



Overview of activities of SASO-NMCC in AUV field

Fheed N. Alsubaey
SASO – NMCC, Saudi Arabia
f.subaey@saso.org.sa

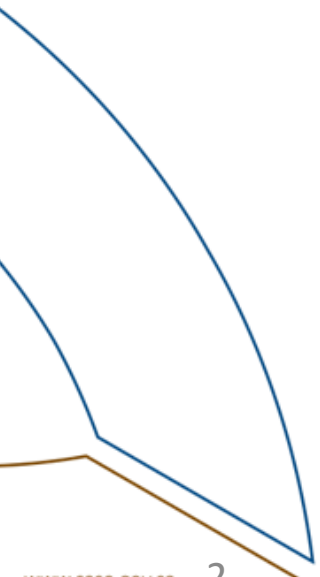
11th CCAUV meeting , BIPM, Paris
19-22 September 2017

➤ General information about SASO

➤ Current status of SASO

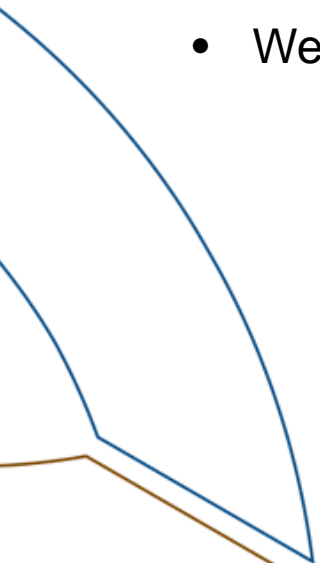
➤ Activities in AUV field

➤ Future plan of AUV



National Measurement and Calibration Center (NMCC)

- (NMCC) was established in 1406 AH (1986 AD). it is the first reference for measurement and Calibration in the kingdom , The Center is responsible for maintaining and keeping: National / reference / secondary and working standards, and enhancing their accuracy whenever required.
- Calibrating the measurement instruments and standards by the highest level of accuracy for governmental and private agencies as well as GCC member states.
- We shifted to new building in the middle of 2013.





Bureau International des Poids et Mesures - the intergovernmental organization through which Member States act together on matters related to measurement science and measurement standards.

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The Kingdom of Saudi Arabia

General info. | Quality infrastructure | CIPM MRA | BIPM services | Senior engagement

→ The Kingdom of Saudi Arabia became a Member State in 2011.



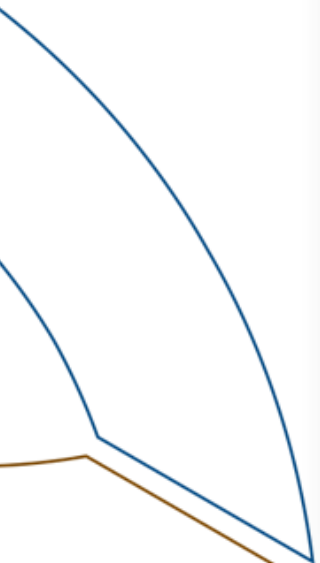
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- List of Member States
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- KCDB
- Participation in key and supplementary comparisons
- Number of CMCs published per domain

Meetings:

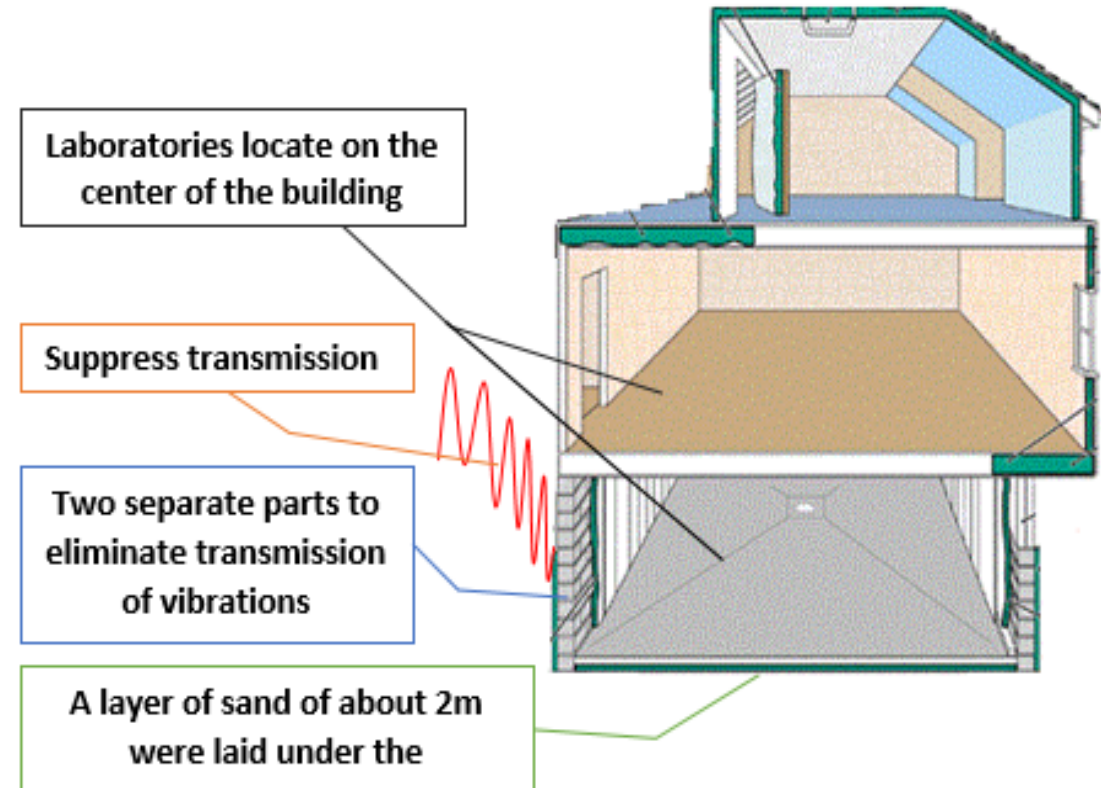
- NMI Directors and State Representatives



