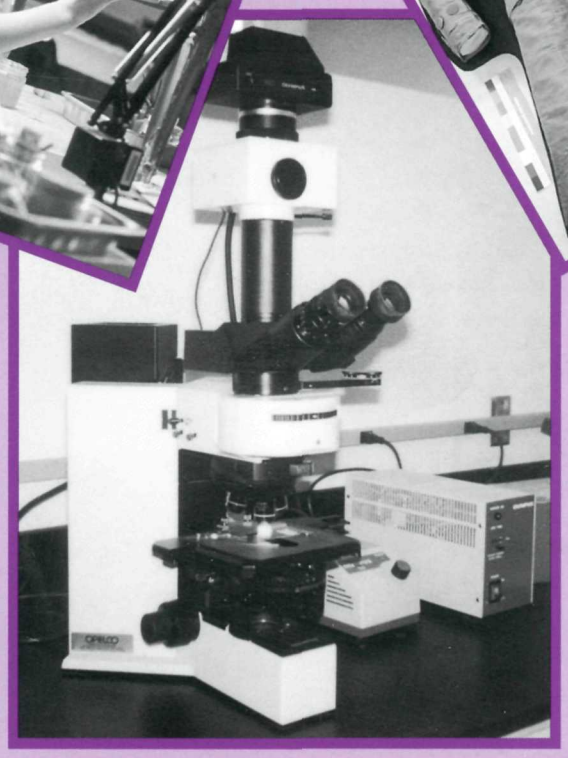
CRM

CULTURAL RESOURCE MANAGEMENT

VOLUME 22 NO. 7 1999

A New Lease on Life



Conserving Museum Collections

U.S. DEPARTMENT OF THE INTERIOR
National Park Service
Cultural Resources

PUBLISHED BY THE NATIONAL PARK SERVICE

Information for parks, federal agencies, Indian tribes, states, local governments, and the private sector that promotes and maintains high standards for preserving and managing cultural resources

An electronic version of this issue of *CRM* can be accessed through the *CRM* homepage at <http://www.cr.nps.gov/crm>.

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 Send articles and correspondence to the Editor, *CRM*, U.S. Department of the Interior, National Park Service, Cultural Resources, 1849 C Street, NW, Suite 350NC, Washington, DC 20240; 202-343-8164, fax 202-343-5260; email: <crmmag@nps.gov>.

Jessica S. Johnson

A New Lease on Life
Conserving Museum Collections

The word "conservation" has deep and significant meaning in the National Park Service. It is set in our mission and reflected in our Strategic Plan, and each day every employee's work helps conserve the natural and cultural heritage of our nation. This issue of *CRM* illustrates what one group of professionals, called conservators, and the professionals and students with whom they work, are doing to conserve collections in museums.

The profession of conservation, based on a scientific understanding of materials and deterioration is a fairly new field. This new, scientific approach to the deterioration of materials developed between WWI and WWII.[1] The first professional society (founded in the UK in 1950) was the International Institute for Conservation (IIC). The American Group of IIC separated in 1972 to become the American Institute for the Conservation of Historic and Artistic Works (AIC). AIC has developed a Code of Ethics and Guidelines for Practice that is used to guide and evaluate the work of conservators. University-level training for conservators became available in the United States in the 1960s and 1970s and standards for experience and training of conservators are continually being upgraded. Conservators worldwide are currently discussing the need for professional certification standards.

These changes toward conservation as a separate profession from others that work in museums and historic preservation are reflected in the National Park Service. The 1941 *Field Manual for Museums,* by Ned J. Burns included a variety of techniques and materials that were recommended to all museum staff for treating objects in collections. The first NPS conservator, Elizabeth H. Jones, a paintings conservator, began work in 1951.[2] By 1976, Ralph Lewis in *Manual for Museums* was outlining a different approach in which day-to-day care and preservation of collections (collections management) is the responsibility of park staff, who request conservation assistance from conservators with particular specialized skills. Basic preventive care information for parks, as stated in the *Museum Handbook,* Part I, Museum Collections, is constantly being revised and updated to incorporate new information and practices. Most preventive care for NPS collections is done by park and center staff and their programs are the foundation of all collection preservation.

However, sometimes this preventive care is not enough. Objects are used and damaged before coming to museums. Disasters like floods or hurricanes strike even with the best risk management and planning. Some objects, made of unstable materials, begin deteriorating immediately upon creation. In these and many other cases, a conservator can treat an object to stabilize its chemical and physical structure and bring it back closer to an earlier condition.

But conservators do much more. Through their intimate knowledge of an object during treatment and analysis, new information about construction, materials, and techniques can be brought to light. Articles in this issue discuss treatments to objects as diverse as firearms, quilts, lighthouse lenses, and stone monuments where treatment or technical analysis added to the information we have about our collections. Conservators also bring new technologies and approaches to collections care by translating research done in a variety of scientific disciplines such as chemistry, physics, and engineering to the practicalities of collection care. Larry Bowers describes new lighting technologies that are less damaging to objects. Our treatment experiences give us a perspective on what kinds of preventive care practices have worked over the long-term and what hasn't so we can advise park staff. Authors writing about integrated pest management and object maintenance include practices improved by conservation research to insure that they work the way we want them to. Conservation science—science directed specifically toward preservation questions—helps improve treatments, procedures, and practices used to care for and preserve collections. Judy

Bischoff describes a new science lab that will directly support research and technical analysis of NPS collections. We also do training so that others develop skills to contribute to the preservation of our cultural heritage. This issue describes three very different training programs for audiences as diverse as tribes, museum staff, maintenance staff, archeologists, and conservation students.

Conservation is collaboration between the conservator and other professionals who work with the collections. Toby Raphael describes a new type of publication that promotes a new approach to exhibit design, incorporating a conservation ethic. Because there are so few conservators working for the NPS and many other federal agencies, much conservation is done by contractors throughout the country. Martin Burke shows how museums can ensure they get quality work done by qualified conservators. Two other articles illustrate successful projects done by contractors working with NPS staff.

Many of the choices that museums must make about conservation treatment are based on condition information for individual objects and collections of materials. It is imperative that we have good information with which to make decisions. The Museum Management Program, National Center for Cultural Resource Stewardship and Partnership Programs in the National Park Service has developed a *Strategy for Improving Condition Information and Conservation Resources* to collect this information for the NPS. This Strategy outlines a variety of projects that will take place over the next few years to support and improve the preservation of collections by:

- supplying park museum staff and NPS and contract conservators with additional tools to document condition and make good treatment decisions;
- evaluating current condition assessments and improving accuracy of documentation servicewide;
- promoting the use of information in collection condition survey reports to document and plan for collection needs;
- developing tools to aggregate object condition information and treatment cost estimates at cluster, regional, and servicewide levels.

The Museum Management Program will soon be presenting a web exhibit on conservation treatment projects done by NPS conservators on NPS collections. You will be able to see this exhibit, titled A New Lease on Life: Museum Conservation in the NPS at <http://www.cr.nps.gov/csd/>.

Conservators come from diverse backgrounds, each with a variety of training experiences and expertise. What they all have is an interest in materials and an assumed responsibility to future generations. This issue of *CRM* illustrates how conservators use all their skills to help preserve objects for the future.

Notes

1 Harold J. Plenderleith, "A History of Conservation" in *Studies in Conservation* 43 (1998), 129-143; Nicholas Stanley Price, M. Kirby Talley, Jr. and Alessandra Melucco Vaccaro. *Historical and Philosophical Issues in Conservation of Cultural Heritage: Readings in Conservation,* (Los Angeles: The Getty Conservation Institute, 1996).

2 Ralph H. Lewis, *Museum Curatorship in the National Park Service 1904-1982,* (Washington, DC: DOI, NPS, Curatorial Services Division, 1993), 343.

Jessica S. Johnson is a conservator, Museum Management Program, National Park Service, and guest editor of this issue of CRM.

Weblinks

Museum Management Program
http://www.cr.nps.gov/csd/

Conserve O Grams
http://www.cr.nps.gov/csd/publications/index.htm

Harpers Ferry Center Conservation
http://www.nps.gov/hfc/conservation/

American Institute for Conservation (AIC)
http://palimpsest.stanford.edu/aic/

International Institute for Conservation of Historic and Artistic Works
http://www.iiconservation.org/

Conservation OnLine
http://palimpsest.stanford.edu/

David H. Arnold

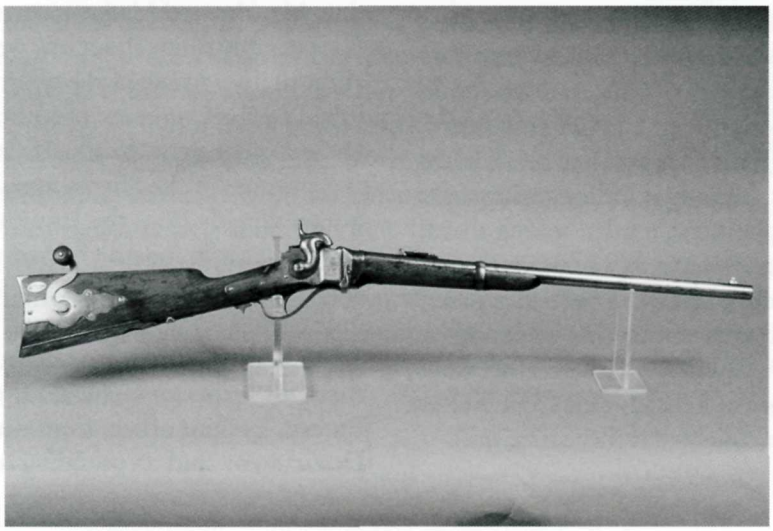
Mr. Fuller's Most Peculiar Firearm

For the past year, I have been treating American military shoulder arms from the Fuller Gun Collection at the Chickamauga and Chattanooga National Military Park (CHCH). In 1954, this collection of over 350 firearms was given to the United States by Claud E. Fuller and his wife, Zenada, of Chattanooga, Tennessee. Claud Fuller was a life-long collector of American military arms (among several other things) and his collection spans four centuries—from 17th-century matchlocks to the Model 1917 Springfield/Remington "World War" Rifle. Mr. Fuller believed it to be the most complete collection of its kind.

The general purpose in treating the entire collection is to document its present condition, stabilize any corrosion of the metals or deterioration of the wooden components, and protect them against future deterioration. Each gun is photographed and its condition documented. Although treatments for each gun are proposed on an individual basis, the basic regimen is the same.

The guns are disassembled as completely as possible. All metal parts are cleaned with solvents, but usually some mechanical techniques are used as well—scalpels, soft brushes; even dental tools are used, but with great care to avoid scratching the metallic surfaces. Any proof marks or other stampings found are noted along with any other observations which might be of interest. Ferrous metal parts are heated and coated with a petroleum-based wax. Brass or bronze parts are coated with an acrylic lacquer. Wooden components are cleaned and coated with pigmented carnauba wax. All of these coating materials can be easily removed or replaced some time in the future. Some cosmetic restoration is also being done—especially where old repairs have failed or where the finish has become marred. Photographs are again taken after the treatment is completed. These, along with the individual treatment reports, will provide the National Park Service base-line documentation of the collection's condition at a fixed point in time. This documentation is essential to tracking changes that may occur to the collection in the years to come.

In theory, conservators treat all artifacts with equal care and attention. However, there are times when something special comes our way, and we need to respond to its uniqueness. It is a fairly routine matter for conservators to study the objects they treat. In some instances the connoisseurship which results can be critical to the development of a treatment strategy. But, in the process of trying to learn about the special gun that is the focus of this article, I suspect I may have put in a few more hours than usual (since it was most unlikely to affect the treatment procedure) as I tried to establish the factual basis for what has been published on the subject.



Model 1863 Sharps Carbine with mill crank installed. Photo by the author.

Well *why not?* Take a look at it! It's a gun with a crank sticking out of its stock. That's certainly odd—and in itself pretty intriguing, especially on a mid-19th-century firearm! It would not be unreasonable to guess that the crank might have some mechanical connection to the loading or firing mechanisms. Considering its martial purpose, what else could it be for?

The gun is a 0.52 caliber Sharps New Model 1863 carbine, serial number 81319. This weapon (without the crank) was

Detail of Sharps New Model 1863 Carbine with mill. Photo by Charles Shepard.

one of the most desirable arms issued during the Civil War. It is breech-loading—and, therefore, its user held a critical advantage over soldiers who often had to expose themselves to enemy fire while recharging their muzzle-loaded rifles. Although it was not the first breech-loading arm purchased by the military—that distinction goes to the Hall breech-loading flintlocks made in Portland, Maine in 1817[1]—it did have the advantage over earlier models of having a self-contained pellet primer which fed an explosive charge between the breech cone and hammer as it was cocked and subsequently released. This eliminated having to put a small cap on the cone between each shot—another step saved and an especially welcome feature when fingers got clumsy during cold weather. While soldiers with muzzle-loading guns raced through a complicated manual of arms to fire at a rate of three rounds per minute, the possessor of a Sharps carbine could easily get off 10 rounds in a minute.[2]

If you guessed that the crank plays a role in increasing the soldier's rate of fire you would be wrong. When the crank and its internal mechanism is removed from the butt stock, it becomes immediately apparent that this attachment is a grinding device of some sort. It has an input port in the upper end of the plate on the lower edge of the butt stock. The plate opposite the crank has an output slot. The question is, just what is supposed to come *out* of that slot?

In his privately published volume entitled *Fuller Gun Notes,* the title of Mr. Fuller's entry for this gun reads: "Sharps Breech Loading Carbine. New Model 1863 with Coffee Mill."[3] Early on, however, I read accounts which cast doubt on its function as a coffee grinder. CHCH park historian Jim Ogden ground a few coffee beans in the gun (just prior to shipping it off for treatment). He reported disappointing results, stating that it would take an excessive number of beans to make a decent cup of coffee using the built-in grinder.[4] Other authors reported similar disappointing results,[5,6] and one logically speculated that since "...coffee was more of a luxury [for Civil War era soldiers], it is more likely that the 'coffee mill' was originally a grain mill," presumably for converting foraged grains into meal or flour.[7]

In looking further into the matter it soon became clear that the Sharps Rifle Manufacturing Co. was not responsible for this adaptation.[8] The question as to who was responsible seemed to have several answers. Here is a sampling: "During the Civil War a workman employed at the St. Louis Arsenal devised a plan to incorporate a coffee mill on the butt stock of the gun."[9,10] "The coffee mill part was added ... by James McMurphy of Camden, New Jersey on contract for the Ordnance department."[11] "The Coffee Mill attachment, located in the stock where the patch box is usually placed, was added to a few of these carbines by a contractor in S [sic] Saint Louis, Mo. The idea being to issue one to a company."[12] "The theory was that the mill would be useful for grinding corn and other grain ... as well as the issue coffee."[13]

While there may be elements of the truth in all of these assertions—the only solid answer came to my attention just before this article was due. Mr. Howard Madaus, curator of the Cody Firearms Museum, thought I would find an authoritative article in the quarterly journal published by the Company of Military Historians. He was quite right. In a brief article on the origin and purpose of the Sharps mill gun, its author quotes directly from the January 6, 1865, report of an inspection board charged with inspecting and reporting about this modification (and other improvements) to the Adjutant General of the Army, Lorenzo Thomas. This board included an Assistant Inspector General for the Cavalry Bureau, a senior officer from the Subsistence Department, and its presiding officer was a gen-

eral officer from the Quartermaster Department.[14]

The inventor was Lt. Col. Walter King who was on "detached service" from the 4th Missouri State Militia Cavalry for all of 1864 and 1865 until he was mustered out on April 20, 1865. He was the son of Austin Augustus King, a former governor of Missouri and a member of Congress during the war. Col. King was actually promoting the adoption by the War Department of a group of four items, which the board characterized as "raiding equipments." Specifically, they were considering their use by small mounted units, especially those in frontier service. The "equipments" consisted of the Sharps carbine with a mill in its butt stock for grinding foraged grain, a cooking kit in a seven-inch square leather container, a saddle bag to hold two months' supply of sugar, salt, and coffee, and lastly a canteen with a shoulder strap.

The board's report was not encouraging. They felt that if there were grain available to be foraged, there would also be mills nearby for its processing. They expressed doubt that grain found in the field would be dry enough to be successfully ground into meal or flour. They also objected to adding more weight to the cavalryman's equipage when recent experience had shown that their first priority should be to see that the soldier is able to carry as much ammunition as possible. They also pointed out that the mill could not be universally installed, and in particular would not work on the more recently adopted Spencer repeating carbine—because its seven-round magazine runs right down the middle of its butt stock.

Allowing that others might disagree with their findings, the board recommended that Lt. Col. King be permitted to conduct a "fair trial in the field," and (at his own expense) be allowed to outfit a squadron of up to 100 men with the permission of the unit's commanding officer.[15]

At present it is not known if the field trial ever took place. In fact, much more research is needed to determine with documented certainty even the basic facts about this gun. Did Lt. Col. King intend for every mounted soldier to be issued his own "raiding equipments," or would they be spread out among the troops? How many Sharps were actually adapted to include a mill, and from what arsenal were they issued? Did Col. King have to purchase them himself or were they on loan and subsequently returned to the issuing armory? Who actually installed the mills and where? How were the guns finally disposed of? Did Congressman King use his influence to get his son a hearing for his inventions and permission to conduct a field trial?

The "Coffee Mill" Sharps carbine is one of the rarest guns collected. I know of four. It is often said that eight genuine examples exist. Others have estimated their being between 50 and 100. Much remains a mystery, and my research will continue in order to "tie up" the loose ends and one day to publish a more expanded article on this most peculiar firearm.

Notes

1 Steward Brown, *The Guns of Harpers Ferry.* (Berryville, VA: The Virginia Book Company 1986), 69.

2 Wiley Sword, *Sharpshooter: Hiram Berdan, his famous Sharpshooters and their Sharps Rifles,* (Lincoln, RI: Andrew Mowbray Incorporated, 1988), 42.

3 Claude E. Fuller, *Fuller Gun Notes,* (Collegedale, TN: Collegedale Bindery, 1957), 732

4 James Ogden, Historian, Chickamauga and Chattanooga National Military Park, personal communication.

5 Richard E. Hopkins, *Military Sharps Rifles & Carbines Vol. I* (self-published in 1960s, San Jose, CA), 50.

6 Arnold Chernoff's account of Andrew Lustyik's grinding trials, *The Gun Report,* "Gun of the Month, " 56.

7 Frank Sellers, *Sharps Firearms.* (Denver: Frank Sellers, 1982) 76.

8 Ibid.

9 From an advertisement for item #2270 in a reprint of a 1920s Bannerman's Manhattan surplus arms catalogue.

10 Hopkins, p 48.

11 Sellers, p. 76.

12 Fuller, p. 732

13 Harold L. Peterson, *The Treasury of the Gun.* (New York: Golden Press, Inc. and The Ridge, Inc., 1963), 175

14 Roger D. Sturcke, *Military Collector and Historian,* "Cavalry 'Raiding Equipment': The 'Coffee Mill' Sharps Carbine Question," XXXI: 4, 181–2, 1979.

15 Sturcke, p. 181.

David H. Arnold is an objects conservator in private practice.

Greg Byrne

The Conservation of the Classical Lighthouse Lens

Most of us can conjure up an image of a lighthouse beacon sending forth its light in the midst of howling wind, weather, and pounding surf. It does not take much imagination for us to see how these bluntly unforgiving environmental forces can threaten our nation's lighthouses. Although we have lost treasured lighthouses to these environmental forces, it surprises many to learn that when it comes to the classical fresnel lighthouse lens itself, it is not environmental factors which cause the most damage to them.

Based on the examination of dozens of deteriorated and damaged lenses, the human factor—visitor contact, ill advised maintenance practices, lens removal, transport and storage, and vandalism—does the most harm. The next most prevalent cause of damage results from the natural aging of the litharge glazing putty which holds the glass and brass together. The putty can release hazardous lead particles as it deteriorates, introduce stress into the system, and eventually will no longer adequately support the glass in the brass. The combination of these two factors can spell disaster for a threatened classical lens.

How Should Lenses Be Treated?

Conservation of a classical lighthouse lens should always begin with a condition assessment which looks at the overall physical and chemical stability of the lens. Each of the constituent materials is examined to identify health, safety, and maintenance issues, and basic stabilization needs. The assessment should result in a treatment protocol which addresses those needs. Treatments which extend beyond stabilization are most often presented as treatment options because decisions about restorative treatments can only really be decided when considered in a broader context. Interpretive goals, historic preservation goals, funding, staffing, and operational issues all come to bear on restorative treatment decisions. The question is not, "What kind of brass polish is best for a classical lens?" but rather, "What aspect of the lens' history is being preserved if it is re-polished?"

