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**DOLBY' S NEW SPECTRAL
RECORDING SYSTEM AND
ITS POTENTIAL FOR THE
MOTION PICTURE INDUSTRY**

**BY
JOHN F. ALLEN**

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FIRST IN DIGITAL STEREO

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DOLBY' S NEW SPECTRAL RECORDING SYSTEM AND ITS POTENTIAL FOR THE MOTION PICTURE INDUSTRY

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In 1965, Ray Dolby Founded Dolby Laboratories in London and introduced his professional A-type noise reduction system. Since then the company has grown into an international organization with over 300 employees and an impressive roll in the audio industry. It is hard to imagine another name in audio that is so well known. In addition to A-type noise reduction, Dolby has also developed the B-type and C-type systems for consumer products. These are used in a wide variety of cassette recorders for both home and car. It is likely that anyone with even a moderate stereo system has something that uses a Dolby circuit. Their name appears on thousands of theatre marquees and newspaper advertisements every day. Industry wide, Dolby now claims to have about 95,000 units of A-type systems and over 250 million of the consumer B and C-type circuits in use today.

In 1969, Dolby began researching the various areas of film sound. Two years later, Stanley Kubrick's A CLOCKWORK ORANGE was the first motion picture recorded using A-type noise reduction on all mixes and masters. By 1976, Dolby had finished their work on the stereo optical soundtrack for 35 MM film. LISZTOMANIA marked the first film released in Dolby stereo. Later, A STAR IS BORN was the first stereo optical film with a surround encoding. Today, over 800 features have been recorded and released in Dolby stereo and over 9000 theatres are said to be equipped with Dolby made processors.

By being involved in the recording phase of all films released in their format as well as the theatres themselves, Dolby and company has been able to make an outstanding, and most welcome, contribution to the standardization, quality control and improvement of film.

Ironically, noise reduction itself is one of those things which we wish we didn't need. After all if recording mediums and transmission lines were flawless and quiet enough to begin with, we wouldn't need the intrusion of the additional processing circuitry that

noise reduction requires. Unfortunately, noise, especially hiss, is an ever present problem with conventional analog tape recorders. What noise reduction schemes do, is to mask the noise (bury it under other sounds) by boosting low level signals so they are high, or loud, enough during the recording stage to stay above the noise floor. At this point, the noise in the recording has not been effected. It is only during playback that noise reduction actually takes place. At the moment of playback, the boosted low level signals are reduced to their proper low levels and in doing so the noise level in the recording is reduced as well.

The basic principal of noise masking is based on the fact that it's hard to hear something when something else is going on at a louder level.

Noise reduction is available in several forms from different manufacturers. None is without some unwanted side effect such as noise modulation, sometimes called pumping. Some systems are better than others. Recording engineers have generally accepted these deficiencies because the advantages of the reduced noise seem to outweigh the disadvantages.

Dolby's approach to minimizing any unwanted side effects has been to divide the audio spectrum into four fixed bands and perform a small amount of noise reduction separately within each band. Though not perfect, A-type noise reduction is generally regarded as capable of doing a good job.

In the past few years a genuine revolution has been occurring in the audio industry. With much fanfare, the venerable and noisy analog tape recorders have been slowly replaced with the newer, better and more complicated digital machines. Digital isn't perfect either (nothing, of course, is). But digital is so quiet that a small amount of noise must actually be added to the recording to mask the quantization sound resulting from the digitization process.

Digital affords lower distortion than analog, virtually no wow and flutter plus about 90 dB of dynamic range. Analog recorders with Dolby noise reduction generally yield about 70 dB of dynamic range and optical 35 MM film, about 60 dB. Another major advantage of digital mixing is the lack of generation losses built up with the successive rerecordings encountered in the production process.

Though the playback electronics are relatively inexpensive, digital production equipment can be very costly. A single 24 track digital tape recorder can cost \$150,000.00. For film production, additional electronic synchronizers are also required. For the film recording

studios that are heavily invested in analog equipment, including sprocketed / multi-channel 35 MM tape recorders and many channels of noise reduction, converting to digital would be a major capital expense. Some doubt there would be enough return to justify this kind of investment. Others argue that the industry simply must modernize to remain (or once again become) competitive.

Earlier this year Dolby announced a new type of noise reduction for analog recorders called Dolby Spectral Recording or SR.

Some may feel that given the seeming obsolescence of analog, Dolby was forced to act. However, SR stretches analog's performance to such an extent that, while it will not replace digital recording, it will certainly give pause to anyone contemplating converting a large multi-track analog facility.

