FIFTH ELEMENT

John Marks

On Mikes & Miking

A brief history of putting microphones in front of things

The intuitive way to make a two-channel stereo recording is to point, in some manner, one of two identical microphones at the left side of the anomalies are created by horizontal offset. Because the directional axes of the two mike capsules intersect, the coincident technique is usually referred to as the X-Y technique, after the axes on a mathematical graph.

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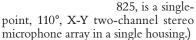
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For microphones look like typical mikes (ie, are shaped flashlights), the capsules vertically overlapped, right-hand mike pointing left, the lefthand pointing right, somewhat like an inverted V. The capsules are arranged at 90° or more to each preferably as much as 110° or 120°.3 Audio-Technica mike I recommended 2002, the AT-



Microphones that look like old RCA broadcast mikes or their progeny are meant to be used in an upright position, and for that reason are called side-address microphones. Coincident placement of two side-address mikes requires a special mounting bracket that holds one mike upside-down directly above the other, and which provides that the horizontal angle between them can be adjusted to 90° or more, as the case may require.

Near-coincident arrays include ORTF (named after the early French

hile you might have been paying attention to other matters, there has been a quiet revolution in affordable recording technology. What if I told you that I've been making pure Direct Stream Digital (DSD), SACD-quality two-channel recordings using equipment that, from soup to nuts, costs less than \$6000? Read on.

I last covered recording equipment in "The Fifth Element" in the August (Vol.25 issue www.stereophile.com/thefifthelement/651/index.html). That column remains the best place to start if you're just getting going. This column reports on some spiffy new equipment I've been working and playing with over the past few months.1

I begin with a microphone preamplifier that is remarkably, perhaps even uniquely, versatile: the True Systems P2analog (\$1999, frequently discounted; www.true-systems.com). The P2analog is designed to be equally at home in a project studio and on the road, doing live-totwo-track recordings. It has three features not usually found in two-channel microphone preamplifiers: two direct inputs (DIs), for instruments such as electric guitar, bass, or keyboards; Mid-Side (M-S) microphone matrixing; and an absolutely hypnotic stereo phase indicator.

I passed over the DIs, because I have never done that kind of recording. Based on the performance of the rest of the P2, I assume that they are fine. I used the M-S matrix function at every opportunity and enjoyed it immensely. And I couldn't stop watching the stereo indicator.

Because M-S microphone technique is far less well known than it should be, some theoretical background is in order.2 Fear not; this will be painless and enlightening.



Cutline

soundstage, the other at the right side. I say "in some manner" because there are, generally speaking, three ways to arrange two microphones for stereo recording: coincident, near-coincident, and spaced.

In a coincident microphone array, the two mike capsules are as close together as possible, usually one above the other, so that no arrival-time/phase

3 Mathematically, a coincident pair of cardioids angled at 90° gives just 6dB separation for soundsources at the left and right positions—"fat mono"—which can be increased by increasing the included angle.

–Ĭohn Atkinson

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² The scarcity of dedicated M-S-capable equipment is only part of the problem. Other than True Systems' P2analog, I know only of Grace Design's Lunatec V3 P2analog, I know only of Grace Design's Lunatec V3 portable combination mike preamp and A/D converter, and a portable mike preamp from Schoeps. AEA's standalone line-level (non-mike preamp) M-S matrix has fallen out of production, sad to say. On the good-news front, Sound Devices' hard-disk-based portable recorders include M-S matrixing. But the lack of dedicated M-S accessions are in not as kine at bank-based portable recorders include M-S matrixing. equipment is not as big a drawback as one might think: The necessary splitting, phase-inversion, and level adjust-ments of raw M-S tracks can be accomplished in postproduction on any fully featured mixing board.

¹ I am grateful to Jerry Bruck, of New York City's Posthorn Recordings (www.posthorn.com), for his constructive criticism of a draft of this column.

TV network) and any other pattern that places the capsules of the stereo pair a foot or less apart. Such techniques often depend on their capsules' placements mimicking the intra-aural distance; that is, the average distance between an adult human being's eardrums, which is roughly 7" (18cm).

In the ORTF technique, two cardioid mikes are placed 7" apart and angled outward 110°. Dutch (NOS) and Swiss (OSS) broadcasters developed other near-coincident schemes. The Dutch scheme actually predated ORTF, but after the Dutch tried the ORTF technique, they discarded NOS and thereafter used ORTF.

The Swiss OSS technique is better known as the Jecklin Disc. In that arrangement, a circular acoustical baffle approximately 1' in diameter is positioned between the microphones, which themselves are 7" apart. This enhances lateral localization for the higher frequencies, because the disc attenuates a certain amount of the high-frequency sounds the fartheraway mike would otherwise receive from off-center sound sources. Yet because the mikes used are omnidirectional, the lower-midrange and bass responses remain robust. The Jecklin Disc is at least the spiritual ancestor of Ray Kimber's Iso-Mike array-which John Atkinson detailed in his report on Robert Silverman's recording sessions for Beethoven's Diabelli Variations (May 2006, Vol.29 No.5), as well as of Schoeps' KFM-6 sphere microphone.

