

EURAMET TC-AUV Report for the 10th meeting of CCAUV

EURAMET TC for Acoustics, Ultrasound and Vibrations
TC-AUV Chair Richard Barham



1. General aspects

This report summarises activities of the EURAMET Technical Committee for Acoustics, Ultrasound and Vibration (EURAMET TC-AUV) for 2014-2015.

EURAMET TC-AUV has representatives from 26 of the 38 members of EURAMET.

The Bureau of Metrology from the Rep. of Macedonia has nominated a new contact person to TC-AUV, and took part in the 2015 TC meeting.

CNR-IDASC (Institute of Acoustic and Sensors), Italy have applied for DI status in the field of underwater acoustics. They are a regular guest attendee at SC meeting and therefore already familiar with TC-AUV activities. They join DPLA-BKSV as the only other DI in TC-AUV.

Three Sub-Committees (SCs) are organised under the Technical Committee covering different technical areas. These Sub-Committees are:

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| SC-A "Sound in Air": | 16 members |
| SC-U "Ultrasound and Underwater Acoustics": | 4 members |
| SC-V "Vibration and Acceleration": | 16 members |

The SCs are responsible for technical activities within their own specialisms and are coordinated by an appointed Convener, whereas the TC is concerned with general issues and technical activities cutting across all three AUV themes, and EMRP/EMPIR activities in particular.

2. Collaborative research projects

Project 1062 *Bilateral comparison in hydrophone calibration up to 50 MHz*: The project objective was to extending measurement capability in ultrasound measurement. It involved a bilateral comparison of hydrophone calibration up to 50 MHz between PTB and NPL and was intended to be a pilot study on which a future key comparison can be based. The project tackled many technical challenges and provides the first experience of such measurements within the global NMI community. The project has now been completed.

Project 1281 *Reference data for pressure reciprocity calibration according to the standard IEC 61094-2:2009*: The objective of this project is to prepare a set of reference data to enable the results of analytical calculations used in primary calibration of microphones to be compared. Beyond this particular exercise, these data files will enable the developers of software for implementing the models given in IEC 61094-2 to validate their systems.

Potential future projects under discussion (*project likely to start in 2015/6)

- Pressure calibration of type WS3 (quarter-inch) microphones*
- Validation of heat conduction models for close-coupler reciprocity calibration*
- (Extraneous) vibration sensitivity of sound level meters and microphones
- Study of discrepancies at very low frequencies in the results of EURAMET.AUV.V-K3*
- Calibration methods for accelerometers with embedded acquisition*
- Key comparison reference curves (potential TC-IM project)
- Dosimetry for cosmetic ultrasound treatment
- Bilateral comparison in underwater acoustic, CNR-IDASC and NPL



3. Key and supplementary comparisons

NMIs from EURAMET are participating in the following CCAUV comparison:

CCAUV.A-K5 *Comparison of laboratory standard microphone calibrations.* This key comparison is an update of CCAUV.A-K1 but with enhanced scope. Among the participants from EURAMET there are three NMIs: GUM (PL); INRIM (IT); NPL (UK); and one DI: BKSV-DPLA (DK). The comparison is piloted by NPL. BIPM published the final report in November 2014.

CCAUV.U-K3 *Ultrasonic power.* This key comparison covered the measurement of the time-averaged, ultrasonic power output of an ultrasonic standard transducer. Among the participants there are four NMIs from EURAMET: INRIM (IT), NPL (UK), PTB (DE), and UME (TR). Final results were published in Dec-13 and have been added to the KCDB. However EURAMET NMIs are involved in a proposed follow-on KC (CCAUV.U-K3.1) to enable some NMIs from other RMOs to resolve their discrepant results.

CCAUV.U-K4 *Comparison of laboratory reference hydrophone calibrations.* This key comparison is an update of CCAUV.U-K2 but with enhanced scope. The participating EURAMET NMIs are NPL (UK), and PTB (DE), with just one other (NIM, CN) taking part. NPL is the pilot laboratory. The measurement have been completed and a Draft A report is in preparation.

CCAUV.V-K2 *Complex charge sensitivity, measurement according to ISO 16063-11.* PTB was the pilot laboratory for this comparison and a further 6 EURAMET NMIs (CMI (CZ), GUM (PL), LNE (FR), METAS (CH); PTB (DE), UME (TR)) and one DI (BKSV-DPLA (DK)) took part. The final report was published in Mar-14 and the results entered in the KCDB.

CCAUV.V-K3 *Complex acceleration sensitivity.* This project has 14 participants. NIM, China is the principal pilot laboratory, with NMISA, S. Africa and LNE, France acting as co-pilots. Accelerometer measurements in the frequency range 0.1 to 40 Hz are underway.

CCAUV.W-K2 *Comparison of free-field hydrophone calibrations in water.* This planned key comparison is piloted by NPL and had nine participants (significantly more than its predecessor), including two further DIs from EURAMET. The protocol has been prepared and is under review by the CCAUV-KCWG.