At first glance, the amount of circuitry involved and the sheer number of parts in an SR module would be enough to make one uncomfortable. However, Dolby points out that about 60 per cent of the circuitry is for control. Only the remainder actually passes audio. Unlike A-type's four fixed bands of operation, Dolby's Spectral Recording system functions with both fixed and sliding bands. In other words, the audio signal is constantly and thoroughly analyzed to determine the frequency content and level. The noise reduction bands are shifted to best accommodate the immediate signal conditions. The use of the fixed or sliding band operation is dependent on the ever changing signal demands. In this way, the best advantages of each type of operation are said to be utilized as required. Another feature of this new system is that the noise reduction process is done in stages instead of all at once. As the level gets lower and lower, successive stages of boosting are brought into play. Each stage boosts about 8 dB. Thus the signal processing at any instant remains reasonably gentle.

In comparing A-type and SR, A-type yields about 10 to 15 dB of noise reduction while SR yields from 16 dB in the low frequencies to 24 dB in the high frequencies. If one is using a modern analog tape recorder running at 15 inches per second, Dolby claims the SR system will produce a signal to noise ratio slightly greater than 16 bit digital systems.

Dolby SR has an additional feature. When a digital system is momentarily overloaded with too strong a signal, a condition called hard clipping occurs. Here the peaks of the signal are simply not passed and become distorted. SR has the ability to handle slight overload conditions without such gross distortion. For especially wide dynamic material, some recording engineers may well chose Dolby SR over digital for original recordings. Time will tell.

The question being asked in the exhibition industry is how Dolby SR might work with release prints and whether it will replace digital. The answer to the latter is that we don't know. Digital offers distinct computerized editing, storage and duplication advantages over any analog system. Digital therefore would seem to be preferable for some production stages, especially those where materials require lots of editing and rerecording such as sound effects and dialog. It would seem that a system such as SR would be good for music mastering. However, a full SR mix would be a real step forward from where we are now, particularly if the film was played in the theatre using the SR process.

At the moment Kodak and others are working to develop a way to store digital soundtracks on release prints. Initially, Kodak's work s being aimed at the Showscan's 70 MM, 60 frame per second format. Several films have been all or partially digitally recorded and mixed.

These productions are, of course, available in pure digital form for home use when they are released on laser discs. There is no way for current theatre presentations to compete with digital films on laser discs, at least at this time. Yet, sadly, I am told that in Hollywood, the interest in digital has recently diminished from what it was a year ago. As said earlier, established studios with millions of dollars worth of sprocketed analog recording systems, have felt that converting these facilities to digital was too expensive. The newer facilities in Hollywood tend to be more digitally equipped.

Dolby no doubt recognized this situation and felt that a relatively inexpensive, plug-in SR type system could provide a genuine alternative to digital. To bring an analog recorder's performance to a level more in line with a digital unit plus gain the advantages of greater dynamic range and lower noise, a studio now equipped with say 60 channels of A-type noise reduction now only needs to substitute the new SR modules for their A-type modules. The two are interchangeable. It's done in minutes, costs only \$750.00 per channel and uses existing analog recorders without modification. There is no doubt that some recording studio executives will see this as a very attractive route to go.

On the exhibition side, SR would seem to really offer something, at least for the immediate future. No matter when or how it is done, a digital soundtrack on release prints will cost more to produce and will require some projector modifications. Whether digitally produced or not, films released in the SR format would avoid both problems. Only the cinema processors would need be modified. This would be done by either direct substitution of the noise reduction modules or the addition of an outboard unit containing the needed units. Currently, Dolby SR costs more per channel than 16 bit

digital decoding. However, a digital movie system may end up costing more should additional error correction be needed to overcome the wow and flutter found in projectors. For other reasons as well, converting the electronic portions of a theatre's sound system to either digital or Dolby SR, will probably cost the same. (Installing the necessary high power speaker systems and amplifiers will be the same for either system).

Would SR or another "super analog" process help exhibition? Absolutely. How? Films would have more impact than current 70 MM presentations, though 35 MM optical will still suffer a limited high frequency bandwidth and from the two channel matrix limitations. Several super wide range analog systems have been proposed for 35 MM film. Most notable is Terry Beard's Nu-optix system. To date however, only Dolby stereo and Jack Cashin's Ultra-stereo processes have been used in wide releases.

Either from a technical or marketing standpoint, especially marketing, nothing, in my opinion, could be better than discrete multi-channel digital stereo recordings on release prints and full digital playback in theatres. The public has accepted digital so well that there are now record stores which sell nothing but compact digital discs. The demand for digital is so strong that compact disc factories are booked many months in advance. More plants are being built to handle the demand. It would seem that in light of this, presenting digital movies in digitally equipped theatres would be not only desirable, but necessary to compete with digital home systems. At this point, anything less would be harder to sell.

On the other hand, a super analog system such as Dolby SR should be given careful consideration. It's simple, inexpensive and easy to convert current processors. The resulting improvement in cinema sound would be immediate and, depending on the ability of the theatre's speakers and amplifiers, dramatic. Since exhibition must compete with digital home systems now, and given the fact that we do not yet have the technology for composite digital release new Spectral Recording prints, Dolby's system could help bridge the gap.

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