Everything your mic closet needs, and then some…
By Paul Stamler – Recording Magazine

What's the biggest difference between a beginner's home studio and a professional, "Downtown" studio? While a beginner's equipment may all work, there's a lot more to it than that. In a startup studio, the owner usually has a couple of good microphones and a couple of crappy ones, the latter probably snaggled from the band's performing mics. Typically, there's enough to record the drums, then add one or two parts at a time.
A professional studio, on the other hand, has a microphone collection that is both broad and deep: deep enough to supply a whole raft of musicians playing at once, and broad enough to allow a real choice of microphones, giving the engineers a good chance at finding the most appropriate match for every instrument.

In this article, I'm going to describe the contents of a really well-stocked microphone closet, as might be found in a professional studio of some years' standing. To make the job manageable, I'll divide the microphones into several broad categories. It's not out of the question for even a small home studio to be equipped with representatives from each category; to this end, I've subdivided the categories into price divisions.

Divide and conquer
These were the divisions that seemed to make sense:

• Low-priced—microphones that give a lot of bang for the buck. In practice, I chose as my delineator the Shure SM81; anything that costs less than that goes in this category.

• Happy medium—microphones in the middle range of prices, offering seriously-better performance than the low-priced units, but without breaking the bank. A project studio's "one good microphone" usually falls into this category. It's delimited by the SM81 on the bottom, and the Neumann TLM 193 on top.

• Sky's the limit—these are the microphones "Downtown" studios rely on every day, the ones that pay the bills. Anything more expensive than the TLM 193 goes in this velvet-lined box.

There are several ways in which you can break down microphone types: you can classify on the basis of pickup pattern, or (for condensers) tube vs. solid-state. I chose to classify them into broad categories based on the type of transducer employed, with an extra classification for specialized application mics. My categories were:
• Moving-coil (dynamic) mics
• Ribbon mics
• Small-diaphragm condenser mics
• Large-diaphragm condenser mics
• Specialty microphones, which include boundary mics, harmonica mics, kick-drum mics, lavaliers, stereo mics, and system mics (modular bodies with multiple capsules).

There'll be some messiness, I'm afraid, since (for example) the lavalier mics are mostly small-diaphragm condensers, with one dynamic. But these categories make operational sense.

Why should you spend more money?
Can't you do everything with a $200 condenser and a couple of SM57s? I'm sorry; you can't. At least, you can't usually do it as well. While there have been astonishing breakthroughs in the level of performance available in low-priced microphones, the big guys are still in another universe of quality. On some level, all other things being equal, you really do get what you pay for.

I still remember the first time I heard my voice coming through a really good microphone. It was a Neumann U 87, and I'd never heard anything like that sound; it was hard to believe that this was coming from my mouth, and yet it was closer to the way I imagined (and hoped) my voice would sound than any other microphone had ever gotten. There was stuff there that lesser microphones hid in the mud; detail, warmth, all the things that give a voice that

reach-out-and-touch-it quality. It was a revelation; I've still never found another microphone that does that for me. (Anyone wishing to lend me a U 47 for comparison is welcome to email the magazine. I'll need it for, oh, five years or so.)

On a more mundane level, when you spend more money on a microphone you get better quality control, and there's a greater chance that two microphones with the same model number will actually perform similarly.

Why should you spend less money?

Having said all that, I shall now proceed to contradict myself. A month or so ago I played a dance with our band, live, in a place we've played dozens of times. Usually I put a Neumann KM 84 on Paul Ovaitt, the mandolin player, but this week I was traveling heavy and didn't want to schlep the extra case with the Neumanns in it. So I figured we'd make do with an Oktava MC012.

Make do, my foot. On that particular mandolin, the Oktava beat the pants off the Neumann; it was richer, it was clearer, and the sound was truer to the instrument. I've since tried the comparison elsewhere, including in-studio, and while the Neumann is still going to be my first choice for most mandolins, the Oktava rules for Paul's.

This is a perfect illustration of the rule that the rules are rubbery, and will stretch often. Everyone "knows" that the KM 84 is "better" than the MC012, but "better" is an abstract concept, and in this case it didn't match real-world practice. Particular instruments (or voices) call for particular solutions, and while it's more likely that an expensive microphone will be good for a particular task, it ain't necessarily so. (Another example: When Dolly Parton recorded for RCA, with every jewel Neumann ever made available to her, she did her singing through a particular Electro-Voice RE15, because that was the one that was right. RCA kept it in a safe, with her name on it.)

The myth of the universal

Okay, you ask, but can't I at least do everything with a single U 87, or another expensive microphone?

No, not really, although if you're careful and do a lot of planning an expensive large-diaphragm condenser can do a lot. But…

Large-diaphragm condensers ("LDCs"), which are the usual candidates for universality, typically have pretty weird response off-axis, a function of the size of the capsule and the microphone body around it. This can be a boon if you need to tailor a vocal sound by rotating the mic a few degrees, but it can make leakage a screaming mess if more than one thing is happening in the studio. Instead of an LDC's brightness, you might want the warmth of a ribbon, or the nice combination of smooth off-axis response and front-and-center thunk you can get from a medium-diaphragm mic. Or you might want some dynamic-microphone compression on a kick drum or a guitar amp, or the simpler, less-cluttered sound of a small-diaphragm condenser. You might want stereo.

Which is why "Downtown" studios have those big closets.

The brightness thang

For reasons I don't quite understand, microphones have been growing brighter in the last decade—and some of them, especially the lower-priced ones, have become more noticeably harsh and "spitty" at the top.

This doesn't really make sense. The recording world, especially the project-studio world, has gone digital, front to back, and it's a characteristic of digital recording that it puts a searchlight on any high-frequency problems. Digital, especially inexpensive digital, has a tendency to make things brighter; so why add to the problem by designing in more and more aggressive peaks? Some great microphones from the early years—the AKG C 12 and Telefunken ELA-M251, for example—were quite bright, but they were intended to push through analog recording systems that were softish on

the high end. Now that the systems have shifted, wouldn't you expect the items of desire to have shifted too?