The following EURAMET AUV comparisons are in progress:

EURAMET.AUV.A-K5 *Comparison of laboratory standard microphone calibrations.* This RMO KC will link to CCAUV.A-K5 and enable the many EURAMET NMIs with capability to maintain their CMCs in microphone calibration. Eleven EURAMET NMIs and NIS (EG) are taking part. Measurements were completed in April 2015 and a Draft A report is in preparation. However publication has been held back to enable AFRIMETS.AUV.A-K5 to complete measurements.

EURAMET.AUV.A-S2 (EURAMET project 1302) *Comparison of secondary free-field calibration of WS2 microphones* : Recent publication of IEC 61094-8 provides the basis for the first international comparison for this measurand, to underpin measurement service provision in a number of NMIs. The protocol was approved and the project registered in the BIPM database. Participant have completed measurements, but the stability of the reference devices has not been ideal. However a model for correcting for the stability has been proposed and further measurements are in progress.

EURAMET.AUV.V-S1 (EURAMET project 1204). *Comparison on primary calibration of the complex sensitivity of a charge accelerometer.* 9 NMIs and one DI are participating. The protocol has been prepared by the pilot laboratory, LNE and approved by the CCAUV-KCWG.

EURAMET.AUV.V-K3 *Low frequency calibration of accelerometers.* This projects supplements CCAUV.V-K3, with measurements in the frequency range from 1 to 80 Hz with an optional extension to DC to 200 Hz. 10 EURAMET NMIs are involved and LNE is piloting. A draft B report is in preparation.

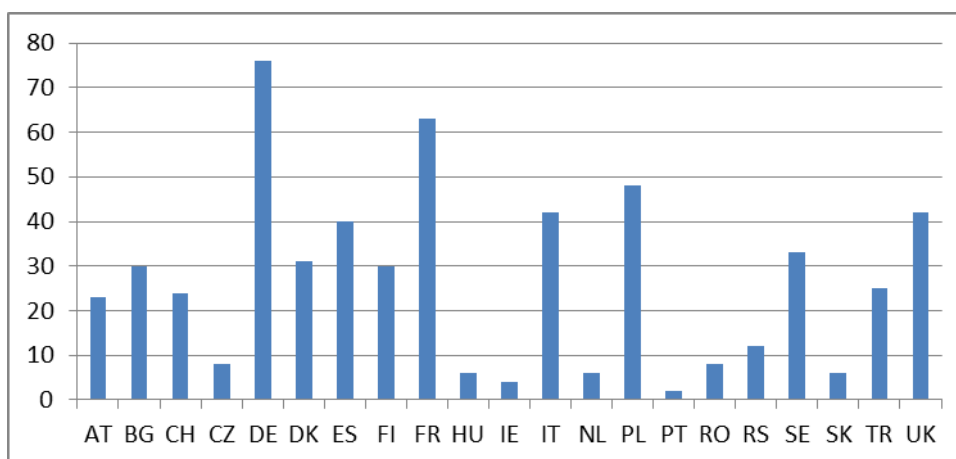
EURAMET NMIs are also involved in the following key comparison within other RMO.

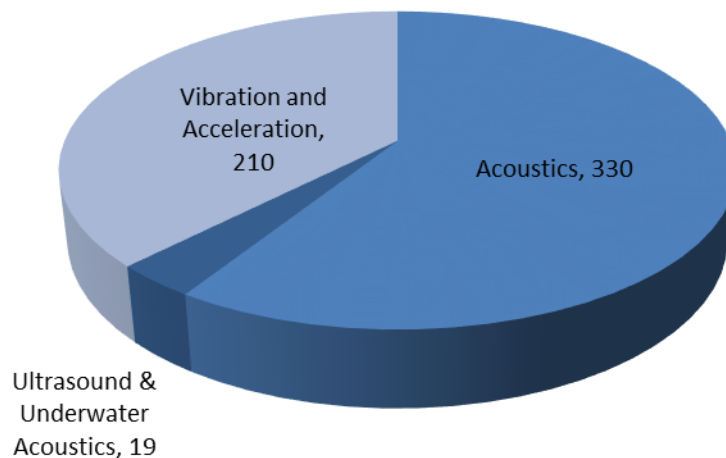
COOMET.AUV.V-K1: Includes 3 participants from EURAMET (GUM, UME, INM). VNIIM, Russia is the pilot of the comparison. The Draft B of the comparison report is under preparation.

AFRIMETS.AUV.A-K5: Includes 3 participants from EURAMET (CMI, MIKES and NPL). NMISA are piloting the project. NPL will provide the link to the KCRV derived from CCAUV.A-K5. This project is using the same microphones as EURAMET.AUV.A-K5 as these have proven long-term stability. This also means that linking to the KCRV is based on the same reference standards used in EURAMET. However, this has also meant delaying the publication of the Draft A report from EURAMET.AUV.A-K5 by around 2 months.

4. CMCs

21 EURAMET NMIs & DIs have a total of 559 CMC entries approved and published on the BIPM KCDB. The distribution by country and technical area is shown below.





