SOUND Balance?

What does it mean to have 'balanced' sound in your auditoriums and how to achieve it? QSC Audio's **Mark Mayfield** examines the three key elements to ensure optimisation of theatre sound quality whilst also doing so on a limited budget.

Achieving good cinema sound requires attention to three things: equipment, auditorium and the integration of the two. But, just like a three-legged stool, the desired result won't be there if you 'short' one or more of the legs. Maintaining the right balance, however, doesn't mean spending a small fortune either, because with a comprehensive understanding of the three components that go to make up good cinema sound, you'll be able to level the stool *and* stay on budget. Let's examine the various elements.

Browsing a catalogue, visiting a trade show, or even just meeting with a [cinema products] dealer, it's tempting to focus first on the sound processors, amplifiers and loudspeakers – after all, these are the tangibles comprising the cinema sound system and are what you'll be spending most of your budget on. But if achieving good cinema sound is the ultimate goal, then the equipment isn't actually the first area to focus on.

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AUDITORIUM

Good cinema sound, like sound in any space, begins with the auditorium itself. Simply put, you cannot expect good sound in a room that suffers from acoustical problems. Period. Sure, there are plenty of sticking-plaster solutions to blow money on to superficially fix these issues, but it's much less expensive, long-term, to build a good space right from the outset. Of course, this is easier to do during new-build projects, but even if the cinema sound system will be a retrofit, there can be several 'sound quality-killers' lurking and so spending a little in this area initially can prevent some expensive headaches later. So, what *are* these 'sound quality-killers'?

- **Poor insulation between adjacent theatres**

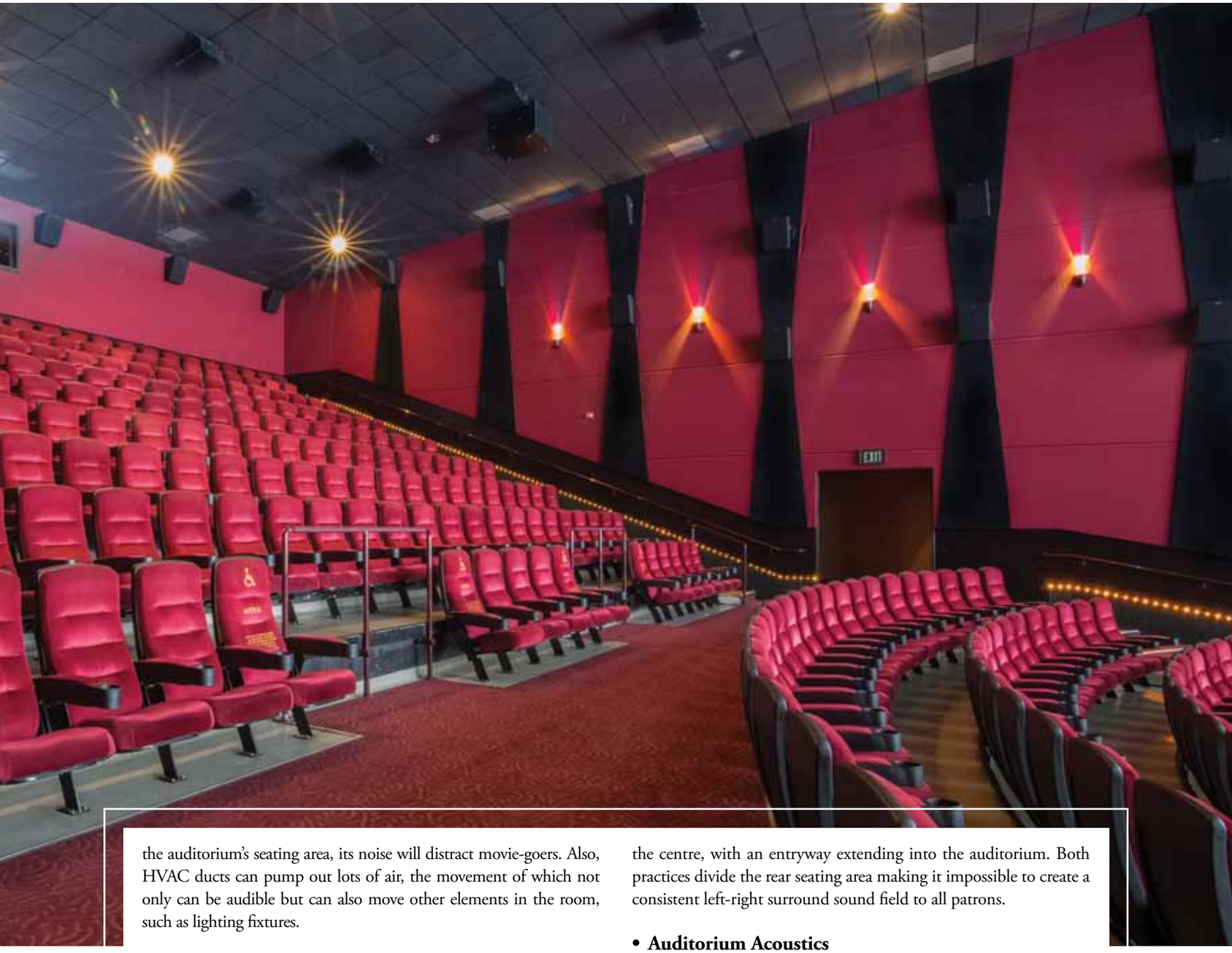
Poorly-constructed demising walls between multiplex auditoria will cause leakage between them and will be especially apparent with low-frequency rumble. The largest auditoria will likely show a bigger problem since they'll have more sub-woofer power and low-frequency energy. And because it's virtually impossible to isolate the structure-borne transmission of very low frequency sound, the best option is to isolate the auditorium itself – an entrance/exit hallway on either side is better than sharing a demising wall with an adjacent theatre. Make sure your architect has considered room-isolation when designing adjacent theatres.