New NMCC Building

The Building of NMCC was built on a total area of (16000 m²) where the area of the actual building is (11380 m²). It consist of three floors,

- ❖ For metrological purposes the following concepts were considered:
 - The foundation of the building was designed to suppress transmission, In order to achieve this goal, a layer of sand of about 2m were laid under the foundation.
 - The foundation consists of two separate parts to eliminate transmission of vibrations from on part of the building to the other.



New Building¹



Old Building²



New NMCC Building

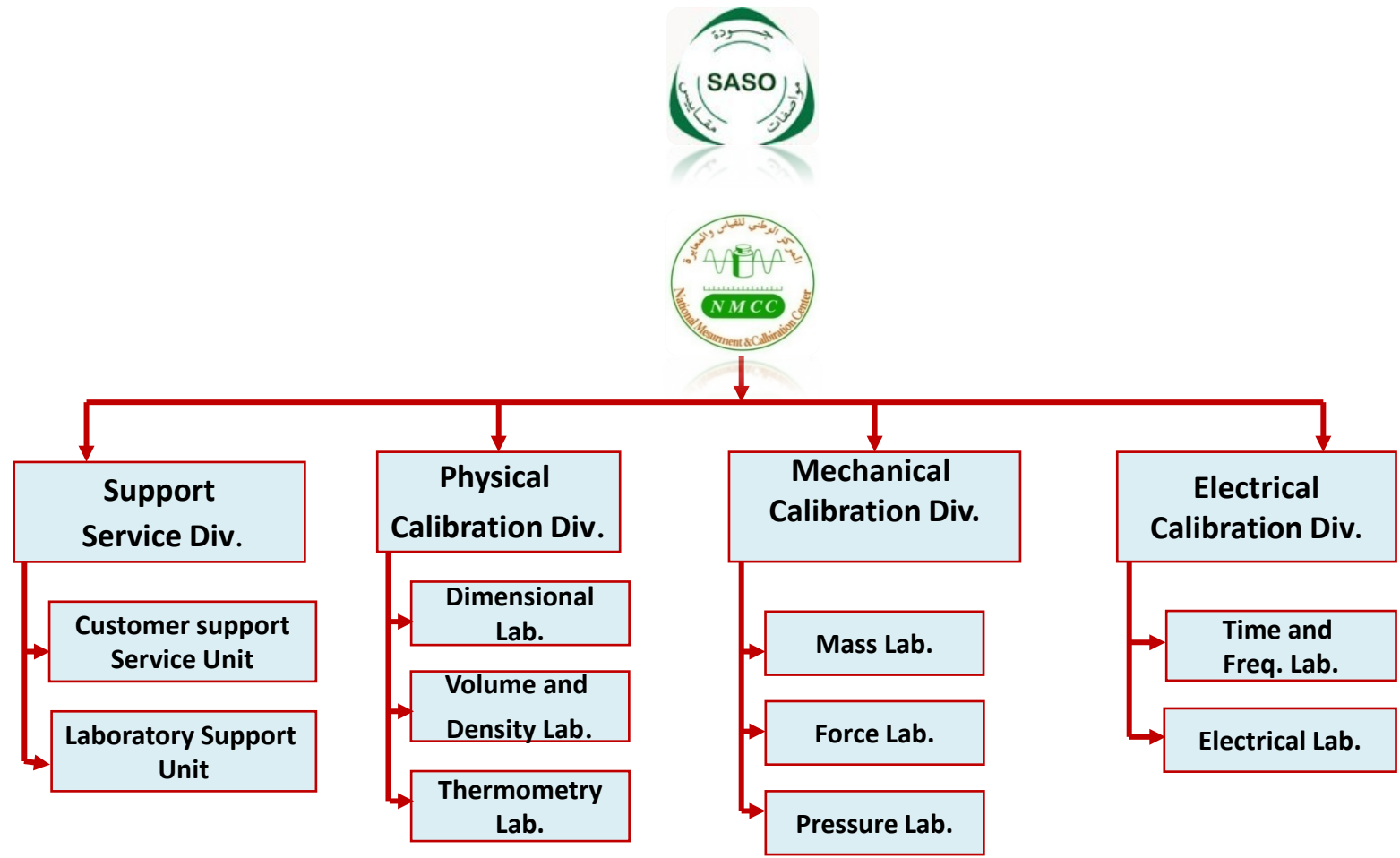


- In 2013 National Measurements & Calibration Center (NMCC)
- has been established on total area of (16000 m²), and total building area of (11380 m²). It consist of:
 1. Basement.
 2. Ground Floor.
 3. First Floor.



NMCC's laboratories

➤ **Previously:** Since 1986 to 2012 NMCC covered only five area in the field of metrology,
Laboratories Structure

