Defining the Difference in Perforated Screens

By Alan C. Brawn CTS, ISF, AIA

For nearly a quarter of a century I have been labeled as a “display guy” in the professional and home theater audio visual industries. I suppose I must plead guilty to the charge after years of teaching the Advanced Display Technology courses at Infocomm and working with display companies like Hughes-JVC, Runco, Samsung, Barco, and Brillian Technologies each of whom advanced the art of the “perfect picture” in their unique way. My “graduate studies” in the pursuit of perfection on screen, was working on the first experiments in digital cinema with Paramount, Miramax, Lucas Films and Stewart Filmscreen. They opened my eyes to the level of detail we need to approach the look and feel of the 35mm film experience.

If the pursuit of digital cinema drove the focus on picture quality over the last decade, today the home cinema industry has picked up the charge and is some notable cases goes beyond the scope of the original mandate. This is the bastion of Joe Kane’s Digital Video Essentials, Ray Soneira’s Display Mate, and the omni present THX stamp of approval. It appears that those of us who are manufacturers, integrators, consultants, and end users that attend the annual CEDIA Trade Show are the next best hope for seeking out the “perfect picture” that is our holy grail.

If we talk about image quality in home theaters, we cannot ignore flat panel displays with advanced plasmas up to 71”, LCDs with their faster panels up to 65”, and we might as well throw in LCD, DLP and LCoS thin profile retro displays in the >80” range to round out the group. The “problem” with all of these displays is that they are not big enough to engulf the viewer and replicate the true cinema experience that many feel is the be all and end all of the quest. For this reason, we want to examine the highest rung on the ladder and look at front projectors and front screens that truly put the viewer in the proper perspective.

We can open up Pandora’s Box relative to which display technology is “best” at another time but from my perspective there are excellent projectors out there using LCD, DLP, and LCoS as the imaging source. The bottom line is that the best of the best in each area will replicate the quality of 35mm color film. We now await the letters telling us it ain’t so, but save your breath because it is finally true!

Those of you thinking ahead will know that this is only half the story and of course we are speaking of the projection screen to complete the picture. In this regard let us once again take the highest road and the true cinema experience as our guide. This path takes us to the topic of the perforated screens similar to what is used in cinemas around the world.

What we thought would be a “simple” examination of what we see and what we hear in the home cinema experience relative to perforated screens, blossomed into a project with a life of its own. In doing research for the white paper there was little information on the topic and even less of a scientific nature. The following white paper evolved into a full research project incorporating some of the best audio and video minds in the industry to help us separate marketing hype from scientific evaluation and fact. It became clear that we needed a scientific approach and metrics providing data and backup for our findings. We therefore dedicate this to the people who spent countless hours humoring us in totally dark rooms, variable ambient light conditions, and testing every screen type and speaker configuration “known to man” in the pursuit of the truth.

The Perf Screen Experience:

It seems that we thrive on the “who is best” arguments in all walks of life. There is the PC versus MAC conflict and the Ford versus Chevy versus Dodge battles that fuel the NASCAR phenomenon. In our realm of replicating the cinema experience we can look to a more profound group of metrics with which to make our decisions relative to perforated screens and perhaps in the process take some of the argument out of the “who’s best” discussion. We must examine:

- Appearance of resolution
- Contrast (local and broad area)
- Brightness and light loss
- Uniformity
- Color saturation
- Cross reflection
- Acoustic transparency in perforated screens

All of these factors must work in concert with one another to give us the image and audio transparency that we strive for on screen.

First of all, let’s take a look at perforated screens and what they bring to the table. In the traditional cinema environment, perforated screens are used in conjunction with speakers mounted behind the screen surface. The primary purpose is to localize the delivery of speech and sound to an appropriate area of the image, in order to heighten the sense of involvement and believability. In recent years as more and more consumers have installed home theaters, the desire to fully replicate the cinema experience has flourished. Many believe that the experience is heightened more in a home theater environment than on the big screen due to the proximity of the audience to the screen.

With the desirability of perforated screens on the rise, the question of how to manufacture the screen with “holes” in it becomes paramount. It is easy to understand that there must be a happy medium between acoustical transparency, loss of reflected light on the screen, and the perforations on the screen surface. The magic in all of this is finding the compromise among all the elements and providing an uninterrupted viewing experience at closer distances than will ever be experienced in a traditional theater.

