Status report of CENAM, Mexico 2017-2019
For the 12th Meeting of the CCAUV (2019)

Organization

The Acoustics, Ultrasound and Vibrations Area of CENAM (DVA) is the leader in México for acoustics, ultrasound and vibration measurements. The DVA develops measurement systems, standards and methods used to improve its scientific and technical capabilities and the means and methods to deliver traceability and knowledge to industry, stakeholders and society. The DVA provides proficiency testing, conformity assessments, gives technical training, short courses and guides students with metrology skills.

The DVA has 13 specialists: 3 Ph. D., 1 Ph. D candidate, 4 M. Sc. and 5 Eng. At DVA, 6 professional services collaborated in our activities: 1 Ph. D candidate, 2 M. Sc. and 3 Eng.

Vitality:

DVA's is active in different AUV fields:

- Development of dynamometer to calibrate dynamic torque sensors (2015-ongoing).
- Technical certainty for the vehicular verification program (2017-ongoimg)
- Standard Technical Committee (Mexico) that establishes the characteristics of the equipment and the measurement procedure for the verification of the limits of emission of pollutants (2017-ongoing).
- Metrological assurance for the equipment and the measurement procedure of chassis dynamometers (2017-ongoing)
- Research of vibro-acoustic emissions as inducers of drought tolerance and production of Capsaicinoids in *Capisicum annumm* (2018-ongoing).
- Characterization of anechoic and hemi-anechoic chambers (2019-ongoing).
- Measurement of normal incidence transmission loss (2017-2019)
- Review of vibration transducers, conditioners and measurement equipment used at low frequencies to attend requirements related with dynamic response for buildings using different transducers (i.e. MEMS accelerometers, accelerometers with built-in conditioning, capacitive accelerometers and servo accelerometers) (2018-2019).
- Calibration and characterization of signal conditioners and signal simulators for electrocardiographic signals (ECG) using low frequency and low amplitude signals (2018).
- Sound source location with acoustic cameras (2018).
- Determination of hardened layer thickness in heat treated carbon steel using ultrasound (2015-2018).
- Backlash dynamic measurement and error transmission in automotive differentials (2017-2018).
- Research and Evaluation of the Effect of Noise Pollution on Mexican Housing (2015-2017)

Primary Metrology

The DVA has four National Standards (1 A, 1 U and 2 V) and two Reference Systems (1 A 1 U):

Reference	Description
CNM-PNF-1	Alternating Acceleration
CNM-PNF-16	Transient Acceleration in Impact and Shock
CNM-PNF-2	Primary Acoustic Pressure
CNM-PNF-7	For Sonometry
CNM-PNF-10	Ultrasonic Power
CNM-PNF-14	Free field calibration system for measuring hydrophones/projectors

During this period, all DVA's national standards and reference systems were maintained.

Key Comparisons & SIM Comparisons

DVA is participating in the following CCAUV Key Comparisons and SIM comparisons:

Identification	Description	Status	Quantity
CCAUV.V-K4	Accelerometer shock calibration	Draft B	Voltage and charge sensitivity at nominal value
CCAUV.V-K5	Primary calibration of magnitude and phase of the complex sensitivity of accelerometers from 10Hz to 20 kHz	In progress	Magnitude and phase of the complex sensitivity of accelerometers from 10Hz to 20 kHz
SIM.AUV.A-S2	Calibration of Sound Pressure Level	In progress	Sound Pressure Level Frequency at 250 Hz

SIM Collaboration

For DVA's international collaboration within SIM, we offered the following training:

Course / workshop	Aimed to	Year
General topics of velocity measurements by non-contact methods	Instituto Nacional de Metrología de Colombia.	2019
Calibration of accelerometers by comparison according to ISO 16063-21. Calibration of audiometers by comparison according to IEC 60645-1.	Instituto Nacional de Calidad (INACAL) Perú.	2019

The DVA has also done proficiency tests for SIM labs:

Proficiency test	Laboratory (country)	Year
Calibration of sound calibrators according to IEC 60942.	K2 Ingeniería S.A.S. Bogotá, Colombia.	2019
Calibration of sound level meters according to IEC 61672.	K2 Ingeniería S.A.S. Bogotá, Colombia.	2019
Calibration of sound calibrators according to IEC 60942.	Lab&Service Electrónica Especializada Ltda. Bogotá, Colombia.	2018
Calibration of accelerometers by comparison according to ISO 16063-21	Universidad Pontifica Bolivariana, Bucaramanga, Colombia	2018 y 2017
Calibration of sound calibrators according to IEC 60942.	Technik Ltda. Bogotá, Colombia.	2017
Calibration of sound calibrators according to IEC 60942.	Fundación equipo profesional para el desarrollo económico social y ambiental (Eprodesa ONG). Cali, Colombia.	2017

CENAM has organized and participated in SIM meetings & workshops:

- AUV SIM Meeting (NIST). July 9th-11th, 2019. (Guillermo Silva and Iris López).
- Challenges in Metrology for Advance Manufacturing and the 4th Industrial Revolution (CENAM). June 18th-19th, 2019. (Salvador Echeverría).
- Dynamic force metrology capabilities and needs in the SIM region (NIST). Oct 29th to Nov 1st, 2018. (Guillermo Silva & Fernando Sarabia).

Osvaldo Llamas held a technical visit to INMETRO (January 22th-24th, 2019). A bilateral cooperation was reviewed, related to LS2P microphone reciprocity calibration in pressure field at infrasound. An informal pilot study has started.

Users Sector

The DVA offers services, courses, training and proficiency tests, among other activities. The list is at CENAM's web page:

http://www.cenam.mx/servicios/

The DVA has 81 catalog services (where 30 are supported by CMC), 8 programed courses and 6 programed proficiency tests: 2 for legal noise measurements and 4 for ultrasound: equipment calibration and non-destructive evaluation of materials.

Considering the period from 2017-2019, we can highlight the following:

- For the Mexican System of Metrology, Standardization and Conformity Assessment (SISMENEC), which includes AUV secondary labs, the DVA did 419 metrological services (363 calibration and 56 measurement services) and conducted 30 proficiency tests.
- For the DVA's users sector, we did 306 metrology services (277 calibrations and 29 measurement services).