Article: Rethinking the monumental: A creative approach to the preservation of a landmark Tony Smith outdoor sculpture

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1. INTRODUCTION

Gracehoper, Tony Smith’s monumental painted steel outdoor sculpture, sits on the north lawn of the Detroit Institute of Arts (DIA) and is the largest of Smith’s sculptures to be fabricated during his lifetime. It stands 22.5 ft. high, 46 ft. long, and 23 ft. wide, and weighs 27 tons with over 3800 square ft. of surface (fig.1). The sculpture was fabricated by Industrial Welding Company of Newark, New Jersey, in 1972 in six large sections out of ¼-in. steel plate welded to a steel armature and then trucked to Detroit and installed in the presence of Tony Smith (fig. 2). Smith designed the cardboard maquette for the sculpture in 1961 (fig. 3). The funnel-like form of the main body reminded him of the hoppers used to load coal onto railroad cars (Smith et al. 2007, 36), and led him to name it Gracehoper, after the mythical beast representing change, progress, and dynamism in James Joyce’s novel Finnegans Wake (Joyce 1939, 416).

By the time it was assessed for treatment in 2010, it had been 38 years since Gracehoper was installed and 21 years since the last topcoat of paint was applied. The painted exterior had long ceased to represent the uniform, monolithic “dull semi-gloss” black surface specified by Smith (Auld 2001). The surface of the sculpture badly needed treatment to restore its appearance and ensure its preservation for another generation.

The first part of this paper focuses on treatment strategy and the decision-making process that led to a satisfactory treatment plan. Decisions were overwhelmingly influenced by the monumental size of the sculpture, yet also took into consideration condition, Smith’s aesthetics, and current coatings...
Fig. 1. *Gracehoper*, Tony Smith, conceived 1961, fabricated and installed in 1972, painted steel plate on steel armature, \(7.32 \times 14.02 \times 7.32\) m, DIA, 72.436, before treatment in 2010 (Courtesy of Detroit Institute of Arts)

Fig. 2. *Gracehoper* installation, 1972 (Courtesy of Detroit Institute of Arts)
Fig. 3. Tony Smith standing behind the painted cardboard maquette of Gracehoper during the installation of the full-scale sculpture at the DIA, 1972 (Courtesy of Detroit Institute of Arts)

technology. These factors led to choosing to treat Gracehoper on-site, and to repaint the surface using a roller-applied high-performance paint—an adaptation not specified by the coatings vendor. The second part of the paper provides a summary of the 2013 treatment as well as observations and commentary on how the plan worked out in practice.

2. STAKEHOLDERS AND THE FINANCIAL CLIMATE

Given the scale and significance of the sculpture, it was clear that this was going to be a challenging, expensive, and high-profile project. The outcome would have to satisfy a number of stakeholders, including the DIA as the owner/caretaker, the Tony Smith Estate as protectors of the artist’s aesthetic intent, the financial supporters of the project, and the public as vocal tax supporters of the museum.

In 2011, a project team was formed consisting of John Steele, DIA Conservator of Sculpture and Decorative Arts; Rebecca Hart, DIA Associate Curator of Contemporary Art; Abigail Mack, Object Conservator of Abigail Mack Art Conservation LLC and specialist in the treatment of modern outdoor sculpture; James Sejd, President of the industrial painting company ASCo; and Sarah Auld, Director of the Tony Smith Estate. Representing the major stakeholders in the project, each team member brought his or her professional expertise to the collaborative decision-making process.

Treatments of this scale are expensive. Costs can range from $200,000 to $700,000 depending on the specific condition issues and the logistics involved. Painting is just one part of the greater project.
budget. There are front-end costs for treatment research and development, and, if the treatment is done on-site, costs for containment, equipment rental, and landscaping; or, if done off-site, costs for rigging, transportation, and facility usage.

The money required to pay for Gracehoper’s treatment was raised exclusively through grants and private donations rather than coming from the DIA’s general operating budget. While a crucial regional tax vote to support the museum’s operating costs for the next decade took place during the planning phase of the project, it was deemed both politically and financially wise to avoid using any funds from the operating budget to pay for such a large project. Though the fundraising effort was difficult and time-consuming, raising the money privately had the advantage of generating a much greater sense of community interest and ownership in the project.

3. TREATMENT APPROACH

To tackle an object of this scale in a financially challenged climate, the team would have to be sensitive to cost as well as to conservation considerations. The development of a treatment strategy was not only important for planning but also prudent with all of the stakeholders looking expectantly over the team’s shoulder. The development of the strategy began with two key logistical questions:

- Can the sculpture be treated effectively on-site or does it need to be disassembled and treated in an off-site facility?
- What paint best matches Tony Smith’s aesthetics and best meets the team’s requirements for durability, application, maintenance, and availability?