- **Centre-aisles in the Seating Area**

Cinema soundtracks are meticulously-crafted to complement the onscreen image and the objective is always to provide virtually the same sonic experience to the entire audience. And while most cinema sound experts might deny it, let's face it, a 'sweet spot' *does* exist, and it's right in the middle. That's precisely where the left/right stereo-mixes converge, both from screen-channel speakers and the surrounds. Unwittingly, theatre-designers might also consider putting an access aisle right down the middle, but, frankly, that's just like giving away the best seats in the house.

- **Poorly-positioned HVAC equipment**

In building-design, it's very common practice to locate air-conditioning equipment out on the roof. But if the equipment ends up directly over



PERFECT START: A well-designed stadium-style auditorium uses soft, absorbent materials on walls and floors; seats that don't extend far above ear-height; and doesn't 'give away' the best seats in the house to a centre-aisle

the auditorium's seating area, its noise will distract movie-goers. Also, HVAC ducts can pump out lots of air, the movement of which not only can be audible but can also move other elements in the room, such as lighting fixtures.

- **Intrusive Balconies**

While balconies can be great for maximising seatcount and sightlines, they can cause real problems for sound-system designers. From the sound system's point-of-view, the space under a balcony is like an entirely separate area with its own acoustics. It's then extremely difficult, to say nothing of expensive, to create a consistent sonic experience from under such a balcony to the main part of the auditorium.

