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by [Barry Rudolph](#)



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Drum Kit Microphone Placement Seminar Held 10/7/06
At [Hyde Street Studios](#) In San Francisco During The 121st AES Show.

Hello And Welcome!

A big thanks goes to [TransAudio Group](#) for organizing everything and to [Soundelux](#) and [Mercury Recording Equipment](#) who also helped make these seminars a reality. Also thanks to Jeff Cleland here at [Hyde Street Studios](#) for the generous use of this facility--If you need a tracking or mixing space, please call them!

This is a practical tutorial on getting a drum kit sound. Like so many processes in the recording studio, there is a multitude of ways of doing this. What I plan to show you is my starting point or basis for a great drum sound. If you were to copy exactly what I do here, you would make a credible drum recording suitable for most Pop music record productions. I would hope that you take this start and "make it your own" by adding your own mic position tweaks, mic choices and processing ideas.

Just a couple of notes: In general, simple setups of minimal drum kits sound best--the more drums a drummer set up--the more microphones will be required. More microphones means more tracks, more time to get sounds, probably more phase anomalies. If you can get your drummer to set up exactly what he needs--only what he plays, you can assure him the drum sound will be better.

Drum Sound And Drum Tuning

Drum tuning is very important--the overall sound of the kit can not be better than the way the kit sounds out in the studio. The timbre and tuning, squeaky hardware and other noises will all be recorded to a greater or lesser degree. An experienced drummer will know all about tuning. It also goes without saying that drum sound is very dependent on the drummer's skill and musicality. Good drummers play their kit in balance where every drum and cymbal is heard in proper mix right in the room.

I've been lucky over the years, to record a lot of very good drummers who played great sounding drums. When people ask me how I got a drum sound on a certain record I engineered, 9 out of 10 times it's just

the sound of the drums and drummer's musicality and not anything particularly stellar I did beyond the basics we're going to cover here tonight.



Hyde Street Studio A Control Room

Room Sound And Size

After drum tuning, the drum room and where the drums are placed in it will make a very big contribution to the overall drum sound. Drums create loud sound energy that brings out both the good and bad attributes of any room. There are no rules regarding how big a room must be to record a drum kit but we relate the acoustical "size" of the drums to the size of the room they played in. How

much of that room sound you capture and playback along with the kit tells our ears this information.

Size refers to both the actual drum sound itself and the allowed "space" the drums occupy within the recording's production. Size is equated to characteristics like: realistic ambience; a good aural "picture" of the drum stage; good internal drum balance between the individual drums; good low frequencies and high frequencies; punchiness or "weight" in the low mid-range frequencies; and dynamic range or how well you can hear the subtle to the loudest playing without distortion.

Here at Hyde Street, since I've never used Studio D before, for a starting point I have the kit placed in the center of the room farthest away from the walls. If I had more time, I'd try putting them a couple of different places (pending practical considerations like mic panels, entrance/exit doors etc, and other musicians I have to record at the same time). You can use wall surfaces to change the sound of the kit dramatically--placing the kit in corners will build bass, hard surfaces add a splashy brightness, rugs and padded walls absorb high frequencies and contribute to a deader or drier sound.

Drum Overhead or Overall Mics

Contrary to a lot of novice recordists, the overhead mics are not for just recording the cymbals. Each drum and cymbal should NOT be treated like separate elements coming out of a sampler or drum machine. Consider the drum set as one huge acoustical instrument with many moving and different sounding parts. Start by capturing or documenting the entire event. After you've achieved that, all further miking techniques, effects, drum tuning etc. become part of music production--be it straight ahead Pop, Rock, Hip-Hop, R&B, Smooth Jazz, Country or whatever.

The best and most important place to start is with the overhead or overall microphones. I compare these mics to the main orchestral mics placed usually near and above the conductor's head. And just as for the orchestra, these overhead drum mics tell you just how the drums actually sound--good or bad! You'll hear how they are tuned and how good a drummer you have and how the room is adding to or subtracting from the sound. If the overheads are placed correctly, you'll hear the kit in the actual balance the drummer achieves. If the drummer is a basher who hits the cymbals as hard as he hits the toms,

you'll hear that. If your drummer has a squeaky bass drum pedal, rattling hardware or a noisy hi-hat rig, you'll hear that too.

