The U.S. Naval Academy in Annapolis, Md., prepares young men and women to become professional officers in the Navy and Marine Corps. Serving as the undergraduate college for the U.S. naval service, students attend the academy for four years, graduating with a bachelor’s degree and then commission as ensigns in the Navy or second lieutenants in the Marine Corps, serving at least five years.

Designated a National Historic Landmark in 1961, the U.S. Naval Academy commemorates bravery and heroism with monuments located throughout its campus. Buildings and walkways are named after Naval Academy graduates who have contributed to naval history and their nation.

At the core of the campus is the academic complex of Mahan, Maury and Sampson halls. Constructed in 1907, Mahan Hall’s 104-year-old copper, polymer-modified bitumen and slate roof systems were overdue for replacement. Wagner Roofing Co., Hyattsville, Md., was selected by the academy’s general contractor, Allen & Shariff Construction Services LLC, Columbus, Md., to perform the $1.8 million roof system restoration project.

### Turn to scaffolding

In April 2011, Wagner Roofing began restoring Mahan Hall’s numerous roof systems. There are three slate roof systems on Mahan Hall—a radial arched mansard roof with dormers, a gable roof over the Hart Room and a clock tower. Additionally, there is a flat-seam copper roof system above the mansard roof and a polymer-modified bitumen roof system between the mansard and gable roofs.

Before roofing work could commence, scaffolding needed to be constructed around Mahan Hall. Erecting scaffolding was quite a challenge—the sides of the radial arched mansard roof on the east and west elevations are directly above a standing-seam copper roof that could not support scaffolding weight, so scaffolding had to be suspended from steel I-beams and tied into the main structure of the mansard roof’s scaffolding. The main mansard on the north elevation had vertical and horizontal radial curves; this is where the scaffolding’s main center structure was erected and tied into the mansard roof’s façade. Separate scaffolding was set on the low-slope roof to access the clock tower roof.

Per the engineered scaffolding drawings, slate was removed from the mansard roof at certain points to allow for epoxy anchors to be installed, securing the scaffolding in place. The main north and east elevations took more than one month to erect. During scaffolding erection, the drawings were revised seven times to comply with Naval Facilities Engineering Command (NAVFAC) Engineering Manual 385, which is the Army Corps of Engineers’ equivalent of Occupational Safety and Health Administration regulations.

Four additional scaffolding decks were erected to cover the 32-foot-long vertical run of slate roofing from the eave to the copper bull-nose transition cornice above the mansard roof area. Ladder decks (deck hatches with foldable ladders) were installed on each scaffolding deck for access between levels, each with its own safety rail and swing-gate system. Eye wash basins, first-aid stations and fire extinguishers were placed on each deck for emergency use.

“This was a complex project with multiple areas of work and significant quantities of phased scaffolding,” says Victoria Mackey, safety director and superintendent for Allen & Shariff Construction Services. “The work was performed from all heights, involved significant fall-protection issues and included numerous lifts. More than 21,000 man-hours were executed with no accidents or incidents.”
THE STATE HISTORIC PRESERVATION OFFICE WAS CALLED IN TO OVERSEE AND APPROVE ALL THE ORNAMENTAL DETAILS BEFORE THEY COULD BE INSTALLED. ALTHOUGH THE 325-FOOT-LONG BY 42-INCH-WIDE BUILT-IN GUTTERS WERE DETAIL IN A SERIES OF 104 FIGURES, THEY WERE HANDLED CAREFULLY TO ENSURE NO DAMAGE TO THE BRASS. THE DORMERS WERE HANDLED CAREFULLY TO ENSURE NO DAMAGE TO THE BRASS.

Scaffolding surrounded the dormers to have been lifted and bolted to the roof at the same time as the gable dormers. coffin elements were then bolted to the roof, allowing the roof to be raised into place. the dormers were then lifted and bolted into place, allowing the roof to be raised into place. this allowed for a seamless integration of the new roof system with the existing structure.
wanted the dormers salvaged and rebuilt with the original patina copper for historic and aesthetic reasons, once in its metal shop, Wagner Roofing had to detail how it would repair the dormers and submit it to the State Historic Preservation Office for approval.

After hours of discussion between Wagner Roofing and Gary Voth, a sheet metal expert from Texas, it was decided to replace the circular copper window tubes and upper crickets with new 20-ounce copper and reline the backs of the dormers’ ornamental façades with new 20-ounce copper because these dormer parts were the least visible from the ground and would patina quickly. Each dormer took about 120 man-hours to remove, repair and reinstall. The result is ornamental dormers that look 100 years old but are solid and waterproof.

“The most rewarding part of the project was relining the huge ornamental dormers so the existing façades stayed but all the integral inner flashings were new,” Morgan says.

A radial dormer and a shed dormer on the Hart Room did not need to be replaced but needed new copper base flashings. The existing copper along the bases was carefully removed, and new copper flashings were installed. Because there weren't nailers or a wood deck on the original roof's concrete deck, the copper dormers needed to be modified to compensate for the change in deck height. Wagner Roofing accomplished this by cutting away the existing copper at the dormers' bases and fabricating and installing a copper-cleated counter that locked to the original copper wall panels. On one side of the shed dormer, a recessed copper trough was created to allow water to properly shed onto the new flat-seam copper roof.

Once the slate and dormers were installed, Wagner Roofing’s sheet metal department fabricated and installed the 20-ounce copper radial hip cap and two-piece bull-nose transition cornice/apron along the top of the mansard. Both details were duplicated to exact dimensions but were installed using a more secure hidden-cleat method than originally had been used.

THE CLOCK TOWER
Wagner Roofing also repaired the clock tower. Work consisted of repairing weathered Buckingham slate and a copper weather vane and replacing half-round gutters, lead-coated copper water tables and a flat-seam lead-coated copper roof.

Wagner Roofing’s team worked with the masons, who were repointing the brick and replacing the clock tower’s stone ornamental urns. The lead-coated copper water tables were fabricated on-site and replaced as the masons replaced the stone urns.

The flat-seam copper roof had multiple angles, and the clock tower's open configuration was challenging. About 90 percent of the lead-coated copper panels were mitered with angle cuts. The clock tower also had a bell that NAVFAC silenced for one month while work was being performed.

DOWN THE HATCH
After installing 9,700 square feet of slate, 4,700 square feet of flat-seam copper, 2,500 square feet of polymer-modified bitumen, 475 linear feet of copper built-in gutters and 275 linear feet of ornamental fascia, Wagner Roofing completed its work in March 2012. Working around the academy’s activities, including a graduation, Wagner Roofing delivered exceptional workmanship and metal work that replicated the way it was performed more than a century ago.

“This was a major once in a lifetime roof replacement on one of our most prominent and revered historic buildings,” says Randolph Ghertler, Naval architect. “It was a privilege to work with Wagner Roofing. Their employees and project managers did an outstanding job on this complicated project.”

For its efforts on Mahan Hall, Wagner Roofing received an unprecedented three 2013 NRCA Gold Circle Awards in the Innovative Solutions: Reroofing category; Outstanding Workmanship: Steep-slope category; and the Platinum Award for superior workmanship and project presentation.

“It was probably the most challenging job I have worked on during my 44 years of roofing, and I am grateful for the great work performed by Kevin Morgan, Sarah Reynolds and Sheila Wagner in our office,” says Chuck Wagner, president of Wagner Roofing. “My grandfather and father would be proud of our company’s accomplishments at Mahan Hall and especially proud Wagner Roofing is celebrating 100 years in business.”

Chrystine Elle Hanus is Professional Roofing’s associate editor and NRCA’s director of communications.