



TC ACOUSTICS, ULTRASOUND AND VIBRATION

Annual Report

April 2003 to March 2004

1. Introduction

The structure of TC AUV remains the same as last year. TC AUV consists of the four sub-committees coordinated by permanent convenors:

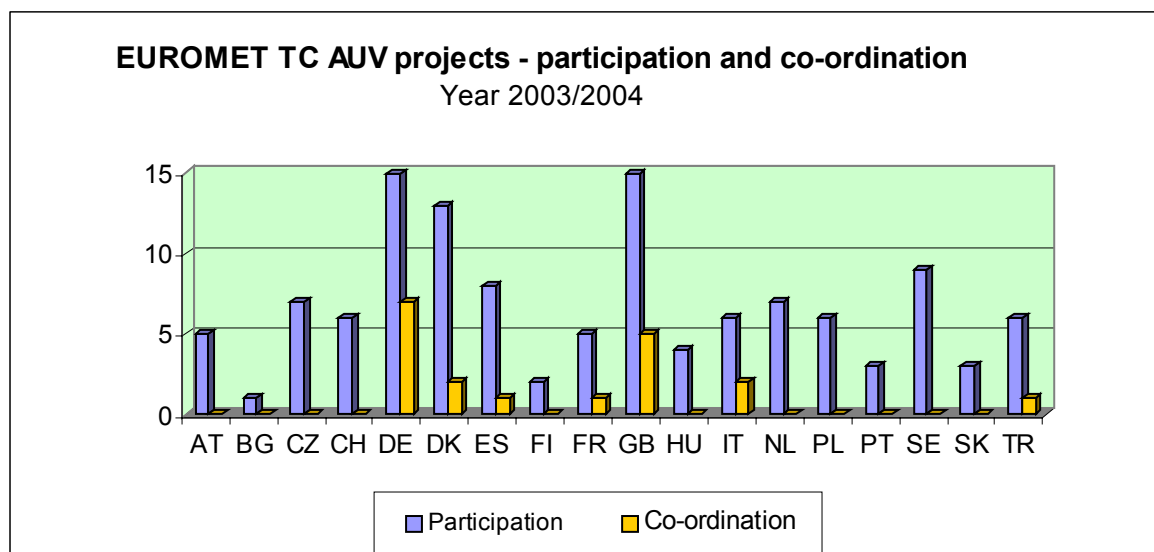
- Sound in air (21 members),
- Underwater acoustics (6 members),
- Ultrasound (9 members),
- Acceleration and vibration (15 members).

The year started with Sound in air SC and the TC AUV Contact Persons meetings held at LNEC, Lisbon, on May 8 ÷ 9, 2003. Then Ultrasound SC meeting in October 2003 at UME, Turkey was held. The year ended with Acceleration & vibration SC meeting in March 2004 also at UME.

2. Most important issues and outcomes

During this year more attention has been paid to R&D collaboration. The 21 ongoing projects have been reviewed, 5 projects has been completed. The final reports were accepted and they will be available on EUROMET website soon. The final and progress project forms have been updated.

The graph below shows the involvement of particular countries in participation and co-ordination of projects.



The majority of projects is conducted within Sound in air SC. The results of these projects are useful mostly for NMIs in development and maintaining of primary standards and to provide traceability of measurements carried out by end users mainly involved in environmental and health protection. The interest of industry in results and consequently in supporting of these projects is rather limited. The results of some projects are to be the input for IEC working groups preparing the requirements for acoustical standardisation.

Within Acceleration and vibration SC the traceability type of projects dominates. In this sub-field only few NMIs maintain primary standards. Consequently the traceability projects are important. Actually three traceability projects are in progress where PTB gives traceability to other NMIs. It should be emphasized the number of participants of these projects still increases.

PTB is involved in the European project "LAVINYA" led by the University of Ancona (Italy). PTB is undertaking work package 3 of the project, "*Calibration, uncertainty and traceability of translational and rotational laser vibrometers*", focusing on the following tasks:

- Establishment and investigation of methods for the calibration of laser vibrometers,
- Evaluation of measurement uncertainty in calibrations of laser vibrometers,
- Specification and standardization of requirements on reference standard laser vibrometers.

In Ultrasound SC the projects are mostly related to large group of end-users such as health care institutions, patients, doctors and medical equipment manufactures as well. It should be emphasized the ongoing project *671 Development of transfer standard devices for ensuring the accurate calibration of ultrasonic therapy machines in clinical use* conducted in cooperation with Australian partner has been selected for potential "case study". The goal of the project is to develop an ultrasound power standard suitable for testing of therapy equipment in small companies and hospitals, and to prepare number of publications for physiotherapists and technicians involved in testing of ultrasound therapy equipment.

Actually there is no ongoing project in underwater acoustics sub-field. Due to the small number of participants and as there was no offer to host a meeting, no meeting of Underwater acoustics SC has been held since 2001. However there remains an interest in proposed projects 616 and 617 from both NMIs and industry, and these will be discussed at the next opportunity.

