LFNR—Large Format Negative Repurposing

By Ben Brunkhardt

Filmmaking occasionally encounters projects that cannot be practically choreographed or economically recreated multiple times, or in some cases it is not feasible or economically practical to photograph an event with multiple cameras. The Large Format Negative Repurposing process addresses these problems with a novel application for 70mm film in which the large format negative is composed as a wide master scene from which various types of shots, both static and moving, can be extracted without undesirable grain, resolution, or motion artifacts, using a specially equipped telecine. An example is presented in which the process was used for the production of a historical short subject.

Traditionally, large format motion picture cameras, 5/70, 8/70, and 15/70 have been used mostly for capturing high-resolution images for display on the big screen. Whereas formats such as Super Panavision 70 and Todd-AO (5/70) have become mostly a thing of the past for theatrical distribution, formats such as IMAX (15/70) and iWERKS (8/70) are still utilized for large format presentations. Alternatively, all three formats are still used occasionally for special-effect purposes such as photographing background plates, and more. Although large format continues to thrive on the big screen and in special-effect uses, Large Format Negative Repurposing (LFNR) may give these formats a new life, not only in future production, but also with previously photographed materials.

What is LFNR?

LFNR is a new post-production process that provides an alternative method for utilizing processed film shot on large format motion picture cameras. This new process can also affect the way in which a filmmaker chooses to photograph a scene and, therefore, provides a new type of cinematographic technique. Through LFNR, a filmmaker can recompose framing and pull out various types of shot coverage or compositions from an original large format negative. The idea of this process is to shoot a scene originating on a large format negative, such as 15/70, 8/70, or even 5/70, capturing the entire action of the scene within a single wide master shot. After processing of the large format negative is complete, the LFNR process occurs in the telecine room.

During telecine, a filmmaker can use the LFNR process to recompose an original large format nega-

tive, utilizing both the pan-and-scan (X and Y planar movement) and zoom-in (Z planar movement) functions of the telecine scanner. Thus, the image on the negative can be manipulated into medium shots, closeups, extreme closeups, and/or simulated tracking/booming shots. Due to the high resolution of large-format film, a subject within the frame can be zoomed into or magnified multiple times before grain is seen within the negative, and resolution or apparent sharpness is lost.

The current LFNR applications have utilized Cintel's Millennium/Millennium II telecine systems, equipped with a specially designed 65mm/70mm gate. This system was chosen to develop and refine the LFNR process because it is currently the only known large format telecine system/gate combination that can zoom tightly into 65mm negatives or 70mm prints and track specific motion within its frames while maintaining a sufficient level of image quality. LFNR's preferred output medium from this system is HDCAM-1080p at 24PsF. This particular format is preferred because it allows an "LFNR Repurposed Scene" to be easily transferred back to a 35mm negative, but alternatively, could also be transferred to any known media format.

Origin of LFNR

A few years ago, I was in preproduction of a short film that was to be the most historically accurate recreation of President Abraham Lincoln's assassination ever captured on film. The director and I had secured Ford's Theatre, the actual site of the assassination, as the shooting location for this film, with one caveat. We were granted only one, 14-hour, shooting evening to capture the entire 5-page screenplay. This proposed a difficult production situation. The director asked me how I thought we could accomplish the task of not only producing this re-creation within one evening, but also how we could get enough shot coverage to put a complete short film together. I told him about a concept that I had for shooting an entire master shot in large format and then zooming into the negative during telecine to pull out shot coverage. The idea seemed like an interesting solution to our production dilemma, but was it technically feasible? I researched the possibilities.

Conversations with multiple engineers at post-production facilities around Los Angeles occurred for several months with little to no progress, until a conversation with an engineer at High Technology Video (HTV) in Los Angeles, gave some hope. The engineer mentioned that Cintel had recently developed a 65mm/70mm gate specifically for their Millennium telecine systems and he believed it would be able to zoom tightly into large format negatives. After a meeting with representatives from Cintel, I felt confident that this system could perform the task, because it was used for a similar military application. The scanner was developed for the U.S. Army White Sands Missile Range to photograph missile launching tests with high-speed large format motion picture cameras from a distance and later zoom into those negatives to study the behavior of missiles during telecine. It is currently the only one in use, with the exception of the prototype housed at Cintel's headquarters in Ware, England.