Always work on mic placement for overall drum balance; tonality through mic choice, signal chain, and equalization; and ambience by way of the overhead mics distant and room mic usage. After that is sounding good, the rest of the close drum mics act like "spot" mics just as used in orchestra recordings. Certain sections or soloists are separately miked because they are not heard well enough in the main microphones. If the sound of the kit is good just with the overheads, then it'll be fantastic when you add the close mics.

Monitoring In Mono

Always get drum sounds listening in mono--by monitoring all tracks in mono. Once all the parts of a drum kit are in balanced and well heard, I'll spread them out in stereo. Mono compatibility was a big issue in the old disc cutting vinyl days where the cutter head would lift out of the groove with excessive anti-phase component--spoiling the master disc. Today, mono compatibility is still important in digital audio because of all the paths and processing (.MP3 or .WMA conversions etc.) those digital files will take to final delivery and playback--via the Internet, radio and satellite uplink. Don't forget it has to sound good on a mono boom box, over mono TV or through an in-store PA system.

Microphone Choices

What kind of mics should we use for overheads? Condenser mics work best for overheads with large diaphragm models providing the best coverage of the entire drum set. Large diaphragms offer better low frequency response noticeable on the tom and snare drum's sound. Small diaphragms (due their smaller mass) respond faster and better to transients--this is usually perceived as a "brighter" sound with more articulation of the stick on the cymbals and toms. There will be a sharper "hit" or attack connected with striking each drum or cymbal.

Small diaphragm cardioid mics are more directional than large diaphragm cardioids and you might miss part of the kit if they are not exactly aimed. If you use small diaphragms on a very large and wide kit, three overhead mics could be required whereas you'd still be fine using two large diaphragms. More than two overhead mics is usually phase-problematic. Large diaphragm mics are more forgiving when it comes to aiming but their usually larger size requires bigger mic stands, more room and time to set up.

X-Y, ORTF, M/S, Blumlein And Wide-Spaced Pairs

There are two main types or approaches to drum overall miking: overhead and front/rear of kit. Both styles work using coincident microphone techniques such as: X/Y, Blumlein, M/S pair or non-coincident microphone pairs such as ORTF and the very popular method: wide-space cardioid or omni pairs.

Coincident pairs are simpler to set up and make foolproof stereo with good mono compatibility. Coincident pairs of mics produce a stereophonic effect by intensity; a sound source is closer to one mic than the other.

There are different reasons for using X/Y, ORTF, M/S, a Blumlein pair or wide spaced mics.



Hyde Street Studio A Live Room

M/S opens up more mixing options due to the inherent control you have over stereo width by changing the level of the side microphone. You must record the mid and side mic's signal on separate tracks and use a sum/difference dematrix to retrieve a L/R stereo image.

X/Y is simpler to do and requires no dematrix setup. X/Y angled from 90 to 135 degrees offers a wider image than M/S. M/S has better mono compatibility with stable center imaging.

Much like X/Y, a Blumlein pair consists of a crossed-pair of bidirectional (figure-eight) microphones mounted so that their pattern lobes are at right angles to each other. This method captures more ambience.

ORTF (Office de Radiodiffusion Television Francais) is where two cardioids are spaced 17cm (7-inches) apart and angled outward 110 degrees to the left and right. This method is similar to a binaural head microphone.

Ambience And The Room

The relative height of the overhead mics over the kit determines how much presence the kit has (in the form of direct sound) compared to the amount of the room's sound picked up at the same time. Lowering the overheads decreases the room ambience and increases kit presence. Too close and your drummer will probably hit them!



Hyde Street Studio D Control Room

For an even wider stereo "look" at the drum kit than is possible with coincident pair miking, use a wide-spaced cardioid pair. Try to space the two mics apart three times the distance to the sound source. Called the 3:1 rule, this will ensure phase coherence but make sure you're getting all the parts of the kit evenly--keep moving them around until you do. Omnis work great here and provide even more coverage, introduce more room sound for a more spacious sound although are less mono compatible and tend to sometimes sound slightly phasey.

Two mics at the rear of the kit are a whole other approach to overheads. They are set to pick up more of the snare, toms and kick than cymbals. Overall mics placed behind the drummer works well but the sound is partially blocked by the drummer's body. Placing them in front of the kit produces more kick drum attack but "masks" the high frequencies coming from the snare drum since it may be blocked by the rack toms.

