

NIST expertise helps protect Emancipation Proclamation at African American History Museum

February 23 2018, by Ben P. Stein



At the Smithsonian National Museum of African American History and Culture (NMAAHC) The Emancipation Proclamation and 13th Amendment to the Constitution are preserved in sealed encasements that were custom-designed, fabricated and outfitted with environmental sensors by the National Institute of Standards and Technology (NIST). Credit: NIST

This month, two seminal documents in American history—the Emancipation Proclamation and the 13th Amendment to the

Constitution—[went on display](#) at the Smithsonian National Museum of African American History and Culture (NMAAHC).

They are preserved in sealed encasements that were custom-designed, fabricated and outfitted with environmental sensors by the National Institute of Standards and Technology (NIST). The documents are made available from the collection of philanthropist David M. Rubenstein and are on display in the museum's Slavery and Freedom gallery.

Each [encasement](#) is fitted with an array of sensors. "The system tracks pressure, temperature, relative humidity and oxygen content 24/7, and updates every 15 minutes," said NIST pressure and vacuum scientist Jacob Ricker, who is responsible for designing the sensors and monitoring system for the two new encasements.

"It's convenient to have continuously updated monitoring data stored on a cloud server and be able to plot the data over time," Ricker said. "If there's a serious change, the system will send an email to the museum so that they can take immediate action as appropriate. This saves significant staff time and makes it much simpler for the users."

Inside each encasement, beneath a heavy two-pane laminated glass cover, the document chamber is filled with argon, an inert gas, and 0.03 percent oxygen. To seal in the gases, two large O-rings, or gaskets, are sandwiched between the two halves of the case, which were precision-milled from solid blocks of aluminum.

"Each encasement bottom was cut from a [rectangular] billet of aluminum weighing around 605 pounds [about 274 kilograms]," said N. Jay Brandenburg, production manager/design engineer in NIST's Fabrication Technology Office. "When finished, the bottom's average weight is 76.8 pounds [approximately 34.8 kg]."

"Each encasement frame was cut from a billet of aluminum weighing around 313 pounds [about 142 kg]. When finished, the frames' average weight is 56.5 pounds [approx. 25.6 kg]." With support structures and instrumentation, the final weight of each display case is about 250 pounds [110 kg].

Tolerances for fitting all of the pieces together range from plus or minus 1/1000th of an inch (approximately 0.025 millimeters) up to 25/1000th of an inch (0.635 millimeters).

NIST has made similar encasements before, most recently for the State of New York's exhibit of the Preliminary Emancipation Proclamation, but also for the Constitution, Declaration of Independence, Bill of Rights and many other national treasures.

"The biggest difference and challenge we faced with this project was the requirements for us to successfully design and fabricate two encasements that are similar in size, but are based on the different document sizes while fitting the two encasements into an existing display case at the museum," said Mark Luce, director of NIST's Fabrication Technology Office.

In addition, the installation posed unique challenges. The display cases must be mounted vertically and aligned together into a display while the monitoring equipment is attached to the back wall of the display case. NIST crafted a support structure for both display cases, placed about 2.5 centimeters (1 inch) apart, and a cart for rolling the structure into the wall.

The gas content in the encasements reflects strategic decisions by conservators at the Smithsonian's Museum Conservation Institute (MCI), Rebecca Kaczowski, and at NMAAHC, Valinda Carroll. Both the primary text and signatures of the 13th Amendment and the signatures

of the Emancipation Proclamation are written in iron gall ink, which is an historic formulation widely employed around the world well into the 20th century. A combination of iron sulfate and the dark tannins extracted from galls that form on oak trees, it was in common use in America during Lincoln's era. However, the degradation of the ink can accelerate the deterioration of the paper and parchment substrates. By sealing iron gall ink documents in an anoxic, or nearly oxygen-free environment, the ink's deterioration can be stabilized.

There had been concern in the past at other venues that the color of the ink—a pigment identified as Prussian blue—would change over time without some oxygen in the case. However, recent research at MCI has shown that light and not anoxia is the cause of fading for this pigment.

Combining the MCI research results with the favorable results previously shown for iron gall ink under anoxia, the conservators determined that argon with 0.03 percent oxygen and a low light level would provide the optimum environment for the documents.

Ricker spent over a week at the museum prior to installation. "We have to do the testing of the encasements, test each seal and every flange with helium to check for leaks," he said. "After that, we put the document in and put the glass on it, and then flush the oxygen out of there by adding argon until the correct level is reached."

This close collaboration of NIST experts and Smithsonian conservators will give visitors from around the world the opportunity to see these rare documents that reveal aspects of the late 19th century African American experience in the United States.

Provided by National Institute of Standards and Technology

Citation: NIST expertise helps protect Emancipation Proclamation at African American History Museum (2018, February 23) retrieved 3 May 2024 from <https://phys.org/news/2018-02-nist-expertise-emancipation-proclamation-african.html>

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