

## Beyond the Rollout – Moving Towards Digital Cinema 2.0

by Michael Karagosian

A narrative of a presentation given at MediaSalles, Munich, July, 2014

My presentation begins with the progress made in converting cinemas around the world. At the end of 2013, there were 116,000 digital cinemas installed. The chart in Figure 1 below (also in my presentation) illustrates the impressive rate of conversion, on a region-by-region basis, over the past five years.

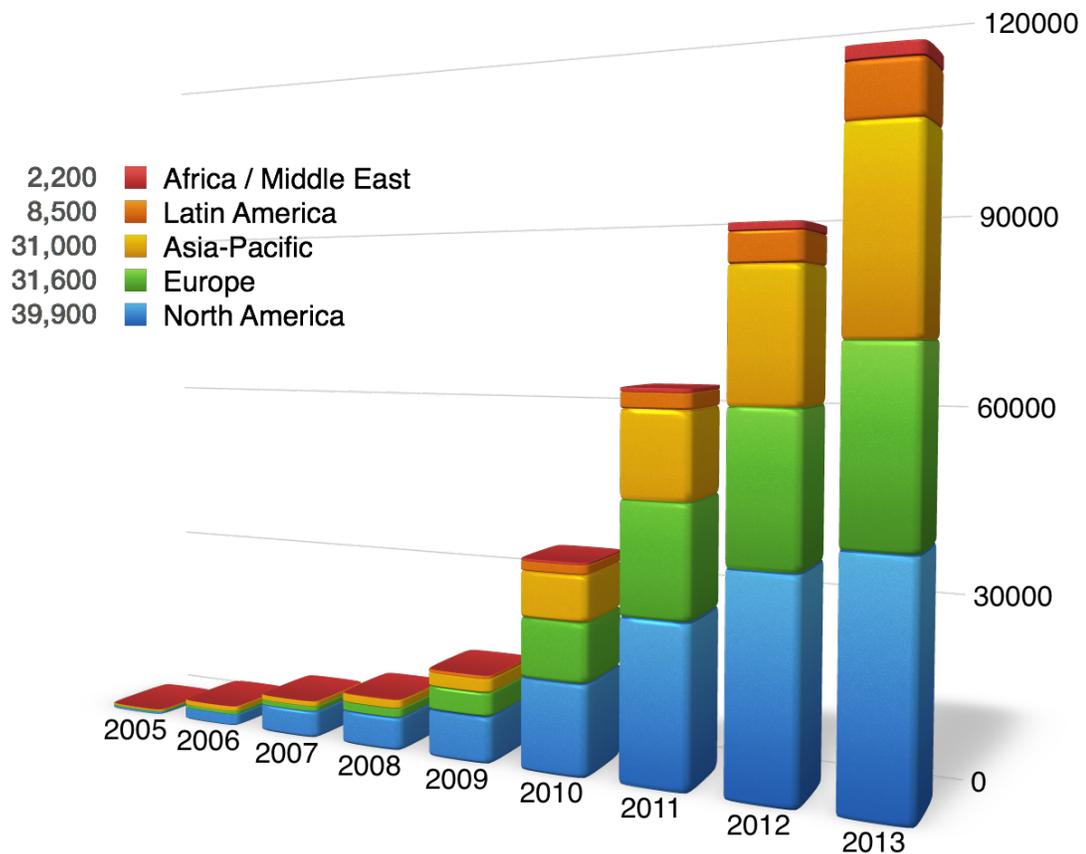


Figure 1

Figure 2 below presents a different view of the data, showing how many screens remain to be converted. As of July 2014, it is estimated that the remaining screens to be converted have been further reduced by 50%.