The viewing distance appropriate for an acoustically transparent screen is dependent upon the type of perforation, and to a lesser degree, the level of illumination. As an example, in a conventional theatre, with a luminance level of 12 Foot Lamberts (nominal), the studio industry standard Stewart Cinema Screen will have the perforations vanish at a viewing distance of 15 feet whereas the Stewart MicroPerf fabrics will vanish at a viewing distance of 12 feet. SMPTE Standard 196M calls for a luminance level of 12-22 Foot Lamberts open gate in a darkened room. Many viewers these days, are not entirely satisfied, however, with a viewing experience in a completely darkened room, and subsequently aim at a luminance level more like 25-50 Foot Lamberts, in a partially darkened room. As luminance increases, perforation or texture of the surface can become detectable at closer distances therefore viewing distance should be analyzed and the viewing area should be determined in a manner that allows the perforation to vanish.

Regarding the issue of brightness emanating from the screen surface and the desire for viewing in a dimly lit room rather than total darkness, one must consider the projector and screen in combination. In our tests some screens required a doubling of the brightness of the projector to meet the viewer’s requirements! It should also be noted that some screens have no cross reflective dampening which controls the spill of light on the walls and ceilings which can further degrade the viewing experience.

Moiré No More:

While we are on the subject perforations and front of screen performance, let’s examine the topic of moiré. It is the term used to describe an interaction between the pixel grid of a fixed matrix projector, and the mechanical pattern of a perforated or woven surface. The two mechanical patterns intersect in non linear geometric iterations, creating differences in luminance creating the moiré effect.

One company that has separated the marketing hype from the reality of eliminating moiré is Stewart Filmscreen. They have a well earned reputation in the screen industry and are committed to providing the finest obtainable viewing experience possible, within the current technical constraints of our industry. As an extension of this commitment, Stewart has undertaken a significant survey of the available projector technologies, and devised techniques for the successful partnering of the Stewart perforated products with these projectors, over a range of sizes. They have found that nearly all projectors have a “sweet spot” for easy integration with their proprietary Stewart MicroPerf surfaces.

Moiré is a phenomenon which has presented itself as the projection industry has migrated away from CRT and film sources, into fixed matrix/pixel projection technologies. Observable moiré decreases as pixel fill ratio increases. 35-millimeter motion picture stock is capable of resolving 3000 lines of resolution directly, or more scientifically, 80 line pairs per millimeter taken directly from the film stock. This translates roughly to a pixel density of 4096 X 2987. Fixed matrix projectors are steadily improving in pixel density, but have a long way to go. Older XGA or SXGA LCD projectors with contrast enhancements obtained through hard shadow masked pixel grids, are the most likely to moiré.

Today there are many LCD projectors with light engines employing secondary elements on the panel which spread the light, effectively obliterating the pixel grid which interacts with perforations to form the moiré. In addition, the family of LCoS projectors, have excellent pixel fill ratios, are basically moiré free. As we move slowly towards 1080p resolving projectors, the moiré effect will be for all intents and purposes a memory. Looking at the heavily marketed DLP market segment, it has some projectors which moiré when deployed with perforated screens. This is a function of the fill ratio mentioned earlier and the interaction of the color wheel on the single chip version. The moiré effect is rare with the 3 chip cinema versions.

The problem is solved by rotating the perf pattern depending on image width. When images are narrow, around 72” to 80” the correction is approximately 8 degrees to a maximum of 26 degrees. The degree of rotation for correction lessens as image width increases. Typically, just about any DLP will be entirely moiré free, at any angle, provided that image width is 107” or wider. Some DLP with anamorphic lenses will require correction to wider widths, because the anamorphic optics increases the width of the pixel grid as well as the content.

As mentioned previously the newer high resolution projectors pose no problems but even with first generation fixed matrix technologies, the “sweet spot” can be obtained through a simple rotation in the orientation of the projector to the perfs. At images above 123” in diagonal, no correction is required. As image width and diagonal decrease, a correction of 8 degrees, to a maximum observed 26 degrees is appropriate. These numbers are consistent with regard to light engine type, and screen image size.

This data has been collected and available from Stewart Filmscreen. When they identify a gap in their data, they borrow the projector or travel to a projector manufacturer and survey the unit at various screen sizes. Special arrangements for unique situations are accommodated and encouraged.

Contrast Unmasked:
Now we come to our personal favorite specification, contrast. The misinformation relative to this topic in displays of all types is incredible. Before proceeding lets define that contrast comes in both a device specification known as “on/off” which is always a much higher number, and a full system contrast ratio stated in a lower number. The display device specification is the ability for a projector to maintain an absence of light in areas that should appear black. When defining the complete projection system contrast ratio, which includes the room conditions, screen, and projector, we measure contrast utilizing the ANSI Checkerboard Pattern which consists of 50% white and 50% black squares.

