



**THE SHOWSCAN PROCESS  
and  
EUROPE'S BIGGEST THEATRE SOUND SYSTEM**

**FROM THE BOXOFFICE MAGAZINE SERIES**

**By  
John F. Allen**

HIGH PERFORMANCE STEREO™



# HPS-4000®

## HIGH PERFORMANCE STEREO

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# **THE SHOWSCAN PROCESS**

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# **EUROPE'S BIGGEST THEATRE SOUND SYSTEM**

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Perhaps the most demanding and dynamic soundtracks available today are those produced for Showscan. Generally associated with special venue theatres and Dynamic Motion Simulators, Showscan also fits extremely well into even the larger theatres, if one has the necessary acoustic power to do the job. This article provides a brief history of Showscan plus a description of an installation in Europe which includes a sound system with the acoustic power of 11 symphony orchestras.

Developed in the late 1970's by Douglas Trumbull and Paramount Studios, Showscan is designed to take the motion picture experience to the limit of practical technology. Today Showscan is a separate publicly traded corporation head-quartered in Culver City, California. Famed exhibitor Henry G. Plitt serves as chairman. Former Plitt Theatres president Roy Aaron now serves as president and CEO of Showscan.

### **THE SHOWSCAN PICTURE**

As we all know, conventional movies are photographed on 35 mm film, at 24 frames per second. While also projected at 24 frames per second, each frame is actually flashed on the screen twice with a two-blade shutter. This results in a rate of 48 flashes or "flicks" of light per second, on the screen. This is the minimum rate required for the eye not to see light flicker, provided the light level is not too high.

In fact, at the standard motion picture light level of 16 foot Lamberts, flicker is all too evident at 48 flicks per second when one simply projects the light on the screen with no film in the projector.

Projectors with three-blade shutters, flash each frame on the screen three times. This results in a flick rate of 72. At 72 flicks per second, the we cannot see flicker even at high light levels.

Alas, a three-blade shutter sends less light to the screen, thus requiring a larger and more expensive light source. Because of this, the great majority of projectors today are equipped with two-blade shutters.

While our eyes require a certain flick rate to eliminate detectable flicker, movies today still only provide 24 frames of picture information per second. Motion must be carefully managed and photographed in order to avoid noticeable stroboscopic effects. Obviously the only way to reduce these effects is to increase the frame rate. But how high should this be?

Over the years, several organizations have experimented with different frame rates. General agreement is found that 60 flicks of light on the screen is required to avoid detectable flicker. However, there has been less agreement concerning the ideal frame rate of the film.

Showscan uses 70 mm film at a rate of 60 frames per second. All original photography is done on 65 mm negatives. Each frame is projected only once through a double blade shutter. Light levels as high as 80 to 100 foot Lamberts can be used without detectable flicker. Even on very large screens, stroboscopic effects are unnoticeable, except for the fastest motions on the largest screens. At their worst, these effects are far less than seen with conventional films.

While theoretical discussions about frame rates continue, Trumbull and Showscan have maintained their strong position that a frame rate of 60 enhances a viewer's involvement in, and perception of motion pictures. My own experience is clear: Showscan remains the most impressive visual presentation medium of any kind that I have ever seen. It looks better than life. It's simply gorgeous!

#### SOUND FOR SHOWSCAN

Try to imagine watching such a picture while listening to a transistor radio. Laughable? Yes. But it points out why Showscan requires an extraordinary sound to compliment its extraordinary images. The evolution of sound at Showscan has been a painstaking process. Originally, Showscan was a double system. The sound was recorded on a 35 mm magnetic film, run in synchronous with the picture. The six tracks were designated; left, center, right, bass, left wall and right wall.

To assure that the audience would be shaken by the bass effects, subwoofers were placed under the floor of the seating areas. This will shake the floor all right, but fails to move any air past the listener. Without the moving air, the overall effect becomes unconvincing.

In the early days of the Showscan process, the total surround effects were dropped in favor of highly directional effects of wide dynamic range. Since the typical small surround

speakers would burn up under the stress of Showscan's recordings, one or two large speakers were placed on each of the left and right walls of the auditorium. Dolby "A" noise reduction was used for their very dynamic (sometimes thunderous) soundtracks. Since the introduction of Dolby "SR", Showscan has used this newer process.

In the late 1980's, Showscan worked closely with others including Teccon's Jack Dimmers to develop a rugged and dependable way to put the sound on their prints. At a linear film speed of 280 feet per minute, head wear was a serious concern. Today, with use of hard and long lasting playback heads, Showscan prints are now composite "sound on film" with Dolby "SR" encoded tracks on magnetic striping. In order to maintain the fully discrete stereo surround format that Showscan prefers, special cards are fitted into Dolby CP-200 processor.

#### A NEW PLAYBACK SYSTEM

In 1988, Showscan conducted a side by side "A-B" comparison with their complete sound system and an HPS-4000™ system which I designed for their screening room. The test setup included two complete Dolby CP-200 processors, two sets of amplifiers and a relay set which selected either system by a switch located in the theatre. Only the magnetic preamplifiers were common to both systems so that each had the identical source.

We had agreed to give Showscan 45 days to decide whether or not to keep our system. Once installed, however, it took less than 45 minutes for the HPS-4000™ system to be chosen. Since then, this sound system has been their system of choice for all new Showscan Special Venue Theatres.

