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MULTI-CHANNEL AUDIO AS AN IMMERSIVE ENVIRONMENT

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1.0 FOREWORD:

As the capabilities available to program producers / engineers / mixers for encoding along with the eventual end user's capabilities for decoding of multi-channel audio signals/programs consistently increase, the fundamental focus of all involved seems to remain on the detailed technical aspects of the process.

However, for any new or improved technology to be truly successful it must supply its' users with an experience or capacity unobtainable through any previous incarnation of the technology in question.

This paper examines those issues by first taking a brief look back at the history of the development of multi-channel sound, and then presenting a summary of the current issues, with an analysis of why immersion and its ability to produce an *environment* is such a critical factor in end-user acceptance of the multi-channel concept.

2.0 INTRODUCTION:

As the audio industry enters its second millennium, the intermingling and merging of what were formerly clearly demarcated, and wholly disparate industry concepts and segments is occurring at a blinding speed. The once carefully isolated and distinct music, theater, television/video, and cinema sound formats along with the production, storage and reproduction methodologies as-well-as the products that allow *display* of those formats, are now more than ever before being mixed and blended.

This process helps to insure a large degree of basic conceptual consistency in the presentation of multi-channel sources across the wide range of consumer and professional reproduction methods and options.

As we noted earlier, it is crucial to remember and recognize that all of this formidable technology should always be squarely aimed at producing *audio environments* that successfully create or recreate specific spaces or places - whether they be *real, virtual or imaginary*. Without that key concept, all we end up with is special effects for the sake of special effects.

In examining the history of multi-channel audio, it became evident that the ideas now being employed were initially conceptualized more than six decades ago, although that fact is rarely remembered or understood today.

Therefore, in order to really understand the current state-of-the-state, it will prove informative and useful to recount how we arrived at today's technology and concepts.

3.0 A BRIEF HISTORY

Although many would trace the concept of audio for the cinema, and thus all the essential progenitors of multi-channel sound just to Edison, this would not be a completely correct assumption.

It would be accurate to say however, that as with many technologies in audio, the practical (or at least the patented and recognized) history of motion-picture sound does essentially begin with Edison.

Although a number of attempts were made to deliver moving pictures during the years between the 1877 première of the phonograph and Edison's 1888-89 launch of his sprocketed loop "peepshows," using George Eastman's ultra-flammable (and occasionally explosive) nitro-cellulose strips, none enjoyed any true commercial visibility or success.

Even though the available historical records show that the experiments conducted by Scotsman W.K.L. Dickson of Edison's laboratory always intended to combine sight and sound on one medium, the actual first *product* Edison's lab put together did not. This is despite the fact that the first effort-if you will-the first commercially viable motion picture (which by the way was of Dickson himself), was linked for sound to the then-nascent phonograph. Therefore the first 'movie' was also the first 'talkie' as well.

In fact Edison's highly successful loop machines had no provision for sound, but one can assume that he intended to provide that a bit later at a higher and more profitable cost, since he had shown the needed technique initially.

As is often the case with new technologies, he didn't quite move quickly enough. By 1895 true theatrical style projection of motion pictures had been demonstrated, and the loops faded quickly into oblivion.

3.1 A CONVOLUTED PATH

The multi-decade long history of sound transmission, recording, and reproduction, and the number of channels employed by the various successful (and unsuccessful) technologies, is complex and intricate. It has proceeded down numerous paths, and found many dead ends.

Beginning with the pre-1900 work of Bell, Edison, Clément Ader, and numerous others lost to the bibliotheca of history, and then moving onward to the fundamental work done at Bell Laboratories beginning in the early teens of the 20th century, and progressing through the 1920's and 30's the technical achievements and insights needed to produce successful and aurally accurate sound reproduction on film, or anywhere else for that matter, required much invention and enormous amounts of insight.

- How many channels?
- Sonic accuracy or artistic effect?
- Loudspeakers or headphones or. . .?
- Live or recorded?

To these and a whole host of other issues there were no ready answers, only more questions.

