

Practical Application of Large-Format Imaging

Notes on the use of video display equipment in theatrical, industrial, and presentational settings.

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Large format imaging is unrivaled in its ability to add visual impact to any presentational event. Be it massive projection screens or numerous flat panels, large format video adds an undeniably high-tech feeling to any industrial show. On the more dramatic side, video can be used as kinetic scenery and lighting, adding subtle dimension to an otherwise motionless scenic world.

This document will outline the current technology in large-format imaging, including imaging technologies, projection surfaces, and supplier information. This document is meant as an introduction to these technologies and as an ever-expanding solutions resource for those needing to apply them to various productions.

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Imaging Technology

Film Projectors are the type commonly found in movie theaters. They rely on a photographic film being passed in front of a light source. Film is generally more time consuming, expensive, and clumsy to use, so it is rarely found in modern applications. However, when very long throw distances and massively large images are used, the near-infinite resolution of film becomes a necessity. It is for this reason film is used in massively powerful makes such as PIGI projectors.

CRT Projectors were the standard in home theater until very recently. These projectors use three cathode ray tubes, or 'guns' to produce distinct red, green, and blue images which are overlaid to produce the final image. CRT projectors use a standard video signal yet produce color depth and richness to rival film. CRT projectors are heavy and difficult to transport, as the guns easily become misaligned from the shocks inherent in travel.

LCD Projectors are the current standard in business, home theater, and most other video applications. Light is passed through a series of liquid crystal screens similar to those found on laptop computers, each contributing a single color to the final image. While the resolution of these projectors is on par with that of CRTs, LCD projectors suffer from 'screen door' effect, a mesh visible between pixels when the image is very large. While not important in many applications, true videophiles have refused to accept LCD projectors for this reason.

DLP Projectors are the new wave in video technology. By using a micromirrored reflective surface, the screen door effect is eliminated. Also, the contrast ratio of DLP projectors is significantly higher than that of LCDs. However, current DLP projectors under \$20,000 use only a single reflective chip, with color discrimination being handled by a rapidly spinning color wheel. Because of this, the depth and range of the colors is not as good as those found in an LCD. Top of the line DLP projectors use three separate colored light sources, eliminating this problem.

LED Video Walls are commonly used in outdoor applications as they are extremely durable and daylight-viewable. Light Emitting Diodes are placed together in clumps of three (Red, Green and

Blue) or, in newer models, a single RGB diode is used. Hundreds of thousands of tiny light sources combine to form a smooth image when viewed from more than twenty feet away. Video walls can be built to any size conceivable, but are expensive to the point of being cost prohibitive.

Plasma Screens are the highest-of-high-tech in television screen technology. Plasma screens have thousands of tiny pockets of electrically active gasses that, when excited by the flow of electricity ionize and emit light. Plasma screens are essentially made up of tiny neon lights and, unlike LCDs, there is no need for a backlight. The image is extremely bright and viewable from any angle. Plasma screens, however, are cost prohibitive with 45" screens running in the \$10,000 range.

Specification Definitions

Brightness: Usually measured in ANSI Lumens, brightness is also referred to as “ANSI Output” or simply “Light Output.” Brightness ranges from 600 lumens for smaller, desktop projectors up to 17,000 lumens for top end models costing tens of thousands of dollars. In a darkened theater where the projection surface is the primary light source, any projector over 1,000 lumens more than suffice. However, when ambient light from windows or theatrical instruments cannot be eliminated (either for practical or artistic reasons) brighter image sources must be used. High-output projectors are especially necessary when using black rear-projection material or when the throw distance is longer than about 30 feet.

Resolution: Resolution is the measure of the number of pixels in a given image source. Traditional analog video sources have a maximum resolution of 525 lines, which is the common resolution for TV monitors. However, large-format imaging often uses higher-resolution sources to combat the pixelation of magnified images. Computers, DVD, and HDTV all provide digital signals containing much more video information. Projectors and Plasma Screens are available anywhere between 640x480 and 1600x1200 pixels. The larger the image, the more important a higher resolution becomes. A 640x480 image projected to twenty feet will have a pixel size greater than a third of an inch, certainly detectable by the human eye in many settings.

