominate contact persons in Horizontal Forum climate change and environment and digital transformation (by January 2022).
CCAUV13/A2	CCAUV President to nominate contact persons in Horizontal Forum health and life sciences, food safety, energy (by December 2022).
CCAUV13/A3	CCAUV President to circulate survey about plans and engagements regarding digital transformation activities (in AUV field) in every NMI (by April 2022).
CCAUV13/A4	CCAUV members to review draft of revised CCAUV Strategy Document (version 01.11.2021) and to submit comment to CCAUV-SPWG Chair (by November 2021).

CCAUV13/A5	CCAUV KCWG to review the document CIPM MRA-G-11 v1.2 submitted by the JCRB Task Group on Statistical Methods for Key Comparisons (by March 2022).
CCAUV13/A6	CCAUV KCWG to review the CCAUV guidance document "Guidance for carrying out key comparisons within the CCAUV, November 2015" (by June 2022).
CCAUV13/A7	CCAUV KCWG to review the CCAUV guidance document "Rules of Procedure of the Key Comparison Working Group of CCAUV, October 2013" (by June 2022).