3.2 IT STARTED WITH TWO-OR DID IT ?

At the Exposition Internationale d'Électricité in Paris in 1881 the French engineer and inventor Clément Ader introduced a device he named the *theatrephone* which employed 2 sets of telephone transmitters (microphones) across the front of the stage of the Paris Opéra, which were transmitted

3 km through distribution coils to the Palais d'Industrie, where the populace could listen to the performances through electro-acoustically based stethoscopic-type headphones.

Each of ten sets of headphones had one side connected to the transmitter(s) on the left, and another on the right, of the Opéra's prompt box. This invention was such a wild success, that after just a few days another *stereophonic* link was provided to the Théâtre Français to accommodate the long lines of the curious.

The singers, the orchestra, and the audience were spectacularly audible, and (probably unintentionally) in the spatially correct position (at least from a L/R perspective).

Shortly thereafter, the President of the French Republic had private lines installed to these same halls, the King and Queen of Portugal had cables installed to the Lisbon opera, and Queen Victoria had cables installed connecting her to the Royal Opera House in Covent Garden and the Theatre Royal.

These other 'Royal' systems also seem to have been dual-channel, binaural, and may have been meant to curry the favor of the powerful to help encourage them to be patrons of the then-fledgling European telephone industry.

Almost 50 years later in a 1926 paper, the Bell Labs' experts would note: "*The use of two ears, that is, two-channel listening, gives the listener a sense of direction for each of the various sources of sound to which at a given moment he may be listening, and, therefore, he apprehends them in their relative distribution in space.*"

3.3 MAYBE IT WAS FIVE?

Just a half decade after that paper was published, beginning in 1931 the Bell Telephone Laboratories electro-acoustics staff initiated a study of stereophonic sound, which culminated in a world-recognized and surprisingly well publicized demonstration in 1933.

They chose to start with three microphones (one more than Ader had employed), placed in the Academy of Music in Philadelphia, one at each side of the orchestra and one in the center, each about 20 ft. (6 m) back and 10 ft. (3 m) above the lip of the orchestra platform.

The Philadelphia Orchestra was conducted by assistant conductor Alexander Smallens, while Leopold Stokowski manipulated a set of level and balance type controls in a box at the rear of the hall.

Telephone lines were used to transmit the three channels to Constitutional Hall in Washington, D.C., where the public was permitted to hear the live transmission through loudspeakers, on 27 April 1933. The reaction was essentially identical to that of the audiences more than a half-century earlier --- *stunned amazement and disbelief.*

The Bell Labs researchers had calculated and observed in their preliminary work on the subject, the apparent angles of localization for 2 through 5 channels. They found two channels to have serious spatial distortions, while three channels were the minimum permitting an almost linear localization transfer function.

Harvey Fletcher a core member of the Bell Labs team, put it this way in 1933: *"Stereophonic systems do not consist of two, three, or any other fixed number of channels. There must be sufficient of these to give a good illusion of an infinite number."*

Seven years later, in April of 1940 at Carnegie Hall in New York City with every major Hollywood studio represented by its sound director, including a number of names that are now revered in the history of film sound: Douglas Shearer of Metro-Goldwyn-Mayer, John P. Livadary of Columbia

Pictures, Loren Ryder of Paramount, and Edward H. Hansen of 20th. Century-Fox, Bell Laboratories' staff again challenged the assumptions, and kicked open a technological door.

They were able to show these heavyweight Hollywood sound moguls a fully functional stereo recording and playback chain using optical sound-on-film, which could have provided them with true multi-channel stereophonic reproduction capability. Instead the industry moved on to disasters like Fantasound.

During the author's review of the many papers, documents and news reports of the day it became obvious that not only did the Bell Labs team essentially create all the needed concepts for multi-channel sound reproduction, they also developed all the needed hardware to demonstrate their conclusions convincingly for both film and other as yet un-explored media. It would unfortunately take another 40 years or so for their observations and their fundamental work to be fully recognized for what it was.