Either way, this setup works great for drummers who hit cymbals as hard as they hit the toms and snare. It also works better when working in a very live and bright room. This is a more Rock approach where a specific stick technique on cymbals (like in traditional Jazz) is not usually part of the music. Also since the mics are closer to the floor, there is a bass build up that compliments the tom and snare sound. There is less of a left and right orientation with this setup so I'll aim the mics outward left and right to try an enhance the stereo width.

Stereo Perspective--Drummer's Or Audience's

Speaking of stereo, you should decide how you and your producer visualize the drum kit's sound image: from the drummer's perspective or from the audience's perspective.

A person mixing your recording might prefer the drummer's perspective and assume that the right overhead track (since you might have marked them just "L" and "R") is over the floor tom side and panned that track and the rest of the kit's tracks predicated on that assumption.

You should name your drum tracks so there is no confusion. Mark the overhead tracks so the left overhead is capturing sound from the left side of the kit where the floor tom is located and the right overhead is recording sounds from the hi hat side. (Audience perspective and right-handed drummer)

To avoid all this right/left-handed--perspective confusion, just mark one overhead as the floor tom side and the other as the hi hat side--unless the drummer uses a very unorthodox setup (that should be documented for the mixer), mixers will get this and correctly pan all the individual drum tracks like you did--or maybe all backwards for the opposite perspective but at least all the drum tracks will correlate.

Compressing the Overhead Mics

I often compress the overhead mic channels and record the compressor's output on two additional tracks. You may not use them at all but it is nice to have these in reserve. By the way, it sounds completely different to compress "live" mics versus recorded tracks. (Which you can always do any time.) Compressing the overs will liven the whole drum sound; it makes the cymbals usually too loud and sustain longer within the mix. The compressor will bring up room sound, noises, subtle playing, squeaky pedals and hardware clanks and, of course, flattens the dynamics.



Hyde Street Studio D Live Room

Bass Drum

With the overheads sounding good, it is now time to add the first spot mic: the kick drum. Producers and engineers look for a "marriage" or a "coupling" of the bass drum with the bass instrument because they both occupy and make up the important bottom end of the record. I prefer to hear the bass instrument play along with the drummer when

getting final bass drum sounds.

My usual starting place for the bass drum mic is half in and half out of the hole in the front head. This distance is variable and I try to keep the mic pointed exactly at the spot on the rear head where the beater hits to pickup the most attack. If there is too much attack, move off-center.

If there is no front head, then you can experiment by moving the mic around the perimeter of the drum shell and from the rim inward to the center of the drum. An assistant wearing hearing protection should make these moves while you listen for differences. You'll find a sweet spot!

If there is a front head, you can place the mic closely and try moving it around the perimeter again. In this case I might have to add a second mic on the beater side of the drum to get enough "snap."

An old '70s' trick is where the microphone goes right inside the bass drum. This produces a very present and dry sound that was great for disco music before the Linn drum machine. You should put a weight (sand bags are good) to hold the mic still and in place inside the drum.

I also like to place a second mic further out in front the kick drum to get a more ambient bass drum sound. Mixing these two mics is touchy business and I recommend using a separate track for this mic. Unless you build a tunnel to isolate the kick, you will get a lot of spill from the rest of the kit that could wash out the total drum sound if this front mic is monitored loudly. In Pro Tools (or any DAW) you can adjust the time (and therefore the phase) of this separate track after the recording.

Compression

When using a compressor on the bass drum, I'm not looking for a compressed, squashed sound. Gain reduction is almost zero...one to two dB max. I am looking for the added low end the compressor will

bring up...it is different from just equalizing in low frequencies. You can also help a drummer who has an uneven bass drum level with a compressor, but you have to commit to a heavier setting to actually fix this problem. Starting out compressor settings would be a medium attack time and a 3:1 ratio.

Snare Drum

I might end up using three mics for the next spot mic: the snare drum. I experiment often when recording snare drums. My ideal setup, when there is room in the tight area around the snare drum, is two mics on top and another on the bottom. I use a condenser and a dynamic on top and a dynamic on the bottom. More for a quick A/B choice behind the console while the drummer plays, I rarely combine (mix) the two top mics together. Snare drum mics should be all end-fire types as side-firing mics are hard to sneak in and around drum kits.

