



# **TC for Acoustics, Ultrasound and Vibration:**

## **Highlights**

**Salvador Barrera-Figueroa, TC-AUV Chair**

**6<sup>th</sup> General Assembly**  
**Copenhagen, May 2012**

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## **Outline**

- Overview of the TC-AUV
- Highlights:
  - EMRP HLT01 EARS
- Other issues
  - Roadmaps – Two examples of reNEWed initiatives

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## Overview of the TCAUV

- Sub-Committees:
- Members: 25
- Comparisons:
  - 2 CCAUV,
  - 2 EURAMET,
  - 2 COOMET,
  - 3 Bilateral
- Projects: 9
- CMC entries: 511



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## Highlights:

### EMRP Project HLT01 *EARS*

**Metrology for a universal ear simulator  
and perception of non-audible sound**

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### Relevance to EMRP

- Provides new capabilities to quantify the hazard to hearing
- Improves dissemination of knowledge to health-care practitioners, government policy, and regulatory bodies
- Strengthens links between NMIs, industry, academia, and clinic

### Vision and Objectives

- Improvement of preventative strategies for hearing conservation: Better quality of life
- New fundamental understanding of auditory perception of non-audible noise + minimum permission sound pressure levels
- Universal ear simulator for better earphone calibration
- Underpinning of hearing assessment methods including newborns and children

### Need

- Noise is pervasive and global – need for objective measurement and description of a subjective sense

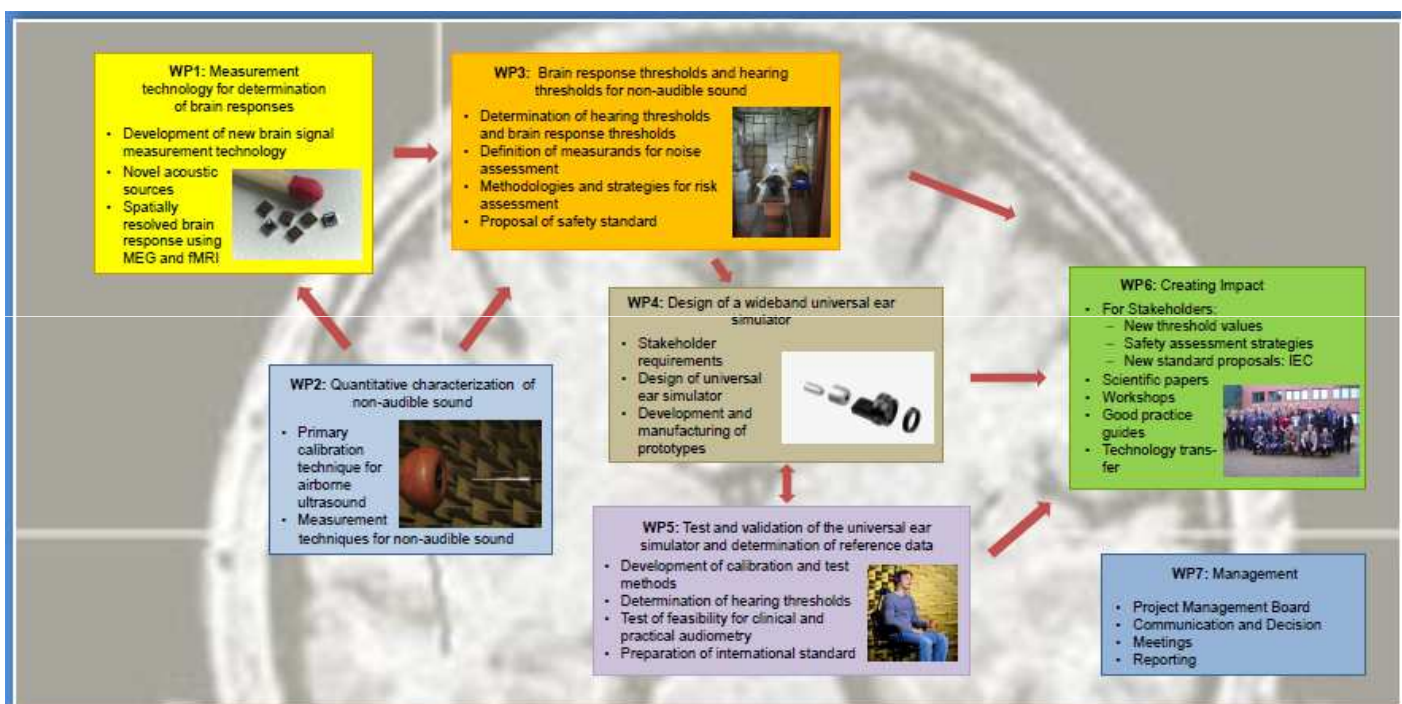
#### Non-audible sound

- Non-audible sound presents a little-known hazard to hearing – need of new understanding
- Lack of rationale for exposure limits and absence of metrological underpinning
- Need for supporting regulations as EU directive 2002/49/EC
- New primary standards for traceability at >20 kHz
- Industry needs new risk assessment criteria for emerging technology