3.4 AFTER W.W.II

The end of the second world war unleashed a huge appetite for the technological developments that had failed to take hold in the last years before the global conflict. It was the British who took the lead. The great British cinema engineer Raymond Spottiswoode developed a 3-D image process accompanied by three-channel stereophonic sound, reproduced from a separate strand of magnetically coated 35 mm film.

These channels were located behind the screen and to its left and right - eerily similar to the Bell Labs' arrangement premiered in 1940. An optical track on one of the two picture films carried a sound track for smaller loudspeakers on the side walls. An almost identical system (we will make no further comment) premiered under the name WarnerPhonic Sound in 1953, for the 3-D movie "House of Wax".

A bit later on, in the early 1950's, came the system developed for the Cinerama films. It initially reproduced five channels, spaced behind the screen, then six channels (adding a surround channel), and then seven channels (a second surround channel, divided left-right) .

3.5 BACK TO THE 1940'S

Then in 1976, came perhaps the biggest noise heard in film sound since Fletcher's original demonstrations almost four decades earlier: Dolby Stereo.

In essence what had gone around had come around, and Dolby stereo-variable-area (SVA) optical recording together with the release of the massively successful Star Wars, once again brought multi-channel sound to the cinema. (It is interesting to note that Dolby actually unveiled this format in 1974 on the film Stardust, but it took George Lucas's marketing of Star Wars to push the hardware into theaters - more than 2000 by the end of 1977).

Suddenly, as if by magic, both Hollywood and the consumer audio community discovered what Fletcher knew when he did the initial demonstration in 1933: if you want the aural perspective to be realistic, and augment, aid, and enhance or even create the visual, then you need multiple channel audio systems to create the needed illusions.

Dolby Stereo, Dolby Surround, and later Dolby Pro-Logic, Dolby SRD, Dolby Digital, and now Dolby Digital EX (6.1) along with DTS, and SDDS have today brought full-circle the concepts and ideas articulated so eloquently by Fletcher and his colleagues more than a half century ago.

The last few years have seen the arrival of multi-channel capability into the consumer marketplace in a gigantic way. In fact many analysts believe that the home theater explosion saved the consumer audio-video industry from another deep decline.

When consumer audio discovered the center and surround channels, and the experience of movies at home could move from squawker-mono to full-range surround, the dollars flowed in. Now almost 70% of the revenue from a motion picture comes from home viewing (and almost 80% of the net profits).

3.6 WRAPPING UP THE PAST

And so, in summary, during the almost six decades that have elapsed since the early Bell Laboratories demonstrations and the Disney/Buena Vista release of Fantasia in FantaSound (1940), the industry has seen a multiplicity of multi-channel film, and a few audio-only formats come and go.

3.6.1 MOTION PICTURE AUDIO

The motion picture industry has seen three distinct waves of multi-channel sound. The first wave, was the pioneering Fantasia effort using a left-sidewall, screen, right-sidewall format by Buena Vista.

The second was the return of this idea in a modified left-screen, center-screen, right-screen, and effects form, over a decade later, by both 20th. Century-Fox for its CinemaScope releases, and by Warner Brothers for their 3D productions with WarnerPhonic sound.

The third wave encompasses the current generation of Dolby formats, and subsequently other developers, beginning with the early matrix version used for "Dolby Stereo" in 1974. It is with this wave that the consumer and professional industries began to re-acquaint themselves with each other.

3.6.2 AUDIO WITHOUT PICTURE

The audio only world has seen its share of cull-de-sac's as well, including the various forms of quadraphonic sound, and similar ineffective implementations, that arrived and disappeared during the 1960's and 1970's. There were even several attempts at crude forms of so-called 3-dimension aural perspective, some using multiple synchronized phonograph records, others employing dual sets of grooves on one disc. All of these concepts and attempts have long since faded (thankfully) into the noise floor of history.

Other technologies such as the Ambisonic UHJ system, and various variants on that idea also appeared. Unfortunately none of these achieved significant commercial success, probably due to the consumer wariness caused by the abject failure of the various Quadraphonic systems.

