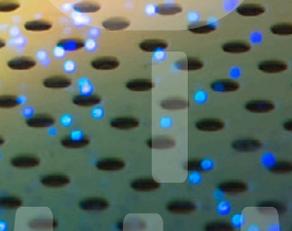
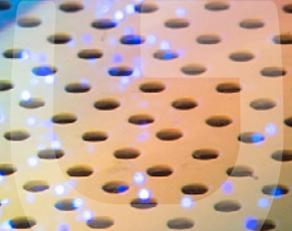
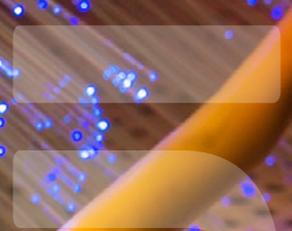


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Cutting Edge Video Display Technology

A look at major technological developments, from projectors to LED for large-scale displays, their distinguishing factors—and their production promise for houses of worship



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Redemption World Outreach Center, Greenville, S.C.

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Cutting Edge Video Display Technology

A look at major technological developments, from projectors to LED for large-scale displays, their distinguishing factors—and their production promise for houses of worship • **By Christian Doering**

Technology is a powerful force for change, and modern worship spaces have been feeling its impact for some time. Fortunately, the pace of change, while rapid, is manageable. We've talked to several leading manufacturers in order to give you a look ahead at the next big (and little) things in video display. Our goal is to inform your planning and budgeting process, so you can ride the waves of video technology gracefully. In the process, we spoke with editorial consultants and a number of manufacturers, including Absen, Elation Professional, Daktronics, and Digital Projection: all of them provided technical insight and expert advice for this article.

Projectors & LED Walls: Apples & Oranges?

Projectors are the old standby and LEDs are the hot new thing, right? Wasn't this year's Nobel Physics Prize awarded to three co-inventors of bright blue light-emitting diodes? Indeed it was, but that doesn't mean projectors are "so last decade." There are major new developments in projector technology. You will be looking at both technologies for large-scale displays, and they are very different. Here are some key distinguishing factors.

Projectors bounce light off a screen, or occasionally throw it through a screen from the rear. Video displays emit light directly. Technically we should use luminance (can-



dela or nit [a unit of luminous intensity] per square meter) to compare display brightness, while projectors are usually compared using units of luminous flux (lumens: candelas per steradian. A steradian is a 3D conical section of a sphere; a radian is a flat pie-shaped section of a circle). For displays, what matters is intensity and size. For projectors, intensity, size of the source, and size of the illuminated cone all matter. You will see published specs for LED walls in lumens, and they will be lower than projectors of similar price. But the perceived brightness may be very different. Again, LEDs emit light, while projectors bounce it off a screen, which has to be white or silver. It's impossible to project black off a white screen. LED displays can use masks or turn light emitters off in order to display black. Because the contrast is higher, LED images can be seen as "brighter" and "sharper," especially when ambient light is present. And despite the lower output in lumens, there's plenty of brightness available: indoors, most LED walls will be run at 20% to 30% of maximum brightness to avoid washing out theatrical lighting or blinding IMAG cameras.

When it comes to resolution, projectors are set once and for all at the factory. Resolution is measured in pixels, a pixel being the smallest controllable element of a picture. Over the past few years, resolution has increased from XGA (1024 x 768 pixels) to WXGA (1280 x 800 pixels), HD (1920 x 1080 pixels) and now 4K (4096 x 2160 pixels). An HD projector can display a WXGA signal via upscaling, but a 4K signal would have to be scaled down for the projector.

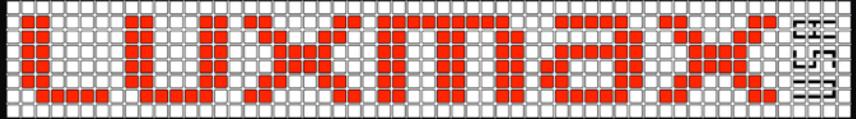
LED displays have a fixed pixel pitch, the distance between one LED and the next. Each LED could be a surface mounted diode (SMD) or a dual in-line package (DIP). SMDs look more like computer chips than lights, while DIPs resemble light bulbs. SMDs can be made smaller and mounted closer together, producing smaller pixel pitch and higher image resolution. To avoid pixelated images in which individual pixels become visible, allow about a meter (a yard and a half) of viewing distance per millimeter of pixel pitch. Videowalls are often divided into "indoor" displays, which have tighter pixel pitch and therefore a closer minimum viewing distance: these tend to use SMDs.



