

18. Handling and Preservation of Color Slide Collections

Selection of Films, Slide Mounts, Slide Pages, and Individual Slide Sleeves

Introduction

Although color slides can be made from color negative originals, the great majority of 35mm slides are one-of-a-kind transparencies produced by reversal processing of the original chromogenic camera film. The Fujichrome or Kodachrome slide that you put in your projector is in most cases the same piece of film that was exposed in your camera.

When an original color slide becomes faded, physically damaged, or even lost, there is no camera negative from which a new slide can be made. In this respect, original color slides are like the daguerreotypes of a bygone era and the Polaroid instant color prints of today: none have usable negatives.

More than one billion color slides are taken each year in the United States alone. Many important collections have hundreds of thousands of 35mm color slides. Some have millions: the National Geographic Society in Washington, D.C. has between 10 and 11 million color slides in its collection, including a significant number of early Kodachrome slides dating back to the introduction of Kodachrome in the 35mm format in 1936; the Time Inc. Magazines Picture Collection in New York City has over one million slides dating from the late 1930's; Black Star Publishing Company has 3 million; Gamma-Liaison, Inc. has over one million; Magnum has over half a million; and Sygma Photo News, Inc. has over one million slides in its collection.

The Image Bank, a Kodak-owned stock agency specializing in color photography for general coverage, commercial use, and advertising, has more than 20 million images — mostly 35mm color slides — in the collections in its New York City headquarters and the 64 Image Bank sales offices worldwide. The Bettmann Archive has more than 16 million B&W photographs and color slides in its collections. When dealing with such vast numbers, it is easy to lose sight of the fact that original color slides are usually irreplaceable.

The guiding principle for preserving color slides is to treat originals *carefully* — the same way valuable negatives should be handled. Slides must be protected from physical damage, fingerprints, dirt, and scratches. Minor physical damage is often tolerated when slides are projected on a screen; however, such defects can be very objectionable if the slide is used to make a print for display or is reproduced in a book, magazine, or advertising brochure. It is also essential that slides be protected from excessive projector-caused fading (see Chapter 6). The best procedure is to make duplicates from original slides, and to then carefully store the originals in the dark. Working dupli-

cates are *essential* to protect an original slide if an image is likely to receive extensive projection or handling.

Choice of Color Film Is the Most Important Consideration

When stored in a typical air-conditioned office environment (i.e., 75°F [24°C], 50–60% RH), the dark fading stability of slides made on *current* Kodachrome, Fujichrome, Ektachrome, and the “improved” Agfachrome RS and CT films introduced in 1988–89 is sufficiently good that most photographers and commercial users will feel no immediate need to refrigerate such slides. Most photographers are reasonably satisfied if a color transparency lasts their lifetime — or at least their working careers — without obvious deterioration.

This is not to say, however, that humidity-controlled cold storage is not a good idea for stock agencies and other commercial collections. Especially for collections that contain valuable material on earlier films such as Ektachrome Process E-1, E-2, and E-3 films, all of which have *extremely poor* dark fading stability, refrigeration is the only way to slow further deterioration.

Refrigerated storage is also vital for long-term preservation of Process E-4 Ektachrome films, Fujichrome films made prior to 1978 (when improved Fujichrome Process E-6 films were introduced), and all Ansco and GAF color transparency films. Also included in this group, because of their relatively poor dark fading stability, are all pre-1989 Agfachrome RS and CT films (at the time of this writing in 1992, only Agfachrome RS 1000 film was still being manufactured with the earlier type of poor-stability yellow dye), and pre-1991 3M ScotchChrome slide films and Polaroid Presentation Chrome 35mm film (made for Polaroid by 3M in Italy).

For museums and archives, where the goal must be indefinite preservation of color photographs in an essentially unchanged condition, refrigerated storage is mandatory for *all* present and past slide films, even Kodachrome.

To avoid fungus growths on film emulsions, in any collection, with or without refrigerated storage, humidity levels in a storage area should never be allowed to remain above 65–70% for prolonged periods.

For current work, a photographer can make an informed decision about which films are best suited to his or her needs. There are many practical advantages in choosing the most stable slide films available, the most obvious being the extended projection times afforded by the films with the best projector-fading stability as well as the ability to store slides in normal room temperature conditions for the next 50 years or more without objectionable fading taking place.

See page 629 for Recommendations



Carol Brower — May 1983

Most of the more than one million color slides and other film transparencies in the Time Inc. Magazines Picture Collection, which includes the files of **Life**, **Time**, **Fortune**, **Sports Illustrated**, **Money**, **People Magazine**, and other publications, are now kept in a cold storage vault located adjacent to the picture collection on the 17th floor of the Time & Life Building in New York City. Constructed in 1983 to preserve the priceless collection, which contains color slides dating back to the 1930's, the vault was designed to operate at 0°F (-18°C) and 30% RH. In recent years, however, because of heavy use of the color collection, the vault has been maintained at 60°F (15.5°C) and 30% RH. Time Inc. Magazines is part of Time Warner Inc.

Fujichrome and Kodachrome Films Are the Best Choices

When the image stability of a slide film is of even moderate concern, there are really only two logical choices among all the slide films currently on the market: Fujichrome and Kodachrome.

Kodachrome films have the best dark fading stability of *any* conventional color film, either negative or transparency. Kodachrome is also the only chromogenic color film that remains completely free of yellow stain formation during extended dark storage. (Only Ilford Ilfochrome Micrographic film [called Cibachrome Micrographic film, 1984–1991], an ultra-stable color microfilm, has better dark fading stability than Kodachrome. But because of its extremely slow speed — an ISO speed of about 1 — and several other constraints, it is not suitable for normal pictorial photography.)

Kodachrome 35mm slide film was introduced in 1936, and for most of its more than 50-year history the film has had a number of practical limitations for many applications. Until late 1986, when 35mm Kodachrome 200 Professional Film and Kodachrome 64 Professional Film in the

120 roll-film format were introduced, Kodachrome films were supplied only as low-speed 35mm materials: ISO 25, 40 (tungsten), and 64.

In the 1970's and early 1980's, many photographers who otherwise liked the fine grain and extremely sharp images offered by Kodachrome had abandoned the film because the then-available “amateur” Kodachrome 25 and 64 films and the downgraded “amateur” Kodachrome processing at Kodak Processing Labs frequently gave unacceptable performance in terms of color balance and film speed. Most professional photographers felt that the previous Kodachrome II and Kodachrome-X films gave better results.

The introduction of Kodachrome 25 and 64 Professional films in 1983 and “professional” Kodachrome processing by independent labs generally improved the situation and as a result, the use of Kodachrome among professional photographers increased for a while — mostly at the expense of Ektachrome film. At one point it was even rumored that Kodak was thinking about once again marketing Kodachrome sheet film. (Kodak initially introduced Kodachrome sheet film in 1938. The film was discontinued in 1955, with Process E-1 Ektachrome film offered as a



An outer vestibule minimizes temperature and humidity fluctuations within the vault, as, for example, when Beth Zarcone, head of the picture collection, and Linda Kurihara leave the facility.

replacement. The Ektachrome film had the advantage that it could be processed by the user, but it was *far* less stable than Kodachrome — a fact that Kodak was careful to keep secret from professional photographers.) But by around 1990, sales of Kodachrome were declining once again.

For many photographers working with transparency films, the fact that Kodachrome film cannot be processed by the user or most custom labs is a serious obstacle to its regular use. The complex processing procedure requires specially built motion picture-type processing equipment and an in-house analytical lab to monitor the chemistry. Professional-quality processing of the film is increasingly difficult to come by and at the time this book went to press in 1992, was available only in Los Angeles and Miami, or by shipping the film to one of the few Kodalux labs (formerly Kodak Processing Laboratories) still offering “professional” Kodachrome processing. Several amateur-oriented photo-finishing labs also process Kodachrome, but by professional standards the quality and consistency of their work are generally unacceptable. Fujichrome, Ektachrome, and Agfachrome, on the other hand, can be quickly processed by the user or by any of the countless labs around the world offering E-6 processing.

A serious drawback of Kodachrome for slide-film users is that, unfortunately, it has the *worst* projector-fading



Temperature and humidity conditions inside the vault are recorded on a circular chart recorder, here being checked by Mary Jane McGonegal and George Zeno.

stability of any slide film currently on the market. How significant this shortcoming is in practice depends on how much a slide might be projected over its entire lifetime. Kodachrome is the best choice when little if any projection of originals is required (for critical commercial applications, this author suggests a maximum of 20 minutes total projection time during the entire life of a Kodachrome slide).

Fujichrome Films Are Superior to Ektachrome, Agfachrome, and 3M ScotchChrome Films

If significant projection is contemplated, or if Kodachrome is not suitable because of processing requirements or other limitations, Fujichrome professional and amateur films are clearly the best choices among all currently available transparency films. Fujichrome professional films are available in a wide range of speeds and formats, from 35mm to 8x10-inch sheet films, in both tungsten and daylight versions. Speeds of the Fujichrome daylight films range from ISO 50 to 1600 (processed normally, this is currently the world’s fastest color transparency film).

Fujichrome films have received excellent reviews in the press, with many top professional photographers praising the color reproduction and image quality of the films.

Thom O'Connor, writing in New York City's *Photo District News*, gave this report on one photographer's reaction to Fujichrome films:

New York advertising and annual report photographer Jim Salzano was introduced to Fuji three years ago by architect Charles Fazio.

"Charles wanted to make photographs of mosaics on a building," recalls Salzano, "and he suggested we use Fujichrome. I laughed a lot, but he gave me a copy of a photo magazine with a favorable review on the film, so we tried it.

"We shot both Fujichrome and Ektachrome, and had it processed a few different ways. I was amazed at how good Fuji looked. It was incredibly brilliant, with a lot of latitude. It was a lot like Kodachrome, but without the really heavy contrast. The Ektachrome looked flat, it had no life."

Salzano, a heavy Ektachrome roll film user, gradually started moving to Fuji. "I had a lot of Ektachrome in my refrigerator, so I told myself I'd use that on unimportant jobs. But every job seemed important, so I kept using Fujichrome. Finally, I sold off my Ektachrome to a photographer in my building."¹

Comments like this and the increasing acceptance of Fujichrome films in the mid-1980's greatly alarmed Kodak — this was the first time that Kodak's stranglehold on the professional market in the U.S. had been seriously threatened — and the company embarked on a crash program to try to match the brilliant color saturation offered by the Fujichrome films. The result, introduced with much fanfare at the 1988 Winter Olympics in Calgary, was Ektachrome 100 Plus Professional Film (the "amateur" version is called Ektachrome 100 HC Film).

In this author's tests, both the standard and the new "Plus" and "X" types of Ektachrome films proved to have identical projector-fading stability. Current Ektachrome film and Fujichrome films all have generally similar, yellowish stain-limited, dark storage stability (see Chapter 5). Fujichrome films, however, have approximately *twice* the projector-fading stability of Ektachrome films (see Chapter 6). Though not as stable in dark storage as Kodachrome films, Fujichrome films are more than *5 times* more stable than Kodachrome in projector fading!

In most commercial applications — given the relatively good dark fading stability of current Fujichrome, Kodachrome, and Ektachrome films — the most critical stability factor in slide film performance is projector-fading stability. In this regard, Fujichrome films — both camera and duplicating — clearly stand out as superior to all other transparency films in the world today.

Although current 3M ScotchChrome slide films have relatively good projector-fading stability, the dark fading stability of these films is inferior to that of Fujichrome and most other E-6 films; for this reason, ScotchChrome films are not recommended. Although the dark fading stability of the "improved" Agfachrome RS and CT films introduced in 1988–89 is better than previous Agfachrome films, nei-



Participants at the Mid-America Art Slide Libraries meeting in Iowa City, Iowa in 1982 examine Agfachrome slides brought to the meeting. Concern had been expressed that older, humidity-sensitive Agfachrome slides (made before 1984, when Agfa converted its films to Process E-6) were less stable than Ektachrome, Kodachrome, or Fujichrome slides. Agfachrome slides were pulled at random from collections, and this subjective examination indicated that at least under some conditions, the Agfachrome images had faded significantly in a relatively short period.

ther dark fading nor projector-fading stability of the new Agfachrome films is equal to that of Fujichrome.

Fujichrome Velvia Professional Film Equals or Exceeds the Image Quality of Kodachrome Film

Fujichrome Velvia Professional Film, a 50-speed film introduced in 1990, is the sharpest and finest grain of all Process E-6 compatible transparency films. Velvia is the first E-6 film to equal — or even exceed — the high resolution and very fine grain of Kodachrome 25 film (in terms of image structure, Velvia is substantially superior to Kodachrome 64).

Writing in the June 1990 issue of *Outdoor Photographer* magazine, Galen Rowell, an internationally known wilderness photographer, had this to say about Velvia:

I ran controlled tests of Velvia against Kodachrome 25, Kodachrome 64, and Fuji Pro 50. On the light table the next morning, I saw the

(continued on page 630)

October 1982

Recommendations

Slide Films

- Choose slide films with the best combination of projector-fading and dark fading stability. This is the most critical factor in determining the eventual life of an image. As discussed in Chapter 5, Ektachrome and Fujichrome films have generally similar, stain-limited, dark storage stability. But because Fujichrome and Fujichrome Velvia films are far superior to Ektachrome films in projector-fading stability, Fujichrome films are recommended for most applications. Agfachrome films are an acceptable third choice, after Fujichrome and Ektachrome. Where projection of originals can be avoided, Kodachrome is the best film to use because of its unsurpassed dark fading stability and complete freedom from yellowish stain formation during long-term storage; when kept in the dark, Kodachrome is more stable than any other chromogenic color film — transparency or negative. Unfortunately, Kodachrome has the worst projector-fading stability of any currently available slide film.
- Color negative films should be considered for original photography. To make slides, color negatives can be printed on Kodak Vericolor Slide Film 5072. Color negatives have much greater exposure latitude than transparency films and color corrections can be made when slides are printed from negatives. With negatives stored in a safe place, new slides can be made as needed. This eliminates concern about fading, scratching, or outright loss of irreplaceable originals during projection, handling, or shipping. In addition, color negatives can be used to make high-quality color and B&W prints.
- Films to avoid: 3M ScotchChrome films and Polaroid Presentation Chrome 35mm film (made for Polaroid by 3M) are not recommended because they have inferior dark fading stability compared with Fujichrome, Ektachrome, Kodachrome, and Agfachrome. Polaroid PolaChrome instant color slide films also are not recommended because of poor image stability, very poor image quality, and numerous other practical shortcomings. Advertising by Seattle FilmWorks and other cut-rate processors notwithstanding, use of Eastman, Fuji, and Agfa motion picture color negative films as a method of making slides (and/or color prints) should be avoided.
- Duplicating films: Fujichrome Duplicating Film is recommended. Currently available only in 100-foot rolls, it is hoped that Fuji will supply the film in 36-exposure cassettes. For large-volume duplication (with an inter-negative), Fujicolor Positive Film LP 8816 and Eastman Color Print Film 5384 are recommended. Agfa CP1 and CP2 print films have very poor dark fading stability and these films should be strictly avoided.

Slide Mounts

- Kodak cardboard Ready-Mounts and the cardboard mounts used by Kodalux Processing Services (formerly Kodak Processing Labs) are made of long-lasting materials, and accelerated tests indicate they are not harmful to color slide images during prolonged storage; the mounts are satisfactory for most applications (no information is available on other types of cardboard mounts).