If an array is neither coincident nor near-coincident, then it is spaced. Spaced arrays are generally referred to as A-B techniques, as in Microphone A and Microphone B. Spacing is usually anything between 3' and 10'—or even more—depending on the size of the ensemble to be recorded. A-B technique usually uses omnidirectional mikes, although figure-8 or cardioid-pattern models are sometimes used. The spaced-omni technique has a long and honorable history; most of Telarc's classical recordings having been made with the label's own variant of it.

With so many microphone techniques, each having an at least plausible story to tell, one might be moved to ask: Why does the world need one more, distinctly nonintuitive technique; namely, M-S? Because, in practical use, each "intuitive" microphone technique has a drawback that is the mirror image of its strongest selling point. (In the following descriptions of these problems, I speak

in broad-brush generalizations. Great recordings have been made using just about every technique under the sun, including techniques that blithely ignore the laws of physics. Conversely, use of a high-zoot technique does not guarantee that the result will be worth

a figure 8, with a positive lobe to the front and a negative lobe to the rear.) The forward-facing Mid mike is usually a directional model such as a cardioid, although another figure-8 or even an omnidirectional mike can also be used. The Mid mike, in and of itself,

BY USING M-S TECHNIQUE, VERY FINE ADJUSTMENTS OF THE BALANCE OF DIRECT AND AMBIENT SOUNDS ARE POSSIBLE BY MERELY TURNING THE WIDTH KNOB ON THE M-S MATRIX.

listening to as music. We are in, after all, the realm of aesthetics. I can imagine someone taking issue with Anselm Kiefer over his art, but not over the brand of paint he buys.)

Spaced omnis give you a huge room sound, yet the specificity of center images can be somewhat vague. This is why Telarc's usual practice, which itself is a derivative of Bell Labs' technique, has been to use a centrally located omni mike bled into the left and right channels in order to firm up the center image. The "Decca Tree" is another such effort. By contrast, coincident techniques give great image specificity, but at the risk of a certain lack of the feeling of spaciousness. Near-coincident techniques can be an attractive compromise, giving more "air" or spaciousness than coincident placement, while having more specificity than spaced arrays. However, to use something like ORTF on a solo instrument such as classical guitar means that both microphone capsules are off-axis to the sound source by nearly 60°.

Would you photograph something to the north of you by aiming one camera west-northwest and another east-northeast? Of course not. It is not only a matter of filling the frame, so to speak. Most microphone capsules are most linear in frequency response for sources directly in front of them, and become less so the more off-axis they are to the sound source.

Mid-Side to the rescue. As nonintuitive a technique as one could ask for, M-S points one microphone directly at the sound source, the other 90° away from it. M-S usually uses two dissimilar microphones, one of which always must be a side-facing figure-8. (Figure-8 mikes are so called because their polar response or directivity looks like

being totally on-axis to the sound source, is as tonally true as possible, and also would give a completely solid center image. The problem is that that image would be monophonic, with no stereo information.

So here is M-S's cute trick. The Side-facing microphone picks up ambient information from the left side of the recording venue on its positive lobe (the "front" of the mike), while its rear-facing negative lobe picks up ambient information from the right side of the recording venue. By splitting the output of the Side mike in two and blending it in and out of phase with the output of the Mid mike, the M-S matrix derives Left and Right channels from a "virtual" microphone pair (assuming a cardioid Mid mike) of angled X-Y directional mikes. Mid plus Side equals Left, Mid plus phaseinverted Side equals Right.

There are two compelling and (one not so compelling) reasons to record this way, instead of just using two actual rather than virtual angled X-Y directional microphones. First, unlike X-Y pairs, in M-S technique the Mid mike is completely on-axis to the sound source. Obviously, this would make less of a difference for an orchestra than for a point source. But for natural recordings of voice, guitar, harpsichord, piano, or any other small source, it should make a worthwhile difference.

Second, by using M-S technique, very fine adjustments of the balance of direct and ambient sounds are possible far more easily than by moving the microphones' physical locations, by merely turning the Width knob on the M-S matrix.

The not-so-compelling reason to use M-S technique is actually the reason for which Alan Blumlein's invention of it was first commercially implemented, by Holger Lauridsen of Danish State Radio. M-S allows stereo broadcasts to be auditioned in mono with little or no degradation. When the Left and Right channels are combined, the ambient information, being phase and antiphase from a common source, cancels itself out, leaving a clear mono signal.

