Reference Imaging CinePro 9x Elite & Teranex HDX Cinema MX

Thomas J. Norton, article from, *Stereophile Guiide to Home Theater*, October 2002

When a video product is arguably the best of its kind, it's hard to find the right words to describe it without blubbering. "The Next Best Thing to Being There" sounds vaguely familiar. "The Real Thing" might perk up your thirst, but doesn't quite gel. And "Must See TV" is only two-thirds right. With the Reference Imaging CinePro 9x Elite CRT projector and Teranex HDX Cinema MX video processor, we're definitely not in TV-land anymore.

Of course, if you've glanced at the specifications of the two products under evaluation here, you're likely to answer, "No, we're in Fantasyland." And if you're referring to the price, you're probably right. Only a small fraction of you will be able to consider a video-projection system that redefines the state of the art as thoroughly as this one does. So what's the point of reviewing it? First, these are products against which all others can be measured. When I say that a particular DLP lacks punch and true blacks, or that an under-review D-ILA's colors look a little odd, you'll know that the criticism is based on having spent time with a true reference—even if that reference was on hand for only a short time. Second, perhaps in some small way we can describe here what "the best" looks like—or, even better, give you the incentive to seek it out and view it for yourself, if only for your own education.

And third, the opportunity to live with such products is not one a reviewer can easily resist. But there's a downside: After four months with the Reference Imaging–Teranex combination, I was spoiled. Having to pack it up and return it was traumatic. The sight of an editor futilely chasing a freight truck down the street isn't a pretty picture. Will I be able to enjoy anything less? I think so, but it won't be easy.

SPECIFICATIONS

Reference Imaging CinePro 9x Elite
CRT projector with 9" liquid-coupled lenses & electromagnetic focus
Resolution: 1640x1400 ANSI pixels
Brightness: 280 ANSI lumens
Inputs: RGBHV & SDI on optional HDCP-15 input card
Bandwith: 200MHz, –3dB
Deflection: 39.5–185Hz vertical, 14–152kHz horizontal, both autolock
Retrace time: <300µs
Power requirements: 90–264VAC, 50–60Hz, 700W maximum
Dimensions: 28" x 17" x 32" (WxHxD)
Weight: 176 lbs
Warranty: 1 year parts & labor
Price: $64,500 (optional HDCP-15 HD-SDI input card, $2890)
Manufacturer:
Reference Imaging
220 Marble Avenue
Pleasantville, NY 10570
tel. (914) 769-5400
fax (914) 769-6102
www.referenceimaging.com

Teranex HDX Cinema MX video processor
Input formats: 480i60, 576i50
Output formats: multiple rates, including 720p23.98, 720p59.94, 1080i59.94, 1080p23.98
Video inputs/outputs: 2 each standard-definition SDI, 2 each high-definition SDI
Audio inputs/outputs: 4 each AES/EBU
Dimensions: 19" x 5.25" x 25" (WxHxD)
Weight: 38 lbs
Warranty: 1 year, parts & labor
Price: $49,500 (as reviewed)
Manufacturer:
Teranex, Inc.
7800 Southland Blvd., Suite250
Orlando, FL 32809
tel. (407) 858-6000
fax (407) 858-6048
www.teranex.com

From the Great White North

The projection side of the equation started with a company called Electrohome. This Canadian manufacturer is active in many areas, but in the video business it was best known for its excellent line of CRT projectors. In the mid-1990s they came out with their premier chassis, the Marquee 9500LC, with 9-inch tubes. This was sold to the consumer market for several years by the now defunct Vidikron Corporation as the Vision One (reviewed in the winter 1997 Guide). It was and remains a superb projector. A couple of years later, the Vision One-X appeared, incorporating a number of significant modifications that had been developed by Chris Stephens, then the tech guru at Ultimate Entertainment in Phoenix, one of Vidikron's largest dealers. The One-X, viewed by hundreds of awed observers at various trade and consumer shows, firmly established Ultimate Entertainment as a major player in the video display and custom installation market.