- Open-frame (glassless) plastic slide mounts made by Wess Plastic, Gepe, Pakon, and others appear to be satisfactory, although accelerated aging data with slide films in plastic mounts were not available at the time of this writing.
- Glass mounts offer protection from fingerprints and scratches during handling and also maintain the film in a flat plane during projection. Glass mounts do not, however, reduce the rate of fading during projection or in dark storage. Glass mounts are routinely used in slide libraries because the slides are handled frequently by students, faculty, and staff; for libraries and other users that do not require pin-registration, the taped-glass Archival Mount available from Wess Plastic, Inc. is recommended.
- With commercially produced duplicate slides intended for use in slide libraries and other reference collections, 3M Photogard anti-scratch film coating and open-frame plastic mounts are recommended as a low-cost substitute for glass mounts. Photogard should not be used to coat original slides or duplicates intended for reproduction or preservation backup.

Projection

- Keep the projection time of original slides or nonreplaceable duplicates to a minimum. For general applications, the total accumulated projection time for Fujichrome should not exceed about 5 hours (4 hours for Fujichrome Velvia); with Ektachrome do not exceed 2½ hours; with Agfachrome do not exceed 2 hours; with Kodachrome do not exceed 1 hour (see Chapter 6). For critical applications, much shorter accumulated projection times are recommended. The accumulated projection time, not the length of a particular projection, is what is important. Lecturers who project certain slides repeatedly should be especially cautious. Use expendable duplicates whenever possible; Fujichrome duplicating film is recommended. Avoid high-intensity xenon arc projectors. Likewise, do not use projectors fitted with non-standard, high-intensity quartz-halogen lamps or that have been modified in other ways to increase lighting intensity.

Slide Pages

- **Recommended:** Polypropylene notebook pages for slides are best (e.g., 20th Century Plastics, C-Line, Light Impressions, Film-Lok, and DW Viewpacks). This author's top recommendation is the line of EZ2C Super-heavyweight polypropylene pages made by 20th Century Plastics, Inc. The heavier 5.0 gauge of these high-clarity pages gives them much better handling characteristics than the flimsier 3.5-gauge polypropylene pages available from most other suppliers. EZ2C Super-heavyweight pages are available for ring-binder notebooks or with steel top-bars for use in file drawers equipped with frames for hanging files. Also recommended, when used in conjunction with Kimac individual slide sleeves (not necessary for glass-mounted slides), are the rigid, open-frame polypropylene Saf-T-Stor slide pages supplied by Franklin Distributors Corp. The Plastican Slide Frame, a rigid, open-frame, molded polystyrene slide "page," is satisfactory for glass-mounted slides and is particularly recommended for vertical storage of glass-mounted slides in file cabinets.

- Products to avoid: Polyvinyl chloride (PVC) slide pages, especially the widely available plasticized PVC slide pages (e.g., 20th Century Plastics and many other firms). Low-density polyethylene pages (e.g., Vue-All, Print File, Light Impressions, and Clear File) also are not recommended.

Sleeves for Individual Slides

- Unless kept in inactive storage, slides should be inserted into individual acetate sleeves to avoid fingerprints and other damage. Kimac sleeves are best. Light Impressions individual slide sleeves lack the snug fit of the Kimac sleeves and therefore are not recommended. ImageGuard rigid slide holders, from Image Innovations, Inc., are excellent for protecting valuable slides during shipping and handling; however, at a price of about \$1 each, the high cost of the holders will restrict their use in most collections.

Handling Slides

- Handle slides carefully to avoid fingerprints, scratches, and abrasion. Slides, especially one-of-a-kind, irreplaceable originals, should be treated with the same care given to valuable negatives.
- With valuable slides, retain the originals and supply duplicates to editors, art directors, lecturers, and other users. Important collections should establish two separate divisions. The preservation collection, consisting of originals, is not projected or otherwise subjected to day-to-day use. The working collection, made up of duplicate slides, can be edited on light tables, projected, sent to clients, and so forth. To reduce the risk of losing or damaging originals, provide for in-house duplication whenever possible.
- Store slides in the dark in a reasonable environment. The storage temperature should not exceed 75°F (24°C) and the relative humidity should be kept as low as possible — to avoid fungus growths, slides should never be stored where the relative humidity is above 65–70% for prolonged periods. Humidity-controlled refrigerated storage should be used to preserve valuable historical and commercial collections (see Chapters 19 and 20).
- Slides made with comparatively unstable films (e.g., pre-1978 Ektachrome films, pre-1989 Agfachrome films, 3M ScotchChrome films, and Polaroid Presentation Chrome film, slides printed on pre-1984 Eastman Color motion picture print films, etc.) and slides of any type or age that show any signs of fading or staining should be duplicated on Fujichrome Duplicating Film and the originals placed in humidity-controlled refrigerated storage.
- Do not allow slides to remain on illuminated viewers or light tables any longer than absolutely necessary. Extended exposure to light from an illuminated viewer can cause significant fading. Kodachrome slides are particularly sensitive to this and other types of light fading.
- To avoid potentially serious, irregular image fading caused by room lights, do not leave slides uncovered on desks or tabletops. Be especially careful in rooms that are brightly illuminated with fluorescent lamps or daylight.

end of an era in my results. At the very least, my opinion was that Velvia was the best of all existing worlds. Its resolution appeared to exceed Kodachrome 25 and the other test films. I preferred the color saturation and separation of tones over Fuji Pro 50 and the other films (although some photographers may prefer Kodachrome's relatively muted colors). To my eye, exposure latitude equals the other films, yet with richer blacks. Its granularity rating of 9 equals that of Kodachrome 25, and exceeds Kodachrome 64's 10, and Fuji Pro 50's 11. In my tests, the grain often looks tighter than in Kodachrome 25 because it doesn't build up as much in dark, continuous toned areas such as blue skies or facial shadows.²

Since its introduction in 1990, Velvia has made serious inroads in the traditional Kodachrome market — especially in the quality-conscious advertising, fashion, and stock photography business, where the fast turnaround of E-6 processing is a compelling advantage. After a significant part of the professional market that until recently used Kodachrome film moved to Velvia and other E-6 films, a number of major commercial labs in New York, Chicago, and San Francisco that had installed complex and costly Kodachrome processing lines in the late 1980's no longer had enough film coming in to make money on their investment and were forced to leave the Kodachrome processing business.

As high-quality Kodachrome processing became more and more difficult to find, increasing numbers of photographers stopped using Kodachrome. If the market shrinks below a certain critical level, Kodak could decide to abandon Kodachrome altogether.

PolaChrome Instant Slide Films Should Be Avoided

Polaroid PolaChrome instant color slide film and its high-contrast PolaChrome counterpart are not recommended for general applications because the films have poor dark storage stability in humid conditions; they can also experience potentially serious and uneven image degradation as a result of prolonged projection. The physically delicate silver image layer on the surface of PolaChrome films may also be unusually susceptible to deterioration caused by airborne pollutants and by contaminants in filing materials during long-term storage, although an assessment of this potential hazard is not currently available. PolaChrome films have very poor image quality and suffer from a host of other practical drawbacks (see Chapter 1).

Slides from Color Negatives and Internegatives

Slides can be printed directly from color negatives, or internegatives made from original transparencies, using, for example, Kodak Vericolor Slide Film 5072. If a slide is made from a color negative, it may be of little consequence if the slide fades or becomes damaged in handling since new copies can be prepared as needed.

If only one copy of a slide is required, shooting with

reversal films such as Fujichrome or Ektachrome is by far the quickest and least expensive method. If the lighting conditions are good and the exposure is precise, one usually can obtain better results from reversal-processed slides than with slides printed from color negatives. For these reasons, when slides are wanted, most are shot with reversal films. Conversely, when color prints are the primary need (by portrait photographers, for example), color negative films are almost always selected.

For reasons of economy, it has long been industry practice to duplicate slides on motion picture color film when large numbers of duplicates from an original are required. Costing much less than Vericolor Slide Film 5072, Eastman Color Print Film 5384 is the film now most commonly used for this purpose. In fact, Eastman 5384 costs far less per foot than any other 35mm film manufactured by Kodak — either black-and-white or color. When you go to a movie, the color image on the screen is projected from Eastman 5384, or a similar motion picture color print film made by Fuji or Agfa. Eastman 5384 is considerably more stable in dark storage than Vericolor Slide Film 5072; the two films have generally similar projector-fading stability.

Because 5384 is a negative-positive material, it must be printed from a color negative. In most cases, however, the originals used for high-volume duplication are transparencies, thus requiring that an internegative be made for printing purposes. In most larger labs, internegatives are made with Eastman Color Negative Film 5247, both because of its comparatively low cost and because it is sensitometrically matched to 5384. Also suitable for printing slides from negatives and internegatives is Fujicolor Positive Film LP 8816, another motion picture print film.

Millions of Color Slides Printed on Pre-1983 Eastman Color Print Films Are Now Faded Almost Beyond Recognition

The use of color motion picture print films for high-volume, low-cost production of color slides began in the early 1960's with Eastman Color Print Film 5382 (followed by Eastman Print films 5385 [1962], 5381 [1972], and 5383 [1974] — 5381 and 5383 were both used by slide producers until about 1983).

Unfortunately, until the introduction in 1982–83 of Eastman Color Print Film 5384, all Kodak, Fuji, and Agfa negative-positive motion picture print films had extremely poor dark fading stability (current Agfa CP1 and CP2 print films still have very poor dark storage stability). Millions of slides made on these earlier films can be found in slide libraries and nearly all have suffered a severe reddish color shift — the result of catastrophic cyan dye fading. As color images, they are now totally worthless. These slides have faded regardless of whether they experienced frequent and lengthy projection or were stored in the dark and never projected. Motion pictures printed on these films have suffered the same fate: all of them have by now suffered catastrophic dye fading. A ghastly reddish image is all that remains of their once full-color brilliance (see Chapter 9).

One of the major art slide producers, Sandak, Inc. of Stamford, Connecticut, was forced to replace well over one million slides printed on Eastman Color Print Films. Harold

Sandak, the founder of the firm, said the fading problem nearly put the company out of business. (In 1988, after 30 years of operation, Harold and Ruth Sandak, the owners of Sandak, Inc., retired and sold the firm to G. K. Hall & Company, a division of Macmillan, Inc. located in Boston, Massachusetts.)

The Sandak production of *Arts of the United States* — sets of up to 4,000 slides that were sold to colleges, universities, and museums, with a subsidy from the Carnegie Foundation — was one of the first applications of Eastman Color Print Film for art slide production in the United States. A 1961 article described the massive project — which proved to be a disaster when all of the slides faded to a horrendous reddish-magenta color only a few years later:

The Carnegie Corporation of New York recently sponsored a major project, the photographing of over 4,000 items of Americana to form a permanent collection of color negatives from which color slides, and black and white and color reproductions can be made.

... An important feature of the program is the photographic technique used to insure accuracy of reproduction. Usually color slides are duplicated by rephotographing the original slide, with a resulting loss of faithfulness to the original. To combat this problem, and make accurate duplicates readily available, the project decided to use the color negative process, a technique which has been employed in the movie industry, and has more recently become popular in Europe as a means of producing color slides.

... All of the slides are permanently mounted in a specially designed plastic frame between thin glass which permits their use in an automatic slide projector.³

The introduction of unstable motion picture print films into the slide market was one of the unfortunate legacies of Kodak's policy of secrecy about color stability, a policy which Kodak adhered to from 1935, when Kodachrome film first appeared on the market, until the early 1980's. Sandak and other slide producers were unaware of the exceedingly poor stability of these films when they started to use them. At the time, Kodak had extensive data on the fading characteristics of all its color films and was aware that the films would become severely faded after only a few years, but the company withheld the information and did nothing to discourage slide producers in the U.S. and Europe from using the films.

Instead of color negative films, Kodachrome film would have been a far better choice for the original photography for projects such as *Arts of the United States*. It would also have been better to make duplicates on Kodachrome film that had been pre-flashed to reduce contrast (for many years Kodak processing laboratories made all slide duplicates with pre-flashed Kodachrome). By the time Kodak finally made dark fading stability data for its films public in the early 1980's, many millions of extremely unstable slides had been produced and sold.

Motion Picture Color Negative Films Should be Strictly Avoided for Conventional Still-Camera Photography

Re-spooled in cassettes for 35mm still cameras, Eastman Color Negative Film 5247 (a tungsten-balanced 100-speed film), Eastman EXR Color Negative Film 5296 (a tungsten-balanced 500-speed film introduced in 1989), Eastman EXR Color Negative Film 5245 (a fine-grain daylight-balanced 50-speed film introduced in 1989), and other Eastman Kodak and Fuji motion picture color negative films are sold to unsuspecting amateur photographers by a number of cut-rate processing labs, including Seattle FilmWorks, MSI/Heritage Color Labs, RGB Color Lab, Images International, Inc., and others. Upon return of the film for processing, the negatives are printed on Eastman 5384 or a similar Fuji or Agfa motion picture print film to produce a set of slides. If the customer desires, color prints on paper are made as well — all at very low cost. Some processors even include a free replacement roll of film with each order in an effort to keep customers coming back. Neither Kodak, Fuji, nor Agfa has ever supplied motion picture color negative films spooled in 35mm cassettes.

Use of motion picture color negative films is ill-advised for still camera applications, especially if optimum-quality color prints are needed; the reader is urged to consult Kodak's publications on the subject.⁴ Motion picture color negative films are designed for exposure at $\frac{1}{48}$ second in a motion picture camera, and almost all of these films are tungsten-balanced and therefore should not be used for daylight or electronic flash photography without an exposure-lengthening daylight conversion filter.

These films *cannot* be processed in standard C-41 color negative chemicals — if by accident they are, the rem-jet backing (a black anti-halation, anti-static, scratch-protection layer coated on the backside of motion picture films that is softened and removed in an alkaline bath with mechanical buffing and a water spray rinse, in processing machines that are specially designed for motion picture films) will slough off and contaminate the color developer and other chemicals in the C-41 process. This can be a disaster for any Kodacolor or other normal C-41 films that have the misfortune of going through the processor in the same run. This danger has forced photofinishers to examine every roll of film they receive for processing to determine whether or not it is re-spooled motion picture color negative film; lab workers live in constant fear that a roll of motion picture film will get through undetected and create havoc with a processing machine.

Projection of Slides

Depending on the film and the pictorial characteristics of an image, slides may show perceptible fading — most obvious as changes in highlight color balance — after as little as 15 minutes of projection time. When repeated projections over a period of weeks or months accumulate to 2 or 3 hours of total projection time, slides on many films exhibit image fading that is readily apparent if the slide is compared with an unfaded original (for a complete discussion of projector-caused fading, refer to Chapter 6).

Fading that occurs during projection is caused almost entirely by light. Although slides are heated to a fairly high temperature during projection, the relatively short time a slide is exposed to heat in a projector means that heat during projection — in itself — makes a negligible contribution to fading. This has been confirmed by accelerated dark fading tests in heated ovens at equivalent temperatures and times of aging (it should be noted, however, that there is some evidence that with certain dyes, very high temperatures during projection can increase the rate of fading caused by the projector illumination). In any event, if a slide were projected long enough for projector heat to cause significant fading, the deterioration caused by the exposure to light would be far more severe.

In the past Kodak often advised that “projection times should not exceed one minute per slide.”⁵ Many people have misinterpreted this to mean that a slide will get too hot if it is projected longer than 1 minute and that the excess heat will cause both physical damage and disproportionate amount of fading to occur. With conventional slide projectors, such as Kodak Carousel and Ektagaphic projectors (unmodified, with Kodak-recommended lamps, and in good working condition), a slide will never become so hot that physical damage to the film will occur — even after hours of continuous projection. Apparently Kodak's intent in advocating short projection times is to reduce the likelihood that, during normal use, any particular slide will receive an excessive *total* projection time during its life.