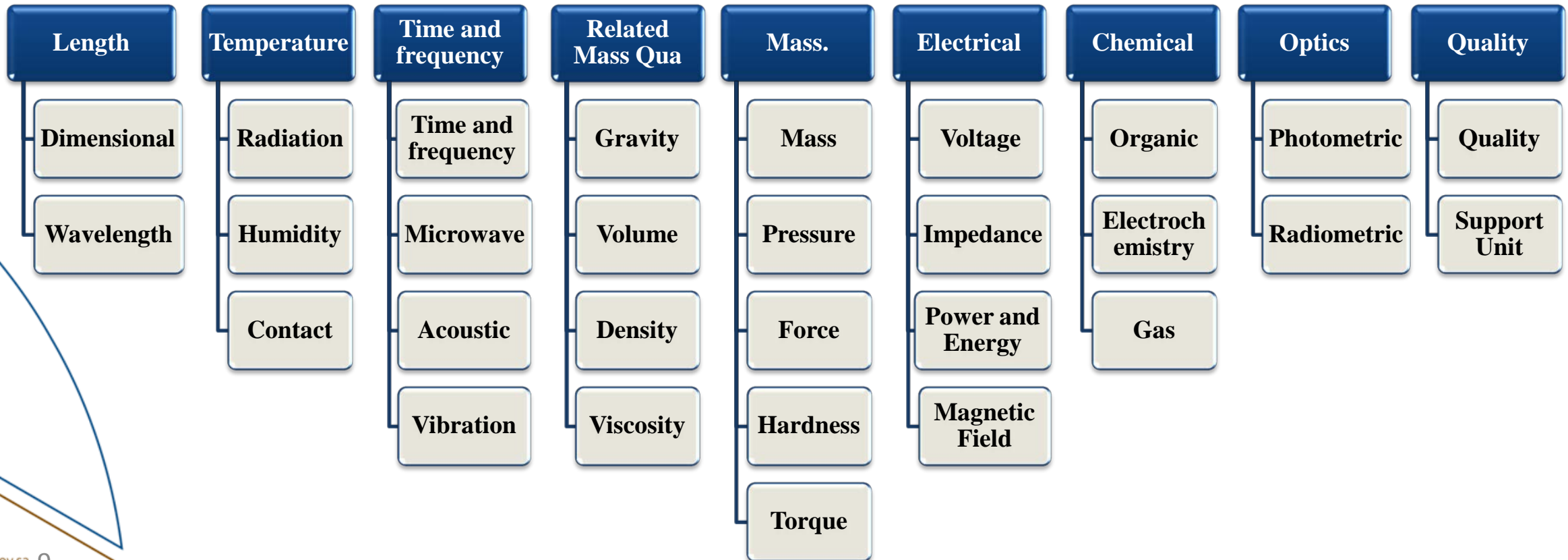


Hierarchy of NMCC Departments ³

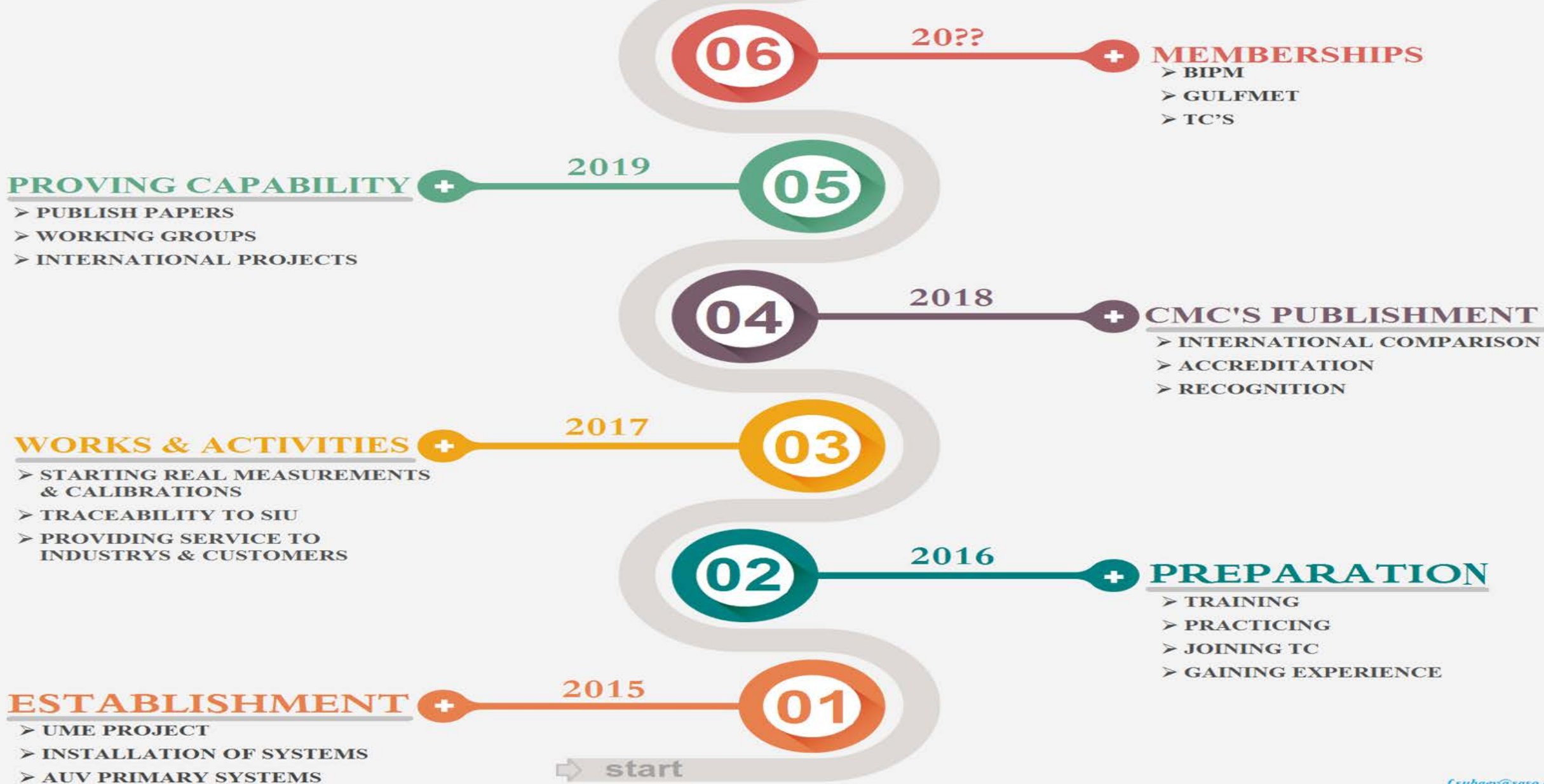
NMCC's laboratories:



In 2014, SASO-NMCC signed Development Project with Tubitak UME -National metrology institute- Turkey.



Department	PhD	MSc	BSc
Mass and related quantities	1 (Physicist)	-	7 (Physicist)
Temperature	1 (Nano Tech.)	-	7 (Physicist)
Time and frequency	-	1 (Physicist)	5 (Physicist)
Chemistry	-	-	5 (Chemist and chemical engineer)
Length	-	-	8 (Physicist)
Electricity	-	-	8 (Physicist)
Optics	-	1 (Physicist)	5 (Physicist)
Management	-	-	20
Total		65	



CALIBRATION & ACOUSTIC NOISE MEASUREMENT

