THE NEXT GENERATION

New Restorers, New Tools *and* New Techniques

BY KANDACE HAWKINSON

The cars we love are often tied in our mind to a particular historic time and place—and even, perhaps, a person. We think of them as a gift from past to present, a gift we hope to pass on. In fact, the lives of cars are ongoing; they run in tandem with ours for a time and may continue long after we are gone.

A new generation is emerging to care for these cars in the coming decades—and they are eager to put to use new scientific knowledge, new tools and new techniques.

Owen Falk

CREATING THE PERFECT PRESERVATION COCKTAILS

Owen Falk admits that his first automotive memories are perhaps "a bit cliché." His father, Steve Falk, used to take him to car shows, and together they would walk around whatever was on display—antique cars, muscle cars, old racing cars, any kind of cars. As you might expect, as a child Owen liked cars with shiny parts, multiple buttons, loud engines. He liked cars he was allowed to sit in. But he also liked older cars—those with what we now call patina. They reminded him of things he had seen only in cartoons.

If he correctly recalls the car's details, his first specific car memory involves an old Delage: "I remember looking up to my dad and asking if it was Cruella de Vil's car," he says. "I was absolutely convinced that it was her car."

In the ensuing two decades, Owen graduated from Stanford University with first a bachelor's degree and then a master's degree in chemical engineering, having served for a time as a research assistant with The Revs Institute there. Now at age 25, he is using his knowledge and his skills to help authenticate and preserve the old cars he is so passionate about.

Mechanical engineering was the more likely path to automotive expertise in years past, but as a chemical engineer Owen is now more readily able to undertake the nondestructive analysis of automobile parts and finishes—and to prescribe the best cocktail of chemicals and methods to preserve a car.

"Spectroscopy is the blanket term for the techniques I use," he says. "It involves shining a light source on some sort of material and collecting the signals that are reflected from that." Certain forms of spectroscopy are better able to detect and provide data about certain materials. High-energy X-rays, for example, are best used to collect atomic information on metals, glass and ceramics, whereas lower-energy infrared light is better able to probe the molecular data of paints and leathers.

In the past, to determine a car's makeup and authenticity, even the best restoration shops, including those organized by major manufacturers, would take small plugs of material from key parts of a car in order to do metallurgical testing. By its very nature, this process was destructive—and could only provide data regarding the plug that was tested. Because spectroscopy is nondestructive, the whole of a car can be scanned and more of its story can be told. "Seeing how a car has been put together throughout its history, not just how it was originally built, adds a lot to the pedigree of the vehicle—and affirms its historic significance," says Owen.

Owen Falk uses spectroscopy to determine the content of cars and car parts. Opposite: Gundula Tutt views paint samples through a microscope; a Bugatti fender comes to life at Autoservice René Große.

At one point, for example, Owen was able to determine that parts of a Bugatti had been replaced in period, with metals used only in tanks from World War II. Despite the science undergirding his work, luck played a role in making this determination: just two foundries had produced metals with the exact alloy composition of the metals found in the Bugatti—and their databases had been opened to the public and uploaded to the Internet, where Owen found them.

"That's the difficult part," says Owen of decoding the data. "You can determine general classes of alloys very easily, and that can be helpful, but to properly identify exactly where and when an alloy was made can be challenging. You need a substantial database of comparative readings to confidently determine where a metal came from."

Airbrush equipment is used to retouch paints. Right: Gundula Tutt injects a special formula to consolidate the chipping original nitro paint layers on a Voisin C 11.

A growing community of scientists is collecting this data. Owen has partnered with the Smithsonian National Air and Space Museum on some of their projects—and the chief conservator, Malcolm Collum, has in turn consulted on some of Owen's projects. Owen has also worked a bit with the FBI and the Royal Canadian Mounted Police, who have been gathering information on cars from the past five decades to help with hit-and-run investigations. And from time to time, old textbooks and manuals are of use. When comparative data can't be found, Owen goes old school: he seeks out a similar vehicle with an unbroken paper trail that speaks to its authenticity—and he scans it to get the comparative data he needs.