High-intensity xenon arc projectors, however, may generate temperatures that are hot enough to cause physical distortion of the film base and, not uncommonly, blistering and other emulsion damage. Plastic slide mounts may be distorted or partially melted by excessive projector heat. Glass-mounted slides are particularly prone to heat damage.

Slides with silver images — including Polaroid PolaChrome instant color slides and all types of black-and-white transparencies — may be more susceptible to heat damage than conventional color slides with dye images. Silver images absorb infrared radiation from the projector lamp (the infrared or heat-absorbing glass filters and dichroic mirrors in Ektagaphic, Carousel, and most other projectors absorb most, but not all, infrared radiation). It is absorbed infrared, in combination with absorbed visible light, that causes the temperature of slides to rapidly rise during projection. Color dye images absorb much less infrared radiation than silver images and therefore tend to stay cooler during projection.

Infrared or heat-absorbing glass filters should never be removed from a projector in an effort to increase screen light intensity; if the filter breaks, the projector should not be operated until it is replaced. Only projector lamps recommended by the manufacturer should be used and high-wattage lamps should be avoided. To help avoid overheating, make sure that the projector fan is functioning properly and that air intakes and exhaust airflow outlets are not obstructed.

Excessive projection of originals is often encountered in educational and training fields where slides are used to accompany lectures. It is not unusual for a particular slide to be projected every time a talk is given over a period of many years; in some cases a slide will remain on the screen



November 1987

James H. Wallace Jr., director and curator of Photographic Services at the Smithsonian Institution in Washington, D.C., examines color slides in the Photographic Services' cold storage vault, which is maintained at 40°F (4.4°C) and 27% RH. More than 175,000 original slides are preserved in the vault, together with hundreds of thousands of black-and-white negatives and duplicate negatives made from nitrate-base originals. Wallace supplies slide duplicates, made in the department's well-equipped lab, to the Smithsonian staff and to outside clients. Most of the slide collection has been put on videodisc for ease of reference.

for 15 minutes or longer to accompany a detailed discussion. Many hours of projection time will soon accumulate and eventually the slide will suffer devastating fading. Unfortunately, it is usually the most important slides that are projected most frequently, and for the longest periods — a kind of self-selection for destruction of the most valuable and visually striking images!

Duplicates Should Always Be Made When Heavy Use of a Slide Is Likely

When slides are likely to be projected often and/or for extended periods, duplicates are always advised. However, trying to duplicate everything, especially under tight deadlines, can be difficult, expensive, and unwieldy.

For educators and others who give frequent lectures, a practical approach to the projector-fading problem is to review periodically — perhaps once every 6 months — all the slides in current use and have duplicates made of particularly important ones, and of those that experience has shown are frequently projected and that are likely to continue to be used often in the future. In this way, serious damage to crucial material can be avoided. In all situations where frequent or prolonged projection is anticipated, it is beneficial to choose the most stable films available.

In commercial and audiovisual applications, where duplicate slides are more frequently made, it is no less important to care for originals properly. One can go back to a carefully preserved original time and time again to make new duplicates. If an original is damaged or lost, however, and only a duplicate exists, a third-generation copy will have to be made from the second-generation duplicate. Because of losses in shadow and highlight detail, color degradation, and other image-quality losses inherent in the duplication process — all of which are accentuated with each generation — the image quality of a third-generation duplicate is frequently unacceptable.

In some situations — landscapes and studio still-lives, for example — the photographer may be able to take multiple originals. This is the best and least expensive form of slide “duplicate.”

During the past 10 years, this author has given many slide lectures on the stability and preservation of color photographic materials and has gained a firsthand appreciation of the problems inherent in attempting to avoid projection of originals by using only duplicates for this sort of presentation (the lectures are updated with new material every time they are given). Initially, most of this author's slides were Ektachrome and Kodachrome originals. Then, concerned about the fading that occurred with some of the more frequently shown slides, and made duplicates of his most valuable slides this author stopped using Kodachrome altogether because of its poor projector-fading stability. At that point, Fujichrome became this author's film of choice for lecture slides.

In 1988, this author switched to color negative film for everything except in-house studio and copy-stand work. (Initially Kodak Vericolor 400 film was used, but in 1991 this author changed to Fujicolor 400 Professional film because of its finer grain and superior sharpness; Fujicolor Reala 100 film is also used when lighting conditions permit.) A set of proof prints is obtained when the film is

processed and, after selections are made from the prints, the negatives are printed on Vericolor Slide Film 5072 to make slides for projection. To have spares on hand, three or four slides are usually made from each selected negative. When required for publication, it is a simple matter to make reasonably good-quality black-and-white prints from the color negatives.

Overall, this approach has proven to be more satisfactory, if somewhat more expensive and time consuming, than working with original slides and duplicates made from originals. Much of this author's photography is done under difficult available lighting conditions with mixed illumination sources, and the wide exposure latitude of color negative films, together with the color balance and density adjustments that are routinely made when slides are printed, has generally resulted in better quality images than had previously been obtained with color reversal films.

After processing and printing, this author's color negatives are stored in a frost-free refrigerator, thus eliminating concern about fading, scratching, or loss of irreplaceable original slides.

Duplicating Films and Slide Duplicators

Conventional slide films are not well suited for slide duplicating because their contrast is much too high and their curve shape does not allow optimum reproduction of shadow and highlight detail. Also, regular slide films are excessively grainy (ideally, a duplicating film should accurately reproduce the *grain structure* of the original slide, without adding any visible grain of its own to the image). To meet the requirements for duplication, special low-speed, low-contrast, high-resolution, and extremely fine-grain duplicating films are manufactured.

At the time of this writing, Kodak Ektachrome Slide Duplicating Film 5071 (for tungsten-illuminated duplicators); Ektachrome Slide Duplicating Film Type K/8071 (for duplicating Kodachrome originals) and Ektachrome SE Duplicating Film SO-366 (for electronic flash duplicators) were the most commonly used slide-duplicating films in the United States. SO-366 is Kodak's designation for selected emulsion batches of 5071 film that Kodak's tests have indicated will work best with short-duration electronic flash illumination (both films are nominally tungsten-balanced). Ektachrome duplicating films have the same image stability characteristics as standard Ektachrome camera films.

Fuji's slide duplicating film, called Fujichrome Duplicating Film CDU, was not actively marketed in the U.S. until 1985. Because Fujichrome is superior to Ektachrome in projector-fading stability (Fujichrome and Ektachrome duplicating films have similar dark fading stability), Fujichrome Duplicating Film is recommended. Fujichrome Duplicating Film is also preferred by many photographers because of its image-quality characteristics. Larry Lipsky, writing in *Outdoor Photographer* magazine, commented:

After several years of experimenting with both the Kodak and Fuji films, I must confess a certain preference for the Fuji product. Although all three films come with recommended filter and film speed settings, which can often vary from batch to batch, I personally found

Table 18.1 Cost of Film to Duplicate a Slide or Make a Slide from a Negative or Internegative (Large Quantities)

Fujichrome Duplicating Film CDU (100-foot roll – from slide)*	\$ 0.07
Ektachrome Slide Duplicating Film 5071 (100-foot roll – from slide)	\$ 0.07
Kodak Vericolor Slide Film 5072 (100-foot roll – from negative)	\$0.10
Eastman Color Print Film 5384 (1,000-foot roll – from negative)	\$ 0.02

* Recommended duplicating film.

Film costs based on 1992 list prices for Fuji and Kodak films; processing and slide mounting costs are additional.

Fuji's CDU film to be more consistent and easier to work with. Duplicates made with this film are incredibly sharp and crisp with exceptional color saturation and pleasing contrast.⁶

When large numbers of duplicates are required from a slide, it is general industry practice to make an internegative (often on Eastman Color Negative Film 5247) and to print the slides on low-cost Eastman Color Print Film 5384; both of these motion picture films require special processing machinery and chemicals. Eastman 5384 is not as stable in dark fading as either Fujichrome or Ektachrome duplicating films; 5384 also is not as stable in projection as Fujichrome.

Kodak Vericolor Slide Film 5072 (processed with standard C-41 color negative chemicals) can also be used to print duplicate slides from an internegative, but due to the relatively high cost of this film, most high-volume commercial laboratories opt for Eastman 5384 instead. The primary application of 5072 is to make slides from original color negatives. The dark fading stability of 5072 is not as good as that of 5384 — or, for that matter, of Fujichrome or Ektachrome films. The approximate cost of duplicating a slide with various Kodak and Fuji films is given in **Table 18.1**.

For routine slide duplicating, there are many practical advantages to having a slide duplicator in-house (if need be, the exposed duplicating film can be sent out for processing). A significant advantage in doing one's own duplicating is that density and color balance corrections can be made to suit the desires of the photographer. Risk of loss or damage to originals is reduced if slides do not have to leave the building, and time will often be saved because orders do not have to be written out and because pick-ups and deliveries are avoided. Even in small quantities, the

Table 18.2 Cost of Duplicating a 35mm Slide (Small Quantities)

36-exposure roll of Ektachrome Slide Duplicating Film 5071*	\$ 8.95
Kodalux processing and mounting	\$ 7.50
Total cost per roll: \$16.45	
Cost per duplicate: \$ 0.46	

*The recommended Fujichrome Duplicating Film CDU is supplied only in 100-foot rolls; 35mm cassettes of the film unfortunately were not available at the time of this writing. Costs are based on 1992 Kodak and Kodalux lab list prices.

cost per slide is moderate for in-house duplication (see **Table 18.2**).

A number of good duplicators are available in the price range of \$600 to \$1,200. Particularly recommended is the Beseler Dual-Mode Slide Duplicator, which features both tungsten and electronic flash illumination, built-in dichroic filtration (which this author considers essential in a slide duplicator), and a contrast-reduction feature that allows "flashing" of the duplicating film during exposure.

Detailed discussion of duplicating procedures is beyond the scope of this book; the reader is referred to the well-written Kodak book, *Copying and Duplicating in Black-and-White and Color*,⁷ as well as other references in the field.

Correctly made duplicates are usually quite satisfactory for projection purposes, but because of the somewhat degraded image quality inherent in any duplicate made from a good original, there is often resistance to accepting duplicates for publication purposes; given a choice, publishers prefer to work with originals. But with careful work and the increased image quality that can be obtained with modern duplicating films, there is an increasing, if begrudging, acceptance of duplicates in the publishing field. New York City agencies such as The Image Bank and Gamma-Liaison now routinely supply duplicates to clients. Others, such as Black Star Publishing Company, generally supply originals to domestic clients but send duplicates to foreign clients to avoid possible loss or damage to slides going out of the country.

The highest-quality duplicates have traditionally been done on 4x5-inch sheet film, but the high cost of such duplicates has limited their use. One agency that has made effective use of 4x5 duplicates is Tony Stone Worldwide (TSW), headquartered in London, England. In 1988 TSW purchased Click/Chicago, a leading midwest stock agency.



November 1987

Douglas Wechsler, director of the VIREO collection of bird photographs at the Academy of Natural Sciences of Philadelphia, makes duplicates of originals with a ChromaPro slide duplicator. Producing duplicates in-house not only lowers costs but also, and much more importantly, eliminates the possibility of damage or loss that can occur when irreplaceable originals are sent to an outside lab.

A *Photo District News* article on Click/Chicago's new owner reported:

Stone says the key to his agency's overseas success, a policy which will be carried over to the Chicago office, is the fact that the agency concentrates on a relatively small number of pictures, but duplicates them many times over. Taking only the best images on file, 50 or so 4x5 dupes are created in "perfect reproduction quality" — Stone says that they are better than the original, although he wouldn't say how they are created. He did, however, say that the company's on-site lab has the capability of creating composite images, enhancing colors and cropping.

The dupes are offered at the same time in many different markets, greatly increasing the prospect of multiple sales. "Our best-selling pictures are duped 80 times or more and sell more than 20 times each year."

Stone says, "Our sales volume outside the U.S. is on par with the top two or three American stock agencies, which would make us one of the largest stock agencies in the world."⁸

Recently, 70mm "enlarged" slide duplicates, with an image area measuring about 2½x3¼ inches, have become available at moderate cost. Produced by a number of labs around the country,⁹ these duplicates offer better sharpness and finer-grain images than conventional 35mm duplicates, and they are much less expensive than 4x5 sheet film duplicates. Carl Purcell, a world-traveling freelance photographer, is one professional who advocates 70mm duplicates:

There is always the danger of loss or damage to the original image, which could substantially cut profits or even put a stock photographer out of business. The stock photography business involves careful safeguarding of one's images as well as careful marketing. Duplicating your images — or "duping" — is, therefore, an integral part of both aspects of the trade.

I believe the 70mm dupe will drastically change the way photographers market their pictures, both directly and through agencies. Basically, it allows a photographer to "clone" an outstanding image as many times as desired, making possible multiple, simultaneous submissions on an international basis.¹⁰

Wilderness photographer and mountaineer Galen Rowell is another advocate of enlarged 70mm duplicates. Rowell's Mountain Light agency, which he and his wife Barbara operate with a small staff in Albany, California, has more than 300,000 slides on file and of these, "the top 500 are stored in a fireproof vault. If someone wants to use one of these, we send out a 70mm reproduction-grade dupe; everything else goes out as originals."¹¹ The color photographs in Rowell's recent book, *Mountain Light*, were reproduced from 70mm duplicates. A prolific photographer, Rowell typically has about 3,000 transparencies in circulation with prospective clients.

Digital Transmission and Storage of Color Slide and Color Negative Images

The recent introduction of computer equipment and associated software to transmit high-quality digitized color images over telephone lines marks the beginning of a revolution in the way publishers and commercial picture collections will operate. At the time of this writing, National Digital Corporation,¹² a leader in this emerging technology, had supplied high-resolution digital image-transmission systems to *U.S. News & World Report* (with systems in both its New York City and Washington, D.C. offices), to *Newsweek* magazine, and to several book publishers, including Houghton Mifflin Company in Boston, and Silver Burdett & Ginn (a subsidiary of Simon & Schuster, Inc.) in Norristown, Pennsylvania.

Among the picture agencies using National Digital systems were Sipa Press in its New York City and Paris offices; Sygma Photo News, also in New York City and Paris; Picture Group; After Image, Woodfin Camp; Photo Researchers; Shostal Associates; and the Click/Chicago agency in Chicago, Illinois. The White House also has a National Digital system to transmit images to publications around the world.