Electrohome ultimately sold the Marquee production line to Christie Digital, who in turn sold it to Florida-based Video Display Corporation. In the meantime, Chris Stephens left Ultimate and started Reference Imaging with Robert Zuch in December 2001. Reference Imaging markets VDC projectors incorporating Stephens' design changes, which he has continued to refine. The current pinnacle of that process is the subject of this review: the CinePro 9x Elite.

But not the Elite alone. Unless you plan on a steady diet of HD only, you'll need a video processor for standard-definition programming. That's where Teranex comes in. The video system reviewed here is promoted as a recommended package by Reference Imaging. But both the projector and video processor are available separately—the projector from Reference Imaging only, the Teranex from Reference and other suppliers as well.

East Side, West Side

When the VDC Marquee projectors arrive at Reference Imaging's Pleasantville, New York manufacturing facility, they're completely disassembled and rebuilt. The changes made to the basic chassis are far more than cosmetic. Some circuits are new, others are modified. Several hundred parts are changed, many of them upgraded to expensive, mil spec–grade components.

The alterations to the basic VDC chassis, according to Reference, improve the projector's performance in a number of areas. For safety reasons and UL certification, these changes do not involve the high-voltage sections. The beam-spot size is reduced, enhancing the design's already outstanding resolution. Since slight vertical movement of the electron beam as it crosses the tube face can subtly degrade the image, this "jitter" is minimized by improving the stability of the vertical deflection circuits. Focus and gamma tracking are also upgraded, and video noise is lowered. The fan noise (already relatively low in the Marquee designs) is also said to be reduced.

The CinePro 9x Elite comes with standard RGB inputs, but since analog cables always have some loss, Reference Imaging's recommended mode of driving the

To attempt to explain the Teranex's full capabilities would require and article longer than this review.

projector is via a serial digital input (HD-SDI). A digital connection not only provides the convenience of a single-wire link to the projector, but can also be used for very long runs without loss (RI claims up to 1000 feet). The SDI source can be either a serial digital connection from a video analog-to-digital converter that accepts component-video inputs (this is the setup we used to watch HD programming on the CinePro), or a DVD player equipped with a serial digital output. To accept the serial digital source, the CinePro 9x must be equipped with the optional HDCP-15 video input card. The latter converts an SDI input to the analog RGB form required by all CRT displays.

DVD players with serial digital outputs aren't easy to find on the consumer market, but Reference Imaging can supply them. The unit they provided for this review was a modified Pioneer DV-737 (apparently, an overseas version of the DV-37). Stephens favors this modestly priced model because he has found it to be free of the chroma bug, unlike any number of expensive high-end players. (There isn't space to completely explain the chroma bug here; briefly, it's a color artifact whose annoyance factor is dependent on the DVD, DVD player, and display. I've found it to be a minor issue, at best, most of the time.)

I Spy

Of course, you wouldn't drive a projector as advanced as the CinePro 9x Elite directly from a DVD player, digital connection or not. You need an outboard scaler and video processor. And to accommodate the preferred SDI configuration, this processor, too, must have SDI inputs and outputs. Enter the Teranex video computer. Equipped only with digital ins and outs (a new model, which adds analog connections and onboard A/D and D/A video converters, is being developed), the Teranex HDX Cinema MX is an ideal if pricey partner for the CinePro 9x Elite. Teranex has an even costlier model for about twice the price. According to RI, however, in a home-theater system the latter offers no performance advantages or useful added features.

Looked at purely as a black box, the Teranex performs the same operations as any number of video

