Getting a big sound from a small room

You can get a big sound from a small room by employing SpaceCoupler panels to achieve loosely coupled spaces, according to Auralex Acoustics chief acoustical engineer JEFF D SZYMANSKI. He takes us through the principles and applications of this interesting new product.

A DESIRE OF MANY STUDIO folks is to have a great sounding 'live' room for instrument and vocal recordings. Unfortunately, inherent space limitations prevent many project studio owners from achieving anything close to a 'live' room in the true sense of a well-controlled space with a useful reverberant tail.

That is about to change. The next generation of acoustical treatment from Auralex is the pArtScience line of products and the focus of this article is to look at one of these new products, the SpaceCoupler (Figure 1). The many acoustical uses of the SpaceCoupler and its high-quality construction and appearance combine to provide many options to the user. Stripped down to the basic science, the SpaceCoupler is nothing new but nothing like it has ever been offered to the pro audio market.

Loosely coupling spaces is a design technique that was developed by Russ Berger, the designer of the SpaceCoupler, to sculpt high quality live recording spaces out of rooms with otherwise small — some would say almost unusable — footprints. Berger has been using the technique for nearly 20 years to create unique acoustical environments in his studio designs.

The loosely coupled space approach starts, for example, with a small room, often just cosy enough to fit a drummer and a kit. For the example shown in Figure 2, the room is, say, 14ft long by 12ft wide with a 15ft high ceiling. All the surfaces of the room are hard including the floor. The lower portions of the walls — say up to about 8ft high — are treated with a good broadband absorber. The absorber coverage is typically as close to 100% as can be achieved. Above the absorbers the walls are left alone, but can optionally be treated with diffusors as shown in Figure 2. The ceiling above is treated with absorbers to remove any flutter echo effects between the hard floor and hard ceiling.

To get the full effect of a space like this — for example, to get that 'fat' drum sound — the boundary between the dead portion of the room and the live portion needs a well-controlled aperture. Enter the SpaceCoupler. SpaceCouplers placed horizontally at just above the 8ft high mark separate the two areas with a controlled aperture. The actual aperture size is smaller than the overall footprint of the room, which is usually around 70-80% of the floor area. The exact aperture size will vary depending on the application. The SpaceCouplers in the aperture redirect sound energy into the upper portion of the room where it is diffused. Sound then returns — again redirected by the SpaceCouplers — to provide a 'big room' reverberation tail that sounds exceptional.

Scientifically, the SpaceCouplers maximise the initial time gap (ITG — Figure 3). Psychoacoustically, this 'pushes' the reverberation tail out in time by several milliseconds without altering its length. The quality of the resulting tail is smooth, without any acoustical artefacts or anomalies that would be difficult to work with in the postprocessing and mixing phases. The subjective assessment of loosely coupled spaces is that 'big room' recordings are a reality. Even in small

Figure 1

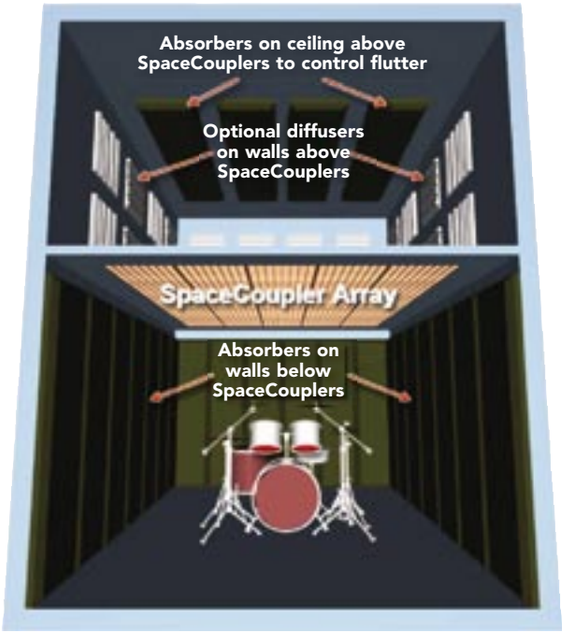


Figure 2

spaces where the reverberation time of the loosely coupled space is less than 1.0 second, processing the sound with conventional postprocessing leads to very musical sounding reverb effects. The net result is a recording that is more aurally convincing than applying digital reverb to an otherwise dry signal.

