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.

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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