System Specifications •

Microphone •

- Frequency Range : 2 Hz to 25 kHz (Primary) –
- Frequency Range : 20Hz to 50 kHz (Secondary) –

Sound Calibrator/Multi Function Acoustic Calibrator •

- Frequency Range : 31.5 Hz to 16 kHz –
- Sound Pressure Level : 94 dB to 124 dB (ref 20 μ Pa) –

Sound Level Meter •

- In accordance to IEC 61672-3 –

Noise Dose Meter •

- In accordance to IEC 61652 –

Audiometer •

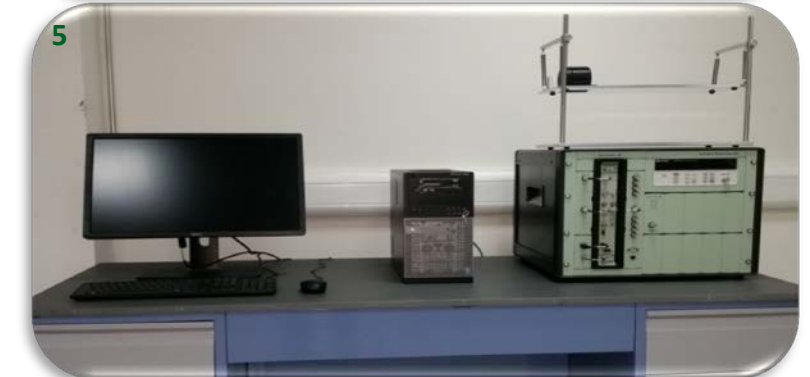
- Frequency Range : 125 Hz to 8 kHz –

Sound Pressure Level Measurement •

- Frequency Range : 10 Hz to 20 kHz –
- Number of Channel : 4, simultaneous measurement –