There are alternatives to the setup shown in Figure 2. First, the SpaceCouplers can be angled such that they are not parallel to the ceiling. This would eliminate the need for absorbers on the ceiling and would increase the length of the reverberant tail. If the floor is carpeted — not advisable, but a reality in some rooms nonetheless — absorbers on the ceiling would probably not be needed. If a high ceiling is not a reality, but there is some extra length to the room, this entire application can be turned on its side i.e. the

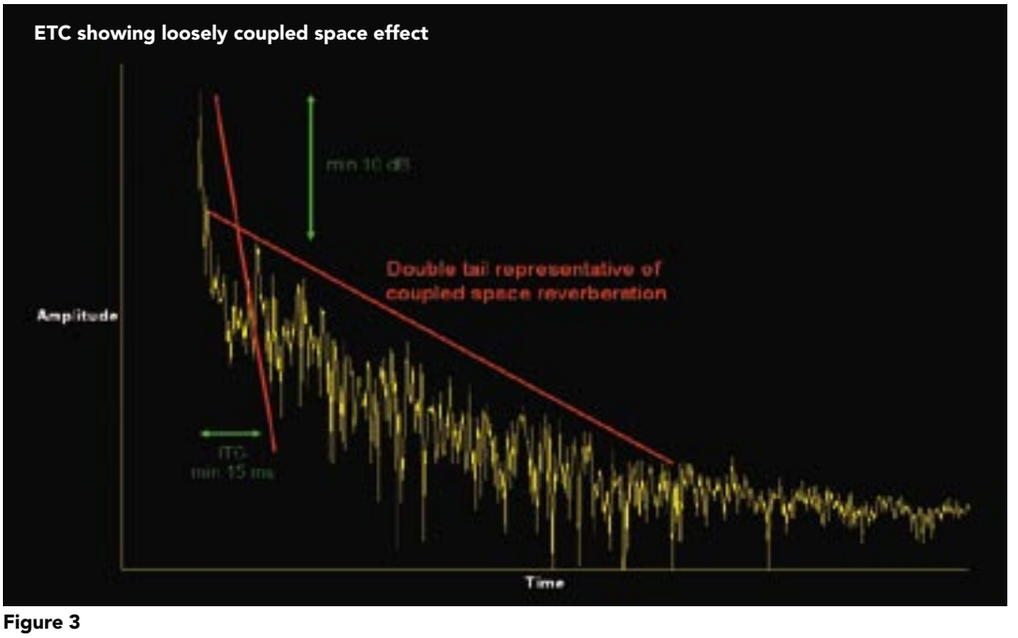


Figure 3

reverberant space can be 6ft to 8ft of a 20-something foot long room. The SpaceCouplers would then be a false 'wall' between a dry area and a reverberant area.

The possibilities for miking instruments and voices in a loosely coupled space are endless. Close miking an instrument or voice would provide a high level of direct sound with just a hint of reverberant tail. Placing overheads above a drum kit, for example, but below the SpaceCouplers would provide a great blend of direct and reverberant energy (The aforementioned 'fat' drum sound!) Miking above the SpaceCouplers in the reverberant area would provide a great reverberant fill recording that combines with the close-miked signal or signals. Different miking techniques would apply to different recordings. A combination of all three of the above might work for a drum kit. A combination of a close mic and an overhead below the SpaceCouplers might be more appropriate for a voice or an acoustic guitar. A combination of a close mic and an overhead above the SpaceCouplers could yield that long-sought-after 'live' guitar amp sound.