M-S's combination of stereo image flexibility and mono compatibility make it a natural for film-sound usc. Indeed, Jerry Bruck was Stereo Sound Consultant for *Fame*, believed to be the first use of M-S microphone technique for a motion-picture soundtrack. Since then, M-S technique has become well established in the film-sound industry.

Practical M-S

Unless you've had the experience of hearing the width of the stereo soundstage and associated room sound go from "not enough" to "too much," then back to "just right," all at the turn of a knob, you can't understand how empowering M-S technique isor how much good clean fun it can be. So here's what I will do. I will make a recording of a point source in which the stereo width goes from alldirect sound to all-ambient sound, then back to what I think is an optimum blend. When this column is posted on Stereophile's website, I will ask JA to post the recording as well, as a stereo MP3 file. You can then download it, burn it to a CDR, and play it on your stereo-or even just route it or Airport it over there, if you're set up for that.

To use the True Systems P2analog in M-S mode, you connect the Mid mike to Channel 1, the Side mike to Channel 2, and engage the M-S button on the front panel. The Channel 1 gain knob controls the volume of the Mid mike, while the Channel 2 gain knob controls stereo width. The P2's analog outputs then put out conventional Left and Right stereo signals. Of course, with the M-S function not engaged, the P2 functions as a conventional 2-channel stereo microphone preamplifier.

As if M-S capability weren't enough, the P2 also boasts a stereo image (phase) indicator consisting of a row of colored lights that run, left to right, from green to yellow to red. The left, green end indicates that both channels are largely in phase, which means that you are, intentionally or not, recording in mono. The right, red end indicates

that both channels are largely out of phase, which suggests that you might have something connected wrong, or that you really like the sound of an M-S array with all S and no M. Centered in the middle of yellow, with excursions into red and green on both sides, means that you're in the stereo ballpark. The stereo display is not only a confidence enhancer, it's addicting to watch. I was happiest with the image when the indicators were more green than red, but I hate the hole-in-the-middle effect.

The P2 has an aluminized front panel of a distinctive fire-engine red. Its industrial design and fit and finish are excellent, as is the owner's manual.

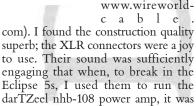
Into the sanctuary

Steve Dreyfuss, an affable local recording engineer, allowed me to tag along on some of his projects so I could play with my new toys. We first made about two dozen mike-position and

Design Model 201 (\$1995; www.gracedesign.com). This is a stripped-down hot-rod of a purist mike preamp: for each channel there is a single indicator light for signal presence (green) and the approach of overload (it changes to red). The construction quality is deluxe. Thoughtful touches abound, such as small ovals near each gain knob that are made of dry-erase marker-board material.

Because the Grace 201 uses stepped resistor arrays to set Gain, it also provides rotary-potentiometer Trim controls (with 10dB ranges) to set fine level adjustments. In normal practice, the Trim pots are left turned fully clockwise; fine adjustments are accomplished only by reducing the Gain. The Trim controls are good to have, because no matter how deft the hand that switches the Gain settings, there will be an audible discontinuity in the recorded sound as one set of resistors is switched out and another is switched in.

For both the True and the Grace, balanced analog outputs were carried to digital the recorders Wireworld Eclipse 5 interconnects (\$345/0.5m balanced pair; www.wireworld-



In two words, the True Systems P2analog is more analytical, the Grace Design 201 more lyrical. I think that both are cases of getting what you pay for. Were the final microphone choice to be an M-S array, the True Systems would get my nod; were it to be a more conventional arrays, I would choose the Grace Design. No tears and no hearts breakin', no remorse.



pattern tests in the Meeting House (1774–75) of the First Baptist Church in America, recording the 1884 Hook-Foley/Baker organ (which includes pipes from the original organ of 1834), preparatory to recording it for the Rhode Island chapter of the American Guild of Organists' planned CD documenting significant pipe organs of Rhode Island. Test-to-test repeatability was ensured by organist Steve Martorella's having recorded a one-minute soft-to-loud flourish onto the organ's hard-disk drive (a "player" system akin` somewhat to Yamaha's Disklavier), so it could be replayed at the touch of a button.

Not to take anything away from the True Systems P2analog, but if you're willing to spend about the same money and do without the P2's direct inputs, M-S matrix, and stereo indicator, there is one microphone preamplifier that I found sounded even more liquid, coherent, and involving: the **Grace**

The envelope, please

no letdown at all.

A few days after the recording tests at the Meeting House, Steve Dreyfuss, Steve Martorella, and I gathered to hear the results on the ESP Concert Grand SI loudspeakers, darTZeel amplifier, and EMM Labs source components. The differences were intriguing.