Measurement Capabilities •

- 1" Laboratory Standard Microphone Calibration –
- 1/2" Laboratory Standard Microphone Calibration –
- 1" to 1/4 " Working Standard Microphone Calibration –
- Calibration of Sound Calibrator –
- Calibration of Multifunction Acoustical Calibrator –
- Calibration of Sound Level Meter –
- Calibration of Noise Dose Meter –
- Calibration of Audiometer –
- Special Acoustical Measurements –
- Audiometric Test in Audiometer Cabin –



CALIBRATION & VIBRATION NOISE MEASUREMENT

• System Specifications

• Accelerometer

- Types, ICP / DIR / CHA / PR
- Frequency Range : 5 Hz to 10 kHz (Primary)
- Frequency Range : 5 Hz to 10 kHz (Secondary)
- Frequency Sweep : 5 Hz to 50 kHz (Secondary)

• Calibration Exciter

- Frequency Range : 5 Hz to 10 kHz
- Vibration Level : Depends on DUT

• Vibration Meter

- Frequency Range : 5 Hz to 10 kHz
- Vibration Level : Depends on DUT
- In accordance to ISO 8041

• Conditioning Amplifier

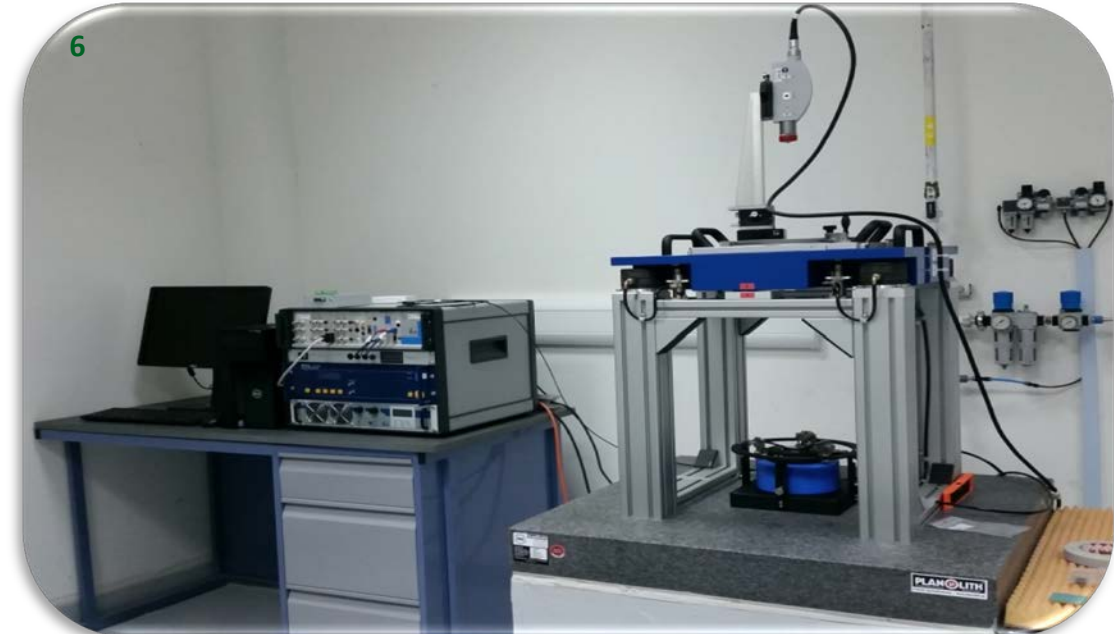
- Types, ICP / Voltage / Charge / Charge to ICP Converter
- Frequency Range : 5 Hz to 10 kHz

• Vibration Measurement

- Frequency Range : 1 Hz to 20 kHz
- Number of Channel : 3, in three axis simultaneously