It is only really in the last 5-7 years, with virtual reality, and the multimedia explosion in all forms of entertainment that the industry has begun to fully explore the real potential of *'Audio as an Immersive Experience'* both with picture and more importantly for some-without. With that, let's look at where we are now.

4.0 THE STATE OF THE STATE - OCTOBER 1999

In order to really understand the concept of creating an immersive audio environment either for picture with sound or in/of itself, we first need to synopsize the available processes employed in the creation of the multiple channel audio streams, and those used in the delivery/presentation of such *audio packages*.

4.1 PROFESSIONAL ENCODE/DECODE PROCESSES = ALPHABET SOUP

As this paper is being written (October 1999), there are no less than 10 formats are available to program producers for encoding/decoding/delivery of multiple channel audio, regardless of the specific medium they chose to release the program on.

Of these formats, which are listed below, three dominate the motion picture industry: DSD, DTS, and SDDS. No major releasing organization supports anything else, and to our knowledge no exhibitors (theater owners) support any other formats. All major releases are multi-format usually containing an conventional SVA Dolby Stereo (or DSSR) analog optical track in addition to the digital format(s), allowing at least a 4 channel surround signal to be produced almost anywhere.

In the late spring of this year (1999) the DSDEx format was premiered on the release of the Star Wars prequel - "Episode One", adding an additional stereo rear/center channel to the theatrical surround presentation.

The list below, with the year the format was introduced to commercial application, includes as many of the viable formats as we could locate.

FORMATS:

The Dolby Family:

- • Dolby® Stereo 1974 - 3 channel
- • Dolby® Surround (Dolby Pro-Logic) - 1974 - 4 channel
- • Dolby Spectral Recording® (Dolby SR) - 1986 - 4
- channel
- • Dolby Stereo Digital® (DSD-AC-3) - 1992 - 6 channel (5.1)
- • Virtual Dolby Surround® concepts - 1996 6=2 channels
- • Dolby Stereo DigitalEx (extended) - 1999 - 7
- channels (6.1)

The Other Options:

- • DTS® (Digital Theater Systems) - 1993 - 6 channels (5.1)
- • SDDS® (Sony Dynamic Digital Sound) - 1993 - up to 8
- channels (7.1)
- • RSP Circle Surround® - 1995 - 6 channel
- • Sound Retrieval System (SRS) ® - 2 channel to virtual
- surround
- • Lexicon's Logic 7® 1995/8 - up to 8 channel + 5/2/5
- encoding/decoding
- • MPEG-2 - - 1992/3 - 1 to 8 channels from PCM
- • Ambisonic® - 1992 - up to 8 channels.

Additionally a number of other processes remain extant, although less utilized within the industry including QSound®.

Further enhancements to these formats such as the THX® extensions to the various Dolby formats, are also commonly utilized by many theaters and releasing organizations.

Dolby has now introduced its E format for transmission and storage of encoded signals, permitting multi-channel to be *contained* on various media and within broadcast signals. This should enhance the available options to program production facilities and releasing organizations.

For audio only use, the most common current choices for use with CD are the DSD-AC3 format, and DTS. Other options including the discrete MLP encoded options for up to 8 channels on the DVD-A disc and Sony's SACD® are still not yet widely available.

It is our opinion that the DVD-A will become the choice for serious multi-channel music releases, especially within the classical music community and those desiring high sample/bit rate (24 bit 96 kHz) signals, although the battle lines have been drawn with the SACD camp and the DVD-A camp each touting their formats wondrous capabilities.

The SuperAudioCD® (SACD) using a version of Sony's DSD® (Direct Stream Digital) process is the other main in-market option. However this format enjoys very limited support (essentially only Sony) and may or may not succeed on a wide basis. Other multi-channel audio-only options include a number of other discrete PCM based processes, none of which has achieved on-the-radar status as yet.