The issue of wider participation was discussed at the TC-AUV meeting, and it was agreed that NPL will take a proactive role in contacting suitable organisations and inviting them to join the SC.

3. Interregional co-operation

The project No. 671 mentioned above, coordinated by TNO (The Netherlands) with PTB (Germany), NPL (UK) and Australian partner is a good example of interregional cooperation. The project is funded by the EC within 5th Framework programme.

The TC AUV members and SCs members are involved in activities of technical committees of international standards organisations (IEC TC29 and TC87 and ISO TC108). Actual information about activities and current work within the particular standardisation committees is reported during every AUV meetings.

The interregional contact continues to be via the CCAUV meetings, held every two years at BIPM. During these meetings the activity of TC AUV is reported by its Chairperson.

The RMO working group meeting for Acoustic, Ultrasound and Vibration CMCs is planned for September 29, 2004, immediately following the CCAUV meeting. During this meeting the issues such as: compatibility of existing CMC and KCRV entries in the KCDB, with respect to the uncertainties quoted in Appendix C and the degrees of equivalence in Appendix B, proposals for review of these compatibilities in the future, review of the existing guidelines for table entries, review of service categories, guidelines for future CMC reviews, intra-regional, inter-regional and any outstanding problems regarding the review of AUV CMCs will be discussed.

4. Research trends

It should be emphasized in AUV subject field new proposals and suggestions have focused on unresolved issues undertaken within the previous EUROMET projects which were completed in reduced range because the participants were unable to address many of the issues at their start or the projects were deleted on the proposal stage.

During the last Sound in air meeting three proposals from NPL have been discussed. There are the following:

- *Measurement of the acoustical impedance of artificial ears* – the project will replace the deleted project No 302. It should give the input for the revision of IEC 60318-1 that specifies the artificial ears. The current version of the standard provides data on the required acoustic impedance, but it does not specify tolerances and measurement methods. The goal of project is to evaluate the proposed measurement procedure and refine the method, and also collect the data on the acoustical impedance of a number of devices that will form the part of sample that defines the data to appear in the revised Standard.
- *Investigation of methods of secondary free-field calibration* – the project is intended to investigate of different methods of secondary free-field calibration and compare the results of this method. Extension of project C400 (completed in 2000), namely the use of signal processing for free field comparison calibration. It also addresses the need for a suitable sound source. The driver for this work is the preparation of the next part of the IEC 61094 series concerning the calibration of measurement microphones by comparison with laboratory standard microphones.

- *Specification of requirements for the calibration of impedance heads for measurements on mechanical couplers* – The purpose of the project is to gather information on the requirements for measurement accuracy in all stage of audiological bone conduction measurements, from the practitioner to the calibration laboratory and to make a report that recommends a specification of requirements for the calibration of impedance heads. It should be noticed that the previous proposed project 577 *Calibration of impedance heads for measurements on mechanical couplers* was withdrawn in 2002 as it generated some discussion on the requirements for calibration of impedance heads including such issues as frequency range, uncertainty, frequency of calibration and other points to be important to users. These issues have not been specified at the start of this project.

None of these proposals has been nominated as IMERA benchmark cooperation project as, according to the feeling of AUV Contact Persons, there is no priority for acoustics in this programme.

As mentioned above there remains an interest in proposed project regarding the assessment of cleaning baths (ultrasound) and registered proposal P616 *Collaboration on uncertainties in the calibration of underwater acoustic transducer* and P617 *Responses of reference hydrophones under real ocean conditions* but at the moment no potential for these projects can be seen.

It should be emphasized the annual meetings give the opportunity to exchange information on scientific and technical activities of particular NMIs. It has been come customary to present scientific papers on newly developed methods designs and constructions. Recently the following papers have been presented:

- *An overview of the fundamental aspects of free field reciprocity calibration of microphones* from DPLA Denmark;
- *The progress in the development of a new standard for acoustical quantities, by the direct measurement of particle velocity with laser Doppler techniques*. It is a project of Edinburgh University, supported by NPL;
- *Heterodyne and time-gated time delay spectrometry for amplitude and phase calibration of hydrophones*, from PTB;
- the presentation from TNO (The Netherlands) concerned the methods of avoiding tissue damage caused by harmful bio effect during medical application of ultrasound;
- NPL presentation concerned new construction of cavitation sensor which used to characterise ultrasonic cleaning baths quantitatively;
- PTB presentation on recent advances in realization and dissemination of acceleration measurement standards and on the EC project „LAVINYA“ and its contributions to the traceability for vibration and shock acceleration measurements.