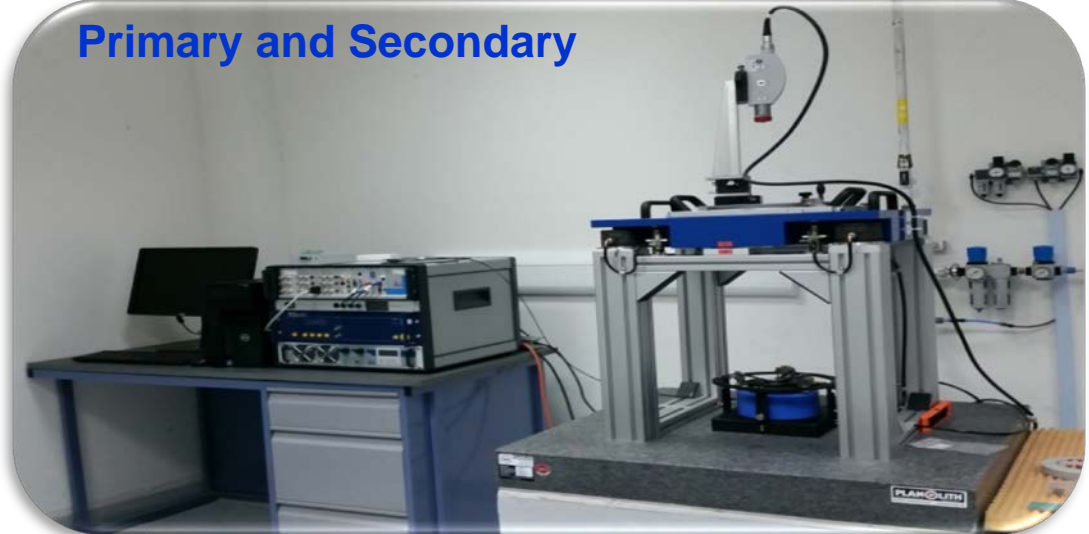
• Measurement Capabilities

- Laboratory Standard Accelerometer Calibration
- Vibration Measuring Chain Calibration
- Working Standard Accelerometer calibration
- Vibration Exciter Calibration
- Vibration Meter Calibration
- Special Vibration Measurements





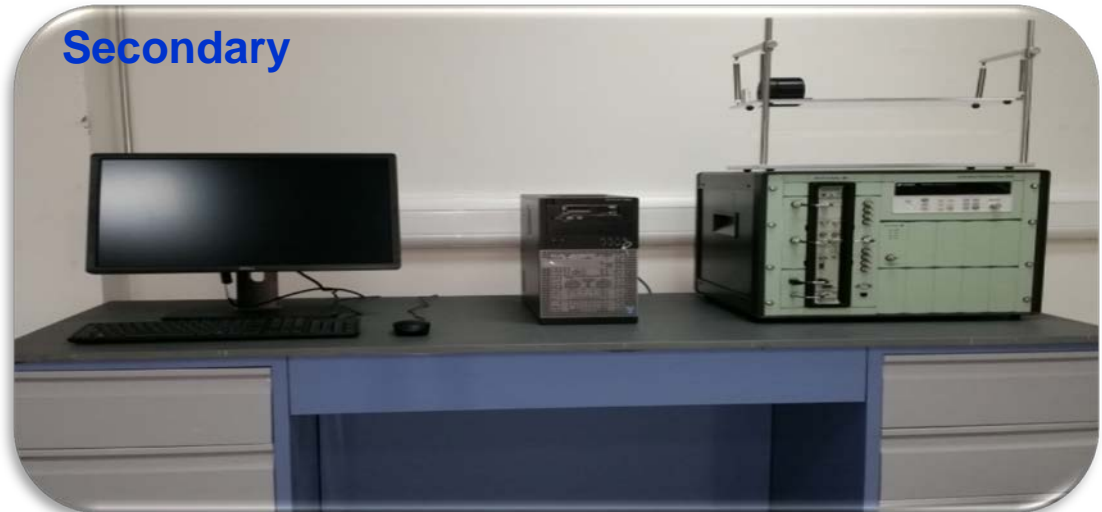
Reciprocity Calibration System



Calibration System for Sensor/Device in Vibration Field



Microphone Calibration System



Sound Level Meter & Sound Calibrator Calibration System



- To prove your CMC any NMI should participate in all fields that he want to be Recognize on the BIPM and other NMI's NMCC just started to participate in some comparison

Comparison	Comparison type	Participants	Status
<i>Comparison on Primary Vibration Calibration of Reference Standard Accelerometer by Laser Interferometry</i>	<i>Bilateral</i>	<i>Saudi Arabia, Turkey</i>	<i>Final Report</i>
<i>Bilateral Comparison On Reciprocity Calibration of LS1p & LS2p Microphones</i>	<i>Bilateral</i>	<i>Saudi Arabia, Turkey</i>	<i>Final Report</i>
<i>EURAMET comparison K5</i>	<i>Key comparison</i>	<i>LNE, PTB, INRIM, UME, MIKES, CMI, DPLA, GUM, CEM, METAS, RISE</i>	<i>In progress</i>