Contrast Ratio: The contrast ratio is the relative difference between white and black in an image. The higher the contrast ratio, the sharper and more realistic the image appears. LCD projectors, for example, tend to have low contrast ratios, resulting in blacks which appear gray.

Inputs: Most video devices have multiple inputs accepting different types of video signals. Composite signals are usually low-resolution, interlaced analog signals which are input

through RCA and BNC connections. A series of three RCA jacks is used for Component (Y/C or RGB) video, a higher resolution frame-based analog signal. A six-pin tubular connector is used for S-Video, a higher-definition version of the standard composite signal. D-Sub connections are often available for connection to computers whose VGA signal offers the highest resolution of any device. Coaxial or optical inputs are used for HDTV signals, an emerging technology with several different video standards.

Aspect Ratio: The ratio of the width to the height of a video device is referred to as the aspect ratio. Traditional video is broadcast in a 4:3 ratio. However, movies and newer TV programs are available in 16:9, a wider-screen ratio considered more aesthetically pleasing by most of the video and film community. Aspect ratio is an important consideration when considering the source of the video signal and the surface onto which it will be projected.

Throw Ratio: In projectors, this refers to the ratio of the distance from the projector to the surface and the size of the resulting image. Like beam angle with lighting fixtures, this ratio is used to calculate the placement of the projector to achieve a desired image size.

Other specifications such as power consumption, operating voltage, operating temperature, audible noise, dimensions, and weigh are self explanatory, but must be taken into consideration when selecting an imaging device.

Professional Projection Screen

Surfaces specifically designed for front and rear projection are manufactured by several companies, including Rosco, Gerriets, and DaLite. This material is a vinyl with properties engineered for the specific requirements of projected light. Roscoscreen is the most common and the most available, sold in rolls of 55", 86", and 100." (See Appendix B for Roscoscreen specifications.)

When ordering screen, there are several specifications to take into consideration.

Purpose: Screens are made for front and rear projection, as well as certain materials which work well for both.

Color: Screen material is available in different colors. White has the highest light gain, resulting in the brightest picture. However, it also stands out on stage and easily picks up ambient light, resulting in diminished apparent image brightness. Black screens eliminate both these problems, being easy to disguise in scenery. However, because the front surface reflects so little light, black screens can only be used for rear projection. Very little light is passed through, but the high contrast of the screen helps to make up for this. Other colors are available, having qualities in between these two extremes. Again, see Appendix B for screen specifications.

Viewing Angle: Projection screens, particular rear-projection types, only pass light through a defined 'cone of visibility.' This means that audience members off-axis from the screen will see an image with reduced brightness and definition.

Light Transmission: Different screen materials transmit different amounts of lights. This is critical when planning for ambient light and projector selection.

Alternative Screen Materials

There are other, lower-cost alternatives to professional screen material. Nearly any surface can be used for front projection, the clarity and brightness of the image depending on the color and texture of the material. However, certain common and less expensive materials can be used for rear projection, with diminished quality. These can be used for artistic effect or to meet a tight budget. In many cases, a bright enough projector will make up for the lower quality of the projection material.

Muslin works marginally as a rear-projection material. Thin dressmakers' muslin is the best choice. Light transmission properties can be increased by wetting the muslin with a mist of water. Muslin tends to produce a noticeable hotspot when used for rear projection.

Tracing Paper, especially frosted velum, works well in many situations. It can be taped with clear packaging tape on the front side with little noticeable effect on the light transmission in that area.

Shower Curtain, particularly the gray, tan, and white vinyl liners. White works passably for rear-projection, but has a sharp decline in image visibility at more than 30 degrees off-axis from the projector. Frosted translucent shower curtains are also usable. Clear vinyl will work when sanded lightly with 60 or 80 grit sandpaper.

