



We Hear

Roundup of news and events:
Mike Bedford brings us the latest to impact
 the world of cave radio and electronics.

Molecular Communication

A novel method of communication for use in mine tunnels and pipes is being developed at the University of Warwick, UK. What makes it so unusual is that instead of radio it uses molecules. Professor Weisi Guo suggests that it has potential for sensory applications in particularly small diameter tunnels, especially those with multiple bends, in which more conventional methods suffer unacceptably high levels of attenuation. In a caving environment, small digs and boulder chokes could pose similar communication challenges.



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 (commons.wikimedia.org/wiki/File:Drivesafe_Breathalyzer_-_controller_board_-_Figaro_TGS812.jpg)

One early realisation of the method utilised pulse-modulated pulses of alcohol to represent a message. A positive air current drift was induced to accelerate the rate of diffusion. At the receiver, an electrical gas sensor (e.g. as shown above) was used to detect the alcohol. Comparisons were made with a 2.4GHz ZigBee signal. In a pipe network between two tanks – albeit one with pipes just 40mm in diameter – the ZigBee RF signal could not be detected around a single bend at 4.8m in an L-shaped network, or around two bends at 3.9m in a U-shaped network. The molecular system provided a detectable signal throughout all the networks used, although with an appreciable delay. Specifically, in the two locations where ZigBee failed, the chemical signal exhibited delays of 6.24s and 8.81s respectively. The rate of data transmission is also very low, at just 0.1 bits per second, although this could be acceptable for some data-logging purposes.

Although any caving applications would involve larger diameter tunnels, it's pertinent to point out that the molecular drift time will be longer in such environments. Free space tests over 4m, for example, involved a 17s delay, and this increased to 65s over 4m between two open tanks with no pipe.

Ambient Soundtracks

While not at all new [*Fortunate we didn't call this column 'News' then – Ed.*], www.ambient-mixer.com was news to us and it quite impressed us. According to the website, it's "a community-driven project offering you some unique quality soundscapes with different atmospheres for chilling, relaxing or your recordings using our endless audio loops". Certainly we can envisage its ambient sound being used as backing tracks for videos or presentations, or on a website and, what's more, all the tracks are Creative Commons-licensed, which means you're free to use them wherever you want, subject to attribution.

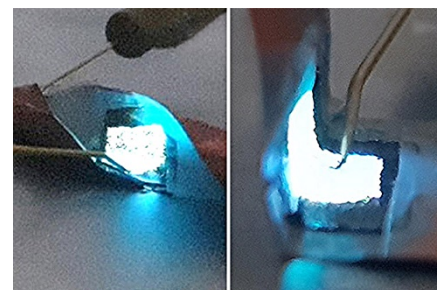
This interesting site came to our attention as a result of searching for cave-related soundtracks. In fact, lots of people have generated such tracks, as you'll see if you substitute 'www' for 'caves' in the URL. And while several of the tracks are impressive as they stand, you can tweak any of them to better suit your needs. Alternatively, you can create new tracks from scratch, using the vast number of sound samples that are provided. The only stipulation is that, before you save any track you have to register, although that's totally free.



Compared to similar online utilities, ambient-mixer's library of sound samples is among the best. However, you don't have to limit yourself to that repertoire. Various water sounds including dripping are commonplace, as are various other sounds associated with caves. However, while it would take quite a while to be sure, we rather suspect you might not find the sound of carabiners clanking together, for example. However, since registered users are allowed to upload their own samples, the sky is surely the limit. If this inspires you to try out ambient-mixer, we'd be interested to learn of your experiences.

Micro LEDs to Offer Exciting New Opportunities

Researchers at the University of Texas at Dallas and elsewhere have developed a method to create micro LEDs that can be folded, twisted, and stuck to different surfaces. They have been attached to various curved surfaces (such as caving helmets?), as well as to flexible materials that were subsequently bent and crumpled. Further hinting at these LEDs' remarkable reliability, it transpires that if you cut one in two, you can still use half of the LED.



Production is through a technique called remote epitaxy, which involves growing a thin layer of LED crystals on the surface of a sapphire crystal wafer, or substrate. However, a layer of graphene was added to the substrate and this is a game changer, as Dr. Moon Kim, Louis Beecherl Jr. Distinguished Professor of materials science and engineering at UT Dallas, explains. "The graphene does not form chemical bonds with the LED material, so it adds a layer that allows us to peel the LEDs from the wafer and stick them to any surface."

A UT Dallas news release explains more about the benefits on offer. "The bendy LEDs have a variety of possible uses, including flexible lighting, clothing and wearable biomedical devices. From a manufacturing perspective, the fabrication technique offers another advantage: because the LED can be removed without breaking the underlying wafer substrate, the wafer can be used repeatedly." It doesn't take a lot of imagination how this could impact caving lamps, camping lamps and more.

If you discover anything that you think would fit in the *We Hear* column, please contact me at BedfordMD@aol.com.