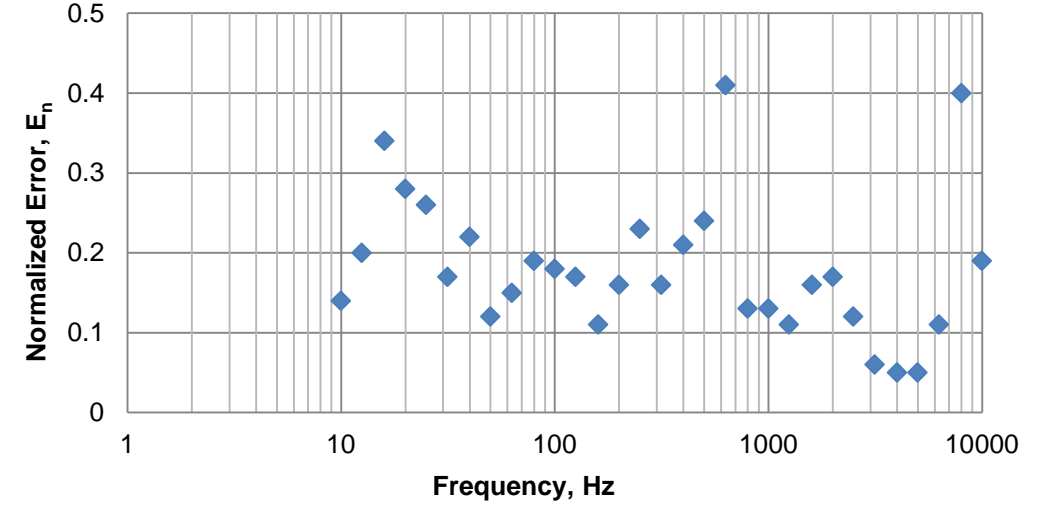
Interlaboratory Comparisons

Two bilateral comparisons were carried out in the framework of cooperation between TÜBİTAK UME and SASO NMCC

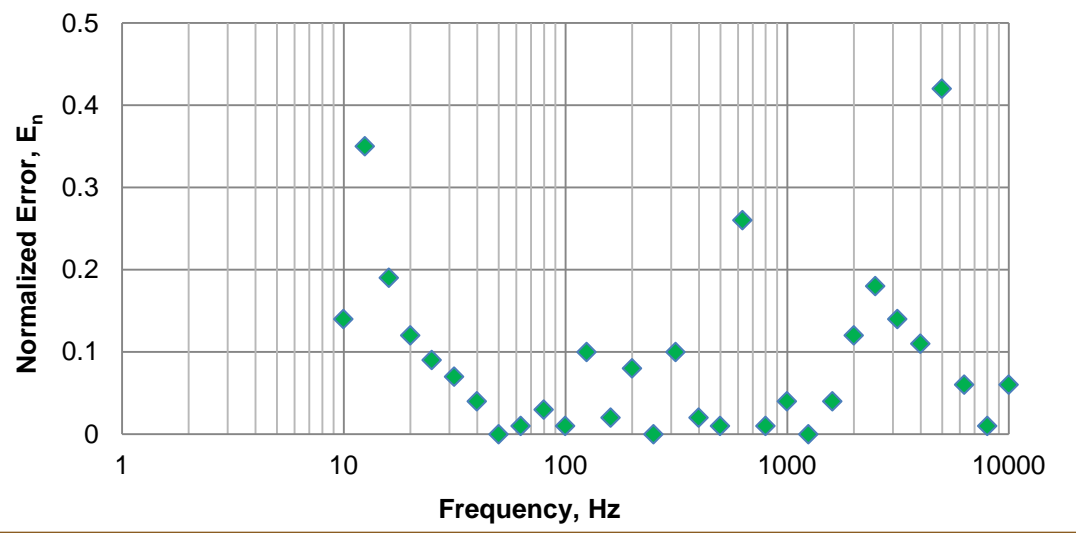
The scope of the comparisons covers:

- Calibration of LS1p and LS2p microphones by the pressure reciprocity method in the frequency range 10 Hz - 10 kHz and 10 Hz - 25 kHz for LS1p and LS2p microphones respectively.
- Calibration of reference standard accelerometers (single ended and back-to-back) by laser interferometry in the frequency range from 10 Hz to 10 kHz

Accelerometer Calibration - Magnitude



Phase



Congresses and Conferences Participated

- 11th National Acoustical Congress, İstanbul Technical University, 19-20 October 2015, İstanbul, Turkey
- 45th International Congress and Exposition on Noise Control Engineering (Inter-Noise 2016), 21-24 August 2016, Hamburg, Germany
- 23rd International Congress on Sound and Vibration, 10 - 14 July 2016, Athens, Greece
- IMEKO 23rd TC3, 13th TC5 and 4th TC22 International Conference, 30 May – 1 June 2017, Helsinki, Finland

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CURRENT SITUATION ON VIBRATION FIELD AT NMCC AND CALIBRATION OF SIGNAL CONDITIONER

IMEKO 23rd TC3, 13th TC5 and 4th TC22 International
Conference, 30 May to 1 June, 2017, Helsinki, Finland.

