THE INDEPENDENT JOURNAL OF THE LARGE FORMAT MOTION PICTURE INDUSTRY

LF examiner®

First published in the Summer 2019 issue

LF Examiner Editor James Hyder on the IMAX Laser Dome System

An Editorial by James Hyder

In 2008 **Imax Corporation** launched its first digital projection system, which used two xenon-powered 2K projectors. Shortly after a demonstration in a New York multiplex as part of the 2008 conference of the **Giant Screen Cinema Association**, I wrote:

"The IMAX digital system projects an image that is bright, with good contrast and slightly better resolution than other digital projectors. But every IMAX digital theater I've been in has also had a noticeable "screen-door effect," that is, a visible dark grid pattern separating the pixels. It is particularly noticeable in lighter image areas, and is less visible the farther you are from the screen. But even with my 53-year-old eyes, I was able to see it from the front half of most of the five theaters I've been in.

"But IMAX — real IMAX — presents reality. Not reality as seen through a screen door." (*tinyurl.com/LFXscreendoor*)

A few years later I wrote,

"What separates the giant-screen experience from all other media (except perhaps fulldome shows) is its immersiveness and ability to give audiences the impression that they have been transported to another place. Chief among the factors in achieving this effect is image quality: the pictures must be bright, clear, and sharp, but the greatest of these is sharpness." (*tinyurl.com/LFXimmerse*)

The new IMAX laser dome projection system, introduced last year and installed in two theaters to date, with three more contracted, uses a single 4K projector to fill the dome screen. Like all IMAX digital systems, its images are very bright and have excellent color and contrast. The problem, once again, is resolution.

As demonstrated in these pages by **Gord Harris** last year (*see Nov.-Dec. 2019*), a 4K image projected on a dome with a diameter greater than 60 feet simply does not have enough pixels to provide eye-limited resolution at normal viewing distances.

In short, the pixels are once again visible.

A 4K image projected on a dome greater than 60 feet simply does not have enough pixels to provide eye-limited resolution at normal viewing distances.

This is what I observed (with my now 64-year-old eyes) in visits to both of the theaters equipped with the IMAX laser dome system. Sitting in the center of the theater near the doghouse, I could see pixels in the center of the screen, particularly in light scenes, and when I sat further down or closer to the sides, they were even more noticeable. Today's DLP chips have a better fill ratio, meaning that the dark, non-reflecting portion of the image between the micro-mirrors is smaller than it was a decade ago, so they don't display as obvious a "screen-door effect" as the first-gen IMAX systems did. But the simple fact is that pixels are still visible, because they are too large.

Consider this: the width of each pixel of a 4K image on a 70-foot (21-meter) flat screen is approximately 0.21 inches (5.2 mm). Whereas the width of each pixel of a 4K image across a dome screen is (on average) is 0.32 inches (8.2 mm), 50% bigger. (The IMAX laser system also stretches the pixels vertically, making them even larger.) Put another way, the surface area of a giant dome is roughly twice that of a giant flat screen that is the same width as the dome's diameter. And to make matters worse, the audience is closer to the screen in a dome.

After the first demos of 4K projectors in 2011 and 2012, the GS industry agreed that 4K was just barely good enough to replace 15/70 film for flat screens. Accepting 4K for domes is like accepting 2K for giant flat-screen theaters, and the universal consensus from the introduction of digital projection in 2008 was that 2K was inadequate for true giant screens.

The result is that the IMAX laser dome system's image simply doesn't have the crispness and level of detail of the 15/70 film it is replacing. Long shots with lots of details, like leaves on trees, are soft and indistinct, and don't provide the "you are there" experience that has been characteristic of the IMAX experience since 1970.

My reaction

I find this disheartening at two levels. First is that this seems to be a real step backwards for Imax Corporation. For a company that built its reputation on outstanding image quality to offer this clearly (in my opinion) sub-standard product seems to be a betrayal of all that Imax has stood for over the past 50 years. (Of course, one could argue that this is not the first time, that Imax did this with the in-

LF examiner
THE INDEPENDENT JOURNAL OF THE LARGE FORMAT MOTION PICTURE INDUSTRY

Founded 1997 as MaxImage!

Summer 2019
Vol. 22, No. 5

Editor/Publisher
James Hyder

Associate Editor
William Hyder

Circulation Manager
Thomas Jacobs

Published eight times a year by Cinergetics, LLC, and distributed by first class mail.
Printed in the USA.

ISSN 1532-5504

Subscriptions: US$447
Outside North America: US$497
All payments must be made in US funds.
Substantial discounts are available for multiple subscriptions to the same address.