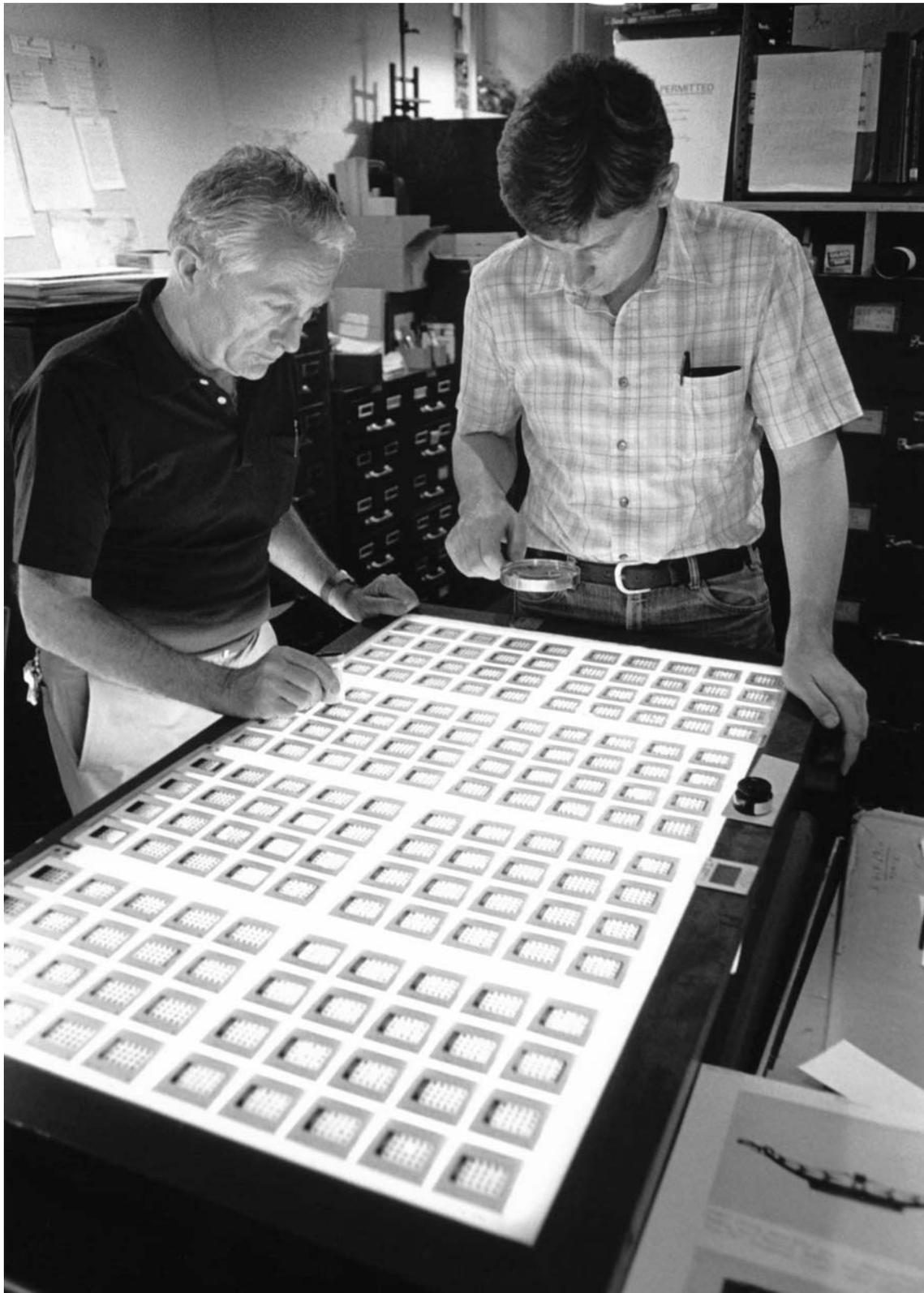
Electronic transmission systems eliminate the need to physically send originals (or duplicates) to prospective clients who have access to an image receiver. This not only saves time but also avoids the hazards involved in shipping transparencies, as well as fingerprints, scratches, projector-caused fading, and other damage (or even loss) that occur all too frequently when materials are in the hands of clients.

With a low-resolution image scanner (\$7,000), the National Digital system allows quick "previews" to be transmitted to receiving locations for picture selection, with one, four, nine, or sixteen images appearing on the color monitor screen; transmission time is from 12 to 50 seconds per image, depending on its size on the screen.

With the National Digital Production Resolution scanner (\$30,000) and Photo Management Workstation (\$18,000), digitized images can be transmitted and stored in a "reproduction-resolution" mode. Interfaced with a Scitex, Hell, Crosfield, or other graphic arts laser scanner, color separations can be reproduced directly from transmitted images for printing in magazines, books, or other publications.

Peter Tatiner, writing in *Photo District News*, reported on the reaction of John Echave of *U.S. News & World Report* after using the National Digital system for a year:

"It's fantastic," says Echave. "It's been doing better than anyone expected." Echave uses it to decide immediately on whether to grant guarantees to participating agencies and for research especially, he says, for stories that require lots of pictures. The most frequent use, though, is to preview pictures sent down by the New York office. "We can see something in advance on a breaking story. . . ." Previewing via NDC allows the magazine to select pictures and lay out pages before the production department has the actual artwork in hand.¹³



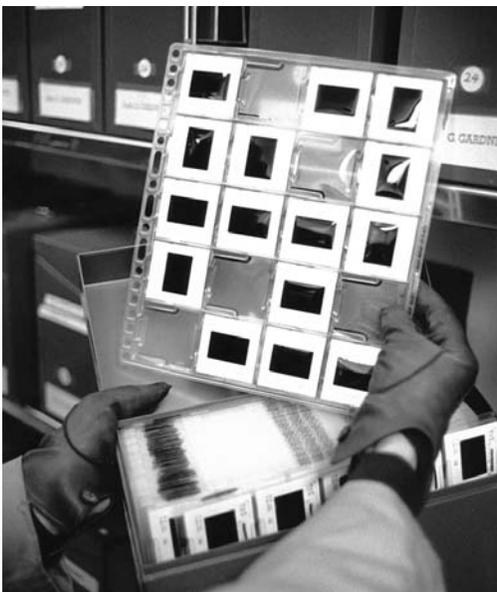
1981

Daniel Jones (left), photography curator at the Peabody Museum of Archaeology and Ethnology at Harvard University in Cambridge, Massachusetts, explains to visiting conservator David Kolody the ingenious “index slide” system developed by Jones for color slides preserved in the museum’s cold storage vault. The inexpensive index slides, viewed with a projector or magnifier, afford an excellent visual record of the material in storage.



Henry Wilhelm (2) – April 1988

Daniel Jones looking at color slides in Saf-T-Stor polypropylene slide pages inside the Peabody Museum cold storage vault. Constructed in 1979 with the aid of a grant from the National Science Foundation, the vault is maintained at 35°F (1.7°C) and 25% RH. It was the first humidity-controlled cold storage vault for photographs in an academic institution (see Chapter 20). Included in the Peabody's holdings is a large collection of color slides and 16mm color motion picture film photographed in the field by noted anthropologist and filmmaker Robert Gardner (the founder of Harvard's Film Study Center).



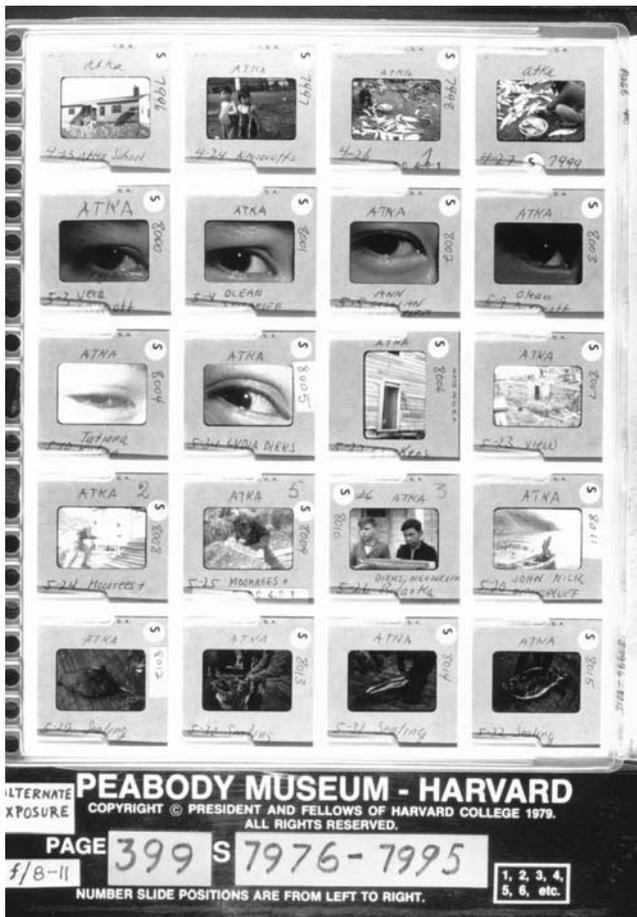
April 1988

Rigid polypropylene Saf-T-Stor pages supplied by Franklin Distributors Corp. are cataloged and housed in metal boxes for storage in the Peabody Museum vault.



Daniel Jones – 1982

This camera set-up was devised by Daniel Jones for producing index slides. Slides in pages are lighted from below to illuminate the images, and from above so that serial numbers, dates, and caption information are visible. Kodachrome 40, a tungsten-balanced film, was chosen for the project because of its sharp, fine-grain images.

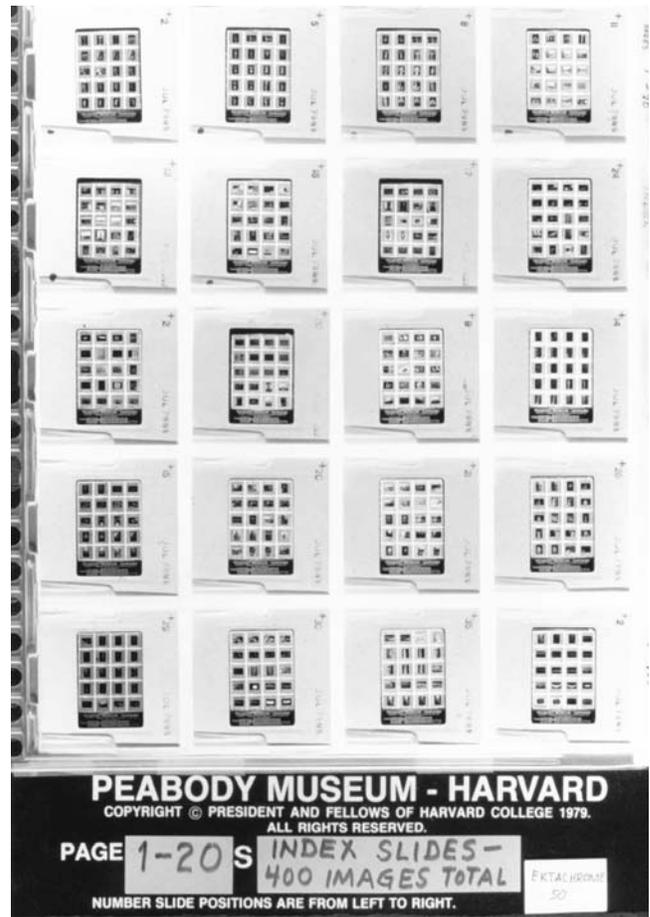


An index slide contains the images of 20 slides in a slide page. These slides were photographed in the same Saf-T-Stor rigid polypropylene slide page in which they are stored.

In the early hours of November 9, 1988, the morning after George Bush was elected president of the United States, *Newsweek* magazine used a National Digital system to transmit color slide images from Houston, Texas, where Bush (a voting resident of Texas) had watched the election returns with his family and staff, to the magazine's offices in New York City. One of the photographs, which showed Bush and his wife Barbara greeting supporters and campaign workers at a victory celebration in Houston, was featured on the cover of the magazine's special election issue. The picture had been taken only hours before *Newsweek's* 4:00 a.m. press deadline:

On Wednesday, November 9, the film arrived in *Newsweek's* Houston office at 2:45 a.m. Ten minutes later, picture editors in New York were looking at a group of five preview-quality images (at 500-line resolution) for viewing and selection. Two of these images were then scanned in production resolution, transmitted, written to tape and loaded into the Crosfield [graphic arts laser scanner] system.¹⁴

Stuart Craig, on the staff of National Digital, expects



To produce an even more compact reference tool, 20 index slides can be photographed on a single frame. When projected or examined with a magnifier, the 400 images are large enough for most identification needs.

that initially the primary application of digital transmission will be as an "office-to-office system" for publishers that operate in more than one location and for picture agencies that sell to magazines and other clients who also have National Digital equipment and software. Craig says that valuable and frequently needed images can be stored on digital optical discs, and originals "will no longer have to be handled or shipped — they can be put away for safe-keeping."¹⁵

Cataloging and Distribution of Color and B&W Images with CD-ROM's and Photo CD's

For stock photo agencies, two technologies that can simplify distribution of color images while at the same time reduce handling of originals and lower duplication costs are the CD-ROM (compact disc read-only memory), and the Kodak Photo CD introduced in 1992. The Image Bank, a leading New York City stock agency purchased by Eastman Kodak for \$25 million in 1991, will be a proving ground for the Photo CD in this type of application. For several years, The Image Bank has used videodiscs to distribute catalogs of images to its 60 sales offices worldwide.

(continued on page 644)



Carol Brower – October 1987

In excess of one million color slides are in the collection of Magnum Photos, Inc. Headquartered in New York City, Magnum also maintains an office in Paris, France. A cooperative agency owned by its member photographers, Magnum specializes in news, documentary, and feature photos. Lining the wall at the rear are ring-binder notebooks filled with slides in PVC pages, which were being phased out when this picture was taken in 1987.



Carol Brower (2) – May 1983

The notebook filing system at Magnum has been replaced by more accessible hanging pages, stored in file drawers. Magnum found that some of the PVC pages stuck to slides and left gooey deposits on film surfaces. Although only a small percentage of the PVC pages in the collection have reached such an advanced stage of deterioration, the agency replaced all of the PVC pages with new polypropylene pages. Shown here is Susan Duane, a picture researcher at Magnum.



With the need to access slides on a daily basis, commercial picture agencies have generally viewed cold storage as unwieldy. Slides are stored at room temperature and without special humidity control. Because of this, it is crucial for the survival of historically valuable images that photographers selling work through picture agencies choose the most stable slide films available — currently Fujichrome and, if projection can be avoided, Kodachrome.



Like most large picture agencies, Magnum has computerized its files. Here, Philip Jones Griffiths (left), photographer and president of Magnum at the time, confers with computer programmer Jeffrey Schlesinger. Commercial agencies are increasingly adopting CD-ROM's, Photo CD's, and electronic transmission equipment to allow low- and/or high-resolution digital images scanned from photographic originals to be distributed to sales offices and directly to clients worldwide.

Carol Brower (2) - May 1983
This document originated at <www.wilhelm-research.com> on June 6, 2003 under file name: <HW_Book_18_of_20_HiRes_v1.pdf>



Magnum has an in-house slide duplicator for making copies of slides sent to clients around the world. Depending on the nature of the request and time constraints, either originals or duplicates are submitted to clients.



Bookkeeper Vijaya Allen operates a Xerox 6500 color copier that can reproduce either individual slides or groups of slides in notebook pages. The color copies are sent to clients for their consideration.

Philip Jones Griffiths - May 1983



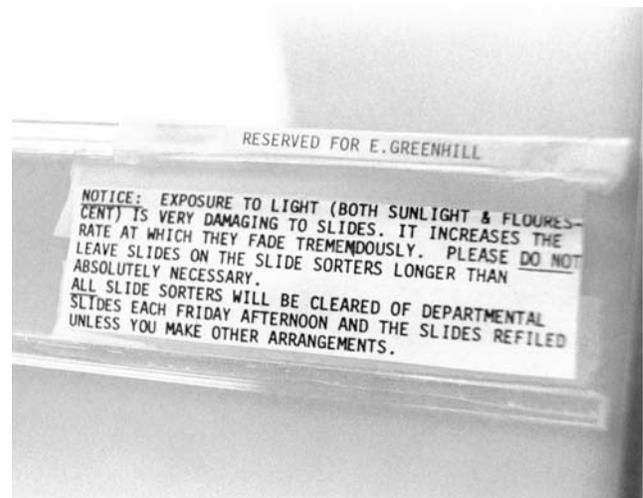
March 1981 (2)

Art slide libraries, such as this large facility at the School of Art at the University of Texas in Austin, Texas, frequently contain hundreds of thousands of color slides. In a demanding environment such as this, good projector-fading and dark fading stability are essential. Fujichrome films are recommended for originals and duplicates.