Context issues are not new to either conservation or the historic preservation field. The *Secretary of the Interior's Standards for the Treatment of Historic Properties* states that, "...the historic character of a property (or object) will be retained and preserved...(and that) each property will be recognized as a physical record of its time, place, and use. Changes to a property (or object) that have acquired historic significance in their own right will (also) be retained and preserved." The standards suggest that an appropriate level of conservation treatment—beyond stabilization—is best made by considering the context.

Historic Preservation most often concentrates on the preservation of historic evidence as preserved in wear patterns, operational damage, and/or interactions with historic figures and events. Evidence that a lens was properly maintained (polished, cleaned, etc.) would be preserved just as evidence to the contrary could also appropriately be preserved. For instance, chips in the prisms would not necessarily need to be filled to achieve historic preservation, especially if that damage is noted in the keeper's log or associated with an important personage or event.

Historic preservation can be less expensive and may require less preventive maintenance than ***restoration to period.*** This type of restoration is most often sought in instances where a lens remains in its historic architectural context. If that context is furnished and interpreted to a specific historic period, then period restoration is appropriate for the lens as well. A period restoration would address the most recent damage or deterioration and leave that which might reasonably be attributed to the interpreted period.

Period restorations can be less expensive and less difficult than ***full restoration,*** which is likely to be carried out when the interpretive goal is for the optic to appear as it would have when it was installed. It is also often the case that an optic that has been removed from its tower and is out of its historic context will be a candidate for full

restoration—especially if the lens is used as an interpretive tool to demonstrate the optical principles of the classical fresnel lens. The thinking is that damage (such as chips in the glass) presents a distraction to the viewer when the interpretation concentrates upon optics and illumination. If less complete restoration is desirable because of cost considerations, then discrepancies between appearance and interpretation can be successfully addressed with interpretive panels which discuss treatment and preservation goals.

Full restorations are often undertaken in the belief that a full restoration is historic preservation. Factors, including material selection and application, combined with the skill and experience of personnel can produce a variety of results. Misguided treatments can permanently scar the glass or brass and otherwise permanently damage the lens. Given the extraordinary value ascribed to classical lenses and the inherent risks in working with hazardous materials, it is imperative that a treatment plan be proposed by experienced offerors and that proposed treatment meet both the preservation objectives of the client as well as the actual needs of the lens. In addition to contextual considerations, there are, of course, the realities of available funding and ongoing maintenance issues which will impact final treatment decisions.

Stabilization Treatments

If the original deteriorated litharge glazing putty can be stabilized, then one of the major threats to classical lenses can be brought under control. As straightforward as this solution sounds, successful treatment depends upon a number of factors, including the composition of the putty, its porosity, previous treatment history, and the degree to which it has physically deteriorated. An alternative to the stabilization of the old glazing putty is its replacement, a time consuming and expensive option. Re-glazing is difficult because the lead putty is a hazardous material which requires special handling and disposal. The good news is that it appears that the French manufacturers changed the formulation of their glazing putty sometime around the turn of the century, opting for a lead oxide which appears orange-red in color instead of the more traditional lead carbonate which appears white. The change produced a more porous, slightly softer putty. A porous putty can be consolidated, hence stabilized—an impervious material cannot. New low viscosity silicone resins appear most promising as an encapsulant and consolidant and low molecular weight resin systems are also being evaluated.

Restoration Treatments

Repair and replacement of damaged or missing glass is the most sought after restorative treatment. To date, the least expensive option for the repair of broken or chipped prisms makes use of either an optical grade epoxy or epoxy/acrylic resin adhesive systems. More "reversible" adhesives are also finding applications for use in repair. Replacement of damaged or missing lens elements is another restoration solution. Options include replacement with cast epoxy, cast acrylic, or replacement with glass. Each approach has its particular advantages and disadvantages. The highest quality glass replacement is also extremely expensive. On the other hand, lower cost cast epoxy replacements can discolor with time.

The other treatment most often requested is that the brass support structure be returned to some previous appearance by repolishing it. The problem with polished copper alloys is that either constant maintenance or a brass coating that protects it from further corrosion is required to

A third order lighthouse lens on exhibit in the lighthouse keeper's quarters. Photo courtesy the author.

retain the polished appearance. Coatings are great when applied to small brass museum objects. They can be applied without much trouble, and when the time comes they can be removed and reapplied fairly easily. Not so with a 10 foot high by 6 foot wide first order lens which is 85 percent glass and 15 percent brass.

The decision to polish lens brass should be made only after a close examination of its condition. A highly developed layer of cuprite (the reddish brown corrosion layer often found on copper alloys) can indicate that the lens did not receive periodic cyclic maintenance during the historic period. Cuprite is a rather benign form of corrosion often thought of as a protective form of corrosion. It is only bright brass which can quickly corrode. Can the brass be returned to its former glory? Yes. Does the reddish brown form of corrosion need to be removed? No. Brass treatment and the impact re-polished brass has upon interpretation, historic preservation, and future maintenance should be thoroughly discussed by all affected parties before re-polishing is undertaken.

Future Directions

Conservation treatments are available now which will preserve the beautiful classical fresnel lenses in our nation's lighthouses. Architectural conservators, objects conservators, and historic preservation specialists continue their search for even better materials to improve techniques for treatment in the hope that a classical lens will no longer need to be removed from its tower because it is unstable. If a lens must be removed for other reasons, stabilization methods and improved packing techniques help ensure a safe relocation. In large part, it is the public's keen interest in these historic beacons which is helping to preserve them. Public support of preservation oriented institutions like the Lighthouse Preservation Society, the U.S. Lighthouse Society, and the new National Lighthouse Museum (to name a few), helps ensure that the classical fresnel lens will remain an integral part of lighthouse history.

Greg Byrne is a conservator at NPS Harpers Ferry Center–Conservation.

Larry V. Bowers

Lighting for Conservation

The National Park Service is the repository for an enormous variety of cultural artifacts. For most of us, the information and knowledge we receive in our visit to an NPS visitor center or museum is directly related to how well we see the art and artifacts presented.

We have learned much over the last 50 years regarding the effect of light on organic materials. Exposure to light energy (photons) induces a variety of chemical reactions, causing structural changes, embrittlement, pigment loss, and finish degradation. The degree of damage produced is the result of the amount of illumination and the length of time an object has been exposed. Ultraviolet light was once thought to be the primary agent of damage. We now know that visible light is nearly as damaging and must be controlled accordingly.

Damage from light is permanent and irreversible. Unfortunately, the only way to prevent that damage is to completely eliminate exposure; an obvious difficulty for parks wishing to display their collections. Complicating that is the fact that exhibits in the National Park Service are often designed as long-term installations, to last perhaps for decades. Under these circumstances it is easy to understand that lighting choices may have a great impact upon the important resources we have on display. And therein lies the problem.

The fundamental question proposed to the conservator becomes: what are the safest lighting levels for paintings, furniture, paper objects, textiles, etc.? From the conservator's perspective, the

answer to that question of course has to be zero. With no light, and an otherwise stable environment, we can guarantee that our objects will last a very, very long time.

Selection of a sensitive artifact for display automatically carries with it curatorial responsibility to provide exhibit circumstances which allow the object to be preserved for as long as possible while still on exhibit. Limiting exposure is the only alternative. This can be done in two ways: minimizing light levels or limiting the time an object is on display.

Visitor education is important and a component of successful object lighting. Visitor response can be negative if the exhibit design is poor or if he/she is unprepared for the lighting levels required for conservation. These are legitimate concerns. As we age, the light gathering ability of our eyes decreases, reducing visual acuity. An aging population poses increased demands on the skills of exhibit designers.

Until recently, many designers were under the mistaken impression that it was impossible to satisfactorily light objects at levels which meet conservation standards. Education, and the skillful work of individual lighting designers, has shown that it is possible to meet the standards of both disciplines, though it may take some skill and creativity. A variety of techniques can be employed to increase the perception of light and increase contrast, including selection of background color and providing adequate transition areas for visual acclimatization.

Conventional lighting manufacturers now produce a wide variety of lamps and luminaires that fulfill most museum lighting requirements. Lighting an object well can often be reduced to simply choosing the proper fixture and lamp.

Fluorescent lamps have traditionally been used in older style NPS exhibit cases. Though usually spurned for sophisticated object lighting, this type of lamp does offer a way of providing general non-directional illumination in an exhibit. Consumer demand has had a positive impact on this technology. Fluorescent lamps can now be had in a wide range of color temperatures (K)[1] and several have a color rendering index (CRI)[2] rating of 90 or more, far above older style lamps and well above the museum minimum of 85 CRI. They are certainly cost-effective, with life expectancies sometimes approaching 20,000 hours, an obvious asset if maintenance costs are paramount. If the lamp is selected well and carefully employed, fluorescents can still be useful in certain applications.

Directional lamps are considered superior for object lighting and allow the user to exercise far greater control over both aesthetic and conservation concerns. In recent years tungsten halogen lamps have become the standard for art and artifact lighting because of their ability to produce a crisp white light with a high color rendering index.

Fixture choice is important with price often, though not always, an indicator of quality. It is generally advisable to avoid the track lighting and fixtures in your local home supply store and deal instead with reputable lighting manufacturers who know their products and can offer advice and product continuity. Good quality fixtures usually offer the ability to alter your lighting through the use of accessory filters, spread lenses, barn doors, etc. These enable the user to control the shape, amount, and quality of light and greatly affect the presentation.

Lamps vary enormously and, within a particular style, offer a wide variety of beam spreads, wattages, and capabilities. Your choice of lamp will depend directly on the following:

- **Area of coverage desired.** This is defined by the beam spread of the individual lamp chosen. Most manufacturers will offer a variety of beam spreads within a given lamp model, ranging perhaps from a wide flood (60°) to narrow spot (10°).
- **Footcandle level desired.** This is a function of the lumens,[3] or light output, and the beam shape. The difference in the amount of lumens produced by an individual lamp type, from a given manufacturer (e.g., General Electric MR-16) is usually defined by the bulb wattage. For instance, a 25 watt GE MR-16 lamp will produce fewer lumens than a GE 50 watt lamp of the same type. Footcandle levels will also be greatly affected by the beam spread chosen. A more focused beam produces a more intense illumination. A narrow spot lamp may produce three times the footcandle levels on a given surface, from the same distance, as that of a similar flood lamp of the same wattage.
- **Quality of light.** The color rendering index (CRI) and the color temperature will affect greatly the appearance of the exhibit. Lamp choice may be related to the nature of the objects displayed. With monochromatic objects, CRI and color temperature may be of

little concern. Conversely, polychrome objects may require exact color rendering and a precise color temperature for proper display.

- **Special features.** Pressure from consumers and government regulation has led manufacturers to offer lamps with an expanded range of features, some of which are useful in exhibits. Some lamps now produce much lower levels in the infrared or ultraviolet parts of the spectrum. We've recently measured MR-16 lamps from one manufacturer, which produced only 5 mW/lumen of UV, very much below the museum standard of 75 mW/lumen.
- **Lamp life.** Depending on the manufacturer, individual lamps can differ enormously on life expectancy, within a given type. A few years ago most MR-16 lamps were rated at around 2000 hrs. Many MR-16s can be had today with 5000 hr. lamp life, lowering lamp replacement costs and reducing overall maintenance.
- **Cost.** Similar lamps can vary somewhat in cost from one manufacturer to another and special features may affect the price. The difference may be negligible however in relation to the required effect. A low-UV MR-16 lamp may only cost six to eight dollars and need replacing only once a year. By comparison, an Optivex UV filter for the fixture may cost 10 times that amount.

Where conventional lighting is inappropriate, developing technologies such as fiber optics and light pipes offer greater possibilities to satisfy conservation needs. Fiber optics, a relative newcomer to the field of museum lighting, were once considered an interesting, though not particularly practical, lighting tool. They are not suitable for all object lighting and they are certainly not a replacement for conventional museum lighting. However, as fiber optics offer the possibility of completely eliminating ultraviolet and infrared radiation from the object environment, they represent a viable alternative for lighting our most important artifacts.

The National Park Service has been using and testing fiber optic systems for exhibit lighting for over eight years. Subsequent to our first crude (but successful) attempts, we have installed a small laboratory in the Division of Conservation at Harpers Ferry to test a variety of lighting components. It has allowed us to compare and evaluate some of the leading fiber optic systems and given us a set of standards for application.

Fiber optics have been successfully employed for object lighting at a number of NPS sites, including LBJ, San Antonio Missions, Agate Fossil Beds, Harpers Ferry, and Friendship Hill. Fiber optic lighting systems are also in development for the Declaration of Independence at Independence NHP, and for a White House exhibit of 18th-century crèche figures.

As with any technology, fiber optics embrace both the positive and the negative. They are by no means perfect and should be approached from a thoughtful, educated perspective. Inappropriate application may lead to failure, increased costs, or maintenance problems.

Fortunately, over the last decade we have come a long way toward better integrating the needs of visual access without sacrificing the very objects which enrich our experience.

Recent advances in case design, environmental monitoring, relative humidity control, and exhibit lighting have changed greatly the way objects can be presented in our national parks. With a little knowledge and forethought, park staff can make effective and often cost saving, decisions about artifact lighting and the object environment.

Notes

1 Kelvin (K): the standard unit of measuring the color temperature of a light source. Ordinary household incandescent lamps are rated at 2500°–2800°K, producing a light yellow in coloration and considered "warm." Tungsten halogen lamps are usually rated 2900°–3400°K.

2 Color Rendering Index (CRI): the degree to which a tested light source accurately renders color compared to a Black Body at the same Kelvin color temperature. Lamps are rated on a scale of 0-100.

3 Lumen: the amount of light flow (flux) through one unit area at distance from a source of one Candela.

Larry V. Bowers is a conservator with the NPS Harpers Ferry Center–Conservation.

Nancy Purinton

Map Printing Techniques
An Introductory Note

Admit it. You have probably used and thrown away dozens of maps in your life—the sketch on a napkin that helped you to a party, the park map after vacation, the atlas that disintegrated under the back seat. But those were tools that helped you make spatial sense of the world! They helped you synthesize distance and observation! That's what maps do, after all. Consider a different situation. You are in a print storage room, looking at a map. It shows California as an island. European 17th- and 18th-century maps often depict California as an island. The image is old, but is the map old?

Many museums have maps in their collections and archives. In these collections old and modern maps are sometimes stored in the same drawer. It is important that museum staff responsible for the care and preservation of map collections be aware that there are old maps in park collections. A single characteristic of maps—print technique—will be discussed in this article. This is just the tip of the iceberg when it comes to learning about old maps. The goal of this article is to make you aware of the fact that there are old maps in many museum collections. If you are responsible for a map collection and it contains a map with the old print characteristics shown in this article, place it in an archival quality folder. If the map turns out to be a facsimile (a modern map that intends to deceive by imitating the paper, size and lines of an old map) you have made an error, yes. But you have erred on the side of caution and that's good. We will not discuss reproductions because they are modern maps that are not made with the intention to deceive; they don't even look old.

Connoisseurs can spend their entire lives learning about old, original maps. That knowledge is based on hundreds of hours carefully examining maps. The watermark, paper color, and texture can reveal information. A mark or stamp that might not even be noticed by the amateur could be a collector's mark and prove important. Even damage can tell a connoisseur about the history of a map. For instance, a cut edge could result from the map being removed from a book. This is a complicated field and this article will not attempt to summarize cartographic connoisseurship. What it will do is explain the basic differences between three important printing techniques that have been used over the past five centuries for making maps. Two will be found in old maps and the third is a technique found only in 20th-century maps. The characteristics of the printing processes described here are visible under magnification. A 10X power lens should be sufficient. A hand held magnifying glass is best because nothing is placed on the surface of the map. Be sure to look at several areas of the map to make sure the characteristics you see are visible throughout the image.

Don't ignore the antiquity of maps in collections. If a mistake is made in identifying a modern facsimile as an antique map (and extra care is taken for it), that is better than treating an antique map in the same casual way as those sold in the gift shop. If a map might be old, place it carefully in an archival quality folder.

Historically, there were only three ways of pressing ink onto paper: relief, intaglio and planographic. The **relief method** presses ink onto paper from the tops of the ridges in a block; examples are woodcut prints, linocuts and letterpress. The **intaglio method** presses ink onto the paper from the bottom of troughs made in a plate; examples are engraving and etching. The

planographic method presses ink onto paper from a flat surface; lithography is an example.

Process/History/Technique

Woodcut. This is a relief printing process and is the oldest printing technique known. Early on it was used for printing designs on textiles, playing cards, and religious prints. In Europe, it flourished in the 15th and 16th centuries where it was used in books printed with movable type.

The white areas of the design were cut out of a plank of wood with very sharp tools, probably knives and chisels. The plank was cut in the grain direction and fruitwoods, beech, and sycamore were used. The map was either drawn directly on the block (reversed) or transferred onto it. All the work had to be done skillfully because once the design was cut it was very difficult to make changes. If a change was necessary, a piece was cut out of the block and a wooden plug inserted.

A "wood engraving" is different from a woodcut because the image is made by cutting on the end grain surface. A sharp tool, the burin, could achieve very fine lines when used to cut the design into the end-grain. Wood engraving was popular in the 19th century.

Engraving. This is the oldest intaglio technique. Engraving had been done to decorate metal for ages. The process of making images by engraving a copper plate, filling the lines with ink and pressing it onto paper started in the 15th century and it was the most important map making technique until the 19th century. The advantages were that more and larger maps could be printed from a copper plate than from a woodcut and finer lines could be made. Revisions were also easier to make.

The plate was a flat, polished sheet of copper and the map drawing (reversed) was transferred onto the plate in a variety of ways. A highly skilled craftsman, the engraver, used a burin to cut the lines into the copper plate. Revisions could be made by raising the selected area, smoothing it and engraving the plate again. To print the map, the whole plate was covered with ink and then wiped carefully clean, leaving ink in the lines. It took a lot of pressure to transfer the ink to the paper and this was accomplished in the press.

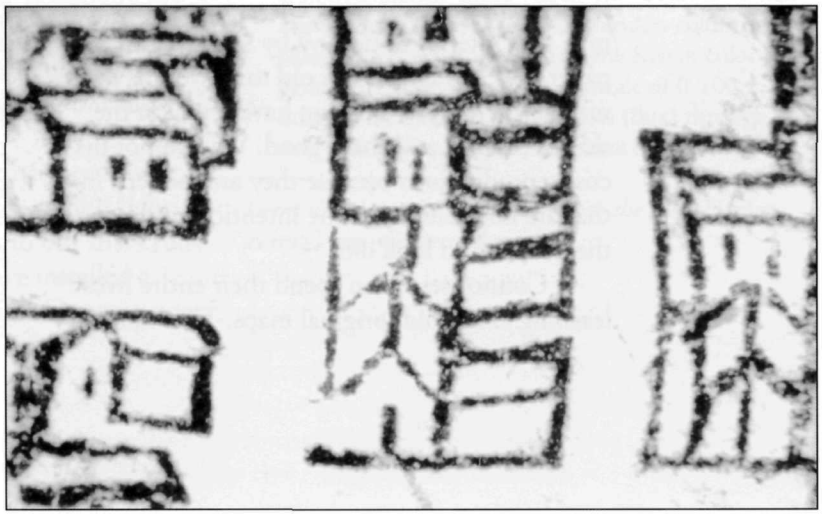
Lithography. Unlike the previous techniques, we do know who invented lithography: Aloys Senefelder, in Munich, in 1798. Senefelder referred to the process as "chemical printing." He used the repelling properties of grease and water to print from polished slabs of very fine textured limestone. He promoted his new printing process and news of it spread rapidly. Images could be made easily with lithography and many more prints could be made in this process than had been possible with woodcuts or copper plates. The demand for inexpensive maps in the U.S. was met by stone lithography during the 19th century. For the entire 20th century, however, offset lithography has by far been the dominant form of commercial printing, which includes maps.

The limestone attracted water and grease equally making this planographic technique possible. When the stone was inked, the ink was repelled by the water and would only adhere to the greasy drawing media in the image areas. In a press, the ink was transferred to a sheet of paper.

