



CCAUV/19-13.21

# **SIM – Interamerican Metrology System / Sistema Interamericano de Metrologia**

**Metrology Working Group 9 (AUV)**

**Status report to the CCAUV**

**12<sup>th</sup> CCAUV meeting, BIPM**

**26-27<sup>th</sup> September 2019**

# SIM MWG-9

- The MWG-9 is responsible for all activities related to Acoustics, Ultrasound and Vibration Metrology within the Interamerican Metrology System (SIM).
- Chairperson:
  - Dr. Gustavo Ripper/INMETRO is chair since October 2015.
  - Dr. Michael Gaitan/NIST will take over after the CCAUV meeting
- Currently, SIM has 10 NMIs with interest in AUV.
- 5 already have CMCs published in the Appendix C of the MRA
  - Canada, USA, Mexico, Brazil and Argentina
- 4 are full members of the CCAUV
  - Canada, USA, Mexico and Brazil

# Current Members of SIM MWG-9

COUNTRY	INSTITUTION (NMI OR DI)	REPRESENTATIVE
Brazil	INMETRO <sup>1,2</sup>	GUSTAVO PALMEIRA RIPPER
USA	NIST <sup>1,2</sup>	MICHAEL GAITAN
Canada	NRC <sup>1,2</sup>	LIXUE WU
Mexico	CENAM <sup>1,2</sup>	ANDRÉS PÉREZ MATSUMOTO
Argentina	INTI <sup>1</sup>	FEDERICO SERRANO
Peru	INACAL	GIANCARLOS GUEVARA
Costa Rica	LACOMET	ADRIÁN SOLANO MENA
Colombia	INM - Colombia	NELSON BAHÁMON CORTÉS
Bolivia	IBMETRO	JHONATAN ALEXIS MÚJICA GONZALES
Paraguay	INTN	EUGENIO DUPRAT; MARIA CELESTE CAMERON AVALOS

1 – Have CMCs in Appendix C

2 – Member of CCAUV

# SIM MWG-9 workshops and committee meetings 2017/2019

- ✓ Workshop on AUV for Wind Energy and SIM MWG-9 meeting (8-10<sup>th</sup> Nov 2017)
  - Held at INMETRO
  - Supported by Organization of American States (OAS)
- ✓ SIM AUV workshop and technical meeting (9-11<sup>th</sup> Jun 2019)
  - Held at and supported by NIST
- ✓ 12<sup>th</sup> CCAUV and WG meetings (24-27<sup>th</sup> Sept 2019)
  - Participants from SIM countries: NRC, NIST, INMETRO

# Workshop on Acoustics, Ultrasound and Vibration for Wind Energy

8-9 November 2017

<http://www.oas.org/en/sedi/dsd/Energy/Metrology/MetrologySIMMWG-9Workshop.asp>



The screenshot shows the OAS website interface. At the top left is the OAS logo with the tagline "More rights for more people". To the right are social media icons for Facebook, Twitter, YouTube, and LinkedIn, along with a search bar and language options for English and Español. Below this is a navigation menu with links: Home, About the OAS, Topics, Strategic Partners, Member States, Media Center, Documents, Accountability, and Calendar. The main content area features a large banner image of a building facade. Below the banner is a breadcrumb trail: Home » About the OAS » Our Structure » General Secretariat » Secretariats » SEDI » DSD » Sustainable Energy. The page title is "Sustainable Energy" and the sub-header is "Metrology for Sustainable Energy Technologies and the Environment (M4SET)". The main heading is "Workshop on Acoustics, Ultrasounds and Vibration for Wind Energy". Below this is a large group photograph of participants. To the left of the photo is a sidebar menu with categories: Home (Mandates, Ministerial Meetings), On-going Projects (M4SET, M4EE), Past Projects (RECS), Strategic Partners (ECPA, NIST), and Highlights (Agenda and Presentations, Photos, Concept Note, List of Attendance, NIST). Below the photo is a text block describing the workshop's location and purpose, followed by another text block detailing the workshop's focus on AUV and its international participation.