Well, they have, to a certain extent; David Royer of Royer Labs, Wes Dooley of AEA, and the gang at Coles have been doing a good business in mellower-sounding ribbons. But the fashion for brightness remains, and certainly a bright-topped vocal microphone can cut through dense backing tracks like a knife. So I'll quit ranting, but not before I make a concrete suggestion: Bright microphones need better preamps.
To simplify an argument I made in a previous article ("Just Like Downtown," Recording January 2000), degradation is cumulative, and inexpensive preamps/consoles and A/D converters tend to exaggerate and multiply intermodulation-distortion problems. These problems are worse with brighter microphones, and a bright mic plus a cheap preamp can equal a headache.

If you must use cheap preamps, you might want to focus your mic acquisitions on flatter or mellower microphones rather than the C 12-like bright ones; a BLUE Mouse, for example, will sound a lot better through a preamp like the Great River or Grace than it will through the preamps of a cheap board. So will, say, a Beyer ribbon, but the difference will be less acute.
If, on the other hand, you want and need brighter-sounding microphones for the music you make, you should be prepared to invest enough money to give them the preamps they deserve.

Tubes redux

Condenser microphones require an amplifier to couple the capsule to the world. For forty years or so after the condenser mic was invented, this was provided by a vacuum tube, with a transformer on the output to drive a low-impedance balanced line.

Tubes are hot, they wear out, and they need an external power supply to run their plates and filaments. Worst, they can be microphonic in their own right, although specially-designed tubes are a great improvement over the bog-standard ones we normally buy. (And they cost to match, when you can find 'em.) The transformers, unless they contain a big chunk of iron, can saturate on loud signals, and their bass response is sometimes wonky.

For all these reasons, when reliable field effect transistors (FETs) became available in the 1960s, manufacturers rushed to put them into their microphones, displacing tubes almost completely. Microphones like the U 87 and the AKG C 414 series used essentially the same capsules as their tube predecessors, but without the tubes. Later, some manufacturers (beginning with Schoeps, I believe) dispensed with the transformer as well, replacing it with a pair of bipolar transistors. And all was hunky-dory.

Until something curious happened: experienced recording engineers bought and used the new microphones, but they kept on using the old ones. The FET-equipped microphones had their own sound, and it was radically different from that of their tube counterparts. Typically an FET mic would be "crisper," while the tube unit (same capsule and housing) would be "smoother" and "richer." And while the FET mics found their place, on many occasions engineers (and musicians) preferred the sound of the tube mics, warts and all.

So tube mics came back, pioneered by Groove Tubes, until now most serious microphone manufacturers have at least one tube condenser mic in their line—some astonishingly affordable, others up there with the moon and stars.
I'm an old tube guy who's been preaching the vacuum gospel for thirty years, but I have to say that I think all three technologies—tube, FET/transformer, and FET/transformerless—have been used in excellent microphones. I own all three, I use all three, and all three are capable of being the right mic at the right time.

Cash and carry

The prices I list are mostly street prices, either the best I could find after cursory Internet searches, or by calling a friendly dealer for mics aren't sold online—that's to give a rough idea of

what compares with what, since MSRP discounts vary wildly. Some mics are never discounted, or are only sold factory-direct; those are marked MSRP. There's no guarantee you'll be able to find exactly the same prices I did, but at least I'm in the ballpark. I've rounded prices to the nearest $5.

I've limited myself to microphones that are available now, not vintage units whose prices are measured by the carat. Those deserve an article all their own—one of these days perhaps I'll write one.

The de facto pickup pattern for project studio mics is cardioid. It's not always the best choice, but it's the most common one (yet another article!); unless I say otherwise, mics listed here should be presumed cardioid.

I suppose it'd be possible to write an article like this with no indication of my preferences, but it'd be boring as hell. So this article is larded with the occasional opinion, which you can correct for easily enough, like bicycling on a windy day. Most of the time I like smooth and natural, hate harsh, and try to make recordings that put the spotlight on the sound made by the actual instruments and voices, with minimal messing. Your mileage will certainly vary (heck, mine does some days too), but now you know my bias and can compensate mentally, like I do when reading William Safire.

Finally, I haven't even begun to cover every microphone on the block; I have over a hundred in this article, and there are plenty I've missed. The absence of a particular microphone from this survey doesn't indicate anything except the finitude of time.

This mortal coil

We'll start with the microphones most of us start with, usually borrowed from our performing kit: moving-coil (dynamic) mics. These work like a loudspeaker (or, really, a headphone) in reverse. Sound waves strike a diaphragm, which is connected to a coil of wire suspended in the gap of a magnet. As you remember from science class, moving a wire near a magnet generates a flow of electricity, and as the coil moves in and out it generates a voltage which is a representation of the sound waves hitting the diaphragm. A transformer steps up the voltage and sends it down the wire.

Dynamic microphones have some important limitations. For one thing, the diaphragm-plus-coil assembly is pretty massive, which limits how quickly it can be accelerated by changes in sound pressure. This, in turn, limits the high-frequency and transient response of the microphone. The large diaphragm, edge-suspended like a speaker's cone, is also prone to breakup modes at high frequencies, leading to sharp resonances and spikes in the response. These can be a bug or a feature, depending on what you're after, but it should be noted that some microphones have done an excellent job at damping down these resonances.

Another potential problem arises from the fact that most moving-coil mics have lower output voltages than most condenser mics, typically 10–15 dB less under comparable conditions. Most of the time this isn't an issue as long as the mic preamp is adequately quiet, and in fact it can be positively useful when recording loud things like kick drums and guitar amps. These probably aren't the mics for a clavichord, though.