In looking at perforated screens we decided to conduct a series of scientific experiments that would once and for all demonstrate the performance differences in screen materials and types. We settled on a comparison between woven fabric screens and non-woven gain materials. We began by asking ourselves the key question, why does video of any definition appear washed out, dull and under-saturated with woven fabrics, as compared too un-perforated Lambertian white fabrics and micro-perforated, engineered gain screens or contrast enhanced micro-perforated fabrics? We found a lot of the answers can be found in methodical contrast ratio measurement. The human eye can see varying quality of visual presentations easily, but quantifying what we see subjectively with objective measurement, can explain what we observe.

Using a reference Sim2 C3x DLP projector on 84 inch diagonal screens we measured ANSI contrast ratios in varying conditions. The area behind the screen fabric was entirely black and non-reflective. An ANSI contrast ratio test pattern with checkerboard black and white squares was fed to the projector.

In a completely darkened room, with a calibrated Minolta LS-100 one-degree spot meter, we verified that the projector had sufficient on-off contrast ratio to deliver a black level at or below a nominal half a foot-Lambert. This was confirmed on a certified Lambertian Reflectance Standard. We then used the ANSI Checkerboard test pattern in various conditions to measure actual fabric performance.

In the totally darkened optical lab, flat black walls, ceiling and floor, the ANSI checkerboard dark field reading on the reflectance standard was < .5 Foot Lamberts. The electrical power supply to the projector light source was not power conditioned and there was a minimal amount of lumen fluctuation. We then checked Foot-Lambert readings for maximum white and minimum black at identical locations on each tested fabric. The measurements were taken over a 45-degree window. The following performance characteristics of several screen fabrics were observed.

Black Level, Screen Brightness, and Contrast Ratio on Axis, Dark Environment				
	MGC03 Reflectance Standard	Woven AT Fabric	Studiotek 130	Firehawk
ANSI Black	<.5 FL	.42 FL	.61 FL	.39 FL
ANSI White	72.9 FL	52.31 FL	86.34 FL	81.6 FL
Contrast Ratio	145:1	125:1	142:1	173:1

What does this mean? We can compare the contrast ratios for these test conditions. In a “black cave” the supposed best condition for the woven acoustically transparent fabric, it underperforms the industry reflectance standard by 28.2 percent in brightness and 14% in lost contrast ratio. The woven fabric, even though it is white, never approaches the brightness of the reflectance standard, regardless of how far a viewer moves off axis.

The woven fabric underperforms perforated Stewart Studiotek 130 by 38% in brightness and 12% in contrast ratio. The Studiotek remains brighter out to 45 degrees off axis, beyond the useful viewing cone for materials in a home theatre.

The woven fabric underperforms perforated Stewart Firehawk by 28% in contrast ratio, and is 36% less bright. In order to achieve the same brightness as the Firehawk, 56% of additional projector lumens would be required. A viewer must be more than 30 degrees off axis before the brightness of the weave is equal to the brightness of the Firehawk. Even in a totally dark room, the Firehawk has a 7% lower black floor.

Why are the Lambertian fabrics giving lower contrast ratios? The dynamic range of available brightness is attenuated. A large amount of light is diffused and re-directed away from the viewing area. This light often returns to the screen surface for a further insult, destruction of the black floor. Woven fabrics have the additional handicap of an inability to block any portion of returning light reflected from the speaker area, and must be used with a black fabric liner, sandwiched between the screen and speakers, presenting an acoustic absorbing barrier. If the liner is not used, diffuse returning light, saturates the body of the screen fabric, degrading black level performance.

Ambient Light Effect:
What happens if the décor of the space allows a bit of cross reflected light? In this test, cross reflected light was allowed to persist, in varying, minute degrees. We began with a modest level of 1.3 Foot-Lambert, measured on the reflectance standard, with the projector blanked. Cross reflected light was generated in the optical lab with precisely controlled incandescent sources, with diffusion in place. The lab is completely black, so very little typical cross-reflected light is present. In this test, the projector’s internal contrast ratio adds energy when the ANSI checkerboard is displayed.

Black Level, Screen Brightness, and Contrast Ratios on Axis, 1.3 FL Ambient Light				
	MGC03 Reflectance Standard	Woven AT Fabric	Studiotek 130	Firehawk
ANSI Black	1.78 FL	1.75 FL	2.00 FL	1.64 FL
ANSI White	73.9 FL	55.06 FL	92.34 FL	88.84 FL
Contrast ratio:	41.5	31.46.	46.17	55.66

The data shows how Lambertian fabric performance, is not the most appropriate for projection environments which deviate from strict black absorption, on adjacent surfaces or back walls. This is the natural application environment for Engineered Neutral Density Gray Fabrics.

- The Stewart Firehawk gray fabric is 77 percent higher in contrast ratio, compared to the woven fabric.
- The Stewart Firehawk gray fabric is 21 percent higher in contrast ratio than Studiotek.
- The Stewart Firehawk gray fabric is 36 percent higher in contrast ratio than the Reflectance Standard.