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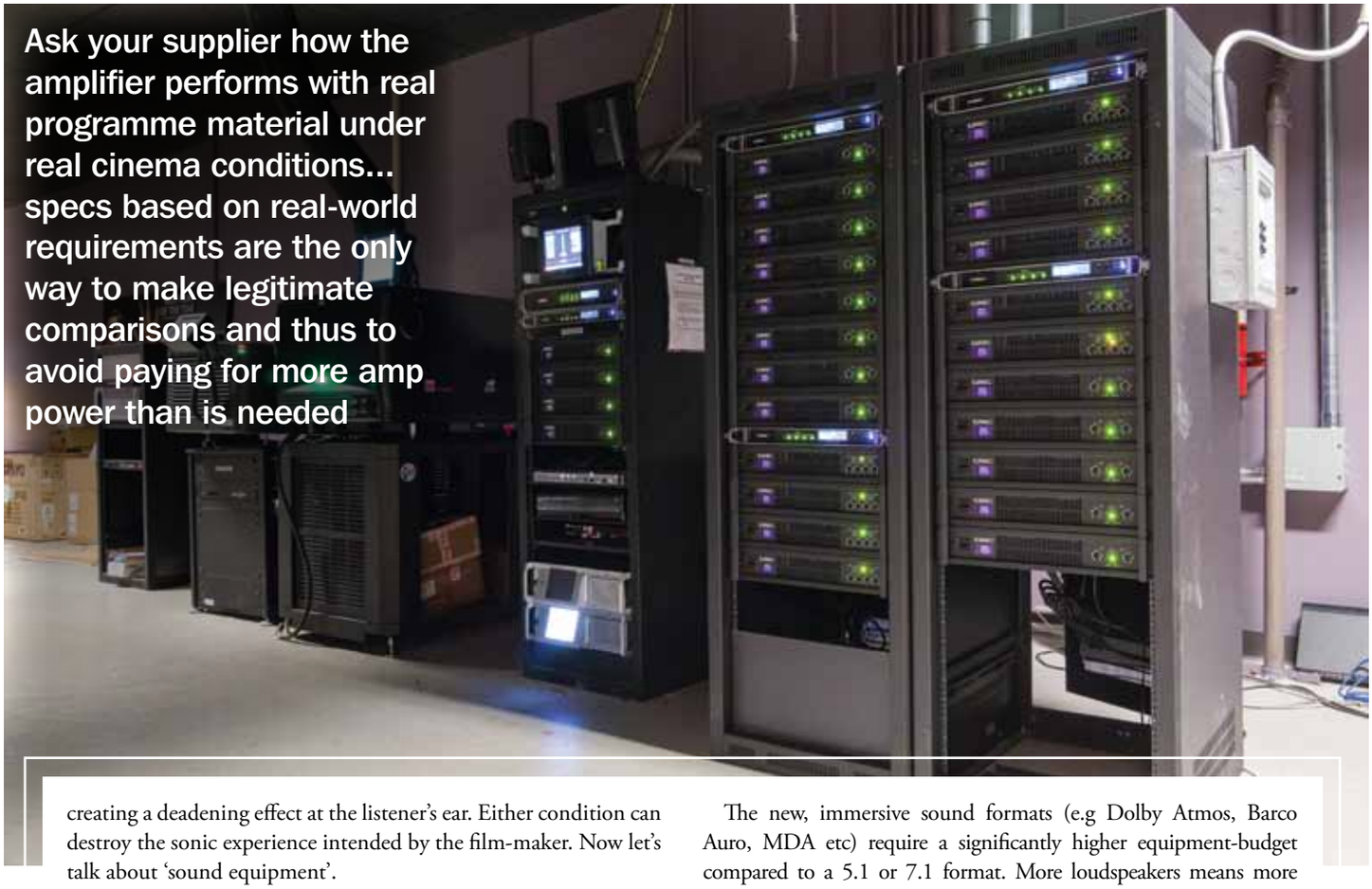
- **Split Rear Seating**

This design flaw can happen in one of several ways. One is when the projection booth extends into the auditorium, separating the rear rows of seating; while another mistake is to locate entrance doors in the centre, with an entryway extending into the auditorium. Both practices divide the rear seating area making it impossible to create a consistent left-right surround sound field to all patrons.

