

P27 assisting the Construction Industry Council (CIC) in the role of 'Construction Ambassador'. Notable involvements include filming a short interview for the CIC about "Working in the construction industry."

Another valuable contribution is the dynamism, enthusiasm and positive 'can do' outlook that he has consistently brought to all of this work. Not only has he made a very significant contribution directly to the promotion of acoustics to the public, but he has made a significant contribution to the promotion to other acousticians of 'the promotion of acoustics to the public', so that they may then make greater contributions to this essential activity.

For all of these reasons the Institute of Acoustics is proud to present the award for Promoting Acoustics to the Public to Alex Krasnic.

Timothy Leighton Rayleigh Medal

Gas bubbles injected underwater are powerful sources of sound – the smaller the bubble, the higher the pitch. As an undergraduate at Cambridge, Tim Leighton was the first to use this relationship to measure the size distributions of bubbles generated in the natural world. It is through an academic career focussed on the acoustics of gas bubbles in liquids, and through related innovations in a diverse range of applications, that he has achieved international distinction.

His undergraduate studies resulted in the award of a double first class honours degree in physics and theoretical physics. Tim stayed at Cambridge to study for a PhD and his interests progressed naturally to looking at the potentially hazardous effects when bubbles are driven with ultrasound.

In 1988 Tim was appointed as a Research Fellow at Magdalene College, Cambridge and was awarded an SERC Postdoctoral Fellowship. In 1992 he was appointed to a lectureship in the Institute of Sound and Vibration Research at the University of Southampton, and shortly afterwards, at the age of 28, he published *The Acoustic Bubble*, a monograph that is now the most cited work in the field.

Since then, in over 120 journal papers, he has presented research based on these principles, and as a result, delivered a remarkable



number of real-world applications. To mention just two, they include the development of needle-free injectors to treat migraines (with sales of over 1 million), and dramatically improved kidney stone monitoring for hundreds of patients to date.

Tim was made Professor in ISVR in 1999 and currently serves as Associate Dean for Research in the University's Faculty of Engineering and the Environment. His work has already been recognised by many learned societies, with the award of numerous medals and prizes.

In addition to being a prolifically productive scientist and innovator, Tim is an outstanding science communicator. His research has been used in extensive public engagement, including 15 TV/video shows that include broadcasts by David Attenborough and Richard Hammond, and in 24 radio shows.

In an academic career of great distinction, Timothy Leighton has made outstanding contributions to science, innovation and public engagement in the field of acoustics. There can be no doubt that he is a worthy recipient of the 2014 Rayleigh Medal. **o**

Amplitude modulation comes under Institute working group's spotlight

The Institute's Amplitude Modulation Working Group held a workshop meeting in London in November. The group's aim is to agree a metric for assessing amplitude modulation (AM) in wind turbine noise. Currently there are several methods in use around the world, each giving a different result and clearly some standardisation is needed. The meeting was fully subscribed with environmental health officers, consultants and developers present. Gavin Irvine, group chairman, introduced speakers from the group who each gave a short presentation.

Matthew Cand, Hoare Lea, began by summarising the RenewableUK report on AM published in 2013. Matthew drew the distinction between "normal" AM, which is caused by the moving blades and the directivity of the trailing edge noise heard relatively close to the turbine, and "other" AM, which is primarily caused by transient stall on the rotor blade as observed at residential distances. This is primarily a downwind, low frequency effect characterised by a "whoomphing" or thumping noise at the blade passage frequency, typically just less than once per second.

The next speaker was Robert Davis who had the unenviable task of summarising around 30 scientific papers on the subject. Of particular interest were those which included subjective listening tests to establish a dose-response relationship. Researchers have proposed different ways of rating AM. Many have taken a Fast-Fourier Transform (FFT) of the time series as represented by short L_{Aeq} or L_{pA} values, e.g. in 100 millisecond samples. By using the FFT,

the modulation frequency appears as a spectral peak in the frequency domain and the periodicity of the amplitude modulation can clearly be seen. The power spectral density of the fundamental can be related to the peak to trough value of the AM. One advantage of this approach is that false positives can be reduced as those with a modulation frequency outside of the expected range can be ignored. However, in Australia, Cooper and Evans used the FFT method only to find the modulation frequency and then used this to select peaks and troughs within a window defined by the modulation frequency again reduces the influence of the spurious results. The outcome is the depth of the modulation, albeit with some averaging depending on the chosen time period. Other methods used included impulsiveness, fluctuation strength and the DAM index proposed by Tachibana's group in Japan.

Jeremy Bass from RES and David Sexton from West Devon Borough Council then described the long-running Den Brook Wind Farm saga from the developer's and local authority's perspectives. Den Brook is one consented wind farm which has an AM planning condition which states that the AM is deemed "greater than expected" if it exceeds 3dB, subject to certain other qualifications. Jeremy described the difficulties with this condition in that general environmental noise, well away from wind turbines can also fail the condition. A way out of the planning quagmire was thought to have been found with the planning authority's discharge of the so-called Condition 21 scheme developed by RES and agreed **P30**