The same chemical properties work on special metal plates and these are most commonly used in the indirect lithographic process called "offset" lithography. In this technique the inked image is transferred to a rubber cylinder that presses the ink onto the paper. In offset lithography the image does not have to be drawn reversed and thousands of prints can be made an hour.

Identification

Woodcut. The appearance of woodcut lines (below) is a result of the tools and materials used



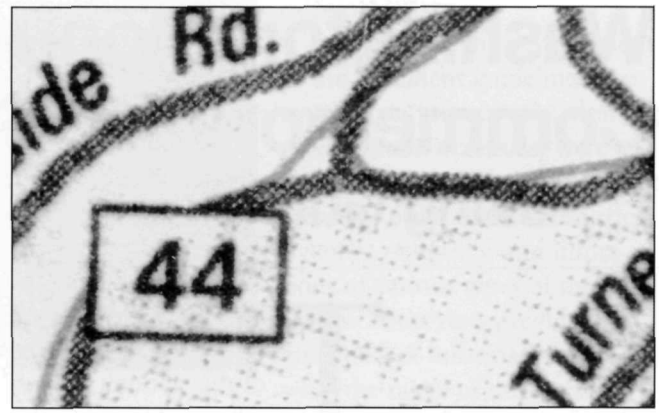
Magnified example of woodcut print.

to make the print block. For instance, a knife cut in a resistant material will usually be straight and sometimes slip. This results, in the print, in angular lines of uneven width. The ends of the lines tend to be square. Small round circles and letters are impossible. This medium is not well adapted to smooth, tight, gracefully turning lines. The woodcut print is characterized by a squarer, more severe and simpler looking image. In addition, the woodcut line was relatively fragile and could break after many printings, resulting in white breaks in the lines. Because the wooden lines are pressed into the paper, the ink can be thicker at the edges of lines and the lines can be embossed slightly on the back of the paper.

Engraving. The engraved line (below) will be pointed where the burin is inserted into the metal and blunt where the tool is removed. The engraved line can be very fine, graceful and curved but it cannot be loose or playful because the force of mechanically cutting the plate makes a casual or quick drawing style impossible. Shaded and dark areas are made with crossed lines, called cross-hatching. Solid, black, wide lines are impossible with this technique. Large, wide letters are made by cutting lines immediately adjacent to each other. Because the ink is deposited from troughs in the plate, heavy lines will be raised slightly above the paper surface. If the paper has not been cut down, there will be a platemark.

Magnified example of engraving.

Lithography. Photography has made lithographic processes the most problematic printing techniques to identify. Facsimiles of woodcuts and engravings have been made using lithography. However, this is a planar technique and the ink will always lie evenly on the paper. In offset lithography, seen magnified above, the image is made of tiny dots that have soft edges and merge in dark areas. Both black and color inks have this characteristic.



Magnified example of offset lithographic process.

Nancy Purinton is a conservator and supervisor of the paper conservation lab at Harpers Ferry Center–Conservation.

Photos courtesy the author.

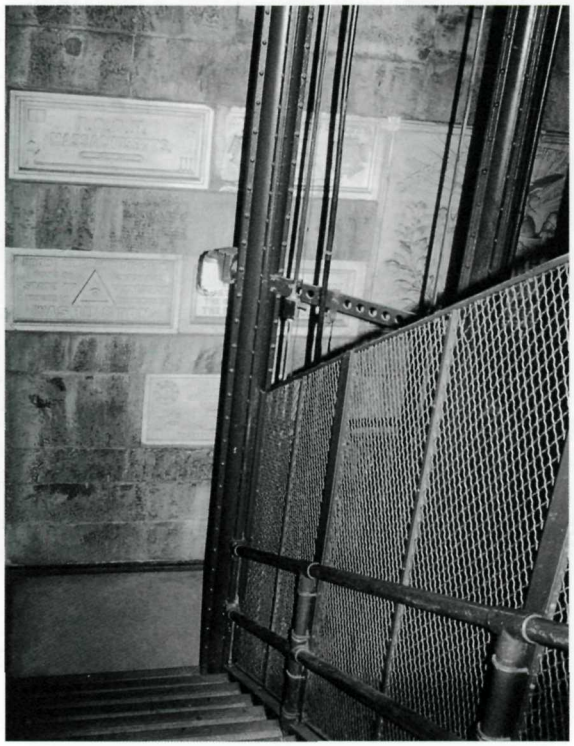
There are many variations of relief, intaglio and planographic printing methods. Only three were discussed here because, over the centuries, these three printing techniques were used more than any others to make maps. Books have been published about print making processes and maps. Two recent publications are *Collecting Old Maps*, by Francis J. Manasek, (1998) Terra Nova Press, Norwich, Vermont, and *How to Identify Prints*, by Bamber Gascoigne, (1986) Thames and Hudson Inc., New York, NY.

Judith M. Jacob

Conservation Treatments for the Washington Monument Commemorative Stones

Using Guidelines

The Washington Monument stands 555 feet tall in the center of this nation's capital.* Visitors take an elevator to the top, view the remarkable landscape, and then return to the elevator for the trip down, unknowingly riding past 193 commemorative stone tablets set into the walls of the interior. The stairs leading past these stones were closed 23 years ago in order to prevent the vandalism that had already damaged many of them. Now, as the exterior is completely enclosed in scaffolding for cleaning, repointing, and masonry repairs, National Park Service conservators are busy inside, carrying out conservation treatments to clean and stabilize the commemorative stones. This article describes these treatments and the guidelines that set the protocol for treatments.



Washington Monument Commemorative Stones on the 140-foot level. Photo courtesy Naomi Kroll, NPS.

What is so wonderful about the stones is their diversity: each stone is different. For conservators, the diversity is also the challenge. The stones range in size from 2-by-2 feet to 6-by-8 feet. Stone types include granite, marble, limestone, sandstone, soapstone, and jade. Some stones are quite simple while others have high-relief sculptures or in some cases, are fitted with bronze and silver plaques and letters. There is a stone from every state, and also from fraternal and community organizations, cities and towns, foreign countries, and individuals. Most of the stones date from 1849-1855. Sixteen stones also date to the 20th century, with the last one installed in 1989 to replace one that had been stolen from the construction site over a century ago.

The significance of the stones lies in the message that each bears through text, iconography, or specific material. The stone from Maine states "MAINE," the stone from New Bedford (Massachusetts) has a whale carved in relief in the center, and the stone from Arizona is made out of three slabs of petrified wood. Many of the messages have been compromised over the years by dirt, structural and surface deterioration, inappropriate repairs, and vandalism. The current work will restore the message of each stone: all text and pictorial elements should be legible and material should be readily identifiable. In restoring the message, the stones themselves may or may not be restored to their original appearances (for example, cleaning dirty white marble will remove a disfiguring gray color, but may not restore the bright white color of a new block of stone).

Conservation treatments are carried out to preserve cultural property for future generations. All treatments are carried out in accordance with the Code of Ethics and Guidelines for Practice of

Conservator steam cleaning the "Colorado" stone. Photo courtesy the author.

the American Institute for Conservation of Historic and Artistic Works. These professional standards ensure that treatments are based on a thorough understanding of the problem(s), they cause no harm to the cultural property, they can be removed at a later time, and are documented with text and photographs.

The conservation treatments that are being carried out on the commemorative stones follow a set of specific guidelines that were formulated based on significance and also on condition, test treatments, treatment limitations, and budget. Guidelines are important for any project, but for this project in particular they are especially necessary. While some stones are more finely sculpted than others, or are in better condition, not one can be considered more or less important than another. All stones are equal and the treatment guidelines help to ensure an equality of treatments. The condition of each stone is evaluated, treatment options are evaluated, and treatments selected that address the condition of the stone in relation to the message being delivered by the stone. Developing the guidelines was a fairly lengthy process and involved discussions with conservators and park management staff.

The condition of the stones at the beginning of the project has resulted from a period of time in which the stones have been completely exposed to the elements and subject to poor environmental conditions. This is evidenced in eroded and flaking surfaces, and also some cracks and fractures. Stones have also been vandalized by graffiti and removal of projecting pieces, and many stones have been scarred with misguided graffiti removal efforts. Previous cleanings have left abraded surfaces. In previous restorations, many missing elements were replaced with epoxy fills that have now yellowed. Incised letters in some stones were painted for easier reading. All stones are extremely dirty.

As part of the development of the treatment guidelines, test treatments (for example, cleaning methods and materials) were carried out on a number of different stones in order to learn the effectiveness, efficiency, and limitations of various types of treatments. These tests provided a great deal of information on what the range of treatments would be. Understanding the full scope of the work would not have been possible without first carrying out these tests.

For this project, all stones will be cleaned. If their condition is so fragile that cleaning would cause further deterioration, surfaces will be stabilized prior to cleaning. Cleaning serves two purposes: the first is to remove dirt and grime to restore a clean surface, and the second is to enable the better assessment of condition. Cleaning often reveals problems not visible beforehand. Following cleaning, the condition of each stone is re-evaluated and further treatments are executed if necessary.

The methods and extent of cleaning are guided, in part, by the lack of a water source in the monument. All water is brought up to the work areas on the elevator, and all dirty water is collected and brought down on the elevator; all elevator work must be carried out during hours when the monument is closed to the public. Therefore, cleaning methods use as little water as possible and cleaning is not expected to produce perfectly clean surfaces. For stones that have been marred with graffiti or otherwise stained, more aggressive cleaning treatments are required and great care is taken to ensure well-rinsed surfaces. In almost all cases, non-original paint in letters is being removed. This paint detracts seriously from the aesthetic impact of the stone itself and does not increase legibility to any great extent. Samples of this paint are being saved for future reference.

The epoxy fills from previous restorations are, for the most part, quite skillfully executed but they have now yellowed and no longer match

the stone. Because they are not harmful to the stone, the fills will not be replaced. Instead, their color will be adjusted by inpainting to match the stone. Inpainting will also be used to visually reduce, where possible, graffiti that has been scratched into the stones.

Missing sculptural elements that prevent the legibility of the message will be replaced with fills if there is sufficient documentation to enable the re-creation of the element. Letters that have remains of original finishes (gold leaf or paint) will be inpainted to restore the effect of the original decorative appearance.

Flaking and powdering surfaces will be stabilized to the extent that is possible. Stone flakes in the process of becoming completely detached will be reattached to the parent material. Structurally unstable stone will be stabilized with reinforcing supports. Powdering surfaces will be consolidated, if further examination and tests indicate the viability of this kind of treatment.

Three stones have deteriorated to such an extent to be completely illegible. These are being cleaned and stabilized only. Bronze plaques, bearing the original text, will be fabricated and installed adjacent to the illegible stone.

The documentation of this project provides a record of condition and treatment for each commemorative stone and is necessary for future conservation efforts. Documentation is also necessary for the future study of the stones and will greatly assist historians, art historians, and park interpretation staff. Stone descriptions, conditions, history of conditions, and treatments are recorded in a database specifically developed for this project. All stones were photographed in their "before treatment" state, and when the project is finished, "after treatment" photographs will also be made.

Ideally, there is no need for conservation treatments if all measures are taken to prevent deterioration and vandalism. Good preventative conservation practices are the absolute best form of preservation for all cultural property. Of the numerous environmental conditions that have lead to the deterioration of the commemorative stones in the Washington Monument, many have been alleviated or are in the process of being alleviated, and from now on, with maintenance, the stones should stay in good condition. Historic reports describe surfaces completely wet and dripping with condensation. This problem was solved last year with the renovation of the heating, ventilating, and air conditioning system. Heavy rainstorms now bring water pouring into the monument through open joints at the top. When the current exterior repointing work is complete, this problem too will be solved. Finally, keeping visitor access controlled with ranger-guided small tours should greatly prohibit future vandalism.

To ensure the continued good condition of the commemorative stones, periodic maintenance is necessary. At the completion of the project, a maintenance plan will be prepared with instructions for the park on caring for the stones. The only treatment necessary for the near future is periodic dusting and the plan will guide park staff in proper dusting techniques. There are some stones whose condition will require monitoring and the plan will give explicit guidance on proper protocol for monitoring. Finally, the maintenance plan will recommend the keeping of an up-to-date list of local conservators to be hired (at a moment's notice) in case of graffiti or other vandalism.

When the current treatments are finished, the stones will be in the best condition since their creation and, with proper maintenance, should remain in this condition for many years. The stones that were set into place a century-and-a-half ago will be ready for viewing, studying, and appreciation for many generations to come.

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* Robert Mills designed the Washington Monument in 1836, and in 1848, the cornerstone was laid. In 1855, when the monument was about 150 feet high, the Washington National Monument Society ran out of funds and construction ceased; the unfinished monument was left completely open to the elements. In 1878, the US Army Corps of Engineers, under the direction of Lieutenant Colonel Thomas Lincoln Casey, resumed construction and in 1884, the monument had been completed. It was first opened to the public four years later.

Judith M. Jacob is senior conservator, National Park Service, Northeast Cultural Resources Center, Building Conservation Branch.

Robin M. Hanson

More Than Simply Treatment

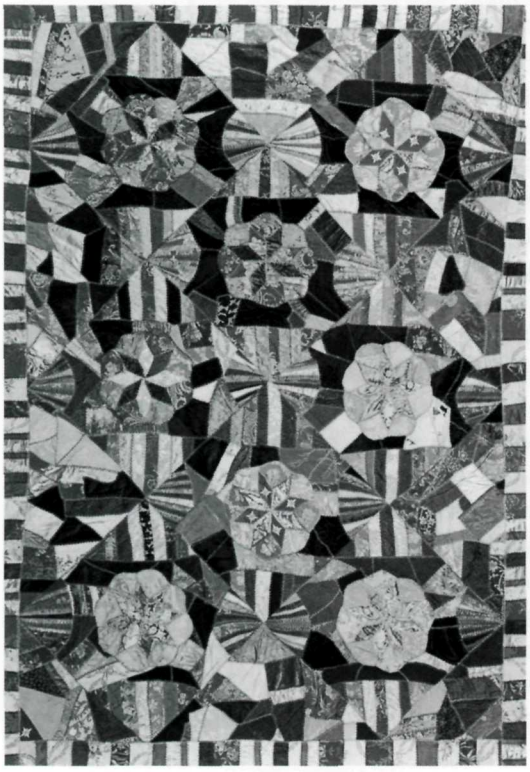
What a Conservator Can Tell You About an Object

Why would someone choose to send to a conservator an object that was not in obvious need of treatment? (The object's condition was excellent and it did not need to be prepared for storage or display.) What could the curator or historic site hope to learn from the conservator? What tools would be needed to accomplish the task?

These were some of the questions raised when the author examined an object from the White House collection. The goal was not treatment, rather it was to collect information. The object's provenance had been established; information provided by the conservator helped to confirm or refute what was already known about the object.

Background

White House object 995.1747.1 is a crazy quilt, a style of quilt popular in America during the last quarter of the 19th century and into the early years of the 20th century. The quilt is very large, measuring over 90 inches in length and 65 inches in width and comprising over 900 pieces and between 80 and 90 different textiles. White House records date the quilt to the period 1893 to 1904. Accompanying the quilt is a pillow sham, White House object 995.1748.1, that measures roughly 19 inches square. Neither the quilt nor the sham is signed or dated.



Crazy Quilt, c. 1893-1904, from The While House Collection. Photo courtesy the author.

The quilt and sham were constructed of scraps of upholstery fabrics, at least some of which were used in White House upholstery projects during the last decade of the 19th century. As such, the objects provide an invaluable record of late-19th-century furnishing textiles, the taste of the day, and textile manufacturing technology. The quilt and sham were made by A. E. Kennedy, a Washington, DC, merchant who provided a variety of services for the White House, including reupholstery, during the years 1893-1904.[1] Both objects were purchased in the summer of 1995 in Frederick, Maryland, at an estate sale of a descendent of A. E. Kennedy.

The quilt and sham are reflective of Victorian sensibilities in their use of a variety of rich textiles such as brocades, velvets, taffetas, and satins. By any measure, the textiles used throughout are sumptuous.

Project Description and Findings

One of the goals of the project was to determine if any of the fabrics used in the quilt and sham could be found on furniture in the White House during the last decade of the 19th century. Research focused on the main formal rooms of state on the first floor, particularly the East Room, and the Green Room, Blue Room, and Red Room. The interiors of the formal rooms of state were photographed frequently, therefore increasing the likelihood that photographs including upholstered furniture might exist and could be matched to fabrics used in the quilt.

As a first step, a Mylar overlay of the quilt was made. Pieces were counted and fabrics inventoried for later reference and characterized as to weave structure and fiber content.

A stereo binocular microscope (common equipment in most large conservation labs) was used to characterize the weave structure of the textiles. This step is particularly important in cases where there are several small pieces of simi-

larly colored textiles; determining the weave structure often can help confirm whether or not the two pieces are from the same textile.

A polarized light microscope was used for fiber identification. Because this testing technique is destructive (it requires the removal of several minute fibers from the object) only limited fiber analysis was accomplished in the course of this project and only in those few areas where existing splits or tears allowed a small sample to be taken. The excellent condition of the object made complete fiber analysis impossible.

Determining if any of the fabrics used in the quilt were the same as those seen in the historic photographs was a process akin to assembling a jigsaw puzzle. From the large black-and-white prints taken of sections of the quilt, all scraps of the same textile literally were cut out of the photograph, laid on a table, and oriented to try and establish a pattern, or repeat, that matched the textile on a particular piece of furniture in a historic photograph. Once properly oriented, the scraps were taped together. The results of this detective work are described below.

East Room

Although envisioned by the architect as a levee or reception room, the East Room—the largest of the formal rooms of state and occupying the entire east end of the first floor of the White House—instead functioned more as a grand salon. Photographs from 1890, taken during the Benjamin Harrison administration, show a room with furniture upholstered in a dark pile textile, presumably a velvet. The furniture was typical of the Victorian era, massive and solid in feel and very ornate, with elaborate fringe known as passementerie.

Green Room, 1893. Photo courtesy The White House (Library of Congress Collection).

While it was not possible to positively match the pile textiles in these black-and-white photographs to the pile textiles that appear frequently in the quilt, clearly pile textiles were commonly used upholstery fabrics. Period photographs reveal a large round ottoman in the center of the room and side chairs along the walls; all are upholstered in the same dark pile textile. Elaborate ornamentation in the form of long fringe is in evidence around the bottoms of some of the side chairs as well as the ottoman.

By the late-19th century, visual records reveal a room with an exotic feel. Large potted palms and ferns, interspersed with seating furniture, line the walls. Only a small section of this enormous room is revealed by the photograph. An upholstered armchair with elaborate fringe is seen in profile in the foreground. From the small yet clearly-visible area of textile covering the armrest, it is possible to identify this textile as one of the fabrics used in the quilt. It is a satin weave with gold warps and wefts in pale yellow and white comprising the design of varying species of exotic flowers—parrot tulips, double or triple carnations, chrysanthemums, and lilies, among others—appearing as "medallions" surrounded by interlocking circular garlands of small flowers such as forget-me-nots[2] and diamonds. The round ottoman, still present in the center of the room, has been reupholstered in a textile similar to or the same as the textile used for the armchair.

Because historic documentation indicated the room was decorated in gold and white, it is not illogical to assume that the furnishing textiles used in the room were gold. By cutting pieces out of the black-and-white photographs that corresponded to the same textile, and piecing them together, the pattern on the armrest could be established.

Green Room

Somewhat lighter and airier in feel than the East Room, the Green Room is a small room located along the south side of the building, between the East Room and the Blue Room. In a photograph dated 1893, taken at the end of the Harrison administration, a large piece of upholstered seating furniture, serpentine in shape, is covered in a lavish textile. Known as an *indiscret,* this type of seating furniture is described as being "typical of conversational seating fashionable

Red Room, 1893. Photo by Frances Benjamin Johnston, courtesy The White House (Library of Congress Collection).

during the Second Empire."[3] While the color of the textile cannot be determined from the black-and-white photograph, it is not unreasonable to presume that it was green. It is another one of the fabrics on the quilt, a satin weave with green warps and white and gold wefts. Again the repeat was established in the same manner.

Red Room

Adjacent to the State Dining Room, the Red Room traditionally is used by first ladies as a reception room. Photographs taken in the summer of 1893, during the second administration of Grover Cleveland, reveal another room typical of the Victorian era. Again large urns flank the fireplace, pictures are hung salon style on the walls, and the massive, solid wood chairs are sumptuously upholstered and finished with elaborate passementerie. The chairs that appear in the foreground of the photograph are upholstered in a textile that corresponds to yet another textile on the quilt. It is a satin weave with red warps and red and white wefts.

