



**The Restoration Advantage:  
LiquiDefinition™  
America's only Wet Gate HD, 2K & 4K Film Transfer System**



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Screen Time Images, an 8-year old company near Chicago that specializes in the restoration of classic movies and television, is pioneering the beginning of a new era in film restoration by offering the only high-resolution wet gate film transfer system in the United States, known as LiquiDefinition™.

The film transfer suite is centered around the Cintel / ITK Millennium Machine telecine/scanner, and da Vinci color correction. The system can transfer film in SD, HD, 2K & 4K high-resolution data. Optical and magnetic audio is simultaneously transferred, unlike traditional HD telecine suites, which require the audio to be transferred separately and synched on another machine. SD & HD are transferred in real-time, while high-resolution 2K & 4K data is scanned at approximately 15 frames per second and 4 frames per second, respectively.

**Film transfer capabilities**

The ability to transfer any variation of Negative, Intermediate and Print film stock in any film format.



## **Supported film formats**

- Super 35 and Academy 35mm, with selection of 2, 3, 4, 6 and 8 perforations.
- Super 16 and 16mm.
- Cinemascope
- Vistavision

The Millennium Machine is a Flying Spot, CRT based telecine, featuring technology befitting of the name. The ability to change sample size at will is a big plus in Flying Spot's favor. Both CCD linear telecines and area array scanning devices have a fixed sample size and thus the film can never be scanned at higher sample rates than the fixed sample set of the sensors. Flying Spot techniques, when properly designed, can manipulate the focal size and shape of the spot of light to tailor it to almost any resolution required.

On the Millennium, film can be scanned natively in any resolution up to 4096x3112. To compare with the Spirit Datacine, a common CCD based telecine; the Spirit can make scans at up to 1,920 x 1,440 resolution, which is just under true 2K resolution. To fill the standard 2K frame, these scans have to be up-sampled, which entails the risk of degrading image quality. What's more, the Spirit samples color more coarsely than a conventional scanner. A more detailed explanation is at the end of the document.

## **Film transport and guidance**

Combination Real Time Steadiness film gates designed by the Steadi-film Corporation and Innovation TK interfaced with the Meta-speed servo system ensure a gentle film handling coupled with precise horizontal and vertical image stability.

## **Cathode Ray Tube**

The Millennium uses the ITK Lightning Tube manufactured by Thomas Electronics Tubes. The design concepts behind the Lightning Tube are unique within telecine film scanning systems to purposefully match today's film scanning requirements and those of the future.

The Phosphor design is a "White Light" Broadband Phosphor. The result is a significantly higher energy level. This new phosphor has a fast decay rate "afterglow" so requiring less correction resulting in quieter film images.



Rectangular in design, the shape of the CRT follows the shape of the scanning patch and encompasses the large run patch in any film format without loss of corner resolution.

The CRT Faceplate curvature is designed to match that of the skidplate to ensure constant focus across the film frame.

### **Air Compression**

The nature of film design is such that the film has to be supported on its edges over the skidplate aperture. As a result the top, centre and bottom parts of the film frame tend to bow into the aperture opening. To overcome this effect and to keep the film as flat as possible whilst traveling over the skidplate aperture we offer the Air Compression system. Compressed air is continuously forced into the lens chamber beneath the film frame and forces the film upwards. The air pressure is variable and stored for various film types. Warped film benefits from this with enhancements in edge-to-edge focus.

### **Other advantages**

Film on the Millennium is processed in 16 bit RGB colorspace. Advanced, state-of-the-art control of image shading offers the ability to take a film with dye fading, that appears for instance, with a red/magenta cast over the entire image, and easily remove it while retaining all of the red that belongs in the image. Masking features also allow special treatment of the different dye layers.

Screen Time Images has pioneered other restoration technologies, such as being the first in the world to use the Revival digital film restoration system in 1999, working closely with da Vinci on the system's development. The company has also developed proprietary digital restoration tools.

See next page for Millennium vs. Spirit telecine comparisons.



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## **Millennium Vs. Spirit**

The Millennium produces a far superior picture than the Spirit for several reasons. The Spirit samples luminance information from film with a fixed 1920 sample CCD array. It samples color information with three 960 sample RGB, CCD arrays. This is, in effect, 4:2:2 scanning. There is less color information available than luminance information.

The Millennium Telecine Scanner on the other hand, samples all 3 channels of RGB information from film at a full color bandwidth. This is, in effect, 4:4:4 scanning. The Millennium samples 3 RGB 16 bit channels containing 1920 samples each in HDTV mode and 2048 samples each in 2048x1556 data mode. Even in 1920x1080 HDTV scanning mode, the Millennium captures more information from the film being scanned.

Some colorists have noticed that the Spirit has problems reproducing certain colors. This makes it necessary to make more use of secondary color corrections.

Since the Spirit has CCD sensor, which are only 1920 and 960 samples long, there is a fixed relationship to the film area being scanned and the sensors. Instead of mapping the 1920 samples to the desired area on the film, the Spirit must throw away information when zooming, panning or tilting. To zoom, the Spirit does interpolation processing on the digital video signal equivalent to a DVE – and just like with a DVE, the picture quality suffers.

In 2K mode, Spirit expands its 1920 samples to fit the 2048 sample output resulting in a lower quality result. Since the color information scanned from the film contains only 960 samples, the resulting video is only really 4:2:2, or contains half of the color information.

In contrast, the Millennium always samples just the desired area of the film and does not throw any information out. It scans the film with a flying spot CRT. When zooming, the CRT raster size is changed to sample only the area of interest on the film – resulting in the best possible reproduced image. The Millennium does not throw any information out nor does any interpolation. In HD, 2K and 4K mode, the Millennium outputs true full bandwidth 4:4:4 color information unlike the Spirit.

In summary, the Millennium Telecine Scanner scans more information from film than the Spirit. It is also noted that the Spirit output, due to the CCD array tends to have a "Video Look" while the Millennium Retains a Full Resolution "Film Look".