5. Mutual Recognition Arrangement

5.1 Key Comparisons

In 2003/2004 the following AUV Key Comparisons were in progress:

- CCAUV.A-K3 – the measurements completed, Draft A report in progress. Four European NMIs: DPLA (Denmark) – pilot laboratory, PTB (Germany), GUM (Poland) and NPL (UK), UME (Turkey) participated;
- EUROMET AUV.A-K3 with 9 participants: BEV (AT), CEM (ES), CMI (CZ), DPLA (DK), IEN (IT) – pilot laboratory, METAS (CH), MIKES (FI), NMi VSL (NL), SP (SE) – the measurements to be completed soon;
- EUROMET AUV.V-K1 with 15 participants: BEV (AT), METAS (CH), CMI (CZ), CEM (ES), PTB (DE) – pilot laboratory, DPLA (DK), BNM-CESTA (FR), GBARL (HU), CNR-IMGC (IT), NMi VSL (NL), SP (SE), GUM (PL), INETI (PT), SIRA (UK) and UME (TR) – the measurements in progress;
- COOMET AUV.A-K1 with 4 EUROMET participants: PTB (DE) as pilot laboratory, GUM (PL), SMU (SK) and UME (TR) – the measurements completed, draft A report under discussion.

5.2 Bilateral Comparison

To ensure the comparison support for some laboratories that have their CMCs approved and published and that have participated neither in CCAUV nor EUROMET Key Comparison the following bilateral comparison projects have been provided:

- EUROMET project 736 *Bilateral comparison of ultrasonic power standards* (PTB, UME) - completed, final report available on EUROMET web site;
- EUROMET project 750 *Bilateral comparison on primary pressure calibration of LS1P and LS2P microphones* (DPLA, CEM) - completed, final report in progress;
- EUROMET project (not registered yet) *Bilateral comparison on pressure calibration of LS1P and LS2P microphones* (DPLA, BNM-LNE) – completed, final report in progress.

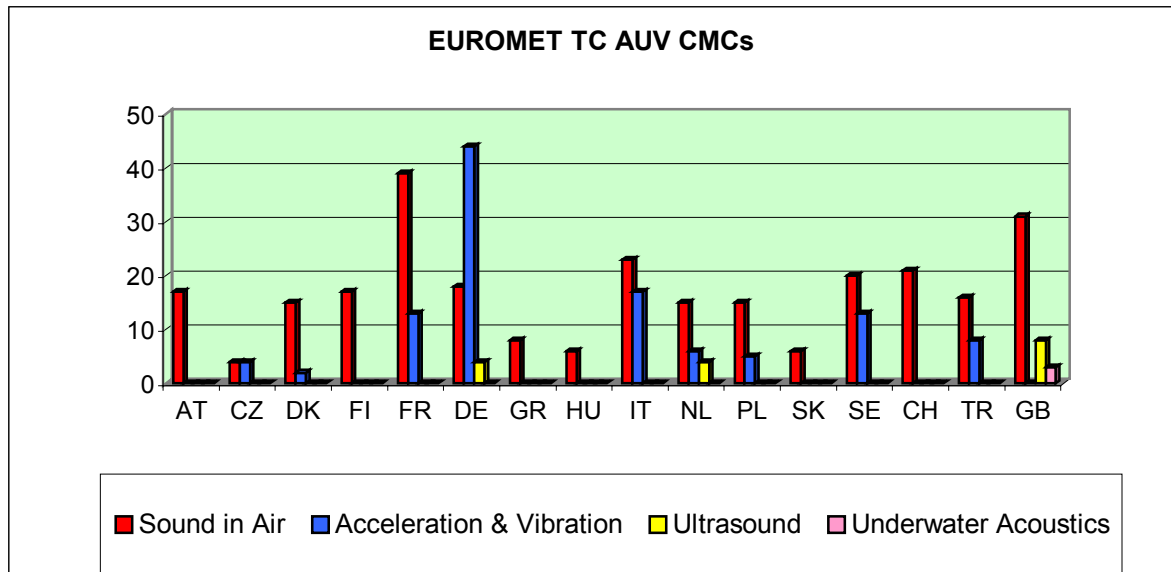
Within Ultrasound SC the EUROMET project 745 *Comparison of high frequency hydrophone calibrations up to a frequency of 40 MHz* (NPL, PTB) has been undertaken. Previous hydrophone comparisons between European laboratories have covered the frequency range 0.5 to 15 MHz. Due the growth in medical applications involving the application of high frequency ultrasonic fields (above 15 MHz); there is a need to compare calibrations in the wider frequency range.

5.3 Status of EUROMET AUV CMCs

Sixteen European countries have data approved and published.

Actually EUROMET.AUV.4.2004 containing the revised data from Poland, The Netherlands and UK is under interregional review.

The graph shows the number of CMCs of particular countries with division into AUV sub-fields.



In 2003/2004 the TC AUV reviewed:

- the APMP.AUV.1.2003 submission containing 23 CMCs from CMS/ITRI Chinese Taipei,
- the COOMET.AUV. 2.2003 CMCs from BelGIM Belarus.

It is worth to point out the increasing understanding between RMOs on the technical issues appearing during interregional CMC reviews.

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