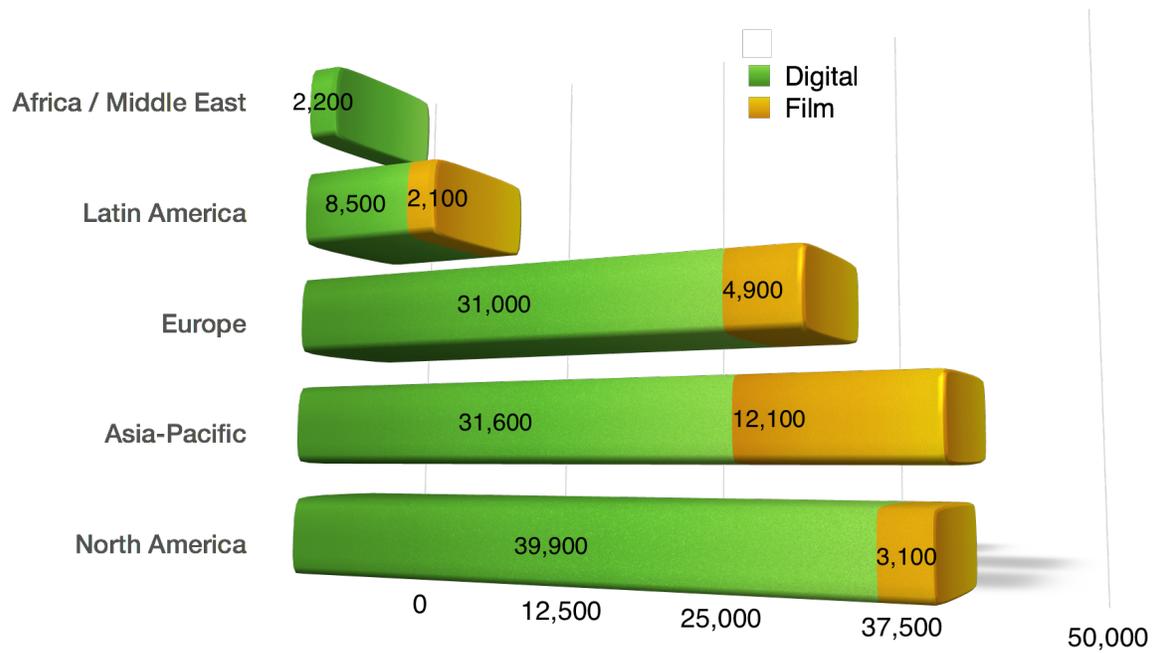
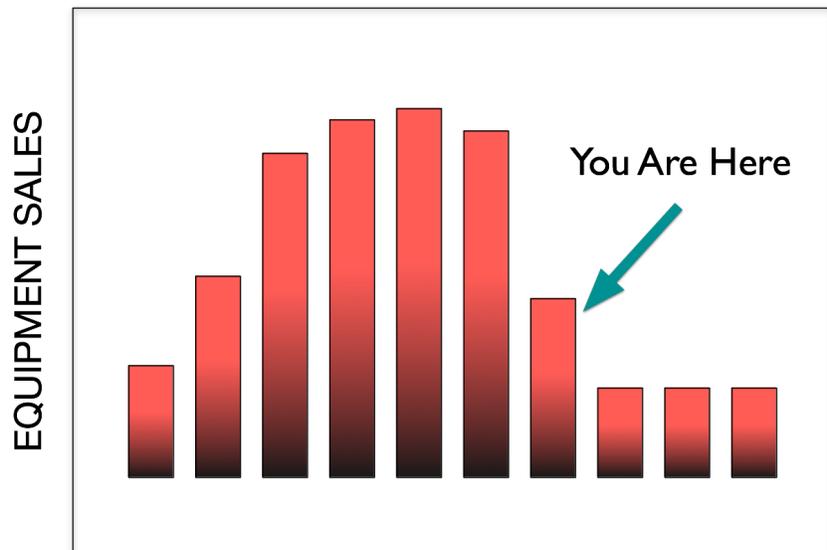


Figure 2

The pace at which conversion took place was a boon for equipment manufacturers. But the cinema equipment market will soon return to its former pace of sales, which will lead to at least three types of behaviors in the marketplace.



The first of these behaviors is consolidation. This behavior has already begun, the prime example being the announcement early this year that Dolby will purchase Doremi. There could be more consolidation to come.

The second behavior is the broadening of product lines, which can also drive consolidation. Up until recently, one bought a projector from one company, media block from another, and sound system from yet another. The sales boom required companies such as Christie and Barco to build extensive sales channels, which can now be leveraged to sell products other than projectors. This is a particularly attractive move to make as sales of the original line of products are falling. Consequently, we see projector companies now selling their own media blocks and sound systems.



### Barco Alchemy module

Integrated Cinema Media Processor (ICMP)



The third behavior is innovation. Faced with a saturated market, the best way to stimulate sales is to obsolete existing equipment by introducing new must-have features. As a result, we hear talk about higher resolution, higher frame rates, higher dynamic range, and, of course, laser-illuminated projectors.

Exhibitors are faced with a lot of messages concerning new technology, and tools are needed to sift through and understand where the value is. While we hear about higher resolution and higher frame rates, we don't hear much about higher contrast and color. Yet, if we were to list the factors that cause us to perceive quality in images, it would be Color, Contrast, and Resolution, in that order. An improvement in contrast will result in an improvement in perception of the image, far more than an improvement in resolution will. To illustrate this, the side-by-side images below have the same resolution, but different contrasts.



