Acoustic Flats: What, How, Why and Where

By Malcolm Chisholm

There is a saying among recording engineers that the setup is 80% of a mixer's work, and the rest is politics.

That's overdrawn, and we do move a knob from time to time, but there's a lot of truth to the perception that a mixer with a bad setup is dead meat, and one with a good setup has got at least a fighting chance of doing good work.

A mixer's setup is generally tailored to his (or her) style, the shape and size of the studio, and the kind of music being recorded, but all setups have a few basic purposes in common.

Specifically, the setup has got to allow the musicians to play decently, the sound of one instrument or section must not trash the sound of another, and it would be real nice if the mixer could see the players.

Visual cues are very helpful when you don't know who's got the next solo.

All three of these criteria involve the use of acoustic flats.

The direct reason for using them is generally (not always) to improve isolation between mikes, but their physical presence affects sight lines between the mixer and the musicians as well as between the players themselves, and to a lesser extent, the ability of one player to hear another.

Throw in the fact that they're the biggest and most awkward tools in the studio and flats start to look like a pretty big deal.

Flats, that is, or screens; not baffles. The only baffling thing about acoustic flats is that despite their having been utilized in studio setups since the 1930's, there is no apparent standard as to how they should be made or employed.

In fact, there is very little published material concerning them one way or another.

This commutations gap has given rise to a widely held view that flats are absorbent, and that their purpose is to isolate instruments by blocking sound travel between one and another.

Neither notion is actually true, although the latter commonly appears to be the case.

Wrapping musicians in Fiberglasss™ often works, but not the way generally thought.

It's a matter of introducing more absorption into the studio than can be hung on the walls, and from that standpoint the flats might as well be suspended from the ceiling. And sometimes are.

Obviously, there's some tricky stuff involved here, and the writer has spent an embarrassingly long time straining out a few facts from a barrel of fiction with respect to these simple looking bits of studio furniture.

To begin at the beginning, flats come in two fundamental types, reflective and absorbent, and are most useful for controlling the local sound environment of instruments. Sort of an acoustical micro climate for each instrument or section.

The optimum acoustical environment varies from one instrument to another, and a number of them work best in live enclosures.

Strings, for example, French horns, real harps, and strange as it might seem, full-fuzz overloaded guitar amps that drive the whole room into resonance and get into every mike on the floor.

Reflective flats allow the mixer to work these and other instruments or sections in a live area rather than a separate live room, which helps no end with communications between players.

For strings and horns, the individual instruments blend over a much shorter distance than otherwise, so you can get a section sound miked at a few feet instead of a few yards, and the section will produce far more sound than it would in a relatively dead studio.

A harp is typical of instruments that sound too raspy for close miking, and the live enclosure smoothes out the sound at a reasonable mike distance.

As to the guitar amp, a resonant sound can be achieved at much lower volume in a small live enclosure than in the whole studio, and mostly kept out of the main room. Eliminates the isolation problem altogether.

In passing, when confronted with working three or four people in an enormous studio, a few live flats behind them will reduce the perceived acoustical size of the room, and make them feel less lonesome.

Also works for overdubbing, which has justifiably been described as a solitary vice.

While we're on the subject of live flats, they're made of 1/4 inch tempered Masonite™ usually set in 2x4 frames with four foot braced cross piece legs to keep them upright.

Castors are a must, because these things are used to build small rooms, and they have to be surprisingly large in order to work.

Generally speaking they'll run six to eight feet wide by a minimum of eight feet high. Twelve's better.

On the plus side, they're cheap, take up almost no storage room at the back of the studio, and will multiply and smooth the sound of instruments in a way that nothing else can. Recommended.

Absorbent flats are the opposite of reflectors in every way. They are low, thick, and made as compact as possible.

Their primary purpose is to present a dead surface to cardioid mikes.

They can be low because most instruments project out and up at about 30 degrees, so most mikes are positioned above the instruments and angled down at about 30 degrees.

O.K., brass is an exception, but given a chance, they'll play downward and bounce off the floor at the usual angle.

No help in recording, but the general case for "up at 30" holds pretty well and a mike basically pointed at the floor behind a musician doesn't need a 12 foot absorber behind him.

Getting back to first principles, musicians play better when they can see and hear each other, the mixer is better off being able to see everybody clearly, and most soaker flats don't have to be tall.

To put some numbers on this, the average player sitting in the usual undertaker's chair is about four feet high.

Eyes and ears will fall at about 3' 8", and mouth about 3' 4".

That puts even a flute a bit over 3 feet off the floor, and a screen higher than that is pure waste.

Drummers sit a little higher, and singers are their own animals, but the majority of screens need not and should not be much over 3 feet.

That's too high to sit on and about right for an ash tray, but most importantly, just below sight and sound lines.

Since the drummer is the player most likely to be jacketed in Fiberglass™ if not actually locked away in a tiny room somewhere, the drummer's acoustical micro climate is a rational starting point for a discussion of how flats can be used to make life easier for a mixer.

The drum kit is also an extreme case, as it constitutes a sizable section, and on small sessions you're likely to have more mikes on drums than are used for everything else.

There is a public perception that the problem with drums lies in their getting into everything else, but as the working mixer knows, it's usually the other way around.

All those drum mikes are open, and drums aren't half as loud as most people think.

A drum booth takes care of both problems, but in addition to cooking the drummer, it destroys communications between the drummer and everybody else, and a booth big enough to accommodate the wavelengths of a floor tom, let alone a bass drum, will run at least 12 feet square.

Anything less makes the drums sound funny, so a booth starts a session with two strikes against both the drummer and the mixer.

It's more practical to put the drums in the middle of the floor, in a four sided anechoic enclosure.

