

Sound Guide

by Steve Church

Surround Cuisine for Newbies

Understanding the Choices

"You can't tell the players without a program!" This rings true as well for the many formats and flavors of audio being offered to consumers. Broadcasters need to know what is out there, so they are not left behind as the technology of recording and transmission continues to evolve.

[CLEVELAND, Ohio] There are things in life you do not know you need until you have experienced them, after which they become essential to good living. TV remote controls and Thai cuisine come to mind. Surround audio is another.

More than a few people had the surround transformative experience at the April NAB when they listened to it in our Acura SUV that was equipped with a prototype HDFM multichannel system. One group chief implored us to get the Acura *pronto* to his headquarters so his company's owners and programmers could share the pleasure—something like taking a friend to enjoy his first Thai restaurant dinner.

A surprising number of people to whom I spoke at the NAB had no idea that surround music was a practical reality and did not know there are a number of consumer delivery formats for it and thousands of discs already on the market.

To address this knowledge gap, here is a round-up of what is out there today and a preview of some things to come. Maybe you savvy engineering types already know all this stuff, but your GM and PD probably do not, so maybe you could pass this article to them when they hit you with a cold stare in response to your surround ranting.

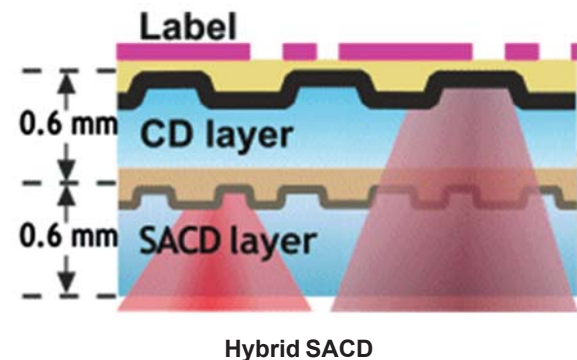
SACD

The Super Audio CD is a joint invention of Sony and Philips, who also invented the original CD. More than 3,000 SACDs have been released worldwide so far. It uses what the inventors call "direct stream digital" or DSD to encode the audio.

This is a one-bit format at a very high sampling rate, 2.8224 MHz. Frequency response extends to 100 kHz (not a typo) and dynamic range is theoretically 120 dB. SACDs can be stereo-only or a surround/stereo combo, with most being the latter. Thus a hybrid multichannel disc would include all three audio formats: CD, SACD stereo, and SACD surround.



SUPER AUDIO CD



Hybrid SACD

Most new releases are in the "hybrid" format that has both a CD and SACD layer so that a disc can be used in both kinds of player. The lasers are able to focus on the layer they need and ignore the other. Most SACDs are now being released in this format so that consumers can play them both ways and retailers do not need to stock two versions.

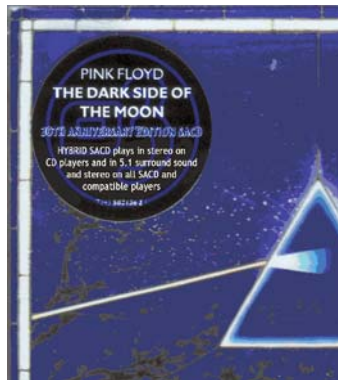
Pink Floyd's *Dark Side of the Moon* 30th anniversary edition was released exclusively in hybrid SACD—there was no CD-only version available.

I bought mine in a very small airport record shop, which probably had no idea they were selling SACDs, so this strategy with retailers seems to be working.

DVD-AUDIO

While DVD-Video is all the rage, most people are not aware that there is also an audio format using "Digital Versatile Discs." DVDs have a lot more capacity than CDs, so they can be used to store audio in much higher resolution than CDs. They support sampling rates up to 192 kHz, but 5.1 surround tracks are usually provided at 96 kHz and 24-bits.

DVD-Audio players are not nearly as common as DVD-Video players, but there are quite a few of them out there from the likes of Pioneer, Denon, Yamaha, and Toshiba. Almost all are combo DVD-V and DVD-A players. You have to look carefully at the oval in the DVD logo to find the word "audio" along with the usual "video" to be sure the audio capability is included.