Because moving-coil dynamics are essentially coils of wire, transformer-coupled, their output impedance is sometimes complex. This makes them more sensitive to loading than some other microphones, and indeed they can sometimes change their sound radically when operated into different preamps. (If you're easily lost when discussing impedance, fear not; I understand Mike Rivers has a worthwhile article series on the subject coming soon in these pages.) Moving-coil mics have some important pluses, too. They're usually pretty tough; I have a few dynamic microphones that took 6-foot spills onto concrete during live shows, and I put them back in place with every expectation that they would still work fine. They did.

These microphones also overload in a benign way; when faced with excessive sound pressure levels, they "soft-clip." Used on guitar amps or kick drums, they act as instantaneous compressors, often a most desirable character. In the low-priced division, we start with two classics (with variations), the Shure SM57 ($80) and the Electro-Voice 635A ($100). The Shure is the descendant of the famous Unidyne microphone, and it has found a home at a million gigs and in thousands of studios. I've gone on record that it isn't my favorite—a little too spiky at the top—but that's me and my tastes, which are sometimes contrarian. For many people it's the microphone of choice for guitar amps and snare drums. A little pricier, the Shure Beta 57A ($140) is similar in design and intent to the SM57, but a little more suave and smooth, which I think is worth the money.

Not that many folks use the omni 635A outside of radio and television (it's a standard interview mic), but Scott Dorsey really likes it for guitar amps. The Electro-Voice RE50 ($145) is basically a 635A with a super internal shockmount, which makes it usable for places where the floor is shaking, like near drummers. The hypercardioid Electro-Voice RE16 ($185) is one of the few survivors of a noble family that began with the 660 and 666, microphones designed with "Variable-D," which means they have very little proximity effect so they don't change tonal quality with distance from the subject. I loved the RE15, may it rest in peace—it's still my "desert island microphone," wonderfully flat on- and off-axis. The RE16 incorporated a pop filter; it's a little brighter and not quite as smooth, but it works well on percussion.

Also hypercardioid, the Beyer M 201 ($270) is similarly smooth, but has heaps of proximity effect. I like it as a drum overhead when I want raw power; somewhat surprisingly, it's also good on gentle instruments like hammered dulcimers. The Sennheiser MD 421 II ($300) is the successor to a classic rock'n'roll mic (see the film The Concert for Bangla Desh to hear and see them everywhere), with a shape like a spaceship. The newer model, introduced a few years ago, is a good deal brighter than the original.

Moving into the medium bracket, Shure's SM7B ($360) is so suave, it ought to be wearing a velvet smoking jacket. This mic, popular among FM announcers for decades, is just the thing to take the edge off a nasal vocalist or too-edgy drum.

The Beyer M 88 ($400 MSRP) deserves a paragraph of its own; to my mind it's the great mic nobody knows about. It's bright, but not spiky-bright; instead, it has a smooth high-frequency plateau rather like the effect of a shelving equalizer. Hypercardioid, it handles kick drum with aplomb, and it's a grand vocal mic as well. It's also great on ethnic percussion (see "The Doom of the Dumbek," Recording October 2002). One of these and a couple of Oktavas can get you rolling in a very professional-sounding way.

The Electro-Voice RE20 ($400) is another classic radio mic, but it has found a home in many recording studios as well, on vocals, kick drum, amplifiers, close-miking snares and toms, and even on the occasional acoustic guitar. A hypercardioid variable-D mic, it has little proximity effect, and the same broad high-frequency bump found in the older models of the Sennheiser MD 421. Like its little RE16 brother, its frequency response on-and off-axis is similar. Finally, topping out the medium-priced moving-coils (there are none in the high bracket), the Sennheiser MD 441 ($700) is a big brother to the MD 421, with a clean, robust, "big" sound and a tight hypercardioid pattern. It hasn't gotten much attention, probably because of its price, but it deserves some acclaim.

Scarlet ribbons

The ribbon microphone has a noble pedigree, having been essentially invented by the great RCA engineer Harry Olson and his team; it was the standard broadcast microphone during the golden age of radio, and some magnificent 78s

by people like Paul Robeson, Billie Holiday, and Ella Fitzgerald were recorded using ribbons.

It works by the suspension of a thin foil ribbon between the poles of a massive magnet; sound waves vibrate the ribbon, which induces a current to flow. (A stepup transformer couples the ribbon to the output.) Notice that the diaphragm and generator are one and the same, dramatically reducing the moving mass and greatly improving transient response. Ribbons also seldom have the sharp high-frequency resonances of moving-coil and condenser mics, so they're renowned for a smooth top end and a warm, rich sound.

They're also renowned for being fragile; a tiny puff of wind or breath blast (not to mention the whap of a kick drum) can permanently deform the ribbon. Recent designs are more robust than the classics, but one is still advised to handle them with care (Royer Labs, in fact, provides a cloth bag to store their mics when they're not in use, to keep them from the howling wind). Ribbons are also significantly low-output, low enough sometimes for noise to become a real issue. They're wonderful on voices, especially women's voices, but if the voice is soft and whispery, the singer had better be close-in, or the microphone's self-noise will be audible. (Of course, soft and whispery voices sound better close-in anyway.) This is probably not the mic for a dulcimer. (But see the Royer R-122, below.) Ribbons are also, like moving-coil mics, snickety about loading, and can sound quite different through various preamps.

With all that, though, ribbons are making a comeback in this digital age, and it's about time. Their smooth top end is perfect for avoiding the excitation of trouble in digital systems, and the clean, clear sound without extra fizz makes a remarkable contrast to many condenser microphones, even expensive ones. A good ribbon can also pick up tiny mouth-sound details in vocals that nothing else will capture, great for verisimilitude.