Home » About the OAS » Our Structure » General Secretariat » Secretariats » SEDI » DSD » Sustainable Energy

## Sustainable Energy

### Metrology for Sustainable Energy Technologies and the Environment (M4SET)

#### Workshop on Acoustics, Ultrasounds and Vibration for Wind Energy



The activity was held from November 8 to 10, 2017, at the National Institute of Metrology, Standardization and Industrial Quality (INMETRO) in Rio de Janeiro, Brazil. The three days' workshop addressed the application of Acoustics, Ultrasounds and Vibrations (AUV) for facilitating wind energy development.

The use of wind energy is increasing worldwide and very strongly in American Countries. Currently many wind farms are under the responsibility of manufacturers but they will be transferred to local administrators soon. Measurement of Vibration and Acoustics can help the development of local projects of better wind blades, generators, etc. and support an easier integration of renewable energy and the community.

The event had the participation of 20 metrology experts from 6 National Metrology Institutes in the Region, whom discussed Calibration and Measurement capabilities in AUV, mutual recognition agreements, requirements and needs to obtain international recognized services in the fields of AUV among others. The National Institute of Metrology, Quality and Technology (INMETRO), the National Institute of Standards and Technology (NIST) and the Organization of American States (OAS) organized this activity.

**Highlights**

- Agenda and Presentations
- Photos
- Concept Note
- List of Attendance
- NIST

## Objective

➔ To raise awareness on how Measurement of Acoustics, Ultrasound and Vibration can help the development of local projects and support an easier integration of renewable energy and the community.

## Participated Countries

- ➔ CAMET (Costa Rica).
- ➔ NORAMET (Canada, Mexico and United States).
- ➔ SURAMET (Argentina and Brazil).

## Coordination

- ➔ Organization of the American States (OAS).
- ➔ National Institute of Metrology, Quality and Technology ([INMETRO](#)).

## Department of Sustainable Development (DSD)

### Energy and Climate Change Mitigation

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Washington DC Operating Status

# SIM MWG-9 meeting and workshop 2017

held at Inmetro, 8-10<sup>th</sup> November 2017

## The activities developed during these events included:

- Awareness sessions about outcomes of recent CCAUV, SIM TC, IMEKO, ISO and IEC meetings
- Workshop about CMCs on AUV
- Technical presentations given by each NMI
- Technical visits to AUV laboratories and discussion about calibration systems
- SIM MWG-9 annual meeting