An additional observation which is important when evaluating perforated fabrics is this: What is the disposition of light which has penetrated the fabric, reflected off of a surface (such as a rear wall) and returned to the rear side of the fabric? This is problematic and the performance of different offerings in the market varies widely. This is an interesting phenomenon we decided to measure.

In this case we started with a Sony VPL-VW50 projector, on 84” diagonal screen. On axis the projector provided 13.72 lumens on to the calibrated Reflectance Standard. Placing a Reflectance Standard one meter behind each screen fabric we noted that the woven material allowed .87 Foot Lamberts on to the Standard, measured with a one-degree spot meter. The same measurement protocol yielded .72 foot lamberts “blown through” a MicroPerf perforated sample. Going further into the idea of “where does the light go if not directly into the viewing area”, we took additional measurements.

To get a direct shot, we had to angle a few degrees off, to avoid capturing incident light from the projector bulb. In white light, a direct shot with the spot meter, two degrees off axis, from one meter behind the fabrics yielded a Foot Lambert reading of .33 off the MicroPerf perforated screen and 4.11 Foot Lamberts from the woven screen. It is evident that quite a bit of energy is available on the back side of the woven fabric.

System Dynamic Range:
The early battle lines are drawn between woven surfaces (Lambertian diffusing) and non woven/gain surfaces. Since Stewart Filmscreen is one of the largest manufacturers in the world of both Lambertian and gain screen surfaces, we decided to get their take on the issue and do some independent comprehensive testing. We found that Stewart is unique in their ability to offer solutions for perforation in a range of gain values from .7 to 3 gain in various fabric surfaces all with perforations.

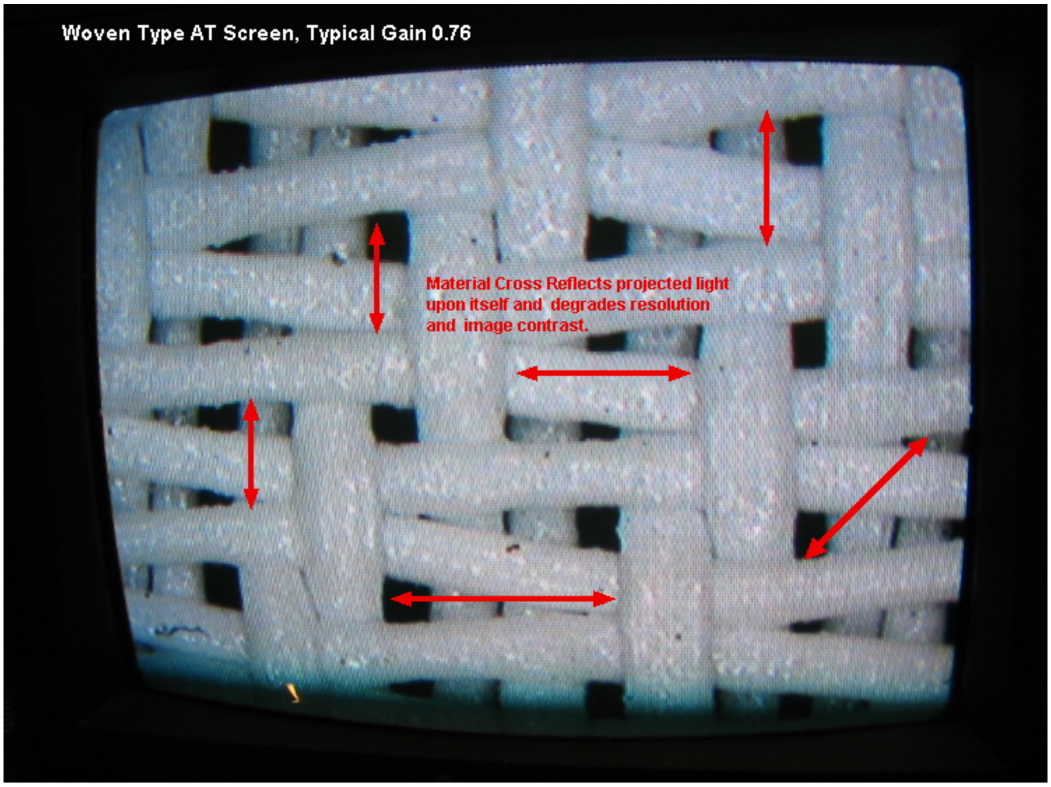
In our tests we discovered that competing woven products currently on the market are all below unity gain, and none were effective in their ability to reject cross reflected light. The marketers of these fabrics have gone to great lengths to claim that anything non-woven is “old” technology. They imply that a Lambertian diffusing surface is appropriate for all viewing. This is patently untrue. It is simply not the most appropriate choice for most venues. In our own tests, we found the woven surfaces hard to light, relatively speaking, and are very susceptible to cross reflection in the viewing environment, which rapidly adversely affects the obtainable room contrast level.