TÜBİTAK National Metrology Institute (UME),
Kocaeli, Turkey, eyup.bilgic@tubitak.gov.tr

The National Measurement and Calibration
Center, Riyadh, Saudi Arabia, f.subaey@saso.gov.sa

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IMEKO 23rd TC3, 13th TC5 and 4th TC22 International Conference
30 May to 1 June, 2017, Helsinki, Finland

CURRENT SITUATIONS ON VIBRATION FIELD AT NMCC AND CALIBRATION OF SIGNAL CONDITIONER

Eyup Bilgic¹, Fehed N. AlSubaey², Ibrahim A. Al-Jalhyani², Cafer Karbas², Emver Sadıkoğlu¹

¹TÜBİTAK National Metrology Institute (UME), Kocaeli, Turkey; www.bilgic@tubitak.gov.tr
²The National Measurement and Calibration Center, Riyadh, Kingdom of Saudi Arabia,

Abstract: This paper introduces the current calibration and measurement capabilities (CMC) in the field of mechanical vibrations field at National Measurement and Calibration Center (NMCC) operating under the Saudi Standards, Metrology and Quality Organization (SASO) in Kingdom of Saudi Arabia. Calibration facilities enable to carry out calibrations of vibration pick-ups at primary and secondary level in accordance to relevant ISO standards. The calibration system is also capable to calibrate different type of signal conditioners. The system performance was proved by calibration of many vibration pick-ups with a long history. In addition, calibration of signal conditioners was carried out by independent system at TÜBİTAK UME and newly established system at SASO NMCC and acceptable agreement between the measurement results obtained at NMCC and TÜBİTAK UME was achieved.

Keywords: Calibration, accelerometer, signal conditioner

1. INTRODUCTION

TÜBİTAK UME is involved in bilateral project, "Development and Realization of National Measurement and Calibration Center at SASO". The aim of this project is to establish the basic infrastructure for metrology laboratories and to provide the necessary training and consultancy services within this scope to the Saudi Standards, Metrology and Quality Organization's National Measurement and Calibration Center (SASO - NMCC). One of the laboratories within the scope of the project is Acoustic and Vibration Laboratory. Scope for calibration and measurement facilities were decided after collating the information on calibration demands from industry and infrastructure at the existing laboratory building in NMCC. In addition, experience of the Turkish National Metrology Institute on the way of establishment and operation of Acoustics and Vibration Laboratory over the past 20 years has been also taken into account at this stage.

Two staff from NMCC was trained at TÜBİTAK UME using existing calibration facilities. The calibration and vibration measurement systems were purchased, delivered to TÜBİTAK UME, where they were tested for performance and sent to SASO NMCC, where they were finally installed in September 2015. Extensive training of NMCC staff was

continued in 2016 on the installed calibration and measurement systems at NMCC.

The calibration system was temporarily installed at TÜBİTAK UME. The shaker was just placed on a heavy marble plate and not secured on it because of the absence of mounting hole. Vibration isolation of laser head was maintained as required. By this configuration functional tests for primary accelerometer calibration, secondary accelerometer calibration, calibration of portable vibration exciter, calibration of vibration meter and calibration of signal conditioners were performed. Performance of the system was proved by calibration of various vibration pick-ups at TÜBİTAK UME. The sensitivities of reference standard accelerometers at 100 Hz obtained by this calibration system was taken as the criteria and it was found that results were in compliance with the sensitivities obtained by UME's calibration system. The functionality of the system for the demanded calibrations was the other performance criteria of the calibration system at this stage. In addition, calibration of signal conditioners was carried out to check and validate the system's performance.

The types of signal conditioner used in combination with an accelerometer are charge, charge to voltage converter, conditioner for accelerometer with built in electronics and voltage amplifier. Some of the signal conditioners were calibrated by using the existing calibration system at NMCC and by using the existing calibration system at TÜBİTAK UME. Results obtained by two different systems are evaluated and are presented in this paper.

2. CALIBRATION AND MEASUREMENT SYSTEMS IN VIBRATION FIELD AT SASO NMCC

Calibration system for the vibration pick-ups installed at NMCC is a combined system, which enables both primary and secondary calibrations. The uncertainty levels for primary calibration of standard reference accelerometers at 95% confidence level ($k=2$) is in the range from 0.5% to 1.2% and from 0.5% to 1.0% for 10 Hz to 10 kHz frequency range. This value increases to 5.0% at 10 kHz for secondary level calibrations.

Although the basic Spectra CS18P HF calibration system is commercially available, it was configured to calibrate accelerometer, calibration exciter (portable vibration calibrator) and vibration meter and signal conditioner at the purchase stage considering the demands

- To use developed infrastructure providing service to customers
- To increase awareness of customers about capabilities
- To seek for participation in key/supplementary comparisons
- To use infrastructure for research activities



المركز الوطني للقياس والمعايرة
National Measurement & Calibration Center

الهيئة السعودية للمواصفات والمقاييس والجودة
Saudi Standards, Metrology and Quality Org.



Thank you so much !

Fheed N. Alsubaey
SASO – NMCC, Saudi Arabia
f.subaey@saso.org.sa