Of particular interest is the description of this upholstery fabric found while examining historic records. It was characterized as a "silk-like fabric with palmette-like medallions interspersed with small diamonds." This pattern can be seen in photographs where the repeat was established in the same manner. These small diamonds have been used as a design element in the quilt; several of the motifs in the center section contain alternating pieces of this red textile with its small white diamond, interspersed with a pile weave textile.

Since completing this research, the author made a fourth match using a photograph in Esther Singleton's 1907 book, *The Story of the White House.* In this undated photograph, Mrs. William McKinley is seated in an upholstered chair; the textile used on the chair is the same one used on the back of the sham. At least two other matches have been made by staff during the course of related research. In these cases, actual fabric scraps were recovered from furniture during reupholstery projects, and matched to fabrics used in the quilt.

As has been illustrated, invaluable information about this unique artifact was provided by the textile conservator. By using a few simple tools and techniques, the conservator was able to obtain information directly from the object itself. This information contributed to the understanding of the quilt's history and of furnishing textiles used in the White House at the turn of the century.

Notes

1 In the 1940s, a Park Service historian went through White House records at the National Archives and copied transactions, including invoices, between local merchants and the White House. From these records, Kennedy can be linked to specific White House projects between the years 1893 and 1904.

2 Forget-me-nots commonly were regarded as an emblem of constancy and friendship. In the Victorian era, the symbolism attached to specific flowers would have been widely understood.

3 Mary Schoeser and Kathleen Dejardin, *French Textiles: From 1760 to the Present* (London: Laurence King, 1991), 130.

Robin M. Hanson is completing an advanced internship in textile conservation at the NPS Harpers Ferry Center–Conservation. The research on this object was undertaken during her training in art conservation at the Winterthur Museum/University of Delaware Program in Art Conservation.

The author wishes to thank NPS textile conservator Jane Merritt for making this project possible and the White House Office of the Curator for facilitating access to historic photographs and allowing results of this research to be disseminated.

Deby Bellman

Passive Supports for Textiles

The Textile Laboratory in the Division of Conservation at Harpers Ferry Center designs mounts for the display and storage of textiles in the national parks. Considered part of a conservation treatment, these mounts provide support enabling textiles to be handled safely and allow for easy exhibit rotation of fragile artifacts.

Several factors determine the type and design of the mounts. These include artifact condition, anticipated duration of the exhibit, method of display, and the desire to handle artifacts without causing stress or damage. With these considerations, the support is designed to meet the individual needs of the object. Whenever possible, a passive mounting technique is used so that excessive handling and stress to the object can be eliminated. Passive supports can perform dual functions; they may be used for display as well as for storage.

Due to the sensitive nature of textiles, passive supports may be necessary for both exhibit and storage. Constructing a support serving both purposes provides a cost saving for the parks. The textile's original intended use, design, and current condition are crucial in determining the method of the support to construct.

Inaugural coat worn by George Washington, Morristown National Historical Park. After treatment support board and interior supports.

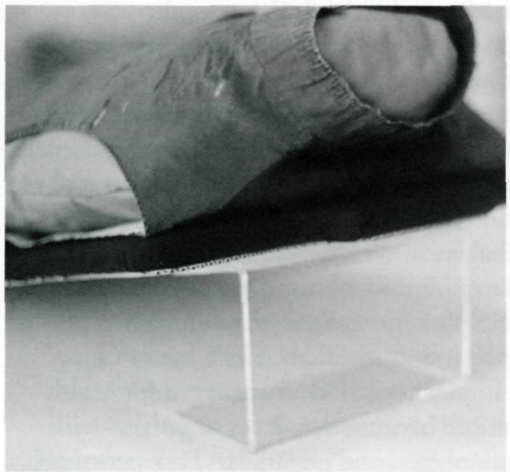
Support Types

There are many types of supports or mounts that can be used with textiles. However, with all methods of support, remember that the materials used for fabrication should be archival or inert. Flat textiles are best placed on archival boards covered with thin polyester batting and washed de-sized cotton fabric. This provides a surface that prevents the textile from sliding. Placing flat objects on padded boards also provides a safe and secure method of moving the object and eliminates direct handling. Not only does the board provide a base for safe storage, but it can also double as a mount. By placing the board on a slight angle, it can accommodate exhibit needs.

Costumes and period clothing are often essential parts of an exhibit or collection. Clothing in good condition can be placed on a custom made padded mannequin that supports all the elements of the garment. Care should be taken to rotate the costume off exhibit as a preventive conservation measure.

A garment in fragile condition requires a different approach. In some storage areas, clothing can be laid flat and the folds of the garment padded by inserting tissue into the folds to prevent the fabric from creasing. Because tissue tends to settle over time, it reduces the support and causes the textile to flatten and crease. Padded pillow supports are an alternative to tissue. They can be made from nylon fabric or polyester stockinette tubing filled with polyester batting, and placed in the garment simulating the shape of the object.

Morristown National Historical Park, New Jersey, has in its collection the inaugural garments belonging to George Washington. The garments, a silk coat, vest, and trousers, are in very fragile condition. The park requested the garments be prepared for long-term storage. However, they also wanted the option to exhibit any one of the



Inaugural vest worn by George Washington, Morristown National Historical Park. Acrylic support in place while artifact is on exhibit.

garments on special occasions for a short period of several weeks. The garments were too fragile to display on a mannequin or even to be handled frequently, so it was necessary to develop a passive system of mounting and storage that eliminated the need for direct handling. A base support was developed for each of the three pieces. This consisted of rigid archival boards cut close to the shape of the objects, each was slightly padded with polyester batting and covered with cotton fabric. An interior support pillow made from nylon fabric with polyester batting was placed into the clothing. The smooth surface of the nylon allows the pillow to slide in place without excess friction on the artifact and the batting will not collapse over time. While in storage, the clothing lays flat on the support. When the park wishes to display one of the garments, the board is placed on exhibit and raised for viewing by placing an acrylic wedge under the board to allow a viewing angle of 15 degrees.

A similar passive support was also utilized on a silk velvet vest in the collection of Andrew Johnson National Historic Site, Tennessee. Upon completion of the conservation treatment, a storage box was made to house the vest. An interior pillow support was fabricated from nylon fabric and polyester batting. This was placed in the vest to provide support for the velvet and prevent any creases from forming.

Textile conservators use a variety of techniques to support and display objects. When possible a passive support system is chosen. While providing a three-dimensional appearance to the object, passive mounting techniques also provide support to the object. This system allows easy exhibit rotation and eliminates the need for direct handling of fragile artifacts. Combining these two preventive conservation factors provides for both the exhibit and storage needs of the object.

Deby Bellman is assistant textile conservator, NPS Harpers Ferry Center–Conservation.

Photos courtesy the author.

Barbara Cumberland

Using Freeze-dried Animal Specimens in Exhibits

The use of freeze-dried animal specimens in National Park Service exhibits became popular in the late-1970s through the mid-1990s. Freeze-drying animal specimens for display purposes is an alternative to conventional taxidermy techniques or fabricating models out of synthetic materials. This article will deal with the use of freeze-dried specimens acquired for national park museum and visitor center exhibits as opposed to their use in scientific study collections in museums.

Conservators at the Harpers Ferry Center Division of Conservation are often called upon by park staff to answer questions about their museum collections. In the mid-1980s, the number of park inquiries about evidence of insect infestation and deterioration of freeze-dried specimens in exhibits increased.

Freeze-drying technology

The Smithsonian Institution popularized freeze-dry technology on natural history specimens for museums in the 1950s. It was a quick, effective technique for interpreting accurate animal forms. Freeze-drying converts water in the specimen from its frozen state directly to its gaseous state, a process called sublimation. Animals are first frozen into a desired position (held by wiring or propping) and then placed in a vacuum chamber at -15°C to -20°C. Ice crystals

are allowed to sublime from the specimens, which results in minimal distortion. In most cases, body organs are retained, although sometimes the animals are first eviscerated (the preferable option). Freeze-drying has an advantage over conventional taxidermy of ease and inexpensive labor costs, although the product is not always less expensive. Freeze-drying can give a more realistic appearance on small, delicate specimens than traditional taxidermy. Although freeze-dry preparators do not readily admit the possibility that incomplete drying and rehydration can occur, there have been many reports of this happening in national parks and other museums. Incomplete sublimation occasionally occurs in larger specimens, sometimes causing brittleness of the outer surfaces, while some internal tissue may still contain its original 90% moisture content. Incomplete drying can be a more likely cause of tissue decay than exposure of specimens to high humidity on display.

The success of an exhibit of freeze-dried materials depends on understanding the limitations of the process, a commitment to maintenance, and proper exhibit design. Contrasted with conventional taxidermy, freeze-dried material is more porous and brittle, and vulnerable to insect attack, biodeterioration and oxidation. Specimens are collapsible and easily scarred if handled improperly.

In animals with a naturally excessive fat and oil content (generally all those that live near water), there may be fatty acid damage because lipid oxidation and degradation occurs when materials are frozen. It can attack the skin, deteriorate protein and go rancid. Microorganism attack follows. Conventional taxidermy is recommended over freeze-drying for fatty and large specimens. Freeze-dried specimens should always be isolated from collection objects to avoid contamination by migration of fats and oils.

Freeze-dried specimens are especially attractive to protein- and keratin-eating insects such as clothes moths and dermestids (carpet beetles and hide beetles), and insect attack is highly probable in unprotected specimens. In the past, some taxidermy specimens were protected from persistent infestation with Edolan U, a mothproofing pesticide (the only pesticide that seemed to work for freeze-dry preparators), but it is no longer on the market and has not been replaced. Well-sealed exhibit cases, combined with periodic pest inspections by trained staff, are the best protection available to parks.

Freeze-dry preparators often recommend either routine (once/year) refreezing of specimens for pest control, or the inclusion of a vapor phase space fumigant such as paradichlorobenzene, naphthalene or dichlorvos (Vapona strips) in a sealed exhibit case with the specimens. However, the NPS does not endorse this fumigant approach in most instances. The use of vapor phase fumigants is now discouraged for health reasons and because they react negatively with museum objects and materials.[1] Park personnel must first request review and approval for any pesticide use from their Central Office or Washington Office Integrated Pest Management (IPM) Specialist. In response to signs of infestation or as a preventive measure, cleaning the case with a nozzle attachment vacuum and the use of a crack and crevice treatment using diatomaceous earth or Tri-Die((silica aerogel containing pyrethrum) may be considered. As part of the park's IPM pest monitoring program, using sticky traps with pheromone lures[2] for webbing clothes moths and varied carpet beetles is effective for early detection in the exhibit space.

To kill all stages of insect pests in freeze-dried mounts, a controlled re-freezing[3] is most often recommended both as a preventive measure and a response to pest evidence. After freezer treatment, any insect evidence is removed from the object mechanically and the specimen is assessed to determine the extent of damage. It may be cleaned, conserved, and re-used if damage (e.g., loose or lost fur or feathers) is minimal. All freezing and conservation details should be documented and kept with the object's permanent records.

There are other methods of disinfesting specimens such as suffocation by various anoxic fumigation methods, toxic vapor phase fumigation, and a newer procedure of plasma field sterilization under vacuum. Freezing is more practical for park staff and many museums because it requires less specialized equipment, and if done correctly, is as effective, cheaper, and safer. It offers no residual protection, although freezing can lower the moisture level in the specimen making it less appealing to insects.

Re-freeze-drying has been recommended when there is moisture regain in the specimen, because freezing itself will not solve the problem. Specimens should not be saved once tissue decay has begun. Strong odors can be a warning sign of deterioration, although the animals can normally have their own peculiar odors.

As with conventional taxidermy, freeze-dried mounts can potentially be damaged and change color at high light levels. Exhibit lighting should be filtered for UV, with 3-15 foot-candles as the recommended light level.

Surveys of NPS Sites with Freeze-dried Taxidermy Specimens

In January 1991, all 16 parks[4] with freeze-dried animals in their exhibits were surveyed to find out if they were experiencing any maintenance problems with the exhibits installed between 1978 and 1990. The survey was updated in March 1999 and 24 parks were contacted[5] that had these kinds of specimens on exhibit (the same parks contacted in 1991 and all others known to have freeze-dried exhibits installed since 1990). Details of the survey questions and results may be requested from the author.

The 1999 survey indicates eight parks reporting no problems with their freeze-dried specimens, while 16 reported that there have been instances of insect infestation, damage and tissue decay. The fact that two-thirds of the parks with freeze-dried specimens reported extensive problems is alarming.

Some parks have open dioramas. Parks claiming well-sealed exhibit cases tended to report fewer insect incidents. None of the parks presently have a fumigant included in the cases with the specimens although one had Vapona strips and one had paradichlorobenzene cakes included at installation. These fumigants were since removed when no longer recommended or available for museum use.

Pests identified in the park surveys included dermestids (varied carpet beetles, buffalo carpet beetles, Trogoderma sp., and unidentified); clothes moths (webbing clothes moths and case-making clothes moths); fungus and stored product beetles (confused flour beetles, rove beetles and minute brown scavenger beetles); psocids, fly maggots and cockroaches. Pest evidence included frass and dust on and beneath specimens, cast larval skins, live and dead insects and larvae, holes, hair loss, feather damage and loss, holes in beaks, skin eaten off feet, specimens eaten from inside out, etc. Reported evidence of rehydration and tissue decay included bad odor, mold, and rotting lesions. In several instances, all freeze-dried specimens at a park eventually needed disposal and replacement with non-freeze-dried options.

The freeze-dried animals in the parks found with pest evidence/damage or tissue decay included owls, turkey vultures, herons, turkey, bald eagles, hawks, ducks, waterfowl, other birds, rat, skunk, raccoons, squirrels, rattlesnake, black bear cub, dungeness crabs, opossum, coyote, badger, prairie dogs, bobcat, muskrat, nutria, otter, mink, weasel, armadillo, baby deer, small alligator, turtle, fish, beaver and wolf. Many of these animals are larger than the size we now recommend for freeze-drying (squirrel or smaller), and some are fatty animals such as those that lived around water.

Case Study

My interest in this subject was rekindled when I did an on-site conservation project at the Alaska Public Lands Information Center in Anchorage in 1997. Their visitor center has many freeze-dried and conventional taxidermy mounts and fish models, both in exhibit cases and out on open display. During my visit, the park replaced two freeze-dried dungeness crabs that were infested with webbing clothes moths and very odorous from tissue decay. The taxidermist who had prepared them provided free replacement freeze-dried crabs to be reinstalled in the closed exhibit cases. Within one year, the new dungeness crabs were infested with dermestid beetles, Anthrenus scrophulariae (Buffalo carpet beetle). The case is not insect-tight but it is also possible that dermestid eggs or larvae were present inside the crabs at installation. After the initial infestation, I recommended that if the crabs ever needed replacement again, synthetic models be made instead of using freeze-dried specimens. This was done in 1998. This visitor center also lost a freeze-dried black bear cub and an eagle to separate webbing clothes moth infestations. The eagle also had minute brown scavenger beetles associated with it. Those specimens were not enclosed in exhibit cases.

The exhibit design here is a clear instance where infestations of individual freeze-dried spec-

imens are a great threat to the other freeze-dried and conventional taxidermy specimens on open exhibit and within cases, and also to sensitive ethnographic collections that are in separate exhibit cases. I had carefully inspected and cleaned the taxidermy specimens during my visit to the park, and advised on a pest management strategy to prevent the spread of infestation. The specimens require close and frequent inspection, and a pest monitoring program that includes sticky traps with webbing clothes moth pheromone lures. When the pest evidence was discovered on the eagle, the evidence was saved for identification, the eagle was sealed in a plastic bag and frozen to kill the pests. After freezing, when the conservator examined the eagle it was found to be too damaged (feather loss, holes) to save. It will be replaced with a specimen prepared by conventional taxidermy and enclosed in an exhibit case. The park is considering changing the exhibit design in the future to include enclosing all specimens in well-sealed exhibit cases.

Recommendations

For very long-term exhibits featuring animals, the best solution may be the use of models fabricated from synthetic materials. While slightly more expensive initially, replacement costs of deteriorated or infested specimens are unlikely to be a factor with fabricated models. It also has the advantage of not harvesting animals from the environment and being less of a maintenance challenge. There are a growing number of exhibit studios that have the ability to produce high quality models. The NPS now uses models for all exhibits with fish.

If a park or their exhibit designers decide to use actual non-living animals in their exhibits, they need to make an informed decision between using conventional taxidermy or freeze-dried taxidermy specimens. The method of preparation should be suited to the particular specimen to be preserved and the exhibit circumstances. Conventional taxidermy is preferred in most instances, especially open displays. It has the advantage of lasting longer, reduced insect vulnerability and reduced humidity sensitivity.

Conventional taxidermy preparation should be used instead of freeze-drying when any of the following conditions exist:[6]

- Specimens are large (larger than a squirrel or songbird)
- Specimens have high fat content (e.g., ducks, fish, otters, beaver, etc.)
- Open displays are to be used (no exhibit cases)
- Ambient humidity levels are likely to be high (above 55% RH)
- Exhibit is long-term

Because the statistical evidence from the 1999 survey showed significant pest and biodeterioration problems in two-thirds of the 24 national parks with freeze-dried exhibits, I tend to advise against the acquisition and use of freeze-dried animals in future exhibits. In instances when the freeze-dried specimens need to be replaced, the replacement specimens should be either models or conventional taxidermy.

For parks with exhibits of freeze-dried animals in less-than-ideal conditions such as open dioramas or poorly sealed cases, it is important to be especially aware of the limitations of the specimens and have a good pest management program in place. Replacement costs are often incurred when the exhibits are expected to last a long time. These displays will always require maintenance, cleaning, and frequent inspection.

Notes

1 Anthony M. Knapp, *Conserve O Gram,* 2/4, "Dichlorvos (Vapona) Update." 1993.

2 Source: Fumigation Service & Supply, Inc. Phone: 800-992-1991.

3 Raphael, Toby, *Conserve O Gram,* 3/6, "An Insect Pest Control Procedure: The Freezing Process." 1994.

4 Alaska Public Lands Information Centers-Anchorage and Fairbanks, Big Cypress NP, Bryce Canyon NP, Cape Cod NS, Devils Tower NM, Effigy Mound NM, Everglades NP, Glacier Bay NP, Great Smoky Mountains NP, Gulf Islands NS, Jean Lafitte NHP, Joshua Tree NP, Rock Creek Park, Voyageurs NP, and Yellowstone NP

5 The National Parks above (4) and also: Big Thicket NP, Buffalo River NP, Glacier NP, Guadalupe Mountains NP, Harpers Ferry NHP, New River Gorge NR, Sleeping Bear Dunes NL, and Theodore Roosevelt NP

6 *Exhibit Conservation Guidelines- Technical Note* 1:8, "Selecting Taxidermy Specimens for Exhibit". Division of Conservation, Harpers Ferry Center, National Park Service. CD-ROM, 1999.

Barbara Cumberland is assistant conservator, NPS Harpers Ferry Center–Conservation.

Alan Levitan

Totem Preservation in Southeast Alaska

Emblazoned on posters, tourist brochures, and now even web sites, totem poles have come to symbolize the land and the cultures of the Northwest coast. The totem region, roughly 1,000 miles long and 100 miles wide, includes both coastal British Columbia and Southeast Alaska. Here in the resource rich, temperate rain forest a complex material culture evolved marked by a unique artistic style,

The art of the Northwest coast is governed by subtle rules of line and form. Few objects, whether wood, bone, shell, or fabric are left unembellished with carved, woven, or painted design. Although the artistic style evolved independently over many hundreds of years, most scholars now agree that carving of monumental wood sculpture did not become common until after contact with Europeans. This contact provided two elements that would make large scale carving easier: ready availability of iron for tool blades and the beginnings of a cash economy with specialization of labor. Russian traders, the first Europeans to explore the coast, highly valued the pelt of the sea otter, found in abundance in coastal waters. Trade in these pelts provided an income source for many in the tribal aristocracy. The newfound wealth and status were displayed most prominently in potlatches, ceremonial gatherings where material goods were given away to the guests. These events were often marked by the erection of totem poles, commissioned and paid for by the host.

Participants in a preservation workshop cleaning pole surface in Wrangell's Kik.setti park in preparation for the application of fungicide. Photo courtesy Randy Rodgers, Sitka National Historic Park.