"I'm by no means the only one capable of doing this kind of work, or the only one who has thought of doing this," he stresses. "The art community, in particular, has been using X-ray fluorescence for quite a while."

Owen developed most of the techniques he uses while he was with The Revs Program at Stanford, working with the professors there, and he also credits founder Miles Collier with being "incredibly helpful and empowering" him in this venture.

Owen is most excited at this point by the preservation work that follows on the heels of authentication. "That's where my chemical background really weighs in heavily," he says. "After I've collected all of the data on the materials present in a vehicle, I can create personalized preservation packages for that vehicle."

His work on the solubility parameters of certain materials determined, for example, that one of the cleaning products commonly used by collectors and restorers actually dissolves and degrades certain antique finishes over time. He is now working with chemical manufacturing companies "to make specialty chemical cocktails that preferentially preserve certain materials."

Gundula Tutt

BRIDGING THE WORLD OF ART AND AUTO CONSERVATION

Gundula Tutt can still hear the alarm ringing at the famed Kunsthalle Tübingen in Germany. She can still see the museum attendant running toward her, shouting. And she remembers that her parents, who were very interested in fine arts and antiques and frequently took their daughter with them to museums, were "quite angry."

"I didn't try to take the painting off the wall," she explains. "I just stuck my nose behind it. I just wanted to peek at the back of it from the side."

At the time, Gundula was just 11 or 12, and she was fascinated with what might be behind paintings or inside sculptures. It was a fascination that didn't diminish with age. She wanted to be able to look closely at art objects. She wanted to touch them. And at a certain point, it finally occurred to her that she could do that if she was the person caring for them.

For a time, she studied art history, but that was "far too theoretical" for her. She eventually found the perfect position as an art conservator. Then, amidst a conservation project at the cathedral in Freiburg in 2005, a random comment from a colleague pulled her sideways into the world of collector cars.

The colleague mentioned that a friend had just purchased a collector car with paint damage. Gundula wanted to be of help but soon realized that her knowledge didn't directly transfer to early automotive paints, which often had a nitrocellulose lacquer base. So she set about expanding her knowledge. She is now considered an expert on vehicle paints and fabrics from 1900 to 1945.

Gundula has a large and growing collection of historic paints and materials, and spends much of her time researching and experimenting with how best to match and apply certain paints

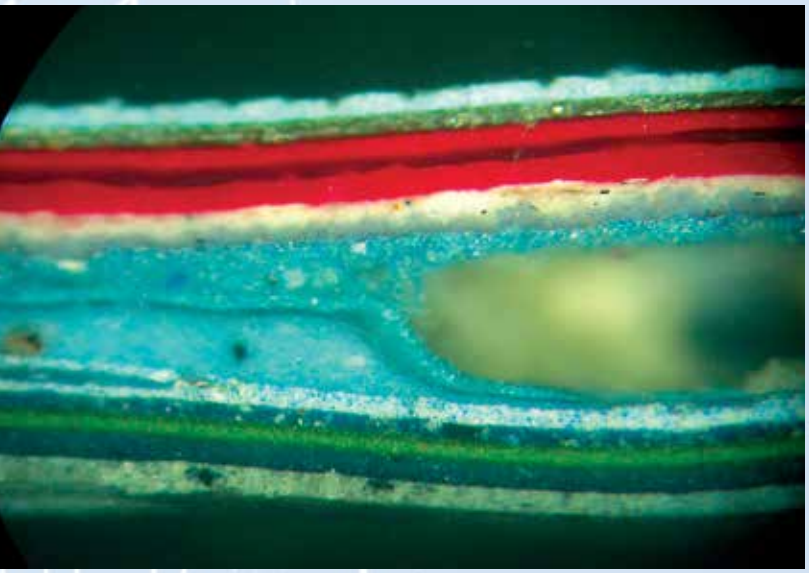
"I think that automotive collectors, like art collectors, are becoming more and more refined in the way they think and act."

or reproduce certain fabrics and leather coverings on cars—whether that involves re-creating old tools and techniques or implementing more modern methods.