Ribbon microphones are bidirectional (figure-8) by nature, but a few models incorporate acoustic phase-shifting networks to make them cardioid or hypercardioid. In the low-priced division, Beyer's M 260 and M 500, both hypercardioid, have been popular for years. The M 260 has a more-or-less flat response with a little bump at 10 kHz; it's enormously popular among female vocalists (both live and in-studio), and indeed it's usually my first choice on a soprano or mezzo singer. The strong proximity effect adds chest tone, good on most women's voices but usually too boomy on men's, although a few guys with reedy voices have sounded good on M 260s. It also does a wonderful job on some mandolins and banjos, finger cymbals, and Margaret Nelson's small hand drum, and Ted Levin did a whole album of field recordings in Bukhara with a pair of M 260s and a DAT recorder. I'd be lost without mine.

The M 500 is a whole different ball of fish. Its frequency response rises steeply, and it's bright, bright, bright, but with the extra warmth that comes with a ribbon (and lots of proximity effect). Rock and roll, for sure. But Beyer also recommends it for things like the bodhran, and I'd guess that the brightness brings out the skin sound.

Moving into the middle price range, still within the Beyer fold, we find two double-ribbon microphones, the hypercardioid M 160 and the figure-8 M 130 ($530 each). Both of these are renowned for astonishing smoothness; a jazz studio of my acquaintance used nothing else for drum overheads, and they make cymbals sound smooth as silk. These are matched designs, and can be used in tandem for M/S recording, where a forward-pointed directional mic (the M 160) picks up the mono signal, while the side-facing figure-8 mic (the M 130) captures stereo difference information; the signals are later matrixed to create a stereo L/R pair with virtually perfect mono compatibility. (See Robert Auld's 'In The Studio' article on classical guitar recording on page 38 for more details.)

The Coles 4038 ($950) has some history behind it. Originally designed for the BBC, and manufactured for many years by STC, this figure-8 microphone was used on many recordings during the British invasion, including a lot of Beatles records. It has recently regained popularity, and well-deservedly so. The 4038 looks both impressive and odd, rather like a stuffed metal mitten with no fingers. The Royer R-121 ($1095) is one of the newest ribbon designs, more rugged than one expects from a ribbon. Again, it's a figure-8.

Now we come to the high end. The Royer Labs SF-1 ($1250) is a different design from Royer's other microphones, tracing its lineage back to the sweet-sounding Bang & Olufsen figure-8 mic that was imported to the USA by Dynaco back in my childhood. This is a delicate mic with a delicate sound, not to be slammed around. The Royer R-122 ($1500) is something else again. Remember I said that ribbons are low-output and fussy about loading? David Royer realized that since phantom power is ubiquitous in studios these days, he could incorporate a head amplifier into a ribbon mic (the actual mechanism's the same as an R-121) and alleviate both problems. The amplifier boosts the output by about 15 dB compared to its sibling, and its output impedance (via transformer) is essentially resistive, making it relatively immune to loading effects.

Finally, we get into Rolls-Royce territory, or should I say Duesenberg? After years of servicing classic RCA ribbon mics, Wes Dooley went into the business of replicating them. His first model was the AEA R44C ($3200), a near-clone of the famous RCA 44BX, which powered thousands of radio programs and recordings. It's pure figure-8 and pure smoothness as well; it's also pretty big and heavy, so you'd best have a serious mic stand ready if you buy one. Like other classic ribbons, the R44C's output level is pretty low, so Wes designed a version using a more powerful modern magnet and correspondingly higher output, the AEA R44CX ($3600). He's also released a more affordable ribbon mic, the AEA R84 ($900).

Condensed version

Condenser mics come in two flavors: small diaphragm (less than 1″ diameter) and large (1″ and greater). Small-diaphragm condensers (hereafter SDCs) are the Cinderella stepchildren of the microphone world; they do a lot of the routine work, but never get the adulation. It's a bum rap; because of their smaller diaphragms, SDCs have the potential for smooth, uncolored off-axis response, which can be a life-saver when you're recording multiple instruments, or when you're far enough away from the noisemakers that room sound becomes important. They're often first-choice for instrument miking, but last for close-in vocals, since they have a tendency to react very badly to P-popping. On the other hand, they're glorious on choirs and other distance-miked vocals, and I've used them at 8′ to record a soprano. (What's the difference between a soprano and the PLO? You can negotiate with the PLO.)

A condenser microphone uses a thin, charged membrane mounted in front of a metal plate as its generating engine; simplifying a bit, as the diaphragm moves toward the plate, it pushes electrons out into a high-value resistor, causing a positive voltage to appear across that resistor; when it moves away from the plate, it pulls electrons in from the resistor, causing a negative voltage to appear. This voltage is buffered and/or amplified by a tube or FET (I talked about that earlier), which is then coupled to the world by a transformer or a pair of transistors.

Because the diaphragm is the only moving part, and it's very low-mass, condenser microphones excel in their response to sharp transients. The down side is that breakup modes in the diaphragm and cavity resonances in the capsule can still cause peaks or bumps in the high-frequency response, and juggling these resonances with diaphragm tension and spacing from the plate, material choice and the like makes the design of condenser microphone capsules (and their repeatable manufacture) a deep and mysterious art.

The diaphragm is usually made from plastic film, coated with metal; some microphones, however, particularly measurement devices, use pure metal sheets, rolled thin. A few microphones, notably Shures and Audio-Technicas, use "electret" film, a plastic which has charge more or less permanently embedded in it (like Saran Wrap™, but more so); the rest charge the diaphragm with an external voltage derived from the phantom power or separate power supply. My list begins in the low-priced bracket with the bargain champion of SDCs, the Russian Oktava MC012 ($100–195). It's really a system mic (it has interchangeable capsules), but since it's often sold as a cardioid-only microphone it deserves its spot at the head of this list—especially since it can, at best, provide more audio bang for the buck than any mic in my closet. I use them for stringed instruments (banjos, mandolins, some acoustic guitars), drum overheads, and choirs, among other things.

