Figure 1. 1929 Rolls-Royce Silver Ghost with Brewster body in front of the Winterthur Museum.

Treatment Protocol for a 1929 Phantom I Wood Body Rolls-Royce Automobile

Mark Anderson & Gregory Landrey

ABSTRACT

The subject of this study is a 1929 Rolls-Royce Phantom I automobile owned by a private collector. This vehicle was "re-bodied" in 1935 when its original limousine passenger coachwork made by the Brewster Company was replaced with a larger nine-passenger wooden "Suburban" style coachwork also fabricated by Brewster. Replacing coachwork for the purposes of fashion or function was a common practice in the early days of high-end automobiles. The chassis, mechanical units, and the 1935 Brewster Suburban coachwork are in un-restored condition except for minor repairs and surface work. The wooden section of the body has a second coat of varnish which the current owner would like to remove due to deterioration. The interior of the body is made up of a structural wood frame, decorative wood paneling, textile floor carpets and black leather seats. The exterior of the body also consists of a structural wood frame, but the panels are woodgrain-painted sheet metal on top of a wood substrate. The roof covering is a sealed canvas textile on top of a wooden deck. Documentation of the history, materials, and mechanisms of deterioration of the automobile will be discussed. The primary focus of the study is the nature and condition of the wood, surface coatings and upholstery in the 1935 Suburban coachwork and fenders of the Rolls-Royce. The treatment proposal will take into account ethical considerations, analytical data, recommendations for cleaning and minor repairs as well as preventive conservation steps for the automobile's long term preservation.

Introduction

Rolls-Royce: Best car in the world! Especially when fitted with a handsome all-wood coach-body. The opportunity to study this motorcar was our first chance to engage the Last Chance Garage located at 13 Cemetery Lane in Unionville, Pennsylvania, where the Rolls-Royce is awaiting restoration. As conservators, we're interested in understanding significant objects better and forestalling ultimate demise. The remarkable state of preservation of this automobile made it an excellent case study for the assessment of the coatings and materials used in its fabrication.

This study resulted in part because Henry Francis du Pont, founder of the Winterthur Museum, had his Cadillacs custom built in a manner very similar to the Rolls-Royce of this study. This was an era when business executives and well-to-do clients engaged custom coach firms to create unique automobiles, carrying on a centuries-old tradition of having a coach built to one's personal taste. A research project has been conducted concerning the historic automobiles that were once a part of the Winterthur estate (Landrey and Thompson, 2005). This interest in the automobiles that graced Winterthur generations ago led us to this Rolls-Royce and the opportunity to document its coatings and upholstery.

Background

The high state of preservation of this Rolls-Royce is explained by its history. The chassis was constructed in 1929 at the Rolls-Royce plant in Springfield, Massachusetts and was fitted with a metal limousine sedan body. In 1934, the limousine body was removed and a nine passenger wooden Suburban coach-body was installed by the Brewster Body Company. Oral history holds that executives of the Pennsylvania Turnpike Commission used the car during the construction of the toll road. It was then sold to the Split Rock Lodge in the Pocono Mountains of Pennsylvania where again tradition has it in use as a jitney between the Lodge and the local train station. In 1950 the car was acquired by Robert E. Ferguson Sr. of Kennett Square, Pennsylvania who stored it in a small rented garage for more than forty years. After decades of inactivity, the car was made roadworthy with little more than soaking the cylinders with oil and a fresh tank of gas. While the motorcar has been exhibited occasionally at antique car shows since that time, it has been driven very little as a restoration plan is developed by the current owner Robert Ferguson, Jr. and the Last Chance Garage of Unionville, Pennsylvania. Any vehicle with a claim and a reputation to be the best in the world is reason for pause and the beauty of this vehicle caught our attention immediately.

