LUCASFILM LTD

SOUND SYSTEM

TWO GREAT NAMES IN SOUND

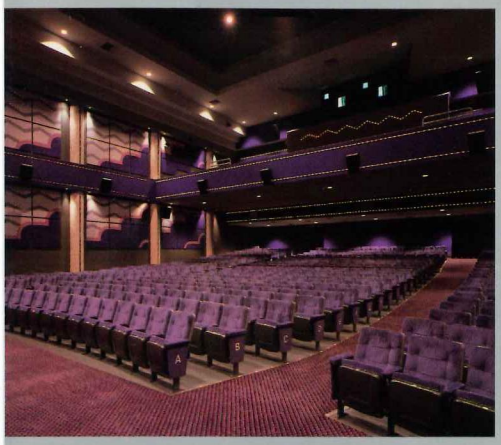
JBL INCORPORATED

The Audience is Listening...

Until the early eighties, cinema sound relied largely on loudspeaker technology developed in the mid-forties. As elegant as these systems were in their heyday, they had fallen out of step with continuing developments in recording, noise reduction, and even home high fidelity technology.

Dolby Laboratories recognized the problem and introduced the benefits of noise reduction and loudspeaker equalization to the cinema industry during the seventies.

JBL also recognized the problem and introduced the concept of flat power response in the cinema via a new line of direct radiator woofers and uniform coverage high frequency horns in 1981.



At the production end of the creative process, Lucasfilm Ltd. recognized serious problems in the field when it became apparent to them that their 70 mm films could not be exhibited with the same sonic impact as heard in the dubbing theatre.

Building on components supplied by JBL, Tomlinson Holman, Chief Audio Engineer of Lucasfilm Ltd., set out to design a new sound reproduction monitoring system specifically addressing problems in the cinema in a unified way. At first, these systems were aimed at dubbing theatres, but they soon found their way into commercial cinemas when the company stated its conviction that every film and audience deserved the best which the industry had to offer.

The audience *was* listening, and the acceptance of THX Sound Systems has far exceeded everyone's expectations.

What is the THX Sound System?

The THX Sound System is basically a system design philosophy which integrates a cinema's acoustical design with the requirements for proper sound reproduction. The following points are essential to the system:

- New loudspeaker components exhibiting state of the art performance*
- A new proprietary frequency dividing network (including time offset correction) allowing biamplification to be optimized
- Ideal loudspeaker placement and mounting, providing the smoothest possible response before equalization
- Adherence to industry standards in sound system and projector operation
- Controlled cinema acoustics

*In order to offer cinema owners a selection of different manufacturers' components, the THX Program routinely tests equipment for compliance with system criteria. Approved equipment is then selected for use in THX System installations.

What Benefits Can the User Expect of a THX Sound System?

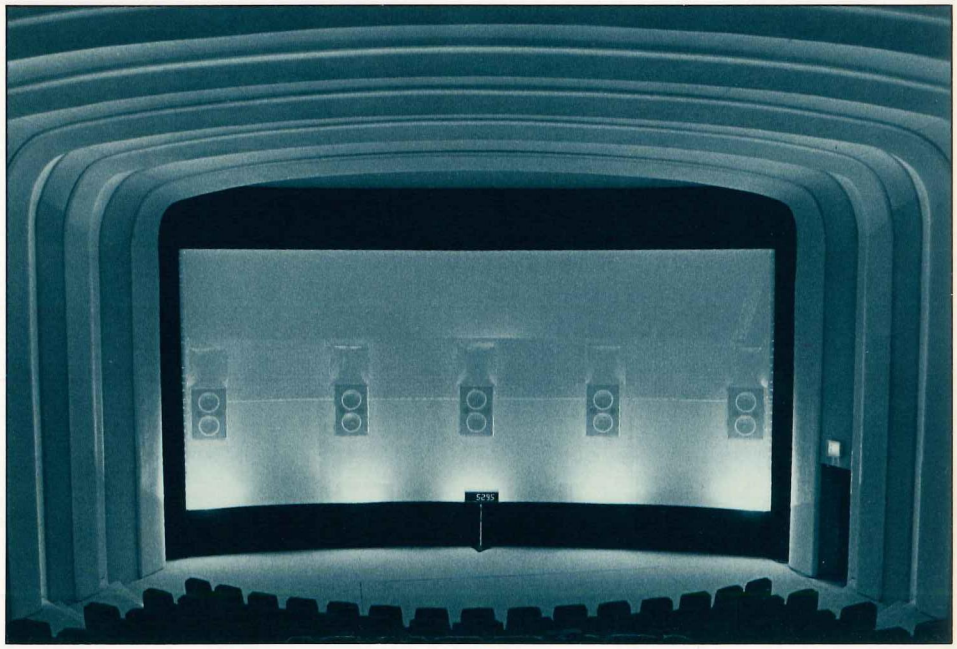
Compared with traditional technology, a THX Sound System will provide:

- Wider frequency range by a full octave in the bass and a full octave in the treble
- Noticeably smoother and more naturally balanced sound throughout the spectrum
- Audibly lower bass distortion
- Increased dialog intelligibility

It is important to realize that these performance attributes result from all aspects of the system's design—not from any one part of it. They certainly cannot be achieved only by conventional equalization techniques in which loudspeaker and acoustical shortcomings are addressed electrically.

In many cases, the design and installation of a THX Sound System costs no more than a conventional system. But it is not just a routine investment in new equipment; it involves careful planning and cooperation between cinema owners, acoustical consultants, Lucasfilm engineers, and installation personnel.

The investment is made by the cinema owner for the advancement of the cinema art, and discriminating audiences will appreciate the difference it makes. The cinema owner's commitment to quality thus becomes the same as Lucasfilm's: the accurate reproduction of all film formats; mono or stereo, 35 mm or 70 mm.



The THX Program Elements...

System Prerequisites:

- Making comprehensive measurements on the cinema's acoustics, making any changes in the cinema which are found to be necessary
- Proper installation of the approved loudspeaker components, THX dividing network, and associated equipment
- Certification testing upon completion of the installation to qualify for the THX license

System Maintenance:

- Because the high standard of presentation is so important, Lucasfilm requires testing of the system every six months to verify maintenance of original certification criteria.

Marketing Commitment:

- As part of the licensing program, Lucasfilm Ltd., provides a variety of professionally prepared marketing aids, including trailers, posters, and advertising materials designed to firmly establish in the audience's mind that the equipped cinema is especially dedicated to high quality film presentation.

Inside THX Sound Systems: A Detailed Look at the Technology

Loudspeakers and Their Mounting:

THX specifies power-flat loudspeaker components. At low frequencies, double or quadruple woofer drivers are used (per channel) and mounted in simple ported enclosures. JBL's 4648 systems were the first to be certified for this application.

The ideal performance of any woofer system is attained when it is mounted in a large flat baffle. In the old days, cinema sound men mounted "wings" on the sides of the large bass horns in an effort to extend response. The newer devices do not have problems with bass extension, but their mounting in large baffles does make for smoother response and lower distortion.

Crossover takes place at 500 Hz, and the upper part of the spectrum is handled by a uniform coverage horn and compression driver. The JBL 2360 Bi-Radial™ horn family and JBL 2445 compression driver were the first to be certified for this application. The horns are mounted on top of the woofer enclosures and protrude through the baffle to within a few centimeters of the perforated screen.

The THX Proprietary Dividing Network:

Frequency division between bass and treble parts of the system is by way of the proprietary THX crossover. Crossover slopes are matched with the natural roll-offs of the horns and woofers in such a manner that the resulting transitions between them are 24 dB/octave. These transitions are based on the work of Linkwitz and Riley and have the advantage of producing in-phase summation between high and low precisely at the transition frequency. Lobing error is minimized, as is distortion. The network additionally provides power response adjustment in its output to the high frequency driver.

The network further adjusts the timing offset between bass and treble by delaying the woofer section so that its acoustical center is effectively in vertical alignment with that of the treble horn. In this manner a seamless transition is made from woofer to tweeter through the crossover range, resulting in uniform response.

There is another advantage here, and that is that the directional characteristics of the dual woofer system and the 90° x 40° horn are very much the same in the crossover region, resulting in perfectly natural voice quality and a seamless texture, bottom to top.

The Baffle:

Normally, the baffle in which the loudspeakers are mounted is made of drywall material, and is braced on the back with metal ribs. Absorptive material is placed on the face of the baffle to control the high frequency reflections between the perforated screen and the baffle itself. The baffle extends from the floor to just above the HF horns.

Subwoofers:

Subwoofers are optional in systems intended for current 35 mm application, but are recommended for 35 mm Dolby SR format reproduction and are required for 70 mm installations in order to handle special effects in the octave between 20 and 40 Hz. The subwoofer system is driven by the appropriate output on the Dolby Cinema Processor.