4.2 CONSUMER DECODE PROCESSES AND OUTPUT FORMATS = ALPHABET SOUP, TOO

Current-generation consumer-market decoders, available in products ranging in cost from US$299 up to US$20,000+ incorporate at least Dolby Surround (4 channel) analog and may also include analog or DSP based options for DSD, DTS, Logic7, CircleSurround, Ambisonics, SRS, and VirtualDolby Surround, and now DolbyEx.

Additionally a wide range of custom and proprietary sound fields simulating anything from a small jazz club or church, to the biggest stadium may also be offered. These will process conventional stereo signals (analog or digitally based) as well as 'modify' the processing of Dolby-type signals. Included in this are such additions as the consumer versions of THX.

Most of these specialized, usually DSP-produced 'modes' are designed to process 2 channel stereo music to recreate *environments* similar to the type of facility where the music might have been performed live. Others are devoted to expanding and enhancing either audio from off-air, cable or satellite delivered television programs or other source such as live sports broadcasts.

Thus, no less than 4 channels is available for both music and sound with picture reproduction to virtually any consumer wishing to enjoy the experience.

With regard to true multi-channel music only source material, usable by the consumer, at this point, the number of actual titles in the marketplace remains so small (under 200) that no clear choice has been made either at the production or the consumer end of the chain.

The next 24 months should see this resolved, and the release of considerably more music-only optical discs of some kind is expected.

5.0 KEEPING THE AUDIO FIELD INTACT

As the early versions of the Dolby Stereo/Pro-Logic® surround decoders proved in the marketplace, the impact of coding schemes and encoding processes on the audio field presented in both professional and consumer environments, as well as transmission processes can substantially impact the delivered audio field. Lossy coding schemes, and other data reduction/manipulation systems can alter both localization and frequency/spectral relationships if not carefully monitored and implemented. Transfers to and from analog media can further introduce errors that 'distort' the original soundfield.

5.1 ANALOG MATRIX SYSTEMS

In the early analog-based matrix formats such as Dolby Stereo, *distortions* produced in the process of coding and decoding were not really a major problem. Because the signal produced from the original multi-channel mix, for film or any other medium, was matrixed down to a two channel transmission, all that need be done was to preserve the phase relationships used by the matrix decoders, and insure the maintenance of the overall spectral content of the signal.

Even the relatively mediocre audio capabilities of standard VHS and later VHS-HiFi format videotape, with its FM modulated audio would allow such signals to arrive at the reproduction point with enough of their content intact to be useful.

The crucial factor was protecting the phase relationships and avoiding any signal processing or other manipulation that could alter those relationships. If this occurred it was likely to produce a decode that contained significant errors such as dialog in the surround channels or bizarre and random localization of sounds far from their original location within the soundfield.

5.2 DIGITALLY BASED SIGNALS

As the technology has progressed into digital delivery systems, beginning with the CD, later the Laser Disc, and now encompassing DVD, DSS(Digital Satellite Systems) and other options, the potential for signal degradation was decreased, but other problems such as cabling and proper detection of flags for various coding options appeared.

Now, the largest issue is insuring that properly formatted bit streams are presented to the decoding systems, and that the signals do not contain coding errors or other fragments that could induce either DSP errors or improper channel distribution.

6.0 DELIVERY SYSTEM ISSUES

As the source delivery systems for multi-channel products progressively move into a purely digital world, it is increasingly difficult to manage the bandwidth needed. Other than direct delivery via DVD or CD, DVDA, etc, both the satellite and cable industries, along with over-the-air broadcasters are now faced with conflicting demands for their limited bandwidth from video and audio signals. It is hoped that a combination of lossy or lossless packing schemes will allow the co-existence of both the needed stereo-analog/digital audio plus multi-channel as the evolution continues.

7.0 THE IMMERSIVE EXPERIENCE

All of the proceeding information is simply statistical and theoretical when it comes to the actual multi- channel audio experience itself.

For if the purpose of creating, producing, post-producing, storing, transmitting and delivering these signals is not to allow the creation of a unique experience for the viewer/listener, then it is all for naught.