I always mic the underside of the snare drum even though I end up using it only about 30% of the time. Depending on the snare drum when a drummer hits hard, the attack or "stick" sound is so loud that you have to reduce the snare drum recording level so the peaks don't distort. You end up with very little of the snares' sound. You can use just about any mic under the snare and sometimes I'll tape the mic right to the post of the snare drum stand with gaffer's tape if I can't get a stand positioned in and around all the other stands--it doesn't matter even though the stand is vibrating. Very little of this microphone's sound is used in my close snare drum mix...no more than 20%. I always flip phase on this mic since the top mic is facing it. Using the bottom mic can brighten the snare sound differently than an equalizer.

True Aim

In general, I always aim snare and tom mics directly at the center of the drumhead where the drummer should hit the drum. I will record as much of the transient part or attack of the drum hit as I can. If I find I have too much "hit" and not enough tonality, then I'll move the mic slightly off center. You'll get more tone and less attack there. Aiming towards the rim gives you more of the higher harmonics. The mic should aim from above the drum looking down from an angle of 20 to 50 degrees.

With close miking, you are using the proximity effect to record more bottom end. Try to make sure not to aim the mic at a single lug by positioning it equidistantly between two lugs.

Pulling the mic back away from the snare drum greatly changes the sound. Doing this generally produces a more open and less choked off sound for a bigger sound with a little less attack and more ambience including leakage from the other drums and cymbals.

If you want to EQ the snare drum mic, use a very clean equalizer that can handle very high peak levels without distorting. Since a lot of the snare drum is heard in the overhead mics, I take the time to make sure the drummer is using the right snare drum for the song.

Tom-Toms

The floor and rack toms are miked from the top only. I have tried miked the top and bottom of toms and I don't think it is worth it except for some strange and very tonal sounds.

Both dynamics and condensers have advantages and disadvantages. Dynamics give you a "dry" and

immediately present sound. You'll have better isolation from the rest of the kit making balancing easier because dynamics are (in general) more directional. Dynamics are also better for loud drummers who hit hard. Condensers give you a fuller sound and are able to capture more of a drummer's subtleties. Condensers are great for light to medium drum volumes such as found in light Jazz.

Condenser disadvantages include: more leakage, more pickup of each tom's sympathetic vibrations when other drums are played, more expense and the risk of damage from being hit, they are (usually) larger, harder to fit in the kit and prone to distort more at loud levels.

Hi-Hat

The all-important hi-hat should be miked even though it usually cuts through all the other microphones. I read at online forums about people cursing the hi-hat--actually they should curse the drummer. This goes back to my opening statement about how a good drummer will achieve a great drum kit balance and playing a loud and/or overly "sloshy" hi-hat is not part of that.

Use a small diaphragm condenser for this bright sound that can handle good, hot levels. I try to get a mic close enough to be almost in the drummer's way and aim it right where he is striking the cymbals. A hypercardioid microphone, like Neumann's KM185, with its back to the snare and the rest of the kit would further isolate the hi-hat track.

I record this mic on a separate track and I sometime roll out low frequencies so that the snare drum's (right next door) low end is not recorded on this track.

Room Mics

Room mics can often save an otherwise miserable sounding drum kit and lackluster drummer! Using hot room mics is my last resort mixing option. The opportunity for sonic treatment of a room mic is almost endless and I always record them on separate tracks for post-processing. You can really experiment here. One time I put a mic in the adjacent bathroom because the drums happened to sound very cool while visiting this room. I put them at my head height while in the sitting position.

Try placing these mics as a stereo coincident pair or wide spaced cardioids looking at the kit or maybe one mic on either side of the kit. You can put the room mics right on the floor, close to the ceiling or in corners to get a bass buildup.

Heavy compression effects work best and sounds better while the drummer is playing because the compressor (and your settings) is working with the microphone pre-amplifier/EQ's full dynamic range (as opposed to the recording medium's and playback system's usually lesser dynamic range and noise floor--be it tape deck or DAW). The old vintage tube compressors like a Fairchild 670 or an RCA BA-6A are popular for this, but I have had good luck with a two Mercury 66s, a pair of Universal Audio's 1176LNs, LA Audio's Classic II Stereo compressor (these are both FET-based units), Chandler Limited's TG1 EMI unit, Manley's Variable-Mu tube-based unit, and also a pair of Empirical Labs' Distressors.

Good Luck!

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