Number of AUV CMC entries in the KCDB by country and technical area

New or revised CMC submissions from MIKES, Finland, CEM, Spain and LNE, France were added to the database in 2014-5. Overall, the number of CMCs appearing for review is not excessive, and the situation is manageable. However TC-AUV’s position is to resist expansion of the service categories into tertiary application area as promoted by other RMOs.

5. Activities of the Sub-Committees

The activities of each Sub-Committee are coordinated by the appointed Convenor. The level of membership in Sub-Committees varies significantly, but it is also common for invited guests from other RMOs and additional technical experts to attend as observers. Each Sub-Committee meets annually. The work of the Sub-Committees is reflected mostly in the variety of collaborative TC-projects. However it has been noted by all SCs that recent focus on EMRP has reduced the capacity for initiating new TC-projects. The 2015 meeting gave this matter some attention and a number of new research topics were discussed at length. The ideas attracting most interest are noted above, and agreement for a number of projects to be developed in 2015 was reached.

6. Participation in EMRP

TC-AUV aims to participate actively in the European Metrology Research Programme EMRP. There have been Joint Research Project (JRP) from the 2010 Call, two from the 2011 call and a currently active one from the 2012 call.

The project IND09 “Dynamic” (Call 2010 Industry) is now completed. It was concerned with the generation of the knowledge and infrastructure needed for establishing and ensuring the traceability for the mechanical quantities force, torque and pressure for measurements under dynamic conditions. For more information please see: <http://www.ptb.de/emrp/ind09.html>

The project HLT01 “EARS” (Call 2011 Health II) ended in April 2015. It was concerned with the metrology underpinning the development of a universal ear simulator and methods for quantifying

the perception of non-audible sound. For more information please see: <http://www.ears-project.eu/emrp/ears.html>

The project HLT03 “DUTy” (Call 2011 Health II) ended in May 2015. It was concerned with the challenges of establishing the metrological basis for therapeutic ultrasound. For more information please see: <http://www.duty-project.eu/emrp/dosultrasound-home.html>

SIB56 “SoundPwr” (Call 2012 SI Broader Scope) is the only currently active project. It is investigating a new means of establishing traceability for sound power measurement using optical measurements of a vibrating source as a primary standard. For more information please see: <http://www.ptb.de/emrp/sib56-home.html>

The last EMRP call was in 2013, and the programme has been superseded by the European Metrology Programme for Innovation and Research (EMPIR). Calls in 2015 focused on Health (on which much AUV activity is closely connected), SI and Research Potential. Three joint research proposals in the *Health* call and one in the *Research Potential* call will be assessed for funding at the EMPIR review conference in Nov-15.

7. TC-AUV input to the EURAMET Strategic Research Agenda

EURAMET has been developing a Strategic Research Agenda to focus the scope of calls and steer research within EURAMET generally. All TCs have been active in providing input in terms of priorities in the development of the SI and contributions to the so-called *Grand Challenges* in health, the environmental and energy.

The output from the exercise to review and revise the TC-AUV roadmaps in 2012, was used as the basis for developing the strategic priorities for TC-AUV in the *Grand Challenge* and thematic areas of EMPIR. The opportunity was taken during the TC-AUV meeting in 2014 to identify the triggers and challenges that can be addressed by each of the SCs across the whole scope of EMPIR.

TC-AUV has endeavoured to provide input at the appropriate level to properly reflect the strategic priorities and potential impact of research in the AUV field, taking account of these strong human factors elements of the work, cutting across all grand challenge areas, but particularly the Health and Environment sectors.

8. Meetings

The TCAUV and the three Sub-Committees meet typically on a yearly basis. In recent years the objective has been to hold meetings of the TC and all SCs together, providing greater opportunities for cross-theme discussions and greater exposure of all delegates to wider EURAMET issues.

The 2015 meetings were held at GUM, Poland on 18-19 February 2015 and followed the now established 2-day format consisting of Plenary and Sub-committee sessions.

The Plenary sessions provided the opportunity to report on general EURAMET matters and information arising from the EURAMET General Assembly and joint meetings of the Board of Directors and TC-Chairs, as well as discuss some of the matters arising from those meetings.

One particular point of discussion was the preparation of *calibration guides*. In all areas of AUV, many members have influential roles in standardisation working groups. Developments over many years have led to a situation where knowledge on calibration and best practices has been embodied in international standards, and these provide very effective and authoritative guidance in calibration. Nevertheless, it was noted that many users may turn to the EURAMET website for such guidance and at present would not find anything there for TC-AUV. It was therefore agreed that new documents would be produced for publication on the EURAMET website that provided basic information and directed users to the relevant ISO and IEC standards as appropriate, thus avoiding the need to reproduce existing material. SCs would also consider areas of work where other types of guidance document may be adopted and where no useful guidance is currently available.

TC-AUV received an invitation from DFM, Denmark, to host the 2016 meeting, which will take place on 24-25 February.

Richard Barham
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