The team identified four major factors that influenced the answers to these questions: the condition of the sculpture, its monumental size, Tony Smith’s aesthetic choice for Gracehoper’s appearance, and current coatings technology to help achieve and preserve the correct appearance.

4. FACTORS INFLUENCING THE DECISION TO TREAT THE SCULPTURE ON- OR OFF-SITE

4.1 CONSERVATION AND STRUCTURAL STABILITY ASSESSMENTS

At the time of the conservation and structural stability assessments, the sculpture had been exposed to the elements for 38 years and had been repainted twice since it was installed. The paint and primer on the surface were a TNEMEC system (topcoat: Series 71 Endura-Shield, aliphatic acrylic urethane) applied in 1986 and top-coated with Series 73 Endura-Shield in 1989.

Prolonged outdoor exposure had disfigured the paint so that it was significantly faded, streaked (fig. 4), and marred by graffiti. Corrosion along the seam lines and around the hatch door (fig. 5) had caused lifting paint and staining from rusty water run-off. The paint on the top surfaces of the sculpture was badly eroded and the paint on the undersides was flaking off.

Conservation condition assessments included an evaluation of the painted surface using paint thickness and adhesion tests. Both showed that the majority of the painted surface, though disfigured by weathering, was well adhered and could be lightly sanded and painted over. Areas where the painted surface was badly corroded and weathered, such as at the seams, could be treated locally by stripping them back to bare metal and recoating.
Fig. 4. Streaked, marred, and faded paint on the west face, before treatment, 2010 (Courtesy of Detroit Institute of Arts)

Fig. 5. Corrosion around the hatch lid, before treatment, 2010 (Courtesy of Detroit Institute of Arts)
A structural stability assessment evaluated the extent of damage to the structure from corrosion, identified joins, and precisely measured dimensions (fig. 6). The steel structure, including the internal armature, footings, seams, and mechanical joins, was found to be stable. Ultrasonic thickness gauge measurements of the steel plate confirmed that the ¼ in. plate was not significantly compromised by interior corrosion.

The interior walls were covered with black Ziebart Sealant applied in 1985. This sealant is used to protect auto underbodies and Ziebart, a local Detroit company, donated the product and its application. Assessment of the 28-year-old coating showed that it was largely intact with the exception of the walls and floor beneath the hatch. Water leaking from the failed gasket around the hatch had caused local corrosion to develop in these areas while the rest of the interior was only lightly corroded overall (fig. 7). Careful inspection showed that the Ziebart coating was stable and could therefore be left in place without posing a risk to the sculpture. To remove it would be difficult, requiring the full disassembly of the sculpture owing to restricted access to the interior, as well as to current health and safety regulations.

Information from the assessments led the team to conclude that the structure and surface were not compromised to the degree that the sculpture would need to be disassembled and removed to an off-site facility for complete stripping and recoating.

4.2 SIZE

Because the overall structural stability was good and the adhesion of the existing paint was generally satisfactory, size then became the determining factor in answering the on-site versus off-site question. The decision was based on the cost and treatment benefits of moving a 27-ton sculpture off-site. The major benefits of off-site treatment would be greater accessibility to both the interior and exterior
Fig. 7. Corrosion on the interior walls just below the hatch caused by water leaking through the hatch (Courtesy of Detroit Institute of Arts)

surfaces of the disassembled sections, and more controlled conditions for painting. Working on-site would mean the opposite: limited access to the interior and restricted access for painting steeply angled surfaces in uncontrolled outdoor conditions.

Though the benefits for off-site work were many, the high cost of moving the sculpture, considered together with its condition, led to the decision to treat it on-site. The estimate for rigging and transportation topped $100,000. The cost of renting a local warehouse or transportation to a more distant paint facility added to that. Travel frames for the six sections were estimated at $6000 to $10,000 each. The element that had the greatest influence in the decision was that after creating a perfectly painted surface at an off-site facility, the team would still face the additional costs of repainting on-site to correct unavoidable damages incurred from rigging and to hide seam lines at the joins. Figure 8 shows the condition of *Gracehoper* in 1972 after installation but before the final coat of paint with numerous scratches, abrasions, and visible seams. It should be noted that the artist and fabricator also chose to apply the final layer of paint in situ.
5. FACTORS INFLUENCING THE PAINT CHOICE AND APPLICATION METHOD

5.1 TONY SMITH’S AESTHETICS

Tony Smith said “[the sculptures] may be seen as interruptions in an otherwise unbroken flow of space. If you think of space as solid, they are voids in that space.” (Wagstaff 1966). An even, unblemished surface is essential for this visual effect. Streaks, corrosion, uneven fading, lifting or failing paint, chalking, abrasion, and accumulation of biological debris all detract from the artist’s intended appearance. Sarah Auld, Director of the Smith Estate and team member for the treatment, advised on aesthetics and described the appearance of Smith’s black sculptures as a “dull semi-gloss” (12–20 gloss units at 60°) (Auld 2001).