REVIEW SYSTEM

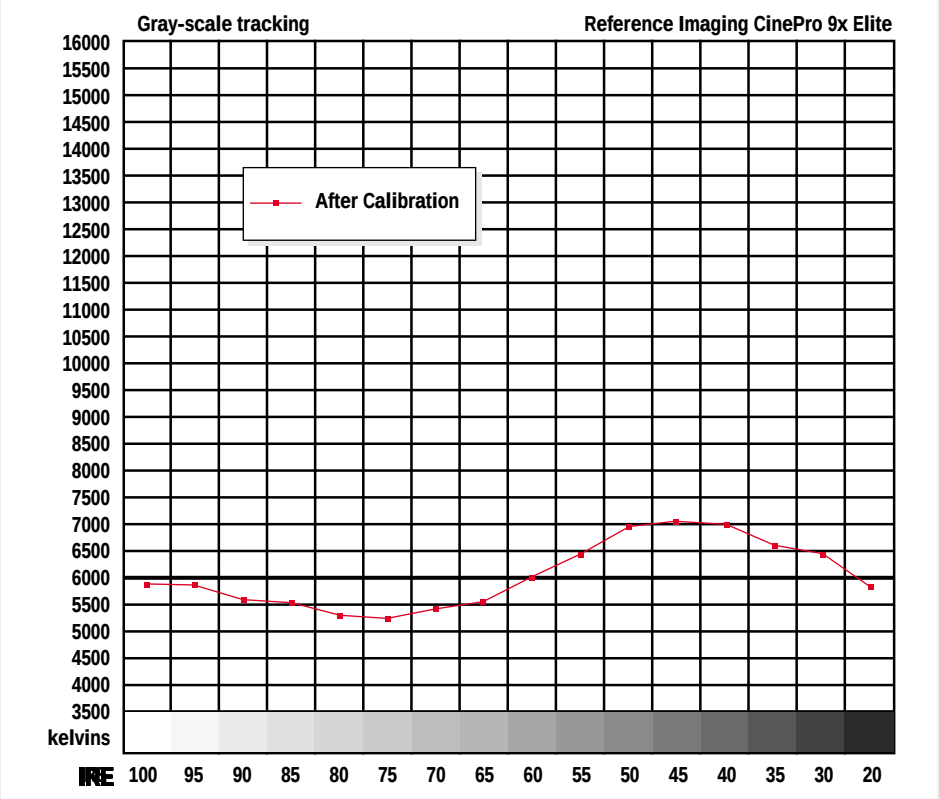
Sources
Pioneer DV-737 DVD player
Panasonic TU-DST51 DTV decoder
Panasonic PV-HD1000 D-VHS deck
JVC HM-DH3000 D-VHS deck

Screen
Stewart StudioTek 130 (78" wide, 16:9, 1.3 gain)

Cables
Reference Imaging SDI (custom)

Misc.
AJA Video HD10A HD component-to-SDI A/D converter
Crestron Control System

SPECIFICATIONS



Light Output: CRTs are generally acknowledged to produce the best pictures, overall, of all video projection technologies. But in one respect, at least, CRT suffers: it can't produce a lot of light.

Or so conventional wisdom goes. When CHris Stephens was finishing setting up the CinePro 9x Elite and told me the light output he was getting, I couldn't believe it. But there it was, as verified by 2 test instruments, the Photo Research PR-650 Spectroradiometer and the Minolta LS-100 spot light meter: more then 19 foot-Lamberts! And with a great picture. Granted, this was on my relatively small, 78-inch-wide screen; the CinePro is hardly a good choice for 30-foot D-Cinema presentations. But it was the brightest CRT-projected image I'd ever seen.

Scaling back the light output to something more traditional—say, 10-12ft-L—markedly reduced the image's punch. As a big believer in video dynamic range, Stephens was reluctant to make this sacrifice. It's the contention that, once the light output drops too low, the eye no longer perceives edges in a realistic way, sharply reducing the image's 3-dimensionality. And image depth, or dimensionality, is a key strength of this projection system.

But on some material, the high light output was a little fatiguing. So during the review period I alternated between peak outputs of 15 and 19ft-L, and never felt, even at the higher setting, that I was getting anything less than the best images I had ever seen from a video projector. They were so good, in fact, that I never was tempted to try a lower light output.

Until, that is, the last 2 weeks of the review. The CinePro's gray-scale tracking, as measured by the Photo Research and as seen on 10-step gray-scale test patterns, was the projector's most obvious shortcoming. (see below). I never found the deviations to subjectively degrade normal program material, but nevertheless, two weeks before the projector was scheduled to depart my studio, I tried reducing the contrast to a maximum of 12.5ft-L to see if I could improve the situation.