Vehicle Type

The Rolls-Royce Phantom I series was introduced in 1925, manufactured in the new Springfield, Massachusetts plant as well as in Derby, England. All Phantom I's came equipped with a six-cylinder, seven-liter gasoline engine capable of producing 120 horsepower. By comparison, a Ford Model A of that era sported a 4 cyl, 3.3 liter power plant generating 40 horsepower (Georgano, 1969). The economy was strong in the 1920s and the luxury car market was growing. Wanting to take advantage of this situation, Rolls-Royce, Ltd. of the United Kingdom built the Springfield works and started producing Phantom I automobiles. This production venture in North America lasted until the 1930s when the plant closed, a victim of the Great Depression. The tradition of Rolls-Royce continues in the United Kingdom, although now the legendary firm is owned by BMW.

Seeing a body made of wood intrigued us as furniture conservators, particularly on a Rolls-Royce. The Brewster Company, the creator of this hand crafted coachwork, was founded in 1810 and became a premier maker of horse drawn carriages in Manhattan. In the early 20th century, the company made a successful transition to the fabrication of custom coaches for the new automotive trade, moving to Long Island City, New York, which is where the body for the subject of this paper was made. Rolls-Royce of America purchased Brewster in 1926, ended its North American manufacturing activity in 1933 and Brewster closed its doors in the mid-1930s (www.coachbuilt.com). By mid-century, the great age of custom coach builders had all but passed from the automotive scene.

The authors were struck by the exceptional state of preservation of the 1929 Rolls-Royce as it is unfortunately uncommon and saw an opportunity to engage in a documentation project. With Winterthur's permission, we proposed to the owner of the Rolls-Royce and the staff of the Last Chance Garage that we pursue a pro bono documentation project on this grand vehicle and they accepted.

Objectives of the Study

The objectives of the project were:

- To gain experience in the assessment of objects outside of Winterthur's collection.
- To secure a unique opportunity for a student documentation project in our Art Conservation program's curriculum.
- To engage conservation in general with our local community.
- And to make connections between the conservation profession and those involved in the restoration of historic automobiles.

Figure 2. Ash coachwork.

Status of Automobile Restoration

Historic vehicles are routinely stripped to bare metal, refinished, replated and reupholstered to create a showroom or better type appearance. In fact, it is commonplace to not only completely restore an historic vehicle but to change colors and materials to suit present tastes. A 2005 American Institute of Conservation general session presentation on the preservation of a Saturn V rocket brought forth some of the same issues of needing to balance preserving a large, very mobile historic object while dealing with a public expectation of a "shiny and new" presentation. Those who attend antique car shows often put a premium on seeing vehicles presented in a better-than-new condition.

In contrast to this, recently, some historic automobile clubs such as the Antique Automobile Club of America have been developing awards for a "preservation class" which acknowledges an increased interest in a less intrusive approach to preserving automotive heritage. Perhaps the time is right to share the potential that techniques of assessment, documentation and treatment protocols common to the AIC membership may have in the realm of antique automobiles. And why not! This Rolls-Royce may well rival a grand carriage of an 18th century aristocrat like General John Cadwalader of Philadelphia.

This assessment covers some of the multi-media components of the automobile by documenting the nature of the wood body, faux painting, exterior black finish and upholstery. We will leave the assessment and documentation of other aspects of the vehicle such as the corrosion of metals, deteriorating safety glass and mechanical concerns to other specialists.

Coachwork Assessment

The coachwork is constructed entirely of ash (*Fraxinus* spp.) utilizing the wood for the thick structural floor elements, the interior trim and roof boards and the joined frame and panel construction. In several instances the wood is covered by protective overlays including faux wood grain-painted aluminum panels exhibited on the exterior of the coach-body and the wooden roof structure which is covered by a sealed textile roof canvas marketed under the name Neverleek. The construction of the coachwork utilizes mostly