One of the happier findings for Showscan was that our SR-70 high performance surround speakers were more than capable of handling their most dynamic surround effects. Coupled with the precise Allen Surround Array™ speaker placement formulas, the performance from such a powerful loudspeaker of relatively small dimensions enabled Showscan to have both directional and non directional surround effects in their presentations for the first time.

In addition, the floor shaking subwoofers could be eliminated due to the fact that the HPS-4000™ woofer system not only shook the floor, but shook the entire building while moving huge amounts of air past the audience.

#### THE THEATRE

One of the first theatres we were asked to do is in a very large and beautifully designed multiplex in Europe. The facility has ten theatres ranging in size from medium to large.

The screens are generally wall to wall. Seating is spacious, comfortable (I mean really comfortable) and raked enough to provide unobstructed viewing for every patron.

Theatre #3 is one of the two largest auditoriums in the complex. It was here that it was decided to install Showscan and HPS-4000™ sound.

The theatre is 128 feet long and 68 feet wide. Patrons enter into a transverse cross aisle. There are four rows of slightly raked seats in front of the cross aisle. Behind the aisle, the remainder of the seats are raked in a grandstand style. The ceiling height at the rear of the theatre is 11 feet.

Good coverage from the stage speakers is no more of a problem in this theatre than usual. However, to get even surround coverage and good bass, one must take extra measures; particularly if the bass is coming from a Showscan recording.

Bass power, like all sound power, means acoustic power. As is often misunderstood, acoustic power is what counts in a sound system. Amplifier power matters only to the extent that one wants to need as little as possible in order to get the desired acoustic output from the speakers. Speaker efficiency remains the KEY to getting the most “bang for the buck”.

Showscan’s films are recorded with the bass channel set four dB louder than normal 70 mm films. With only four high efficiency woofers, we were able to provide enough low frequency output for Showscan and such a large theatre. Each woofer is powered by a 525 watt amplifier. This yields a low frequency level of about 110 dB Sound Pressure Level (SPL) in the middle of the theatre. With all four woofers running, the peak level is about 122 dB SPL.

#### SIX SURROUND CHANNELS

Achieving even stereo surround coverage in a raked, low-ceiling theatre such as this requires that the speakers be divided into six separate surround channels: Left and right front side-wall, left and right grandstand side-wall and left and right grandstand rear wall.

The front seating area of only four rows requires only four speakers (two on each wall). These four surround speakers must, as a group, produce the same output levels as a single screen speaker. This is a normal requirement (though seldom accomplished) for a surround channel. It is usually done with 10 or 12 speakers evenly dividing the load. In this case, we will only have four speakers doing the work of ten or twelve.

Producing the proper surround level in a room this wide, even with the relatively high efficiency of the surround speakers we use, requires 1500 watts.

Typical speakers sold for surround use would require 8000 watts to do this job and would self destruct. Dividing 8000 watts into four typical surround speakers yields 2000 watts per (60 to 80 watt capacity) speaker. INCREASING the efficiency of the surround speakers by a factor of 5, REDUCES the power required by 80 per cent.

So with the more efficient and rugged surrounds, theatre #3 divides only 1500 watts into four speakers and uses 375 watts each. This is quite acceptable. Two BGW 750-G amplifiers operating in bridged mode provided the power.

The grandstand area of theatre #3 is like a balcony in that the ceiling is quite low at the rear of the auditorium. This makes it impossible to place the surround speakers high enough above the audience to provide even coverage and an absence of single speaker localization. The solution is a combination of more speakers, CAREFULLY balanced sound levels and staggered delays.

The need for a greater number of speakers is fairly obvious. The low ceiling means that the speakers will be closer to the audience. The closer they are to their target, the more of them you need to maintain an even sound source since each speaker is covering fewer people. It's the same phenomenon you see when you move a flash light towards a wall. The spot of light gets smaller.

The largest single group of surround speakers theatre #3 is the group of eight units across the rear wall. This is to minimize localization and to ensure that there is a dominance of arrivals from behind the audience. Since the majority of any audience is not seated in the center of the theatre, most people will tend to hear the side speakers they are closest to. Strong rear arrivals are necessary to provide the greatest sense of being surrounded.

Localization to the nearest side wall surrounds is such a distraction in low ceiling theatres, that not only must the arrivals from the rear dominate, but the levels of the left, right and rear groups must be precisely balanced by ear to produce an even sound field. In addition, as I described in the February, 1991 issue of BOXOFFICE, adding an additional delay to the side wall speakers (relative to the rear wall units) is enough to largely restore a surrounding effect for those seated off center.

Because a surround effect is by definition a sound of multiple arrivals coming from lots of

speakers, the delay differential between the front side-wall and grandstand side-wall speaker groups cannot be detected as an echo anywhere in the theatre. The primary arrivals from any two speakers are made indistinct by the swamping effect provided by the other speakers and the room's own reverberation. Lucky for us!

With our normal 70 mm sound system, augmented with a specialized surround array and a doubling of the bass channel components, a theatre as large as theatre #3 can present Showscan. To see such a picture on a 60 foot screen and to listen to the sound in such a large and luxurious space is a fantastic experience.

Motion picture theatres are in a fierce competition for the public's entertainment dollars. Home video is now reported to be nearing the two to one ratio over theatrical exhibition. For many, the choice is for convenience and price. For others, simple quality. High quality presentations such as those produced by Showscan, in beautiful, not to mention, comfortable theatres, provide a lure and experience which I, for one, find unforgettable.

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