



ANNUAL REPORT **of COOMET TC 1.2 "Acoustics, Ultrasound, Vibration"** **(on the work performed over 2022)**

1 GENERAL CHARACTERISTICS OF COOPERATION IN THE SUBJECT FIELD

In TC 1.2 "Acoustics. Ultrasound. Vibration" NMI's from 12 countries are officially represented: Azerbaijan, Armenia, Belarus, Bulgaria, Germany, Georgia, China, Russia, Tajikistan, Turkey, Ukraine and Uzbekistan.

In October 2022, the Ministry of Economy of Ukraine officially informed about the suspension of Ukraine's participation in COOMET structural bodies. Georgia and Ukraine have also officially informed COOMET of their intention to acquire full membership in EURAMET.

At the 16th meeting of the TC (2021) in accordance with 4.3.3. of document COOMET D5/22/202 "Regulation on TC 1.2", it was decided to transfer TC members from Azerbaijan, Bulgaria, Germany and Tajikistan to the status of observers.

The National Body for Standardization and Metrology of the Ministry of Economy of the Republic of Armenia has notified that:

- does not have a reference base in the field of acoustics, ultrasound and vibration;
- has not participated and does not plan to participate in comparisons in these types of measurements;
- has no publications in AUV subject areas;
- has not participated in conferences, seminars and meetings of working groups.

Thus, at present, NMI's of 11 countries are represented in TC1.2, of which only 4 countries - Belarus, China, Russia and Turkey - have a developed infrastructure in the field of AUV.

Within the framework of TC 1.2, the following areas have been identified:

- "Acoustics of the air" (coordinator is being specified);
- "Ultrasound" (coordinator is being specified);
- "Acoustics of the water" (coordinator - Dr. Alexander Isaev (VNIIFTRI, Russia));
- "Vibration" (coordinator is being specified).

Candidates for field coordinators are discussed among TC members. The approval of the new composition of coordinators is included in the agenda of the 17th meeting of TC1.2, which will be held online on May 11, 2023.

2 TC MEETINGS

The 16th meeting of TC 1.2 was held online on September 30, 2021.

Meeting participants: Belarus, China, Russia, Turkey, Ukraine.

Main issues discussed:

- Chair's report on the work of TC 1.2 in 2020-21 and implementation of resolutions of the previous meetings;
- information on the status of current COOMET projects in the field of AUV;
- proposals to the COOMET Program of Comparisons;
- information about the decisions of the COOMET Committee and Presidential Council;
- information report on the resolutions of the 21st meeting of the COOMET Joint Committee for Measurement Standards and discussion of issues related to the adopted resolutions.

- on the implementation of the CIPM MRA;
- information about the regular meetings of the CCAUV working groups and activities of the EURAMET TC AUV;
- on the implementation of the activities of the Cooperation Plan between COOMET and EURAMET for 2021 and proposals for the Plan for 2022.

No TC meeting was held in 2022.

Members of TC 1.2 participated in the implementation of a number of activities envisaged by the COOMET Development Program for 2020-2022 and by the Roadmap for the implementation of the COOMET Strategy for 2020-2025, namely:

- 9. (Ind-a.1.9) Carrying out of an analysis of the timeframe for conducting COOMET comparisons and taking corrective actions for its reduction: work was carried out on the official completion of the comparisons, conducted under the auspices of TC 1.2, in the KCDB.

3 STATUS OF COOMET PROJECTS

Comparisons completed in 2021-2022

Project №	Title of the project	Project code in KCDB	Project coordinator	Status
706/RU/16	Comparison of the results of measurements of the velocity of propagation of longitudinal ultrasonic waves in solid media	pilot	V.A. Lugovoi Far Eastern branch of FSUE "VNIIFTRI"	Completed, an article is being prepared for publication in the journal Measurement Techniques. <i>Participants of the comparison:</i> BelGIM, Belarus; DVF VNIIFTRI, Russia; Ukrmetrteststandard, Ukraine; Dneprstandartmetrologiya, Ukraine; NIM, China
CCAUV/W-K2	Comparison of results of free-field hydrophone calibrations in the range from 250 Hz to 500 kHz	key	Isaev A.E. VNIIFTRI, Russia	Completed, results published in the JASA journal of the Acoustic Society of America. <i>Participants of the comparison:</i> UK, Turkey, Russia, USA, China, South Africa, Brazil, India.
CCAUV.A-K6	Key comparisons of the BIPM in the field of measuring acoustic quantities	key	Nikolaenko A.S. VNIIFTRI, Russia	Comparisons completed successfully. Final Report published https://www.bipm.org/documents/20126/79915786/CCAUV.A-K6.pdf/8dbc8831-e3ef-6c48-2bec-4ff89d16fc33

Comparisons in progress

Project №	Title of the project	Project code in KCDB	Project coordinator	Status
846/RU/21	Regional key comparisons in the field of ultrasound power measurement in water		E. Sadikoglu TÜBİTAK ÜME, Turkey	Preparation of and agreeing on the key items of the technical protocol of the comparisons. <i>Participants of the comparisons:</i>