In speaking to Stewart Filmscreen, they prefer to sell their fabrics at what they call an “optimal specification.” They have found that at 1.3 gain there is synergistic viewing environment enhancement due to the judicious use of angular reflective elements within a largely Lambertian surface. In short, this means that the fabric is tuned, to be more responsive to light arriving from perpendicular angles as opposed to a Lambertian woven surface, which is indiscriminate in responding to light from any angle. The result is better net ANSI contrast performance in the theatre.

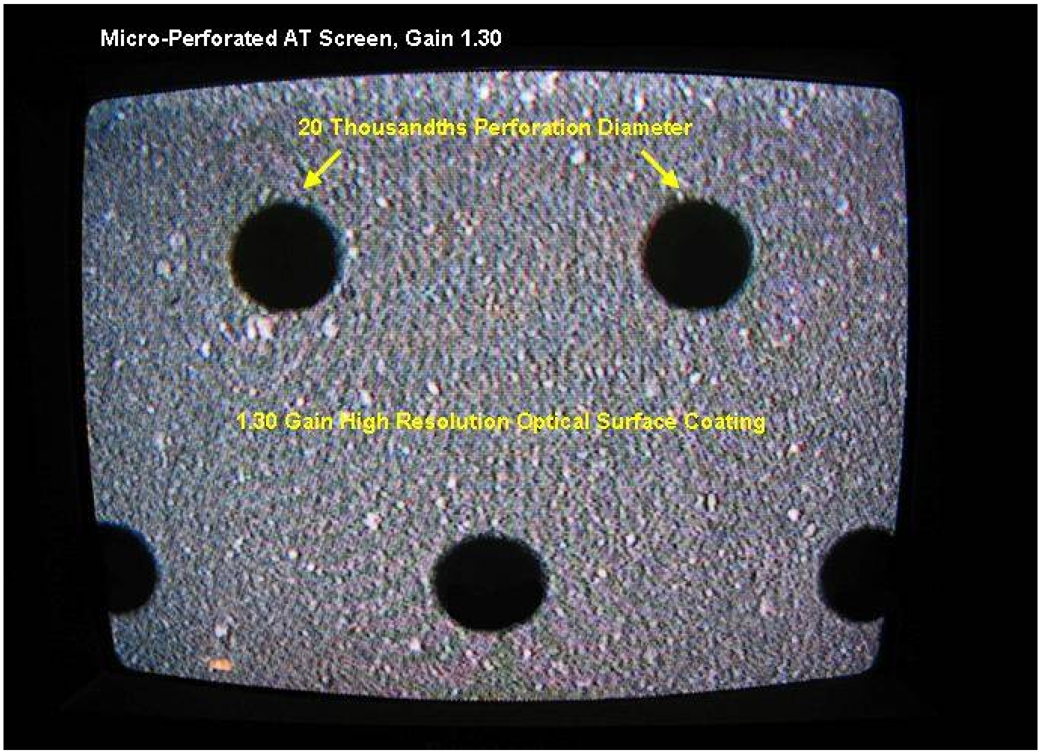
This increases the overall dynamic range of the display. In our tests their fabrics were able to deliver a true and vivid representation in the upper IRE region, and at the same time preserve shadow level detail in the lower IRE illuminations. Remember that stray light attenuation is an integral key to dynamic range, and dynamic range is what separates an involving experience from a bland exercise. A second important benefit is the ability to run a projector in a lower light mode, or cinema mode which allows better image engine contrast ratios, or on/off contrast ratios.

We then constructed a tunnel off of the face of the test screen rig, so that we could measure relative energy re-transmitted into the viewable area. The tunnel, closed off and eliminated the incident light from the projector, and we were able to measure only re-transmitted light, coming from behind the fabric, reflected from a typical rear wall white surface. This light first penetrated the viewing surface, then reflected off a wall, then re-penetrated the rear surface and appeared on the viewing surface. It intermingled with the incident light, diminishing the ANSI contrast ratio. We were able to isolate this energy and measure it.   The Stewart MicroPerf fabric re-radiated .08 Foot Lamberts; the woven material re-radiated .13 Foot Lamberts under identical test conditions.

The Appearance of Screen Resolution:
We've talked extensively about contrast ratios. The difference in obtainable contrast ratios has implications in image fidelity. If energy is not delivered to the viewer, it is either absorbed or lost. We can look for it in an analysis of the relative resolving abilities of the two types of fabrics. Where the energy is lost, detail is also lost. Where energy is absorbed, detail is obscured. This is a qualitative result based on further objective evaluation. Let's look at some photos. What is the optimum surface for resolving the resolution of the new generation of 1080P projectors?