As Harvey Fletcher pointed out six decades ago, *"Stereophonic systems do not consist of two, three, or any other fixed number of channels. There must be sufficient of these to give a good illusion of an infinite number."*

What that meant then and still means now is simply that creation of an ambiance, a sense of place, or a sense of being there, of being involved, of participating, should be the goal of all these efforts.

Once all the tricks and games have been played out, and the jet planes flown through the room, the real goal is to use sound to create such an totally encompassing presentation, that in and of itself it is sufficient to keep the listener/viewer involved and believing that they are at the place or time when the event took place.

8.0 IS IT LIVE OR POST-PRODUCED?

Motion picture experts have repeatedly noted that the willing suspension of disbelief is a crucial element in the success of any movie. This applies equally well to any television program, or almost any other reproduced event with or without picture.

The capability of today's multi-channel audio systems to deliver that belief suspension has never been higher - technically.

What is now being learned by those other than the motion picture sound professionals, is the *how* of creating the sense of *there* so critical to listener involvement - if you will, the sense of immersion in the soundfield.

No one will dispute the knowledge and ability of the professional film mixing/postproduction industry to use sound as a tool to enhance and expand the image on the screen. In fact today's digital systems allow such flexibility in placement, image movement, definition and localization that even some of the most experienced are finding new options and more effective ways of creating a sonic canvas that immeasurably improves the mixture of picture and audio.

What has been added to the mix in the last 4-5 years is the use of surround audio for a long list of non-motion picture productions including animated television (the Simpsons, Dilbert,), Sci-Fi television (Star Trek -The Next Generation/Voyager), and major sporting events (NFL® Football, Baseball, Figure Skating, Hockey, the Olympics, even Golf!).

These events require a significantly different audio presentation to create their unique ambiances and desired sonic impression.

Although some form of film-style mixing and production techniques will still be employed for those programs which undergo a post-production process, live events must deliver the audio experience without that option. Additionally every listener has a mental sonic *map* of what they think the immersive audio field should be, based on their own actual experiences at similar events.

Therefore the creation of these audio presentations requires a detailed understanding of not only the capabilities of the technology, but the real world sonic canvas that must be reproduced in literally millions of individual rooms and listening spaces.

To understand how multi-channel is being used to create the unique immersive audio experiences for non-theatrical events, lets look at some of what is being done right now.

9.0 EXAMPLES AND CONCEPTS

(note: all examples are taken from programming available in the United States. The author has limited direct exposure to programming from other areas in multi-channel formats and has chosen not to discuss them in this presentation.)

9.1 LIVE SPORTING EVENTS

Since the mid-1990's the National Football League® telecasts have sporadically used surround audio. In 1998 and forward, almost all of the games on CBS are supplied in Dolby Surround (Pro-Logic), with the High-Definition feed for those broadcasts containing a DolbyDigital 5.1 bitstream.

This year ABC is producing all of its Monday Night Football® telecasts (consistently the ratings leader for such events) in 720P high definition with a full 5.1 surround audio mix.

Playoff games and other such events (the Super Bowl®) are also being offered in surround. Although individual stations re-broadcast capability for surround varies, it is estimated that 80% of the US viewing audience can receive the surround audio and probably 35% can decode it. As the US market reaches the mandated on-air status for High Definition in the 30 top markets (November 1999) all of those cities will be able to receive the full 5.1 bitstream for those telecasts which contain it.

The audio mix is usually designed to place the crowd and stadium ambiance in the surround channels and to a lesser degree in L/R stereo, with the announcers/ commentators located center. Our experience in decoding these broadcasts has varied, although when it is done properly it can change the whole viewing experience.

By adding in the stadium, and the ambiance of *the place* plus shotgun microphone *Foley effects* from the field, the realism of the telecast is substantially enhanced, and becomes far more involving. It can produce a real sense of location, and a feel for the spectators experience, drawing the viewer deeper into the game, while still keeping the features of the telecast (commentary, replay, etc), making it in many cases far better than actually being there.

The same is true for baseball broadcasts, with the added feature of not having the game moving L/R, allowing more specific localization of sonic images such as the sound of the bat hitting the ball.