Supplied by Mega Systems Inc. of San Antonio, the I-5 Dicolor LED Display at Redemption World Outreach Center in Greenville, S.C., is on a 5mm pitch and uses Dicore processing cards, which allow for individual pixel calibration.

Image courtesy of AE Global Media.





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Fortunately, the pace of change, while rapid, **is manageable.**

“Outdoor” displays have looser pixel pitch and are often made with DIPs. Scaling might be needed, but it’s usually built into the back-end electronics that drive the wall. “Wall controllers like ours will scale the input image up or down to match the actual resolution of the videowall,” says Matt Anderson in video products marketing with Daktronics in Sioux Falls, S.D.

What about the Benjamins? The comparison you are most likely to see at this point is initial purchase vs. cost of ownership. In a nutshell, LED walls are most expensive to buy while projectors are more costly to own. You should make your own calculations of

payback period and expected lifespan, rather than relying on a manufacturer’s sales team to do the math for you.

**Projectors:
New Light Sources, New Inputs**

Before you bought your last projector, you probably spent some time deciding between xenon and UHP lamps. Today, you have more choices. HID (high intensity discharge) lamps have been available for quite a while, but they’re only now making their way into large video projectors. They use less power and generate less heat than xenon or UHP, while producing more lumens.



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Laser lamps like those in the Digital Projection Inc. (DPI, based in Kennesaw, Ga.) Insight 4K Laser projectors will also save you money by consuming less power and generating less heat. A lot less: DPI Product Manager Phil Laney says that if these projectors are left on overnight in an air-conditioned space, they'll be blowing cool air, not hot, by morning. DPI uses a blue phosphor laser in its 3 chip projectors. Laser lamps have a 20,000-hour useful lifespan, and the color space is larger than previous lamps, with particularly rich reds and blues. Laser projectors can be mounted in either portrait or landscape orientations. WUXGA models output 1920 x 1200 (or 1080p) images, enabling them to handle almost all of the content currently available. If you want to be ready for 4K, DPI already has 4096 x 2160 projectors for you, but it may be three years before your content generation catches up to your display.

LED projectors are also very efficient, and have an even longer lifespan—you will probably replace an entire DPI Insight LED projector before its 50,000 hours of life have expired, and even then, the projector will still be running at more than 50% of its original brightness. LED light sources output fewer lumens than lamps do: DPI's offerings are in the 1,000-lumen or 3,000-lumen range. But LED lumens look

brighter, Laney points out. That's because the LED's color space is so much wider, so images have more contrast and are generally more eye-pleasing than the projected images you've grown used to. "LED projectors are great in light-controlled environments, for rear projection, or with smaller screens," Laney says. "For brighter, larger image areas, laser light sources are the way to go."

Both kinds of Insight projector offer warp and blend controls along with precise control of geometry. So if you want to expand coverage with overlapping images, or develop greater brightness with overlays, a little tweaking will yield great results. Laser lamps' brightness and depth of field lend themselves to environmental projection, and third party

software is available to tailor the image to the contours of the architecture.

**LED Videowalls:
 A Whole New Display Option**

Linked LED displays (videowalls) are poised to disrupt the video projector market. Following a now-familiar pattern, LED displays have been getting bigger, brighter, sharper, and less expensive at the same time. "Videowalls still have a higher initial purchase price than projectors of similar size," admits Ewa Tsai, sales manager (house of worship) for Absen, Shenzhen, Guangdong, China. "But prices are coming down. If you look at



Redemption World Outreach Center
 Image courtesy of AE Global Media.



an 8-to-10-year product lifespan, however, churches can save thousands or even tens of thousands in maintenance costs.