The reduction didn't make much of a change in the gray scale, but it did noticeably improve the resolution. At the higher outputs, some blooming was clearly occurring even though I had not found it subjectively annoying. And, surprisingly, the enhanced sharpness did not appear to compromise the video dynamic range. The wow factor was still very much there. Why had it looked compromised at the lower output when the projector was first installed? I can speculate only that the change had something to do with the projector setting in during the additional hours of operation.

Wondering how much wear and tear those high peak light levels put on the tubes? Judging from the image quality and measurements, very little. At the time the projector was returned, it had over 600 hours of operation (about 400 of which I had accumulated) still produces 19.4ft-L at the settings STephens had used. The kelvins reading at peak white (a key indicator of wear, particularly on the blue tube) was also virtually unchanged. This is a testament to the design of the CinePro, and to the quality of its tubes. By no ,means would I extend this argument to all CRT projectors.

Contrast: We would love to be able to measure the contrast on CRTs, but the fact is that they produce blacks so dark that it would take test equipment far more sophisticated and sensitive than ours to get a reading. Even at its remarkable peak white output level of 19.2ft-L, the CInePro 9x Elite's contrast, if we could measure it, would likely be in the multi-thousands.

Test Patterns & Gray Scale: All conventional test patterns looked superb on the CinePro, including HD resolution limits very close to the limits of the 1920x1080 format. The single exception was the 10-step gray scale. This was consistent with the measurements (shown in the accompanying diagram for the 1080p24 setup). The actual color points of the red, green, and blue tubes were very close to the standard HD points for green and blue, but red showed a slight orange shift—not very different, in fact, from the coordinates found on the uncorrected red tube of a Dwin HD-700 CRT projector.—TJN

processors: deinterlacing, scaling, selectable aspect ratios, and detail enhancement. It has both video and film modes, the latter with 3:2 pulldown recognition.

One feature of the Teranex is, to our knowledge, unique among video processors: color space conversion. The HDX Cinema can correct electronically for the slightly imprecise phosphors used (for good reasons) in all CRTs, rather than

relying on the color filters employed in some other projectors. The upside: no light lost to the filters. The downside: the color correction applies only to standard-definition sources upconverted by the Teranex. Future updates are in the works that will provide the Teranex with the ability to color-correct HD sources as well.

SALES & SETUP

Reference Imaging's business plan calls for marketing their projectors directly to end-users, as well as through custom installers and some dealers. The company has showrooms in Armonk, New York and Phoenix, Arizona. Service support is provided from both the Armonk and Phoenix locations, as well as through selected custom installers.

As you might imagine, a product of this price and sophistication will never sell in huge quantities, so at present all installations are performed by designer CHris Stephens himself. The cost of the actual physical installation, wiring, setup, and calibration may or may not be included in the price, depending on the complexity of the individual installation. Stephens put in my system—a simple table-mount setup without cosmetic niceties (the temporary installation required none)—over the course of two days. Setting up the Teranex is also not an operation for the faint of heart. I won't go into it here, because RI provides a professional setup.

Stephens is a firm believer in a set up mode offered by the Teranex but not by most other processors: 1080p24. That is, the picture is scaled up to 1080 progressive lines and, instead of being converted from the 24 frames per second (fps) rate of film to the 30fps rate of video, it's left at 24fps—though each frame is flashed on the screen twice, as in a film projector. This eliminates the need for a 3:2 pulldown and produces smoother motion free of the judder typical of normal video reproduction of film-based material. The difference is not dramatic, but is visible on some material. So is flicker, particularly at the higher light output levels available from the CinePro 9x Elite. But while 72fps is possible and would reduce flicker to invisibility, Stephens believes that the picture is better overall at 48fps because the projector doesn't have to work as hard.

Chris set up my 9x for three different formats: 1080p24, 720p60, and 1080i60. The Teranex can be had at a lower price without 24 frame capability, but I'd recommend popping for this option. While all three formats looked good, I preferred 1080p24 and used it for most of my viewing.

