THE BIG PICTURE

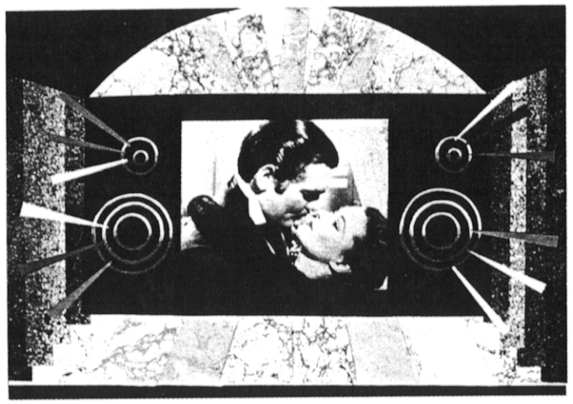

ILLUSTRATION: SALLY COCHRANE

A SUCCESSFUL CAREER IN FILM MUSIC IS A COMMON MUSICIANS GOAL, YET TODAY'S CINEMAS ARE STILL USING YESTERDAY'S SOUND TECHNOLOGY. WHAT CAN BE DONE TO BRING FILM SOUNDTRACKS INTO THE '90S? TEXT BY TIM GOODYER.

SO YOU'RE NOT going to be a pop star or pioneer new techniques in experimental sound composition - instead you're going to put music to pictures on The Big Screen. Aside from the music, what technical considerations need to be made? Sure, films use stereo imaging for the music, but what about the dialogue and fx - how do they fit into the picture? And what about the last link in the chain, the replay of the soundtrack in cinemas country- or world-wide?

With the launch of more television channels in the UK and the increasing quality of home video replay systems, it's small wonder that movie theatres are currently facing some stiff competition. What the cinema currently has is a virtual monopoly on new films and a screen big enough to give the images a presence beyond the scope of domestic television. What the cinema does not have at present is a sound system that matches the scale of its pictures. Let's take a look at the 1990 film theatre - not at the quality of the images, not in terms of theatrical presentation, not even in terms of the state of the auditorium, but simply the sound the audience hears.

The history of cinema sound is well documented, with today's systems little changed from techniques developed over 20 years ago. While digital techniques for storage and transmission of sound have improved the production stages, the same cannot be said for the average movie theatre.

The cinema needs to recapture a sense of awe and mysticism that it has lost over the years, to offer an experience both visual and aural not readily available within the home. Technological advances in the professional audio sector have progressed to the point where a distinction between domestic systems and the movie theatre should be more than clearly obvious. Naturally it is the task of the producer and director to use the tools and people at his or her disposal to their best advantage. Unfortunately, a lack of adherence to standards and bad practice within the theatre industry can easily ruin the efforts of all concerned. A large screen poorly illuminated, or a projector with motion instability is an irritation compounded by scratches, dirt, bad splices and irrational cue dots. Poor sound in the form of unclear dialogue and distortion is a good case for renting or buying the video instead. Admittedly, sound is subjective because we all hear slightly differently, but ground rules should still apply to allow a satisfactory sound balance to be achieved.

Television sound uses a mono FM transmission system which is technically superior to the 35mm optical system which serves the cinema – and then there's the more advanced two-channel digital NICAM that is now beginning to be broadcast. Couple this with domestic hi-fi video recorders, CDV machines and Dolby Pro-Logic stereo decoders – and with HDTV (High Definition Television) around the corner, what price a cinema ticket?

SOUND ON FILM

THE MAJORITY OF 35mm film soundtracks are optically based using Dolby SVA encoding with Dolby A noise reduction. Lately, film prints using Dolby SR noise reduction (offering increased dynamic range and reduced distortion) have become more widespread. From the film's two tracks, four tracks: "left", "centre", "right" and "surround" are derived. Basically the stereo pair take care of the music, leaving one channel each for dialogue and ambience or special effects. The engineering behind this is straightforward and admirably suits the requirement for central dialogue, stereo music and ambience when required. However, there are serious limitations to the optical sound reproduction system in its current form, besides the replay system in the theatre. With an optical dynamic range of 45dB (60dB with Dolby A), a frequency response from 40Hz-12kHz and a THD (Total Harmonic Distortion) that varies between 4% and 40%, the optical system by comparison with other storage media is a poor relation.

Many theatres still do not decode the two tracks on film to a reliable mono, wrongly assuming that a mono solar cell accomplishes this task automatically. Compression-related effects of the noise reduction encoding process for either Dolby A or SR are simply ignored. Fortunately the acoustic properties of the cinema screen (behind which some of the speakers are usually positioned) as an attenuator of high frequencies allows it to act as a good mask for those theatres not fitted with the correct decoding equipment - but the nuances of low-level detail and dynamic punch are lost all the same.

For a reduction in inter-channel crosstalk and improved frequency response, 70mm magnetic prints use discrete tracks for each channel. Furthermore, each track may be encoded with either Dolby A or SR noise reduction for greater fidelity. In contrast with 35mm optical, the cost of producing a 70mm print is approximately five times greater, even though the result may not be five times better.