#### Ear simulator

- Hearing screening: 500 000 children in DE need treatment on hearing disorder – no traceability of hearing assessment
- Ear simulators are developed mainly for pure tones and only for adults: Need for particular devices for children and newborns
- Existing devices and protocols are complex: extension needs new approach
- Need for cost reduction and flexible handling and application







### Scientific excellence beyond state of art

- Innovation in the use of neuronal brain response techniques (MEG and fMRI) to study human perception of non-audible noise stimuli using novel sound presentation techniques



- New measurement techniques for airborne ultrasound including MEMS technology
- The world's first primary standard for airborne sound pressure by free-field reciprocity up to 120 kHz

- A traceability infrastructure, measurement techniques and safety criteria will be available for non-audible sound risk assessment

- New universal methods for earphone calibration

- An ear simulator with universal application will be specified, modeled, designed, and tested in the field of audiology



### Impact

- Set exposure limits for rationally based safety requirements for manufacturers, health and safety agencies, patients, workers, and employers
- Provide manufacturers with tools for environmental impact assessment
- Reduce unnecessary introduction of requirements for sound protection of products
- Improve reliability and quality of screening results for newborns



- Improve effectiveness, simplicity, removes ambiguity and thus reduces costs of audiometer calibration
- Create better environmental conditions by better knowledge of sound perception mechanisms
- Design the universal ear simulator as a new product for the medical engineering market
- Provide new standard proposals to IEC working groups



### Consortium

- Coordinator: PTB (DE)



- DPLA (DK)



- DFM (DK)



- LNE (FR)



- NPL (UK)



- UME (TR)



### Collaborators/ Stakeholders

- Clinic:



- Technical:



- Other Stakeholders:





# Roadmaps

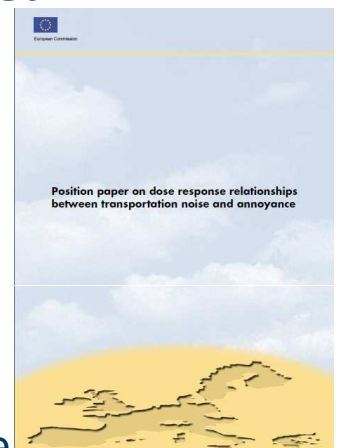
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## Sound in air: Scene Setting for Need

- Noise assessment tools currently limit to energy based metrics
- Approaches considering *wellbeing* have positive impact on 3x the population
- Research in this field is active but hampered by an ability to measure, leading to lack of consensus on metrics
- ISO (TC43 WG58) are seeking to standardise perceptual-base approaches to noise mitigation and planning, via the EU Noise Directive.



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## • Sound in air – perceptual metrics in noise assessment

### – Need

- Noise Directives and action planning having impact on wellbeing
- Capability to relate physical measurements and perceptual impact (e.g. annoyance)
- Noise mitigation strategies related directly to reducing health effects and mortality

### – Solution (Non-technical description)

- New standardised metrics relating to perceptual impact of noise

### – Proposed work

- Develop metrology for distributed measurement (instruments, procedures, analysis of uncertainty etc.)
- Exploit distributed measurement capability in case studies to identify key parameters in perception and annoyance
- Research to produce appropriate perceptual metrics and corresponding measurement systems and methods, validated with case studies
- Standardise methods and metrics in ISO Standards



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## New drivers for metrology in underwater acoustics

- Marine environmental concern is main driver
- Increasing man-made noise in ocean
  - Construction noise (offshore oil & gas, marine renewables)
  - Increased shipping traffic (3 dB level increase per decade)
  - Geophysical surveying and military sonar
- Incipient regulation
  - EU Habitats Directive → national legislation
- Marine Strategy Framework Directive
  - Two noise indicators define Good Environmental Status
- Underpinning metrology is immature
  - No agreed methodologies and standards
  - Requirement for absolute calibration and traceability



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## Metrology required to address environmental needs

- Development of standards for in-situ measurement of radiated noise and modelling it's propagation
- Development of standards for monitoring and modelling ambient noise
- Standards for measuring and parameterising impulsive sources in shallow coastal waters
- Development of vector sensor methods for in-situ marine noise measurement and sea-bed vibration
- Development of new acoustic metrology for gas leak detection for subsea Carbon Capture and Storage
- Existing activity in ISO/IEC must be supplemented

