



Johnson Atelier slashes the time for enlarged sculpture reproduction from 3 months to 2 weeks

“By using PolyWorks/Modeler™, we succeeded in reducing the time of a typical enlargement process by more than 83%”.

- Jon Lash
Director of
Special Projects,
Johnson Atelier

In its quest to replicate magnificent masterpieces faster and more accurately, Johnson Atelier closely evaluated several techniques. Its final choice was InnovMetric's PolyWorks/Modeler, the most complete 3D modeling software solution on the market. Using a non-contact digitizer combined with the PolyWorks® point cloud processing software solution, Johnson Atelier is now able to build large sculptures of any size directly from small maquettes while maintaining the details of the artist's original creation. Discover how PolyWorks has enabled this sculpture institute to create perfect enlarged sculptures six times faster.

Summary

Initial Situation

- The original artist's work had to be brought to the foundry to serve as a maquette.
- The maquette was enlarged using a device called pantograph.
- Two persons were involved in measuring points on the original maquette and situating each point on the enlarged model.
- Intermediary models were created en route to the final enlarged model.
- The final model was retouched and corrected at the finishing station.

Drawbacks of the Initial Situation

- Using the pantograph is complex and necessitates well-trained technicians.
- Errors and deformities were accumulated from one intermediary model to the next along the process.
- The fine details and intricate shapes were very difficult to reproduce.
- The final product differed from the original model, necessitating extensive work at the finishing station.
- The entire process could take up to 3 months.
- High cost in terms of man-hours.
- The original sculpture had to be brought to the foundry, which wasn't always technically possible, making some projects unrealizable.
- Many projects had to be refused pending completion of projects in process.

The PolyWorks Approach

- The original artist's work is digitized using a high-density point cloud digitizer.
- The various scans are loaded into PolyWorks and are accurately aligned in a single 3D point cloud model.
- The 3D point cloud model is meshed to create a highly accurate polygonal model.
- The polygonal model is edited and then enlarged by a scaling factor.
- The polygonal file is directly exported as an STL file to the machining equipment (CAM).
- The model is automatically machined in stone.
- The model can also be machined in foam or plaster to create a master model from which a casting will be created.
- The final model is sent to a finishing station for fine detailing, high polish and patina applications.

Benefits of the PolyWorks Approach

- An **83% reduction in overall time requirements.**
- The enlargement of various objects by **more than 14 times.**
- The final objects are almost **identical to the original models**, preserving the same degree of detail.
- The use of **physical targets during digitizing is not necessary.** The objects and scanner can also be moved during the digitizing process.
- The original sculpture does not necessarily need to be brought to the foundry, as the **scanning can be done on-site.**
- **More projects realized** every year.
- Comprehensive training offered and direct technical support provided to users for **immediate assistance** during projects.



The Johnson Atelier Case Study

Reproducing Masterpieces

Reproduction of artwork has been around for centuries. Since its foundation in 1974, Johnson Atelier, a full-service, educational, non-profit art casting and fabrication facility located in Mercerville NJ, has earned a place among the world's leading fine art foundries for the quality and originality of its sculptures. Johnson Atelier offers leading-edge services to professional artists searching for a foundry to cast their work, to art students seeking a facility to enhance their skills, to municipalities looking to restore their statuary, and to architects hunting for the perfect sculpture to crown a winning design.

To reproduce original sculptures and recreate identical enlarged models Johnson Atelier used to utilize a device called Pantograph. High labor costs and long production cycle led Johnson Atelier to evaluate new production technologies. "Using the pantograph required that the artist build intermediary models, which involved one or two persons developing points on the original maquette and locating each point on the enlarged model" said Jon Lash, Director of Special Project at Johnson Atelier. "Errors and deformities are accumulated from one intermediary model to the next along the process, which necessitated extensive work at the finishing station. With the costs of foundry work rising each year, this method had become prohibitive."

PolyWorks® in the Hand of an Artist

To eliminate the inefficiency of its traditional reproduction technique, Johnson Atelier leaped into the future by evaluating 3D laser scanners and point cloud processing software solutions. This revolutionary approach led them to PolyWorks/Modeler™, InnovMetric's state-of-the-art point cloud modeling software solution. "We evaluated several point cloud processing software packages, and found PolyWorks to be the best solution to unite our processes together" declared John Rannou, Systems Engineer at Johnson Atelier. "PolyWorks/Modeler offers us a complete set of tools that allow us to quickly align and mesh dense data sets, creating accurate polygonal master models that can be edited and used directly for milling & rapid prototyping, casting & moldmaking, or exported to other CAD/Edtion software."