The media industry is evaluating a new standardized color space called ISO Rec 2020 that incorporates more colors than current cinema projectors can display. It's worth noting that digital cinema projectors already display a larger color space (called P3) than that used by consumer displays. DCI recently issued a directive that new technology projectors conform to the P3 color space so as not to disrupt current workflow and distribution.

It's unlikely that xenon-illuminated projectors will move into larger color spaces. Laser-illumination technology, however, appears to be a good candidate for this. Laser-illuminated projectors has become quite the buzz lately, positioned as the cure for low light levels in 3D. This is why we see 6-primary laser projectors introduced in the marketplace. These projectors apply 3 primaries to the left eye, and the other 3 primaries to the right eye, which allows color separation glasses, similar to the Dolby 3D glasses now in cinemas, to be used in a very efficient fashion. However, the cost of laser projectors is extremely high, in the US\$8-\$10 per lumen range. This technology is not going to rollout quickly in cinemas to boost 3D light levels.

### 6 Primary 3D Laser Projection **CHRISTIE**



### 6 Primary Barco Laser3D Single projector 6P 3D system



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Laser-illumination technology is best suited, however, for high dynamic range (HDR) projection. (An approximation of which is illustrated by the right-hand

images below.) HDR requires the high light output possible with laser illumination, and also benefits from the larger color space possible with laser primaries. But again, the high cost of laser projection tells us that this technology isn't going to roll out quickly, either. In fact, an HDR projector capable of lighting a very large screen could cost in the range of 1M Euro. Given this, exhibitors can expect that their DCI P3 xenon-illuminated digital projectors will have a very useful life.

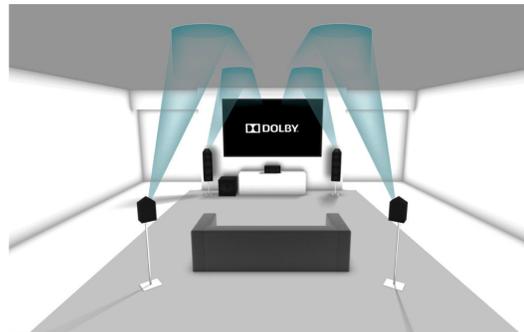


While laser projectors may not be the killer solution for higher 3D light levels in cinema, less costly advances in technology are making it possible to get more 3D light output from existing systems. The efficiency of 3D polarization systems has improved significantly. To complement this, the latest polarization-preserving screen technologies from Harkness, MDI, Severtson, and RealD now provide much wider viewing angles than before. The result is that polarized 3D solutions are now the affordable technology of choice for higher brightness 3D.

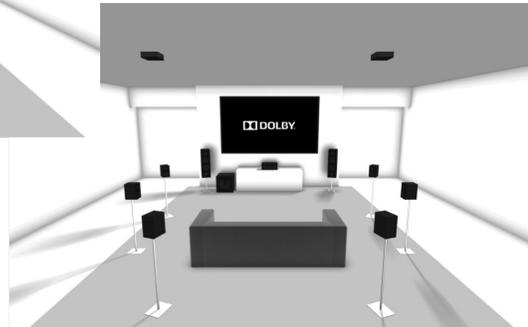


Innovation in cinema is also taking place in sound. Immersive sound systems are making their way into the marketplace, both the cinema and the home. The

concept behind immersive sound is to surround the listener in a hemisphere of sound.