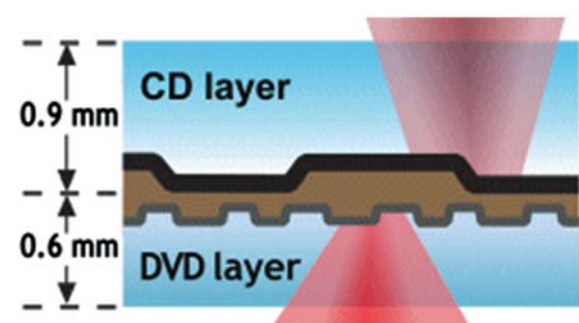
The high-resolution DVD-Audio tracks cannot be played on DVD-Video-only players. But DVD-A disc producers usually include compressed Dolby Digital or DTS tracks that can be played on run-of-the-mill DVD-Video gear.

The DVD-Audio format has a limited still picture capability and a menu scheme that lets you select tracks using a TV for display. Producers can mix DVD-A and normal DVD-V content, so you can have both hi-res sound and video clips on the same disc.

DUAL DISC

This is the newest format. Sony BMG Music Entertainment, the joint venture between Sony Corp. and Bertelsmann AG is leading the charge make this the next big thing, with support from a number of other major labels, including Universal, Warner, EMI, and 5.1 Entertainment.

These discs are a CD on one side and a DVD on the other. They are, in fact, two thin discs glued together. The DVD side can be DVD-A, DVD-V, or a combination of the two.



DualDisc

The idea is that consumers will value discs that have video and surround content in addition to the basic stereo CD, and that this will drive people away from MP3 downloads to disc purchases. "The CD is a fading technology that has lost some of its appeal," says Andrew Lack, the

chief executive of Sony BMG and one of the most vocal proponents of DualDiscs. "We had to come up with a way to give consumers a compelling experience."

Mr. Lack says he envisions, "a day, possibly not too far from now, when all new music releases come out on DualDisc." As part of the big-bang introduction, Bruce Springsteen's *Devils & Dust* was released in this format—and only in this format—in early May.

Sony/BMG plans to release more than 40 DualDiscs this year, from classics like Miles Davis's *Kind of Blue* and AC/DC's *Back in Black*, to new releases like Jennifer Lopez's *Rebirth*.



A SLIGHT INCOMPATIBILITY

You might be thinking, "Why can't they just put both on the same side like SACD hybrids do?" The answer is: because they left it until too late. All DVD players now are programmed to look for the CD-layer of hybrids, so they would not see the DVD content.

Both Sony (oddly enough) and Pioneer have sent bulletins to their dealers concerning actual and possible problems with the DualDisc format. Typical CDs are 1.2mm thick while the DualDisc is 1.5mm thick, which is at the maximum specified by the CD "red book" standard.

The CD layer, at 0.9mm, is actually thinner than the standard as well. As a result, Philips' Intellectual Property & Standards Group did not grant DualDisc a license to use of the official Compact Disc logo. That is why some companies refer to the CD side as the "non-DVD" or "audio" side. It remains to be seen if player incompatibility will be a real world problem as sales ramp up.

As with SACD hybrids, record companies hope that record stores file the discs in with the regular stock rather than having a dedicated section. They hope that this will spur sales and that eventually they will not need to release CD-only versions.

DTS, MP3 AND DVD-VIDEO

DTS has its origins in cinema. But early on, before the other surround disc formats got underway, the DTS guys noticed that their compression system would allow 44.1 kHz-sampled 24-bit 5.1 surround to fit on a CD, since the total bitrate, 1.411 Mbps, is the same.

This compression scheme is a perceptual approach similar to Dolby Digital and MPEG, but has a high rate compared to the others, so is considered to be higher fidelity. Dolby Digital, as used for the audio tracks on DVD-Video discs, for example, operates at 384 kbps.

The DTS Entertainment division has released a number of discs in this format and many DVD-Video and universal players are able to handle them. Recently, the company has been including DVD-Audio tracks on their releases and they seem to be quite active in bringing new and interesting surround productions to market. Sting's *Brand New Day* and Queen's *A Night At The Opera* are examples of DTS recent releases.

MP3 Surround was introduced late last year and is catching on as an Internet download format. DIVX has adopted it as the preferred soundtrack codec for their TV file system. It uses a very efficient coding technique to provide surround at a very small bitrate increase over stereo. MPEG AAC has a discrete surround mode that is being adopted into some players. Microsoft has extended Windows Media Audio to multichannel and this is now standard in the latest Media Player versions.

