Preserving the Works of Shakespeare

By Jessica Lavin Reid

What do an IAMFA sponsorship, social media, and Shakespeare have in common? They're all essential to the story of Mueller Associates' current engineering services for the Folger Shakespeare Library in Washington, D.C. This beautiful, historic building is home to the world's largest collection of Shakespeare's works, including 82 of the "First Folios"—the first printing of the English poet and playwright's collected works. These and other centuries-old books, manuscripts, playbills, and paintings draw visitors and scholars from all over the world to this renowned museum, educational center, and performing arts venue.

The Folger Shakespeare Exhibition Hall.

IAMFA Networking

As marketing director for Mueller Associates—a Baltimore-based mechanical/electrical engineering firm that specializes in museums and cultural facilities—I became a member of IAMFA in 2011. Mueller has been an active sponsor and supporter of IAMFA for many years. Once I became involved, I quickly learned that the organization provides an ideal networking environment—both in person and online—to help consultants connect with museum organizations.

Our firm's relationship with the Folger Shakespeare Library is a good case in point. In the summer of 2011, Melody Fetske, the library's director of finance and administration, posted an inquiry on IAMFA's LinkedIn site, one of the organization's social media tools for members. IAMFA's LinkedIn discussion group offers facility managers and other members an opportunity to share questions, concerns, and lessons learned, while also providing referrals and suggestions.

Melody's inquiry focused on engineering consultants that specialize in environments for collections and rare materials. Thanks to the online discussion and related member recommendations, we were able to follow-up and meet with Melody as well as David Conine, the library's head of facilities, to discuss their needs for building system improvements.

Increasing the Preservation Index

"The Folger Shakespeare Library is well known for its important collection of Shakespearean works," says David Conine. "As IAMFA members know and frequently discuss, temperature and humidity control are key to maintaining valuable artifacts. We want to be sure to preserve the collection for future generations."

With support from two grants from the National Endowment for the Humanities, the Folger Shakespeare Library has been able to plan and implement a multi-phase improvement program highlighted by numerous upgrades to its air-handling units. The building, which opened in 1932 on Capitol Hill, has mechanical/electrical systems that date to the 1970s. A 2010 assessment by the Image Permanence Institute (IPI) evaluated the library's lower-level vault environment, where the First Folios and other significant materials are maintained, using the Institute's time-weighted preservation index (TWPI).

"We wanted to monitor the areas where we preserve books, and examine the extremes of summer humidity and the dry air of winter," says Conine. "We used a PEM (Preservation Environment Monitor) Datalogger, which measured the temperature and humidity every five minutes, then created a 30-minute average data point. From there we were able to graph highs, lows, and fluctuations."

IPI's analysis suggested that redesign of the cooling coil in the dedicated ventilation air handling unit serving the vault area, and the addition of a booster chiller, would help maintain more effective temperature and humidity control by depressing the dew point in the vaults, which is vital to increasing the TWPI. Our team at Mueller, under the leadership

of Project Manager Daniel Carmine and Mechanical Project Engineer Paul Czajkowski, then conducted a thorough study that included schematic design for the upgrade, equipment needed, a schedule, and cost estimates for the proposed work.

The team investigated the feasibility of several different options for performing dehumidification and air conditioning (depressing the dew point to 35°F), because this is a very energy-intensive process. Options included a patented liquid desiccant process, a solid desiccant process, and conventional vapor compression mechanical refrigeration (a glycol chiller). Due to numerous site constraints, the only feasible option was the glycol chiller. As a matter of energy conservation, wrap-around heat pipes were also considered, but our team determined they would not be feasible due to space constraints.

"The IPI analysis found that the air-handling unit that provides outdoor air, or ventilation, for the four air-handling units serving the multi-room vault area was not sufficiently dehumidifying that air," says Czajkowski. "Humid summers and dry winters in Washington, D.C. are challenging. During our study, we found that the existing dedicated ventilation air unit was not capable of being retrofited with a re-designed cooling coil for the extreme requirements; and that a new air-handling unit, pumps, piping, and control systems were needed, including an air separator, glycol feed system, and buffer tank. The new air-handling unit will subcool the air to 35°F to get the moisture out using glycol supplied from the new chiller. In addition, the chiller was specified and piped as a heat-recovery chiller, with its water-cooled condenser piping connected into the building heating water system, so it has the potential to be much more sustainable and energy-efficient."

After completing the design of the improvements for the vault area, Mueller began to explore other climate-control issues in the Library's Reading Room and Exhibition Hall. "Again, with these spaces, our focus was on 'depressing the dew point', and removing moisture from the air in the summer and adding moisture in the winter," says Czajkowski. "The overall goal is to increase the preservation index." The work to improve conditions in these large spaces involved modifications to three additional air-handling units.

The Folger Shakespeare Reading Room.

Minimizing Disruption

Throughout the planning process for all of the improvements, Melody Fetske and David Conine emphasized the importance of keeping spaces open and accessible as much as possible, to avoid interrupting the activities of scholars and visitors. Much of the work has been done through construction shifts that began as early as 2 a.m. to allow for normal operations during the day. For the Reading Room, contractors have often worked on weekend shifts, clearing out of the space by 6 a.m. on Monday mornings.

For Paul Czajkowski at Mueller, the compressed schedule is just one of many unique features of the complex work for the Folger Shakespeare Library. "It's a fascinating, historical environment," he says. "The building finishes include many fine woods and millwork, special features like balconies, and intricate spaces that we needed to work around. The engineering challenges we've addressed at the Folger Shakespeare Library required us to draw upon our decades of museum environmental control projects. But I've never worked with such intense requirements—we're taking the air in the vault spaces all the way down to 35 degrees to wring out the moisture before we bring it back up. This has been one of the most exciting projects I've ever worked on during my 33 years with Mueller." 🏛

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