UK ACOUSTICS NETWORK ANNIVERSARY EVENT

7 January 2019

EVENT SUMMARY TABLES

(These tables were developed as a part of roundtable discussions at the UK Acoustics Network event in January 2019 in Sheffield. This event was attended by 114 Network members.)

TABLE 1: SUMMARY OF CRITICAL CHALLENGES AND PREFERRED POTENTIAL SOLUTIONS (Rounds 2 and 3)

Challenge Theme	Preferred Potential Solutions (i.e. those that had at least one vote)
Noise (39)	• *Understanding of noise from unmanned vehicles* • *Development of new active noise control methods* • *Better noise control for highly sensitive environments* • *Development of low-mass, low-cost noise control devices, including those for low-frequency noise* • *Use of crowd sourced measurement data to determine noise exposure - response relationships* • *Better integration of noise control solutions and sensors with inverse methods for source identification* • *Tyre and road noise reduction*
Sensors and transducers (8)	• *Embedded sensors* • *High power ultrasonic transducers* • *Development and adoption of emerging sensing technologies, e.g. distributed fibre-optic sensing and swarm robotics* • *New algorithms, sensors and control* • *Better understanding of uncertainties* • *Pervasive, reconfigurable sensing, sensor cooperation and data mining (e.g. mobile phones)* • *Development new research partnerships, e.g. with https://gow.epsrc.ukri.org/NGBOViewGrant.aspx?GrantRef=EP/S016813/1* • *Development of new physical, statistical and machine learning models* • *Better understanding of sound reflection of a complex interface* • *Low-cost and miniature sensors*
Nano- and metamaterials (7)	• *More collaboration among different fields of science* • *Materials with new properties* • *Drug delivery with nano-materials* • *New modelling and computing methods* • *More reliable characterisation methods* • *Design random / heterogeneous materials for broadband applications*
Modelling of complex phenomena (13)	• *Use of field programmable gate arrays (FPGA) modelling* • *Differentiation modelling* • *Multiple scattering* • *Better modelling of complex materials (e.g. nano- and meta-)* • *Development of better understanding through better modelling* • *Robust model validation and verification* • *AI and machine leaning integration* • *Better relation with current research grants in the area, e.g. Digital Twins [http://digitwin.ac.uk/]*

	• *Adopting alternative existing modelling tools for systems with high uncertainties, e.g. used to model bubble behaviour in bio-acoustics research* • *Making use of right facilities for validation and verification of models, e.g. [www.lvv.ac.uk]* • *Better make use and understanding of big data* • *Increase experience with experimental methods - not everything can be simulated or modelled* • *Work closer with theoreticians by offering experimental validation facilities*
Standards and education (10)	• *Modifying existing standards with mutual agreements among expert teams* • *More research-non-academic collaboration* • *Better networking across Europe and specialists European networks* • *Make use of existing groups - EU, IEC, WHO, ISO &EN, ACOUSTICA* • *Introduce more programming and maths training in acoustics and engineering* • *Training and upskilling* • *Deposit a bank of published papers in one place online (i.e. medbank), list of experts and case studies* • *Better engagement with 14-18 year olds through outreach* • *Stricter noise legislation against transport noise* • *Better communication of the true value, financial and social, of acoustics research and application of practice. (inc health and well beng).*
Psychoacoustics, human perception and audio engineering (17)	• *Better engagement between academia and end-users* • *Development of autonomous sensor networks and new metrics substantiated with traditional methods* • *Development of better AI* • *Development of machine learning and big data methods linked to physical models* • *Use of speech intelligibility models with phonetics* • *Make better of VR and simulation tools* • *Better understanding of room acoustics design in a more sophisticated way than just reverberation time* • *Develop quality uncertainty models; think about how hearing happens in the brain, perception not detection*
Health and well-being (6)	• *Better ultrasound in cancer treatments* • *Exploring antibiotic effects of ultrasound* • *Development of new big data analysis and relations between noise metrics, well-being and health*

Note: The numbers in brackets indicate the number of times this word got mentioned.

TABLE 2: SUMMARY OF INTERESTING NEW DEVELOPMENTS (Round 5)

TYPE OF DEVELOPMENT THEME	Specific examples of interesting developments in each theme
Experimental methods, measurements, devices and sensors	• Cellular Sonar at Caltech • Ultrahaptics • Vibro-tactile sensing • Ultrasonic levitation • Targeted soundspot reproduction

	• Use of GIS-systems and large acoustical data • Tri-axial vibrometry • Use of Raspberry Pi to implement a long-term sound monitoring system with near real-time web-based data display and transfer • Further minaturisation of sound measurement device. e.g. MEMS microphone • Innovation in sound intensity measurement and acoustic cameras • 3D scanning sonar sea bed imaging • Distributed fibre-optic sensors • Robust caption, higher-orders techniques for beam formers and super resolution • New flow-noise decomposition for jet noise (based on wavepacket description of the jet) (wavelet theory) • Acoustic fridge - energy storage/conversion potential • Time reversal methods • Laser ultrasonics for previously impossible uses of ultrasonic testing • Water coupled ultrasound - non contact, industrial testing • Starstream - use of small bubbles/ultrasound to clean surfaces • Electromagnetic acoustic transducers, non-contact NDT, potential for testing • Compressed sensing • Wavenumber spectroscopy • Structural health monitoring with real time data and control • Crowd sourcing • Use of acoustics for feedback mechanism • Soundscaping • Thermofluid acoustic manipulation. • Very high power ultrasound which is powerful enough to shatter bone and corrode titanium. • Active detection of marine mammals.
VR, psychoacoustics, AI and audio engineering	• Visualisation and ambisonic methods • 3D Virtual Soundscapes • Psychoacoustic tonality models based on loudness • Voice recognition deep learning • Artificial audio Intelligence • Source identification by spatial characterisation • Sound quality assessment through better VR • High reality binaural reproduction by phone • Auralisation with VR integration • FDTD in room acoustics • Headphones that transmit the sound through the bone and allow you to listen to ambient sound
Materials	• Nano-porous media • Aerogels • Tuneable metamaterials • Acoustic cloaking • Auxetic materials • Sustainable materials
Medical and health	• Thera-acoustics and drug delivery

	• 3D medical imaging with super-resolution ultrasound • Non-invasive surgical methods • Use of high intensity focused ultrasound for spinal disk replacements • Ultrasonic methods for wound cleaning and drug delivery
Noise	• Quiet aerofoils
Modelling and computing methods	• Machine learning for solving inverse problems • Using physical models to build in invariance in machine learning • Drawing analogies to acoustics from quantum mechanics • Julia language for acoustics • Pseudo noise CDF for aeroacoustcs • Adjoint methods for sensitivity analysis (towards flow control) based on more detailed (RANS) base flow • Use of FPGA for solution of partial differential equations • Development and use of Open Source codes (e.g. Github) • Efficient computational models for 3-D propagation •

Note: Not all points have made it to this table. Some points were too ambiguous to add. See the original Google Sheet for the complete set.

the names out.