Conservation and restoration of the Fisher period stained glass dome

…there is no form that color takes which appeals more powerfully to the senses then in glass.

Colored Glass for Home Decoration, Mary Gay Humphries, 1881

DRIEHAUS MUSEUM

The most dramatic intervention to the interior of the Nickerson house was made during the Fisher period of occupancy. In 1900–1901, Lucius Fisher engaged architect George Washington Maher (1864–1926) to redesign the Nickerson Art Gallery at the northwest corner of the main floor. Fisher re-envisioned the space as a Trophy Room to display his collection of game animals, weaponry and rare books. The crowning achievement of Maher's new decorative scheme was the installation of a striking stained glass dome that replaced the original Nickerson period clear glass skylight.

The dome is comprised of eight wedge shaped segments arranged around a circular center panel (oculus), and four flat lay-lights, all held within a steel frame. The dome depicts four trees, the trunks of which arch towards the oculus, while their leaves, rendered in autumnal colored drapery glass, form a canopy against a turquoise sky. Each lay-light features a central area of green and white striated glass, framed by a band of leaves rendered in autumnal colored drapery glass, in turn framed by a border of emerald green drapery glass.

Botti Studio of Architectural Arts of Evanston, Illinois, conducted an extensive assessment of the dome during the summer of 2004. Upon inspection the stained glass dome and perimeter lay-light surround were found to be in a state of failure. Poorly conceived restoration attempts by previous owners of the house, had added to the deteriorated condition of the structure. In fall 2004 the contract for the restoration of the Fisher Dome was awarded to Botti Studio.

Condition assessment

The dome panels and lay-lights are comprised of multiple pieces of glass held in place by lead cames. Cames consist of two parts, the flange and the heart. The flange is made up of two parallel elements which are shaped around the glass. The heart connects the two parallel elements of the flange. The came is soldered together at the points where the individual pieces of glass meet. While lead cames provide the majority of the support for the glass, they are not enough to support the entire structure of the dome. Steel support bars reinforce the structure and act as lateral braces to bear the weight of the individual panels. The panels of the dome all exhibited buckling and bowing of up to three to four inches throughout. In many instances the stained glass panels had bowed inward to such a point that substantial areas were left either entirely unsupported or just barely affixed to the structural frame.

The lead cames were severely deteriorated throughout the dome and lay-light surround. Under pressure many of the cames had separated with multiple breaks occurring between the solder joints. The original steel support bars of the dome, plus those installed as part of later restoration attempts by previous owners of the house had pulled away from the cames. In most instances this process had caused structural damage to the came where it was affixed, leaving voids in the top flange. In many areas the damage was deep enough to tear and cause losses to the heart of the came as well. Poorly conceived attempts to adhere new structural support bars had involved heating the bars to a high temperature in order to melt the original lead cames to fuse with the bars. This approach had flooded the surface of the glass with solder, leaving particular areas in a very brittle state and cracking glass during the process. Additionally, the new support bars had been crudely bent into shape to accommodate the radiused surface of the dome. This had led to tremendous stress being

placed upon the panels, which ultimately caused the glass to bow, buckle and crack.

As the weight of the overall structure pushed down on the individual panels, the base rows of the panels had collapsed in on themselves. While certain glass pieces had simply become detached from the cames, many pieces had broken under the pressure. Over the years, as glass pieces had been forced out of place within the dome, the gaps had been filled with replacement glass that was poorly matched in terms of texture and color. These replacements had again been performed in-situ thus further weakening particular areas of certain panels.

The radiused vertical steel members of the structural frame had been detached from the compression ring at the top and the base ring at the opening for the dome. The most likely explanation for the removal of the mechanical bolt and nut system was to aid in the removal of stained glass panels from time to time. In addition the steel vertical supports had been twisted out of alignment through poor handling.

The dome was originally protected by an exterior casement that featured an operable glass sash at all elevations. The glass sash allowed natural light to illuminate the dome and aided convection and ventilation of the attic area above the dome. In the later history of the house, the sash had been paneled over so that natural light no longer came through at all elevations. The original incandescent artificial light system designed to illuminate the dome at night was no longer functional, however the system had been left in place within the exterior canopy.

Due to the unstable condition of the stained glass panels and lay-lights, the conservation team decided that a complete conservation and restoration of the dome and surround was necessary. In order to achieve this, the entire dome and lay-light surrounds would need to be removed from the steel frame support. During the restoration of the Fisher Dome, Botti Studio adhered to the guidelines and specifications established for repair, restoration and conservation of historic stained glass established by the Stained Glass Association of America, National Preservation brief #33, American Institute of Conservation and the Corpus Vitrearum, an international organization dedicated to the study and preservation of stained glass throughout the world.

Conservation and restoration

Extensive documentation of the existing condition of the dome was carried out by the Studio. Documentation included written journal entries, photo documentation in digital and 35 millimeter format in both artificial and natural light as well non transmitted (reflected) light, and in-situ and studio rubbings of the glass with written notations. Rubbings are full scale tracings that record the position of lead lines and are used by the Studio to allow for the correct repositioning of the pieces after the panel is dismantled for re-leading. The rubbings record the original condition of the panels, indicating cracks, missing pieces, broken or missing leads, the location of tie wires, and materials added during previous restorations. Once a conservation plan had been established in accordance with the documentation, Botti Studio began work on the restoration of the dome.