Parachute Silk can be used for both front and rear projection, though it will have lower resolution when shot from behind.

Diffusion Gel, particularly a light frost, works as well as velum, but with reduced bright spots. This is a particularly good solution, when affordable.

Visqueen construction vinyl (used for moisture proofing and insulation) can be used when both sides are lightly sanded with 60 or 80 grit sandpaper.

Perforated Movie Screen distributed by cinemagraphic installers can be used as a front-projection surface, or as a very dim rear-projection surface (the light 'bends' through the holes, making it visible.) Dissolve-through effects are possible, similar to a scrim. Rosco and Gerriets both make a similar material with projection/transparent dissolve possibilities.

Projector Suppliers

Barco: www.barco.com -- Manufacturer of professional-grade, high brightness projectors, plasma screens, and LED walls. Reported to have poor customer service.

BarcoView, LLC (Distributor / Regional Office)

4420 Taggart Creek Road

Suite 101

Charlotte, North Carolina 28208

Phone: 704.392.9371

Fax: 704.399.5588

Christie: www.christiedigital.com -- Manufacturer of professional installation and touring projectors.

10550 Camden Drive

Cypress CA 90630

PH: +714-236-8610

FX: +714-503-3385

Toll free: (800) 407-7727 (North America only)

sales-us@christiedigital.com

InFocus: www.infocus.com -- Manufacturer of high-quality corporate and home-theater projectors.

27700B SW Parkway Avenue

Wilsonville, OR, USA 97070-9215

Telephone: 503-685-8888

Fax: 503-685-8887

Toll-Free in North America: 800-294-6400

info@infocus.com

Proxima: www.proxima.com -- Professional products division for InFocus

See InFocus above.

Screen Suppliers

BMI: www.bmisupply.com -- Distributor of all things theatrical.

BMI Supply South:

Roderick Dampier

ph: 800-670-4264

fax: 864.877.1062

bmiSC@bmisupply.com

Roscoscreen,	55":	\$15.75/yd
	86":	\$14.92/yd
	110":	\$91.20/yd

Rosebrand: www.rosebrand.com -- Theatrical distributor, excellent online catalog.

Rose Brand East

75 Ninth Avenue

New York, NY 10011

Toll Free: 1-800-223-1624

Phone: 1-212-242-7554

Roscoscreen,	55":	\$15.70/yd
	110":	\$96.60/yd

Texas Scenic: www.texasscenic.com -- Theatrical distributor, excellent customer service.

Phone: 1-800-292-7490

Fax: 210-684-4557

Application Notes

This section contains various tips, trick, and application notes pertinent to the use of large-format imaging.

Super-large images can be created using multiple imaging devices. A video-wall processor can be used to split a single video signal out to multiple screens or projectors. Alternatively, the video can be split during pre-production and played back using a computer, DVD player, or VCR which is capable of synchronizing to SMPTE timecode.

Throw Distance can be increased through the use of mirrors. Mirror and projector placement suggestions and data can be found in Richard Pillbrow's [Stage Lighting Design](#)

Controlling Sidelight is especially important, as it cuts down on both image brightness and viewing angle.

Tensioning of alternate materials (and professional materials, if not factory-bound) can be done by gaff taping the edges, then inserting grommets on 6" centers.

Hot Spots can be reduced by placing the projector off-axis with the audience's viewpath, as well as by suspending a coin a few inches in front of the projector to mask the hotspot. Shadows may become a problem with some high-quality lenses.

A 3D effect can be generated by projecting onto a three-dimensional surface. For example, video of an actor speaking could be projected onto a large, white Styrofoam 'blank' head, creating a stunning and convincing 3D animation effect.

Wrinkles can be removed from screen materials by hanging them at room temperature for several days. More aggressively, a diffuse wash of stage lights will gently warm the surface, releasing deeper wrinkles.

Lens Selection can be approximated using the rough estimate:

image size = lens length x throw distance

For example, a 2" lens will produce a 20' image at 10 feet.