				Russia, Ukraine, Turkey, China
757/RU-a/18	Supplementary comparison of national standards of the unit of sound pressure in air in terms of determining the level of sensitivity to pressure of working reference microphones of the WS2 type in the subsonic frequency range.	Supplementary COOMET.A UV.A-S3	Nikolaenko A.S. VNIIFTRI, Russia	The measurement part of the comparisons is completed. Pilot laboratory (VNIIFTRI) awaits measurement results from Turkey <i>Participants of the comparison:</i> China, Ukraine, Belarus, Turkey, Russia.
790/TR-a/19	Calibration of sound calibrators	Supplementary COOMET.A UV.A-S4	TÜBİTAK UME, Turkey	Approval of the Technical Protocol of the comparisons with CCAUV WG Monitoring of the calibrators stability. <i>Participants of the comparison:</i> TÜBİTAK UME, Türkiye; BELGİM, Belarus; VMC, Lithuania; VNIIFTRI, Russia; NSAI-NML, Ireland; DNDI Systema, Ukraine
786/RU/19	Comparison of the results of amplitude-phase hydrophones calibrations at frequencies from 10 to 500 kHz	pilot	Isaev A.E. VNIIFTRI, Russia	Completed in April 2023; the results will be published in the 3-rd issue of the journal "Measurement Techniques" for 2023. <i>Participants of the comparisons:</i> Russia, China

Planned comparisons

Project №	Title of the project	Project code in KCDB	Project coordinator	Status
	Supplementary comparison in the field of microphone calibration in order to confirm the calibration capabilities (services) for microphone calibration. The comparison will use a microphone - the working standard WS2P.	Supplementary	TÜBİTAK UME, Turkey	The form of the proposed COOMET project is being prepared. <i>Participants of the comparison:</i> Uzbekistan, Turkey

COOMET NMIs have taken part and are trying to take part in CCAUV comparisons. Due to "sanctions and logistical restrictions" the Russian Federation was denied participation in supplementary CIPM comparisons in the field of underwater acoustics.

4. STATUS OF AUV CMCs OF COOMET NMIs

Information on AUV CMCs of National Metrology Institutes, submitted through COOMET and published in the KCDB

CMC AUV	Date of publication in the KCDB	NMI	Number of published entries
COOMET.AUV.1.2001 COOMET.AUV.5.2009	2002-06-07 2009-09-18	VNIIFTRI, Russia	72

COOMET.AUV.2.2003	2004-04-07	BelGIM, Belarus	31
COOMET.AUV.7.2014	2015-01-27		
COOMET.AUV.9.2017	2018-01-17		

Since February 1, 2023, the NMIs and DIs of Georgia and Ukraine have been carrying out their activities to implement the CIPM MRA in EURAMET, remaining in COOMET membership.

5. PARTICIPATION OF COOMET IN INTERREGIONAL REVIEW OF CMCs

During the reporting period, the TC took part in the interregional review of the following CMCs:

- SIM-AUV-CA-0000091(K-2, R-2, S-3) - Canadian CMCs in the field of air acoustics;
- CMC APMP-AUV-CN-00000N7(G-1, H-1, I-1, J-1, K-1, L-1) - CMC of China in the field of air acoustics.

6. COOPERATION WITH INTERNATIONAL AND REGIONAL ORGANIZATIONS IN THE FIELD OF AUV

6.1 In 2022, TC representatives took part:

- in the meeting of TC 011 "Medical devices, devices and equipment";
- in IEC WG15 TC87 online meetings (April 29 and November 2-3, 2022);
- in online meetings of ISO TC43 SC3 WG1 (April 5 and June 10, 2022);
- in the online meetings of ISO TC43 SC3, working group 3 (November 17, 2022).

6.2 Participation in international and national conferences

Two reports at the 8th All-Russian Scientific and Technical Conference "Measurements and Tests in Shipbuilding and Related Industries", 2022, St. Petersburg, Russia.

Report at the IX scientific and practical conference of young scientists, graduate students and specialists of the Federal State Unitary Enterprise "VNIIFTRI", 2022, Mendeleevo, Russia.

Report at the XXXIV session of the Russian Acoustic Society on February 14–18, 2022, Moscow, Russia,

Online report at the Russian-Chinese seminar "Metrology in medicine and healthcare" on July 14–15, 2022

Report at the XI All-Russian scientific and technical conference "Problems of metrological support in healthcare and the production of medical equipment" on September 26–30, 2022, Sochi, Russia.

6.3 Publications

6.3.1 Acoustics of the air

D.V. Golovin, Numerical Simulation of Sound Pressure for an LS-Type Calibration System of Measurement Microphones, Mathematical Models and Computer Simulations, volume 14, pages 419–426 (2022).

Golovin D.V. Module of the complex acoustic impedance of air in a cylindrical closed volume: calculation using numerical simulation. Measuring Techniques. 2022. No. 11, pp. 65–71.