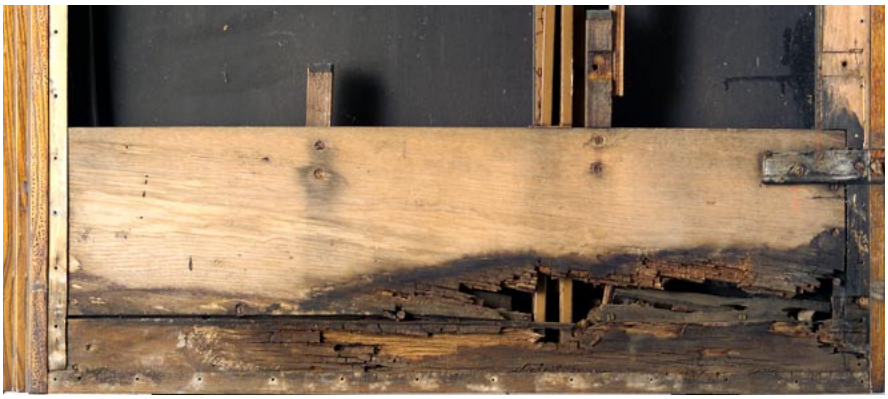

Figure 3. Degraded wood, interior of door.

open bridle style joinery which is augmented by mechanical fasteners. The "open finger" system of joinery is slipping and separating in many areas of the doors and coachwork structure.

While setting a rustic tone and creating a warm feeling, the wooden body parts have yielded to rot and decay in some areas of the coachwork and require restoration. Ash has only moderate resistance to rot and decay but coach builders often chose it for its high strength to weight ratio, for its easy machining and for its ability to take and hold stain and varnish. The joined wooden coachwork from the Brewster shops, while of high quality is certainly the product of a "modern" commercial technology, employing power shaping and sawing and mechanical fastening systems. (fig. 2).

The interior aspects of construction reveal degradation that is the result of trapped moisture combined with the relatively decay-prone timber. (fig. 3). This deterioration is the result of design and material failure built into the original construction. Unlike today's rubber window seals this Rolls-Royce makes use of a woolen felt weatherstrip at the interface of the window sill area and the crank down window. While making for a quiet and easy descent of the window glass, the felt seal has allowed water to collect in the interior areas of the lower door. The vertical metal track lined with felt helps guide the lowering of both the small triangular vent window and the larger side window. With the deterioration of the felt the track has also acted as a rain spout, channeling water down and into the lower areas of wooden door framing.

Many of the deteriorated elements are not important structural components but they retain important period documentation and therefore should be preserved rather than replaced. The signature of "Rudy" in red chalk, that could date from the 1930s on a door panel covered by upholstery, and other factory markings like the script on the lower areas of the door panel are also valuable in the overall context of the vehicle's history.

In some areas the rot has extended into the hinge stiles causing weakness in the door-to-frame attachments as in a heavily deteriorated area above the hinge. These losses will require inserting new structural wood elements.

Coachwork Treatment Options

It is our recommendation to consolidate as much of the existing rotted material as possible and add new spliced or patched wood elements only as necessary. Because the car is intended to be used, the repairs must be strong and field serviceable and will require mechanical fasteners as needed. This more active approach differs from the very passive way most furniture conservators would treat a fine joined wooden object. As in furniture conservation though, we recommend that any added wood elements be sympathetic to the original grain, color and porosity of the original timber and any finish variances between old and new should not be immediately obvious. Previous repairs meet some but not all of these criteria.

Surface Coating Assessment

Varnish on Wood: Wood and varnishes used in the fabrication of early 20th-century vehicles were not dissimilar to the manner and passion with which we might write about 18th century furniture. The transparent coating applied to the inte-

Figure 4. Degraded varnish on the exterior coachwork.