Totems are almost always carved from a single log, although appendages such as wings and beaks may be carved separately and attached by means of a mortise and tenon joint. Western red cedar (*Thuja plicata*) was the wood of choice. This species grows to tremendous size, is relatively easily carved, and has natural resistance to the fungal deterioration that progresses quickly in the moist environment of the coast. The region where totems were traditionally carved is limited by the natural occurrence of cedar. In the southern reaches, where the cedars grow large, poles four to five feet across and 50 feet high were not uncommon. However, in the north where environmental conditions limit the size of the cedar tree, totem carving changes in scale and style.

The golden age of totem carving is short, generally considered to be between 1830 and 1880. By the 1880s disease had decimated the population of many of the native communities. This, together with governmental and church efforts, resulted in the destruction of many aspects of the traditional culture. At about the same time, expeditions, often organized by museums in the large cities of both Canada and the United States, began to assiduously collect material culture of the Northwest. While some were scrupulous in paying for the cultural property, others assumed that all goods in villages not permanently occupied were free for the taking.

Shortly after the turn of the century the territorial governor of Alaska, John Brady, sent out the sailing ship Rush to collect poles from Tlingit and Haida villages on the shores of Prince of Wales Island. Brady's intent was to send the totems to expositions in St. Louis and later Portland to draw interest to the Alaska exhibits. Most of these poles were eventually shipped back to Sitka, the territorial capital, where they were erected on the old Russian walk along a small peninsula just outside of town. Initially administered by the territorial government, this site was declared a national monument in 1910 and was incorporated into the national park system in 1916. The poles and the scenic trail along which they are erected now form one of the primary cultural resources of Sitka National Historical Park.

Pole Preservation

The condition of many of the poles was poor at the time they were collected, and this was a concern of the territorial government. Notes and early photographs in the park archives indicate that the poles were repaired before they were shipped south and again prior to erection in Sitka. Early preservation efforts consisted primarily of filling checks with plaster and wood shims, covering decayed areas with sheet metal and linseed oil coated canvas and re-painting. Though traditionally paint was used sparingly to highlight features or carved forms, in the early days of the park it was applied over all surfaces, often in non-original colors. The caretakers were aware of the deteriorating condition of the pole collection, however, their ability to improve the situation was limited by lack of money, manpower, and knowledge of the nature of wood decay.

The CCC Era

New efforts were directed to preserving the poles in a depression-era Civilian Conservation Corps program administered by the U.S.Forest Service. Experienced carvers were hired to teach unemployed young native men carving skills. Sitka was one of about half-dozen sites in Southeast Alaska where the CCC worked to preserve poles and by so doing preserve important cultural traditions as well.

The work included both repair of poles and replication of those that were considered beyond repair. The repair process typically entailed recarving of the outer weathered surface, extensive wood patching of decayed areas, filling of checks with plaster, fastening of sheet lead caps to end-grain surfaces, applying fungicides and repainting. Although some of the techniques and materials employed would not be acceptable by today's standards, without the efforts of the CCC program most of these poles would not now exist in any form. Today many of the original poles have been placed in protective museum environments. A few, carved from particularly resistant logs, can still be found standing in totem pole parks throughout Southeast Alaska.

The highly deteriorated poles were taken down and placed beside new cedar logs for replication. A few segments of the original poles were salvaged at that time, but most were left to decay. At some sites a few of these totems remain recognizable, lying on the forest floor covered with mosses and saplings. The replicated poles, which now possess historical value in their own right, form the core of the collection of poles still exhibited outdoors at Sitka as well as other totem parks.

Recent Preservation Efforts

Recognizing that the CCC era poles in their collection were deteriorating, the staff of Sitka National Historical Park asked the wooden artifact conservators in the Division of Conservation, Harpers Ferry Center, to undertake a condition survey. In conjunction with that survey, the park hosted a conference in the summer of 1991 that brought together subject matter specialists, conservators, carvers, cultural resource managers and members of the local community both native and non-native.

Initially one of the more contentious issues was the propriety of preserving poles at all. Traditionally, little value was placed on preserving poles and some members of the native community thought it best to allow old poles to simply deteriorate and return to the earth from which they came. After considerable discussion, a consensus emerged that it was indeed appropriate to preserve examples of earlier carvings to provide inspiration and information to contemporary carvers as well as the general public. The conference attendees felt that this effort should go hand-in-hand with efforts to preserve the skills and cultural traditions associated with totem carving, one of the activities of the park since the 1960s.

In consultation with the park staff, the research and planning for the preservation of the pole collection began. It was apparent that the most pressing need was to stabilize the poles on exterior exhibit and that treatment of the original poles and pole fragments in interior display and storage should be put off until a later phase. In early discussions it was emphasized that conservation treatment and continuing cyclic maintenance could extend the exhibitable life of the poles considerably, but they could not be preserved for the long term in an outdoor environment. We therefore recommended that plans be made for eventual placement of the poles in protective storage or display.

Seven poles were taken down and remounted on new yellow cedar support posts in the first phase of treatment. The rest were stable enough to undergo treatment while standing. Treatment generally included cleaning, consolidation of areas deteriorated by fungi and insects,

structural repairs, and the application of a non-toxic fungicide and insecticide followed by application of water repellent. In some instances where the splits in the poles were extensive, support systems were fabricated out of stainless steel or aluminum and attached to the rear. Generally, lost elements were not replaced. Where replacements were made, either for aesthetic or structural considerations, native craftsmen, familiar with the art form were asked to carve the elements. A number of factors led to the decision not to repaint the poles: the original paint colors and patterns were not known with certainty, an intact paint layer restricts the penetration of fungicide, and we felt that fresh paint tends to look awkward on weathered wood surfaces.

The preservation work at Sitka took place over a number of summer sessions. This enabled us to assess the effectiveness of the materials and techniques after a few years of exposure and adjust the treatment accordingly. Based on that assessment a cyclic maintenance plan for the outdoor poles was prepared. The park maintenance staff initially worked with us on the pole treatment to gain experience and in recent years has successfully taken over the cyclic maintenance tasks.

Spreading the Word

As word of the preservation work at Sitka spread, caretakers of other pole collections in southeast Alaska approached the park about sharing its expertise. Recognizing the broader responsibility of the NPS to the preservation of these unique artifacts, the park responded by serving as a local clearinghouse for preservation information and helping to underwrite travel to perform condition surveys for other totem collections.

After assessing the condition of the poles at a variety of totem parks we began to realize the magnitude of the preservation problems, the similarity of the problems from site to site, and how pressing the need for treatment is if the CCC era poles are not to be lost. Although some of the preservation tasks require the knowledge and skills of a conservator, it was evident that with proper training individuals who are steeped in the tradition and live in close proximity to the resource could accomplish many aspects of treatment at less cost. Further we felt the treatment of totem poles could potentially serve as a focal point for community activity and help galvanize interest in the preservation of cultural traditions.

With that in mind, the Division of Conservation, in partnership with the Wrangell Museum, and Sitka National Historical Park, applied for and received a grant from the NPS's Cultural Resource Training Initiative (CRTI) program to provide training in carved pole preservation to residents of Southeast Alaska. The goals of the workshop were to enable participants to understand the nature of the threats to pole preservation, evaluate the condition of poles in their own collection, identify the treatment options, and perform some of the basic treatments. The course was geared to individuals, particularly members of native organizations, who have direct responsibility for caretaking the monuments but little background in the philosophy or practice of preservation.

The response to the workshop, which took place in April 1998, was encouraging. It brought together carvers, curators, conservators, and tribal administrators for an intense week of information exchange through lecture and hands-on work. Perhaps most valuable, the participants came to realize that others shared their concerns and that although the preservation problems are substantial, they are solvable. By the end of the week a fledgling pole preservation organization was established with the mission of disseminating information and working to secure funding for carved pole preservation.

The participants were unanimous in asking that a follow up workshop take place that will focus on additional hands-on preservation techniques. Thanks again to funding from the CRTI the course is scheduled to take place in Wrangell in August of 1999. This project provides a good example of how the NPS can leverage its expertise and funding and thereby have a positive effect on cultural resource preservation beyond it's own boundaries. One of the course participants wrote:

> I have learned much and been inspired and encouraged to go home and care for our poles. I feel more confident about what I can do.

If that attitude can be sustained the outlook for the preservation of these significant artifacts will be much enhanced.

Alan Levitan is a conservator of wooden artifacts, Harpers Ferry Center–Conservation.

Martin Burke

Contracting for Object Conservation Treatment

The National Park Service regularly contracts for object conservation services. Services include conservation treatment of individual museum objects, collections, historic structures, and various types of collection and condition surveys. The few conservators in the NPS cannot address all of the object treatment and survey needs of the parks. This situation necessitates contracting for professional conservation services. The majority of contracts are developed, issued, and monitored by park and regional staff. The challenge of conservation contracting is:

- to develop an unambiguous statement of work,
- to find and select a qualified conservator,
- to understand the technical approach in the language of a treatment proposal,
- to monitor the work while in progress, and
- to determine whether some standard of quality has been achieved.

It is important to understand these steps because conservation treatment can result in a permanent change in the object. This article explores some of the problems and issues of contracting for conservation services and provides some suggestions on how to become knowledgeable about and control the process. The mechanics of the federal contracting procedures will not be discussed. Although the article is written primarily for NPS staff it is applicable for government agencies or individuals hiring a conservator.

Developing the Scope of Work

The contract scope of work is a written description of what the contractor is required to do, conditions under which the work must be conducted, how the work will be assessed, and goals to be achieved. Standard scopes of work for conservation surveys and object treatment are available from NPS regional Curators, NPS Museum Management Program office in Washington, and Harpers Ferry Center-Conservation. These standard scopes of work were written to speed up developing contracts and ensure critical elements are not forgotten. Common mistakes in writing a scope of work involve using long sentences and paragraphs, abstract, vague or ambiguous language, and including unrelated materials. The objective is to write clearly, use exact descriptions, and avoid misunderstandings before and during the contract.

Finding and Selecting Qualified Conservators

How can you locate a professional conservator to bid on and complete the project? A list of potential conservators can be developed by consulting other park curatorial staff, the regional curator, calling local museums or historical societies, the American Institute for Conservation in Washington DC or calling Harpers Ferry Center–Conservation for recommendations. Conservators usually specialize in a particular type of object such as archeological and ethnographic materials, paper and photographs, textiles, and paintings. Conservators are not evenly spread over the U.S. so do not be discouraged if potential contractors have to travel a great distance to examine, survey, and treat objects. The goal is to find a conservator who has experience treating the type of objects you have or have conducted surveys. Selecting the right conservator requires evaluating qualifications. Does the individual have the education and experience for the project? The more time spent gathering information and understanding qualifications, calling previous clients about past performance on similar projects, and reading writing samples, the better the match between the conservator and the project. Unfortunately the selection process is time consuming and people are often hesitant about asking pointed questions and following up on references.

Treatment Proposal

After the contract has been issued the next step is for the conservator to examine the object and submit a treatment proposal or plan for written approval. The treatment proposal is a detailed statement of what and how the work is to be accomplished, and it serves as the basis of com-

munication and discussion between the conservator and the client. The plan must include:

- Report of examination, i.e., purpose of examination, identification, dates, maker/origin or scientific classification, accession or identifying numbers, measurements
- Materials to be used
- Time estimate
- Cost estimate
- Objectives and limitations of the proposed treatment
- Risks and benefits
- General description of the materials to be used
- Alternatives to the proposed treatment, if and when appropriate
- A statement that information revealed during treatment may require minor variations from the approved plan

It is critical to understand the treatment proposal because it details changes that will be made to the object. The submission of the treatment proposal presents the opportunity to discuss questions, reservations, or alterations with the conservator prior to commencing work. If the proposal presents issues, ideas, or terms that you don't understand park staff can call one of the NPS conservators for assistance or consider having an NPS conservator act as a technical representative to monitor the contract. Once the treatment proposal is approved and signed the conservator will proceed with the work. If contracting for collection or condition surveys the treatment proposal is not submitted, but the management goals of the work should be clearly identified

Contract Monitoring

When work begins it is important to monitor the contract's progress until the project is complete. Conservators are required under the AIC Code of Ethics and Guidelines for Practice to contact the client if there is any substantial change in the treatment proposal, but adding a monitoring element to the contract allows a greater degree of control of the process. Appropriate monitoring depends upon the complexity and scope of the contract. Two methods of monitoring are inspection, a visit to the conservator's studio to view the work in progress, or by submitting written progress reports.

The goal of contract monitoring is to ensure the contract is being performed properly and problems are identified during the performance period instead of waiting until the project is complete.

Determining Quality and Performance

Quality standards have yet to be developed for object conservation treatment. Currently the measure of performance is that the contract was completed on time, on or under budget, there is some cosmetic or physical difference in the object, and a written report of treatment with photographs is submitted. The final treatment report should discuss not only any variations from the treatment proposal but also results of any analysis and recommendations for subsequent care either on exhibit or in storage. Conservation contracting is a process. Understanding and controlling the process is critical, because object treatment may change the way the object is perceived and interpreted by staff, researchers, and the public. Subtle changes in appearance such as color or gloss can result in changes in the interpretation of age or value. Of even greater importance in object treatment is loss of information that may reside in damage, deposits, wear, or other clues to the history of an object.

Contracting for conservation services is a common way to accomplish the variety of preservation projects facing NPS staff. Being knowledgeable and conversant about the contracting process and truly understanding the importance, historic value, and use of the object results in preservation of the unique qualities of the objects in our care.

Suggested Readings

The American Institute for Conservation developed the *Commentaries to the Guidelines for Practice* which defines accepted practice for the conservation profession and provides recommendations that assist in the pursuit of ethical practice. The commentaries are available online at <http://palimpsest.stanford.edu/aic/pubs/comment.html>

National Park Service. 1990. *Museum Handbook* Part I, Chapter 3: Museum Objects Preservation: Getting Started and Chapter 8: Museum Object Conservation Treatment.

Martin Burke is Associate Manager, NPS Harpers Ferry Center–Conservation.

Susan Kraft

Conservation of a Yellowstone Studebaker Wagon

One hundred years ago, visitors to Yellowstone fell into a distinct hierarchy. The "dudes" were the wealthy visitors who arrived by train, traveled by stagecoach, and stayed in grand park hotels like the National Hotel in Mammoth Hot Springs and, later, the Old Faithful. "Sagebrushers" were those with fewer resources, more adventurous spirits, or both, who brought their own vehicles and pitched their tents amid the sagebrush, or virtually anywhere they pleased. Falling roughly in between were the park's tent campers.

Before the automobile came to Yellowstone, there were two official tent camp companies in the park: the Wylie Permanent Camping Company and the Shaw & Powell Camping Company. Their camps were arrangements of log buildings and brightly-striped, furnished canvas tents. Typical tent camping company patrons included middle class visitors, as well as wealthy tourists who either eschewed the luxuries of the park hotels and wished to rough it a bit, or simply had not been able to obtain reservations for the dude's tour. These visitors toured the park and moved from tent camp to tent camp in stagecoaches or buggies owned and operated by the two companies.

Today, one of these buggies survives to tell the story of Yellowstone's tent campers. In the lobby of the Old Faithful Inn stands a vehicle once owned and operated by the Shaw & Powell Camping Company. Last year, it became the first historic vehicle in Yellowstone National Park history to receive professional conservation treatment, and the first to be exhibited indoors. The story of this vehicle's preservation and conservation begins a new chapter in the history of transportation artifacts in Yellowstone, following a long tradition of displaying retired stagecoaches and other horse-drawn vehicles outdoors, and watching vehicles deteriorate in substandard storage.

An Anniversary Opportunity

In 1997, in conjunction with the 125th anniversary of Yellowstone National Park, Yellowstone museum staff proposed the conservation of a historic vehicle from the museum collection as a 125th anniversary project, and obtained estimates for treatment of several carriages, including the Shaw & Powell. In the end, the Shaw & Powell vehicle stood apart from its competition for its rarity, its obvious need for treatment, the quantity and quality of surviving original fabric, and its unique but untapped potential for interpreting the way in which many early turn-of-the-century visitors—particularly middle class visitors—experienced Yellowstone.

While its competitor, Wylie, operated in several national parks, Shaw & Powell was a small, local business (based in Livingston, Montana) that operated only in Yellowstone from 1898-1916. Wylie vehicles are not common, but Shaw & Powell vehicles are extremely rare. Manufactured by Studebaker Bros. of South Bend, Indiana around 1898, Yellowstone's buggy is actually a mountain stage, a type of mountain spring wagon. It carried up to 11 passengers and was pulled by two horses. It is the only Studebaker, as well as the only tent camping company vehicle, in the park's collection.

Little is known of the history of this particular wagon, but much can be surmised from a close examination of the vehicle. Painted on the driver's box is the number 6, painted over either the number 1 or the number 11. These low numbers suggest that the buggy was probably an early member of Shaw & Powell fleet. The company name had been painted and repainted several times on each side of the passenger compartment, suggesting that the buggy remained in service a number of seasons. The fact that it survived at all strongly suggests that the wagon was still in service when the stagecoach era ended with Yellowstone's all-motorized 1917 season.

The only photograph known to have been taken of the wagon before its accession into the museum collection is a 1961 snapshot which shows the buggy outdoors at park headquarters in Mammoth Hot Springs. In this photograph, the buggy appears in a state of disrepair similar to that observed when it was finally added to the museum collection in 1993. Its side springs, tongue, most of its roof, and parts of all four seats (including the driver's seat) were missing. As one might expect, given the fact that the buggy spent at least a portion of its retirement years outdoors, virtually all the upholstery and stuffing, as well as the side curtains, were missing. The leather panels that had enclosed the sides of the front boot or storage compartment under the driver's feet had been deliberately sliced out.

When the buggy was accessioned and its condition documented, additional problems were noted. Most disturbing was the fact that the buggy was full of dead leaves, rodents' nests, rodent droppings, spider webs, and other evidence of long-term neglect. Many of its painted surfaces were unstable, with portions of the faded gray-green of the body, the yellow lettering and undercarriage, and the black pinstriping flaking. A surviving bit of roof was found to contain more than 30 years of graffiti, with dates ranging from 1910 to 1944. Early entries may well have been made by Shaw & Powell employees or customers, and may be viewed (depending upon one's perspective) as items of historical interest, rather than vandalism.

Before conservation treatment became a financial possibility, special project funding enabled the park to hire a seasonal museum technician to clean each of the 30 historic vehicles in the museum collection. Thorough cleaning and examination of the Shaw & Powell buggy, which required use of personal protective equipment as a precaution against Hantavirus, underscored the need to take positive steps toward preserving the vehicle's remaining original fabric.

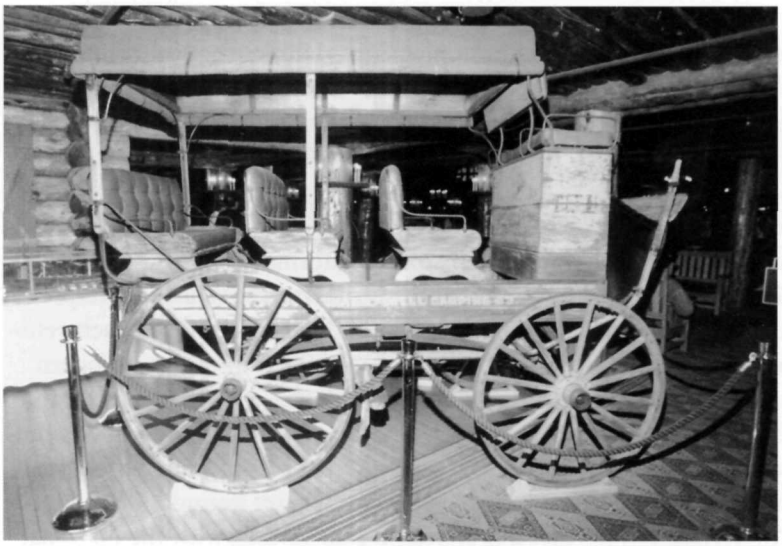
Shaw & Powell buggy, before conservation, being loaded for transport to conservator's workshop in Cody, Wyoming, 1997. NPS photo.

The park prepared a funding proposal detailing options for treating five different carriages from the museum collection. The proposal included historical information and broad cost estimates, and addressed each vehicle's interpretive potential. Historic photographs of each vehicle (or comparable vehicles) in use and modern snapshots showing current conditions illustrated the proposal. The Shaw & Powell wagon was presented as the park's preferred alternative for treatment. The Yellowstone Park Foundation, a nonprofit organization that works with the National Park Service to preserve and protect Yellowstone's resources, accepted the proposal as a 125th anniversary project, and rapidly identified a private donor willing to cover the estimated $15,000 needed to conserve the Shaw & Powell wagon.