# SIM Metrology workshop on AUV held at NIST



Place: NIST, Gaithersburg

Dates: 9-11<sup>th</sup> July 2019

## Participants from:

1. USA
2. Canada
3. Mexico
4. Brazil
5. Colombia
6. Argentina

## Attendance list:

Name	Expertise	Email	Country	NMI
Lixue Wu	Acoustics, Ultrasound and Vibration	Lixue.Wu@nrc-cnrc.gc.ca	Canada	National Research Council Canada (NRC)
Zemar Martins Defilippo Soares	Acoustics	zmsouares@inmetro.gov.br	Brazil	National Institute of Metrology, Quality and Technology (INMETRO)
Ronaldo da Silva Dias	Vibration	rsdias@inmetro.gov.br	Brazil	National Institute of Metrology, Quality and Technology (INMETRO)
Adrián Solano Mena	Acoustics	asolano@lacomet.go.cr	Costa Rica	Laboratorio Costarricense de Metrología (LACOMET)
Federico Ariel Serrano	ACOUSTICS / ELECTROACOUSTICS	fserrano@inti.gov.ar	Argentina	Instituto Nacional de Tecnología Industrial (INTI)
Alexis Gaston Zapata	ACOUSTICS / VIBRATIONS	gzapata@inti.gov.ar	Argentina	Instituto Nacional de Tecnología Industrial (INTI)
Iris Mariela López Bautista	Vibrations (MEMS)	ilopez@cenam.mx	Mexico	Centro Nacional de Metrología (CENAM)
Guillermo Silva Pineda	Vibrations Group Coordinator	gsilva@cenam.mx	Mexico	Centro Nacional de Metrología (CENAM)
Nelson Bahámon Cortés		nbahamon@inm.gov.co	Colombia	Instituto Nacional de Metrología de Colombia (INM)
Jhonatan Mujica		jmujica@ibmetro.gob.bo	Bolivia	Instituto Boliviano de Metrología (IBMETRO)
Steven Crocker	Sensors & Sonar Systems Department	steven.crocker@navy.mil	USA	Naval Undersea Warfare Center
Gustavo Palmeria Ripper	Head of AUV Division	gripper@inmetro.gov.br	Brazil	National Institute of Metrology, Quality and Technology (INMETRO)
Andrés Esteban Pérez Matzumoto	Head of UAV Department	eperez@cenam.mx	Mexico	CENAM
Patrick Timmons	Calibration Systems Engineer	ptimmons@modalshop.com		The Modal Shop
Michael Grissom				The Modal Shop
Bruce Swanson		sales@spektra-usa.com		Spektra

# SIM Metrology workshop on AUV held at NIST

## Agenda

NMI Reports, Technical presentations (NMI & Industry), Lab Tours

Tuesday July 9: Day 1 Status Reports from the NMIs	Wednesday July 10: Day 2 Technical Presentations	Thursday July 10: Day 3 Industry Presentations and Lab Tours
9:00 Welcome and Introductions	9:00 Welcome	9:00 Welcome
9:30 Presentation from our Chair, Gustavo Ripper	9:15 Insights on the redefinition of the SI, Jon Pratt	9:15 Statistics at NIST: DEX/EDA and R4IP, James Filliben
10:00 Break	10:00 Break	10:00 Break
10:15 Argentina, Alexis Gaston Zapata	10:30 Primary calibration techniques of vibration transducers and laser vibrometers, Guillermo Silva Pineda	10:15 Presentation from The Modal Shop
11:15 Break	11:00 Shock Calibration System at IMETRO and CCAUV.V-K4 Report, Ronaldo da Silva Dias	11:00 Break
11:30 Brazil, Gustavo Ripper	11:30 Characterization of IMU using a hexapod robot, Iris Mariela López Bautista	11:15 Presentation from Spektra
12:00 Lunch	12:00 Lunch	12:00 Lunch
1:30 Colombia, Nelson Bahámon Cortés	1:30 Method for characterization of laser heterodyne velocimeters, Michael Gaitan	1:30 Lab Tours
2:00 Canada, Lixue Wu	2:00 Measurements to characterize the performance of signal processing features in hearing aids, Randall Wagner	4:30 Wrap up
2:30 Break	2:30 Break	5:00 Adjourn
2:45 Costa Rica, Adrián Solano Mena	2:45 Acoustical Calibrations and Testing of Hearing Aids, Zemar Martins Defilippo Soares	
3:15 Mexico, Guillermo Silva Pineda	3:15 Underwater sound calibration services and future needs, Steven Crocker	
3:45 Break	3:45 Simulation of the Reconstruction of a Flat Figure in Computed tomography (CT), Nelson Bahamón Cortés	
3:30 USA, Ako Chijioki	4:15 Break	
4:00 Other Business	4:30 Other Business	
5:00 Adjourn	5:00 Adjourn	
	6:30 Workshop dinner, Ted's Montana Grill at Crown Gaithersburg	



# Recent cooperation activities between SIM NMIs

## Vibration

- Technical visit of Richard Allen from NIST to INMETRO (Nov/2017)
  - Informal Comparison between NIST and INMETRO on primary interferometric accelerometer calibration from 10 Hz to 20 kHz.