Editorial Offices
1413 Eastbrooke Way
Marietta, GA 30066 USA
Tel: 770-693-9755
editor@LFexaminer.com

4K pixels on a 70-foot flat screen (all shown actual size)

4K pixels on a 70-foot dome

4K pixels on a 70-foot dome with anamorphic stretch (IMAX laser dome)

6K pixels on a 70-foot dome

troduction of its original 2K digital system in 2008. But that system was intended for multiplex theaters, most — but not all — of which were smaller than the true giant screens found in institutional GS theaters. Even so, it did find its way into more than a dozen museum theaters.)

With a very small market — there were only about 50 IMAX dome theaters when the company began research and development on its laser products, and fewer now — Imax could never have recouped the cost of designing a digital dome system from the ground up. It had no choice but to adapt its existing flat-screen laser product. The original configuration of the dome system announced in 2015 placed two IMAX first-gen "GT" laser projectors at the back of the theater. This design probably would have offered slightly superior image quality over a single-projector system: two projectors blended with a small offset would have reduced or eliminated the screen-door effect, even though the actual resolution would have been unchanged.

But after spending several years and a great deal of money on R&D, Imax ultimately had to scrap it in favor of the single-projector system rolled out last year. The dual system for domes proved impractical for several reasons, including its high cost and the fact that retrofitting existing upper projection booths, or building new ones, turned out to be prohibitively expensive for many theaters.

The decision to settle on the single-projector system gives me the impression that Imax just threw up its hands and gave up, fobbing off a sub-par, Plan-B product on customers it no longer seems to care much about. One sign of Imax's attitude toward its institutional clients is that it has no plans to update or improve the laser dome projector, even though the contracts lock clients in to ten years of license and maintenance payments. Resolution, frame rate, dynamic range, and other characteristics will not be improved, even though suppliers like Christie and **Barco** routinely offer upgrades to enhance the performance of their existing systems.

And the IMAX GT laser system (in both domes and flat screens) is already behind the curve in terms of frame rate. It can only project 4K at 24 fps, even though most modern projectors from other vendors can project up to 120 fps. (The IMAX laser system can run at 48 fps, but only by dropping down to 2K resolution!)

In my view, Imax would have better served its dome customers, its own reputation, and the giant-screen industry in general if it had not released this system at all, and simply said, "We were unable to develop a dome system that meets our own standards for image quality."

The other development I find disappointing is that theaters are actually installing the IMAX laser dome system. I consider most of the managers whose institutions have made this decision to be my friends, and I don't want to appear to be second-guessing or criticizing them. I realize that it is easy for me to be idealistic. I don't have to weigh budg-

ets, business plans, visitor perceptions, system reliability, service track records, board and donor preferences (or directives!), and a thousand other factors that complicate the process of selecting a new projection system.

As I've said, for me, resolution is the *sine qua non* of immersive cinema, and I find the resolution problem of the IMAX laser dome system to be glaring and significant. Others may find the laser dome system's resolution to be good enough, or they may recognize the problem but not feel it outweighs other advantages of the IMAX system. So I give my friends at those five museums the benefit of the doubt and assume they made the right decision for their theaters. But I'm still dismayed.

Of course, compromising on image quality is nothing new in the giant–screen world. Reportedly, the founders of Imax Corporation were initially quite reluctant to adapt their new 15/70 film format to dome projection for the second permanent IMAX theater, the **Reuben H. Fleet Science Center** in San Diego. In 1976, the IMAX theater at the **National Air and Space Museum** was crammed into a previously designed space, and could only fit a screen with a 1.5:1 ratio, instead of 1.33, which forced all future films to give up use of the tippity-top of the frame. Many decried 8/70 film as a sub-standard format for capture. And in the digital era, the majority of theaters that have converted to digital have abandoned the 1.33 aspect ratio in favor of digital's 1.9 frame. The IMAX laser dome system is yet another step along this path of compromising the GS experience, in my opinion.

Even though I now have 35 years in the GS business, I recognize that my opinions are hardly infallible. But I have spoken with several GS experts who have seen the IMAX laser dome system, and the majority, at least half a dozen, agreed with my perception of its inadequacies. As a journalist I prefer to remain neutral, and whenever possible to present the opinions of people with greater expertise in place of my own. Unfortunately, despite my urging, no one would speak on the record. However, two agreed to speak on condition of anonymity.

Every GS show presented with a projection system that doesn't live up to the highest standards of image quality degrades the reputation not only of that venue but of the whole industry.