But perhaps her primary contribution is being made in other ways—in helping to translate the concerns and standards of an art conservator to the automotive world.

In 2012, she was involved in drafting the Turin Charter, which set professional standards for the preservation, conservation and restoration of vehicles, much as UNESCO's Venice Charter established such standards for work on historic buildings back in 1964. Ratified by FIVA (the Fédération Internationale des Véhicules Anciens) in October 2012, the Turin Charter emphasizes the importance of understanding and respecting a vehicle's complete history, seeking to preserve and conserve its originality whenever possible, and undertaking its restoration, when necessary, in such a way that new work and parts are documented—and the restoration efforts can be reversible.

After initially inspecting the collector car owned by her colleague's friend, a Bugatti Type 43C where someone had stripped large portions of the paint with grinders and a blowtorch, Gundula's personal standards were challenged. Many restorers would have determined that a new finish from the ground up was more than warranted; the remaining nitrocellulose paint was incompatible with modern two-component coatings. But Gundula found a way to reconstruct a suitable base coat and nitrocellulose lacquer to retouch the damaged areas in such a way that they would blend with the remaining original surface. While trying to approximate the original paint as closely as possible, she also included a modern additive in the paint so her efforts could be traced.



A microscopic cross section of paint layers on a car that was often repainted.

Similarly, when working on an early Renault that featured partinium metal sheets painted with gold lacquer and covered with perforated cane work, Gundula filled corroded areas with an intarsia of metal held in place by an araldite adhesive, which can be removed if warmed.

"I think that automotive collectors, like art collectors, are becoming more and more refined in the way they think and act," says Gundula. "They bring an increasingly detailed approach to these vehicles. They have a refined perception of their use and restoration."

Gundula stresses, of course, that the automotive world differs from the fine art world in that automobiles have more than an aesthetic purpose; they were made to be used. It is that utility, in large part, that draws her to them.

"I like to work on things that are inhabited, things that are used," she says. "That's why I initially focused on conserving buildings. That's why I decided against working in a museum. How do we make it possible for automobiles to maintain their originality as much as possible while also allowing them to be used?

"We have a word in German, *Stehzeug*, that is a play on words for use and movement. *Stehzeug* refers to an object that was made for transportation but is just standing around, in contrast to *Fahrzeug*, an object made for transportation that is being driven. It is a bit like calling a 'vehicle' a 'statical.'

"Use is the fourth dimension of an automobile, and if you lose that you lose a lot. Using it is an important part of preserving it."

Brice Chalançon uses a camera to inspect the engine of the Bugatti Type 41 Royale Coupé Napoléon; Gundula works to consolidate the historic numbers while Brice strives to maintain the mechanics on an early Germain Lambert Race Car.

Brice Chalançon

MOVING A MUSEUM TOWARD THE FUTURE

At just 29 years of age, Brice Chalançon heads restoration efforts at Cité de l'Automobile/Musée National de l'Automobile, which houses the Schlumpf Collection in Mulhouse, France, and is said to be the largest automobile museum in the world.

Brice is the first to admit that museums and collectors have often had very different goals—particularly when determining how automobiles are to be used and preserved. But he also sees these two worlds coming together.

"There has always been a gap between collectors and museums, but the gap is much smaller than it was 15 years ago. At that point, museums often said, 'A running car is a dying car,' and collectors said, 'No, a non-running car is a dying car.' But now museums realize that maintaining a car in running condition is a part of preservation, it preserves the car's utility, it continues its history, it adds to our knowledge and experience of that car. And some collectors are driving their cars less often or less fiercely—or they are creating replica engines and other parts so they are not endangering the original."

As a first step toward this, Brice is seeking to get more museum cars back on the road. To do that, he and his team have used cameras to scan the engines of cars with an eye to spotting developing problems.