Since the Ternaex performs no functions (at present) for hi-def images, we played back the latter via an outboard HD10A video A/D converter from provideo supplier AJA video. This converter accepts a hi-def component input and produces a single-cable serial digital output—the setup configuration recommended by Reference Imaging.—TJN

Features and performance aside, I could tell from the Teranex's sheer size—not to mention its current draw of 9–11 amps and the wind-machine racket it makes (it must be located in a room separate from the home theater space)—that something special was going on here, and to attempt to explain its full capabilities would require an article longer than this review. The Teranex is an outgrowth of capabilities first developed for the military, and originally had to perform such feats as recognizing a missile launch registering on only a single pixel of a large video display. It was declassified only a few years ago. It processes a 480i source virtually down to the pixel level, and its main boards contain a total of 75,000 microprocessors on 75 large chips. No one familiar with electronic technology, and the realities of limited-quantity manufacturing for military and professional video applications, will wonder why this product costs as much as it does. Nevertheless, during the review period, Teranex was soliciting input about desired features for subsequent models. My suggestion: a price of $2000. Yeah, right.

Fly Me to the Moon

First, the negatives: The gray-scale tracking of the projector (as measured through the Teranex; see "Calibration" sidebar) was not impressive, though the subjective color quality with real program material was very good. At the 48fps frame rate favored by Chris Stephens (see "Sales & Setup" sidebar), I saw occasional flicker. There was also a subtle horizontal band running across the picture at

mid-screen, visible primarily with very bright, monochromatic images such as a full white field or a clear blue sky. This is apparently a generic problem with the Marquee projector chassis—I've seen it on the Vidikron Vision One and the Madrigal MP-9—and can sometimes be eliminated in setup, though with great difficulty. It was a very rare distraction.

Less rare was the lip-sync delay caused by the Teranex processor. Ever-present and significant, it put the picture about four frames behind the sound (this varied a bit with the selected scan rate). Fortunately, the AES/EBU audio inputs of the Teranex are designed to compensate for this. Alternately, you could use a surround-sound processor with up to 200 milliseconds of selectable lip-sync delay. This could be more convenient than running a digital audio lead to the Teranex and back.

Late in the review period, the Teranex began booting up with the picture broken into dozens of vertical bands separated by straight, pencil-line-thin black lines. These could be cleared by rebooting, switching scan rates on the projector, or both. It was fixed permanently by replacement of one of those 25-chip microprocessor boards.

Finally, the A/D converter that RI supplied for use with HD material would not sync to 720p from the JVC HM-DH30000 D-VHS deck, though it would produce 720p images (with occasional jerkiness) from a combination of a Panasonic PV-HD1000 D-VHS deck and TU-DST51 DTV decoder. This problem will be looked at by AJA Video, the manufacturer of the converter.

Apart from these problems, the system never had the slightest hiccup, and provided me with 400 hours of the best video I've ever seen. The CinePro 9x Elite was also incredibly stable. In four months using it, I checked its convergence only two or three times, and the maximum correction needed was never more than the width of a scan line. Warmup was quick; the projector looked great just a few minutes after turn-on, although, like all CRTs, it settled in best after an hour or so of operation. It wasn't completely silent, but from 2 feet away the projector's fan noise never bothered me.

The black level and black-level detail were the best I've ever experienced from a CRT, and miles better than any other technology can produce. When the screen faded to black between scenes, it was very nearly true black, and if the fade-out was from a moderately bright scene, it was sometimes hard for me to make out the border of the screen (in a properly darkened room) until my eyes had adjusted for a second or two. Even then, the black screen area looked as near to true black as I've ever seen from a projector.

This incredible black level, combined with excellent black-level detail, was, in my judgment, the biggest single component of the CinePro's striking performance. What it did for dark scenes, such as the star fields in any Star Trek or Star Wars film, should be self-evident. But other very dark scenes profited as well. The pervasive gloom of The Mothman Prophesies didn't get washed out to gray. And I could clearly see the small, dimly lit details in the submarine interiors from the DVD of U-571, which the production crew clearly sweated to put on film. (The D-Theater, HD version, not surprisingly, looks more amazing still.)