My favorite array was M-S with figure-8 microphones for both Mid and Side (in this case, AKG 414 dual-capsule, variable-pattern condenser mikes). I felt that this gave the most

detailed center image, as well as conveying information about the room's shape and size. Figure-8 mikes, however, roll off in the bass. That is a tradeoff I might be willing to make for my own listening, but in the real world, most people judge an organ recording by the bass pedals and little else.

A compromise I could live with was M-S mode, figure-8 for Side (of course) and wide cardioid for Mid. Interestingly enough, a third Steve, Stereophile's Stephen Mejias, with whom I shared the test record-

ings, preferred wide cardioids in X-Y mode angled at 120°. (I'll ask JA to put a representative selection of these tests up on *Stereophile*'s website as well.)

However, nothing gives an impression of size like an A-B spaced-microphone array. As of this writing we are still of two minds (at least) between spaced wide cardioids, which Steve Martorella and I think has the best overall tonal balance, and Steve Dreyfuss' preference for spaced omnidirectionals, which gives the most bass.

I like to benchmark my own work against commercially successful recordings, so one of the tracks I thereafter played was "Jul," from the audiophile staple *Cantate Domino* (Proprius CDP 7762). Steve Martorella did a bit of a double take and asked to see the CD booklet. He read it, looked up, and said, "I've played this organ!" Seeing as the organ in question is in Stockholm, all I can say is: schmall verld! I think our work held its own very well against *Cantate Domino*.

A new organ recording I've been listening to a lot is *In Spiritum: Olivier Latry Plays César Franck*, recorded at Notre Dame de Paris (SACD, Deutsche Grammophon 00289 477 5418). The playing and sound are beyond superb; the delicacy of Latry's playing in the Op.18 Prélude is especially gratifying.

Highly recommended.

DSD on the cheap!

Back in 2002, I wrote: "DAT is, as far as I am concerned, the most practical and intuitive approach to affordable



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live digital recording." Belay that. Digital audio tape, sad to say, is on its way out. Although DAT machines will continue to be made for the foreseeable future, the handwriting is on the wall: as time goes on, fewer and fewer DAT machines will be supported by replacement parts.

But despair not. The TASCAM DV-RA1000 digital recorder sounds phenomenal and is a screaming bargain (\$1500, frequently discounted; www.tascam.com). The DV-RA1000 is a component-width, two-rack-unit-height professional recorder that records "Red Book" 16-bit/44.1kHz CD data to conventional CDRs, orthis is the rather mind-boggling part-records hi-rez audio directly to DVD+RW blanks, all the way from 24/88.2 PCM up to Direct Stream Digital (DSD), the SACD format.4

Two good microphones (the AKG 414 has a street prices under \$1000), some cables and stands, a good mike preamp, and the DV-RA1000 will, all told, set you back less than \$6000, and the results are tremendous. We recorded the 24 microphone-placement and pattern tests to "Red Book" standards

4 Answers to FAQs on TASCAM's website claim that the DV-RA1000 is a true DSD recorder and that it does not reformat hi-rez PCM to get DSD.

for transportability. However, after we were covered on that, I asked Steve Martorella to repeat the test piece and also to play live, so we could have DSD tracks for comparison. I don't think anyone will be surprised to learn that

the DSD versions blew the "Red Book" tracks into the weeds. Forget the music, even—DSD's superiority was plain from the room ambience and my speaking voice while slating the takes.

So, have we immanentized the eschaton? Not quite, sorry to say. Once you've recorded something in DSD onto a DVD+RW, apart from listening to it on the DV-RA1000, playing it for your friends, or lending it to another DV-RA1000 owner, there isn't much you can do with it. Even basic editing of DSD is a legendary chore. As far as I know, the cheapest rig that would let you go from DSD tracks on a DVD+RW to an authored project ready to send to the SACD pressing plant are \$25,000 Sadie or Pyramix workstations.

My guesses are that dilettantes-I use the word in its good sense, of an admirer or lover of the arts-will have fun with the DV-RA1000's DSD capabilities, while professional users will use it to capture higher- but not highest-rez PCM, then bounce those tracks over to a more affordable PC- or Macbased PCM music-production program. One could even take a thwack at the piñata by the Quixotic gesture of using a DVD-Audio production program such as Minnetonka Discwelder (from \$99; www.minnetonkaaudio. com)⁵ to create regular DVD-Video discs, the default stereo soundtracks of which would be 24/96 PCM, and replicate those videoless DVD-Vs on a DVD burner. Perhaps that might work for live-band tapers. Indeed, 24/96 hirez stereo on DVD-V was the hi-rez format that should have been, as it is playable on the untold millions of standard DVD-Video-only players. It was doomed by its lack of copy protection and surround-sound capability.

Questions or comments: jmrcds@jmrcds.com.

⁵ By the time you read this, TASCAM may have released a special version of Discwelder Bronze, available free to registered DV-RA1000 owners in the US, that will import (but not export) DSD files.