Additional requirements for the paint include durability, the ability to be applied evenly over large surfaces, ease of touching up if damaged, and ready availability in small quantities.

To achieve the visual effect that Smith valued, most sculptures were sprayed at indoor facilities under controlled conditions, where with great effort, the painters were able to produce close to perfect surfaces. However, owing to the specific needs of Gracehoper, it would likely not have been possible to achieve such perfection on-site. High-performance semi-gloss paints are challenging to handle under the...
best of conditions and the added variables introduced by on-site application, including accessibility and weather were too much of a gamble. Second, Smith’s early surfaces were not perfect. Gracehoper is a case in point since the artist specified roller application. It is, however, clear that fabrication and surface treatments of Smith’s early sculptures have evolved from loosely painted to the more flawless painted surfaces of his posthumous editions. While the flawless appearance has become generally accepted criteria, plenty of documentation exists showing irregular and textured surfaces (fig. 9) (Detroit Institute of Arts 1967).

The project team then reconsidered the quest for a “perfect” surface, especially in light of the challenges of painting on-site. If some texture or irregularities were considered acceptable and, it could be argued, even intended by the artist, there could be some latitude for application. This also provided the possibility to forgo the intensive masking of individual surfaces, adding time and labor costs, and the large enclosed containment structure required for spraying. It should be noted that from the onset, roller marks (impressions or lines created by the edge of the roller) were not considered an acceptable irregularity. However, amorphic and subtle textures that would visually dissipate within a normal viewing distance of a monumental sculpture were permissible. The challenge then became how to allow for some acceptable texture while avoiding the impression of a “bad” paint job.

Fig. 9. A 1966 painted plywood mock-up of Smith’s We Lost (conceived 1962) with visible brush marks. The sculpture is shown here on the cover of the 1967 DIA exhibition catalog Color, Image, Form. (Courtesy of Detroit Institute of Arts)
5.2 CURRENT COATINGS TECHNOLOGY

While surveying current coatings technology, it became clear that available paint choices were limited, and appropriate aesthetic criteria represented a small portion of the coatings industry. In simplistic terms there are two broad categories of paint to choose from: low-performance paints, referred to here as common paints, which are easy to apply but are not durable, and high-performance paints, which are durable but can be difficult to apply. Therefore careful consideration was required to select a coating that would provide durability, reduce life cycle maintenance costs, and minimize difficulty in application.

In addition to considering paint types, application difficulties exist that are found with all semi-gloss paints, from hardware store-bought acrylics to aerospace fluoropolymers. For example, whether the paint is sprayed or rolled, blotches and stripes occur where passes overlap. Application of semi-gloss coatings often presents multiple gloss values for the same coating on a particular piece due to the irregular or non-uniform film thickness that results in striping (fig. 10).

The team briefly considered semi-gloss low-performance hardware store paints that are inexpensive and easy to apply, for instance alkyds, acrylics, and some acrylic polyurethanes. Tony Smith himself chose an alkyd paint, Benjamin Moore Ironclad Retardo, for Graebooper when it was installed. Applied by roller, the overlaps in these paints are immediately visible but diminish quickly with weathering to yield a more uniform appearance. Unfortunately, continued weathering alters the paint's

Fig. 10. Example of “striping” on a Tony Smith sculpture (Courtesy of Abigail Mack)
color and gloss noticeably within one year and dramatically within four years (fig. 11). While the team briefly considered using low performance paints on Gracehoper for their low cost and ease of use, the lack of durability and quick change in appearance was deemed unacceptable, especially when faced with the enormous cost associated with repainting a sculpture of the size every five years.

The team then investigated high-performance coatings. Recent developments in coatings technology by the military, and aerospace and auto industries, along with newly mandated environmental restrictions, have led to a number of high-performance coatings becoming available on the market; these include waterborne acrylic polyurethanes, siloxanes, and highly durable fluoropolymers. New additives such as polymeric beads as a substitute for traditional silica flattening agents are also available. These high-performance paints require greater expertise, familiarity and knowledge of application techniques than previous coatings systems, and when used on works of art, they require painters to respond quickly during application with improvised handling techniques.