Panels have a lifespan of 100,000 hours.”

LED video walls offer the designer and integrator a whole new set of options: different dimensions and form factors that escape rectangular boundaries: columns,

crosses, digital scenery, concave and convex curved shapes. “You can go as big as you want with a videowall, and still maintain HD resolution,” Tsai points out. In fact, because the pixel pitch is fixed, the bigger the wall, the higher the maximum resolution: “If the displays are going to be rearranged in different shapes and sizes in different locations,”



Celebration Church, Jacksonville, Fla.

Image courtesy of Ketterman.

Buying the entire wall at the same time is the best way to get **bin-matched LEDs**.

says Alexander, “Daktronics portable displays come with configuration software that lets users arrange power and signal panel-by-panel to match the new layout.”

Because LEDs emit light rather than bouncing it off a screen, it’s easier to get excellent image performance. In fact, most LED walls are so bright that they need to be turned down in darker rooms, or when used as digital scenery. “Lowering the brightness will still produce good IMAG performance,” Tsai says, although colors will be less accurate. IMAG cameras aren’t disturbed by videowall backgrounds, as long as they’re dimmed. “We have several churches that broadcast their services without any issues,” reports Alexander.

When it comes to input formats, videowalls can go head to head with projectors: controllers will typically accept all the analog or digital signals you can throw at them. The processing takes about 3 frames or 40 milliseconds, which is barely visible.

Although videowalls are a newer technology than projectors, they’re robust. Absen, for example, ships spare parts and even panels with its videowalls. Just make sure to check the displays before the service, and to leave enough time to swap out any panels that are not performing. Manufacturers will service defective panels at a central location.

Another advantage of videowalls is the very wide viewing angles, typically ± 70 degrees both horizontally and vertically. “This means that colors don’t drift, even at corner seats,” says Tsai.

The LEDs themselves will last between 50,000 and 100,000 hours before losing half their original brightness. That’s a long

time, especially when you consider that your church may actually turn on a videowall about 1,000 hours in the course of a year. Red Walter, product specialist with Elation Professional in Denver, says that “fans, power supplies, the video receiver card or the CAT5 data cable are the normal maintenance issues: you can expect Mean Time Before Failure (MTBF) to be 3,000-5,000 hours, or three to five years of normal usage.” Preventative maintenance and the standard lifetime of the technology will keep an LED wall functioning much longer than a projector. Some manufacturers, like Daktronics, offer service plans: you can expect technical support for “under the hood” tasks like re-calibration, as well.

Control system failures are something to worry about, though. “Typically, the wall will black out downstream from the failure, just like a river being blocked by a dam,” says Walter. “Elation control systems have automatic redundancy, feeding signal both from the first and last panels to ensure no loss of video signal unless power is interrupted or a panel fails.” In the event of panel failure, the bad panel can be replaced with a spare, or bypassed by re-mapping. Elation’s EMAG4 holds panels in place with magnets, making them quick and easy to swap. Daktronics builds redundant power supplies into its systems, so backup is available immediately.

Like old-school CRT displays or projectors, video displays all look different. Ideally, your entire wall will be built with panels whose LEDs came out of the same bin: that way the color spectrum will be consistent across the wall. Buying the entire wall at the same time is the best way to get bin-matched LEDs.



Calibration and careful construction that minimizes differences between adjacent panels are also important. Walter points out that “tolerances are plus/minus, so a panel with a 3% tolerance can actually vary 6%.” The tighter the tolerance, the more pricey the panel.

As with any type of video display, constant use of a solid color will decrease its life exponentially more than color-balanced video. Drift is directly related to how much of that particular color is used during the production. Even so, you’re more likely to lose the electronics first. “Color drift is normally perceived as a change in the white temperature,” Walter explains. “If you have the Coke logo burning for a year on one panel and you then put on a full white, the area where the red had been will be noticeably more aqua or cyan. That’s because the red LEDs will be

degraded while the green and blue LEDs will still be very strong [since] they haven’t been used as much. Or white LEDs can dim over time as the components and gases break down—that has a similar visual effect.” You can re-calibrate the wall, but shifting the white balance will shrink the color space.