Surround Loudspeakers:

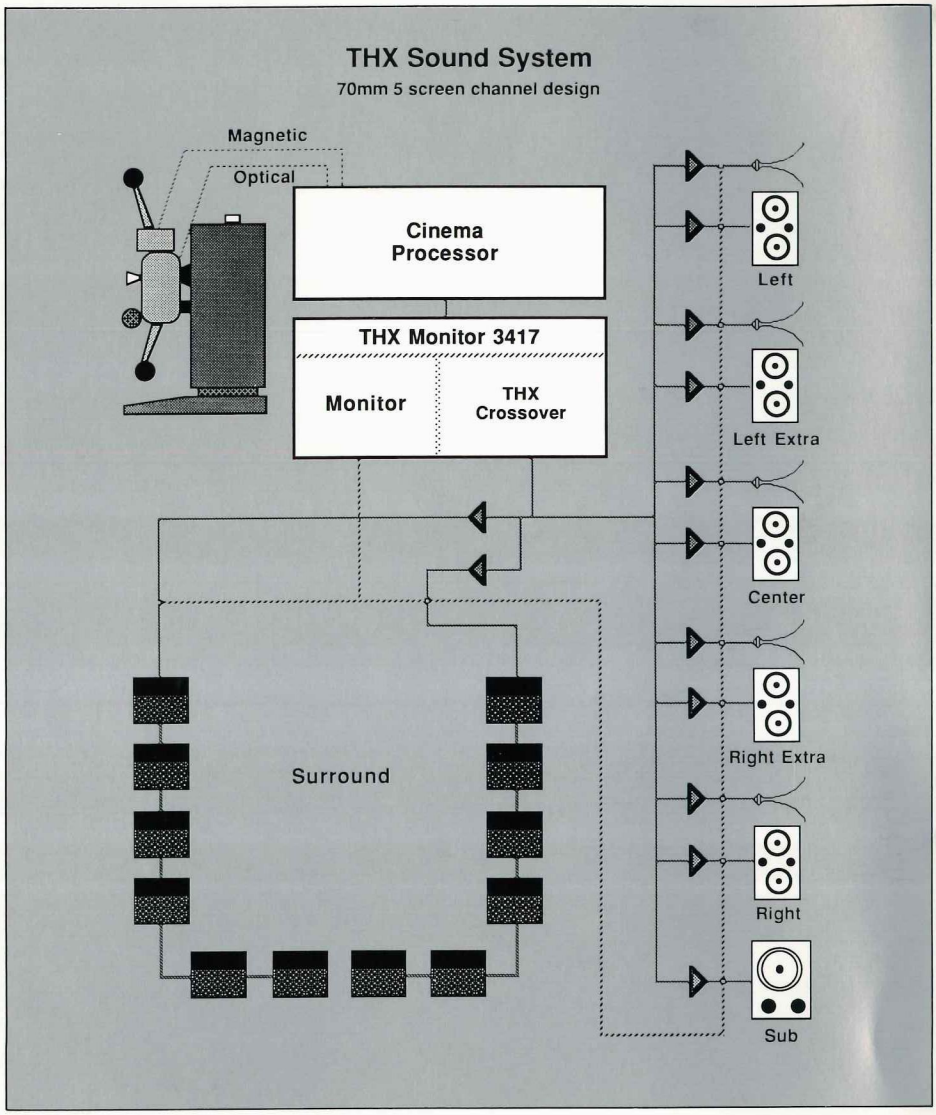
A variety of surround loudspeaker models are approved for THX application, depending on the quantity involved and certain appearance factors. Unlike the screen loudspeakers, where the intent is to maintain a very high direct-to-reverberant ratio for each listener, the surround loudspeaker ensemble is tailored to provide as diffuse a sound field as possible in which a listener is unable to localize at any one of them.

Acoustical Requirements:

The control of direct, early reflected, and reverberant sound fields is critical in the cinema. An allowable range for reverberation versus frequency is stated for THX applications, and minimizing of flutter echoes is essential.

Noise level in the cinema, due to air handling and other such disturbing factors, is set at a maximum of NC-30. NC-25 is recommended where practicable.

Leakage from one cinema to an adjacent one in multicinema complexes is a very complicated matter. It would not be realistic to insist that there never be any disturbance between adjacent cinemas. As a practical matter, THX standards state that there should be interference between cinemas no more than 1 percent of the time.



THX® Sound System Program
P.O. Box 2009
San Rafael, California 94912, USA

JBL Incorporated
8500 Balboa Boulevard
Northridge, California 91329, USA

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