Conservation or Restoration?

With advice and assistance from the NPS Harpers Ferry Center Division of Conservation, Yellowstone museum staff drafted a scope of work detailing treatment needs and documentation requirements. Goals included stabilization of surviving original fabric; preservation of all evidence of historic use; replacement of missing parts with either historically accurate reproductions or parts from the same time period; recovery and documentation of all original elements that could not be left *in situ;* and making the buggy presentable and safe for display. Putting the buggy into running order was never a goal; such consumptive use of a rare and historically significant vehicle was out of the question.

The treatment that was ultimately performed on the wagon is best characterized as a mixture of conservation and restoration. A noted expert on Yellowstone stagecoaches with a resume including treatment of vehicles in private collections and museums including the Buffalo Bill Historical Center in Cody, Wyoming, was selected for the job. Compromises to the original scope of work were made to accommodate some of his preferred techniques and materials, since he was deemed to be the best qualified, overall, to work on the vehicle. Before work began, Yellowstone's museum staff photographed every part of the vehicle, using both black and white and color film.



Shaw & Powell buggy—after conservation—on display in the Old Faithful Inn Lobby, summer, 1998. NPS photo.

The conservation/restoration of the vehicle was performed locally over a period of six months, and entailed stabilization as well as wholesale replacement of missing elements. Described and photodocumented in a final report, treatment included rebuilding most of the top of the wagon and replacing the left side-panels of the driver's box and the driver's footrest. A set of side springs, correct for this vehicle and from the same time period, was located near Helena, Montana and installed on the wagon. The original front springs were re-arched to match the side springs. Original seat parts, found lying on the floor of the wagon, were combined to create one complete seat. The two other passenger seats, all of the leather upholstery, the front leather boot, and the side curtains are historically accurate reproductions of the originals, based on archival photographs and Studebaker catalog illustrations. The seats were stuffed with a rubberized hair product recommended by HFC in place of the excelsior with which the seats appeared to have been originally filled. The iron tires of all four wheels were tightened, but required no other treatment. Pigmented microcrystalline wax may be applied to the wagon's ferrous metal elements at a later date.

The major compromise in the treatment of the wagon involved the use of a 40% linseed oil/60% turpentine mixture as a surface coat on some parts of the vehicle. Because linseed oil tends to cross-link and can leave a dark, sticky film, the scope of work called for the use of a clear microcrystalline wax on painted finishes. However, the conservator had never used microcrystalline wax, and was not comfortable working with it. Replacement wood parts were painted with a blend of 50% enamel paint and 50% of the linseed oil/turpentine mixture, applied to achieve an appearance compatible with that of the rest of the vehicle. No inpainting was done, and parts of the buggy that were stable, including the Studebaker Bros. logos in gold leaf that appear on the tailboard, were untouched. Every generation of lettering ever used to identify the buggy as a Shaw & Powell vehicle is still visible.

Minute paint chips were taken from several areas of the vehicle before conservation and sent to HFC. Analysis of these samples may reveal the number of layers of paint on the vehicle, the types of paint used (from which the approximate date of application might be deduced), and the relative length of time each coat served as the surface coat. It may be possible to differentiate paint applied during the wagon's use by Shaw & Powell from paint applied later in an effort to approximate the historic appearance of the vehicle.

Studebaker part numbers were found throughout the vehicle during treatment, and were documented in the wagon's catalog record.

Samples of all original materials removed from the wagon, including fragile fragments of original upholstery and stuffing, were also documented and will be retained in the park's museum collection

Following treatment, the wagon was delivered directly to the Old Faithful Inn, the site selected for its display. Although the inn was historically associated with the dude rather than the tent camper, the site of the former Shaw & Powell camp at Old Faithful is nearby. As the buggy was being installed and photographed, visitors crowded around it and bombarded park staff with questions. An accompanying display on tent camping includes a portion of the original roof, samples of historic tent canvas recovered in the park several years ago, photographs, postcards, and various Shaw & Powell-related artifacts. The buggy remains the only vehicle in the park's collection that is on display. Judging from its popularity, interpretation of the park's early transportation history and preservation of its material culture were long overdue.

Susan Kraft is the supervisory museum curator at Yellowstone National Park.

Audrey T. Tepper

Restoration of the Lincoln Memorial Murals

In 1995 and 1996, two decorative murals by the artist Jules Guerin were restored at the Lincoln Memorial in Washington, DC. The murals, painted between 1917 and 1918, were in such poor condition that they were easy to miss when visiting the memorial. They are very high off the floor (37 feet) and were obscured by the dirt and the damage of 76 years of exposure to the elements. The restoration was one component of a multi-million dollar preservation effort sponsored by the National Park Service (NPS) for the memorial as a whole. It was completed by the firm of Cunningham-Adams Fine Arts Painting Conservation of Sandy Hook, Connecticut.

The Lincoln Memorial, designed by the architect Henry Bacon, is open to the outside because there are no doors at its main entry. The materials on its interior, limestone and marble with an ornamental cast-metal ceiling, have held up nicely since the memorial was dedicated on May 30, 1922. The murals, however, have not fared as well because of their exposed location and because they are painted with oil on canvas, the same as an average oil painting intended to hang inside a building. This presented an extremely challenging conservation problem. The murals' paint and ground (preparatory) layers were cracked and flaking loose from the canvas; they were dirty and, in addition, their colors had faded dramatically. The initial goal of the restoration was to stabilize the paintings. The method developed by the conservators to stabilize them, however, had the added benefit of protecting them from the weather, as well as returning their original color and vibrancy.

The murals are located in the north and south chambers of the memorial, above the inscriptions of the Second Inaugural Address and the Gettysburg Address. These side chambers flank the central space of the interior, which houses Daniel Chester French's marble statue of Lincoln. The murals are each 12 feet high by 60 feet long. They add color and texture to the interior of the memorial and complement its neoclassical architecture.

The Subject Matter

The murals contain a total of 48 figures in classical costume that allegorically portray the accomplishments of Lincoln, the 16th president of the United States and the emancipator of the slaves. The figures are divided into three groupings on each mural. The mural on the north wall above the Second Inaugural Address is titled "Unification." The Angel of Truth is at its center joining the hands of two figures representing the reunion of the north and the south. The other groupings of figures depict unity, fraternity and charity, as well as art, science, and the humanities. These images were chosen to stress the importance of continued progress in the once-divided nation. The mural on the south wall above the Gettysburg Address is titled "Emancipation." The Angel of Truth is shown freeing slaves, their chains dropping to the ground as the angel raises her arms. Other figures in the painting represent faith, hope, and charity, as well as justice, law, reason, intelligence, and immortality.

The Artist and the Murals

Jules Vallee Guerin was born in St. Louis, Missouri on November 18, 1866 and died in Neptune, New Jersey on June 14, 1946. In 1911, Henry Bacon hired Guerin to assist him in a design competition sponsored by the Lincoln Memorial Commission for a new memorial. Guerin, a prominent architectural illustrator, created exquisite watercolors of Bacon's design and Bacon was ultimately awarded the contract. He later chose Guerin to create the two large murals, which along with the statue, inscriptions, and ceiling, were an integral part of the memorial's interior decoration.

The murals were painted on two continuous pieces of canvas in the artist's studio in New York City. Guerin used a platform similar to a stage to paint, where the canvases could be raised or lowered as desired. Remarkably, the charcoal

sketches he made on the canvases before he began painting are still in place, despite the harsh environment in the memorial. In 1919, the murals were brought to Washington rolled onto large wooden drums. The drums were hoisted into place and the murals were gradually unrolled from the center out. They were then adhered directly onto the limestone walls and tamped down with felt-covered bricks. The murals are still extremely well adhered to the walls from this original treatment.

Guerin executed the paintings in a style which combined his early classical training in art with impressions from extensive travel in the Middle East and contemporary stylistic trends. Painted in rich, exotic colors and bold, distinctive brush strokes, the paintings resemble tapestries, and serve the same purpose of warming the stone interior of the memorial that Medieval tapestries served in stone castles.

A conservator on the team of Cunningham-Adams Fine Arts Painting Conservation treats the north mural. Photo by the author.

Guerin's work in public buildings prior to the Lincoln Memorial included maps painted on the ceiling of McKim, Mead, and White's Pennsylvania Station in New York City, now demolished. He later went on to paint murals in other cities, including Chicago, San Francisco, Baton Rouge, Kansas City, and Cleveland.

The Conservation Treatment

The National Park Service determined early in the overall preservation effort for the memorial that the murals needed attention. Since little was known about the history of the murals and their unusual environmental conditions, the NPS contracted with the firm of Einhorn Yaffee Prescott of Washington, DC, to conduct a preliminary evaluation. After learning more about where the problems lay and what might be required to restore the paintings, the NPS set parameters for the selection of a conservator to complete the task. Their choice, after careful screening, was the team of George W. Adams, a conservation engineer, and Christiana Cunningham-Adams, a fine arts painting conservator, who together have extensive experience in painting conservation in both the United States and in Europe.

The Cunningham-Adams team worked from two decks of aluminum scaffolding erected in each chamber to study the murals carefully and develop a strategy for conservation. They closely examined all 200,000 square inches of the paintings' surface, which they documented photographically and on computer-generated survey sheets. To determine the extent of the deterioration, they employed Fourier-transform infrared spectroscopy, x-ray diffraction, and the scanning electron microscopy, and had laboratory analysis done on micro samples for salts, fabric, and microbiological characterization, as well as cleaning tests evaluation. The paint and ground layers of the murals had fractured into a grid of tiny fissures running in all directions. Many of the paint squares between the fissures were either coming loose from the canvas or had fallen off entirely. Moisture had penetrated through the small cracks and as a result, dirt, black fungus, and salts had formed on the surface. Due largely to the pitting effects of the passage of salts and the disruption of the surface by cracks, visibility of the imagery became obscured and the original colors became veiled by a white haze.

The conservators tested methods of cleaning and consolidating the murals before selecting treatments. The first step was to clean the paintings very delicately with one-foot square com-

presses of a solution of one part ethyl alcohol and one part lacquer thinner, allowed to dwell for two minutes. The cracked and lifting paint and ground layers were then pressed back into place, inch by inch, and then consolidated with multiple applications of microcrystalline wax (at 5%, 7.5%, and 8%), followed by multiple applications of methylacrilate resin (Acriloid B72; at 5%). This process not only re-adhered the lifting paint and ground to the surface, but re-saturated the colors as well. The re-saturation process is similar to waxing or oiling dry wood, where the grain and luster of the original material returns as its surface becomes wet. Even with the first applications of the wax, the results were extremely dramatic. The original colors and subject matter were brought back to life, showing how the artist and architect intended the interior of the memorial to be experienced. Before treatment, many original features were obscured. After treatment, even the red rouge of a little girl in the north mural is visible.

An essential property of the wax and resin mixture is that it acts as a moisture barrier. Washington, DC has a very humid climate and the interior of the memorial can become extremely wet. On an unusually balmy winter or spring day when warm air from the outside comes in through the main opening of the memorial and hits the cold stone walls, dewpoint can be reached. As a result, condensation forms on the walls and water runs down the murals, almost as if it is raining in the interior. It is interesting to note that Henry Bacon anticipated that moisture might be a problem and designed a heating system for the memorial, not for human comfort, but to eliminate condensation on the inside. Unfortunately, the system did not work properly and was abandoned early on. Since condensation continues to be a problem, the wax was applied to seal the cracks in the murals and moisture no longer penetrates below. Water, which once soaked directly into the paintings, now beads up and rolls down. By stopping the repeated moisture penetration, this treatment will slow the mural's rate of deterioration. The minimum life of this treatment is approximately 20 years, but it is expected to last considerably longer. A program of monitoring and inspection of the murals will identify any problems and improve its longevity.

Lighting the Murals

Now that the murals have been returned to their original glory, the next step is for the National Park Service to see that they are properly lit. In 1997, a lighting study for the memorial was completed by Einhorn Yaffee Prescott. This study included computer-generated mock-ups and on-site testing to arrive at the best lighting solutions. The type of lighting that most complements the murals is incandescent. Fixtures will be mounted above the chamber ceiling and directed through louvers to the paintings below.

In addition to artificial light, the interior of the memorial is partially lit by three skylights. Below the skylights, set directly into the floor of the memorial's attic, are a series of translucent marble panels through which light enters into the chamber below. As a part of the recent ceiling restoration, the panels—which are thick slabs of Alabama marble—were cleaned and re-saturated with beeswax. The beeswax adds tremendously to the panels' light transmission and this greatly enhances the reading of the murals during daylight hours.

The transformation of the murals from their pre-restoration state to what they are today is truly remarkable. Now the total composition of decorative elements makes sense: the earth tones of the restored murals, the color of the marble and limestone, the leathery-brown color of the restored metal ceiling, and the diffuse light streaming through the cleaned translucent marble panels. While the statue and the inscriptions are somewhat somber and serve to memorialize Abraham Lincoln, the added color and light is inspirational and helps to interpret the values and greatness of this exceptional statesman.

Audrey T. Tepper is a historical architect with the National Park Service, Technical Preservation Services Branch in Washington, DC.

Acknowledgments

I would like to thank the following individuals for contributing to this article: George W. Adams; Christiana Cunningham-Adams; Michael Auer; Michael Zisk; and the staff of National Capital Parks-Central.

Gretchen L. Voeks

The Importance of Curatorial Planning in Condition Surveys

Conservation collection condition surveys are increasingly being used to determine the overall condition of museum collections, and to identify levels of deterioration and project conservation treatment costs. Curators need this information to plan storage projects effectively, develop funding requests, and evaluate preservation options. A successful survey will produce this kind of information as well as additional documentation critical for long-term collections management.

Conservation collection condition surveys are expensive undertakings. In order for a survey to be cost effective, the curator must be well prepared for the conservator's visit.

The scope of the survey must be determined and goals must be defined: Why are you conducting this survey? Is it for general overall condition information? Are you concerned about a specific collection or type of deterioration? What do you intend to do with the survey? Have you considered the significance of the objects? Are your objectives clearly defined?

Make good use of the conservator's time by planning the survey with him/her. Talk with the conservator beforehand to ensure that background documents, object lists, and assistance are available. While the conservator is on-site, ensure that objects are easily accessible and a knowledgeable staff member is available to answer questions. Conservators often require information that is not documented in the catalog record. They may need to examine environmental records, previous conservation treatment records, or discuss the history of the care of the collections. These needs will differ depending on the scope and goals of the survey.

Ensure that the significance of the objects included in the survey is considered. The conservator is not responsible for determining significance. The curator must decide which objects are important enough to warrant the cost of survey and potential costs of treatment. Discuss future funding with the conservator so options for treatment are explored.

Recently the Western Archeological and Conservation Center (WACC) contracted a collection condition survey of plastics and rubber to address storage issues. This case study is presented to illustrate the planning process the Center used to obtain the desired information.

Identify the problem. Several plastic objects stored at WACC from the historic collections of Faraway Ranch at Chiricahua National Monument were deteriorating. The objects were brittle and small fragments were detaching. Acrid smells were noticed in several cabinets. A plastic tablecloth was sticky to the touch. Staff wondered whether anything could be done to halt or slow the deterioration. Most of the collection appeared stable, but could anything be done to repair the few deteriorating objects? Were other plastics in the collection degrading in a similar fashion? Were the rubber objects deteriorating too? A collection condition survey was needed to address these questions.

Define the project. In order to understand the magnitude of the potential survey, a list of objects was assembled. This created a challenge for the curator. Materials fields in the National Park Service's Automated National Catalog System (ANCS+) ranged from detailed entries such as vulcanite, acetate, PVC, etc., to generalized "synthetic." A list of all material types in ANCS+ was printed and all plastics and rubber were noted. This allowed the curator to compile a group of approximately 2,500 objects and object parts manufactured from plastic or rubber stored at WACC from various parks. Because all objects on the list were deemed significant, cost estimates included all in the survey.

The results had to supply information useful to us in the preservation of these specific collections: identification of the type of plastic or rubber and of the best method of storage for the artifact, determination of the need for treatment, and estimation of the treatment time.

The WACC conservator determined that baseline photographs of the surveyed objects would enhance the condition record. The deterioration of most plastics and rubber is inevitable and the photographs would allow visual tracking of the damage over time. Each object was first photographed in black and white, and color slides. Obvious deterioration was recorded using microphotography at up to x50 magnification in black and white prints and color slides.

Locate and hire the consultant conservator. Specialized skills are required to identify plastics by sight and touch. Because these skills were not available at WACC, we hired a private objects conservator with an extensive background in plastics and rubber. In order to locate this individual, we began by searching the literature on the subject of plastics and rubber conservation. We then queried members of the American Institute for Conservation of Historic and Artistic Works (AIC). (A referral service is provided by the AIC.)

The conservator, Sharon Blank, spent approximately three weeks at WACC conducting a conservation condition survey of 597 plastic and rubber objects. Time did not allow for a survey of all identified rubber and plastic items in the collections. Since many are duplicates, examples of each object type were chosen for identification and condition reporting.

Assist and plan with the consultant. We supplied the conservator with background information regarding the history of the collections, a list of objects, our concerns about their preservation needs, a draft of the survey format, and a list of necessary components for the final report. We discussed the survey in advance and decided to make several changes to the survey format. We toured the conservator through the storage space and discussed environmental conditions and present storage materials. We supplied the database and were available to assist the conservator when needed. Two pre-program conservation interns, Audrey Harrison and Terri Moreno, worked with Sharon, locating objects, removing and returning objects to storage locations and entering data. This planning and interaction resulted in a greater number of objects surveyed, more information about specific deterioration mechanisms affecting the collections, and a greater understanding by staff members how to preserve the collections.

The format of the survey was designed in ACCESS by the WACC conservator and computer specialist, with later input from the consultant. The type of plastic or rubber was recorded in order to make the best storage decision for each object. A field was included to allow comments on the condition of the object and any conservation treatment needs. Twelve fields were included to indicate the special storage conditions required and an additional comment field was used to relay any specific instructions for individual objects. Basic data from the catalog record, including the catalog number, object name, location, measurements, etc., were transferred from ANCS+ into the survey format to speed the process of data entry and avoid duplication of information. This allowed the conservator to view existing information, add missing data (e.g., measurements), and correct any errors in materials identification.

Using the survey. The next step in the project is to use the survey data to segregate off-gassing plastics from stable plastics to reduce deterioration of adjacent objects and metal cabinets. The number of objects requiring storage upgrades and the amount and type of materials required to complete the task will be determined by consolidating survey data. Objects not on the survey list will be examined for similarity to surveyed items, and will be stored in the same fashion. After this analysis is completed, pre-program conservation interns from the University of Arizona will be hired to conduct the actual storage upgrade.

Careful curatorial planning of a collection condition survey is crucial to produce a document that is a meaningful and useful tool for preservation. The importance of curatorial planning cannot be underestimated. Clearly defined goals, well-organized assistance and information, and early interaction with a conservator will greatly improve the final product and its relevance for further storage, environmental, and treatment decisions. Collection of data in a format that is compatible with existing systems will maximize its usefulness in the future management of collections.

Gretchen Voeks is a conservator with the Western Archeological and Conservation Center, NPS

Amy L. Lubick

Architectural Drawings

Valuable Records Requiring TLC

In recent years, architectural drawings have become highly regarded for their aesthetic and historical content. The desire to collect and prize architectural drawings has ballooned and spurred preservation awareness for these materials. Organizations such as COPAR (Committee on the Preservation of Architectural Records) have been established in several states and U.S. cities since the 1970s to protect architectural records. Conferences, seminars, and workshops on the production, appraisal, accession, and care of architectural drawings and records have been held in countries across the globe. Research into materials used in fabrication of original architectural drawings and photo-reproductions (blueprints, diazotypes, van dyke prints, etc.) has grown, permitting a greater understanding of appropriate conservation treatment and preventive care.

Original architectural drawings and reproductions are often created from poor quality materials. Poor quality materials, extensive handling, and inappropriate storage affect the stability of these drawings. Proper storage and care will extend the life span of architectural records. The selection of suitable housing materials for storage requires identification of components used in the fabrication of original drawings and photo-reproductions. Several photo-reproductive processes are sensitive to alkali (such as blueprints) and risk damage when placed in contact with buffered interleaving materials. Ideal storage conditions require architectural drawings to be sorted by photo-reproductive process. Storage of different photo-reproductive processes together may have detrimental effects on the documents. For example, some materials used in the manufacture of diazotypes have the ability to affect alkaline-sensitive drawings and silver based photographic prints such as Photostats.[1] Valuable workshops to aid in identification of photo-reproductive processes have been held for archivists, librarians, and museum personnel. Verification of a photo-reproductive process may be provided by a conservator specializing in architectural drawings if identification is uncertain.