Why do I list two prices? The MC012 is available from several retail outlets for $150, maybe $100 on sale, but it's also available for $195 elsewhere. Why should you pay the higher price? Oktavas tend to suffer from the poor quality control endemic to Russian factories; the more expensive units have undergone additional inspection and grading to ensure that they meet specs and, if you buy two, are matched in sensitivity and sound. Worth it, in my book. Similarly priced, the RØDE NT3 ($140) is hypercardioid. The MXL 600 ($200), a Chinese-based design, has gotten some good comments on rec.audio.pro (a USENET Internet newsgroup). A perennial Scott Dorsey recommendation, the Crown CM-700 ($220), has been around for quite a while, and has a tighter-than-usual cardioid pattern.

The Electro-Voice RE200 ($240) is an unusual critter: it's a small-diaphragm condenser with flat response until you get to about 8 kHz, where there's a whopping sharp 8 dB peak. With my taste for flat, that's just the sort of thing I'd be expected to hate, but when I got them for review (April 1997) I found that they were my microphone of choice on guitar amps (the peak comes right around the place where many guitar speakers roll off, and adds a little sparkle to the attack) and hand drums (the peak delineates the skin sound). So I bought 'em, and use 'em a lot. I recently tried the M-Audio GT33 ($280), made by Groove Tubes, which is a medium-diaphragm solid-state mic. In my review I found the sound very close to that of a Shure SM81, but the GT33 has an omni capsule available as an accessory, which the SM81 doesn't. The Audio-Technica AT4041 sells for $300, and has a reputation for low coloration (I haven't tried one yet).

Bob Ross reviewed the RØDE NT5 ($300 a pair—yes, I said a pair) in January 2003 and found it to be exceptionally flat, even mellow-sounding compared to some of the peakier mics out there. Sounds like just the thing for a particular fiddler I know. Last month I reviewed the Shure KSM137 ($300), which has a little bump up at 9 kHz and exceptionally clean sound, and which likes nice preamps. Finally, the Shure SM81 ($330) deserves the title of classic; its uncolored sound and smooth off-axis response have made it a studio workhorse for a couple of decades. Arbitrarily, I've made the SM81 my delineator between the low- and medium-priced divisions; not arbitrarily, its flat response makes it my reference when testing new microphones.

Moving into the middle division, the MBHO MBNM 440 ($370) comes from a German company, better known for its system microphones, that's just beginning to be known in the American market. The AKG C 451 B ($400) is a modern incarnation of a vintage classic that made a reputation as a good mic for acoustic guitars (and in fact the original sounds better on my Martin than anything else I've tried). The old one was a system mic, with several interchangeable capsules and a series of amplifier bodies; the new one is cardioid-only, with a fixed capsule and a new amplifier design, so it's more a modern creation than a vintage replica.

The Shure KSM141 ($399), also reviewed last month, adds to the KSM137 the option of an omnidirectional pickup pattern, controlled by a moving metal piece that closes off the back of the capsule (shades of the RCA 77 series!). The Josephson C42 ($480 MSRP) is a lower-priced entry in what has hitherto been a high-bracket microphone line—see the review in this issue. Our first tube microphone in this roundup is the M-Audio GT44 ($410), which I reviewed along with its siblings in the November 2002 issue. I liked it a lot on string bass and percussion instruments like congas, where it captured the thunk with remarkable impact. A pair of them makes a nice set of drum overheads too. Like the GT33, this mic has an omni capsule available.

Earthworks has recently been making a name for itself with small-capsuled microphones that promise exceptionally low coloration and wide bandwidth. Their SR68 ($420) and TC30K ($485) have hypercardioid and omni pickup patterns, respectively. The Shure KSM32 ($500) uses a small-diaphragm capsule in a side-address housing, which more usually houses a larger capsule. Like the KSM137, its electronics are very clean.

For many years the Neumann KM 84, with wide and flat frequency response, on and off axis, defined the small-diaphragm condenser microphone's virtues. The KM 84 is gone; its replacement is the KM 184 ($520), which follows the fashion for brightness by adding a bump at 10 kHz. Unlike the KM 84, its capsule is non-interchangeable.

Two more from Earthworks, the SR77 ($550) and the QTC1 ($800) offer more wideband, uncolored sound, in cardioid and omni patterns, respectively. The Audio-Technica AT4050 ($600) is unusual, being a three-pattern microphone with a small capsule in a side-address package, reminiscent of the Neumann KM 86.

Leaving aside the system microphones (these are usually, but not always, small-diaphragm condensers), we are ushered into the high end by a series of microphones from Sennheiser that use the condenser capsule in an unusual way. Instead of the standard head amplifier, described above, these mics use the capsule as an element in an oscillator circuit; the changing capacitance of the capsule frequency-modulates the high-frequency signal, which is then demodulated to extract the audio. They include the omni, cardioid and hyper MKH20, MKH40 and MKH50 (all $1190) and the bidirectional MKH30 ($1280); I reviewed the MKH40 in our June 1997 issue and was mightily impressed by its ability to grab and hold the listener's attention.

Another company with a long pedigree is DPA (Danish Pro Audio). Originally Brüel & Kjær, they made their reputation on high-quality calibrated, very flat measuring microphones until some recording engineers began using them for classical sessions. Knowing a good thing when they saw it, DPA introduced the DPA 4003 and DPA 4006 (both $1485); these use identical omni capsules, but the 4003's amplifier runs from standard 48V phantom power, while the 4006's uses a special outboard 130V supply for increased dynamic range. The DPA 4011 and DPA 4012 ($1665) offer the same amplifiers, but with a cardioid capsule.