## Acoustics

- Technical visit of Osvaldo Llamas/Cenam to Inmetro (Jan/2019).
  - Discussion of cooperation related to ½-inch microphone reciprocity calibration in pressure field down to infrasound.
  - Informal pilot study was started.
- Technical visit of Thiago Milhomem/Inmetro to INTI (Feb/2019).
  - Discussion of future cooperation related to microphone calibration in pressure field.
  - Possibility of having a pilot study using the new signal processing system acquired by INTI.
  - Comparison and Reciprocity calibration of 1-inch microphone in pressure field.

# SIM Participation in CCAUV and its WGs

## CCAUV:

- Members from SIM: NIST, INMETRO, NRC, CENAM

## CCAUV Working Groups:

### ➤ SP WG

- Chair: Michael Gaitan / NIST
- Members from SIM: NIST, INMETRO, NRC, CENAM

### ➤ KC WG

- Chair: Gustavo Ripper / INMETRO
- Members from SIM: INMETRO, CENAM

### ➤ RMO WG

- SIM representative: MWG-9 chairperson

# 11<sup>th</sup> CCAUV meeting – September 2017



**SIM:** 2017: 7 participants from 4 NMIs ( 2019: 6 participants from 3 NMIs)

**CCAUV members from SIM:** NRC, NIST, CENAM, INMETRO

# Inter-regional review of CMCs

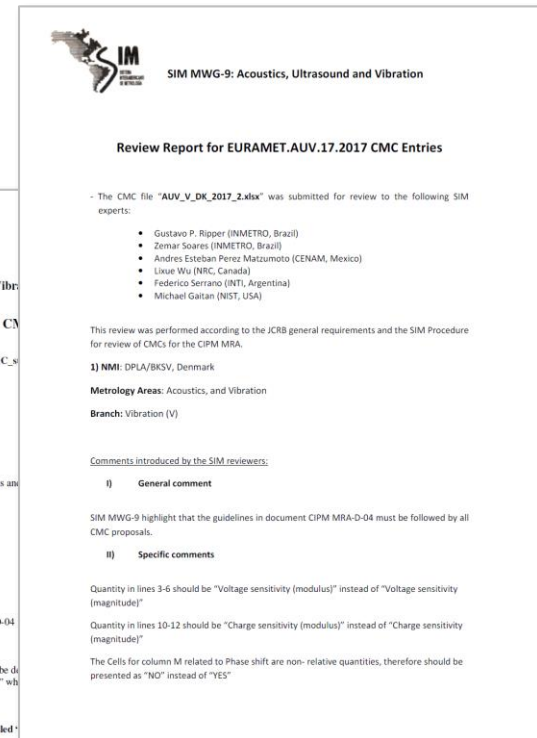
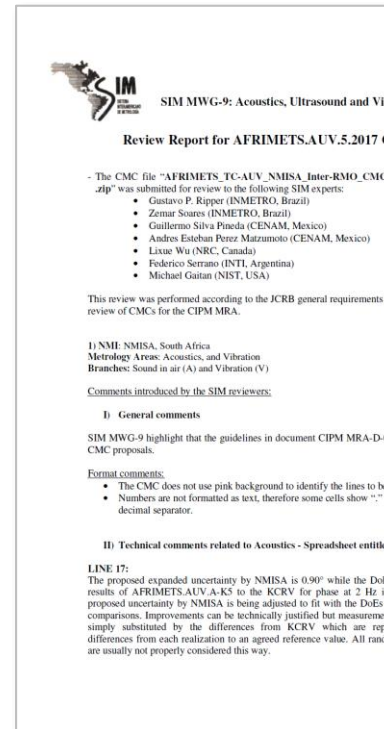
- All CMCs posted for interregional review have been analyzed by SIM.