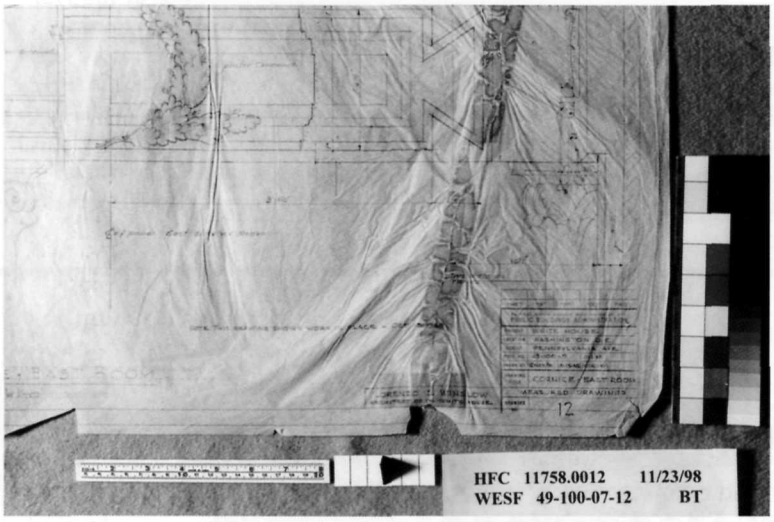
A one-year project focusing on the treatment of a collection of original architectural drawings belonging to the National Park Service is currently underway at the Division of Conservation at the Service's Harpers Ferry Center in West Virginia. The collection consists of 84 drawings of the White House completed prior to the extensive renovation that took place during President Harry Truman's second term in office. Renovation of the White House began in December 1949 and was completed in March 1952. This collection of measured drawings was created on-site over one year from August 1948 through August 1949, in anticipation of the changes the White House was slated to undergo. The drawings document floor plans, interior elevations, details, and ornamental embellishments of the White House as they existed prior to the renovation.

Lorenzo Winslow, architect of the White House during the renovation, supervised a team of seven architects to complete the drawings. A drafting room used by the architects was located in a temporary wooden building south of the Rose Garden during the renovation. Fifty years later, the collection of renovation drawings remains historically significant as a record of the White House as it existed in 1949.

Seventy-eight of the drawings are executed in graphite on tracing paper. Six of the drawings are on tracing cloth, five executed in graphite and black ink, and one a photo-reproductive process. Tracing paper and tracing cloth are transparent supports that were used for the rendition of master drawings since the 19th century. Copies of drawings on the transparent supports would be made using one of the various duplication processes. Tracing cloth was typically made from linen, and later cotton, coated with starch and calendared. Three of the tracing cloth drawings in this collection are coated with cellulose nitrate instead of starch.

Since the majority of drawings is executed on tracing paper, ample information was needed in dealing with these supports. The tracing papers in the collection differ in weight and color and are in various conditions. Some of the papers have aged and yellowed while others remain fairly white. Fiber analysis of several tracing paper samples reveal the papers to be made of cotton. Five of the drawings have a watermark indicating the fiber content is 100% rag.

Tracing paper is not always composed of cotton fiber; chemical wood pulp may also be used. A paper published in 1992 reported manufacturers' characterization of modern transparent papers and their fiber processing.[2] The two types of transparent supports associated with architectural drawings are natural tracing papers and prepared tracing papers. The natural tracing papers are extensively beaten during fiber processing. Increased fibrillation from beating increases the amount of fiber bonding. Transparency of the paper is increased when there is minimal interruption of light transmission through the sheet. Impregnants and coatings may be added during sheet processing to form prepared tracing papers. Among materials used to transparentize paper are starch, mineral oils, and acrylic films. Historical tracing papers were impregnated with oils, fat, waxes, varnishes, and resins.



Before treatment photograph of a measured graphite drawing on tracing paper. Lengths of pressure-sensitive tape applied to the reverse side of the drawing have caused staining and severe distortions of the paper. Photo by the author.

In addition to the conservation literature, various trade catalogs at the Harpers Ferry Center Library and National Museum of American History provided interesting information regarding transparent supports. A drawing material catalog printed in 1955 by the company Keuffel and Esser, listed for sale a natural tracing paper of 100% white rag stock and prepared tracing paper.[3] The catalog warns that the prepared tracing paper may be subject to some discoloration with age. Samples of available tracing papers were included in a number of historic trade catalogs, providing an excellent reference for examination.

The drawings in the collection vary greatly in size. The smallest drawing measures 20 inches x 27 inches and the largest measures 183 inches x 42 inches. Each drawing in this collection is in need of conservation treatment including surface-cleaning, mending of tears and losses, humidification, and flattening. All of the drawings appear to have been handled extensively—many were rolled and folded causing deep creases and edges that are especially weak, brittle, and vulnerable. Sixty-two of the drawings are in need of pressure-sensitive tape removal and/or adhesive staining reduction. Many of the drawings possess staining from pressure-sensitive tape adhesive that has transferred during direct contact with another drawing.

A survey was conducted to obtain additional information regarding current conservation treatment of tracing paper and then used to develop a conservation treatment plan for this drawing collection. A list of paper conservators was compiled from existing tracing paper conservation literature. The survey was mailed to 62 conservators in the United States, Canada, and Europe. Thirty-eight conservators responded to the survey, providing many helpful ideas and suggestions for treatment. Survey respondents frequently advised minimal intervention when treating tracing papers. Respondents emphasized conservators must be aware of the type of tracing paper being treated. Since prepared tracing paper is very different in composition from natural tracing paper, conservation treatment techniques will often differ from one paper to another. An organic solvent safely used to reduce pressure-sensitive adhesive residue on a natural tracing paper may have catastrophic effects on a prepared tracing paper. The organic solvent may reduce adhesive and remove the oil or resin in the prepared paper as well, rendering the paper opaque and reducing the transparency of the sheet, permanently altering its composition.

Stains are difficult to remove from tracing paper, particularly the pressure-sensitive adhesive tape stains. The barrage of organic (and often toxic) solvents required to reduce an adhesive stain do not always produce satisfactory results.

The disfiguring tape stain in the photo on page 41 will require approximately 10 hours of conservation treatment, including the application of heat, mechanical reduction of adhesive, solvent application to stabilize and reduce (but not completely remove) the tape stain, humidification, and flattening to minimize planar distortions in the sheet.

This brief description of the conservation treatment required for a damaged drawing from the collection illustrates why all aged tracing papers should be handled with care. Tracing paper is a fragile and tricky material, requiring delicate handling. All architectural drawings, regardless of support material, need special attention in order to retain their information and aesthetic composition.

Notes

1 Reed, Judith, Eléonore Kissel, and Erin Vigneau. "Photo-Reproductive Processes used in the Duplication of Architectural and Engineering Drawings: Creating Guidelines for Identification." *The Book and Paper Group Annual* 14 (1995): 41-49.

2 van der Reyden, Dianne, Christa Hofmann, and Mary Baker. "Some Effects of Solvents on Transparent Papers." The Institute of Paper Conservation: Conference Paper Sheila Fairbrass, 234-46 United Kingdom: G.W. Limited, 1992.

3 Keuffel and Esser Company. *Catalogue of Keuffel and Esser Company Manufacturers and Importers of Drawing Materials.* Hoboken, NJ: 1955.

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Price, Lois Olcott. "The History and Identification of Photo-Reproductive Processes used for Architectural Drawings Prior to 1930." *Topics in Photographic Conservation* 6 (1995): 41-49.

A comprehensive bibliography compiled in 1994 on conserving architectural drawings and oversize works of art on paper, by paper conservator Nancy Carlson Schrock, may be accessed via the internet at: http://palimpsest.stanford.edu/bib/

Amy L. Lubick is a post-graduate paper conservation intern with the NPS Harpers Ferry Center–Conservation.

Judith J. Bischoff

Conservation Science in the Parks

Not Just for Natural Resources

Ask the general public what they know about conservation in the National Park Service and they will likely reply—"You mean saving trees, water, animals and the environment in the parks?" If one were to ask what a conservation scientist working for the Park Service does, the answer would probably be that such a scientist studies the parks' natural resources. Most would be surprised to learn that one Park Service conservation scientist has little or nothing to do with natural resources, but instead studies cultural resources.

The cultural resources conservation scientist has several roles:

- To provide information to park curators and interpretive staff to aid them in interpretation of an artifact
- To provide information to conservators to aid them in their decisions regarding object storage, exhibition, and conservation treatment
- To carry out research projects related to the technology or provenance of museum artifacts, studies on mechanisms of deterioration of such artifacts, systematic development of new conservation materials, and evaluations of the long-term efficacy of previous conservation treatments

Tools of the Conservation Scientist

Several tools commonly used by the conservation scientist for examining or analyzing artifacts are infrared spectroscopy, optical microscopy, and ultraviolet-visible spectroscopy.

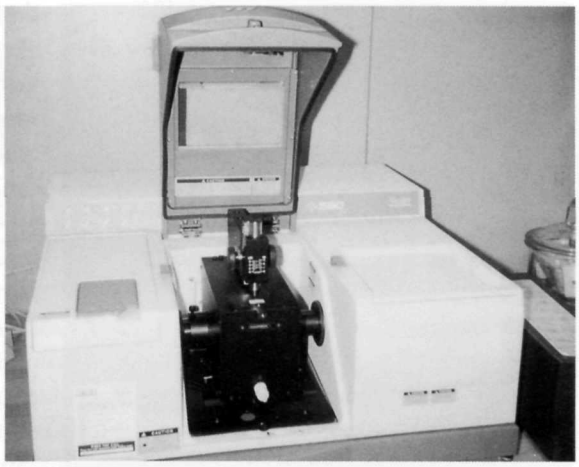
Fourier-transform infrared spectroscopy (FT-IR) is one of the most important tools of the conservation scientist. It can be used not only to

identify organic materials including adhesives, coatings, and consolidants, but also for an array of inorganic materials such as paint pigments, metal corrosion, or salts from archeological objects. For example, FT-IR can help identify an adhesive used in a previous restoration, the varnish coating on historic furnishings or identify a fiber type or a paint binder.

The science lab at Harpers Ferry has successfully used infrared spectroscopy to confirm shellac as the original coating on a Baltimore, Maryland, wine cellarette from Hampton House National Historic Site, copper stearate as the waxy green corrosion product on a gun from the Fuller collection at Chicamauga-Chattanooga National Military Park in Georgia, and pyroxylin (cellulose nitrate) on some historic tracing papers being studied in conjunction with the conservation treatment of architectural drawings.

Optical microscopy is another important multi-purpose tool. For example, optical microscopy allows identification of fibers, paint pigments, corrosion products, or salt encrustations. It may also be used to examine objects or to observe chemical changes during microchemical testing on small samples from artifacts.

Ultraviolet-visible spectroscopy (UV/VIS) works on the same principle as infrared spectroscopy, but uses ultraviolet and visible light instead of infrared as the light source. One can use UV/VIS for analysis and identification of dyes found in textiles, lake pigments, leather or quills, or intentionally colored lacquers or glazes. This simple analysis involves extracting the dye into an appropriate solvent such as alcohol or water and measuring its spectrum. Although two dyes might appear to be the same color red, the spectrophotometer can detect differences that the eye cannot; that is, each dye has its own characteristic spectrum. Such information can be used to assign attribution to an object; for example, a particular weaver of a Native American tribe may use a particular group of dyes in weaving her rugs, or to determine that a coating on a brass lamp contains a yellow dye to brighten the appearance of the brass.



Fourier-Transform Infrared Spectrophotometer. Photo courtesy the author.

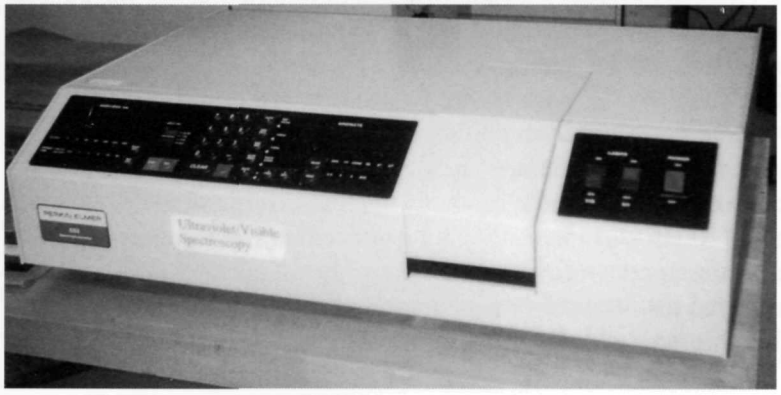
There are, of course, many other tools important in the work of the conservation scientist, but they are beyond the scope of this article.

Current Project

Cumberland Island National Seashore, Georgia, is home to both natural and cultural resources. The endangered loggerhead sea turtle, numerous species of birds and plants, and the dunes come to mind when one thinks of some of the island's natural resources. The island is also home to a broad range of cultural resources. It was originally populated by Native Americans, and at some point, the Spanish had a mission on the island. Familiar are the 18th-century Miller-Greene tabby house and the 19th-century Carnegie mansions. At "The Settlement" on the north end of the island is the First African Baptist Church, known most recently for its famous wedding of John F. Kennedy, Jr.

The science lab at Harpers Ferry was recently asked to perform paint analysis on nine of the island's historic structures. This project began with a week-long sampling trip to Cumberland Island to work with Jennifer Bjork, Chief of Resource Management, and John Mitchell, curator. Several arduous but exhilarating days fending off sand flies and ticks, and imagining snakes at every turn produced nearly 60 paint samples for cross-section analysis.

Each small sample was imbedded in polyester resin, which when hardened, was polished to reveal the various paint layers. The color of the original paint layers were matched with a standard color system, the *Munsell Book of Color,* which gives the hue (color), value (lightness or



Ultraviolet/Visible Spectrophotometer. Photo courtesy the author.

Plum Orchard Mansion. Photo courtesy NPS-HFC Photo Archives.

darkness) and chroma (color saturation). Matches were also made with commercial paint fan decks.

Some simple microchemical tests were used to help identify the paint pigment used. For example, the paint on the stucco of Plum Orchard Mansion was identified as a whitewash, while that on the window frames, columns, and balustrade was probably lead white.

Information about paint binders will also be obtained from the cross-sections. Special colored dyes or stains which preferentially bind with a particular paint binder and fluoresce in the presence of ultraviolet light will be applied to the cross-section. Application of the fluorescent dye, rhodamine B, will help identify oil paints, while the colored dye, Ponceau S, will help to identify casein (milk) paints or glue-based paints.

The results from the various analyses will aid the park in its restoration and preservation efforts. They will also provide more detailed information for interpretation of the park's historic structures to visitors enjoying the island's cultural offerings.

Future Project

Part of the role of the conservation staff is to advise exhibits staff on appropriate exhibit materials. This collaboration between conservation and exhibits ensures that objects are given the best possible care, while at the same time being exhibited to their best advantage. Thus, use of an exhibit case material that can harm objects is something that both conservators and exhibit specialists wish to avoid.

To support conservators and exhibits staff in this effort, the science lab at Harpers Ferry will be setting up a new testing method for identifying exhibit materials that might be hazardous to museum artifacts. This method involves a relatively simple setup requiring a specially equipped computer and an electrochemical cell. The method measures the level of harmful substances extracted from a material being considered for use in an exhibit case. It is hoped that this rapid and efficient method, that takes less than a day to perform, will replace the earlier Oddy test, which was not only extremely slow (greater than one month for results), but also inconsistent and subjective in its results. The science lab plans to develop a database of appropriate materials for construction of exhibits and to train other conservation labs wishing to adopt this method to create their own databases.

Of current concern to Native American groups is the presence of pesticide residues on artifacts being requested for repatriation. Because these objects may be worn during ceremonies, it is of extreme importance that any toxic pesticide residues be identified. Pesticides such as toxic arsenic and mercury compounds, chlorocarbons such as Chlordane, and para-dichlorobenzene (PDB) or fumigants such as sulfuryl fluoride (Vikane) and ethylene oxide, were commonly used to prevent insect infestation of organic objects. Although some information is known about what pesticides were used in collections of Native American objects, little is known about how toxic these materials still are, how to identify them and most importantly, how to remove such residues. We hope that our part in this major research effort will be to develop some "low tech" field methods for the identification of organic pesticide residues.

A Final Word

The few examples reported here are intended to give the reader a sense of the important scientific work being done to aid in the interpretation and preservation of the vast cultural resources of the national parks. While no one would argue the importance of preserving and interpreting the parks' natural resources, the fact that most Americans think of the parks in terms of their natural beauty, gives those of us who work on the cultural resources side the opportunity to raise the awareness of preserving these equally important park resources.

The issues facing scientists studying cultural resources are not all that different from those concerned with natural resources. In keeping with the Mission of the National Park Service, both groups are dedicated to protecting those resources and providing for "the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Judith J. Bischoff, Ph.D., is a conservation scientist, NPS Harpers Ferry Center–Conservation.

Brigid Sullivan Lopez

Summer Projects in Parks for Conservation Program Interns

School's out, and students enrolled in the graduate conservation training programs are looking for hands-on conservation work. Museum collections of the National Park Service are as diverse as the parks themselves, encompassing all types of organic and inorganic materials, and preservation requires the expertise of conservators working in every specialty recognized in professional conservation. It's a good match for the National Park Service.

National Park Service conservators represent most of these specialty fields. The Division of Conservation at Harpers Ferry Center in West Virginia functions as a central conservation resource for the NPS nationwide. With a staff of 17 conservators, the Division of Conservation is equipped with specialized laboratories for conservation of archeological objects, decorative arts and historic objects, ethnographic materials, furniture and wooden artifacts, paper, and textiles and has recently developed and staffed a conservation science laboratory as well. With a staff of two objects conservators, the Collections Conservation Branch of the Northeast Cultural Resources Center provides conservation services to parks in New England and the mid-Atlantic states for treatment of historic and decorative art objects including outdoor sculpture.

Suzanne Davis, summer intern from the NYU Conservation Center of the Institute of Fine Arts Program, stabilizes fragile flaking gilt on a chair from a suite of furniture in the Vanderbilt Mansion. Photo by Eugenie Milroy.

The major conservation training programs in the United States are the University of Delaware (Winterthur), New York University (Institute of Fine Arts Conservation Center) and New York State University at Buffalo. Summer internships are a graduation requirement of the Winterthur and Buffalo graduate training programs. Although not as an academic requirement, NYU program students are encouraged to take on summer work for professional growth. In every case, training programs seek to match the students' interest and abilities with the activities of a professionally recognized conservation facility.

The Harpers Ferry Center Division of Conservation has established cooperative agreements with the training programs to place both year and summer interns and trains an average of three program students a year, placing interns with specific laboratories and projects according to their skills and interests. Rigorous academic and technical conservation curricula have equipped these students with knowledge and skills that can make them valuable team members in completing conservation treatment projects. Students in turn expect to gain valuable experience in the "real world" of conservation by developing treatment proposals based on accurate condition assessment, and completing conservation treatments including all documentation within the proposed time-frame estimate.

These cooperative agreements also provide the administrative umbrella that enables the Collections Conservation Branch (CCB) to access and fund program interns for projects both on-site and in the CCB conservation laboratory in Lowell. Working with the programs through Harpers Ferry, the CCB conservators (the author and Carol Warner) have supervised interns on such on-site projects as the survey and conservation of plaster sculptures at Saint-Gaudens NHS, and treatment of the bronze Colonel Prescott statue at Bunker Hill Monument in Boston.

On-site conservation projects are particularly well suited for use of summer interns because, by their very nature, the treatment goal(s) must be achievable in a set period of time. Each project requires summer interns to review material characteristics of the object, diagnose

deterioration mechanisms, undertake appropriate testing, collaborate in the development of a treatment proposal, and participate in the final treatment and documentation reports.

When funding was made available for an ideal summer project at Roosevelt-Vanderbilt National Historic Site in Hyde Park, New York, the CCB contacted nearby NYU to see if any of the conservation program students would be interested in participating. The result was that, in the summer of 1998, graduate students Suzanne Davis and Eugenie Milroy from the NYU Conservation Training Program became a key element in the successful completion of a conservation project at the Vanderbilt Mansion.