The top of Sennheiser's FM microphone range is the MKH800 ($2600), reviewed March 2001, which has five possible pickup patterns. And the Curtis AL-2 ($3495 MSRP) is a tube small-diaphragm mic that is the top of the top end for SDCs.

Specialty Mics

I've sketched out the ground rules for choosing mics for a broad, deep mic closet capable of handling a variety of client needs, and provided a detailed look at several categories of microphones: dynamic (moving-coil) mics, ribbon mics, and the useful but underappreciated small-diaphragm condensers. Now let's round out our list.

Before I dive into the stack of large-diaphragm condensers, which threatens to topple over and crush my house, let's take a pleasant detour into

some less-traveled byways: the many designs I call “specialty mics.”

Lav lamps

First we have the little lavalier microphones, or “lavs;” these are more usually associated with live performance and TV/movie recording, but I’ve found many uses for them in the studio too, so they’re worth a mention—issues of size apart, some of them are simply good-sounding microphones. Most of them fall into the low-priced category.

For lavs, an omnidirectional pickup pattern is the norm, so that’s the default in this section. First up comes a maverick, the Shure SM11 ($100). Most lavs are electret condensers, but the SM11 is a miniature dynamic microphone, with a reputation for high SPL capability.

Audio Technica lavs have become a de facto standard in the folk and ethnic music scenes, offering good-sounding microphones at reasonable prices. The AT831b and Pro 35X (both $120) are cardioids, while the AT803B ($130) is an omni. A bit higher up the price scale are the Electro-Voice RE90L ($185) and Shure SM93 ($190).

In the midprice bracket, the DPA 4061B ($400 MSRP) offers exceptionally flat frequency response. So, by reputation, does the Sennheiser MKE2-60/K6 ($455), which is really part of a modular system but is often sold on its own.

Finally, the mysterious stranger: Last winter I heard the wonderful Danish band Phoenix perform; their bass clarinet player, Anja Prost, was using a couple of Ramsa WM-S2 lav mics and getting superb sound. A hard-to-find miniature mic with optional clip-on gooseneck, this mic is no longer available through regular import channels, according to Panasonic/Ramsa, and may not be in production any longer even in Japan.

Harps, boundaries, and getting your kicks

For many years, Chicago-style harmonica players have relied on the Shure 520DX (aka the “Green Bullet,” $120). It’s an omnidirectional microphone that normally ships wired for high-impedance; that means it’s designed to run into an amplifier, as Little Walter intended, rather than a mic preamp. You can, however, rewire it for low-impedance—but why would you want to? Similar in intent but very different in appearance, the Shaker Madcat ($120, reviewed July 1999—if you don’t have that back issue, you should, as it has no less than twenty in-depth mic reviews!) was designed by Ann Arbor harmonica whiz Peter “Madcat” Ruth; it too was designed to run into an amplifier.

In the 1980s, boundary microphones (usually known by their Crown trade name, “PZM,” for “pressure zone microphone”) had a distinct vogue. It has faded, but boundary microphones will still solve some studio problems when nothing else can. The classic is still the original Crown PZM-30d ($260).

I’ve mentioned several microphones above that work beautifully on kick drum; recently, manufacturers have been bringing out microphones dedicated to nothing but. The best-known are probably the Shure Beta 52 ($190) and the AKG D 112 ($200, reviewed way back in October 1987, our first issue!), the latter descended from the vintage D 12.

Two on a mic

Dedicated stereo microphones have been available since stereo became a commercial reality in the late 1950s. A midpriced possibility, and one that’s just plain cute as a kitten, is the RØDE NT4 ($450, reviewed January 2003). It has two small-diaphragm condenser capsules, similar to those on the NT5 we mentioned last time, mounted nose-to-nose in XY configuration on a single amplifier body. Like the NT5, its frequency response is flat verging on mellow, just the thing for a blatting horn section.

Moving upscale, the Royer SF-12 ($2250, reviewed June 2000) combines two figure-8 ribbon sections (each essentially an SF-1 as

mentioned last month), allowing their use in the so-called “Blumlein” configuration. Bidirectional (figure-8) microphones are good for stereo miking, if the room is good-sounding enough to allow it; their off-axis response is typically very similar to on-axis. Robert Auld talked about this in his Classical Guitar ‘In The Studio’ last month, if you want to learn more.

Finally, moving way upscale, the Manley Gold Reference Stereo microphone ($7200) combines a pair of large-diaphragm condenser capsules with continuously-variable pickup patterns, a rotating collar for an infinite selection of capsule angles, and tubed electronics.

I got a system, Louie

Microphone systems are another idea that dates back to the 1960s; separate, interchangeable capsules and amplifiers provide a degree of flexibility that can get you a lot of possibilities for a reasonable expenditure. A case in point in the low-priced division is the Oktava MC012 system ($200–$300), which offers cardioid, hypercardioid and omni small-diaphragm condenser (SDC) capsules. (See the discussion of the MC012 in the SDC section last month for the rationale behind the double price; check out www.oktava.com for more information.) Neumann really started the whole system-microphone thing with their KM [Kleine Mikrophone] series, all of which featured unusually flat response; as I noted last month, the KM 80 series is gone now, but it’s been replaced by the transformerless KM 180 series, which is not modular.

In the mid-price range, MBHO offers the 648 system, which gives you a choice of 7 capsules with various pickup patterns and frequency responses, including two side-address large-diaphragm units. A typical amplifier body, with one small-diaphragm capsule, runs $525; additional capsules are $250–$765 each. Their 603 system, using the same capsules but a transformerless amplifier, typically runs $640 with one small capsule.

A brand name guaranteed to give spell-checkers fits is the THE KR system. Like the MBHO, it offers various interchangeable capsules (small- and large-diaphragm) on a single amplifier body; we looked at a number of these in our October 2001 issue. However, their capsule prices vary a lot, so an amplifier with a single capsule can run anywhere from $675–$930.