- **Auditorium Acoustics**

Unlike a live theatre or concert hall, a cinema auditorium should be acoustically-neutral. It's the job of the soundtrack design and the sound system to create the acoustical environment to match the image onscreen. In general, hard surfaces are bad, while soft ones are good. Hard surfaces create acoustical reflections which can diminish dialogue-intelligibility and – in extreme cases – make every scene sound like the inside of your shower. By contrast, soft surfaces absorb sound and allow the sound system to provide the acoustics that correspond to the scene.

It's also important to realise that while the screen's principal task is to reflect light, it also does a good job of reflecting sound. If the rear wall of the cinema is a hard surface, sound will be reflected from the back of the auditorium to the front. Another, perhaps less apparent, acoustical issue can be caused by seating. Seats that are too high (i.e above ear-level), will block sound from rear-channel surround loudspeakers, while also causing a 'focusing effect' of sound from the front. And if a high-backed seat is also composed of material that is too hard – e.g. like vinyl or other polymer – it can reflect sound. But, too soft, and it could absorb too much sound,



Ask your supplier how the amplifier performs with real programme material under real cinema conditions... specs based on real-world requirements are the only way to make legitimate comparisons and thus to avoid paying for more amp power than is needed

creating a deadening effect at the listener's ear. Either condition can destroy the sonic experience intended by the film-maker. Now let's talk about 'sound equipment'.

SPACE-SAVING: Multi-channel amps and networked-audio systems save both money and booth rack-space, especially with the new object-based immersive sound-formats

EQUIPMENT

Now that the auditorium is in good acoustical shape, it is easier to make informed decisions about the right equipment to use. Work with a supplier who has a sufficiently large catalogue so as to be able to provide the appropriately-sized selections for each auditorium. Remember: there is no 'one-size-fits-all' solution.

- **Match Amps to Speakers**

Despite what some experts say, bigger is *not* always better. Amplifier power should be properly matched to the loudspeakers. This sounds straightforward enough, but the matter can be muddied by the way that different equipment-manufacturers tend to state their performance specifications. Since there is no standard way to cite amp specifications, it becomes almost impossible to compare like-for-like by studying published specs in catalogues or brochures. Instead, ask your supplier how the amplifier performs with *real* programme material under real cinema conditions. Specs based upon real-world requirements will be the only way to make legitimate comparisons and thus to avoid paying for more amplifier power than is actually needed.

- **Match the Speakers to SPL requirements**

Fortunately, in cinema sound, standards exist for how loud a soundtrack ought to be played in theatres and is based upon how the soundtrack was heard during the mixing of the film. The goal, as always, is to attempt to recreate the artistic intent of the film-maker. This means choosing loudspeakers that will be capable of producing the required sound pressure level (SPL) and sound coverage for any specific auditorium. Ensure your cinema equipment supplier meets that particular requirement and ask them for proof of how it does it.

The new, immersive sound formats (e.g Dolby Atmos, Barco Auro, MDA etc) require a significantly higher equipment-budget compared to a 5.1 or 7.1 format. More loudspeakers means more amplifiers, not to mention the cost of a more sophisticated processor.

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Once the equipment is procured, it can be especially tempting to try to cut corners in other areas, like auditorium acoustics, but to do so prevents you from realising the true benefits of immersive sound while also robbing your patrons of the full experience they've paid for.

IN-AUDITORIUM INTEGRATION

Time is money and even with the best equipment, your budget-targets can be obliterated by the cost of installation and set-up time. However, cinema sound components that are designed to work together as a unified system can greatly reduce this expense. Multiple-channel amplifiers (four or more) can decrease the number of inter-connections needed in the rack, as well as the rack-space itself. Loudspeakers with special features, such as pre-installed brackets with aiming-angles, can also cut installation-time. And signal-processing that is pre-matched at the factory to your loudspeakers can help minimise, or even eliminate, the need for in-theatre equalisation.

In following the above guidelines, it is possible to achieve the best of all worlds: a cinema sound experience that properly supports the film, provides a high quality sound experience for your guests, *and* keeps you well within your budget.