

# Bedknobs and Broomsticks: Using a Distressed Work Print as a Color Master Positive

Scott MacQueen

*A 25-year-old, color-faded, heavily scratched 35mm Eastmancolor positive work print trim was the only existing preprint for one sequence of the restored special edition of Walt Disney Pictures 1971 feature film Bedknobs and Broomsticks. The objective was to resurrect the degraded color imagery to a 35mm internegative of sufficient integrity so that this sequence could be reasonably integrated with original camera negative. Liquid gate duplication of the master print to a color-corrected internegative yielded an improved element for digital scanning. Electronic image processing permitted further image reconstruction before the data were output as an analog motion picture negative suitable for conventional motion picture laboratory printing.*

The Walt Disney Pictures musical fantasy *Bedknobs and Broomsticks*, starring Angela Lansbury, had a number of scenes cut before its theatrical opening in 1971 due to exhibitors' demands that the film not exceed two hours in length. In 1996, 22 minutes of excised scenes were returned to the motion picture. When research proved this was the original artistic intent of the work's creators, it was determined to permanently conform the original cut camera negative to this longer version and preserve this edition (with additional 35mm interpositives and 35mm Estar separation masters) at film archival standard.

## Degraded Work Print Sole Picture Master

Twenty-one minutes of Eastman Kodak 5254 camera negative deletions, in excellent condition, were located and reintegrated in the original continuity. Of the five additional minutes added to the "Portobello Road" sequence, four minutes existed as original work picture backed up by original spliced negative trims. Once the restored continuity was determined, it was relatively simple to reintroduce the negative trims to their correct position in the cut camera negative.

The additional minute, however, was comprised of a dozen shots that existed solely as positive work picture. If the sequence were to be restored to full contextual length, this work picture would need to suffice as a picture master.

This 25-year-old work picture (Fig. 1) was Eastman Kodak 5385 color print film, an unstable dye-coupler stock. As a positive trim roll never intended for archiving, it had been stored for a quarter-century in an

ambient warehouse environment that had done nothing to help color stability. Virtually all of the yellow dye and an appreciable amount of the cyan dye had faded. The remaining photographic image was exceptionally low contrast and monochromatic, primarily magenta-violet in hue. The minimum density was well up from the film base. Subjects that should appear as photographic black were milky magenta-purple, a yellow dress was pale fuchsia, and flesh tones appeared violet-pink.

This was the original 1971 editorial copy (probably the original daily print) and displayed wear and tear consistent with repeated projection on a Movieola: vertical emulsion scratches (minus density print value), vertical cel scratches (plus density print value), and intermittent gouges and nicks on the emulsion and cel (minus density and minus color). Editorial handling was evident in the form of grease marks, imbedded dirt, and tape splices.



Figure 1. A frame from the original color-faded 5385 work print, with inherent plus density cel scratches and minus density emulsion scratches. No other picture material survived for this sequence.

Presented at the First Annual Spring Film Conference (paper no. 8), Los Angeles, Calif., March 20-22, 1997. Scott MacQueen is with Walt Disney Pictures and Television, Burbank, CA 91521. An unedited version of this paper appears in *Film: Still the Master in a Digital World*, SMPTE, 1997. Copyright © 1998 by SMPTE.