For many classical recordists, the Schoeps CMC series (a.k.a. the “Colette”) is a benchmark for high-quality, uncolored SDC sound. A CMC unit, with one capsule, will run anywhere from $875–$1350, edging into high-end territory. The same capsules can be used on a tubed amplifier body; this now becomes the M222 series, and prices run from $1850–$2245.

American manufacturer David Josephson makes his Series Six system; also SDC, an amplifier-plus-capsule costs $1100-$1225. And the BLUE Bottle (typically $4395 with one capsule) is patterned after the famous Neumann CMV 3, with interchangeable capsules on a large cylindrical body (filled with tubed electronics) that let you tailor the pickup pattern and sonic flavor to your heart’s content.

The Shanghai perplex

Hoo boy, now we come to the big category, large-diaphragm condensers (LDCs), and immediately we run across a huge, indigestible lump. To wit: I think there are more large-diaphragm microphones, sourced in China and selling for under $500, than there are hot dogs at Jones Beach. In the five or so years since these mics became available, they have proliferated to the point where listing them all would make this article (already much too long) into the Recording equivalent of War and Peace.

It’s not surprising that these microphones exist in such a bewildering variety. The manufacturer provides a series of lists from which a company can choose: body shape, screen shape, capsule response tailoring, rolloffs, transformer/transformerless/tubed, et cetera. You pick from the columns, silkscreen your logo on the body, and you’re in business.

So I'm going to punt, and talk about most of the Chinese mics in a lump. In a way, they have wrought tremendous change in the project-studio world, as the better ones offer a level of performance not previously available in their price range. There are, however, a few things worth noting. First, as everywhere in the world, within the confines of the breed, you get what you pay for. The $400 Chinese microphones typically have better electronics than their under-$100 brethren, and the transformers (if present) are usually better too. Perhaps more important, the less-expensive mics necessarily have poorer quality control; if you're retailing a microphone for $90, you can't afford to reject a lot of capsules for being out of spec.

So the rule remains, as always: use your ears. Particularly if you're buying toward the lower end of the price range, be sure you have a chance to listen to the actual unit you're buying, and be sure you buy from a store or mail-order place that offers an ironclad money-back return policy. (A restocking fee is standard, and fair, for this sort of return.)

Remember also that if you get a microphone with a good-sounding capsule, the sound can almost certainly be much improved (especially in the important high frequencies) by replacing the electronics with Scott Dorsey's modification (Recording January 2002). And remember the rule that the less expensive your preamp and A/D, the better off you're likely to be with a flatter mic.

All that said, if you shop carefully, you can get a lot of sound for a very reasonable price.

Condensed milk

Here we go (deep breath): In the low-priced category, in addition to the broad variety of Chinese microphones, the Australian RØDE NT1-A ($200) and NT1000 ($300) have been popular among project-studio people for years. RØDE, I believe, originally used Chinese parts but switched to another source a few years ago. The Audio-Technica AT4040 ($300) is relatively new; A-T's earlier 4000-series microphones have become studio fixtures (and not just in project studios), and this one is reputed to have less brightness than some of its stablemates.

The RØDE NT2 ($400) moves us into the mid-priced category, with switchable cardioid and omni patterns. The M-Audio GT57 ($420) is a Chinese-based 3-pattern mic (cardioid, omni and figure-8) mic with a difference: M-Audio has done a serious upgrade to the electronics, particularly the transformer. I reviewed this and liked it. Groove Tubes, which is responsible for the GT57, helped spawn the renaissance of tubed microphones with their MD-1 (reviewed November 1992). They've reintroduced it as the Model 1b ($490), again distributing through M-Audio. Welcome back to a modern classic!

Speaking of classics, one of the first condenser mics to have made a name for itself was a Neumann unit with its capsule in a round doohickey on top, resembling an old Standard Oil gas pump—that was the CMV 3, mentioned above. BLUE has taken this mechanical design, added solid-state electronics and a mellower-than-usual-for-them capsule, and called it the Baby Bottle ($500). Scott Dorsey liked it in his March 2002 review. At the same $500 price, the RØDE NTK (reviewed December 2001) uses hybrid electronics: a tube, followed by a transistor output stage rather than a transformer.

The Neumann TLM 103 ($650) was a breakthrough—the first LD Neumann to list for under $1000. It doesn't any more (ah, the whims of international currency), but it has nonetheless earned a place in many project and Downtown studios. Its capsule is a variant on the well-liked U 87 design, a bit brighter but with the same lower-end richness. My voice likes it. The M-Audio GT67 ($700) is the top of their line; another design with Chinese hardware and much-improved tubed electronics, it has cardioid, omni, hyper and figure-8 patterns available. The Shure KSM 44, also $700, offers cardioid, figure-8 and omni.

The AKG C 414 series goes way back; originally AKG used the capsule from the legendary C 12

series, with transformer-coupled FET electronics, in the C414-EB. That's been replaced by the vocal-tailored C 414 B-ULS ($750) and the transformerless C 414 B-TLII ($940), both offering cardioid, hyper, omni and figure-8 patterns from a modified capsule.

BLUE's Dragonfly ($780) looks like almost nothing in the world, with a spherical, swiveling capsule housing mounted on a slim metal body with transformerless FET electronics. I found it offered unprecedented flexibility in positioning, and the most remarkably accurate reproduction of a guitar amp I've heard. Did I say it looked like "almost nothing" else? The exception is its big-brother BLUE Dragonfly Deluxe, up with the high-priced spreads ($1300). It offers the same unique design with slightly upgraded and suaver-sounding electronics.

The Lawson L47SH ($995 MSRP) is an attempt to build a microphone similar in sound to the legendary Neumann U 47FET. Since no two U 47s sound alike, thanks to aging of their PVC diaphragms, it's impossible to say whether they've succeeded, but everyone who's tried an L47SH agrees that it's a very fine microphone in its own right.