In general, LED walls work well for IMAG, but depending on the camera angle, you may see moiré effects when the wall is in the background of a shot. Filters can mitigate this issue.

How wide your color space is will depend on both the LEDs and the controller. “All the Elation processors have a minimum of 14-bit processing, and some are 16-bit,” says Walter. “The controller can prioritize either brightness or grey scale accuracy.” But be careful: If you go as wide as possible, you may push the LEDs to their limits. The



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old familiar NTSC standards give a “warm” look, but may prevent you from displaying intense colors such as deep ruby reds or forest greens. Ask if dimming and color balance are separate functions within the videowall signal processing chain: “Daktronics separates dimming from color balance to ensure clear, sharp images,” says Alexander.

Indoors, particularly when theatrical lighting is also in use, LEDs can be too bright. To maintain color balance, send a balanced signal to the wall, and set the controls for grey scale priority.

Projector lamps lose brightness and color, but it may not be obvious. Panels are right next to each other. What happens if one panel starts to die before its neighbor? Panels don't work like that because each LED is individual, unless you are in a position that you hold a static image in one panel and a different one in the next panel.

From Connectors to Networks

Most projectors or videowalls today offer a wide range of connector options, from digital HDBaseT, to HDMI and even old-school analog (VGA, etc.). But making physical connections to all those different sources can be a headache. That's where the switcher/scaler comes in. “For most churches, a 6- to 8-input switcher/scaler is the heart of the signal distribution system,” says Clint Hoffman, vice president of marketing for Kramer USA in New York. “It will take a wide range of sources and deliver them in the native resolution of the projector or display screen.” Hoffman points out the many advantages of HDBaseT for typical churches. These include 330 feet of range (HDMI, designed for the home, has a very limited range), glitch-free transition between sources (the switch takes place during a very quick fade-in-and-out). Integrators like Bobby Taylor, vice president of



Redemption World
Outreach Center
Image courtesy of AE Global Media.

LED video walls **offer the designer and integrator a whole new set of options**—different dimensions and form factors that escape rectangular boundaries—columns, crosses, digital scenery, concave and convex curved shapes.

business development at Pensacola, Fla.'s All Pro Sound, find that HDBaseT makes it a lot easier to wire up a system. "Until very recently, we'd have needed five coaxial cables, electrical power, a control cable and an Ethernet cable," he says. "Now we have one CAT6 cable for uncompressed 4K video, high quality audio, IR, serial, USB and other control data, plus 1,000 MB Ethernet, and even 100 Watts of DC power. That's a game changer."

Hoffman points out that projector and display manufacturers have embraced HDBaseT, which is crucial: no signal distribution technology has value unless there are plenty of endpoints for it. In the audio realm, Kramer recently became the 150th manufacturer to adopt the Dante audio-over-Ethernet technology. There are lots of audio endpoints for Dante, and a growing number for Audio Video Bridging (AVB), which promises digital audio and video over Ethernet. "For uncompressed high-definition video, you need at least 10GBps link speeds," says Jan Eveleens, CEO of Axon Digital, Breda Area, Netherlands, whose AVB-based Neuron production system is designed for the broadcast market.

"Between switches, at least 40 GBps of bandwidth is required, and you're better off with 100 GBps." Extreme Networks' Summit X670 can be configured as with one 40 GBps port or 10 GBps ports, and is AVB-certified. The AVNu Alliance of audio, video, automotive, and semiconductor manufacturers expects to begin certifying more AVB video endpoint devices in 2015. Meanwhile, Barco and technology partner Excelfore have teamed up to develop an AVB software stack for use with video walls. The software features Gstreamer Media Framework integration, APIs for multimedia, easy porting to a variety of chips, and both Listener and Talker component for use in a range of AVB endpoints. Excelfore is offering the AVB software stack as an open platform at reasonable licensing terms.

The Future's So Bright ...

Projector or video wall? Laser or LED? Coax or CAT5? You have a lot of choices to consider, and no doubt plenty of homework to do before committing to a new video display system. On the other hand, your prospects for delivering clear, crisp and attractive images have never been better.

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