Panning-and-scanning fluidly across a large format negative, however, was a different issue. The scanner's movements had never been tested for such use, so this was of concern. Using the prototype of the 65mm/70mm gate, the fluidity of scanner movements were tested across a large format negative. Test footage, shot on an iWERKS 15/70 camera, was threaded up on a Millennium II telecine system together with the prototype 65mm/70mm gate. The test footage on the negative was zoomed into and pan-and-scanned across the negative in various scenarios, and subsequently put on D-5 tape stock. Many adjustments were made to the programming within the system's hardware and software, but ultimately, the tests proved that this concept was technically feasible. From that point forward, the process was dubbed large format negative repurposing.

Description of Process and Examples

The LFNR process was ultimately used as the main cinematographic technique and post-production process in the Lincoln film, officially titled *The Persistence of Dreams.* Much work was done on the storyboard prior to production. Extreme emphasis was placed on all the detail within the frame, since at any point in the film, shots within the frame might be magnified tremendously during the LFNR process. The wide master shot that was ultimately chosen is shown in the Fig. 1.

During production, six 3-min takes of the entire wide

master shot were captured on an iWERKS 15/70 camera using Kodak Vision2 stock 5218. The scene was photographed with a 80mm lens (roughly the equivalent to a 27mm lens in 35mm) at f/8, since the entire frame needed to be in critical focus. Depth-of-field covered the entire frame from 37 to 73 ft. All the action that occurred in the 3-min scene was captured within this wide master shot.

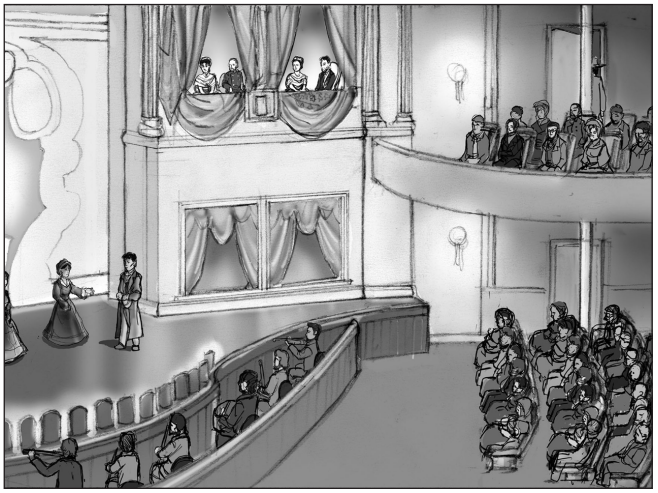

Figure 1. Preconceived storyboard depiction of wide master shot.

Figure 2. Entire wide master shot of Ford's Theatre pillarboxed within the HDCAM format.

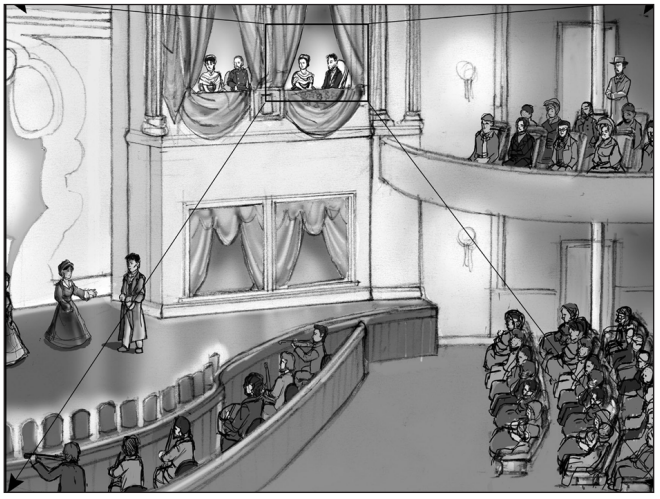

Figure 3. Preconceived storyboard depiction of wide master shot and intended recomposed frame to be extracted.

At the end of shooting, it was determined that Takes 5 and 6 were the best for camera and performance. One original negative and one interpositive were used for post-production. A 65mm interpositive of Take 6 was printed to protect the original negative for an intended 15/70 print of the single-shot short, which was to be printed later. The first step was to put the original 65mm negative of Take 5 on the Millennium II scanner. The entire wide master shot was first color-corrected from beginning to end on a daVinci 2k scanner, before it was transferred to HDCAM 24PsF. Color-correction information was noted before the process was repeated to Take 6's interpositive. To maintain the original 1.44:1 aspect ratio of the 15-perf/65mm frame, the master shot, as well as the LFNR coverage, were pillarboxed within the 16:9 HDCAM format. The resulting wide master shot appeared as illustrated in Fig. 2.