High-performance coatings are very durable; many have life spans of 15–20 years with excellent color and gloss retention. Formulated for spray application, they are expensive, costing as much as $500 per gallon, and they are not readily available outside the industrial painting arena. As with all semi-gloss paints, achieving an even application is difficult, and because these paints are durable, overlaps and other surface flaws from the painting process will be visible for years. Still, their durability trumped both the

Fig. 11. This picture shows a coupon, newly painted with Benjamin Moore Ironclad Retardo black paint, against the dramatically faded surface of a section of a Smith sculpture (in storage) painted with the same paint after seven years of outdoor exposure. (Courtesy of Abigail Mack)
cost per gallon and handling difficulties. The team chose to more closely examine application methods in hopes of finding one that best suited *Gracehoper*.

Rolling a high-performance paint combined an easier and more forgiving application method with the durability advantages of the paint. Compared to spraying, rolling produces more surface texture and a thicker line overlap. However, if the roller marks could be minimized with the right paint formulation, a bit of surface texture in exchange for easier application would be acceptable. Rolling could also be cheaper, cutting down on labor costs and the size of the containment structure. The only problem was that these paints were formulated for spraying and had not been thoroughly tested using other application methods.

6. TONY SMITH PAINT STUDY

In Spring 2013, Sarah Auld, conservator Abigail Mack, painter James Sejd, and coatings specialist John Escarsega of the US Army Research Lab, also known as ARL, initiated an independent study to evaluate commercially available high-performance paints. The aim was threefold: to identify commercially available high-performance paints that best match Smith’s aesthetic; to measure their color and gloss retention after artificial aging; and to evaluate the application and appearance of rolled samples for possible use on *Gracehoper* and other Smith sculptures. A group of 10 high-performance paints were selected for the study. For the artificial aging tests and outdoor exposures, each coating system was sprayed onto coupons according to manufacturer guidelines. ARL conducted the weathering and sample evaluation using standard procedures and instrumentation. Sample sets were evaluated in three different exposures; QUV chambers, Xenon chambers, and static outdoor exposure. The samples were evaluated at various increments and all exposure times are being converted to total UV irradiance. Given the depth and detail of the data collected the information will be published in a separate technical report providing highlights in regard to the instrumentation used and lessons learned. The figures below show a typical QUV chamber and a coupon exhibiting both color and gloss loss (figs. 12, 13).

For the roller application evaluation, the same paints were first rolled onto 4 ft. × 8 ft. steel sheets often with the inclusion of additives provided by the manufacturer (fig. 14). Some paints were
Fig. 13. An example of a coating that aged poorly being evaluated under natural light (Courtesy of Abigail Mack)

Fig. 14. Evaluating the roller applied paint samples for color, gloss, roller marks, and surface texture (Courtesy of Abigail Mack)
identified for additional testing using alternate additives, different roller types, and different application
techniques. As already mentioned these high-performance paints were designed to be sprayed, and many
manufacturers were reluctant to support a study that used any variation in application methods or
additives that varied from their specifications.

Roller application of the high-performance paints proved to be very challenging. The study was
designed to continue until all the paints failed to determine the farthest data point, however initial results
from May 2013 (table 1) showed that though no single paint met all of the team’s requirements, some
were promising. One paint was eliminated almost immediately because it did not fit the minimum
durability criteria and another was eliminated because the matte clear coat could not be applied by
roller. Many samples were too matte or too glossy, ranging above or below the Estate’s recommended
12–20 gloss units. Texture and roller marks were still an issue despite multiple attempts to minimize
them by adjusting the formulas using manufacturers’ additives. Surface texture, however, is less of a
concern than roller marks since, as noted above, roller marks will be highly visible for years.

7. SUMMARY OF THE TREATMENT STRATEGY

Despite these issues, the project team was able to choose three top contenders for further evaluation
based on the main criteria of acceptable roller application: Sherwin Williams Fluorokem HS, PPG