Since we previously measured that there is light "blow through", one can clearly see that this is due to the 20 significant voids and countless undulated "yarn" surfaces which distribute light in an indiscriminate manner.



Please note that the perforated sample, at the same magnification, has only 5 significant voids, which is exactly 10.2% of the surface area, and has minimal effect on the picture.

Audio Completes the Picture:
Now we turn our attention to the audio portion of the cinema experience. One of my favorite comments about the relationship between audio and visual is that you can never fully appreciate a superb picture without experiencing great audio. In exhaustive tests over the years, cinema audience members have been shown great images with mediocre audio and vice versa with mediocre visuals and outstanding audio. In exit interviews after the tests, respondents gave higher marks to the sessions with outstanding audio and actually criticized the picture in the samples with mediocre audio! The eye, ear, and brain are inexorably linked and nowhere is this more true than with perforated screens.

There are several pertinent audio issues to consider when specifying a perforated surface. The issues involve the fact that the sound waves are being transmitted through a medium (screen material). Unlike transparent grill cloth that minimally colors the sound, depending upon the design of the perforated screen, some products on the market will result in -2dB attenuation as the sound waves pass through the screen surface. In addition to this some manufacturers use a black liner on the rear of the screen surface to control reflected light off of the back wall and this may also create more attenuation, or if you prefer, loss of audio. Much ado about this is brewing in the marketing hype of some competing screen products.

The engineers at Stewart Filmscreen along with original product testing at the THX labs have come up with what we consider an “elegant yet simple” solution to this law of physics issue. They knew that the spectral response curves of drivers located behind the fabric would be affected in the frequencies above 10k Hz. In collaboration with Tomlinson Holman, a key industry figure for professional acoustics, Stewart designed and implemented the Cinemasonic Processor, a simple, active network which restores attenuated information in the 10 K-20 kHz region. The speakers behind the screen need to be a minimum of 12 inches away from the rear surface for the best performance. They found that if the speakers are closer to the fabric, comb filtering can occur but when installed to specification, minimal attenuation occurs permitting truly transparent audio.

THX awarded the Stewart Microperf product their highest rating of THX Ultra. “THX Ultra brings high end performance to interconnects, equalizers, projection screens and DVD players, complementing the THX Ultra2 category. Both the THX Ultra and THX Ultra2 specifications are designed for the home audio enthusiasts who demand peak performance from their equipment in their dedicated home theater, representing the best THX has to offer in one package.”

Audio “Transparency”:

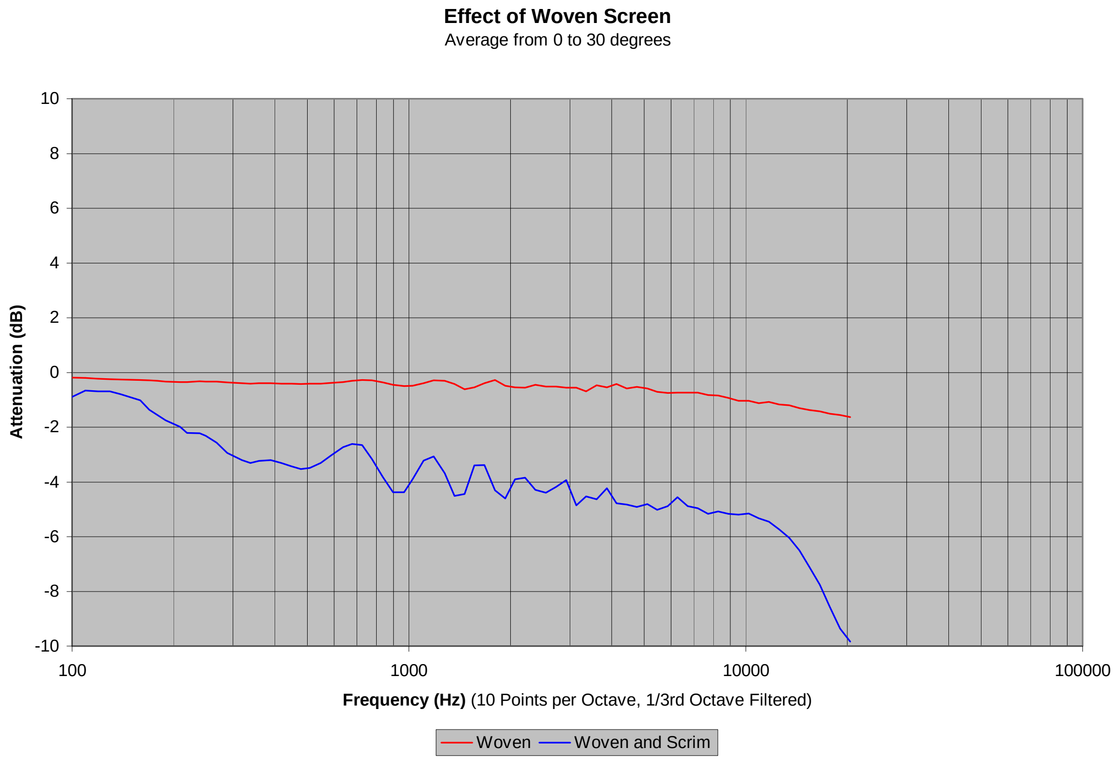
Recent marketing materials from one provider of woven screens characterize the relative acoustic quality which can be achieved with perforated fabrics, or the woven fabric. The claim is made that “MicroPerf fabric will always comb filter”, and as “evidence” a graph is offered in which the speaker is placed four inches behind the perforated fabric. There is comb filtering. The “test”, if you will, was not done to specification from the manufacturer. The disappointing part of this situation is that the test was purposely designed to make the product look bad. In speaking to Stewart they remind us that “From the inception of the MicroPerf product, Stewart has taken pains to recommend that speakers be placed one foot behind the screen fabric, four inches is never recommended.” So where there is one un-truth or obfuscation, might there be more? A need for fresh testing seemed to be indicated.