Types of Slide Collections

During the past decade, as snapshot photographers converted en masse to color from black-and-white photography, nearly all of the growth in the amateur market has been in color negative films. It has been estimated that in 1990 color slides accounted for just 5% of the approximately 16 billion color photographs made by amateurs in the U.S. (black-and-white photographs accounted for a mere 2% of the total!).¹⁶ Amateur photographers have shown a very strong preference for color prints. Slide projector sales have fallen steadily over the past few years, and the home slide show is on the verge of becoming a thing of the past.

In many applications, however, the availability of color prints is not the primary need. Color transparency films continue to be the norm in commercial and stock photography, advertising photography, and magazine photojournalism (although most newspaper photographers now use color negative films). Color slides are also very popular in educational and training fields (the filmstrip, a close relative of the color slide, still is popular in elementary



A notice warns users of the hazard of exposing slides to room lights or the more intense illumination of slide viewers.

schools). Slide-accompanied lectures are widely used at conferences and technical meetings; the market for slides with computer-generated color images featuring graphs, charts, and special effects is expanding rapidly. Commercial picture agencies such as Black Star, Magnum, Photo Researchers, Tony Stone Worldwide, The Image Bank, Sipa Press, and Sygma work almost exclusively with color transparencies — the vast majority being 35mm slides.

There are a number of practical advantages to color transparencies when photographs are to be reproduced in magazines, catalogs, books, etc. Since the printing separations are usually made directly from the original transparency, there is no loss of image quality caused by second- or third-generation duplication or the making of positive transparencies or prints from internegatives. Slides and larger transparencies are the lowest-cost form of color photography because they can be viewed directly after processing with no additional labor or materials required to make prints. Editing is simplified and — assuming the exposure and color balance are correct in the original slide — color balance variations that usually appear in making prints are avoided.

The color photographs in large documentary and magazine collections such as the Time Inc. Magazines Picture Collection (part of Time Warner Inc.) and the National Geographic Society consist almost entirely of color transparencies. In the United States, 35mm Ektachrome and Kodachrome films have until recently been the almost universal choice of magazine photographers, although by the mid-1980's Fujichrome films had gained a loyal following among professional photographers, especially commercial photographers and magazine photojournalists.

Because Fujichrome, Ektachrome, and other Process E-6 compatible films are available in high-speed daylight and tungsten versions and can be rapidly processed without complex equipment, they are preferred over Kodachrome for fast-breaking news photography.

Slides have also become increasingly important in commercial and industrial photography over the past decade. Elaborately produced multi-image slide shows, using two or more projectors, often synchronized with a sound track, have been popular in recent years. Tom Hope, a market analyst, commented on the 1986 slide market: "The 2x2-inch (35mm) slide medium continues to dominate all AV systems in total expended dollars. In fact this past year, with the exploding use of computer graphics, total dollars for AV slides and equipment jumped to more than \$7 billion."¹⁷

Academic Slide Libraries

The academic slide library is a specialized type of slide collection found in most colleges and universities that have art or architecture departments. These collections are usually quite large — many include more than 100,000 slides, most of which are duplicates purchased from commercial suppliers, museums, and other organizations all over the world. Prices for slides in this field are typically \$2 or \$3 each for copies made on reversal duplicating film or motion picture print film, and \$5 or more for "originals" (when photographing a painting or other still object, it is a simple matter to shoot hundreds of identical slides with a camera equipped with a long-roll back).



March 1981

Glass mounts can provide physical protection during handling; however, glass mounts offer no added protection against image fading during projection or in storage.

The academic slide library represents one of the more demanding applications for color slides: precise color reproduction and retention of subtle highlight detail are critical, yet the slides are subjected to frequent and prolonged projection — it is not unusual for a professor to have a slide image on the screen for 15 minutes or more while discussing a painting or drawing, and to use the same slide year after year. The most important slides inevitably are the ones that get handled the most and projected the longest.

Because of its superior combination of projector-fading and dark fading stability, Fujichrome Duplicating Film is the recommended film for duplicates sold to slide libraries (Fujichrome and Fujichrome Velvia camera films are recommended for "originals"). While it is more expensive to make duplicates on Fujichrome reversal duplicating film than it is to make them on motion picture print film with an internegative, the total pass-along cost for the better Fujichrome duplicates is only about \$0.05 each — a small price to pay considering the extended useful life afforded by the film.

In examining the preservation problems of academic slide libraries, this author has concluded that in the long run the only practical solution is to establish two separate collections: the permanent *preservation collection* and the expendable *working collection*, which consists of a complete set of duplicates made from the preservation collection. The preservation collection holds all of the originals and first-generation duplicates purchased from outside vendors; these slides remain in their original mounts, are never projected, and are never accessed for study purposes. They are stored in the dark in a reasonably cool (refrigerated if possible), low-humidity environment.

Although it is recognized that most commercial slide suppliers will object to this proposal, claiming that it would violate their copyrights and fearing that it could reduce their sales, both users and suppliers should be able to come to an equitable agreement that would ensure that only one duplicate made from each purchased original is circulated at any given time. For the user, there are a number of important advantages to this approach:

- Original slides, whether purchased from outside sources or photographed by staff members, will be preserved.
- Over time, money will be saved. Slides need be purchased only once.
- Replacement duplicates can be made as needed; the color reproduction quality of slides in the working collection can be maintained.
- Unprojected slides in the preservation collection are available for visual comparison with slides in the working collection to determine whether excessive fading has taken place.
- Unfaded originals photographed by staff will be available to make duplicates to distribute to other slide libraries.
- Concern about loss, damage, and projector-caused fading is reduced; the integrity of the collection is maintained.

Types of Slide Mounts

There are currently four types of common slide mounts:

1. **Cardboard mounts.** The prototype of the modern cardboard slide mount was the Kodaslide Ready-Mount introduced by Kodak in 1939 — 3 years after Kodachrome 35mm film became available in 1936. (Before the introduction of the cardboard Ready-Mount, Kodak returned processed Kodachrome to the customer in strips which then had to be cut into individual frames and placed in glass mounts before the transparencies could be projected.) Kodalux processing laboratories (formerly Kodak Processing Laboratories, now operated by Qualex Inc.) continue to use Kodak cardboard Ready-Mounts for Kodachrome, Ektachrome, Fujichrome, and all other transparency films, including duplicates.
2. **Open-frame plastic mounts.** The Pakon plastic mount was the first widely available plastic mount and is still the most popular,¹⁸ although many other brands are now on the market.
3. **Glass mounts.** Most glass mounts are supplied with the glass sheets already in place in easy-to-assemble plastic or aluminum frames; glass mounts made by Wess Plastic, Inc.¹⁹ and Gepe²⁰ are among the most popular. Some glass mounts have “pin-registration” to secure precise positioning of the film in the mount — a requirement for multi-image slide presentations. Although glass mounts offer protection against scratches and fingerprints, they are not without their problems (discussed below).
4. **Glass mounts with tape binding.** Long popular with academic slide libraries to protect slides from fingerprints and other physical damage that can result from repeated handling by students and faculty, glass mounts originally were made with 2x2-inch sheets of glass and an interior paper “mask” to locate the film in the proper position and cover non-image areas; they were bound together with gummed paper tape. More recently, metalized polyester pressure-sensitive tape has been used to seal the edges of the two sheets of glass with the piece of film “encapsulated” within, in tight contact with the glass (interior paper or aluminum-foil masks are

not recommended). The taped glass unit is then placed in a plastic or metal frame. Sealing the edges of the glass prevents dust and fungus spores from entering the interior of the mount and minimizes moisture intrusion during periods of high relative humidity; this helps prevent emulsion damage during projection and reduces the likelihood of fungus growth. Recommended is the Wess Archival Mount supplied by Wess Plastic, Inc. (described below).

Although the subject has not yet been comprehensively studied, there appears to be no meaningful difference between Kodalux (Kodak) cardboard mounts (no information is available on other types of cardboard mounts), plastic mounts, and glass mounts in terms of their effect on color film image stability. Many photographers, this author among them, prefer cardboard slide mounts because they handle nicely, weigh much less than plastic or glass mounts, are easy to write and print on, and readily accept rubber stamp impressions.

When projected, color films in glass mounts fade just as fast as do films in open-frame mounts (see Chapter 6). Glass mounts do, however, offer complete protection from fingerprints, dust, and scratches and other physical damage during handling (unless, of course, the glass is accidentally broken, in which case the slide could be seriously damaged). During projection, film mounted between glass becomes hotter than film in open-frame slide mounts, but unless the glass-mounted film should get so hot as to be deformed or suffer other physical damage, the short periods of exposure to the higher temperatures appear to have little if any significance in terms of image life.

One principal advantage of glass mounts is to insure that the film remains flat during projection so that focus is accurately maintained over the whole image area. This is particularly important in multi-image presentations where images are projected side-by-side or superimposed one on another. Glass mounts also appear to reduce the incidence of fungus attack when slides are stored in humid environments.

The Problems of “Steam Clouds” and Newton’s Rings in Glass Mounts

When slides in traditional glass mounts (with interior paper or aluminum-foil masks) are projected, moisture can evaporate from the heated emulsion and film base and then immediately condense on the comparatively cool cover glass; the result is a disconcerting amoeba-like “steam cloud” that is superimposed over the projected image on the screen. Sometimes a number of smaller “steam clouds” may be observed scattered over different areas of the image. This moisture condensation problem is sometimes called “steaming-up,” or the “heat effect.” The film heats faster and stays hotter than the cover glass for three reasons: (a) more light and infrared radiation is absorbed by the dye image — and is in turn converted to heat — than is absorbed by the transparent glass, (b) the outside surfaces of the glass are constantly cooled by the projector fan, and (c) the air in the thin cavity between the film and glass acts as an insulator, retarding the transfer of heat from the film to the cooler glass.

If projection continues long enough, the cover glass and air in the thin space between the film and glass will usually become hot enough to cause the condensed moisture “steam cloud” to re-evaporate — the water vapor is re-absorbed by the gelatin film emulsion, with the size and shape of the “steam cloud” changing constantly until eventually it disappears. In extreme cases, the film emulsion will ferrotype (develop areas of irregular gloss) or even adhere to the cover glass. The problem is especially acute when slides are stored in humid environments.

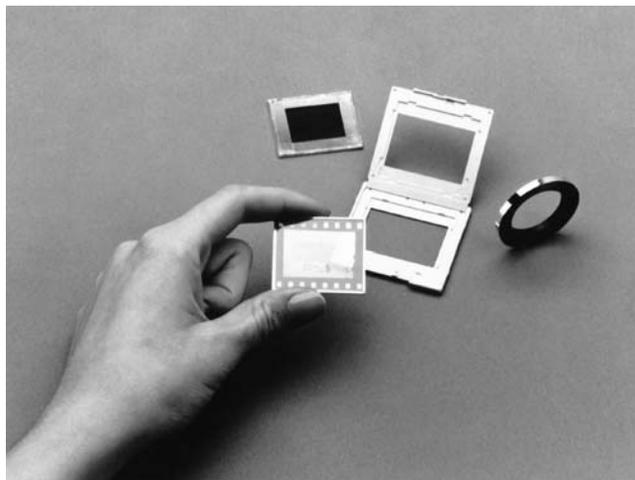
Investigation of the problems of glass-mounted slides by A. G. Tull in England,²¹ and more recently by Christine L. Sundt in the U.S.,²² has made it clear that formation of condensed-moisture “steam clouds” and other difficulties commonly encountered with glass mounts can be largely avoided if certain guidelines are followed.

Glass mounts traditionally have been made with a thin aluminum or paper mask located in the interior of the mount, between the film and glass. Depending on the specific design of the mount, the mask may (a) hold the film in the proper position, (b) provide sharp borders to the projected image, (c) attach the cover glass sheets to the two sides of the mount so that the glass does not have to be handled separately during the mounting operation, and/or (d) provide a small air space between the film and glass surfaces in an effort — which is often unsuccessful — to avoid Newton’s Rings. (Newton’s Rings are rainbow-colored optical interference patterns that may appear on the screen when a glass-mounted slide is projected. They are caused by loose, irregular contact between the smooth surfaces of the film and glass. “Anti-Newton Ring” glass reduces their incidence but does not always eliminate the problem.)

Some glass mounts are made without interior masks, but in most cases their design nonetheless maintains a slight separation between the two sheets of cover glass (this may be intentional, to allow two or more pieces of film to be placed one on top of another in the same mount, or it may result from the method of attaching the glass to the mount frame).

Tull demonstrated that the air gap between the film and cover glass was the principal cause of both condensed-moisture “steam clouds” and Newton’s Rings, and he recommended “glass-contact binding” in which interior masks are not included and the film is secured in tight contact with the glass. The elimination of the air space provides a direct heat conduction path from the film to the glass, thus minimizing the temperature differential at the film/glass interface. During projection, the film stays cooler, the glass gets warmer, and moisture condensation on the glass is avoided.

Finding then-available plastic tapes to be unsatisfactory for slide binding (Tull’s articles were published in the 1970’s), Tull recommended assembling mounts with 2x2-inch pieces of cover glass and gummed paper tape; the non-image areas were masked by attaching strips of a black, pressure sensitive material to the outside of the mount. Tull suggested doing the actual mounting in a fairly humid environment to avoid attraction of dust to the cover glass and film by static electric charges. Since he used moisture-permeable paper binding tape, the slides reached moisture equilibrium with ambient storage conditions soon after mounting was completed.



Wess Plastic, Inc.

The recommended glass Wess Plastic Archival Mount developed by Wess in consultation with Christine Sundt, a slide and photograph curator at the University of Oregon. Although designed specifically for tape binding, the mount may also be used without tape binding.

The Wess Archival Slide Mount

Christine L. Sundt, a slide and photograph curator in the Architecture & Allied Arts Library at the University of Oregon who has done considerable research on glass slide mounts and mounting techniques, has suggested a number of improvements to Tull’s rather time-consuming “glass-contact binding” method, and has adapted the procedure to commercially available glass mounts. One of Sundt’s most important recommendations is that films be conditioned and mounted in a low-humidity environment, and the slide bound with low-permeability metalized polyester tape.²³

Taping the glass and film together of course requires that the cover glass sheets be easily removed from the mount frame for taping, and this, together with the absence of interior masks, is the basis for the design of the Wess Archival Mount, which was developed by Wess Plastic, Inc. in consultation with Sundt.²⁴ The mount was introduced in 1988.

For some years Sundt had recommended Swiss-made, aluminum-framed Perrot-Color glass mounts. But when Perrot-Color mounts ceased to be available in the U.S. in 1987, Sundt contacted Wess Plastic, a leading manufacturer of glass slide mounts, to see whether she could interest the company in producing a suitable replacement product. After reading several of Sundt’s articles on slide mounting, Wess agreed to work with her on the design of the new mount. Wess Plastic has also developed a manually operated machine to tape the edges of the film/glass sandwich rapidly and precisely; the machine, which costs about \$300, will be manufactured if there is sufficient interest in the device.

The mounts are supplied with anti-Newton Ring cover glass sheets that are slightly larger than a standard 35mm frame (so as not to cause buckling should the film expand during projection or storage). The glass is held in position in a pocket molded in a light gray, high-temperature-resistant Noryl plastic frame. The frame itself serves as the mask (two aperture sizes are available). The projected



A slide is inserted into a Kimac individual slide sleeve. Made of cellulose triacetate, the sleeves offer excellent protection from fingerprints and scratches during handling. Most types of slide pages can accommodate slides in Kimac sleeves. The National Geographic Society in Washington, D.C. and many other major collections use Kimac sleeves for slides in their active files to protect the slides during handling and editing.

image area can be further reduced (masked) if necessary by applying metalized polyester tape to the outside of the film/glass sandwich prior to placing it in the slide mount — thus avoiding the need to apply tape to the film itself (which in any event should *never* be done!). The mounts are 3mm thick and will fit in standard 80-capacity Kodak Carousel and Ektagraphic slide trays; the mounts are inexpensive, costing about \$0.25 each. If desired, the mounts can also be used without taping.