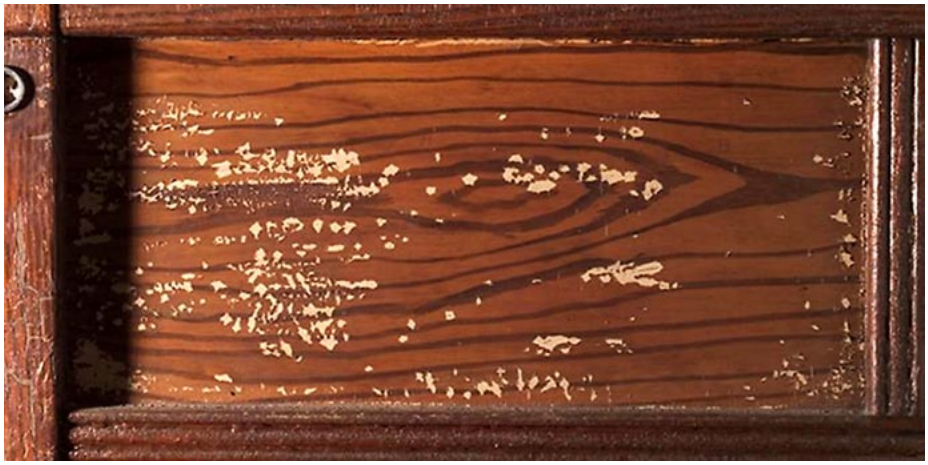

Figure 5. Grained paint on aluminum substrate.

rior wood is close in visual character to the look of traditional coach varnishes which were usually full-bodied long oil varnishes (Augerson, 2004). The varnisher's trade is known to most of us as a skilled endeavor but the current top varnish coat has developed defects, including traction crackle and curtaining. A contemporary advertisement indicates that Rolls-Royce used Valentine Varnishes along with other well known trademarked products of the period, including Neverleek roofing materials. We located publications produced by the Valentine Company from the same era as our Brewster coach-body. The advertisement informs the public that the traditional materials of "the old coach and carriage days" are changing, a truth that will be corroborated in the analytical section of the talk (Valentine's 1923).

The Valspar vanish product line is mentioned in the Valentine publication, and specifies its use for both clear and tinted varnishes. It is interesting to note that Valentine's suggests several colors for staining wooden coachwork including light oak, dark oak, and even green. Many Brewster bodies included their special moss green curly maple trim, though our Suburban body is all ash, tinted to one of the oak colors. The long oil varnishes required two days of drying before recoating and in other sections of the Valentine guide, finishing schedules span a full three week period from start to completion to accommodate the many layers and rubbing out processes.

We have noted the quality of the existing top varnish coat on the Suburban body examined for this study is less than superior and Valentine's provides information on this topic as well in their publications of the period (Varnish Difficulties). In fact most of the pitfalls warned against in the Valentine's literature are evident on the current topcoat of varnish on this Phantom I. (fig. 4)

Paint on metal: The exterior door panels are grained painted on aluminum which is particularly fragile. Flakes seem to pop from the surface with energy all their own. (fig. 5) The other non-wood components of the body, fenders, hood and cowl are painted black. There is some separation but little corrosion.

Coating Analysis

Analysis of the coatings was performed to under-

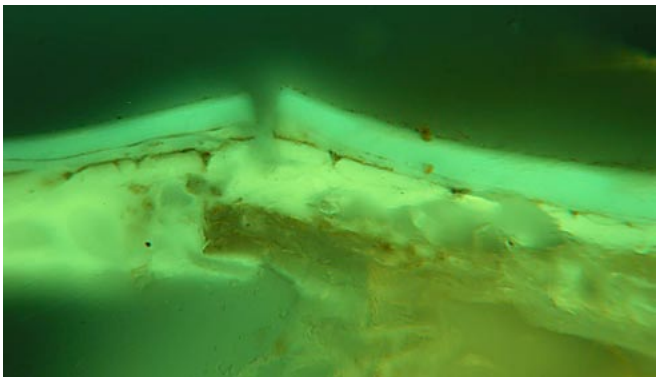

Figure 6. Cross section, exterior varnish, UV light, Leitz D filter cube.