Testing Clears the Air:

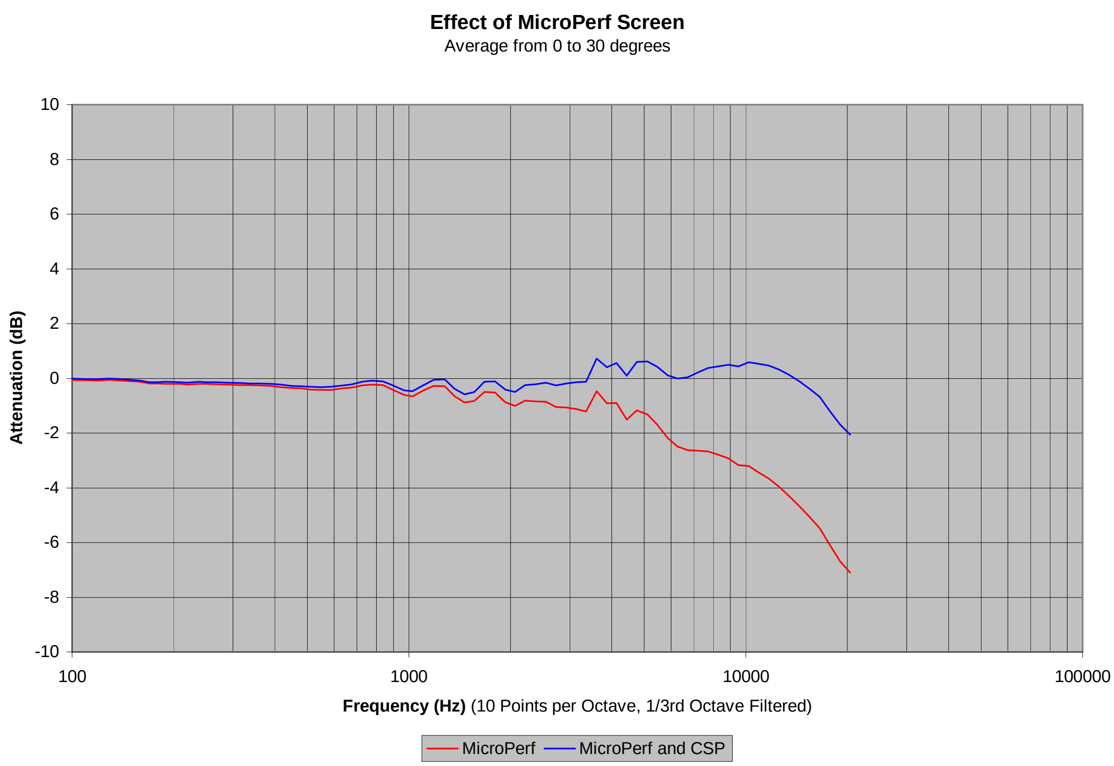
Harman International, a leading provider of loudspeaker products, with a very long track record and impeccable testing facilities and protocols, was contacted. Mr. Allan Devantier, Manager of Objective Evaluation, designed an exhaustive round of testing in their anechoic chamber. MicroPerf products as well as conventional “cinema perforation” products and woven products were tested. Speakers of varying scale and configuration were tested, on and off axis and differences and properties were analyzed, using Fast Fourier Transfer (FFT) technique with a MLSSA system. Fabrics were tested in an impartial manner.