JRC Scientific and Technical Reports



### MARINE STRATEGY FRAMEWORK DIRECTIVE

Task Group 11 Report

Underwater noise  
and other forms of energy  
APRIL 2010

M.L. Tasker, M. Amundin, M. Andre, A. Hawkins, W. Lang, T. Merck, A. Scholtz-Schlomer, J. Tellmann, F. Thomsen, S. Werner & M. Zakharis

Joint Report

Prepared under the Administrative Arrangement between JRC and DG ENV (no 51210 - 2009/2010), the Memorandum of Understanding between the European Commission and ICES managed by DG MARE, and JRC's own institutional funding

Editor: N. Zampoukas

EUR 24341 EN - 2010



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**"The world is changing, I feel (hear) it in the air..."**

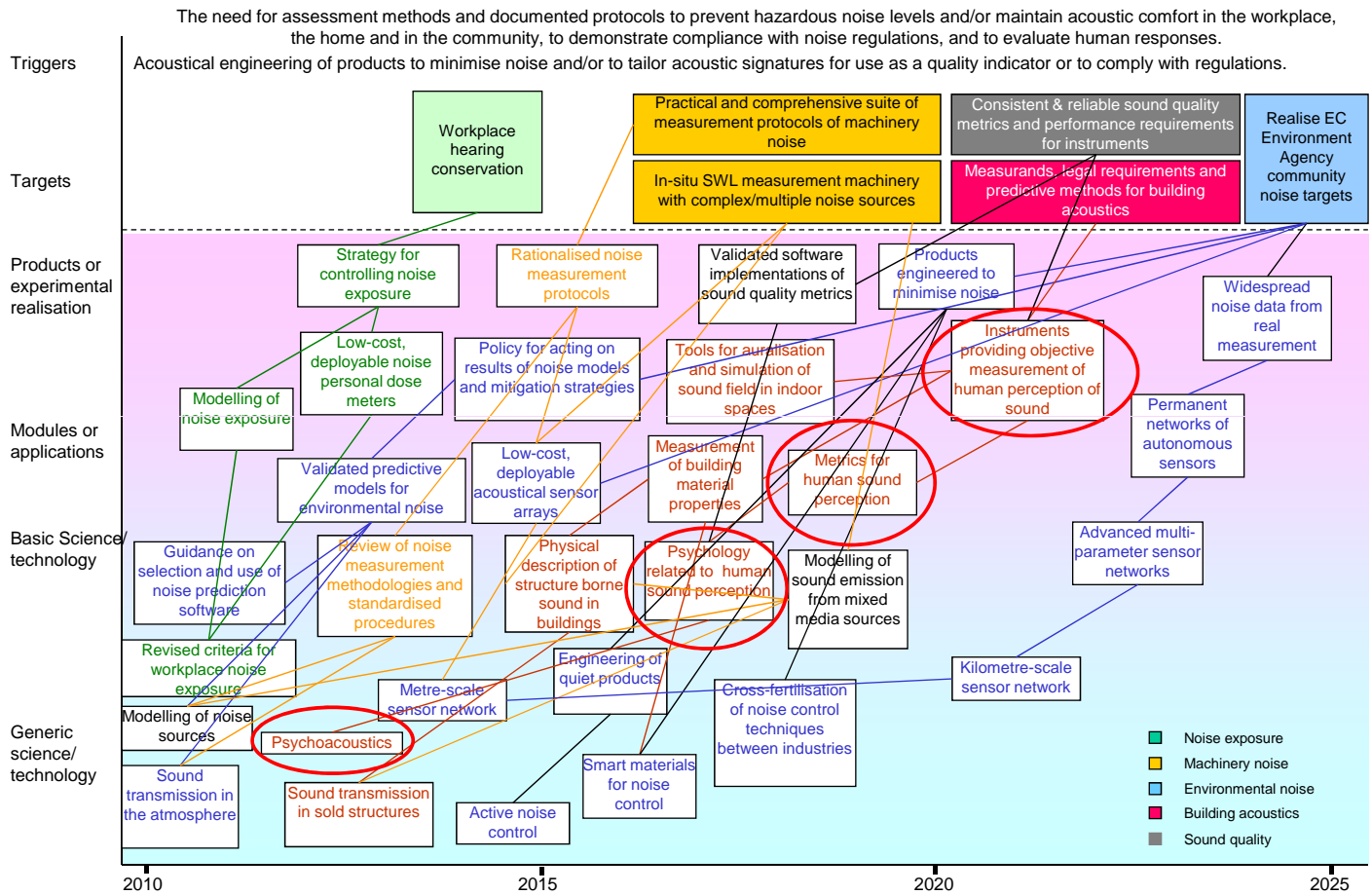
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## Roadmap for the development of acoustical measurement technology to sustain and improve quality of life in the 21<sup>st</sup> Century

### Part II: Metrology in practice



## Development of Acoustical Measurement Technology to Sustain and Improve Quality of Life in the 21<sup>st</sup> Century: Core Metrology Requirements