The enlargement process reinvented:

Digitizing the object

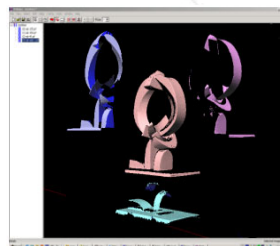
This new reproduction approach begins at the digitizing stations, where a 3D laser scanner captures the original piece from several angles, producing various individual scans, thus rendering the geometrical print of the object. "One great advantage of the software is that you can move your object freely to expose every surface of the object to the scanner scope" said Lash. "You don't have to worry about the orientation of the object and the scanner. This accelerates the digitizing process significantly."

Aligning the multiple scans

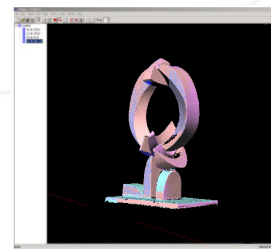
Using PolyWorks IMAAlign™ module, Johnson Atelier unifies the multiple point clouds obtained from the scanner, expressed in different coordinate systems, into a single coordinate system. PolyWorks IMAAlign's technology uses the object's own features to align the scans very precisely, without using reference targets. PolyWorks' automatic alignment technology is the most accurate and easiest solution within the 3D modeling software industry.



Digitizing a wax sculpture by Artist Ray Jacobson



Multiple scan alignment in PolyWorks IMAAlign

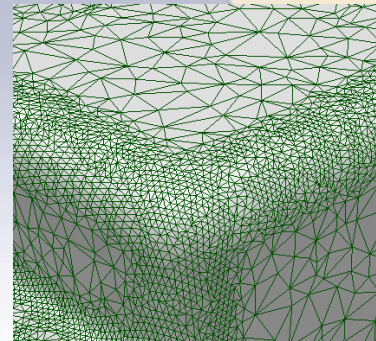


Aligned 3D point cloud



Creating an accurate polygonal model

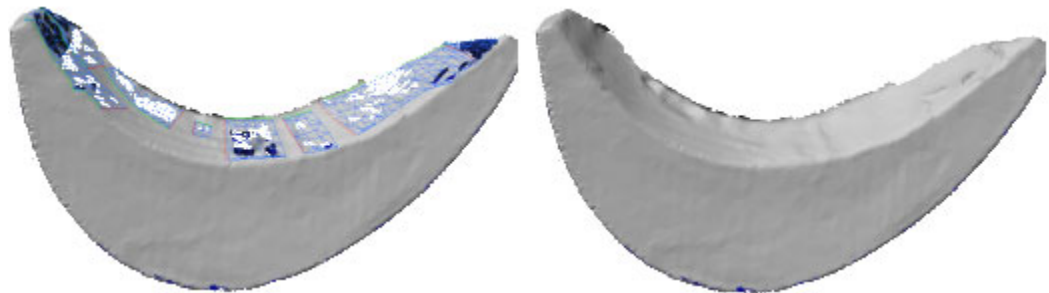
PolyWorks merges the aligned 3D scans using the PolyWorks IMMerge™ module to create a highly accurate polygonal model, eliminating overlapping areas by using intelligent averaging. Based on a user-defined tolerance, PolyWorks/Modeler adapts the polygonal mesh to the curvature of the surface, preserving high resolution over edges and fillets while creating larger triangles in flat areas. The technicians at Johnson Atelier also use PolyWorks IMMerge’s sophisticated smoothing parameter to reduce the level of noise of the model.



Polygonal object with resolution adapted to curvature of the object

Editing the polygonal model

In order to build a close-to-perfect enlarged model, Johnson Atelier needs to create an accurate and watertight polygonal model. PolyWorks/Modeler offers a complete set of editing tools to prepare the polygonal models for applications such as machining, rapid prototyping, visualization, etc. Since a large number of the models that Johnson Atelier uses have extremely complex surfaces, large areas are out of the scanner scope during the digitizing process. PolyWorks IMEdit™’ sophisticated NURBS-based hole-filling tool can easily be used to patch these holes. PolyWorks IMEdit also offers an automatic hole-filling function for smaller holes, that will fill them all in one click of a mouse.