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<table>
<thead>
<tr>
<th>Paint</th>
<th>Type</th>
<th>Gloss Units</th>
<th>Roller Application</th>
<th>Other Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akzo Nobel Aerodur 5000</td>
<td>Polyurethane</td>
<td>4 spray, 5.5 roll</td>
<td>Fair, Roller marks</td>
<td>Poor coverage, requires multiple coats</td>
</tr>
<tr>
<td>Carboline Carboxane 950 Satin</td>
<td>Fluro-urethane</td>
<td>17.6 spray, 7.5 roll</td>
<td>Poor, Roller marks, Sags</td>
<td>High minimum order</td>
</tr>
<tr>
<td>Deft Deftanhe 4750</td>
<td>Acrylic Polyurethane</td>
<td>33.5 spray, 27 roll</td>
<td>Poor, Roller marks, Sags</td>
<td>Too glossy</td>
</tr>
<tr>
<td>NCP N-9498A</td>
<td>Siloxane</td>
<td>33.5 spray, 41.5 roll</td>
<td>Poor, Roller marks, Sags</td>
<td>Too glossy, Poor durability</td>
</tr>
<tr>
<td>PPG Coraflon Intermix Matte</td>
<td>Fluoropolymer</td>
<td>2.5 spray, 2.5 roll</td>
<td>Good</td>
<td>Too matte, High minimum order</td>
</tr>
<tr>
<td>PPG Coraflon Intermix Semi-gloss</td>
<td>Fluoropolymer</td>
<td>21-40 spray, 15.5 roll</td>
<td>Poor, Roller marks</td>
<td>Large gloss range</td>
</tr>
<tr>
<td>Sherwin Williams Fluorokem HS</td>
<td>Fluoropolymer</td>
<td>28 spray, 15.5 roll</td>
<td>Good</td>
<td>Texture in paint film</td>
</tr>
<tr>
<td>Tnemec 1072</td>
<td>Fluoropolymer</td>
<td>44.5 spray, 34-44 roll</td>
<td>Fair</td>
<td>Too glossy, Does not spray well</td>
</tr>
</tbody>
</table>

The three top performing paints are highlighted in green. The two products eliminated early in the study are not shown here (Table by Abigail Mack).
Coraflon Intermix Matte, and PPG Coraflon Intermix Semi-Gloss. With the painting of Gracehoper scheduled to begin in 8 weeks, the team knew that choosing a paint from the study would require two compromises. First, the study was not yet complete, and the team was relying on early data. Second, the initial study results suggested that the team would have to accept some surface texture to achieve an acceptable gloss level. Given the 15 to 20 year life span of the painted surface, the team was willing to make some compromises. Availability in small quantities for future touch-ups was another issue the team needed to consider. Finally, a containment structure would still be crucial even with roller application since rain and heat from the sun could interfere with the paint’s application, drying, and curing.

8. TREATMENT—JULY 2013

With the July 2013 start date fast approaching, the project team made a decision on the coating system based on the paint study results, the experience and advice of painters from the American Stripping Company (ASCo), and the cost and availability of each paint system. The three paints selected as top contenders had distinct advantages and disadvantages, and in the end the team chose to use the Sherwin Williams system, accepting the slight surface texture found in the Fluorokem HS roller tests. In fact, the Tony Smith Estate believed that the slight texture more closely resembled the surfaces on early Smith sculptures.

The decision was also a practical one based on cost and availability. The great advantage of Fluorokem HS is that it can be purchased by the gallon, compared to the PPG Coraflon products which are only available by special order in 50-gallon lots. All three products cost approximately $500 per gallon, so the ability to buy a single gallon of Fluorokem HS, should it be needed for touching up damaged surfaces in the future, was the deciding factor in choosing this system.

The treatment plan for Gracehoper consisted of several components including site preparation, exterior surface preparation and local priming, interior surface preparation and coating, overall primer application, the topcoat application, and the fabrication of a new hatch lid. The following is a brief description of each component as well as observations on how the plan worked out in practice.

8.1 SITE PREPARATION

A large, fabric covered truss frame tent was erected on-site during the week before the ASCo paint crew arrived (fig. 15). Prior to erecting the tent, one tree was removed near the sculpture and three others trimmed to accommodate the tent footprint (fig. 16). The purpose of the tent was to protect the surfaces of the sculpture (and the crew) from rain, wind, and the hot sun during painting.

The tent was installed on wheels that ran on two steel rails that allowed it to be rolled away during the topcoat application. Moving the tent off of the sculpture allowed the project team to evaluate the appearance of just painted surfaces in direct sunlight for uniformity, gloss, and texture. Surfaces that did not meet the standards set by the Smith Estate could then be sanded and repainted as necessary.

The tent allowed the paint crew to work for 22 days uninterrupted by weather conditions until the job was completed. It was rolled away a total of four times. This was not as easy as originally anticipated because the wheel chassis caught on the upright posts attached to the rails. Instead of moving it away in one smooth, continuous push the tent had to be slowly ratcheted from post to post, taking up to two hours per move in one direction.

8.2 EXTERIOR SURFACE PREPARATION AND LOCAL PRIMING

Rusted seams between the mechanically joined sections of the sculpture were blasted with Black Beauty coal slag abrasive, 30/60 grade, at 100 psi to conform to SSPC-SP5 “white metal clean” standards in preparation for repainting (fig. 17). Bare surfaces were immediately coated with Zinc Clad IV zinc-rich
Fig. 15. Assembling the tent on-site prior to commencing the treatment (Courtesy of Cindy Lee Scott)

Fig. 16. Site plan for the *Gracehoper* project on the north lawn of the DIA (Courtesy of Detroit Institute of Arts)
Fig. 17. Blast cleaning the rusted seams with abrasive in preparation for priming and painting (Courtesy of John Steele)
epoxy primer. Following the zinc primer, the seams were sprayed with yellow-tinted and then white Macropoxy 646 epoxy primer to ensure adequate coverage by allowing the painters to immediately see missing areas in the primer application. Gaps in the seams were filled with 3M Fast ‘N Firm Seam Sealer 08505 after priming.