Even bright scenes benefited from the CinePro's blacks, and combining good blacks with the projector's superb color and resolution resulted in unbelievable eye candy on the DVDs of both Shrek and Monsters, Inc. I've seen both films projected by DLP in first-class theatrical presentations, and, apart from sheer picture size, I'd rate the quality of the images from the CinePro, using standard-definition DVDs upscaled by the Teranex, as superior.

Granted, the sharply drawn edges and limited video dynamic range of animation make it less challenging to reproduce well on video than live-action films. But the combination of CinePro 9x Elite and Teranex showed its pedigree on those as well. On film after film, its blacks, color, resolution, depth of image, and lack of video noise made it not only a delight to watch, but an exceptional evaluation tool. I could easily differentiate between poor, average, and exceptional video transfers. For example, the episodes on the new Star Trek: Season 3 boxed set, while very clean, colorful, and noise-free, were a little uneven in quality—sometimes very crisp, at other times noticeably soft. Subtle focus differences in the player close-ups in chapter 6 of The Rookie—a superb transfer—were also clearly apparent. And while the DVDs corresponding to the new D-Theater D-VHS high-definition tapes looked remarkably close to true hi-def on the CinePro-Teranex, the CinePro itself revealed the obvious superiority of true hi-def over even the best DVDs. (For more on how the CinePro 9x Elite looked with HD material, see the review of the first four D-VHS D-Theater tapes in this issue; the evaluation was conducted on the RI projector, with the Teranex processor used in the DVD comparisons.)

The video deinterlacing and scaling of the Teranex was superb with the rooftops in the opening scenes of Star Trek: Insurrection, the ship railings of Titanic, and the multiple deinterlacing challenges on the new Faroudja test disc. That is, as long as I used a 60fps rate and the Auto or On video settings with video-sourced material. (The 48fps format used for most of my film-based viewing—described in "Sales & Setup"—produced very jumpy images with material that originated on video, including the menus on most DVDs.)

At the end of the review period, I briefly compared the Teranex to the Faroudja DV-3000, the latter operating as a quadrupler. The difference in detail reproduction was not subtle. The Faroudja images looked like outstanding video. The Teranex images were a significant step closer to looking like true HD. This advantage comes, of course, at more than twice the Faroudja's price. Would I pay the difference? If I had it to spend, I would. Sad to say, I don't.

Conclusions

Words can't do full justice to the performance of this system. Yes, the price would choke all but the largest horse, but if you can afford to play in this particular corral, you owe it to yourself to see just how amazing projected video can be.

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Reference Imaging CinePro 9x

Editor:

We greatly appreciate Tom Norton's comments regarding the Reference Imaging CinePro 9x Elite Video Projection System, which includes the top of the line projector in our CinePro Series. It was our goal when designing this product to create a system that, as Tom stated, "redefines the state of the art". We are glad the system was recognized as such.

We believe that the ultimate in home theater picture quality is only achievable by combining the extraordinary qualities that a well designed CRT projector can offer, with a sophisticated video computer and an all digital signal path. No other available technology can offer the true film quality, exceptional dark scene detail, and accurate color rendering of which the CinePro-based Systems are capable.

We would like to comment on the gray scale measurements. RI has developed near perfect gray scale on our projection systems. We have done this by design upgrades to the projector, installing our "Perfect Picture" software on the Teranex upconverter, and our special alignment procedure that measures critical properties of the projected image. This information is entered into the software to exactly match the upconverter's image processing to the specific display device. Previous attempts to improve gray scale have resulted in compromises in other areas, such as light output. We believe our solution gives us unmatched color rendering without compromising other aspects of the picture.

The gray scale variations that Tom mentioned were caused by squeezing the image from the CinePro's 9" CRT's onto a small screen combined with the time restraints of setting up the review system. This effect, as Tom mentions, was too small to observe in the picture. Had we noticed this during setup, this could have been easily corrected and much flatter measurements would have resulted.

Thank you for your very enthusiastic review.

Robert Zuch
President
Reference Imaging