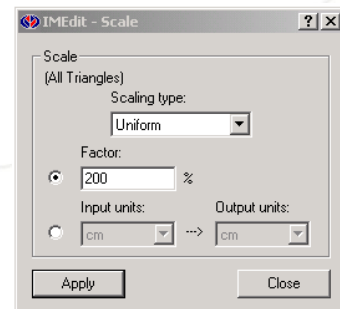


NURBS-based hole-filling with PolyWorks IMEdit

Johnson Atelier’s staff also uses PolyWorks IMEdit’s offsetting tool, prior to the casting production, to create an extra-thickness all around the pattern, enabling the artist to add its final touch (engraving, buffering, polishing, etc). PolyWorks IMEdit also offers several other tools to Johnson Atelier’s artists to enhance the polygonal model and to prepare it for production, such as edge & corner reconstruction, boundary smoothing, extruding, filleting, capping, slicing etc.

Enlarging the polygonal model

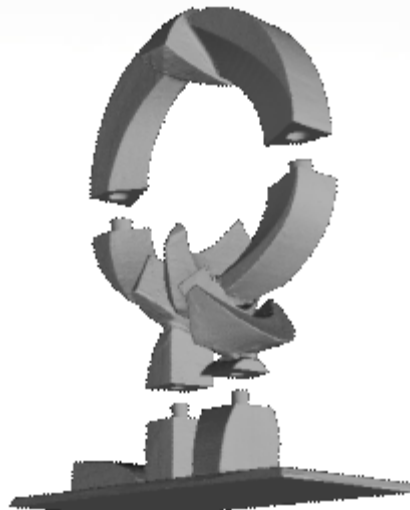
In order to avoid any faceting of the final enlarged model, each polygon is intelligently subdivided into smaller polygons that follow the original curvature of the surface. Then, using PolyWorks IMEdit’s “Coordinates/Scale” function , these smaller polygons are increased by a factor corresponding to the enlargement level required by the artist, which automatically results in an entire new enlarged model preserving the same fine details.



PolyWorks IMEdit’s scale window

Exporting the model to production

"There is almost no limit to the size of the piece we can build" relates Jon Lash. One great advantage of PolyWorks IMEdit is the ability to section the model for milling. Using PolyWorks IMEdit, we have the ability to easily section the entire model into modular units for milling on our 10'x10' bed, and easily fit them together at the assembly station. The master model will then be rubber molded, or used as a pattern for sand/metal casting. On occasion, Johnson Atelier generates a quick model for rapid prototyping for early appreciation of the model. Using the various PolyWorks/Modeler modules we are able to scan, align, edit, and have a STL model out to our production department in just a couple of hours" Lash concluded.



Using PolyWorks IMEdit to section the model into several blocks and insert dowels for quick and easy assembly



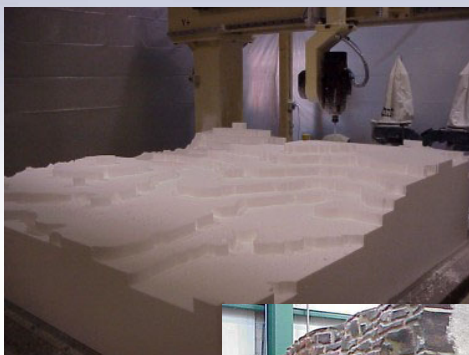
The final piece of 116x72x41" was cast in bronze and sent to Highland Park, Ill. USA

Possibilities Limited Only by the Artist's Imagination

Using PolyWorks/Modeler, Johnson Atelier succeeded in reducing the time of a typical enlargement process by more than 83%. "This outstanding technology has enabled us to slash our production time from our traditional two-to-three month production time window to a two-week period" declared Lash. "With the cost savings associated with this time reduction, we consider that the software paid for itself in less than 6 months" he continued.

"Thanks to InnovMetric's comprehensive training and judicious technical support, we were able to get up and running with a PolyWorks project within days," said John Rannou. "Our training session was personalized and oriented towards the effective use of the software within our processes. Furthermore, I know I always have immediate access to application engineers for technical assistance. After 2 ½ years of using PolyWorks within our production process, we can proudly declare that this software solution has revolutionized the way we reproduce our sculptures. With the continuous new functionalities being added to the software every year, we are looking forward to realize even more breathtaking projects."

Other Magnificent Projects Realized with PolyWorks



Building the "Eureka", a 60-foot high wavy wall from artist Brian Tolle

The 6'X6' sections are directly milled in EPS foam directly from PolyWorks' polygonal model



The sections are painted and sealed with an armor coat of urethane



The final product is assembled and installed on site



Enlargement of a 6-foot high sculpture to a 20-foot model, by Artist J. Seward Johnson



Sculpture of an aviator enlarged six times



The casting of the aviator at the patina and coating station