Efforts were taken to get the flattest results from each product, regardless of manufacturer. We found the results that were obtained quite interesting. All of the products benefited from placement at or near 12 inches from the speaker. All of the products benefited from a slight toe-in of the speaker driver, relative to the screen surface. Comb filtering was observable in all of the products, when they were close coupled at two inches, or six inches, from a speaker, regardless of the speaker type, 2-way, in-wall or horn loaded.

So how do the actual test results compare to the marketing claims out there? What has been claimed is not necessarily what has been delivered. The woven screen fabric is very acoustically transparent when tested in isolation, with no black scrim coupled with it. We found the black scrim was needed for the preservation of their contrast. When the recommended black scrim is introduced, as the product is actually implemented in a theater, the acoustic transparency is lost. The following graph shows the acoustical performance of the woven fabric at 12 inches with a 6" two-way speaker at ten degrees of toe in, the red trace is the averaged response over at 30 degree listening window. The blue trace is the same set-up, with the recommended scrim placed behind the fabric.



We found that the MicroPerf fabric does not need a liner to preserve contrast, but there is an acoustical penalty paid for this, which is less high frequency energy above 10 k. But, as we know, Stewart identified this issue years ago with THX and makes available a single channel line level equalizer, the Cinemasonic Processor, which compensates to a degree. The following graph shows the MicroPerf fabric, under the same test conditions, 6 inch two-way speaker, located 12 inches behind fabric, 10 degree toe in. The red trace is the frequency response averaged over the same 30 degree listening window. The blue trace is the MicroPerf fabric with the correction of the Cinemasonic Processor. It is noted that some high frequency attenuation is present in the highest octave. There is somewhere between ½ and 1 db of extra energy between 10 and 15 kHz.



Please note that the “clear unobstructed audio” that the marketers of the woven fabrics promise, is not what is delivered in the actual applications. They require a black scrim which is necessary to “cure” the light blow through. It acts as a broad band filter, unevenly attenuating high and low audio frequencies. In our tests of the Stewart MicroPerf screen, it performed as advertised and we recognized their successful efforts to correct attenuation. These tests were not “leveraged” in any way to portray either product in a negative light. So the bottom line acoustically is that if you decide to live with the reduced contrast and dynamic range of an unlined woven screen, the audio will be acceptable, see the graph. But if you wish to meet a cinema visual standard, preserving the hard earned contrast performance of an expensive, high resolution projector, the black scrim or liner associated with woven fabrics is going to interfere drastically with the acoustic performance at a minimum of 2 decibels or more, and you are left to your own devices to correct for this.

Summing It Up:
What we discovered is that the laws of physics prevail! What you see (and hear) is what you get and no amount of obfuscation and hype will change this. We examined the core elements of a front projected image from the perspective of contrast, brightness, and resolution. We delved deeply into the effects of ambient light on different types of fabrics and the relationship this has to the pictures we view. With the able assistance of Allan Devantier at Harman we tested and measured every detail of audio and acoustics as it relates to what we hear. It is really cool to “see” what you are hearing! The bottom line is that we now have data from which to draw conclusions and not simply hopeful suppositions and ad hoc opinions served up by a marketing department.

As a “display guy” I am truly glad that companies like Stewart Filmscreen and Harman along with dedicated projector manufacturers continue to strive for that perfect audio and video experience. There is an old saying in the photographic industry that says “If you do not know cameras then you had better know a good camera dealer” and this is certainly true in the realm of home cinema. If you do not know projectors, screens, and audio then most assuredly rely on those that do.

Biography at a Glance:

Alan C. Brawn

Alan Brawn is a principal of Brawn Consulting, an audio visual consulting, training, educational development, and market intelligence company with national exposure to major manufacturers and integrators in the industry. He was formerly President of Telanetix and previously National Business Development Manager and National Product Marketing Manager, Pro AV Group, Samsung Electronics. Brawn is an AV industry veteran with experience spanning over 2 decades including management of a Pro AV systems integration company for 7 years, and one of the founding members of Hughes-JVC back in the early 1990s. He is a recognized author for leading AV industry magazines such as Systems Contractor News, Archi-Tech Magazine, Digital Signage Quarterly, Video Systems and Rental & Staging. Brawn has been an Imaging Science Foundation fellow and instructor since 1993, and holds CTS certification and membership in Infocomm's PETC group as well as an adjunct faculty member of that organization. In addition, he is an NSCA instructor and content provider and an AIA Certified instructor. He was the recipient of the Pro AV Hall of Fame recognition from rAVe in 2004.