Microtech Gefell is the corporate descendant of the original Neumann company; left shredded after World War II, and located in East Germany, they carried on the tradition in their way while Georg Neumann did the same in West Germany. Their M930 ($1000) offers a cardioid pickup pattern and FET electronics.

Audio Technica's AT4060 ($1050) carries on the 4000 series with tubed electronics; its sound is reputed to be smooth but detailed. Sony's multi-pattern C-48 ($1100) is another mic with a history; its capsule is modeled on that of the C37, an unsung microphone J. Gordon Holt used to make wonderful recordings in the 1950s and 1960s.

The Soundelux U195 ($1125) is cardioid and FET, with a brightish sound. And Neumann's TLM 193 ($1175) is a watershed; I arbitrarily made it the delimiter between the mid-priced microphones and the stratosphere. The TLM 193 is unusual; it's a large-diaphragm condenser mic designed without a brightness peak up top, and its response is both extended and flat. I used one for the first time last Christmas, and was mightily impressed. I want one.

Into the ozone

Now we come to the "jewels in the crown," the high-end large-diaphragm condenser microphones that have driven the majority of hit records for half a century. Although, as noted above, they can't do everything, every grown-up microphone closet has at least one, and usually several.

The BLUE Mouse ($1270) was the first microphone the company sold, and it made quite a splash, with its swiveling capsule, bright sound and cute ears. The MBHO MBNM-608 ($1355) offers selectable patterns (cardioid, omni and figure-8), while the Neumann M 147 ($1450) offers a capsule patterned on the one used in the U 47, with hybrid tubed/solid state electronics. RØDE's Classic II ($1600) offers nine patterns—the usual three, plus intermediate settings—and tubes. Lawson's L47C ($1695 MSRP) is a cardioid-only version of their U 47 inspired microphone; jumping ahead, the L47MP ($1995 MSRP) offers infinitely variable pickup patterns. Both use tubed electronics. And the Soundelux ifet7 ($1900) offers a unique take on the U 47 idea; it incorporates transformer-coupled FET electronics designed to mimic the sounds of U 47FET and U 87 mics.

The Neumann U 87ai ($1950) is the latest incarnation of the mic that gave me my epiphany, way back in the 1970s. There have been changes in production over the years, but the basic sound remains—robust lower-mids with a gentle treble boost. You still get the cardioid, omni and figure-8 patterns, and this is still one of my desert island mics.

BLUE's Kiwi ($2000) has a unique sonic signature; bright (like most of their products), but with a clean, rich deep bass. I found it excellent

for recording string or electric bass, among other things. The pickup pattern has nine settings, and it looks like a bigger Baby Bottle. Microtech Gefell's UMT800 ($2145 MSRP) offers five patterns, while their M92.1S ($2200) is a cardioid tube microphone made using the latest incarnation of the M7 (U 47) capsule. The UM92.1S ($2695 MSRP) adds omni and figure-8 patterns. Soundelux's U99 ($2250, reviewed October 2000) has a continuously-variable pickup pattern and a tube.

Neumann's U 89 ($2275), like the TLM 193 (which uses a similar capsule) never got the attention given to some of its flashier brethren; with a capsule slightly smaller than the U 87's, and five pickup patterns, it offers slightly flatter response and less off-axis coloration. A sleeper. From here on, everything has tubes unless otherwise noted. Lawson's L251 ($2,495 MSRP) is a modern recreation of the legendary and rare Telefunken ELA-M251, a microphone renowned for its bright and clear sound. (Essentially the same capsule went into the AKG C 12, equally legendary.) The pattern is continuously variable. Brauner's Valvet ($2500) offers cardioid and omni patterns; Manley's Cardioid Reference ($2700) was one of the first microphones of the tube renaissance. AKG's C 12VR ($2900) is a modern redesign of the classic C 12, offering nine pickup patterns, while Neumann's M 149 ($3000) also offers nine patterns, but uses hybrid electronics.

Two omni microphones with legendarily flat frequency responses: DPA's 4041S ($3040 MSRP) has FET electronics, while their 4041T ($3120) uses tubes. (DPA, you may recall, is the former Brüel & Kjær.)

Soundelux's U95S ($3150) is a new design offering nine patterns, while their E47 ($3500) is an attempt to get as close as possible to the sound of a new U 47; users say they've done a credible job. Microtech Gefell's UM900 ($4000) is an innovation: a tubed microphone (with 5 patterns) that runs from standard 48V phantom power, not needing a separate power supply. Its styling is unique, too, reminding me of a Victorian gaslight bracket. The Josephson C-700A ($4250) is a high-end FET mic offering continuously-variable pickup patterns.
Another microphone patterned after the ELA-M251 is Soundelux's ELUX 251 ($4500); with multiple pickup patterns, it's been called a near-clone of the original. Brauner's VM1 ($4500) has continuously variable pickup patterns, as does the Manley Gold Reference ($4950). And topping out the list with a bang, the newly-organized Telefunken (America) company offers its remake of the ELA-M251 for a cool $10,000 MSRP.

Whew
That's some closet, and some variety—from $80 to $10,000, from SM57 to ELA-M251. Well, that's what you'll find in a "Downtown" studio, and that's one of the reasons they get the fees and results they do.

I'm not suggesting that everyone with a project studio should emulate the folks Downtown. For one thing, we'd all go broke if we tried. But it's certainly worth diversifying one's collection of microphones to cover each of the broad categories I've described, in whichever price bracket you can afford. A broad selection of microphones of decent quality gives you a broader palate of sonic flavors from which to choose, and a greater chance of finding just the right match for a particular instrument or voice. Vive la difference!

And while you're picking out the right microphone, don't forget: we're in this for the music. Enjoy!

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