While our topic here is audio, you cannot leave out DVD-Video discs as audio carriers. Almost all recent DVD-Vs have 5.1 surround audio tracks. Concerts and music clips are growing in popularity, partly because people with surround home theater set-ups enjoy the enhanced audio experience.

WATCH FOR THE COMING ATTRACTIONS

But DVD and all of its associated formats, like DVD-Audio and DualDisc, could soon have one foot on a banana peel and the other in the grave. The reason is that DVD,

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while a powerful format and currently the king of the AV world, cannot reproduce a movie in HDTV.

With digital TVs selling at 850,000 sets per month, the demand for high quality content in HDTV from early adopters will probably get vastly stronger in the next year or two.

There are two competing formats and a war brewing. Both of them, HD-DVD and Blu-ray, are based on blue lasers. Blue light has a shorter wavelength than the red light used in CD and DVD systems, allowing the laser beam to make a smaller spot on the disc surface. With each bit of data taking up less space on the disc, more data can be stored on a 4.7-inch disc.



HD-DVD discs can hold between 15 GB and 30 GB of data, depending on the variant of the format used, compared to current DVDs that can hold between 4.7 GB and 9.4 GB of data. The main backers of the HD-DVD format are NEC and Toshiba.

The competing format, Blu-ray, comes from a group of companies led by Sony and including Dell, Hewlett-Packard, Hitachi, LG Electronics, Panasonic, Mitsubishi, Philips, Pioneer, Samsung, Sharp, TDK, and Thomson Multimedia. Blu-ray discs can hold 25 GB-50 GB. They also include support for multi-layer, which should allow the storage capacity to be increased to 100 GB - 200 GB (25 GB per layer) in the future by adding more layers to the discs.

CONTENDERS FOR DOMINANCE

While Blu-ray has more backers and higher tech, there is still a chance HD-DVD will win this war. Hollywood movie studios prefer HD-DVD because they are cheaper to make and existing production lines can be easily converted to manufacture the discs. At NAB 2005, word leaked out that the proponents might be working out some kind of compromise, but it remains to be seen if this becomes reality.

Whichever way it goes, with such high capacity, these discs would allow lots of hi-def audio storage. So far the focus has been video, but no doubt some multichannel audio formats will eventually be announced.

A bit further down the road there is the Holographic Versatile Disc (HVD). While Blu-ray and HD-DVD use the same laser, other inventors thought of combining the two lasers (red and blue), in a single ray. With this technology, on a DVD-sized disc, One Terabyte of data could be stored (20 times more than on a Blu-Ray disc).

WHERE'S THE MUSIC COMING FROM?

While there are a lot of new recordings being made intentionally for surround release, many discs are produced from tapes that were intended only for stereo delivery. Fortunately, multi-track recording goes back quite a long time and many of the original session tapes have been found in record company vaults and remastered to surround.

I have been amazed by some of the gems that have popped-up. For example, the surround versions of such classic pieces as Jan & Dean's *Surf City*, the Outsiders' *Time Won't Let Me*, Marvin Gaye's *Let's Get it On*, and the Beach Boys' *Wouldn't it be Nice* are surprisingly good. More modern multi-tracks from the likes of REM and the Eagles have been mixed to surround with stunning results.

On these latter, it seems that the performance had been caged up and waiting to break free, the surround version just feeling so natural and right for the expression of the music. *Dark Side of the Moon* is an aural masterpiece in surround, mixed from the 30-year-old 16-track master tape.

Impressive as the oldies are, new recordings made on digital workstations with 24-bit capability can be awesome – especially if the bass guitar is recorded via direct box. My current favorites are Spyro Gyra's *The Deep End* and Ray Charles' *Genius Loves Company*.

AND THE WINNER IS ...

Which of these formats is "best?" Which are getting the most attention in the marketplace and among record companies? Until the intro of DualDiscs, it was looking like SACD was winning. There are more of them in shops than DVD-A and word is that they are outselling DVD-A by a wide margin. The SACD hybrid format offers a benefit that was not matched by DVD-A.

DualDiscs solve this problem in a different way, but not all DualDiscs have DVD-A tracks – some have only videos and Dolby Digital surround audio tracks on the DVD side – the recent Springsteen release, for example.

With regard to fidelity, SACD and DVD-A have similar excellent quality, despite their very different technologies. One argument in favor of DVD-A is that most recordings are done in PCM and the DVD-A is capable of exact reproduction of the studio masters, while SACD requires a transcode from PCM to DSD.