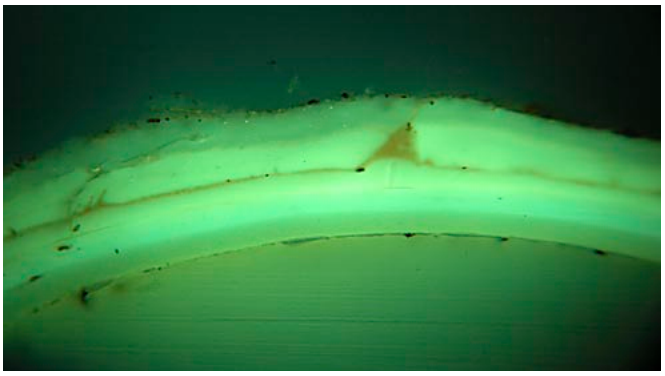

Figure 7. Cross section, UV light, grained paint.

stand the vehicle better and to help develop surface treatment recommendations to the owner and the staff of the Last Chance Garage. Samples were taken from the varnish from exterior wood of the driver's side front door, the grained paint on the driver's side rear door and the black paint under the lower hinge of the driver's door.

The coatings on the wood and metal parts of the body were analyzed by the staff of Winterthur's Scientific and Research Analysis Laboratory: Dr. Jennifer Mass, Catherine Matsen and volunteer scientists Janice Carlson and Dr. Chris Petersen. The varnish on the ash wood body was analyzed using optical microscopy and Fourier transform infrared spectroscopy (FTIR) and gas chromatography-mass spectrometry (GC-MS).

Varnish on Wood: A cross-section was taken from the front passenger's exterior wood door frame member and viewed in ultra-violet light using the Leitz D filter cube. The image indicates the presence of two zones of a transparent coating. (fig. 6). Note the weathered characteristic of the first, lower layer in figure 6, which could well be the varnish applied by Brewster in 1935. A second, upper layer covers the earlier weathered surface. This second coating most likely dates no later than 1950, the year Mr. Ferguson purchased the vehicle, since the oral history indicates that nothing has been done to the wood body since that time. The fluorescence emission of the two layers suggests that the properties of the two coatings may be sufficiently different that they could be separated, but this is just speculation at this point. Additional layer-by-layer analysis may help identify specific characteristics that could be taken advantage of should selective cleaning be desired.

FTIR

Analysis with FTIR indicated that the top coating seen in this section was primarily an alkyd resin and oil, possibly tung oil and GC-MS confirmed these findings. Additional analysis is needed to determine the composition of the lower layer. A spot test of the outer surface indicated that the varnish softened readily with ethanol. This may be in contrast to the experience of some, that alkyds are resistant to such polar solvents. However, alkyds are vulnerable to a degree to alcohols and this may be good news if the owner wishes to selectively remove just the later layer.

Grained Paint on Metal: A sample of the grained paint was analyzed using scanning electron microscopy-energy dispersive spectroscopy (SEM-EDS). A variety of elements were found in the base layer of the grained paint including silicon, aluminum, sulfur, barium, calcium, and zinc. (Carlson, Mass, Matsen, Petersen, 2005). A cross-section of a cupped grained paint sample shows the layering of the semi-transparent varnishes used to create the grained effect as well as the complexity of this coating. (fig. 7).

FTIR and SEM-EDS analysis indicates that the grain painting is a combination of cellulose nitrate, fillers, phenolic resins and oils. (Carlson, Mass, Matsen, Petersen, 2005). To summarize the grained painting analysis, the faux surface was achieved by using a white base of kaolinite and barium sulfate in a cellulose nitrate binder with the grained effect produced by using sparsely dispersed pigments in a phenolic resin and tung oil binder.

Black Paint on Metal: Optical microscopy indicates three zones, a thin reddish primer, a gray base and a black show surface. XRF, FTIR and SEM-EDS were used to analyze these components. (Carlson, Mass, Matsen, Petersen, 2005)

The thin reddish layer is primarily iron oxide which could be primer for aluminum. The sample studied was taken from an aluminum door panel reducing the possibility that this is residue from a ferrous substrate. However, the authors would like to re-analyze this paint to be sure that we are not confusing this with iron contamination from elsewhere on the door.