The loosely coupled space application is just the beginning. A byproduct of the acoustically optimised grid of a SpaceCoupler is that it can be used over flat absorbers to increase their efficiency and provide a decorative finish to what some might consider a 'ho-hum' flat acoustical panel. Simply placed over any flat absorber, low frequency absorption can be increased by more than 40% below 250Hz (Figure 4). Above that, the absolute absorption of the panel does not change, but the exact nature of the absorption that is occurring does change. This has to do with the angle-dependence of absorption and is a more typical scenario for small room applications than the random incidence absorption normally quantified by laboratory tests.

A flat absorber (as opposed to a sculpted absorber) absorbs the most sound when the angle of incidence is perpendicular to the panel. This is described as normal incidence. As the angle of the sound source is increased, the absorption decreases and reflection off the face of the panel increases. We have researched this quite a bit and have found that as the angle of incidence is increased, the reflected sound level increases as well. Figure 5 illustrates some scenarios.

To improve the otherwise poor off-axis performance of flat absorbers, a SpaceCoupler can be placed over the flat panel. Sound arriving at non-normal angles of incidence is redirected into the absorber. Each time redirection occurs more energy is lost until the reflected sound emerges from the treatment reduced significantly in level. There is actually a threefold benefit to this application of the SpaceCouplers: the efficiency of the absorber is increased; the overall depth of the absorber is increased, extending the low frequency effectiveness; and it provides off-axis scattering. This last benefit is highly desirable as it

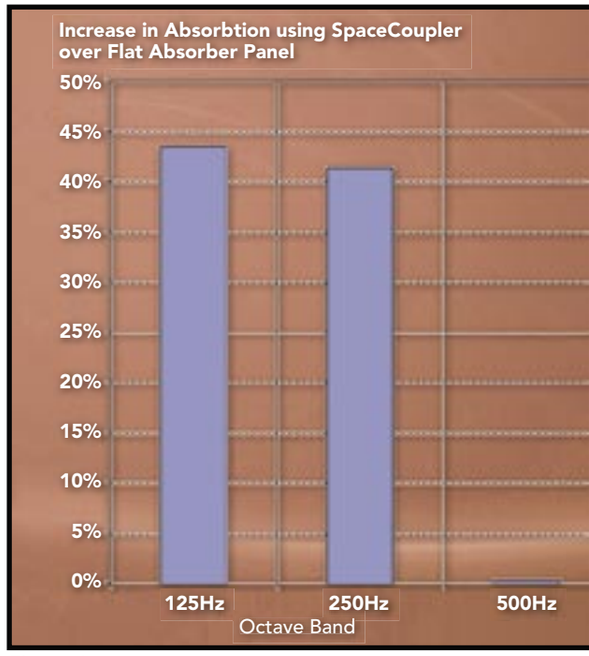


Figure 4

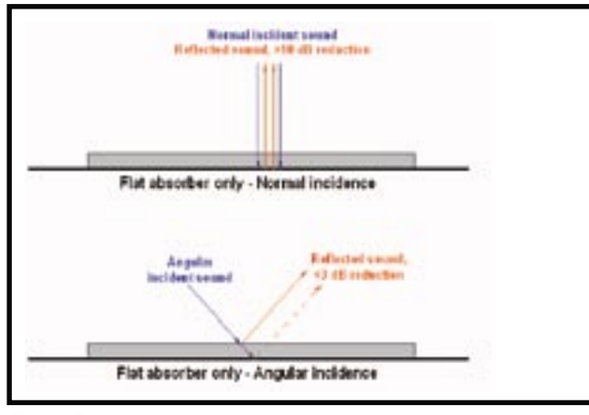


Figure 5

can greatly improve the sound quality at listening locations behind the main mix area. Producers' areas and comfy couches are notorious for not having the same sonic quality as the sweet spot. Using SpaceCouplers over the side wall absorbers can make the sound more consistent and actually widen the sweet spot to encompass the other areas where producers and players might be sitting when evaluating mixes.