Something similar happens at the other end, where most players convert DSD to PCM to simplify digital-to-analog conversion. Logically, it does not seem to make a lot of sense to sandwich the DSD layer between the PCM in and out interfaces. Nevertheless, it does not seem to be an impediment to good sound. With my player, a Pioneer 575A that plays both, and my ears, the SACD format has a very slight edge for some reason. Perhaps it is the result of a subtlety in how the D-A converter in the player handles the two signal input types.

The visual content on DVD-A is rarely interesting, so that feature is pretty meaningless. (One gotcha, though, is that a few discs *require* a TV display for playlist menu navigation and selection. I hate firing up the TV just for that. Indeed, I find the visuals to be a distraction to music enjoyment.) But, with my Pioneer player being universal, I buy and enjoy discs in both formats. The content drives the purchase, and I do not particularly care which format a disc is.

Since DualDiscs may have any combination of DVD-A, Dolby Digital, or DTS tracks on the DVD side, each has to be evaluated on a case-by-case basis. DVD-A is better than DTS, which is better than Dolby.

Unlike CDs, SACDs are not compatible with PC players and are not digitally rippable, so if you need to transfer them to your delivery system, you will need to dub them realtime from a player's analog outputs to an analog input converter of some kind.

While DVD-A tracks can be played on PCs equipped with DVD drives, the right software, and soundcard (Creative's top-end Audigy, for one), they have very tight copy protection and are also not directly rippable. However, there are tools to copy the DTS tracks, if any, to PC wav files.



SO WHAT'S GOING ON WITH CONSUMERS?

Surround music discs have not been mass-market big-sellers. A public awareness campaign for both SACD and DVD-A has been almost nonexistent and the average man-on-the-street has never heard of either. Nevertheless, you can walk into a Fry's, Tower Records, Best Buy, or J&R and find a few hundred discs in stock.

There is plenty of pop and rock, from Marvin Gaye to Santana to the Eagles to David Bowie to Sheryl Crow to Beck to Nine Inch Nails to Usher to Keane. There is enough of an enthusiast audience to keep the releases coming. Most of disc sales are online rather than in CD shops, it seems, though. You can choose from a few thousand titles on specialist web sites like Acousticsounds.com.

Surround breathes fresh air into older music and gives the new titles a chance to really impress. It is not an evolutionary change like from LP to CD, but a revolutionary change like from mono to stereo.

As Bob Woods, co-founder of the Telarc record label says of SACD multichannel, "Three-dimensional audio is capable of allowing the emotional content of a performance to reach a listener more than you can in stereo. Such as the reproduction of the actual thumbprint of an acoustic space, a truly accurate soundstage, and never having to hear performers/instruments/whatever layered behind another – each sound lives realistically in its own space. In short, this technology serves the music in a way that nothing else, so far anyway, can."

GOTTA FEEL IT

So why has it not caught-on in a big way? Back to this article's opening sentence: Because surround audio is experiential. You can talk about it all you want, but what is missing are places to go to hear what it is really all about. Those pathetic demo displays in Best Buy and Circuit City are pretty laughable and are not going to convince anybody. There really is not any way for most people to hear good systems and be turned-on by the tech.

And there is plenty of competition from other media stuff these days: MP3s and iPods, home media centers and music servers, high definition television, TiVos, digital cameras, satellite radio, better PCs, etc. There is only so much leisure a guy has time and attention for.

Nevertheless, daring audiophiles who have figured this stuff out are spreading the word slowly and surely. And a lot of people are installing surround audio systems for their TVs and getting exposed to surround via DVD films.

There is no question surround downloads are coming to the Internet and could well become very popular. Surround listening is also growing in cars. Acura is running full pages touting their surround audio systems, for example.

Radio is the wildcard in all this. Should our industry jump on surround and promote it the way we promoted stereo on FM; we would probably get surround discs going in a very big way. This would create a virtuous circle – as we broadcast more surround, record companies would be motivated to release more of it, which would give us more to broadcast.

On-air surround would bring renewed excitement and growth to both the recording and broadcasting industries. With a few thousand discs out there, we have enough material to get started now.

CEO of Telos-Omnia, Steve Church is a broadcast audio CODEC pioneer. His company's focus is helping broadcasters transmit exciting audio. Email Steve at schurch@telos-systems.com

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