6.3.2 Underwater acoustics

Isaev A.E. Certificate of state registration of computer programs No. 2022618410 dated 06.06.2022

Isaev A.E. Certificate of state registration of computer programs No. 2022618409 dated 06.06.2022

Isaev A.E. Certificate of state registration of computer programs No. 2022618275 dated 05.06.2022

Isaev A.E., Khatamtaev B.I. Decision of the Federal Service for Intellectual Property Rospatent dated November 7, 2022 to grant a patent for inventions under application No. 2022111196.

Isaev A.E. On the issue of measuring the sound reflection coefficient using a virtual low-element phased radiating array. Almanac of modern metrology. No. 1(29), 2022, pp. 127-135.

Isaev A.E., Polikarpov A.M., Khatamtaev B.I. Experimental determination of the acoustic center of the measuring hydrophone. Almanac of modern metrology. No. 2(30), 2022, pp. 56-71.

Isaev A.E., Khatamtaev B.I. The Acoustic Center of a Measuring Hydrophone. Acoustical Physics, 2023, Vol. 69, No. 1, pp. 93–101.

Khatamtaev B.I., Shcherblyuk N.G. Experimental determination of the acoustic center of the measuring hydrophone. Measuring Techniques, 2022, No. 10, 53-57.

Isaev A.E. Patent for invention No. 2776616 dated July 22, 2022

Enyakov A.M., Panin O.A. Ecological problems of noise pollution in the Arctic waters of Russia. Proceedings of the 8th All-Russian Scientific Conference "Measurements and Tests in Shipbuilding and Related Industries", St. Petersburg, 2022, p. 93-95.

A.E. Isaev, A.M. Polikarpov, B.I. Khatamtaev. Approaches to the amplitude-phase calibration of a hydrophone by the reciprocity method. Almanac of Modern Metrology, 2022 No. 4 (32).

A.E. Isaev, Chen Yi, A.N. Matveev, Jia Guanghui, B.I. Khatamtaev, Wang Shiguang, N.G. Shcherblyuk COOMET 786/RU-A/19: Results of pilot comparisons of amplitude-phase calibrations of hydrophones in the field in the frequency range from 10 to 500 kHz. Almanac of Modern Metrology, 2022 No. 4 (32).

Isaev A.E., Nikolaenko A.S. Receiver sensitivity for measuring underwater noise. Proceedings of the 8th All-Russian Scientific Conference "Measurements and Tests in Shipbuilding and Related Industries", St. Petersburg, 2022, p. 79-82.

6.3.3 Ultrasound

Kirillov N.A., Lukin G.S. Application of thermal converters for measuring the intensity of focused ultrasonic fields. Proceedings of the IX scientific and practical conference of young scientists, graduate students and specialists of the Federal State Unitary Enterprise "VNIIFTRI", 2022, Mendeleevo, Russia, p. 48-54.

7. PROSPECTS

Creation and modernization of national standards:

The State Institution "UzNIM" has created a national standard for the unit of sound pressure in the air (Pa). The standard provides storage and transmission of the size of the unit of sound pressure in the air - pascal (Pa) in the frequency range from 20 Hz to 25 kHz. The expanded uncertainty in the frequency range from 20 Hz to 25 kHz is not more than 0.03 to 0.14 dB with a confidence level of 0.99. In accordance with the Decrees of the President of the Republic of Uzbekistan No. PP-2935 dated April 28, 2017 and No. PP-4059 dated December 12, 2018, UzNIM acquires the standard of the unit of length, speed and acceleration during the oscillatory motion of a rigid body, in the frequency range from $1 \cdot 10^{-1}$ Hz to $2 \cdot 10^4$ Hz, which will be delivered to UzNIM in 2023.

The standard will provide:

- primary calibration of vibration sensors in accordance with ISO 16063-11:1999 method 3 (sinusoidal approximation) using a laser interferometer;
- calibration of vibration sensors by comparison according to ISO 16063-21:2003;
- calibration of vibration calibrators in accordance with ISO 16063-44:2018
- impact calibration by comparison with a reference transducer ISO 16063-22:2005;
- calibration of seismic sensors and geophones.

8. PREPARATION OF CMC DATA BASED ON THE RESULTS OF CCAUV AND COOMET KEY COMPARISONS

Participation of COOMET NMIs in CCAUV key comparisons.

Acoustics Sound in the air	Acoustics Sound in water	Ultrasound	Vibration
◆ CCAUV.A-K1 ◆ CCAUV.A-K2 ◆ CCAUV.A-K3 CCAUV.A-K4 ◆ CCAUV.A-K5	◆ CCAUV.W-K1 ◆ CCAUV.W-K2	◆ CCAUV.U-K1 CCAUV.U-K2 ◆ CCAUV.U-K3 CCAUV.U-K4	◆ CCAU.V-K1 ◆ CCAU.V-K2 ◆ CCAU.V-K3 ◆ CCAU.V-K4 ◆ CCAU.V-K5

9. INFORMATION ON THE EXPECTED VENUE AND DATE OF THE NEXT MEETING OF TC 1.2

The next meeting of the TC is scheduled for May 11, 2023 (online).

Alexander Isaev
Acting TC 1.2 Chair

Valentina Pozdeeva
TC 1.2 Deputy Chair