In the LFNR process, the master shots were first examined to determine all the possible static coverage options that could be pulled out of the original master shots. The desired shots were then isolated. The desired static LFNR coverage options all occurred in Take 5, therefore, its negative was threaded onto the scanner, cued to its head, color-corrected to the original specifications, and coverage shots were recom-

Figure 4. Two-shot extraction of President Lincoln and wife Mary Todd.

Figure 5. Resultant two-shot extraction of the President and his wife from the Millennium II scanner.

Figure 6. Two-shot of actors on stage.

Figure 7. Medium shot of John Wilkes Booth firing his Derringer.

Figure 8. Close-up of Booth prior to making his jump onto the stage.

Figure 9. "Sic Semper Tyrannis!"

Figure 10. Laura Keene attempts to calm the audience.

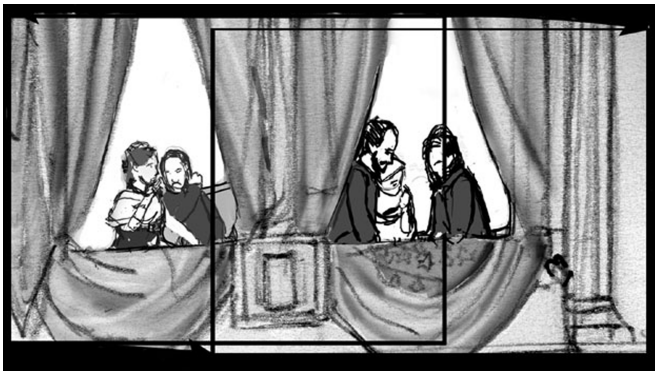

Figure 11. Preconceived storyboard depiction of frame tracking from the left side of the Presidential Box to the right.

posed from head to tail. For example, the first shot isolated through LFNR was a two-shot of President Lincoln and his wife, both sitting on the far right-hand side of the Presidential Box. Figure 3 represents the full wide master shot and the intended recomposed frame to be extracted, and Fig. 4 represents the final extracted frame. To achieve this composition, the colorist zoomed into the 15-perf/65mm negative and repositioned the scanner until the desired framing was isolated. The resulting image is shown in Fig. 5.

It was then determined that this isolated frame was an important coverage option for the entire duration of

Figure 12. "In-point" key-frame programmed into the Millennium II scanner.

Figure 13. "Out-point" key-frame programmed into the Millennium II scanner.

Figure 14. Still-frame progression of simple simulated camera movement as Clara Harris moves from the left hand side of the Presidential Box to the Right.

the 3-min wide shot. The negative was again cued up to the beginning and run through the scanner at 24 frames/sec and the recomposed frame was transferred onto HDCAM. The process was repeated for other desired closeups, medium shots, and singles. Figures 6 to 10 show examples of recomposed static shots taken from the original wide master shot.

The next step was the recomposed coverage, which had slight realtime readjustments (simple simulated camera movements) to the frame during action. One such example occurs halfway through the scene, after President Lincoln is shot. Figure 11 depicts the beginning and end frame of this simulated camera movement. In every case of the desired LFNR-simulated camera movements, Take 6 was preferable, therefore, the interpositive was threaded to the scanner and advanced frame by frame, up to the moment directly after Lincoln was shot. The colorist zoomed into the 15-perf/65mm frame and isolated the desired beginning recomposed frame of this shot. Since there was to be a scanner movement within this shot, an "in-point" or "start-point" had to be programmed first into the scanner to designate where and when it should begin its pan. That in-point key-frame is shown in Fig. 12.

Next, the film was advanced frame by frame for 72 frames until the interpositive was cued up to the desired ending of the recomposed shot. The colorist then panned the scanner over to the right and found a new composition that was the desired ending recomposed frame for the pan. This "out-point" key-frame had to be programmed into the scanner to designate where and when it should end its pan (Fig. 13).