All exterior surfaces, previously painted with a TNEMEC aliphatic polyurethane paint system in 1986 and 1989, were sanded with handheld orbital sanders using 3M purple abrasive discs of 80- and 220-grit aluminum oxide (fig. 18). Following sanding, light abrasion marks were filled with white
Macropoxy 646 epoxy primer. The TNEMEC paint was more strongly adhered and tougher to sand than initially anticipated which led to a longer preparation time.

Heavily pitted areas were spot blasted with Black Beauty coal slag abrasive, 30/60 grade, at 100 psi, and then primed with Zinc Clad IV zinc-rich epoxy primer. Rough areas were filled with Glaze Coat liquid polyester finishing putty, and spot primed with Macropoxy 646 epoxy primer (fig. 19). Heavily pitted flat surfaces around the hatch opening were filled with Smart Light Weight Filler polyester putty. The putty was gently sloped up to the hatch rim on all sides to direct water away from the hatch when it rains. The putty fills were primed with Macropoxy 646.

The top and bottom surfaces of the sculpture, more badly weathered and eroded than the side surfaces, were aggressively sanded with orbital sanders until much of the old TNEMEC black topcoat was removed and the old underlying red and gray primer layers from the 1986 repainting were exposed (fig. 20).

8.3 INTERIOR PREPARATION AND COATING

A steel ladder was fabricated by ASCo and installed inside the sculpture below the hatch to allow easy access to the interior in the future. The ladder is clamped to the interior armature, and can be removed by unscrewing the clamps if necessary.

Loose corrosion and an old, thick, detached layer of Ziebart coating (approximately 1/8 to ¼ in. thick) were cleaned from the floor below the hatch using a rotary wire brush tool and an industrial vacuum (fig. 21). The area measures approximately 40 square ft. The floor was then coated with Dura-Plate 235 Multi-Purpose Epoxy rated for water immersion (fig. 22). The rest of the
Fig. 20. Exposed layers of old red and gray primer on the top surfaces of the sculpture after sanding (Courtesy of John Steele)

Fig. 21. The floor inside the main body of the sculpture, directly below the hatch, before treatment, showing corrosion and old, degraded Ziebart sealant (Courtesy of Detroit Institute of Arts)
Fig. 22. The floor inside the main body of the sculpture, after cleaning and coating with Dura-Plate 235 Multi-Purpose Epoxy (Courtesy of John Steele)
interior, including the Ziebart sealant on inside walls of the main body and the lightly corroded walls elsewhere, was not deemed a threat to the structural stability of the sculpture and was left untreated.

8.4 OVERALL PRIMER APPLICATION

All exterior surfaces of the sculpture were washed using a solution of Simple Green detergent mixed 1:15 in water, and rinsed with water overall to remove dust and dirt from the prep work. Prior to applying both the primer and topcoats, windscreens were erected at both ends of the tent to cut down on air movement around the sculpture (fig. 23). Dark gray-tinted Macropoxy 646 epoxy primer was then sprayed on all surfaces (fig. 24). After priming, a few scattered rough spots on the surface were corrected by filling, sanding, and spot priming as necessary.

8.5 TOPCOAT APPLICATION

The plan, in theory, was to spray Fluorokem HS in all of the corners and on all of the edges and seams of the sculpture, and then roll the paint over the broad surfaces of each facet. This system
Fig. 24. Spraying gray-tinted Macropoxy 646 epoxy primer overall (Courtesy of Detroit Institute of Arts)
was developed after multiple large-scale application tests at ASCo. As stated earlier, rolling was pursued as an application method for the broad surfaces because the project team believed it would be easier to roll than spray a uniform coat of high-performance paint in situ, given the challenges presented by variable weather conditions and accessibility. Rolling would also save time and money by avoiding the elaborate masking necessary when spraying, and make future touch-ups of damaged surfaces cheaper.