It was a challenging project. The Vanderbilt Mansion contains one of the finest intact collections of furniture from the Gilded Age designed *en suite* for the mansion in 1897. However, decades of uncontrolled climate extremes within the building have led to problems of extensive flaking and loss of gesso, bole, and gold leaf on the high-style furniture. At the time of the project, even light routine dusting was impossible without further loss of gilded surfaces. To exacerbate the problem, oily soot from a boiler puff-back covered every surface throughout the 54-room mansion.

The Williamstown Art Conservation Center, a private regional conservation organization in Massachusetts, had been contracted by the park the previous year to develop a comprehensive plan for soot removal, but the fragile gilded furniture could not be cleaned using normal soot removal techniques without first stabilizing insecure surfaces. Based on selection criteria of severity of condition and visual prominence within the furnished room, park curator Anne Jordan selected specific items for treatment using information supplied from a comprehensive Furniture Conservation Survey completed in 1992 by contract conservator Robert Mussey of Boston. With the goals of the Gilt Stabilization Project defined and funding secured for the CCB to undertake the work, the CCB and park curator began logistical planning for the project.

Although interns are paid a modest stipend for their eight-week commitment, rental apartments can be difficult to find for only two months and weekly hotel rates can be prohibitively expensive for students. To facilitate the project, the park generously provided living arrangements for the conservation team. This housing turned out to be the original mansion gatehouse, which, along with the mansion, was designed by the premier architectural firm of McKim, Mead and White. Having been used for park housing for decades, the gatehouse itself bore no signs of the Gilded Age, but was extremely comfortable and convenient to the work site. The park supplied furniture, sheets and basic kitchenware. The students brought additional comfort items to the site and a few luxury items such as a coffeemaker, toaster and shower curtain were loaned by CCB conservators. The terrific living arrangements provided by the park went a long way in contributing to the success of the summer project.

The mansion's large and well-lit basement laundry room was converted into a field conservation laboratory by the park and the CCB. The park cleared, cleaned and painted the room, and supplied worktables, shelving and various supplies and tools already available at the site. Additional materials were ordered from conservation supply companies, and a vanload of supplies and equipment was sent from the CCB Conservation Laboratory in Lowell.

The project began with an introductory workshop by furniture conservator Hugh Glover of the Williamstown Art Conservation Center on the theory and practice of gilding and gilt stabilization for conservation team members and interested park staff. Conservation treatment of selected furniture then began under the guidance and direction of CCB conservators. For the duration of the project, one or both conservators visited the site two days a week to work with the interns and monitor their progress. In addition, two park staff members also participated in several phases of the treatment under close supervision. Treatments involved re-attaching flakes of gilded surface, consolidating weak areas, soot removal, and filling and toning losses when necessary to blend with the surrounding surface and unify the visual appearance of the piece for exhibition. At the end of the summer, 12 fairly complex pieces were completed, but there are many more pieces that must be stabilized. The park is pursuing funding to continue this work, and the CCB will again advertise this internship opportunity to conservation training programs.

A major reason for the success of this summer project was the collaboration of several agencies to ensure that the project would satisfy the expectations of all parties. Collaborators for this project included the park, which wanted to be

able to remove soot from gilded furniture; the CCB conservators, who needed daily on-site activity for completion of the conservation treatment hours required to finish the selected pieces during the project time-frame; NYU academic program officers, who seek appropriate professional internship opportunities for their students; and, finally, the students themselves, who seek enriching and challenging summer projects in a great location. All of these expectations were met.

Past surveys by the CCB have identified treatment projects in addition to the continuing Vanderbilt Mansion Gilded Furniture project that are also good matches for summer interns. These projects include stabilization of an exterior painted frieze at Saint-Gaudens NHS in New Hampshire, treatment of plaster sculpture at Weir Farm NHS in Connecticut, and conservation of sculpture and large historic objects in the home and library of Thomas Edison in New Jersey. When funding for these projects is in place, they will be advertised to the conservation training programs with hope of attracting bright and skilled summer interns to work on-site with the CCB conservators. Living quarters designed by McKim, Mead and White may not be available for all on-site summer projects, but the parks and their collections are fabulous.

Brigid Sullivan Lopez is Chief Conservator, Collections Conservation Branch, Northeast Cultural Resources Center, Lowell, Massachusetts.

Allen Bohnert

A Workshop

Integrating Field Archeology, Conservation, and Culturally Appropriate Treatments

An interdisciplinary workshop, Integrating Field Archeology, Conservation and Culturally Appropriate Treatments, was organized through the Curation Program of the National Park Service's (NPS) now defunct Intermountain Cultural Resource Center (ICRC). The workshop occurred in June, 1997, and was held at the Center's Santa Fe, New Mexico, office and at Pecos National Historical Park. The workshop had two primary purposes. One purpose was to provide training on fundamental field conservation philosophies, techniques, and materials. The workshop also provided a forum and an opportunity for discussion and training on various aspects of culturally appropriate treatments as they pertain to certain material types, artifacts, and features. The workshop was highly unique in that concepts of culturally appropriate treatment were linked with those of field archeology, field conservation, and museum management.

There is a long history of collaboration between European archeologists and conservators on archeological field projects. This has resulted in several notable publications, including: *Conservation on Archeological Excavations,*[1] *The Elements of Archeological Conservation,*[2] *Retrieval of Objects from Archeological Sites,*[3] and *First Aid for Finds.*[4] Such collaboration is the exception rather than the rule in the United States, however. It is not surprising, therefore, that the single comprehensive U.S. publication in this area is *A Conservation Manual for the Field Archeologist,* by Catherine Sease.[5] The Sease publication served as the main 'reference' for the workshop. The need to further integrate the principles of archeology, conservation, museum management, and general resource management in the planning and execution of archeological field projects has been recognized as a need for many years in the U.S. and has been called for in numerous publications.[6] While we have seen some progress through national and regional initiatives on archeological site protection and collection management in general, archeological field conservation remains virtually invisible. This is of particular concern when publication such as "The Federal Curation

Regulations" (36 CFR 79)[7] and "Federal Archeological Contracting: Utilizing the Competetive Process"[8] are examined.

If one considers the execution of an archeological project as a process, the process may be divided into planning, field, laboratory, reporting, and repository phases. In such a continuum, archeologists, curators, resource managers, tribal representatives and other cultural specialists can be seen as having joint responsibilities during each phase. Given the recognized need for expanded interdisciplinary collaboration and joint or interdisciplinary responsibilities, this workshop was designed to illustrate the benefits of interdisciplinary collaboration, to facilitate dialogue and promote collaboration, and to serve as a potential model for further efforts in these areas.

The workshop was funded under the NPS's Cultural Resource Training Initiative. Cosponsors and partners for the workshop represented diverse organizations, institutions and levels of government. For example, representatives from the Pueblo of Jemez served as instructors and, through their Historic Preservation Office, the Pueblo served as a cosponsor. Other sponsors and instructors represented the Office of Archeological Studies of the Museum of New Mexico, the Graduate School for Historic Preservation at the University of Pennsylvania, Pecos National Historical Park, and Dean and Associates Conservation Services of Portland, Oregon. Zuni Tribal Historic Preservation Office personnel, private conservators from Santa Fe and the South Florida Conservation Center, along with staff from the ICRC Curation Program also served as instructors. Everyone attending the workshop brought with them their own particular experiences, professional training, and cultural perspectives, from which others benefitted. Of particular interest were the perspectives shared by participants from the Crow, Navajo, Lakota, San Ildefonso, Santa Clara, Zuni and Jemez tribes.

Field Conservation Workshop artifact recovery exercise at Pecos National Historical site. Photo courtesy the author.

Workshop sessions included: general introductions to the history and philosophy of conservation; critical aspects of planning for conservation, curation, and consultation with affiliated tribes in the early stages of project development; and various basic issues pertinent to conservation in field archeology settings. Separate sessions were devoted to the preservation of features and in-situ preservation concerns. Additional sessions focused on discussions and presentations of the methods and materials appropriate to certain material types such as metals, faunal or botanical samples, bone and shell artifacts, glass and ceramics, and wood or other organics encountered under a variety of site conditions.

One of the highlights of the workshop, according to all participants, was the tribal representative-led panel covering specific topics of culturally appropriate treatment. These topics are potentially very sensitive and emotionally charged. Nevertheless, the discussions were frank and informative. Representatives from the Pueblo of Jemez discussed certain concerns the pueblo has with the care and handling of objects from their heritage and site etiquette when on the pueblo's ancestral sites. The concerns were not only for the physical and spiritual well being of the objects, but also for the people handling them and for the pueblo as an organic whole. Discussions by representatives from Zuni Pueblo also emphasized the special concerns of the Zuni people. A guest presenter from the Navajo Nation expressed concerns about the typical methods and materials used by museums during fumigation and other preservation-related activities. The methods and materials used, while physically preserving the object, may in fact have serious detrimental effects on the spiritual well-being of objects, especially ceremonial and other sacred objects. Other discussions and presentations covered culturally appropriate treatment issues resulting from consultations held as part of

implementing the Native American Graves Protection and Repatriation Act. These included keeping associated funerary objects and ancestral remains together while in the custody of museums, allowing zoomorphic and anthropomorphic objects access to fresh air, ensuring containers housing ancestral remains do not have a solid lid, that ancestral remains are not in association with plastics, and others

Two days of the workshop were held on site at Pecos National Historical Park. The park's sites served as a focal point for several discussions. It illustrated decades of in-site preservation strategies, diverse methods of interpreting sacred and secular spaces, and approaches to museum collection use and storage. Another highlight of the workshop was the field recovery exercise held at the park. The author and Erik Blinman created a simulated archeological site comprised of several excavation units several weeks before the workshop occurred. The intent was to simulate a variety of preservation-related, consultation-related, and data-related decision points one might encounter during an archeological project. Each unit was comprised of a wide range of preservation conditions, material types, and objects. These included: burnt/worked wood and bone, whole/broken ceramics and glass; features such as hearths and caches of artifacts/food stuffs, decorated collapsed earthen wall surfaces, fragile metals and composite objects, and paper/textiles. All participants and instructors were assigned to teams and each team was responsible for 'excavating' one of the units employing the methods and materials discussed earlier during the workshop.

Along with the Sease publication, each participant received a notebook containing copies of several conservation articles and bibliographies on archeological conservation and historic preservation. The notebook was also sent to over 125 offices in an effort to encourage and support future workshops. The notebook was distributed to all tribal historic preservation offices, National Park Service sites in the Intermountain Region and those in other regions with substantial archeological collections responsibilities, and to selected universities.

Clearly the workshop was a success in and of itself. More importantly, however, it clearly demonstrated both the need for and the potential benefits of integrating the perspectives of indigenous peoples , archeology, conservation and museum management in the execution of archeological projects. Two points made by all workshop participants and instructors alike were that more training of this type is needed on a regular basis and that topics covered during the workshop must become a component of U.S. academic training. Both will help to ensure such training becomes institutionalized and not left up to infrequently held workshops such as this one.

Notes

1 N.P. Stanley Price, ed., *Conservation on Archeological Excavations,* (Rome, Italy: I.C.C.R.O.M., 1984).

2 J.M. Cronyn, 1990, *The Elements of Archeological Conservation,* (NY and London: Routledge, 1993)

3 Robert Payton, ed., *Retrieval of Objects from Archeological Sites.* (Clwyd, Wales: Archetype Publications, 1992).

4 David Watkins, ed., 1987 *First Aid For Finds.* 2nd Revised Edition. (England: Rescue and UKIC Archeology Section, 1987)

5 Catherine Sease, 1992, *A Conservation Manual for the Field Archeologist. Archeological Research Tools* 4. (Los Angeles: UCLA, 1992).

6 Richard I. Ford, "Systematic Research Collections in Anthropology: An Irreplaceable National Resource." In *Report of Conference Sponsored by the Council for Museum Anthropology and the N.S.F. Peabody Museum,* 1997; Catherine Sease, *A Conservation Manual;* Sydel Silverman, and Nancy J. Parezo, eds., 1995 *Preserving the Anthropological Record,* 2nd ed. (NY: Wenner-Gren Foundation for Anthropological Research, Inc., 1995); N.I.C., 1984; N.I.C., 1990; National Institute for the Conservation of Cultural Property, Ethnographic and Archaeological Conservation in the United States," (Washington, DC: NIC, 1984); National Institute for the Conservation of Cultural Property, "A Suggested Curriculum for Training in Ethnographic and Archaeological Conservation," (Washington: DC, 1984); National Institute for the Conservation of Cultural Property, *Training for Collections Care and Maintenance: A Suggested Curriculum,* Volume I: Archaeology and Ethnology," (Washington, DC: NIC, 1990);

7 U.S. Department of the Interior, 1991 36CFRPart79. "Curation of Federally-Owned and Administered Archeological Collections." (Washington, D.C.: National Park Service, 1991).

8 Jameson, John Jr., et al., Technical Brief No. 7 (revised), Federal Archeological Contracting: Utilizing the Competitive Procurement Process (Washington, DC: NPS, 1992).

Allen Bohnert is Chief, Curatorial Services, Southeast Region, NPS.

Toby Raphael

Creating a Set of Conservation Guidelines for Exhibitions

Exhibit conservation focuses on practical techniques that protect museum collections from unnecessary damage while on display. The Harpers Ferry Center–Conservation has recently completed a technical resource to assist exhibit specialists achieve preservation-responsible exhibits. The resource is called the *Exhibit Conservation Guidelines* and has been produced as an electronic publication, presented in a CD-ROM format. Excerpts are included below.

Improperly designed and poorly fabricated exhibits are a significant source of damage for the collections of the National Park Service. Several years ago the NPS Harpers Ferry Center's Division of Conservation embarked on a major preventive conservation project to develop a set of practical, exhibit guidelines. The objective was to create a "user friendly" technical resource for both NPS personnel and exhibit specialists in general.

The *Exhibit Conservation Guidelines* establishes a methodical approach for the inclusion of conservation in the often-confusing processes of exhibit development and production. It defines the critical areas of involvement for conservation specialists, includes the baseline information known in the field, and adds what we at Harpers Ferry Center have learned from many years of producing exhibits.

Only by involving conservation early and throughout the process can we ensure preservation-responsible planning, design, and production. Years of experience have taught us that successful exhibits require a close, constructive working relationship between exhibit, curatorial and conservation specialists. A sense of shared responsibility for collection preservation and trust are invaluable parts of the equation.

The technical resource includes 250 pages of guidelines, technical notes, and illustrations; the following summarizes the key guidelines.

A. Exhibit Planning

Integrating Conservation into the Exhibit Process

Integrate conservation early in the exhibit planning phase.
Provide adequate time and resources.
Search for balanced conservation solutions.

The Exhibit Team

Work cooperatively with the team.
Utilize supportive design staff who have conservation experience.
Require detailed plans that specify performance criteria.

The Role of the Exhibit Conservator

Include an exhibit conservator on the exhibit team.
Involve the exhibit conservator in the earliest stages of the process.

Selecting Objects

Select appropriate display objects. Avoid selecting too many objects.
Take into consideration the aesthetics and treatment requirements of each object.
Avoid permanent exhibit of objects.
Allow enough time and resources to safely prepare, mount, install, or replicate exhibit objects.

Establishing Conservation Criteria

Determine the conservation needs of each individual object chosen for display.
Establish necessary but realistic conservation criteria for display.
Incorporate the conservation criteria into exhibit design.

Collections Management

Ensure safe handling of objects in all phases of exhibit development.
Stabilize all objects according to need.
Include the appropriate documentation for each object.
Protect objects during photography.

B. General Planning

Multilevel Conservation Response

Design for environmental stability and protection.

Consider both macro and micro approaches.
Choose an appropriate level of response from the multiple options.

Exhibit Format and Layout
Use enclosed display when possible.
Allow sufficient room for traffic flow.
Group together objects that have similar conservation criteria.

Temperature and Relative Humidity
Obtain baseline information about the temperature and relative humidity.
Control the environment within the entire exhibit space.
Locate sensitive objects in the most stable locations.
Provide additional control for sensitive objects.

Particulate Contamination
Monitor pollutants and enclose sensitive collections.
Use high-efficiency filters in environmental systems.
Use localized filtration equipment as needed.

Chemical Pollutants
Monitor pollutants and enclose sensitive collections.
Incorporate chemical filters in the environmental systems.
Provide air circulation.
Select stable construction materials.
Aerate the exhibition space before object installation.

Exhibit Lighting
Develop a lighting plan that responds to conservation criteria.
Limit total light exposure.
Filter all sources of ultraviolet radiation.
Control infrared radiation.
Exclude sunlight.
Construct lighting mockups.

Biological Infestation
Examine objects for signs of infestation and active mold.
Design exhibits to inhibit infestations.
Enclose objects when the risk of infestation is high.
Avoid introducing insects through props and unchecked exhibit materials.
Control human behaviors that encourage infestation.

Physical Security
Conduct a risk assessment.
Provide the appropriate level of protection.
Use tamper resistant hardware.
Facilitate authorized curatorial access to the objects.

Emergency Preparedness and Fire Protection
Develop fire protection and emergency response plans.
Perform a risk assessment and address potential problems.

C. Exhibit Case Design

Designing a Conservation-Grade Case
Design cases as protective enclosures.
Establish performance criteria.
Provide detailed, explicit drawings and specifications.
Build and test complicated case designs as prototypes when possible.
Test the fully assembled case in its final location.

Case Stability, Security, and Access
Construct a physically stable, structurally secure case.
Provide appropriate security features.
Ensure practical access design for curatorial entry.

Sealed Exhibit Cases
Use sealed display cases when appropriate.
Design well-sealed cases with tight joints and with gaskets.
Use conservation-appropriate sealants.
Test case performance.

Ventilated Exhibit Cases
Use ventilated cases for appropriate applications.
Control the design and construction of ventilated cases.
Use positive-pressure cases when appropriate.

Lighting Design within Cases
Develop a case lighting plan and specify appropriate lighting equipment.
Isolate lights from the display chamber.
Reduce heat gain and temperature cycling.
Incorporate heat-reflecting and insulating materials when necessary.

Humidity-Control Principles
Provide a well-sealed case that will support humidity control.
Ensure adequate air circulation within the case.
Provide separate access to the environmental maintenance chamber.
Test the case before enclosing objects.
Monitor the interior relative humidity for the duration of the exhibit.

Active and Passive Humidity-Control
Establish whether the goal is stabilization or control.
Select an appropriate passive or mechanical system.

Provide safeguards for mechanical systems.
Include appropriate and sufficient moisture-absorber medium for passive control.
Test and monitor the case.

Pollution-Control Systems

Incorporate enough absorber to remove pollutants for six months to one year.
Ensure unrestricted airflow.
Provide access to change the absorber.
Maintain the absorber.

D. Installation and Maintenance

Choosing Conservation-Appropriate Materials

Select conservation-safe materials for case construction.
Avoid adhesives within the object display area.
Review the composition of commercial interior finishes.
Allow sufficient curing time before installing objects.
Isolate objects from painted or varnished surfaces.
Select and attach decorative fabrics carefully.

Using Less Stable Materials

Use the least hazardous material available, and isolate objects from them.
Aerate the case after applying coatings and sealants.
Isolate objects from problematic surfaces.
Incorporate a pollutant absorber or scavenger.

Design and Fabrication of Exhibit Mounts

Design and fabricate mounts for object installation ahead of time.
Protect the integrity of the object.
Support the entire object to avoid physical stress.
Provide adequate support for flexible objects.
Support all parts independently over as large an area as possible.
Stabilize objects from vibration.
Ensure the security of framed works.

Exhibit Production and Object Installation

Avoid transporting objects into production areas.
Inspect exhibit assemblages that affect objects during the production phase.
Complete construction before object installation.
Evaluate the exhibit teams performance.

Exhibit Maintenance

Provide a maintenance manual which includes the conservation criteria.
Monitor exhibit conditions.
Perform necessary maintenance to ensure the continued performance.
Keep the exhibit area clean.
Plan ahead for the safe movement of objects.

Toby Raphael is a conservator, Harpers Ferry Center–Conservation.

Illustration courtesy Kevin Brookes.

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U.S. Department of the Interior
National Park Service
Cultural Resources (Suite 350NC)
1849 C Street, NW
Washington, DC 20240

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Cultural Resources
Washington, DC

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