"Before we start a car that hasn't run for 50 years, I want to see if the valves are okay, if the cylinder block has cracks, if anything seems amiss," says Brice. "If we do spot something, we take apart the engine and fix it."

They are also making 3-D computer diagrams of unique engine parts and compiling a database of engines in cars in the museum "with the hope of predicting and more easily fixing problems in coming years." And they are moving toward 3-D printing of parts; working with ENSISA, the local engineering school, they scanned a wheel on a Farman NF2, with the goal of making a spare. The school then used rapid-printing technology to create a 1/7 scale model of the wheel. A full-scale model is the next step.

Pat Knapp

LEARNING THE CRAFT, EXPLORING NEW TECHNOLOGY

Pat Knapp is just 23 years old, but he has already logged a decade of experience in auto shops.

Pat grew up in a suburban New Jersey home in a relatively white-collar neighborhood about 40 miles from New York City. More importantly, his home was just a few doors away from two neighbors who were "very into cars." One neighbor was into off-roading, the other was into early muscle cars—and when other kids headed out to play, Pat headed over to the neighbors and did what he could to help out. He was just 13 when one of those neighbors got him a job at a local auto shop.

"It was a pretty cool setup," says Pat. "I wasn't making a bunch of money, but the shop specialized in German and Italian imports, so at that age I was getting to work on some pretty awesome cars. From there on out, I knew what I wanted to do."

Pat went on to attend McPherson College, the only U.S. school offering a full four-year bachelor's degree in automotive restoration. And today, Pat works at Motion Products, a leading restoration shop in Neenah, Wisconsin, where some of the most skilled craftsmen in the industry work alongside—and utilize—some of the very latest technology.

At McPherson, where Phil Hill Scholarships from Pebble Beach Company Foundation support several students, new technology and new techniques are beginning to make their way into the machine shop and the curriculum, but the emphasis remains on teaching traditional restoration techniques that might otherwise be lost. Pat recalls, for example, that the sheet metal program offered extensive lessons on using lead filler rather than Bondo. He also learned to manually machine the parts he needed.

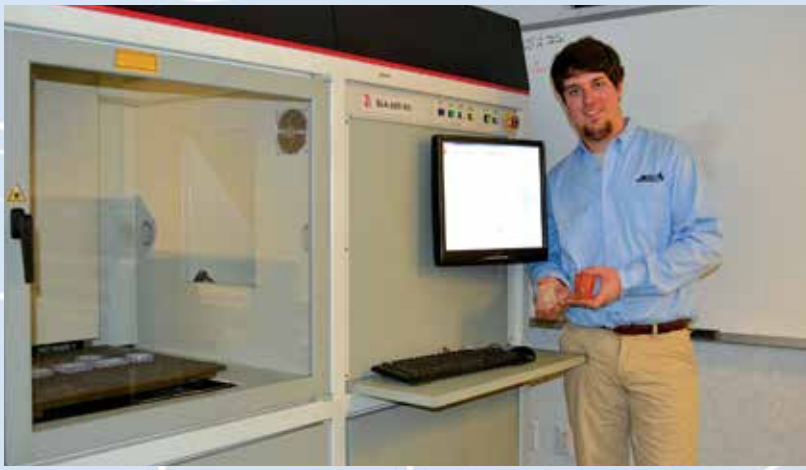
"You learn to do it the old-fashioned way, spending basically a full semester at school manually machining three or four parts, bending over a lathe or mechanical mill. Then you watch a machinist here upload a file, and a part zips out in a matter of minutes or a couple of hours. That alone is enough to sell you on some of the new technology. It makes you a believer real quick."

Motion Products bought its first 3-D printer about six years ago, out of necessity.

"We were at work on a project, and we had searched the world for one particular part," says Chief Financial Officer Bill Murphy. "We couldn't deliver the project without it, so we finally decided that we would have to figure out how to build it."