Three of those sides are screens, and the fourth is a thick drum rug.

Shag works well in this application, as it's about as thick as you can get. Thickness in critical because the performance of an open absorber

Thickness is important as the frequency absorption of an open box (as opposed to a tuned box or panel absorber) at low frequencies is chiefly dependent on it's thickness.

With one or two exceptions noted below, the mass and rigidity of the material have very little effect on absorption.

Interestingly enough, there are no absorption figures published for frequencies below 125 cycles.

The reason for that, given by one of the labs dedicated to generating those figures, is that the anechoic chambers aren't big enough to accommodate the wavelengths involved.

Bass, defined as 60 cycles, has a wavelength of over 18 feet, and it takes more than one wave to get good measurements.

That same lab has expressed the opinion, however, that doubling the thickness of an open absorber should halve it's low frequency cutoff point.

The cheapest, lightest, and handiest open absorber material commonly available is unfaced Fiberglass™ wool. It is also a first class acoustical material both in terms of

absolute absorption, at 1 Sabin per square foot and flat response, within .7 Db from 250 Hz through 4000 Hz.

Absorption figures are published for several thicknesses of Fiberglass™ batts.

The deepest of them is 3.5" (R11) which shows a 25% drop in absorption at 125 cycles when mounted 16 inches off the nearest wall.

When placed directly on a wall the drop at 125 Hz increases to 230% so for movable screens any solid backing should avoided.

As stated above, the figures for 6-1/4" (R-19) batts should produce similar figures at 60 Hz.

Presumably a foot (R-38) would yield even absorption down to 40 cycles or so, but since these things have to be handled by real people in real studios, 6 inches seems a reasonable compromise.

If for some reason an absorber must be mounted on a wall, 6 inches of semi-rigid Fiberglass™s board (Corning 703) will result in flat absorption to 60 Hz, but it's both heavier and harder to work with than the soft stuff.

For those reasons, boards are best left to wall treatment, where they work very well indeed.

Given all the above, a proper absorbent flat would be nothing more than 6 inches of Fiberglass™ behind a musician, and no higher than necessary for the mike pattern. Which leaves the problem of how to get it there.

No problem. You'll need 3/4' plywood, 2x2's, hardware cloth, burlap, 4" hinges, and 4 to 5" casters.

Hardware cloth amounts to very big window screen. It's made of galvanized iron wire welded at each intersection, with spacings of 1/4, 3/8, or 1/2 inch.

Standard width is 3 feet, cost is 50 to 65 cents per square foot.

It is strong enough to use as a hammock, is slightly springy, and makes an excellent enclosing material.

Burlap comes in a couple of textures and several colors. It doesn't sag or shift once it's mounted, looks good, and overcomes some small problems with Fiberglass™, which gets a little weird at very high frequencies.

Cost is about $1.20 a yard for 3 feet wide and $1.60 for 52 inch wide. Very durable material.

Do not cheap out on the casters. Those rotten little one inchers can't be pushed over a cigarette butt, let alone a bundle of mike cables. Three to five inch light/medium duty casters cost about a buck an inch, and save incredible amounts of frustration every day.

So: Rip some 3/4" plywood into 6" strips and use them to build an open 6" frame, screwing the corners together with 2x2x6" blocks. Drywall screws are terrific for this.

Get some 1/4 to 1/2 inch hardware cloth and staple it on one side of the frame. Drop in the Fiberglass™, and cover the second side with another length of hardware cloth. With the hardware cloth in place, the box is self supporting, as the cloth is quite rigid.

If you feel the need, the box can be braced with 2x2's, but they add weight, and probably won't be needed.

Now wrap the whole thing in burlap, staple it down, and you've got a near perfect absorber.

Perfect, but terribly clumsy. Light though these flats may be, carrying them around is a pretty dumb idea.

Also, they tend to fall over on people's instruments, and you don't need that.

Since flats are normally used three at a time in "U" shaped formations, the obvious solution is to build them that way using hinges between the three sections, and add casters for mobility.

The hinges can be installed at the edges of each section if the studio has enough room to store the composite flat in the open position.

For smaller rooms, they can be built with 6" double-swing hinges or with a 6" plywood strip with hinges on both sides.

Either system will allow the composite flat to be stored in a very compact zig zag position.

Four casters are customary, with two on the center section and one at the end of each wing.

Small touches include screen door handles to give the engineer something solid to grab, and a set of screen door hooks to hold the composite screen closed for storage and moving.

One inch aluminum right angle stock can be used as outside trim on the edges, and looks pretty glitzy, but it's a lot of work.

Standard wood outside trim is easier, and untrimmed is acceptable.

Depends on the image projected by the studio.

A studio will normally need several sets of dead screen sets. The normal compliment is listed below.

2 for vocals, 6W x 4H' sections. Six feet is plenty if you place the vocal mikes high and point them down as in film practice.

That avoids pop and proximity problems, reduces sibilance and intake breath sounds, and gives the vocalist a clear sight path to the lyrics and the band. Helpful.

1 for drums, 8 to 10W x 3H' center, wings at half width. Allow passage room for the drummer at one side of the kit. If nothing more, the screen avoids multiple wall reflections back to the drummer.

2 or 3 for acoustical instruments, and sometimes open backed amplifiers; 4W x 3H.

1 for piano, 5H x 8W overall. This one can be two sections.

Actual heights will be up a few inches because of the casters. The gap has no effect.

Since each flat absorbs on both sides, the set listed above will add about 500 Sabins of absorption to the studio (and improve isolation) whether they are in use or not. They work even when they aren't working.

In summary, the control of isolation is a major part of an engineer's professional effort, and the use of correctly designed, well constructed screens can reduce a mixer's setup time as well as greatly improving that control.