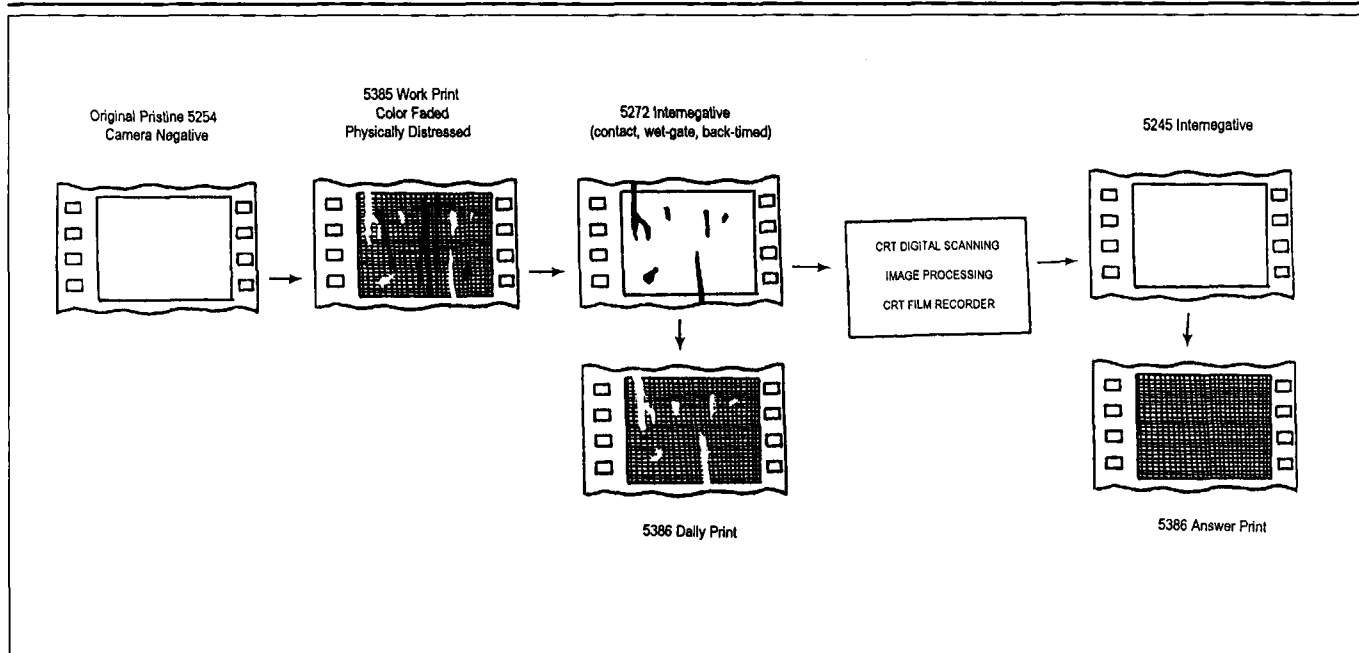


Figure 2. Flowchart of steps and procedures used in restoring the prints.

**Restoration Methods Considered and Rejected**

It was a critical objective that the 1 min of returned footage must fit as seamlessly as possible alongside original negative. Several approaches were considered and rejected:

- A straight dupe negative was rejected immediately. Even if made wet gate, it could serve no purpose beyond mere capture of the distressed image for historical purposes. One-to-one capture of the color fading and emulsion damage would render the footage “commercially unacceptable.”
- The print could be rephotographed through color separation filters to create silver YCM (yellow, cyan, magenta) negatives, with the low yellow and low cyan information raised in processing. This approach was rejected as, even if sufficient color information could still be captured for augmentation, the forced processing would increase film grain to an intolerable level. Two further printing steps would be required: a three-strip interpositive, and a contact internegative. The generational losses would be unacceptable.
- A black-and-white dupe negative could be made and then digitally scanned at high resolution, matched to the palette of uncorrupted reference scenes, artificially rendered in color

with an electronic ink-and-paint system, and output to film. Previous restoration experience with this process made it clear that this would be a highly expensive, highly experimental trial-and-error ordeal with no certainty of a viable result.

**Technology of Choice #1—  
Photomechanical**

The decision was made to make the best possible manipulated color intermediate copy by photomechanical methods, and use the resulting film intermediate as a starting point for further digital correction (Fig. 2).

At Four Media Co.’s film laboratory, before any mechanical operations, the 100-ft roll was inspected and prepared, identifying and correcting physical deformities (damaged perforations, parting splices, excessive shrinkage) that might jeopardize the film during machine transport. After hand cleaning, the print was sonic cleaned in a solution of trichlorethylene to remove particulate dirt and grease.

The print was copied onto Eastman Kodak 5272 acetate camera film on a Bell & Howell modular contact panel printer fitted with a perchloroethylene full-immersion liquid gate. Processing was normal.