Prior to mounting, the slides should be moisture-conditioned in a low-humidity environment (40% RH or lower) for several hours — or overnight. Slides can also be conditioned by projecting them in an open-frame mount for a minute or two (Sundt says that heating slides to a temperature of 140°F [60°C] appears to kill any fungus spores that may be present, while at the same time reducing the moisture content of the emulsion to a very low level).

Sundt recommends that glass cover sheets be cleaned by swabbing with ethyl alcohol and dried with a clean white cotton cloth. Prior to mounting, both the glass and film should be carefully examined and particles of dust or lint should be blown away using a child's ear syringe or canned, pressurized air.

With the film in place, the film/glass sandwich is taped together around the edges with metalized polyester tape (Horizon Tape Products Company No. 425 Ultra Thin Metalized Polyester Tape, which is metalized on both sides to avoid pinholes and to improve moisture resistance, is recommended by Sundt).²⁵

Mounting slides with this procedure prevents periods of high humidity in the slide storage area from affecting the film sealed within the mount. This helps reduce the likelihood of Newton's Rings, fungus growth, and emulsion "ferrotyping" against the cover glass. The interior of the mount is also kept free of dust. The equilibrium moisture content of a piece of film sealed in a mount according to Sundt's

method will, over a long period of time, assume an average value of the year-round conditions in the storage area. Short-term humidity changes in the storage area caused by, for example, a week or two of rainy summer weather, will have little effect on the sealed film.

3M Photogard for Coating Slides

Producers of slides for slide libraries should consider 3M Photogard film coating (discussed in Chapter 4) as an economical alternative to glass mounts for duplicate slides. Photogard is an abrasion-resistant coating that protects films from scratches, fingerprints, moisture, and fungus. Once applied, Photogard is impossible to remove without destroying the film; for this reason, Photogard is not recommended for valuable original slides.

Kimac Sleeves for Protection of Individual Slides

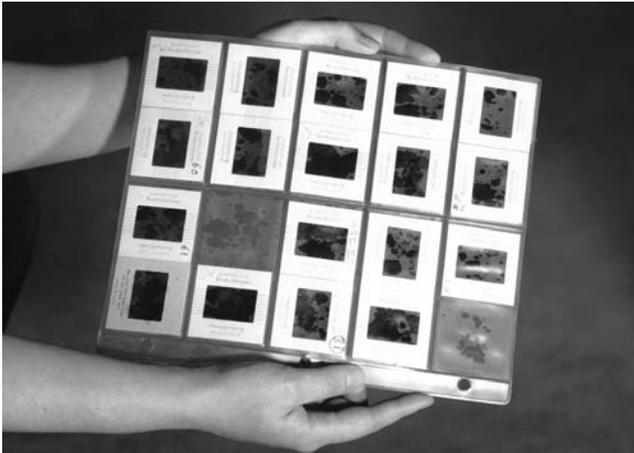
Physical protection from fingerprints, scratches, and dirt for individual slides during handling and shipping can be obtained with Kimac cellulose triacetate sleeves, supplied by the Kimac Company, Ltd., of Guilford, Connecticut. The sleeves have a snug fit so that slides will not slip out during handling, but the sleeves are also simple to remove when desired. Slides in Kimac sleeves readily fit into the individual pockets of most slide pages; the slides also fit into most types of slide storage boxes, compartmented drawers, etc. Slides should *always* be in individual sleeves when being sent to a lab for duplication or printing, loaned to clients, or given to printers for making color separations. At a cost of only about \$0.05 each, Kimac sleeves are available in quantities of 100, 500, and 1,000 directly from Kimac (see **Suppliers** at the end of this chapter) and from most major photographic supply houses. Kimac sleeves protect circulating slides in the National Geographic Society collection and in many other major publication and commercial operations.

To be serviceable, slide sleeves must be precisely manufactured, with side folds of the proper radius. If the folds are too tight, slides will be difficult to insert and remove. If the folds are too loose, or if the sleeve is even slightly too large, slides may fall out. To date, this author has found Kimac sleeves to be the only suitable product (the polyester individual slide sleeves supplied by Light Impressions Corporation have overly sharp side folds and lack the nice snug fit of the Kimac sleeves).

Some Kimac sleeves manufactured in the mid-1980's were made with a semi-opaque, pressure-sensitive seam adhesive that had a tendency to come unglued with extended usage. Kimac has offered to exchange these defective sleeves for the current type, manufactured with a strong, colorless solvent adhesive.

ImageGuard Rigid Plastic Slide Holders

For protecting valuable slides during shipping or handling by clients and labs, ImageGuard rigid transparent slide holders offer an excellent, if rather expensive, solution.²⁶ At a price of about \$1 each, the slide holders ac-



Plasticizer oozed from a flexible PVC slide page onto the surface of Kodachrome slides in the collection of Magnum Photos, Inc. The New York City agency has since replaced all of the PVC pages with new polypropylene pages.

commodate both cardboard-and-glass mounted slides and are only slightly larger than the slides themselves. By applying a pressure-sensitive label over the top of the holder, the slide cannot be removed without breaking the seal (thus discouraging unauthorized projection or duplication by prospective clients). ImageGuard slide holders are also satisfactory for long-term storage of slides.

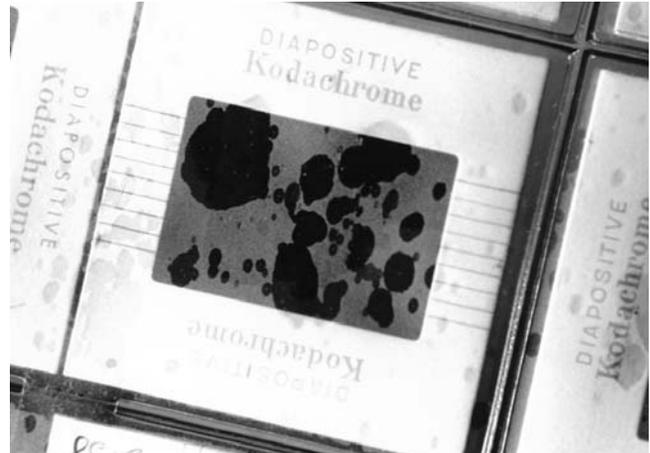
Plastic Slide Pages and the Hazards of Plasticized PVC

During the past two decades, plastic slide pages have become a popular means of storing and viewing slides. Most of these pages are made of heavyweight plasticized polyvinyl chloride (PVC), which gives the pages very good transparency and handling characteristics. Unfortunately, PVC is one of the materials specifically prohibited in the ANSI storage standards — see, for example: *ANSI IT9.2-1991, American National Standard for Imaging Media – Photographic Processed Films, Plates, and Papers – Filing Enclosures and Storage Containers*.²⁷

While the actual damage to color slides that PVC pages might cause during long-term storage has been the subject of debate, this author and others have found a disturbing number of flexible PVC slide pages that have seriously deteriorated, with gooey plasticizers exuding from the PVC sheet and sticking to the surfaces of the slides. Because of this, this author strongly recommends that flexible PVC pages be avoided for anything other than short-term applications.

Although the problems of plasticized PVC as a photographic enclosure material are discussed in detail in Chapter 14, it is worth repeating here what R. Scott Williams, a conservation scientist at the Canadian Conservation Institute, said in a 1985 report:

I have examined two cases where slides were damaged by storage in phthalate plasticized poly(vinyl chloride) enclosures. In the first case,



Plasticizer exuding from the PVC caused the Kodachrome film to stick to the slide page.

oily droplets were formed on slides. These were identified as phthalate plasticizers identical to those contained in the poly(vinyl chloride) enclosures. When projected, the droplets on the slide are visible as disfiguring spots on the image.

In the second case, a waxy film formed on slides with protective glass covers. Only slides with glass covers show this phenomenon. Unglassed slides in the same enclosure do not have the waxy film. Analysis of the waxy film showed it to be composed of carboxylate salts of the type used as lubricants or more commonly as heat stabilizers in poly(vinyl chloride), and that these components were also found in the PVC of the enclosure.

In addition, there is the further, often cited, disturbing possibility that the PVC may degrade to produce acidic hydrogen chloride gas. It is to prevent this degradation that PVC must be highly compounded with additives to inhibit these reactions or to scavenge degradation products before they escape from the plastic.²⁸

Polypropylene Slide Pages Are Recommended

Probably the most satisfactory material for flexible slide pages is polypropylene, a clear plastic which, unlike polyvinyl chloride, can be made naturally flexible without the addition of plasticizers. Polypropylene pages are now available from a number of manufacturers.

In this author's opinion, the best flexible polypropylene slide pages are the EZ2C Super-heavyweight polypropylene slide pages manufactured by 20th Century Plastics, Inc., of Los Angeles, California (see **Suppliers** at the end of this chapter). These high-clarity pages are made with heavy 5.0-gauge polypropylene that gives them much greater rigidity and better handling characteristics than the thinner 3.5-gauge polypropylene slide pages supplied by most other manufacturers. The EZ2C Super-heavyweight pages, which cost about \$0.45 each, handle much like the popular PVC

July 1991



20th Century Plastics EZ2C Super-heavyweight 5-gauge polypropylene slide pages are recommended by this author as the best available flexible slide pages. The pages are supplied for ring binders (3-ring notebooks) or with top-bars for file cabinets equipped with hanging file frames.

slide pages. The pages have individual slide pockets and physically cover both sides of the slides. EZ2C [Easy-To-See] Super-heavyweight polypropylene pages are available in several formats, including 3-hole pages for use in ring-binder notebooks: #EZTL2-00, in which slides are inserted from the top; and #EZJV2-00, which are side-loading. Also available is an EZ2C slide page fitted with a plated-steel top-bar for use in file drawers equipped with frames for hanging files: #EZHTL-00, which cost about \$0.75 each.

20th Century Plastics, Inc. also supplies less expensive polypropylene pages under the Century-Poly name; these pages, which cost about \$0.35 each, are thinner and somewhat less transparent than the recommended EZ2C Super-heavyweight pages. (20th Century Plastics, Inc. is also a leading supplier of plasticized PVC slide pages; the pages are not safe for long-term slide storage and should be avoided.)

Another good if rather expensive line of polypropylene pages are the Super Archival 20 Transparency Files supplied by the British firm, DW Viewpacks Limited. The pages were introduced to the American market in 1985 (see **Suppliers** at the end of this chapter). DW Viewpacks Super Archival pages cost as much as \$2.50 each.

Probably also satisfactory are the Poly-C flexible polypropylene slide pages manufactured by C-Line, Inc. of Des Plaines, Illinois. The C-Line pages have also been sold by Light Impressions Corporation, Kleer-Vu Plastics Corporation, and others under private label.

Flexible polypropylene slide pages are also available from the Joshua Meier Corporation under the VPD Hang-20 name, and from Franklin Distributors Corporation under the Perma-Saf name. These pages have provision for hanging bars for suspension in standard letter-size file cabinet drawers.

20th Century Plastics EZ2C Super-heavyweight, DW Viewpacks Super Archival pages, C-Line Poly-C pages, Film-Lok Archival pages, and most other slide pages can accommodate slides in Kimac cellulose triacetate sleeves (described previously). Use of Kimac sleeves in combination



November 1987

Saf-T-Stor rigid polypropylene slide pages are used for reference duplicate files at the VIREO collection (the originals are carefully stored in frost-free refrigerators — see Chapter 19). Located at the Academy of Natural Sciences of Philadelphia, VIREO is said to be the world's largest collection of color photographs of birds.

with polypropylene slide pages provides a very high degree of physical protection to slides during storage and handling; in addition, the sleeves prevent fingerprints and scratches on slides when they are removed from a page. The sleeves also eliminate the possibility that the surface-coated materials used to make flexible polypropylene (or polyethylene) pages could eventually stick to film surfaces or leave undesirable residues on the film. (See Chapter 14 for discussion of surface coatings and sticking problems associated with polyethylene and polypropylene pages.)

When slides are stored for long periods in non-recommended flexible PVC pages, Kimac sleeves are *essential* to protect film surfaces from plasticizer residues.

Saf-T-Stor Rigid Polypropylene Slide Pages

The Saf-T-Stor rigid slide page, introduced by Franklin Distributors Corporation in 1975, was the first slide page manufactured with polypropylene. The pages were developed at the request of Peter Waters at the Library of Con-

gress in Washington, D.C. Manufactured in Japan, the rigid translucent white pages have recessed pockets to accommodate 20 slides; the pages can be kept in ring binder notebooks, stored in boxes, or placed in standard file cabinet drawers (hanging bars are available for the pages as an accessory).

Saf-T-Stor pages are very similar in appearance to the rigid PVC pages sold by Joshua Meier Corporation and one should be careful that the proper page is obtained. Saf-T-Stor pages are identified along the edge opposite the ring binder holes with: "No. PV-20 – Franklin Dist. Corp. – Denville N.J. 07834." Surprisingly, the Saf-T-Stor name itself does not appear on the pages.

At a price of about \$1.30 each, Saf-T-Stor pages cost much more than 20th Century Plastics EZ2C Heavyweight, C-Line Poly-C, and other flexible polypropylene slide pages.

A significant drawback of the Saf-T-Stor pages when used with slides in glassless slide mounts is that the pages are molded from a single sheet of polypropylene and the open-face slide pockets leave one side of the slides unprotected against scratches, fingerprints, and other physical damage. This problem can be alleviated by placing each slide in a transparent Kimac sleeve. Franklin supplies transparent full-page cover sheets called Saf-T-Covers as an accessory (about \$1 each), but when fitted with the cover sheets the pages are rather unwieldy to handle.

Saf-T-Stor pages, with their recessed slide pockets, are thicker than flexible polypropylene pages and require more storage space. However, because of their rigidity, Saf-T-Stor pages handle and stack better, and, unlike the flexible pages, can stand vertically in file drawers or boxes without sagging or curling. Saf-T-Stor pages are used by a number of institutions, including the Library of Congress, the Peabody Museum of Archaeology and Ethnology at Harvard University, and the Visual Resources for Ornithology (VIREO) collection at the Academy of Natural Sciences of Philadelphia (see Chapter 19).

Other Types of Slide Pages

A very good but rather bulky and expensive "page" for storing slides is the System J slide cassette, which is made of rigid, transparent acrylic plastic. Similar to a thin, two-sided box which opens like a book, each cassette accommodates 24 slides and offers complete physical protection to slides while at the same time allowing unobstructed viewing. System J cassettes cost about \$5 each when purchased in quantity. Accessories include storage boxes and cabinets for the cassettes, illuminated viewers, and magnifiers. The cassettes are made in West Germany, where they are sold under the Journal 24 name, and are distributed in the United States by Leedal, Inc.

A rigid slide page that can be recommended for glass-mounted slides is the open-frame, molded polystyrene Plastican Slide Frame. These heavy-duty pages, or "frames," as the Plastican Corporation calls them, resist flexing and sagging and are particularly well-suited for vertical storage of glass-mounted slides in file cabinet drawers (glass-mounted slides are heavier than slides in glassless mounts, and the extra rigidity of the Plastican Slide Frames gives better support to glass-mounted slides than do Franklin Saf-T-Stor and other "rigid" pages). The Plastican pages,

each of which holds 20 slides and costs about \$1.25, can also be used in ring-binder notebooks. Because the individual slide compartments in the Plastican Slide Frames are open, both front and back, and leave the surfaces of film in glassless mounts unprotected and vulnerable to scratches, fingerprints, and dust, the pages should not be used with slides in glassless mounts unless the slides are protected with Kimac sleeves. The Plastican Corporation also supplies flexible polypropylene and plasticized polyvinyl chloride (PVC) slide pages.