The gray base layer is heavily bulked out with the pigment lithophone (barium sulphate, zinc sulphide) as well as a host of other materials containing lead, calcium, magnesium and silicon.

The closest match for the binder of the gray base layer is an alkyd resin, which is the second time that an alkyd has come up in the analysis. As furniture specialists, this struck us as an early date for this material as we are not used to seeing it in regular use on furniture until later in the century. However, the DuPont Company developed an alkyd resin for automotive finishes in the mid 1920s marketed under the trade name "Dulux" which was a successor to the successful "Duco" line of paint.

FTIR analysis indicates that the black paint on top of the gray base is a cellulose nitrate coating. Cellulose nitrates were introduced as automotive finishes shortly after the First World War being marketed by DuPont as "Duco" in 1922 (www.heritage.duPont.com). The use of DuPont cellulose nitrate paint products on Rolls-Royce bodies built by Brewster is documented in a sales contract for Henry Francis du Pont's 1928 Cadillac that specifies the body to be painted "all black, striped white, same as John D. Rockefeller, Jr.'s new Rolls-Royce, but in Duco finish and polished."(Winterthur Archives) Thus the analytical findings are consistent with the documents from the time period.

Analytical summary

The varnish on wood is in two layers and appears to be comprised primarily of an alkyd resin. The grained paint contains kaolinite, barium sulfate, cellulose nitrate, phenolic resins and pigments. The nature of the black body paint is consistent with cellulose nitrate on top of an alkyd base.

Surface Coating Treatment Options

What should be done with these surfaces? Perhaps the most important step may be helping the owner to not only accept but to desire a presentation of the vehicle in a preserved state rather than better-than-new. We need to know more about the base layer to develop specific treatment options. However, it seems likely that a controlled solvent system such as an ethanol gel may be successful in removing the later layer and thereby retaining the original coating applied by the Brewster Company.

It seems likely that the vehicle will be driven and exposed to the elements, even if infrequently, increasing the need for a protective top coat over the existing varnish. This is where our colleagues who deal with large scale exterior projects may be helpful in selecting a coating that would be as reversible as possible and aesthetically pleasing while protecting the original varnish and wood from the elements.

The treatment options for the grained paint are varied. It does seem reasonable, even if not easily reversible, to consolidate this grain painting using a weather resistant material. Possibilities for consolidents need to be researched and explored to select

Figure 8. Seat cushion.

a material with proper glass transition point, UV stability and colorfastness. Acrylic resins are materials that may meet these criteria and are common to the conservation profession.

Areas of loss could then be inpainted to blend visually. While such a treatment might not win this vehicle 100 points in a competitive concourse exhibit, the skills common to a decorated surface conservator could bring the aesthetic to a point that the grandeur of the vehicle could be brought back while retaining the originality of the unknown Brewster artist who rendered this faux surface in 1935. Another approach would be to create a precise reproduction of each of the panels and retain the originals either in place behind the reproductions or in secure storage.

The options for the black paint were discussed with the staff at the Last Chance Garage. The specific original visual quality of this particular black paint could be reproduced using the analytical information generated by the Winterthur scientists. The areas of loss could be consolidated and skillfully inpainted, rendering a sense of overall completeness to the paint while preserving the original integrity of the surface. The owner will need to decide on the ultimate balance of presentation and preservation.

A conservation principle that we will strongly encourage for all surfaces, no matter what treatment choices are made, is to leave at least some small portion of the varnish, grained paint and black paint intact and undisturbed as a physical document of the surface history of the vehicle.

Upholstery Assessment

Interior

The interior upholstery of the Phantom I appears to be well preserved. (fig. 8). The primary upholstery material for the seats is leather, but durable faux rattan slipcovers have been made for each of the self-contained seat units. At first we thought the cases covering the leather upholstery were comtemporary to the 1934 body but upon further study they now seem to be associated with the Split Rock Lodge Period and were nailed over the leather to protect it while the car was used as a jitney.