After the in and out-points were programmed into the scanner, the interpositive was rewound and cued up to 240 frames prior to the in-point key-frame. The film then ran forward though the scanner at 24 frames/sec. When the film hit the in-point, the scanner recomposed the interpositive to the beginning programmed desired key-frame. It slowly panned over to the programmed end key-frame by the out-point 72 frames later, while transferring the newly recomposed shot over HDCAM. A still-frame progression of the simulated camera movement is illustrated in Fig. 14.

There were five different LFNR recomposed shots that included simple simulated camera movements. Therefore, the process was repeated four more times for the remaining shot recompositions and laid down to HDCAM. A still-frame progression of another simple simulated camera movement is illustrated in Fig. 15.

Figure 15. Still-frame progression of simple simulated camera movement as Booth jumps from the Presidential Box onto the stage.

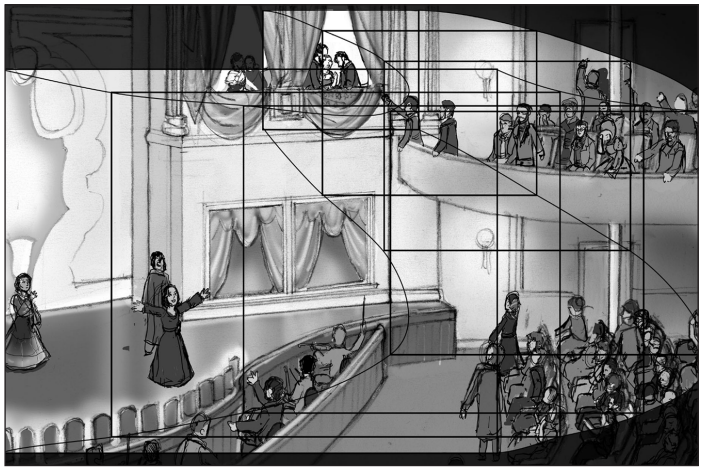

Figure 16. Storyboard depiction of desired complex simulated camera movement to be extracted from the master shot.

In the final step, coverage was pulled from the original master shot, which resulted in complex simulated camera movement within the frame. This is depicted in Fig. 16. In this case, the frame begins close up on the Presidential Box then becomes increasingly wider as it pans right, tracks down, and then pans back left throughout the frame.

Figure 17 depicts a clearer still-frame progression, point by point, throughout the desired simulated camera move. To accomplish this, individual in and out-point key-frames need to be programmed into the scanner to designate where and when each move would begin and end, before changing direction. In this LFNR-simulated camera movement, Take 6 was once again preferable, therefore, the interpositive was left on the scanner and advanced frame by frame until the film was cued to the moment in which the desired recomposed shot was to begin.

The colorist then zoomed again into the 15-perf/65mm frame and isolated the desired beginning recomposed frame of this shot. Since there were to be several scanner movements within this shot, an in-point key-frame had to be programmed first into the scanner to designate where and when it should begin its pan. Next, the film was advanced frame by frame for 105 frames until the interpositive was cued to the desired ending of the first completed scanner movement of the recomposed shot. The colorist then panned the scanner over to the right, tracked down and found a new composition that was the desired ending recomposed key-frame for the first scanner movement. This became the first out-point of six to be programmed into the scanner for this recomposed shot. The first out-point key-frame was then programmed as the second in-point key frame for the beginning of the second scanner movement during the recomposed shot. The process of programming in and out-point key-frames for scanner direction changes was repeated five more times until each of the seven still-frame progression storyboards (Fig. 17) received an in- and out-point key-frame designation.

After all of the in and out points were programmed into the scanner for this LFNR-recomposed shot, the process of transferring to HDCAM was repeated similarly as before, except this time, recomposing the interpositive through seven programmed key frames instead of two. In total, there were three different LFNR recomposed shots including complex simulated camera movements used in *The Persistence of Dreams.*

The short was then edited at Filmworks/FX in Santa Monica, CA. The LFNR-recomposed shots all edited together seamlessly between each other and the original wide master shot. The final edited film resulted in 15 different LFNR coverage shots, including the master, and displayed a running time of 4 min and 55 sec, including titles and credits. Currently, it is the only film incorporating LFNR as a cinematographic technique, as well as a post-production process.