The 5272 internegative was then timed in an attempt to compensate for the yellow and cyan dye loss. The

resulting daily showed a marked improvement in color saturation, separation, and contrast. The wet gate printing solution successfully prevented the majority of cel scratches from being photographically transmitted to the internegative.

A second 5272 internegative was generated by the same method, back-timed with a color correction of +2/3 stop Red and -2/3 stop Green exposure, with +3/4 of a stop of overall exposure. This placed the new color relationship in the negative and created more latitude in the printing scale.

**Technology of Choice #2—  
Digital**

Pacific Title and Optical coordinated with Pacific Title Digital for the scanning of the color-corrected 5272 internegative. Pacific Title Digital was supplied with a newly created 35mm color answer print from the original color 5254 negative of surrounding production scenes to match for color reference. Test frames of each shot were scanned and approved as “photographic wedges.”

Once the wedges were evaluated and the selected frames were approved, the entire sequence was captured by a custom-built Information International cathode ray tube (CRT) scanner at 4K by 3K at 12 bits log (16-bit linear). This was downsized to Cineon standard 10-bit resolu-



Figure 3. The frame shown in Fig. 1 following photomechanical and digital restoration. This is a daily print before final scene-to-scene color correction.

tion because the image processing was to be performed with Cineon software.

Three processing passes were performed:

- A color correction pass in red, green, and blue (RGB) mode to establish neutral color values (black, gray, and white) within each shot.

- Contrast adjustment to establish the optimum D-min and D-max of each shot.

- Hue and color enhancement to maximize the color data in relation to hero (main character) reference frames of the same subject from an uncorrupted color wedge.

Finally, proprietary scratch removal algorithms (similar in function to a frame comparator) were used for the automated removal of minus density and minus color artifacts. A sharpening kernel was employed to enhance resolution before the digital data was output on a custom Information International high-resolution CRT film recorder to Eastman Kodak 5245 camera negative. This negative was processed as normal.

The first and last frame of each camera shot was repeated in the film output to provide a frame handle for the negative cutter. Once the new 5245 negative was integrated into the original 5254 camera negative, the full

cut reel was answer printed again, with final color correction unifying the transition between original and dupe negatives.

### Final Product

Even though the task undertaken should have been an impossibility (the filmic equivalent of making a silk

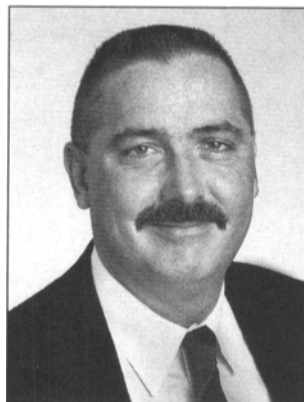
purse from a sow's ear), the result is remarkable. The full range of colors, including such problematic hues as black and yellow, has been regained relative to their original pure values (Fig. 3). The rainstorm of print wear has been removed without introducing troubling new artifacts. The restored footage has higher contrast, is distinctly softer and more desaturated as compared with the original scenes it cuts into, yet it appears no more objectionable (and substantially cleaner) than some of the original production opticals found elsewhere in *Bedknobs and Broomsticks*.

### Conclusion

The blending of conventional analog and digital techniques allowed for the best of both worlds. Although it may be argued that the restoration could have been performed entirely in the digital domain, this would have been grossly inefficient in both time and money. Each technology offered the correct response to some portion of the problem. Using both processes in tandem gave the best value at an affordable cost. The photomechanical operation was a partial solution, elegant in its simplicity and attractively priced, that provided a sturdy foundation for the subsequent and substantially more expensive digital imaging process.

---

## THE AUTHOR



**Scott MacQueen** is manager, library restoration, Walt Disney Pictures and Television, Burbank, Calif., responsible for the preservation and restoration of the studio's film library. He has a BFA in Film from New York University. Prior to joining Disney in 1991, MacQueen worked as a line producer and assistant director. He is a member of SMPTE, the Directors Guild of America, and the Association of Moving Image Archivists. MacQueen has written on film history and restoration for *American Cinematographer*, *The Perfect Vision*, *Cinefex*, and *Animato!* and is a 1997 Anthology Film Archives Film Preservation Honoree.