To achieve good results from both 35mm and 70mm requires continual maintenance, especially azimuth alignment on 35mm and head wear on 70mm. From this point on in the sound chain – equalisers, amplifiers, loudspeakers and the auditorium acoustics – the commissioning sound engineer is responsible. Blind faith in spectrum analysers and lack of good hearing accounts for some theatres sounding well-alanced, while others sound shrill and tiresome.

Fortunately work is going on to improve the cinema sound situation, not least of which is being conducted by a British company called AGM. Disregarding the film industry's reluctance to confront new technology, AGM have been considering the evolution of cinema sound from current analogue-based systems to complete digital systems. Digital sound on film is on its way, complete with distortion figures, a dynamic range and a frequency response comparable to that of Compact Disc. The signal source then can be considered clean, but put a punchy CD through many existing cinema replay systems and you'll witness the acoustic phenomena of HF distortion, under-amped loudspeakers and 'hot spots' due to theatre acoustics. Improvements in these areas may be used to advantage on existing 35 and 70mm systems, but only digital will show the true capability of the new techniques.

THE SOUND CHAIN

TO ALLOW PROJECTION staff to be in total control (and to abide by local fire safety regulations), power amplifiers usually reside in the production box. To overcome damping losses of long cable runs, amplifiers capable of monitoring the load at the speaker should be used to maintain a tight transient response.

The majority of screen loudspeakers presently use high-frequency compression drivers coupled to various shapes and sizes of horns. Low frequencies are mainly reproduced from either horn, or now becoming more popular, bass reflex cabinets. The HF compression driver is efficient and with matching horn offers predictable frequency coverage. However their impulse and distortion characteristics fall way short of other methods of generating clean undistorted sound at high SPLs (Sound Pressure Levels). To cover the full frequency range, passive crossovers built into the cabinet need to be used. A passive crossover on the end of a long cable works wonders on damping factors. To avoid the crossover, an alternative technique is to use an array of small multiple full frequency range drivers. However, electronic equalisation is required to correct for falling HF response due to mechanical damping.

The cinema screen acts as a filter and reflector of sound. To overcome the high-frequency attenuation a drive unit capable of sustaining a considerable HF boost but with very low distortion is required. The Compact driver is a new class of loudspeaker component - new loudspeaker technology. It is neither a conventional compression driver nor a ribbon, but uses a flat, rectangular membrane, the driving force being applied over the entire sound radiating surface. The very low moving mass (typically one sixth of a similar compression driver) offers a fast transient response and a 1-30kHz frequency range. The absence of a phasing plug keeps compression-related distortion to below 1.5% at peak power leveis of 1kW (other drivers exhibit distortion figures between 30% and 50%). By arraying this type of drive unit, uniform coverage of a film theatre can be achieved without the need for horns.

ACOUSTICS

THE PROPAGATION OF sound within the auditorium has never been properly considered in the majority of cinema complexes in use today. Instead, the decor fundamentally determines the sound treatment. Ventilation systems, door hinges, loose floorboards and projector noise are all distractions that get overlooked - along with the rustling of popcorn. The cost of improving the acoustic conditions is often high and disruptive, and so a system that actively assists the distribution of clean sound throughout the auditorium, effectively overriding the original acoustic is an ideal solution to the problem.

The classical approach of three loudspeakers behind the screen and surrounds for the rear, places a great burden on the acoustics of the theatre for good imaging. Experimentation has shown that by employing a matrix of loudspeakers all around the auditorium, the original sound can be greatly enhanced. The approach proposed by AGM is not a replacement for existing decoders but is designed to be used as an extension to the conventional theatre replay of left, centre, right and surround tracks. The source material may be 35mm two-track optical, 70mm magnetic or any other standard. The acoustic image generated by the processor (called the CSP"A") is not unstable with regard to head movement or seating position and ameliorates the "drawn-in" character of sound towards the screen.

To generate a complete soundfield in the horizontal domain, loudspeakers would need to be regularly placed around the walls of the auditorium - the number and type of speakers required would be determined by its size and shape. Greater energy vectored towards the screen requires more powerful "soundfill" loudspeakers than those commonly employed towards the rear. Each speaker feed would be unique and therefore require individual amplifiers and loudspeakers to suit. As an example, to satisfy a 1000-seater theatre, approx-imately 20 feeds would be needed.

Leakage of sound from theatre to theatre, especially in multiplexes, could be a major problem with such installations as, with reduced loudspeaker distortion and increased number of speakers, peak SPLs will rise. Those theatres with good isolation will realise the difference obtainable by a sound level that stimulates an audience as opposed to one that irritates.

Besides improving the quality of the reproduced sound, today's technology allows some degree of automation of a cinema sound system.

A high speed, digital multipoint communications bus has been developed to allow connection of the amplifier and other ancillary equipment to a central controller if required. Lighting systems, tabs, projectors and so on, may all be controlled via suitable interfaces by the controller. With digital soundtracks incorporating SMPTE timecode, an entire performance could conceivably become entirely automatic. It could be the next step in cinema - if the industry can be persuaded to take it. ■