Only one seat cushion unit was removed from the car and brought to the labs at Winterthur for study. This seat was offered as a documentation project during the Organic Materials unit taught for the first-year students in the Winterthur/University of Delaware Program in Art Conservation. Mayumi Yoshizawa selected the cushion as her object and created a very thorough work on its materials and construction.

The upholstery under the faux rattan case is a standard panel and buttoned leather cover common to the 19th and early 20th centuries. There are dissimilar aging qualities on the outer edge of the seat. A student working on the project was the first to observe this wear and minor deterioration which is localized to the three outer panels (Yoshizawa, 2005). This is illustrated quite clearly by the sharp area of degradation transferred to the paper rattan on the underside of the top case which is acting as a useful, yet unfortunate, litmus test.

Obviously, a different batch of leather was cut to make the outer panels and it is not known how much more of this grade material exists on the other seats. For the time being the degradation is not at all severe, even though the car is kept in totally uncontrolled storage.

The interior of the seat is difficult to access due to the relatively tight and intact cover. The seat bottom is tightly covered with a cotton oil cloth bottom. One small air vent hole allowed access to the interior to assess the spring work. An x-radiograph that we made gave a clear image of the complicated coil spring and metal accordion tie construction of the inner seat. Curled hair stuffing is visible in the digitally processed x-radiograph and a single hair was sampled and correlated to known photomicrograph library samples. A complete catalogue of loft measurements and fibers was generated for this study (Yoshizawa, 2005). A printed reference from an early Rolls-Royce brochure from the '30s touts the upholstery provided in their Brewster coachbodies:

> "UPHOLSTERY - Between each fold of Brewster upholstery, a shell of fine curled hair is filled and rounded with soft swan's down.
> The springs are firm at the front of the seat and the lower part of the back cushion; soft and resilient at the back of the seat and upper part of the back cushion." (www.coachbuilt.com)

Other textile components surviving in the Phantom I included woolen carpet with almost no evidence of insect grazing, though the leather piping on the edges is beginning to embrittle.

Exterior

The "boot" mounted on the outside back of the car is lined with a light-weight cotton oil cloth that is in serious need of stabilization. The roof is covered with Neverleek, which is an oil cloth.

Upholstery Analysis

The assessment of the original seat indicated that it is a vegetable-tanned leather. Microscopy indicated that the seat covers are paper and cotton fibers which comprise the "faux rattan" covers.

Upholstery Treatment Options

It is recommended that the rattan covers be kept in place as they do serve to protect the original leather seats. The covers could also be removed and preserved separately following routine conservation guidelines (Landrey et al, 2000). Binding and consolidation of piping areas on the interior upholstery is recommended along with standard cleaning procedures. The boot (trunk) compartment should not be used for the current collection of tools and jumper cables that it holds.

Conclusion

The assessment and analytical tools described here were useful in understanding more completely the nature of this historic motor car, how its body was crafted, what its original appearance might have been, and how it has aged. This information can be drawn on directly by staff at the Last Chance Garage and their contractors so that they may restore a grand vehicle in an informed manner while preserving its history in the process. We do not know what direction they will take with this object. However, it seems that a carefully planned and crafted treatment of this Rolls-Royce could result in an immensely satisfying balance of preservation, function and aesthetics without losing the integrity of its history.

The results of this study along with additional analyses will be shared with the historic automobile collecting and restoring community. In the process, it is our desire that the influence of the conservation profession may continue to grow in new areas of our heritage including historic automobiles. Exceptional examples of historic automobiles are just as deserving of the input from conservators and scientists as are the more established aspects of cultural property.

Even conservators want to take a ride in the Rolls. We were treated to a ride around the Winterthur estate getting a sense of the vehicle and all of its materials in motion.

A vehicle such as this appears right at home at the front door of the Winterthur Museum and Country Estate.

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