## CMCs recently reviewed and approved by SIM after revision:

- AFRIMETS.AUV.6.2018
- APMP.AUV.14.2018
- EURAMET.AUV.18.2018
- EURAMET.AUV.19.2018

## CMC currently under review

- EURAMET.AUV.20.2019
- EURAMET.AUV.21.2019



# Participation of SIM members in interlaboratory comparisons

## Comparisons concluded recently (2018/2019):

- **AFRIMETS.AUV.V-K3** – SIM Participants: INMETRO (2011)
  - Appendix B with link to CCAUV.V-K3 was added to Final Report in Dec/2018
- **CCAUV.V-K4** – SIM Participants: INMETRO (2017), CENAM (2017)
  - Final Report approved by the CCAUV. To be published.

# Participation of SIM members in interlaboratory comparisons

## Comparisons in progress:

- **CCAUV.A-K6** – SIM Participants: CENAM (2020), NRC (2020), INMETRO (2020)
  - **Measurements in progress**, pilot laboratory: LNE/France
- **CCAUV.V-K5** – SIM Participants: NIST (2017), CENAM (2017), INMETRO (2018)
  - **Report Draft A in progress**, pilot laboratory: PTB/Germany
- **CCAUV.W-K2** – SIM Participants: INMETRO (2017)
  - **Report Draft A in progress**, pilot laboratory: NPL/UK
- **EURAMET.AUV.A-S2** – SIM Participants: INMETRO (2016)
  - **Report draft B in progress**, pilot laboratory: LNE/France. Review by the CCAUV KCWG concluded.
- **SIM.AUV.A-S2** – SIM Participants: INMETRO (2018), NRC (2018), NIST (2018), CENAM (2019), INTI (2019), LACOMET (2019), INACAL (2019)
  - **Report Draft A in progress**, pilot laboratory: INMETRO/Brazil

# SIM interlaboratory comparisons

## Ongoing comparison:

- **SIM.AUV.A-S2** - Calibration of pistonphone (only amplitude by insertion voltage using 1" and 1/2" microphones)
  - Started: Sept/2018
  - Pilot laboratory: INMETRO
  - Participants: INMETRO (2018), NRC (2018), NIST (2018), CENAM (2019), INTI (2019), LACOMET (2019), INACAL (2019)
  - Measurements completed: Sept/2019
  - Analysis of data and Report Draft A in progress

# Future activities of SIM MWG-9

- Conclusion of pistonphone comparison SIM.AUV.A-S2
- Approval of Technical Protocols and registration of other SIM comparisons
- Start of other SIM comparisons (2019/2020)
- Participation in CCAUV key comparisons (CCAUV.A-K6, 2020)
- Increase of technical exchange and cooperation among members
- Provide support to younger NMIs that joined MWG-9



# SIM interlaboratory comparisons

## Other possible future comparisons:

- calibration of ½” microphone by simultaneous comparison in pressure field,
- low-frequency vibration (based on CCAUV.V-K3),
- mid-frequency vibration (10 Hz – 10 kHz, CCAUV.V-K5),
- 1” microphone (based on CCAUV.A-K5, but only magnitude and in the frequency range from 31.5 to 10000 Hz in octave-bands),
- sound power,
- ultrasonic power.

# Future CMC updates

- Onsite peer review of INMETRO
  - **Vibration** – Thomas Bruns / PTB (24-28/June/2019)
  - **Acoustics** – Dominique Rodrigues / LNE (13-17/May/2019)
  - **Ultrasound** – Giovanni Durando / INRIM (6-10/May/2019)
  
  - **Quality Management System** - Sally Bruce /NIST (10-14/Jun/2019)
- Intra-regional review of CMCs:
  - Review of Acoustics and Vibration CMCs was concluded by the MWG-9 in Sept/2019
  - Ultrasound CMC proposals from INMETRO will be submitted for review by the MWG-9 soon
  
  - QMS was submitted to SIM QSTF in Sept/2019 and approved for AUV
- Inter-regional review of CMCs:
  - Updated CMC proposals from INMETRO will be posted soon for inter-regional review

# Thank you!

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