Immersive Audio  
in the Home



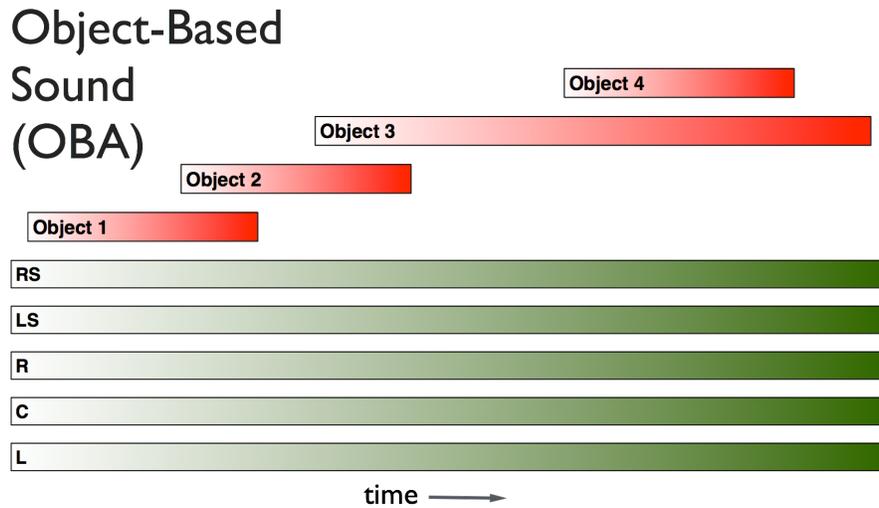
 **DOLBY** ATMOS

Immersive  
Audio  
in the  
Cinema

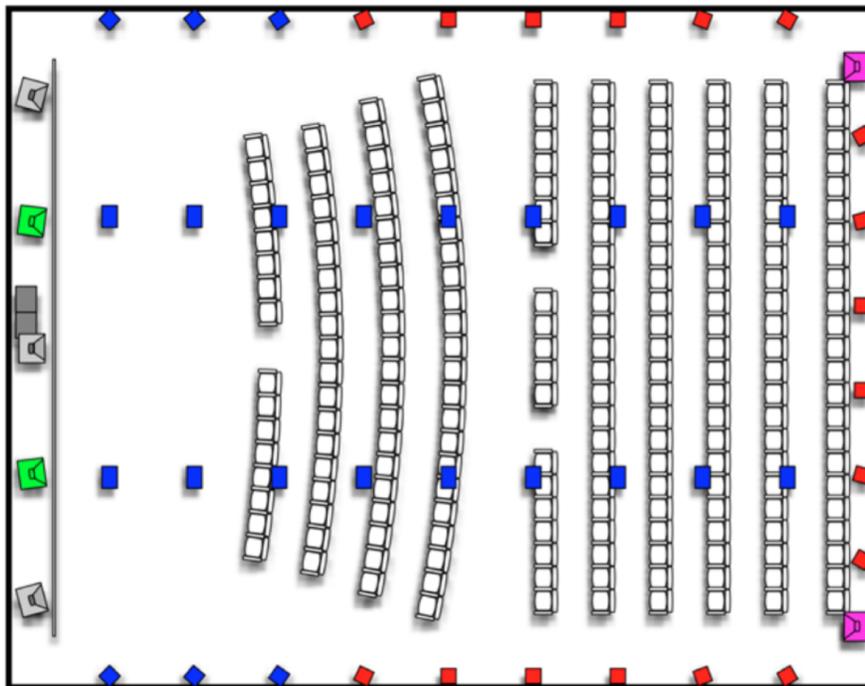


Both the Dolby and DTS systems employ a new technology called Object-Based Audio, or OBA. OBA sound tracks are comprised of both channel-based audio (such as 5.1 or 7.1 audio), and chunks of sound, called “objects.” Sound channels are directed to a specific speaker system, such as a left screen speaker, or a right surround speaker array. Sound objects can be directed anywhere in the sound system, such as the right front corner of the room near the ceiling. A sound object can be panned from one position in the room to another, say from the right front corner near the ceiling, to the back of the room, traveling over the heads of the audience. The panning of the sound is actually *rendered* by the audio processor in the cinema. The concept behind this is that the rendering device in the cinema can be programmed with the actual

speaker locations, so it can best figure out how to accommodate such pans. While channels of sound are recorded from the beginning of the movie until the end, an object of sound more likely has a short duration. The drawing below compares short sound objects with long sound channels.



Object-based sound can employ a lot of speakers. The projected floor plan below, showing speaker locations, is taken from a marketing sheet for Dolby Atmos.



Object-based audio imposes new challenges to cinema in terms of interoperability. Audio objects are positioned in space according to data embedded in the sound track. There are no standards for OBA sound tracks as of this writing, so competing immersive sound systems cannot share the same sound distribution, causing massive problems for both distributors and exhibitors. As a result, DCI is moving to correct the problem, and a new Immersive Sound group in SMPTE is now working towards the creation of OBA standards.

What has just been presented is an array of innovative technologies that take cinema beyond where it is today. What I didn't talk about is higher frame rates, or HFR, which isn't going away. HFR is only in its infancy, and will appear in select movies in the future where the director finds it complementary to their story. Most notably, with the exception of HDR, the concepts presented are incremental in nature. They can be incorporated as upgrades to existing systems if and when desired, and for the most part do not represent wholesale changes in cinema systems. However, if we were to lump all of these concepts together in one cinema, it would be noticeably different from what we have today. We could call it the digital cinema of the future, or...

## Digital Cinema 2.0

To summarize, the worldwide digital cinema rollout is nearly complete, ending the largest sales boom of cinema equipment in history. The roll-off of sales is cause for different market behaviors, ranging from consolidation, to expansion of product lines, and innovation. I described many of the exciting innovations that are emerging in cinema, but which are incremental in nature, optional, and do not require the wholesale refresh of newly acquired capital equipment.

I hope you found this talk useful in understanding the developments that are emerging in cinema. My contact information is below. Copies of my presentations can be downloaded at <http://mkpe.com/mediasalles>.

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