The corners and seams were sprayed as planned (fig. 25), but rolling the broad surfaces was problematic. The painters knew right away that the limited working time of the paint (less than 30 minutes) would not allow them enough time to apply it to an entire facet and rework it as necessary before it started to catalyze. The paint catalyzed more quickly than it did in the shop tests, a factor most likely related to the warmer outdoor conditions in July versus the indoor tests done earlier in the spring. The painters had anticipated a shorter working time in warmer conditions, but not to this degree. Their solution to delivering paint to the surface quickly was to spray an initial coat of paint across a surface, and then back-roll the just sprayed surface with wetted rollers to even it out.
Four painters worked together during the application process. One person mixed the paint by the gallon, another applied the initial spray coat to the surface of a section, and two people, working side by side, evened out the just sprayed paint with rollers. Application was a challenge because the men had to work from lifts, scaffolding, and ladders (figs. 26, 27). Also, masking adjacent surfaces became necessary to protect them from overspray (fig. 28).

After the first few facets were painted, roller marks were still visible, as well as surface texture (“orange peel”) caused by the roller running across the quickly drying paint. The painters switched to wider rollers to cut down on roller marks, and became more adept at handling the paint, which lessened the visible texture. Roller marks were still visible though, much to the frustration of everyone involved. The painters’ solution to successfully diminishing the marks was to feather them out with yet another light spray application of Fluorokem HS.

The process of spraying the topcoat on broad surfaces, then back-rolling it and spraying it again varied from the originally planned single roller application, and though it worked well, it was still challenging to achieve an even application on every facet. Three to four facets with visible roller marks and/or surface texture were identified for sanding and repainting during each of the three times the tent
Fig. 27. Back-rolling the spray coat of Fluorokem HS on the west face of the sculpture (Courtesy of Detroit Institute of Arts)
Fig. 28. Back-rolling Fluorokem HS on an interior face of the sculpture. Adjacent surfaces, newly painted, are masked with plastic and brown paper to protect them from overspray. (Courtesy of John Steele)
was rolled back for viewing the sculpture in direct sunlight (figs. 29, 30). The gloss on the newly painted surfaces was also checked during the viewings and registered consistently in the range of 18–21 units on a Tri-gloss meter. After the fourth roll back and inspection, the project team agreed that all surfaces of the sculpture met the aesthetic requirements of the Smith Estate and the treatment was declared complete (fig. 31).

8.6 HATCH COVER

The badly pitted and corroded hatch cover was replaced with a new cover constructed by DIA mount fabricator Jim Storm in October 2013. The new cover is made from 1/8 in. cold rolled steel with a TIG welded 3/8 in. wide by 1/8 in. thick lip. Old, decayed gasketing was removed from the rim of the hatch opening and the opening was relined with strips of new ethylene-propylene-diene monomer (EPDM) foam gasket material. The hatch lid was attached to the rim with new stainless steel screws and foam washers. Both the cover and the screws were primed and painted using Macropoxy 646 and Fluorokem HS. The original cover is now kept in the Objects Lab in the Conservation Department.

9. CONCLUSION

The project, originally scheduled to take place over four to six weeks, was completed in 22 days largely due to the protection the tent offered during treatment and the skill and determination of the painters. It took eight men nine days to complete the surface preparation, one man one day to spray
Fig. 30. An example of a facet that had visible roller marks and too much surface texture ("orange peel") that required sanding and repainting (Courtesy of John Steele)
the primer overall, and four men 12 days to first spray and roll the topcoat overall and then sand and repaint the facets that needed correcting. The value of using experienced painters on these large-scale painted outdoor sculpture projects cannot be stressed enough. It was crucial to the success of the *Gracehoper* treatment that they were both knowledgeable and flexible enough to make the changes necessary in the application plan due to the unanticipated shortened working time of the Fluorokem HS on-site.

Although the topcoat application process varied from the original plan, the final appearance of the sculpture met and exceeded the expectations of the project team. *Gracehoper’s* surfaces meet the aesthetic requirements set by Smith and his estate, and though the application was more difficult than anticipated, the topcoat is expected to last many years. Also, should the surface need retouching in the future, Fluorokem HS is available by the gallon.

In conclusion, treating outdoor sculpture can be challenging in itself, but *Gracehoper’s* monumental size magnified all of the problems. The challenges—assessments, rigging, transport, access, and paint choice—were not just doubled owing to a jump in size, but seemed to increase by logarithmic amounts. Planning for treatment required flexibility, and careful and cooperative consideration of all the variables affecting the treatment. Hopefully the information gathered from this treatment will help guide conservators with the crucial choices that must be made for the treatment of other large-scale sculptures. In particular, on-site application methods that incorporate rolling suitable high-performance paints have the potential to make the treatment of not only Smith sculptures, but also other large-scale sculptures cheaper, easier, and longer lasting.
Finally, the success of the *Gracehoper* treatment demonstrated the value of involving key stakeholders, including the public, from the beginning. Specifically, the public fundraising effort had the added benefit of rallying the local community behind the project and showed that even in difficult financial times in the city of Detroit, it was still possible for people to come together and support the restoration of this important landmark sculpture for another generation.