Additionally some broadcasts have used localized panning to enhance the sense of motion following the flight of the ball up and or L/R-front/back switching audio images to track camera angles and locales.

Fox Television has expanded the options by placing microphones inside the bases, and behind homeplate adding the availability of highly detailed effects to the audio mix, which can dramatically improve localization, especially when coupled to their special cameras inside the catchers mask and elsewhere on the field.

Figure skating and Hockey broadcasts have used arrays of microphones around the rink to add a feel for the ice surface and motion to the audio mix. In those events the crowd is usually mixed in a 360 degree sense duplicating the actual physical plan of the space. Again audio-matching camera-angle effects have been experimented with to a more or less successful degree so far.

In the few Golf events done so far, an overall sense of outdoors ambiance was attempted, with shotgun microphones again being used to add *Foley effects* such as the sound of the club on the ball and footsteps on the course, in addition to the crowd ambiance from the galleries.

9.2 WEEKLY TELEVISION SERIES

A present more than 3 dozen televisions shows are available weekly in surround (again at least a Dolby Pro-Logic format). *[A full listing is available from Dolby on their website].* Some showcase the surround options while others do not promote it on screen. In our experience the best audio and thus the best decode is obtained using DSS-DTH (direct to home) feeds, and their much cleaner digitally delivered audio.

We have studied and experimented extensively with the Star Trek telecasts, and find that the motion picture like production mix makes the program far more like a short film than a television show. Since it is post-produced at a film facility (Paramount), all the usual techniques are employed. True sub-woofer (LFE style) bass is available, and extensive sound effects are employed to create the ambiance of the ship itself (there whenever it is), varying by location, and point of view.

9.3 LONG FORM TELEVISION PROGRAMMING AND SPECIAL EVENTS

Almost every movie for television or long form dramatic show or special is now produced in surround. Since many of these are essentially motion pictures from a production/post-production standpoint they employ techniques and processes familiar to that milieu.

Most end-users can and do decode these programs just like a movie from videotape, with similar results.

10.0 SUMMARY AND CONCLUSIONS

The idea behind using a multi-channel sound option to create an immersive effect and expand or enhance the presentation of audio-only or audio-with-picture programming is rapidly becoming an accepted practice. From industrial films to training materials, surround sound is being employed to add a sense of realism and place to all forms of programming.

Audio-only products are also beginning their expansion into this area, led by the classical and popular music communities, seeking to offer the listener a more involving and *realistic* experience. Surround processing of convention stereo CD's is also something that many consumers enjoy, since recovery of the ambiance inherent in those recordings can add immeasurably to the music, and in many cases provide a whole new experience for the listener.

Given the de-escalation of costs for consumer audio equipment incorporating surround capabilities, the immersive audio experience can now be enjoyed by almost anyone with just a few hundred dollars to invest.

Once they have done so it is often quite disappointing to return to *just stereo* and often the investment in technology increases as they seek to enhance the experience further.

In closing, I would like to quote a remark made by Ben Burt of LucasFilm, which summarizes the whole thing quite nicely:

"Always remember- SOUND is the secret weapon."

11.0 SOME DEMONSTRATIONS

(pending facilities availability)
Some short immersive audio presentations from various program types courtesy Dolby Laboratories.

Author's note:
For those seeking more information on the history of sound on/for motion pictures, we recommend Mr. Ted Uzzle's monograph "When the Movies Learned to Talk" (Kinotic Press, 1991, available from Mr. Uzzle - fax 913-385-0701).

Additional technical information for this paper was obtained from Dolby Laboratories, and The Society of Motion Picture and Television Engineers (SMPTE) and the following sources:
H. Fletcher, "Basic requirements for auditory perspective," J. C. Steinberg and W. B. Snow, "Physical factors in auditory perspective," E. C. Wente and A. L. Thuras, "Loudspeakers and microphones for auditory perspective," all reprinted in Jour. Soc. Motion Picture and Tele. Eng., v. 61 n. 3 pt. 2 pp. 415-446, September 1953.