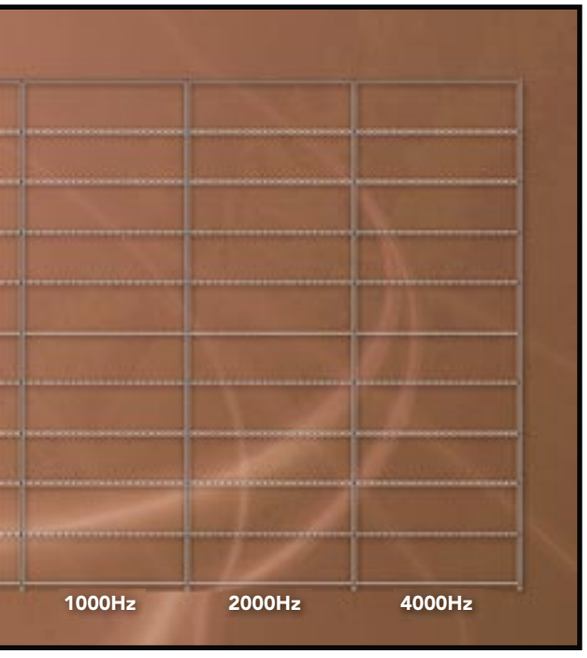
Two of my favourite applications of the SpaceCoupler are over absorbers above the mix position and over deep absorbers on the rear wall of a control room. The former is a very efficient, space-conserving method of eliminating the floor-ceiling first and second order axial modes that plague basement and bedroom studios. A relatively small area of SpaceCouplers over a few inches of absorption on the ceiling can greatly increase the low frequency punch in the room and allow for better mixing decisions for low frequency content.

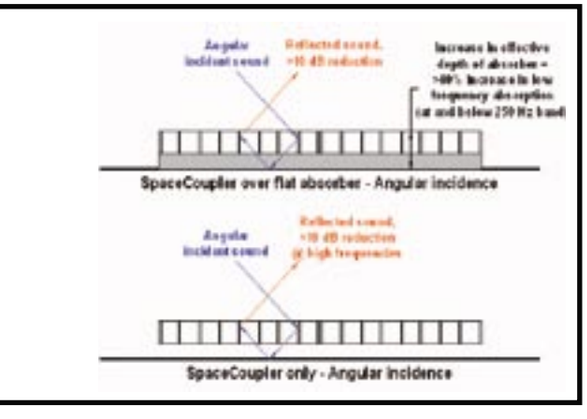
The second application — SpaceCouplers over deep absorbers on the control room rear wall — is a very aesthetically pleasing way of finishing out what might otherwise be a very dull, fabric-covered rear wall. This use of deep absorption is most often found in 'neutral' room designs. Mixing the SpaceCouplers with some diffusors can provide high frequency scattering, yet still allow the low frequency sound into the deep absorbers to control modal build-up and cancellation in the room. Angling the SpaceCouplers over the deep absorbers can also help facilitate the 'waveguide' approach of the Hidley/Newell 'non-environment' approach to control room rear wall design.

Even used without an absorber underneath (bottom right of Figure 5), early (high frequency) reflections can be reduced by 10dB or more. Used at varying angles and depths, performance can be increased even more.

The SpaceCoupler is handmade from solid wood. The craftsmanship is high and the musical qualities of the Paulownia wood (used in musical instrument construction in Asia) give a very natural feel to the room. What Berger and others (including myself) have found is that using a high quality, natural wood diffuser — as opposed to diffusors made of more 'manmade' materials — can give a room a natural sound quality that isn't really quantifiable.

The possible applications for the SpaceCoupler are increasing daily; coupled spaces, increased absorber efficiency, well-scattered (diffused) sound, and so on. The high-end appearance makes the SpaceCoupler the newest alternative to flat absorbers and diffusors in studios around the world. ■





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