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REFERENCES

Auld, S. 2001. Personal communication. Director of Tony Smith Estate. Guidelines provided were used to develop the black matte paint project at the National Gallery of Art’s objects conservation department.


FURTHER READING

SOURCES OF MATERIALS

3M Purple Abrasive Disc, P80E, 3M Hookit, catalog number 30684, 152 mm, 6 in./lb.—aluminum oxide-based abrasive discs for handheld orbit sanders; 3M Fast ‘N Firm Seam Sealer 08505—heavy bodied styrene copolymer-based sealer/caulk

3M Corp.
3M Center
Saint Paul, MN 55144-1000
(866) 279-1235
http://www.3M.com

Black Beauty Abrasive—coal slag abrasive, extra fine, 30/60 grade
Harsco Minerals International
5040 Louise Dr. Ste. 106
Mechanicsburg, PA 17055
(888) 733-3646
www.blackbeautyabrasive.com

Glaze Coat—polyester finishing and blending putty, product number 100417
ITW Evercoat, a Division of Illinois Tool Works Inc.
6600 Cornell Road
Cincinnati, OH 45442
(513) 489-7600
www.evercoat.com

Simple Green All Purpose Cleaner
Sunshine Makers, Inc.
5922 Pacific Coast Highway
Huntington Beach, CA 92649
(800) 228-0709
www.simplegreen.com

Smart Light Weight Filler—lightweight polyester body filler
Gearhead Products Inc.
54 Monument Circle, 8th Fl.
Indianapolis, IN 46204
(317) 237-2150

Sherwin Williams Protective & Marine Coatings
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Allsite Structure Rentals, LLC
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www.allsitestructures.com

Weather-resistant EPDM Foam, adhesive-backed, ¼ in. thickness, ½ in. width ethylene-propylene-diene monomer, catalog number 93725K74
McMaster-Carr
9630 Norwalk Blvd.
Santa Fe Springs, CA 90670-2932
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www.mcmaster.com

JOHN STEELE is conservator of sculpture and decorative arts at the Detroit Institute of Arts, where he has worked since 1990. His responsibilities include all aspects of preservation and treatment of 3D works spanning all cultures and time periods in the museum's encyclopedic collection. He received an MA in art conservation from the State University of New York College at Buffalo. His conservation experience ranges from treating limestone sculpture on the west front of Wells Cathedral to working as site conservator for the Brooklyn Museum's Mut excavation at the Karnak Temple Complex. Recent projects include a technical examination of the DIA's Netherlandish altarpiece the Arenberg Lamentation, treatment and installation of 110 objects for the DIA's traveling exhibit Through African Eyes, and participation in a symposium to determine the authenticity of the DIA's Mesopotamian sculpture of Gudea of Lagash. He is currently responsible for the care and maintenance of 16 outdoor sculptures on the grounds surrounding the DIA, including works by Alexander Calder, Anthony Caro, George Rickey, and Tony Smith. His latest project, the conservation of Tony Smith's Gracehoper, has led to extensive research into the complex issues associated with the treatment of contemporary outdoor painted sculpture. Address: 5200 Woodward Ave., Detroit, MI 48202.
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ABIGAIL MACK holds an MA in art conservation from the State University of New York College at Buffalo and is a professional associate of the American Institute for Conservation of Historic and Artistic Works. Most recently, she was an object conservator at the National Gallery of Art (NGA) in Washington, DC, where she was hired as a lead conservator for the installation of the Sculpture Garden. Since 2006, Ms. Mack's private practice has built on her experience with modern and contemporary art. Currently she acts as consulting conservator to the Calder Foundation, Storm King Art Center, the Tony Smith Estate, the modern art collection from the Hessel Museum at Bard College, and other private collections of modern art. A portion of her business involves the conservation treatment of large-scale outdoor sculpture which requires her to work closely with industrial painters, fabricators, riggers, and coatings specialists. One of Ms. Mack's specific interests is the conservator's role in the long-term care of outdoor sculpture. Since the sculpture placed in an outdoor setting will inevitably change, the goal shifts from traditional conservation ethics to striking a balance between the preservation of the physical object and the preservation of the artists’ intent for appearance. To this end, Ms. Mack remains involved
with the NGA on a research project that aims to develop more durable matte coatings for painted outdoor sculpture. This project includes the collaborative efforts of the Calder Foundation, the Tony Smith Estate, and the US Army Research Laboratory. For additional work experience, photographs of previous treatments, and a complete list of publications and lectures, please refer to Ms. Mack’s website at www.abigailmack.com. Address: PO Box 155, Red Hook, NY 12571. E-mail: amack@abigailmack.com