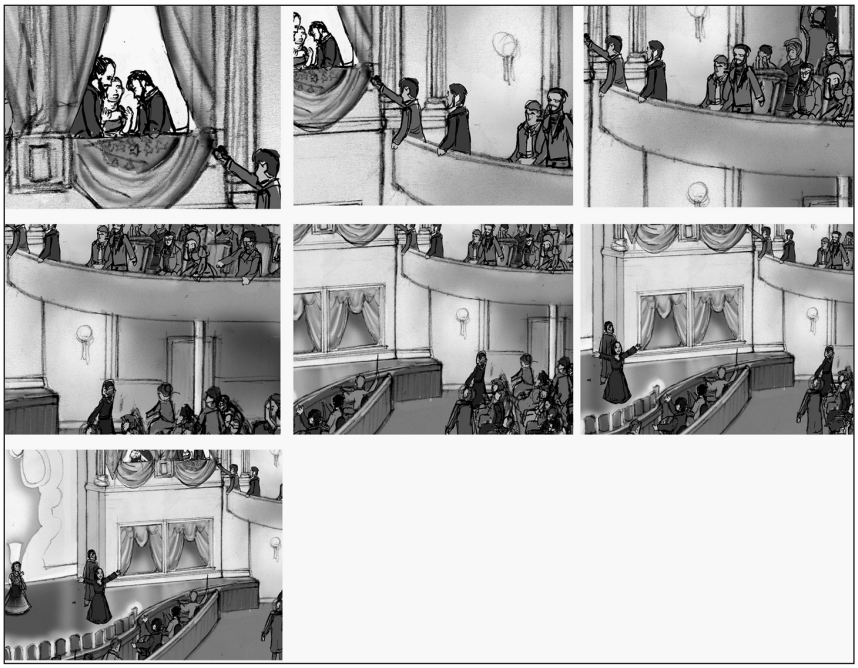

Figure 17. Clearer still-frame progression, point by point, of the desired complex simulated camera movement.

Conclusion

There are many practical reasons why a filmmaker may choose to utilize the LFNR process. One is to capture a single occurring event that cannot be practically choreographed or economically recreated multiple times with multiple coverage options. It can also be used in scenarios where it is not feasible or economically practical to photograph an event with multiple cameras. Recomposing large format negatives with LFNR could also potentially solve common problems frequently experienced by editors, such as coverage that crosses the 180° line and has inconsistent lighting from master shot to closeup. It could also eliminate soft-focus problems frequently encountered with closeups that are photographed with long camera lenses. As an added benefit, LFNR could possibly eliminate the necessity of a camera dolly and dolly grip, or a camera crane and its operators in certain situations, potentially saving production time and money.

It is important to note, however, that LFNR is not intended to replace traditional production or post-production methods, but rather to provide a possible alternative. In an industry rapidly moving further into a digital era, LFNR can potentially increase the use of film as an origination medium, as well as provide a new "film/digital-hybrid" process that could bring new ancillary product possibilities to previously photographed large format films, not to mention existing large format stock footage libraries.

Finally, LFNR can promote increased awareness, understanding, and possible usage of the large format motion picture mediums to all other non-large format filmmakers. Although the large format industry has long embraced and continues to utilize the incredible resolution and clarity of 65mm negatives, the standard Hollywood and documentary film industries may have overlooked or under-utilized all the benefits that 65mm negatives can offer. This is due, in part, to the cost-prohibitive nature of the format. LFNR, however, has the possibility to offer non-large format filmmakers a 65mm, cost-effective, solution to many commonly experienced production problems.

Winner of the 2005 SMPTE Student Paper Award.

THE AUTHOR

Ben Brunkhardt is a fulltime cinematographer working in Los Angeles. Over the past 12 years, he has served as director of photography on 21 short films and music videos, and on one feature-length film. He is the founder of Arrowhead Productions, an independent film production company, currently in preproduction of both large format and feature films.

Brunkhardt developed the new, patent-pending post-production process for large format-filmed motion pictures (LFNR). He produced and photographed the first 15/70 (IMAX) film utilizing the LFNR process. The film, *The Persistence of Dreams,* as well as his new process, debuted at the 2005 Large Format Cinema Association conference in Los Angeles in April 2005. He is currently consulting with other producers who hope to incorporate the LFNR process into future projects.

Brunkhardt was the recipient of the 2005 SMPTE Lou Wolf Memorial Scholarship Award and the SMPTE Student Paper Award.