The part was a unique lens cover with both nomenclature on the exterior and design work on the interior, so it could not be duplicated with more traditional methods—with manual molds and mills and lathes—or even with CNC machines (computer-aided machining tools) that many restoration shops introduced decades back. Scanning an existing lens cover and reproducing it with 3-D rapid-prototyping equipment seemed to be the only option.

"With CNC equipment, you design a part on a computer and then take a chunk of material and whittle away what you don't want," explains Murphy. "It's called 'putting chips on the ground.' What you are left with is the piece you use. Rapid prototyping does basically the opposite; you start with nothing and build the parts you want and only what you want. There's no waste."



Pat Knapp holds the rear directional lens for a 1957 Ferrari 250 Tour de France Berlinetta. CAD technology was first used to create a template from the original broken pieces and then the design was perfected using SLA (sterolithography) rapid-prototyping technology.

Once the equipment was in place, the staff at Motion Products started to look at it in new ways. With handheld scanning equipment, any automotive part or even an automobile as a whole can be reproduced exactly—with individual idiosyncrasies and even the tiniest dents and dings of history intact.

"We're starting to realize that any one-off automobile should probably be scanned as soon as possible as a preventive measure," says Murphy. "That way, if there's an accident in the future, you will have the data to rebuild any part."

Murphy is also captivated by the fact that the new equipment can serve as a draw, enticing young people to enter and stay in the industry. It might even help us rebuild the workforce we need to preserve and restore the cars we love in the coming decades.

A restorer at Autoservice René Große planishes a large panel using a pneumatic hammer; the wooden frame of a Hispano-Suiza is given a partial restoration; this model for a Bugatti fender was made by laser-scanning an intact fender, flipping the image, and using a water-jet cutter.

René Große

MESHING OLD AND NEW, EAST AND WEST

René Große has a history that works to his advantage in the world of automotive restoration. He was born and raised in Brandenburg, when it was a part of the German Democratic Republic.

There, he notes, all trades related to the automobile "were highly appreciated" as new cars, or spare parts for older automobiles, were in very short supply: "The repair shops had queue times of about four months just to get a simple regular inspection of your car."

He started to restore vehicles in his early youth, and against the advice of nearly everyone he knew, he opted not to go to college but to vocational training to become a mechanic. He was "particularly taken with the craft of shaping panels," so he specialized in coachbuilding. But, of course, he did a bit of everything.

Over time, he learned skills that had not been taught in the West in decades—skills like the best techniques to use when painting a car with one-pack coatings. He also learned to use his ingenuity to find a solution when none was evident.

"On many occasions, we had to make our own spare parts, which developed our ad-lib talents, our creativity, our inventiveness. Saying 'It just won't work' was not an option."

In 1989, with his own options for advancement being limited, René fled to the Federal Republic of Germany via the German embassy in Prague. And there, he found he had to learn his craft anew; although his knowledge and skills were respected, he didn't begin to know how to use the tools and techniques in a modern repair shop. To say he gained a great appreciation for these new things and new possibilities they offered would be an understatement.

In 1996, after the Wall between East and West Germany was torn down, René returned to his hometown where he worked for years as the director of a classic car company. And then in 2003, he realized a dream; he founded his own firm, blending East and West, old and new.

His work completely restoring the long-lost BMW 328 Mille Miglia Touring Coupé a couple years later, put his firm on the map, bringing many other projects his way.

Today, René talks with excitement about the many ways automobiles are being preserved and restored with ever-increasing respect and sensitivity, using every available tool and technique. He talks about old techniques, like gas fusion welding, tin coating, and hand panel beating. And he talks about laser measuring and scanning, computer cutting and printing.

Photos of his work show, for example, how the damaged left fender of a Bugatti emerges from the mélange of all these things: the right fender of the car is scanned with a laser, the details are reversed, a water-jet cutter creates a new vertical wood framework, and then a new fender is hand crafted over that model.

What else is possible now? What will be possible in the near future? All things. Just ask.