Low-density polyethylene pages supplied by Vue-All, Inc., Print File, Inc., Light Impressions Corporation, and others are superior to plasticized PVC pages, although not as satisfactory as polypropylene enclosures (see Chapter 14 for discussion of the pros and cons of the various types of plastics used to make slide pages and other photographic enclosures).

Slide Storage Boxes

To the best of this author's knowledge, the cardboard boxes supplied by Kodalux Processing Services with processed slides are satisfactory for long-term storage of slides (Kodalux labs are a joint venture of Eastman Kodak Company and Fuqua Industries, Inc.; prior to 1988 the labs were operated by Kodak and were known as Kodak Processing Labs). Plastic boxes also appear to be safe for keeping slides — however one should be careful to store slides in plastic boxes in a dark place because, to a greater or lesser degree, the plastic used to make such boxes transmits light which could cause gradual fading of the outermost slides in the box during prolonged storage.

For low-cost storage of larger groups of slides, the economical Lig-free Type II Archival Slide Storage Box (#35ST) supplied by Conservation Resources International, Inc. is recommended.²⁹ The boxes cost about \$5 each in quantities of 5, or \$4 each in quantities of 10 or more (shipping additional). Each box has a capacity of 360 slides and is 18x2⁵/₈x2⁵/₈" in size. Also available is a large Master Unit consisting of six #35ST slide boxes inside a drop-front cardboard box 17x19x2³/₄" in size; a Master Unit (#35MU) has a capacity of about 2,190 slides and costs \$34.50. Boxes of similar design are also available for mounted 120 roll film transparencies. The interior of these boxes is made of nonbuffered, lignin-free cardboard.

Another good-quality cardboard slide storage box is the Slide-File Box (Code No. 5015) supplied by Light Impressions Corporation.³⁰ Made of alkaline-buffered, lignin-free cardboard with metal corners, Slide-File Boxes cost \$2.00 each in quantities of 10 or more; each box can accommodate about 200 cardboard-mounted slides. The boxes are supplied with movable cardboard interior dividers. Six of the Slide-File boxes will fit inside a Light Impressions Code No. 5012 Drop-Front Box, which is 1¹/₂Hx11Wx14D-inches in size (\$5.75 singly or \$4.60 each in quantities of 10 or more). Unfortunately, the Code No. 5012 box has a shallow interior and is only barely high enough to accommodate the slide boxes. The "standard" Light Impressions 11x14-inch Drop-Front Box (Code No. 2021) is too tall, however, and wastes valuable storage space; in addition, the top of the box tends to sag because it is unsupported by the shorter slide boxes inside. Also recommended is the Light Impres-

sions Slide Stack Box (Code No. 3211), a polypropylene box with a snap-closing lid that accommodates about 50 slides. Slide Stack boxes cost \$5.95 for a package of 6.

Light Impressions also sells an attractively finished box called the Photo Archive for Slides (Code No. 4290). Intended for slide storage in the home, the boxes hold only about 600 slides and at a price of \$24.95, they are rather expensive.

Very good low-cost polypropylene plastic boxes suitable for slide storage are manufactured by Flambeau Products Corporation.³¹ Box No. M-812, recommended for slides, has 12 interior compartments, each holding about 65 slides (about 800 in total). The box, which has a hinged lid and is made of yellow polypropylene, is 2½x13x9-inches. Flambeau requires a minimum purchase of \$200 when ordering directly from the company; No. M-812 boxes cost only \$3.24 each (5 boxes to a carton) when purchased direct.

The Conservation Resources, Light Impressions, and Flambeau Products slide boxes also are excellent for packing slides for storage in a humidity-controlled cold storage vault or frost-free refrigerator.

Slide Storage Cabinets

A complete discussion of the many slide storage cabinets and other slide storage systems that are available is beyond the scope of this chapter. Christine L. Sundt, a knowledgeable slide and photograph curator at the University of Oregon, has recommended Neumade cabinets (see **Suppliers** at the end of this chapter) as being the best for general slide storage. Sundt cautions against purchase of Luxor slide storage equipment which, in her experience, is not as well-designed as much of the other equipment on the market.

To Avoid Damage, Never Leave Slides on Desks or Tables Exposed to Light

Many slide users are aware of the damage that can occur if slides remain on light tables for an extended time, but few suspect that exposure to ordinary office illumination while slides sit uncovered on a desktop can cause serious image fading in a surprisingly short period. Such fading may be irregular, assuming, for example, the pattern of rubber bands around a group of slides. Or, if slides in pages are left in the open, casually stacked together, the mount edges of slides in the topmost page may leave clearly defined outlines on the images of slides below.

Robin Siegel, the archivist at the National Geographic Society in Washington, D.C., discovered that after the Illustrations Library was moved into a new office in 1984, some of the slides in the collection began to exhibit unexpectedly rapid image fading — often in strange and irregular patterns. The new office was brightly illuminated with Norelco (Philips) Color 84 full-spectrum lamps in energy-efficient, bare-bulb fixtures. Suspecting that the office lighting might be the source of the problem, Siegel ran a test in which Kodachrome, Ektachrome, and Fujichrome slides housed in polypropylene slide pages were placed on countertops both in the new office and in the less brightly lit area previously occupied by the Illustrations Library. According to Siegel:

The slides were exposed to approximately 100 foot candles (1,076 lux) of illumination, 18

to 24 hours a day, for 10 weeks. The variation in daily exposure time was because we were never really sure when the cleaning people came in and turned out the lights. The temperature remained between 72° and 75°F (22 and 24°C) and the relative humidity between 45 and 55%. As was expected, the Kodachrome showed a far greater rate of fade than either the Ektachrome or Fujichrome, especially in the magenta dye. The Kodachrome lost as much as 50-percent of the magenta dye by the end of 8 weeks.³²

Investigating the matter further, Siegel tested various brands of fluorescent lamps, including both standard types and special “UV-free” lamps. She found that the UV output of the lamps made relatively little difference in the measured fading rates of test slides — the total light output of the lamps proved to be the most important factor. These findings led Siegel to recommend that the fluorescent fixtures in the Illustrations Library be operated with only one bulb — instead of the usual two — in each fixture. This, combined with the addition of a plastic diffuser over the light fixtures, would spread the light more evenly in the Library office and lower the overall illumination level.

Siegel also launched a campaign to alert the Geographic staff about the hazards of leaving slides uncovered on tables, desks, and shelves.

Notes and References

1. Thom O'Connor, “Pros Winners of Film Wars,” **Photo District News**, Vol. VII, Issue II, February 1987, pp. 1, 14, 16, 18. See also: David Walker, “Kodachrome’s Dramatic Decline,” **Photo District News**, Vol. XII, Issue II, February 1992, pp. 14–21.
2. Galen Rowell, “A Major New Film – Fuji Velvia Ups the Ante in the ‘Chrome Wars,’” **Outdoor Photographer**, Vol. 6, No. 5, June 1990, pp. 8, 12–13. See also: Jack and Sue Drafahl, “Super Film Shootout! Kodak Kodachrome 25 vs. Fujichrome Velvia . . . Let the Film Wars Continue,” **Petersen’s Photographic**, July 1990, pp. 86–91; George Craven and Lynn Jones, “Fujichrome Velvia: A New Opportunity for Labs,” **Photo Lab Management**, Vol. 12, No. 6, June 1990, pp. 8–12.
3. Anon., “Arts of the U.S.,” **American Artist**, Vol. 25, No. 9, November 1961.
4. Eastman Kodak Company, “Using Eastman Color Negative Film 5247 (35mm) and Eastman Color High Speed Negative Film 5293 (35mm) for Still Photography,” **TIPS – Technical Information for Photographic Systems**, Vol. 15, No. 2, March–April 1984, p. 6.
5. Eastman Kodak Company, **Conservation of Photographs** (George T. Eaton, editor), Kodak Publication No. F-40, Eastman Kodak Company, Rochester, New York, March 1985, p. 69.
6. Larry Lipsky, “The Artful Dupe,” **Outdoor Photographer**, Vol. 5, No. 8, October 1989, pp. 50–55.
7. W. Arthur Young, Thomas A. Benson, and George T. Eaton, **Copying and Duplicating in Black-and-White and Color**, Kodak Publication No. M-1, Eastman Kodak Company, Rochester, New York, September 1984.
8. Jacqueline Tobin, “Tony Stone of London Buys Click/Chicago,” **Photo District News**, Vol. VIII, Issue X, September 1988, p. 26.
9. 70mm enlarged slide duplicates are available from a number of labs, including: The New Lab Inc., 22 Cleveland Street, San Francisco, California 94103; telephone: 415-431-8806 (toll-free: 800-526-3165); Comcorps, 243 Church Street, Vienna, Virginia 22180; telephone: 703-938-7750; and Chromatics/Borum Photographics, 625 Fogg Street, Nashville, Tennessee 37203; telephone: 615-254-0063.
10. Carl Purcell, “Do-It-Yourself Stock Photography: Introducing the 70-mm Dupe,” **Popular Photography**, Vol. 93, No. 8, August 1986, pp. 16–17.
11. David Weintraub, “What’s In Stock? Galen Rowell’s Wild Places,” **Photo District News**, Vol. VIII, Issue VIII, July 1988, pp. 58–60.
12. National Digital Corporation, Suite 125, 7700 Leesburg Pike, Falls Church, Virginia 22043; telephone: 703-356-5600 (New York City office: National Digital Corporation, Empire State Bldg., Suite 7720,

- 350 Fifth Ave., New York, N.Y. 10118-0165; telephone: 212-268-0040).
13. Peter Tatiner, "National Digital Delivers," *Photo District News*, Vol. VII, Issue VIII, July 1987, pp. 1, 22.
 14. Anon., "Weekly Elects Photo System," *Publishing Technology*, Vol. 2, No. 4, p. 73.
 15. Stuart Craig, National Digital Corporation, telephone discussion with this author, September 29, 1987.
 16. Photofinishing News, Inc., "Photo Processing – North and South America," *The 1991 International Photo Processing Industry Report*, Chapter 2, p. 1 (1991). Photofinishing News, Inc., Suite 1091, 10915 Bonita Beach Road, Bonita Springs, Florida 33923.
 17. Thomas W. Hope, "Hope Reports," *SMPTE Journal*, Vol. 96, No. 4, April 1987, pp. 387–388.
 18. Pakon plastic slide mounts and mounting machines are manufactured by Pakon, Inc., 106 Baker Technology Plaza, 6121 Baker Road, Minnetonka, Minnesota 55345; telephone: 612-936-9500.
 19. Wess Plastic, Inc., 70 Commerce Drive, Hauppauge, New York 11788-3936; telephone: 516-231-6300.
 20. Gepe Division, HP Marketing Corp., 16 Chapin Road, P.O. Box 715, Pine Brook, New Jersey 07058; telephone: 201-808-9010.
 21. A. G. Tull, "Moisture and the Slide," *The Journal of Photographic Science*, Vol. 22, 1974, pp. 107–110; A. G. Tull, "Film Transparencies Between Glass," Part I, *British Journal of Photography*, Vol. 125, April 1978, pp. 322–323; A. G. Tull, "Film Transparencies Between Glass," Part II and Part III, *British Journal of Photography*, Vol. 125, May 1978, pp. 349–354, 355.
 22. Christine L. Sundt, "Moisture Control Through Slide Mounting," *International Bulletin for Photographic Documentation of the Visual Arts*, Vol. 8, No. 1, September 1981, pp. 1–10; Christine L. Sundt, "Moisture Control Through Slide Mounting – Part II," *International Bulletin for Photographic Documentation of the Visual Arts*, Vol. 8, No. 4, December 1981, pp. 8–11; Christine L. Sundt, "Mounting Slide Film Between Glass – For Preservation or Destruction?," *Visual Resources*, Vol. II, No. 1/2/3, Fall/Winter 1981–Spring 1982, pp. 37–62; Christine L. Sundt, "Transparencies in Paper Mounts," *International Bulletin for Photographic Documentation of the Visual Arts*, Vol. 11, No. 4, Winter, 1984, pp. 20–22; Christine L. Sundt, "How to Keep Slide Mounts Clean," *International Bulletin for Photographic Documentation of the Visual Arts*, Vol. 13, No. 2, Summer 1986, pp. 14–15; Christine L. Sundt, *Conservation Practices for Slide and Photographic Collections*, Special Bulletin No. 3, Visual Resources Association, 1989.
 23. Christine L. Sundt, "Perrot-Color Mounts – Current Status and Options," *International Bulletin for Photographic Documentation of the Visual Arts*, Vol. 15, No. 4, Winter 1988, p. 22.
 24. Wess Plastic Archival Slide Mounts (AGI 001AF for standard 35mm slide image area and AGI 500AF for full-frame images) are available from Wess Plastic, Inc.; the mounts are also available from Light Impressions Corporation. See **Suppliers** listing below for addresses and telephone numbers.
 25. Horizon No. 425 Ultra Thin Metalized Polyester Tape for binding and masking glass slides is available in ¼- and ½-inch widths in 100-foot rolls from Horizon Tape Products Company, 251 West Lafayette Frontage Road, St. Paul, Minnesota 55107; telephone: 612-224-4083. Also available from Light Impressions Corporation; see **Suppliers** listing below for address and telephone numbers.
 26. ImageGuard rigid plastic holders for individual slides are available from Image Innovations, Inc.; see **Suppliers** listing below.
 27. American National Standards Institute, Inc., **ANSI IT9.2-1991, American National Standard for Imaging Media – Photographic Processed Films, Plates, and Papers – Filing Enclosures and Storage Containers**, American National Standards Institute, Inc., 11 West 42nd Street, New York, New York 10036; telephone: 212-642-4900. See also: **International Standard ISO 10214:1991(E) Photography – Processed Photographic Materials – Filing Enclosures for Storage**, International Organization for Standardization, Geneva, Switzerland.
 28. R. Scott Williams, "Commercial Storage and Filing Enclosures for Processed Photographic Materials." Presentation at the **Second International Symposium: The Stability and Preservation of Photographic Images**, "Printing of Transcript Summaries," sponsored by IS&T, the Society for Imaging Science and Technology, 7003 Kilworth Lane, Springfield, Virginia 22151; telephone: 703-642-9090. The conference was held at the National Archives of Canada, Ottawa, Ontario, August 25–28, 1985.
 29. Conservation Resources International, Inc.; see **Suppliers** listing below.
 30. Light Impressions Corporation; see **Suppliers** listing below.
 31. Flambeau Products Corporation; see **Suppliers** listing below.
 32. Robin Siegel, "Light-Fading of Color Slides Left Sitting on Desk Tops," presentation at the 1987 Winter Meeting of the Photographic Materials Group of the American Institute for Conservation, New

Orleans, Louisiana, February 7, 1987. A shortened version of the presentation was published in 1988: "Light-Fading of Color Transparencies on Desk Tops," **Topics in Photographic Preservation – Volume Two**, Photographic Materials Group of the American Institute for Conservation, pp. 62–68, 1988. American Institute for Conservation, 1400 16th Street, N.W., Suite 340, Washington, D.C. 20036; telephone: 202-232-6636.