One long-time observer of the GS world told me, "Imax's digital dome system, while appearing reasonably bright with good color gamut, is at the low end of the spectrum when it comes to pixel resolution. A single 4K projector cannot cover a giant-screen dome with sufficient pixel density to be considered 'best-of-class.' Its unusual fisheye lens mapping attempts to increase pixel density towards the screen's 'sweet spot,' but as a result is not well suited to accurate image mapping. The system is robust and easy to use and will no doubt find favor with some theater directors; however those theaters wishing to maintain the high resolution of 70mm film will want to consider multi-projector solutions, or wait until an 8K version is developed."

Another GS veteran said, "Imax deserves credit for what they've achieved with a single-projector system. You have to admire its simplicity. Aside from resolution, it probably checks most of the boxes for dome theaters. Yet, for all its virtues, a 4K system for domes is not worthy of the IMAX brand. I have to wonder if competitive pressures will eventually lead Imax to develop an 8K 60 fps solution."

(Please note that these experts are entirely independent of each other, and did not know about the other's comments. The fact that they both mentioned the possibility of an 8K upgrade is coincidental and entirely speculative, and as far as I know does not reflect any inside information that Imax, or any other company, is considering a single-projector 8K system.)

The fate of GS theaters

As with films that fail to use the GS medium appropriately, every GS show presented with a projection system that doesn't live up to the highest standards of image quality degrades the reputation not only of that venue but of the whole industry. Sub-standard shows turn away visitors who hoped to be immersed and transported, but were instead let down by a lackluster presentation. Those people may not come back to that theater, and may never go to any other GS theater, either. And so the downturn in attendance across all our theaters continues.

But it doesn't have to.

Dome theaters now have many options. Multi-projector systems with 6K or 8K resolution, as offered by vendors like **D3D Cinema** and **Evans & Sutherland**, are as good as, or better than, 15/70 in terms of resolution, and much better than the IMAX laser dome. It is true that, until fairly recently, some of those systems couldn't match the brightness or contrast of the best film presentations, but new laser projectors are changing that.

And there are several new technologies in the wings that promise even greater improvements. True high dynamic range (HDR) is now available for dome and flat-screen theaters. As we report in the Summer issue, the Hayden Planetarium at the **American Museum of Natural History** in New York City has just upgraded to new Christie projectors that boast a nominal contrast ratio of 20,000,000:1, a vast improvement over conventional projectors' 2,000:1 range. Although the full extent of that range cannot be realized in practice on the Hayden's 68-foot (21-meter) dome, the new Eclipse projectors provide much deeper blacks than conventional units, essential to showing realistic star fields, and beneficial to the perceived realism of any type of production.

Perhaps the most exciting new development is direct-view screens that do away with projectors entirely and promise vastly greater brightness and contrast for both dome and flat-screen theaters. E&S' DomeX, and similar systems said to be coming from other vendors (*see May-June 2019*), could significantly change the landscape of dome theaters. Flat LED screens are already being used in some multiplexes, and could conceivably also be installed in GS theaters, offering a dramatic upgrade in image, brightness, contrast, color, and resolution.

Multi-projector systems with 6K or 8K resolution are as good as, or better than, 15/70 in terms of resolution, and much better than the IMAX laser dome.

These and other options are available to the 38 dome theaters and 19 flat screens that are still only running film. This plethora of choices, and the expectation of even more options, may be among the reasons that only five domes have signed up for the IMAX laser dome system more than a year after it was introduced.

If the GS industry is to turn around the slow decline of the last few decades and remain a vital and relevant source of immersive, entertaining, and informative experiences, it must innovate and differentiate itself from other forms of out-of-home entertainment. The giant-screen experience has never been about "good enough." It has always been about being the biggest and best, and exceeding the ordinary.

Our movies must continue transporting people to places they have never been, and immersing them in amazing "you are there" experiences. It can't be done with compromised old tech. New technologies can make those experiences even more compelling, more realistic, and perhaps even more lucrative.

LF Examiner welcomes, and will consider publishing, all responses to its editorials. Please send e-mails to editor@LFexaminer.com.

James Hyder has worked in the giant-screen industry since 1984, including managing the IMAX theater at the National Air and Space Museum, then the most popular giant-screen theater in the world. He has been editor and publisher of LF Examiner since founding it in 1997.

The Giant Dome Theater at the Museum of Science and Industry in Chicago has a D3D Cinema three-projector 6K laser dome system.

Marco Verch, CC BY 2.0

The IMAX with Laser projector installed in the Robert D. Lindner Family OMNIMAX Theater at the Cincinnati Museum Center in Ohio.

LF Examiner