To safely remove the sections of the dome individual foam molds were created to stabilize the panels. The individual interior sections of the dome were faced with 1/64″ thick sheets of Teflon. Liquid foam was then sprayed in a layered method onto the Teflon so as not to exert any pressure on the stained glass from the interior side. The individual foam molds were

built up to approximately four inches in thickness. A series of two inch thick rigid Styrofoam "ribs" were imbedded into the foam to strengthen the molds. Upon completion of each mold staff members from Botti Studios were able to remove the stained glass panels from the frame by pushing them up into the roof enclosure. The stained glass panels were then carried out across the roof of the Nickerson house and into the building through an access door at roof level. The panels were transported to Botti Studio's workshop by truck. The stained glass panels remained with their custom support molds throughout the remainder of the restoration project until they were reset in place.

With the glass removed, work could begin on the restoration of the steel frame and exterior casement. The steel frame members needed to be structurally re-secured and re-trued prior to the re-installation of the restored stained glass panels. The vertical steel "T" bar structural supports needed be refastened to the top compression ring and base plate. "T" bars are structural elements that act as supports to receive the weight of the panel and transfer it to the frame. The restoration of the frame needed to be closely coordinated with the restoration of the stained glass panels to ensure the separate elements would fit back together. To ensure the glass panels matched the form of the restored structural frame, the panel molds were continually adjusted throughout the project. Upon completion of the realignment of the steel frame Botti Studio prepared the frame to accept an approved primer and finish coat of paint.

While the existing casement was restored and opened to provide natural lighting for the stained glass dome, a new artificial lighting system was designed by the museum's lighting and design consultant, Gordon Anson. The system was installed in the attic area above the stained glass to provide an even illumination for the dome on overcast days and at night. The interior of the attic area was painted white to provide a reflective surface to enhance the lighting for the dome.

In the workshop studio technicians were able to create more detailed rubbings of the glass than in-situ rubbings allowed. The rubbings served as a guide for the ensuing conservation process. Each piece of glass was numbered individually both on the glass and on the studio rubbing. Using the concave sprayed foam molds produced in the field prior to removal of the panels the studio produced convex wood molds and convex foam molds. These molds allowed the dome panels to be re-assembled following the complex shape of the dome.

The deteriorated lead cames were carefully removed and the panels were slowly dismantled. Samples of residue adhered to the glass were tested to verify the absence of asbestos and any other hazardous materials that might be present. All glass pieces were cleaned, while broken pieces were cleaned and carefully edge glued using ultra-violet stable, optically clear conservation grade adhesive. The acrylic adhesive used was fully reversible but resistant to atmospheric reagents and impervious to commonly used cleaners and chemicals. Missing or broken pieces of glass were replaced with glass supplied by the Opalescent Glass Works, Kokomo, Indiana. The factory, founded in 1888, had supplied the original glass for the dome. The replacement glass was selected to match the original as closely as possible in terms of hue, color density, thickness, texture and light transmission. After damaged and missing glass pieces were repaired or replaced, the panels were then re-leaded using conservation grade

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lead that exactly matched the size, profile, and heart height of the original lead came.

Once re-leaded, a weather proofing compound was applied to the panels. This weather proofing process filled all gaps between the lead and the glass, strengthened the panels and batinated the lead came matrix. The freshly weather proofed panels were allowed to set until the weather proofing had skinned over. After the panels had been weather-proofed they were ready for the installation of a new support bar system.

The existing support bar system was comprised of bars applied by the original fabricator of the dome and an assortment of bars applied in situ during later attempts to stabilize the structure. Using the historical bar placements as a template a new bar system, comprised of ⅛″x ½″ galvanized steel bars, was installed. Horizontal bars were applied to the interior (concave) side of the panels and vertical bars were applied to the exterior (convex) side of the panels. In order for the panels to fit in place, the interior support bars were turned 90° in order to lay flat against the vertical steel frame structure. While the historical bar placements served as the guide for the new bar system, particular attention was paid to areas where the panels had failed. To prevent structural faults from developing in the same locations again additional galvanized steel bars were installed. The additional bars were placed so as not to introduce any new lines into the overall design of the dome.

A support bar system was also created for the four flat lay-light panels. The system was attached to the underside of the panels and was designed to evenly transfer the weight of the panels into the surrounding steel frame system. The bars were applied to match the locations of the original historic bars. Again, all new bars were placed so as not to introduce any new lines into the overall design. In addition to the underside bar system, a system of ⅛″x ½″ galvanized steel "fins" was applied to the upside bars of the lay-light panels. The "fins" were turned at the edges to run parallel to the panels. They were also drilled to allow screws to be installed to secure the panels to the upside vertical steel frame members system. After the support bar system was applied to both sides of all the stained glass panels and lay-lights, all parts were re-cleaned in their entirety. The panels were then carefully packed for transport back to the Driehaus Museum on Studio trucks.

On site at the museum, staff from Botti Studio prepared the steel frame for installation. The frame extrusions were cleaned and a "gapped" foam setting tape was applied to the areas of the fixed stop upon which the restored panels would ultimately rest. The "gapped" tape allowed for increased air circulation between the panels and the stop. Studio staff set each section of the dome and each of the lay-lights back into the restored steel frame. When all stained glass sections were set back in place minor adjustments were made to the individual panel settings to assure the design aligned correctly. Upon completion of all adjustments the panels were secured to the steel frame through pre-drilled holes at the perimeter of the support bar system.