Additional References

- Steve Anchell, "Super Slide Dupers — Darkroom Control for Color Practitioners," *Camera & Darkroom*, Vol. 14, No. 8, August 1992, pp. 48–53.
- Gene Balsley and Peter Moore, "How to File and Store Slides," *Modern Photography*, Vol. 44, No. 1, January 1980, pp. 104ff.
- Norine D. Cashman and Mark M. Braunstein, *Slide Buyers' Guide*, fifth edition, Libraries Unlimited, Inc., Littleton, Colorado, 1985.
- Marian Z. DeBardeleben and Carol G. Lunsford, "35mm Slides – Storage and Retrieval for the Novice," *Special Libraries*, Vol. 73, No. 2, April 1982, pp. 135–141.
- Nancy DeLaurier, ed., *Slide Buyers' Guide*, fourth edition, Mid-America College Art Association, Visual Resources Group, University of New Mexico, Slide Library, Fine Arts Center, Albuquerque, N.M., 1980.
- Etsuo Fujii, Hideko Fujii, and Teruaki Hisanaga, "Evaluation on the Stability of Light Faded Images of Color Reversal Films According to Color Difference in CIELAB," *Journal of Imaging Technology*, Vol. 14, No. 2, April 1988, pp. 29–37; see correction of 2 tables in the article: "Errata," *Journal of Imaging Technology*, Vol. 14, No. 3, June 1988, p. 93.
- Betty Jo Irvine, *Slide Libraries*, second edition, Libraries Unlimited, Inc., Littleton, Colorado, 1979.
- Eastman Kodak Company, *The Source Book – Kodak Ektagraphic Slide Projectors*, Kodak Publication No. S-74, Eastman Kodak Company, Rochester, New York, October 1984.
- Eastman Kodak Company, *Storage and Care of Kodak Color Materials*, Kodak Pamphlet No. E-30, Eastman Kodak Company, Rochester, New York, May 1982.
- Peter Moore, "Preservation of the Image," Chapter 10 in *ASMP Stock Photography Handbook*, American Society of Magazine Photographers, Inc., New York, New York, 1984, pp. 148–151.
- Gillian Scott, ed., *Guide to Equipment for Slide Maintenance and Viewing*, Mid-America College Art Association, Visual Resources Group, University of New Mexico, Slide Library, Fine Arts Center, Albuquerque, New Mexico, 1978.
- Nancy Schuller, ed., *Guide for Management of Visual Resources Collections*, second edition, Mid-America College Art Association, Visual Resources Group, University of New Mexico, Slide Library, Fine Arts Center, Albuquerque, New Mexico, 1979.
- Nancy Schuller and Susan Hoover, chairpersons, *Production and Preservation of Color Slides and Transparencies*, a conference in the Advanced Studies in Visual Resources series, University of Texas at Austin, Department of Art and School of Architecture, Austin, Texas, March 27–28, 1981.
- Bob Schwalberg, with Henry Wilhelm and Carol Brower, "Going! Going!! Gone!!! – Which Color Films and Papers Last Longest? How Do the Ones You Use Stack Up?," *Popular Photography*, Vol. 97, No. 6, June 1990, pp. 37–49, 60. The article contained image stability data excerpted from this book and also discussed accelerated test methods.
- Susan Garretson Swartzburg, ed., *Conservation in the Library*, Greenwood Press, Westport, Connecticut, 1983.
- Henry Wilhelm, chairperson, *Conservation and Preservation Issues Beyond the Book: Slides, Microforms, Videodiscs, and Magnetic Media*, ARLIS-VRA Joint Session (co-sponsored by the Smithsonian Institution), 18th Annual Conference of the Art Libraries Society of North America, Penta Hotel, New York, New York, February 14, 1990. The presentations included: Klaus B. Hendriks [National Archives of Canada], "Magnetic Media and Optical Disc Storage Technology: The Challenge of Non-Human-Readable Records"; James M. Reilly [Image Permanence Institute, R.I.T.], "Silver Gelatin Microfilm: Update on Toner Treatments for Improved Image Stability"; Henry Wilhelm [Preservation Publishing Company], "The Stability and Preservation of Color Slides: Duplicates for Use, and Cold Storage of Originals Provide the **Only Answer**"; Peter Krause [Consultant], "Cibachrome Micrographic Color Films"; James H. Wallace, Jr. [Smithsonian Institution], "Color Slide Preservation at the Smithsonian: Cold Storage for Originals, Videodiscs for Reference, and Duplicates for Use."
- Betsy G. Young, "Picture Retrieval in the Time Inc. Picture Collection," *Picturescope*, Vol. 30, No. 2, Summer 1982, pp. 57–61.

(See Chapter 18 Suppliers List on Following Pages . . .)

Suppliers

Recommended Glass Slide Mount

Wess Plastic, Inc.
70 Commerce Drive
Hauppauge, New York 11788-3936
Telephone: 516-231-6300
(Slide mount sold under the Wess Archival Mount name.)

Flexible Polypropylene Slide Pages

C-Line Products, Inc.
1530 East Birchwood Avenue
P.O. Box 1278
Des Plaines, Illinois 60018
Telephone: 312-827-6661
Toll-free: 800-323-6084
(Pages sold under the Poly-C name.)

DW Viewpacks Limited
Unit 8 Peverel Drive, Granby
Milton Keynes, Buckinghamshire MK11NL
England
Telephone: 01-0908-642-323
(Pages sold under the DW Viewpacks Super Archival name; available in the U.S. from Sam Flax, Inc.)

Sam Flax, Inc.
39 West 19th Street
New York, New York 10011
Telephone: 212-620-3010
(U.S. supplier of DW Viewpacks Super Archival polypropylene slide pages.)

Franklin Distributors Corporation
P.O. Box 320
Denville, New Jersey 07834
Telephone: 201-267-2710
Fax: 201-663-1643
(Pages sold under the Perma-Saf name.)

Joshua Meier Corporation
7401 Westside Avenue
North Bergen, New Jersey 07047
Telephone: 201-869-8200
(Pages sold under the VPD Hang-20 name; Joshua Meier is best known for its VPD Slide-Sho and VPD Hang-up Slide-Sho pages which are made of rigid, nonplasticized vinyl; both types of pages are almost identical in physical design to the rigid polypropylene Saf-T-Stor pages listed below.)

Kleer-Vu Plastics Corporation
Kleer-Vu Drive
Brownsville, Tennessee 38012
Telephone: 901-772-5664
Toll-free: 800-677-3686
(Pages sold under the Pro-Line name [#14914].)

The Kimac Company, Ltd.
478 Long Hill Road
Guilford, Connecticut 06437
Telephone: 203-453-4690
(Pages sold under the Kimac Slide Page name.)

Light Impressions Corporation
439 Monroe Avenue
Rochester, New York 14607-3717
Telephone: 716-271-8960
Toll-free: 800-828-6216
(Pages sold under the Slide-Guard name.)

Savage Universal Corporation
800 West Fairmont Drive
Tempe, Arizona 85282
Telephone: 602-967-5882
Toll-free: 800-624-8891
(Pages sold under the Film-Lok Archival Slide Page name.)

20th Century Plastics, Inc.
3628 Crenshaw Boulevard
Los Angeles, California 90016
Telephone: 213-731-0900
Toll-free: 800-767-0777
(Recommended polypropylene slide pages sold under the EZ2C Super-heavyweight name: top-loading #EZTL2-00 for 3-ring notebooks; side-loading page #EZJV2-00 for 3-ring notebooks; and #EZHTL-00 with top-bar for hanging files. Lighter weight and less expensive slide pages sold under the Century-Poly name: top-loading #PTL20 for 3-ring notebooks and side-loading #PJV20 for 3-ring notebooks.)

Rigid Polypropylene Slide Pages

Franklin Distributors Corporation
P.O. Box 320
Denville, New Jersey 07834
Telephone: 201-267-2710
Fax: 201-663-1643
(Pages sold under the Saf-T-Stor name.)

Low-Density Polyethylene Slide Pages

Light Impressions Corporation
439 Monroe Avenue
Rochester, New York 14607-3717
Telephone: 716-271-8960
Toll-free: 800-828-6216
(Pages sold under the Slide-Guard Heavy-weight Polyethylene slide page name.)

Print File, Inc.
1846 South Orange Blossom Trail
Apopka, Florida 32703
Telephone: 407-886-3100
(Pages sold under the Print File Archival Preserver name.)

Vue-All, Inc.
P.O. Box 1690
Ocala, Florida 32678
Telephone: 904-732-3188
Toll-free: 800-874-9737 (outside Florida)
(Pages sold under the Vue-All Slide-File and Slide Pak 20 names.)

Rigid Acrylic Slide Cassettes

Leedal, Inc.
1918 South Prairie Avenue
Chicago, Illinois 60616
Telephone: 312-842-6588
(Cassettes made in Germany under the Journal 24 System name; sold by Leedal under the System J name.)

Rigid Polystyrene Open-Frame Slide Pages

Plastican Corporation
10 Park Place
P.O. Box 58
Butler, New Jersey 07405
Telephone: 201-838-4363
(Pages sold under the Plastican Slide Frame name.)

Plastic Sleeves for Individual Slides

Image Innovations, Inc.
7521 Washington Avenue South
Minneapolis, Minnesota 55439
Telephone: 612-942-7909
Toll-Free: 800-345-4118
(ImageGuard Rigid Slide Holders for protection of slides during shipping and handling; the transparent holders cost about \$1.00 each.)

The Kimac Company, Ltd.
478 Long Hill Road
Guilford, Connecticut 06437
Telephone: 203-453-4690
(Sleeves sold under the Kimac Protector name; made of cellulose triacetate.)

Photofile, Inc.
2020 Lewis Avenue
Zion, Illinois 60099
Telephone: 708-872-7557
Toll-free: 800-356-2755
(Polyester sleeves for individual slides and larger transparencies mounted on cards and sold under the Quik-Mount name.)

Reeves Photo Sales, Inc.
9000 Sovereign Row
Dallas, Texas 75247
Telephone: 214-631-9730
Toll-free: 800-527-9482
(2 1/4 x 2 1/4-inch high-density polyethylene thumb-cut envelopes for individual mounted slides; sold under the RPS Plastine name.)

20th Century Plastics, Inc.
3628 Crenshaw Boulevard
Los Angeles, California 90016
Telephone: 213-731-0900
Toll-free: 800-767-0777
(#PGS22-00 sleeves for individual 35mm slides sold under the Polypropylene Film Sleeves name.)

Suppliers

Slide-Storage Boxes

Conservation Resources International, Inc.
8000-H Forbes Place
Springfield, Virginia 22151
Telephone: 703-321-7730
Toll-free: 800-634-6932

(Lig-free Type II Archival Slide Storage Box No. 35ST [nonbuffered cardboard on the inside] with 18 interior index/divider tabs; holds about 360 slides [\$4.95 each]. No. 35MU, which holds about 2,160 sides, consists of six No. 35ST boxes contained in a larger, drop-front box [\$34.50]. Company has sales offices in Ottawa, Ontario; Oxon, England; and Brisbane, Australia.)

Flambeau Products Corporation
15981 Valplast Road
P.O. Box 97
Middlefield, Ohio 44062
Telephone: 216-632-1631

(Rigid polypropylene plastic boxes. Box No. M812; size: 13 $\frac{1}{8}$ x9x2 $\frac{5}{16}$ "; 12 interior compartments; hinged lid; each box holds about 800 slides, with about 65 in each compartment. Boxes are \$3.24 each; minimum order direct from Flambeau Products is \$200.)

The Hollinger Corporation
P.O. Box 8360
Fredericksburg, Virginia 22404
Telephone: 703-898-7300
Toll-Free: 800-634-0491

(Slide Box No. 1162 made of alkaline-buffered cardboard has 20 separate interior boxes to hold slides; holds a total of about 400 slides. Boxes No. 12210 and No. 12510 hold slides packaged in Kodak 24-exposure and 36-exposure cardboard slide boxes.)

Light Impressions Corporation
439 Monroe Avenue
Rochester, New York 14607-3717
Telephone: 716-271-8960
Toll-free: 800-828-6216

(Slide-File Box No. 5015 made of alkaline-buffered cardboard; 11 inches of file space and supplied with movable cardboard dividers. For storage, 6 of the boxes will fit in an 11x14-inch Light Impressions Drop-Front Box No. 5012. Slide Stack Boxes No. 3211 are polypropylene boxes with tight-fitting lids that accommodate about 50 slides each.)

Slide-Storage Cabinets and Files

Multiplex Display Fixture Company
1555 Larkin Williams Road
Fenton, Missouri 63026
Telephone: 314-343-5700
(Multiplex System 4000 and Director Series)

Elden Enterprises, Inc.
1 Ramu Road – Toporock
P.O. Box 3201
Charleston, West Virginia 25332-3201
Telephone: 304-344-2335
(Abodia and Lowdia Slide Storage Systems)

Neumade Products Corporation
200 Connecticut Avenue
P.O. Box 5001
Norwalk, Connecticut 06856
Telephone: 203-866-7600
(Neumade Slide Cabinets)

Luxor Corporation
2245 Delany Road
Waukegan, Illinois 60087
Telephone: 708-244-1800
Toll-free: 800-323-4656
(Slide-Bank and Unlimited Slide Storage Systems)

Bretford & Knox Manufacturing
111 Spruce Street
Wood Dale, Illinois 60191
Telephone: 708-595-0300
(Acculight Modular Storage Systems)

Leedal, Inc.
1918 South Prairie Avenue
Chicago, Illinois 60616
Telephone: 312-842-6588
(Matrix Library Storage Cabinets)

Moderate-Cost, Manually Operated Slide Duplicators

Charles Beseler Co.
1600 Lower Road
Linden, New Jersey 07036-6514
Telephone: 908-862-7999
Toll-free: 800-237-3537
(Beseler Deluxe Dual-Mode Duplicator)

Bogen Photo Corporation
565 East Crescent Avenue
P.O. Box 506
Ramsey, New Jersey 07446-0506
Telephone: 201-818-9500
(Bowens Illumitran 3SC Slide Duplicator)

Karl Heitz, Inc.
34-11 62nd Street
P.O. Box 427
Woodside, New York 11377
Telephone: 718-565-0004
(Alpha Master Dia-Duplicator)

Kenro Corporation
250 Clearbrook Road
Elmsford, New York 10523
Telephone: 914-347-5520
Toll-free: 800-592-6666
(Kenro Spectra 1000 Slide Duplicator)

Byers Photo Equipment Company
6955 S.W. Sandburg Street
Portland, Oregon 97223
Telephone: 503-639-0620
Toll-free: 800-547-9670
(ChromaPro Slide 45 Duplicator)

HP Marketing Corp.
16 Chapin Road
Pine Brook, New Jersey 07058
Telephone: 201-809-9010
(Kaiser System V Slide Duplicator)

Photographic & Technical Services
226 Westbourne Grove
London W11 2RU, England
Telephone: 01-221-0162
(Beseler Dichro Illuminator Slide Duplicator)

High-Volume Slide Duplicators, Animation Cameras, and Copy Cameras

Double M Industries
P.O. Box 14465
Austin, Texas 78761
Telephone: 512-251-4044

ECB Technologies, Inc.
1140 19th Street, N.W., Suite 300
Washington, DC 20036
Telephone: 202-223-6906

Forox Marketing Corporation
250 Clearbrook Road
Elmsford, New York 10523
Telephone: 914-592-7776

Hoffman Camera Corporation
19 Grand Avenue
Farmingdale, New York 11735
Telephone: 516-694-4470

Hostert Fotomata, Inc.
31 Louis Street
Hicksville, New York 11801
Telephone: 516-935-5363

Maron, Inc.
2640 West 10th Place
Tempe, Arizona 85281
Telephone: 602-966-2189

Oxberry Division
Cybernetics Products, Inc.
180 Broad Street
Carlstadt, New Jersey 07072
Telephone: 201-935-3000

Slidemagic System, Inc.
30401 East Colfax Street
Denver, Colorado 80206
Telephone: 303-388-2971