# COOPERATION CREATES A CUSTOM CRATE: CONSERVATION, LASER SCANNING, 3D MILLING and CRATE BUILDING WORK TOGETHER

Lynda Zycherman and Steven K. O'Banion
*Museum of Modern Art*

*Red Tights with Fragment 9* (Front).

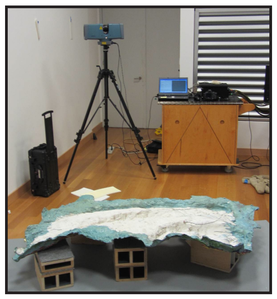
## OVERVIEW

Claes Oldenburg's *Red Tights with Fragment 9* (1961) is created from single piece of contoured chicken wire, over which pieces of plaster-coated textile were draped and then painted. The sculpture hangs on the wall from a coat hanger embedded in the plaster. The edges of the sculpture have been consolidated, filled and inpainted in several campaigns over the course of the 50 years the work has been in MoMA's collection. For a major Oldenburg retrospective, the sculpture was requested for a five-venue international exhibition lasting two years. We judged the sculpture unsafe for travel in the hanging orientation. Laying the work flat for travel seemed safer, if we could develop a packing system to adequately support the sculpture without touching the edges.

To design a custom-contoured bed that would prevent horizontal movement in two directions, **MoMA** commissioned **Direct Dimensions** to laser scan the reverse of the work. **Digital Atelier** transformed the scan into a milled polystyrene support, whose contour closely matched the underside of the sculpture. **Boxart**, the crate manufacturer, recommended that the support be cut into five sections for ease of fitting and handling of the sculpture. We made the milled support bars narrower than the sculpture so that the edges were free. The custom bed held the sculpture in place inside the crate so that it did not shift front-to-back or side-to-side. In a few locations, positive pressure was applied from horizontal bars with pendant blocks to prevent up and down motion of the sculpture during transit.

The design was successful and the sculpture arrived at the first venue with no travel damage.

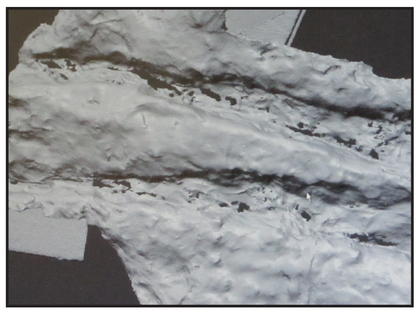
*Red Tights with Fragment 9* (Back).



Surphaser 25HSX with *Red Tights* in the foreground.

## A. LASER PARAMETERS

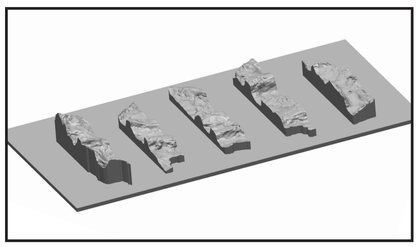
The "Surphaser 25HSX," built by Basis Software, was employed for this application. The instrument has an optimal range of 5m to 30m and collects data using "Phase-Based" technology. With a nominal accuracy of .25mm to .5mm, the laser comprehensively can scan anything that is within its view. The Surphaser was chosen because its accuracy would provide the necessary level of detail in the time available to scan the object (1 day). Other tools would allow for scanning with increased detail, but would take much longer.



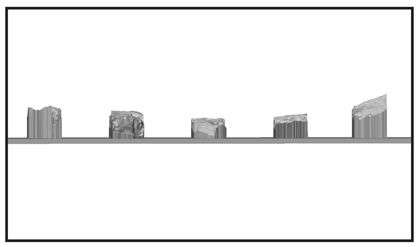
Detail of 3D computer model.

## B. DATA AQUISITION

The Surphaser uses "Phase-Shift Measurement" technology. A camera on the system captures the difference of frequency in the laser pattern between when it leaves the system to travel to the target and when it returns. The Surphaser then places a point at the measured distance. 1.2 million points can be placed in a second. All of the points can be saved in a "point cloud" file. To scan the entire object, captures were taken from a few different positions, thus acquiring a comprehensive data set. The cloud was then brought into software, where it was cleaned and processed into a 3D computer model.



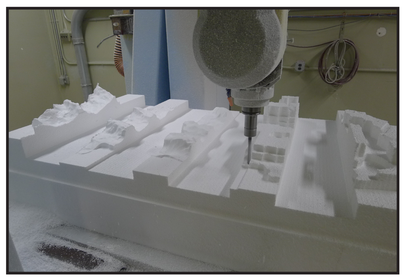
Digital model (from above).



Digital model (side view).

## C. DATA MODIFICATION

The individual scan positions were aligned into one cohesive CAD model (PolyWorks). Once the model was built, the surface was inverted, so that one sees the back-side surface from the front. The surface was offset back by 0.25 inches (PolyWorks). The model was then digitally extruded down, which also eliminated undercuts in the scan (Freeform). The model was brought into CAD software and boxes were built that would serve as the handling strips (Rhino3D). The strips were then subtracted from the model, allowing room for one's hands to reach underneath the sculpture (PolyWorks).

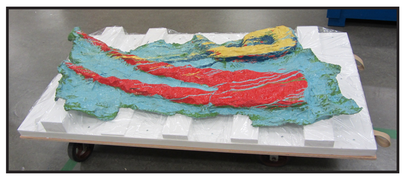


Support being milled at Digital Atelier.

## D. FABRICATION

The final digital model was sent to Digital Atelier, where it was milled from 2# expanded polystyrene (EPS) foam. Boxart incorporated the custom-milled support into their crate design. The support was lined with Dartek® film (Nylon 6/6 cast film from Dupont®) and attached to a removable inner tray with handles.

Contoured fit of final support beneath the sculpture.
The foam is covered with Dartek®.



*Red Tights* on removable support (designed to reduce handling).

*Red Tights* in finished crate.

## ADVANTAGES OF 3D SCANNING

3D scanning enables fast, dimensionally accurate 3D documentation of complex forms without the need for contact. Once captured, data can be manipulated virtually to design and manufacture crates and/or display fixtures that fit the surfaces of the works exactly, providing optimum support. When accuracy, safety, and speed are taken into consideration, scanning becomes an ideal choice for crating many types of fragile art objects.

MoMA

DIRECT DIMENSIONS
RAPID SOLUTIONS TO 3D PROBLEMS

DIGITAL ATELIER

BOXART